

ECOHHEALTH

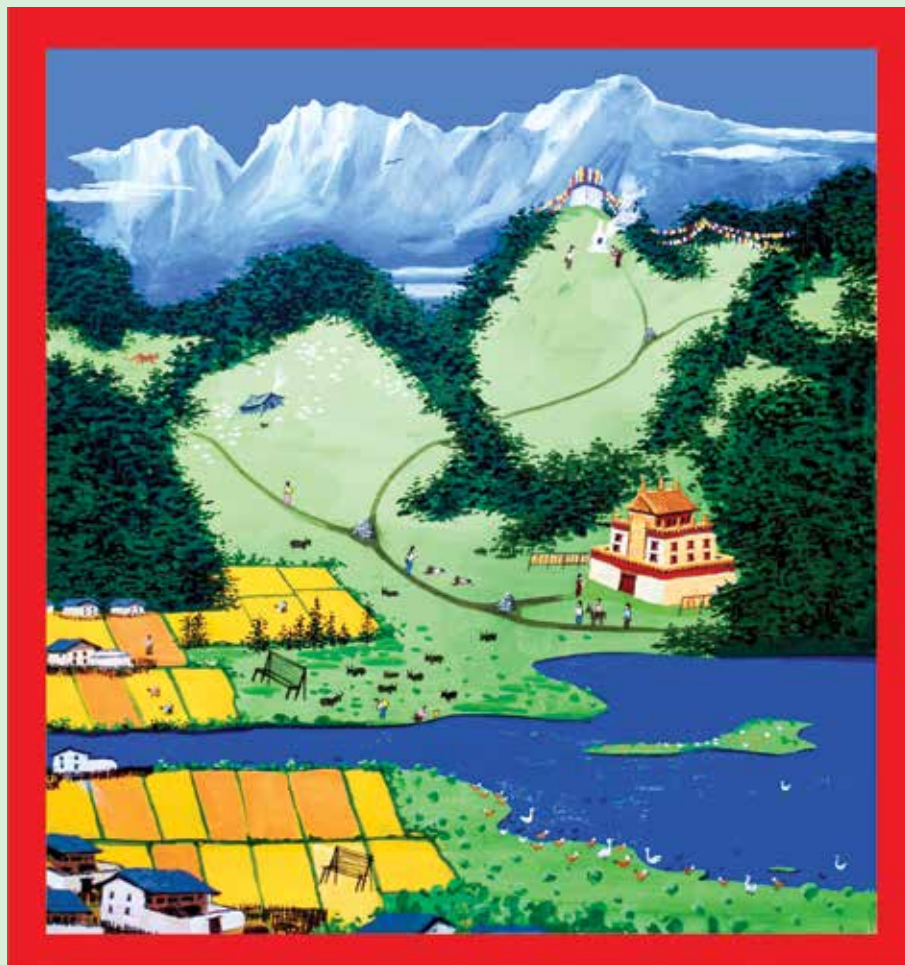
INTERNATIONAL ASSOCIATION FOR ECOLOGY & HEALTH

Sustaining Ecosystems, Supporting Health

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Abstracts



Conference co-organizers



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SYMPOSIUM
and
WORKSHOPS

Student contributions to field-building in EcoHealth

Chairs: Lindsay N Beck and Maya Gislason

University of Sussex

EcoHealth is an emerging field, breaking new ground at a time of considerable transition in research, education, policy, funding priorities, and practice. In these foundational field-building efforts, student networks and communities serve as fertile ground for innovation, knowledge exchange, and capacity building. It is important to critically reflect on the unique contributions of students, as well as barriers and opportunities to student engagement in the context of iterative and converging field-building efforts. This symposium will bring together student representatives from various locations to share perspectives on student contributions to field-building in EcoHealth. In particular, IAEH student section leaders will engage in a roundtable discussion to illuminate the history and current agenda of the group, with an emphasis on lessons learned and opportunities to link international student efforts and dialogue with local research and outreach. This discussion will also highlight the particular challenges (logistical, financial, technical, and otherwise) encountered by undergraduate and graduate programs in obtaining interdisciplinary training and peer mentorship in EcoHealth research, and how transitions in the field as a whole are experienced from the student perspective. In addition to perspectives offered by roundtable speakers, the symposium will incorporate student feedback received on the online blog of the Student Section in response to a series of discussions planned for summer 2012.

The roles of the medical profession in promoting sustainable ecosystems - lessons learnt across the globe

Chair: Grant Blashki

University of Melbourne

Global environmental issues represent a substantial threat to global health in the coming century including climate change, access to clear safe water and sanitation, food security just to name a few. Increasingly these environmental dilemmas are being understood and framed as health issues. The health profession is potentially well placed to provide leadership in the area of ecohealth including community education, research and policy advice. However, the medical profession is often swamped with immediate clinical concerns and the provision of day to clinical services. In our symposium we will define the concept of ecohealth and explore how it relates to the medical profession. Utilising the different perspectives of Australia, China and Canada and other countries (additional presenters welcome) we will reflect on the implications for the role of health professionals with a particular focus on education, advocacy and a research agenda.



Adaptation to climate change impacts on water and health security in North and West Africa – first research experiences from an ecohealth perspective

Chair: Guéladio Cissé

Swiss Tropical and Public Health Institute

Africa is one of the most vulnerable continents to climate change, climate variability and climate extreme events like floods and is presenting very low institutional and financial capacities for adaptation to these. In North and West Africa many poor and vulnerable communities are exposed to a high burden of some communicable water-related diseases like malaria, schistosomiasis, oncocerciasis and leishmaniasis, which are highly sensitive to climate change.

To help communities adapt to the effects of climate change in Africa (ACCA), IDRC's Programme on ecosystems and human health (Ecohealth) launched in 2008 a competitive call for projects addressing "water, health and climate change adaptation" in West and North Africa from an ecohealth perspective.

The Initiative funded 7 projects including Algeria, Morocco, Tunisia, Egypt, Guinea, Ghana, Cote d'Ivoire, Mauritania, Senegal, and Togo. The projects focused on two distinct areas of climate change impact pathways: (i) health and diseases; (ii) water and more integrated related issues.

We propose a symposium that will bring together presentations from the 7 "ecohealth" projects over two sub sessions (2*90 minutes) following the two above groups.

- **Group 1**, health related results session, 4 presentations: (i) Ghana team (Wilson Michael et al.) on the effects of climate change on the transmission of Onchocerciasis (river blindness); (ii) Guinea team (Kourouma Dan Lansana et al.) on the vulnerable forest communities' capacity to adapt to climate change effects on schistosomiasis; (iii) Algeria team (Houti Leila et al.) on the impact of climate change and land-use changes on Leishmaniasis (iv) Tunisia team (Chahed Mohamed Kouni et al.) on the impact of climate change and agriculture transformation on Leishmaniasis.

- **Group 2**, integrated and water related results session, 3 presentations: (i) Cote d'Ivoire team (Koné Brama et al.) on the adaptive capacity of urban communities to floods in two climate contexts in four countries (Ivory Coast, Togo, Mauritania and Senegal); (ii) Morocco team (Abderrahmane Ait Ihaj et al.) on the adaptation options around small dams in rural Morocco; (iii) Egypt team (Farouk Ahmed et al.) on integrated adaptation strategies in the Lake Nasser settlement areas.

The teams will share and discuss with the participants the lessons learned, the added value and the remaining challenges for ecohealth approaches to climate change adaptation among vulnerable groups. Outcome-oriented research on climate change is well grounded in vulnerability frameworks (chain of exposure, vulnerability and incidence); but there is a challenge to bridge between large-scale and often ambiguous climate change-information (modelling) and local vulnerability and adaptation.

USAID-PREDICT: Developing a global early warning system for emerging pandemics

Chair: Peter Daszak

EcoHealth Alliance

Nearly 75 percent of all new, emerging, or re-emerging diseases affecting humans at the beginning of the 21st century have originated in animals. These include HIV/AIDS, severe acute respiratory syndrome (SARS), H5N1 avian influenza, 2009 H1N1 influenza virus, and more. The speed with which these diseases can surface and spread presents serious public health, economic, and development concerns. It also underscores the need for the development of comprehensive disease detection and response capacities, particularly in areas where disease threats are likely to emerge.

Recognizing this need, in 2009 the United States Agency for International Development (USAID) launched the Emerging Pandemic Threats (EPT) PREDICT program to establish the capacity to detect viral agents in wildlife that may have the potential to emerge in human populations and spark future pandemics. The PREDICT consortium works at the human-wildlife interface with local partners in countries most vulnerable to emerging zoonoses. The EPT PREDICT program is active in 22 countries and uses SMART surveillance strategies to target viral agents in animal taxa most likely to carry zoonotic agents, such as bats, rodents, and primates. PREDICT draws on expertise from across the animal- and human-health sectors to build regional, national, and local capacities for early disease detection, laboratory-based disease diagnosis, disease response and containment, and risk reduction.

In this symposium, the participants will discuss the investments and issues involved with moving towards a global surveillance and response system for emerging zoonotic diseases, and lessons learned the past 3 years of the EPT program. This will include an EcoHealth or 'One Health' strategy for wildlife pathogen discovery, risk determination through the use of geo-temporal models, and strengthening local laboratory and field capacities for investigating and responding to disease outbreaks.

Education for Environment, Health and Development: experience from China and Europe

Chair: Fang Jing

Kunming Medical University

It is widely acknowledged that the relationship between development, environment and health is multi-directional and dynamic, and that professionals and citizens need an understanding of these issues that goes beyond the confines of disciplinary-based learning. Yet, interdisciplinary approach in education remains the exception rather than the norm. This panel will explore the experience of a number of programs that have sought to build capacity for environment and health education in China and Europe. These include: the EcoHealth capacity building programs in Asia; the research capacity building work of the Forum on Health, Environment and Development (FORHEAD); a mapping of existing programs and needs in four universities in Beijing, Guangzhou, and Kunming; and a review of interdisciplinary MA programs in the UK and the Netherlands. The papers discuss the ways in which knowledge from different disciplines is integrated in the various programs and explore opportunities for mutual learning.



Education and innovations in the global field of Ecohealth

Chair: Sonia Fèvre

Veterinarians without Borders

Communities of practice and networks in different parts of the world are developing new forms of teaching and research using Ecohealth approaches. This Symposium will bring representatives from different regions together to share global perspectives on developing and delivering innovative and varied educational programs in Ecohealth. Speakers will discuss how such initiatives have attempted to embody the praxis of Ecohealth, impacts of Ecohealth capacity building, and lessons learnt from different regions. The themes of the presentations will address: tailoring Ecohealth training to country expertise and educational contexts in Latin America and the Caribbean Region, CoPEH-LAC (Latin America and Caribbean region); transforming an Ecohealth Graduate Short Course into a Modular Teaching Manual, by Community of Practice for Ecohealth in Canada (CoPEH-CAN); multi-level training platforms adapted for students, researchers and professionals, by CoPES AOC (West and Central Africa); strategies for collaborative training linking research with educational field building, Field Building Leadership Initiative (FBLI), Southeast Asia; learning by doing in the MENA region (CoPEH MENA); and the importance of networking and technology for Ecohealth and Vector-Borne Diseases in Latin America and the Caribbean (Ecosalud y ETVs).

Ecosystem Approaches to the Better Management of Zoonotic Emerging Infectious Diseases project in SE Asia: Collating Research Outputs and Lessons Learned

Chair: Jeffrey Gilbert

International Livestock Research Institute

The 'Ecosystem Approaches to the Better Management of Zoonotic Emerging Infectious Diseases in SE Asia' project is now in its fifth year of implementation. Six research teams and two universities are carrying out research on diverse emerging zoonoses such as brucellosis, rabies, salmonellosis, campylobacter and hepatitis E; also conducting desktop reviews and developing conceptual frameworks.

As the project enters the 'consolidation' phase the various outputs from the diverse teams and research focus will be collated - to 'add value' beyond the sum of individual outputs, and to produce recommendation on 'best practices'. There are successes, challenges and other lessons learned - which are beneficial to share between the EcoZD teams and also with a greater audience.

The symposium is a forum for presentations of EcoZD research but especially an opportunity to debate the 'added value' through sharing of experiences by the country teams, IDRC, ILRI and other experts who have supported the teams, - as well as interested parties not directly involved so far.

Water Access, Sanitation and Human Health: Challenges in the Fast Growing Economies China and India

Chairs: Daphne Gondhalekar and Subramanian V Saravanan

Center for Development Research (ZEF), Bonn

The proposed session assumes importance with the growing concern of addressing major water-related diseases. It is well known that water and sanitation are important to address major water-related diseases. Less known is the impact of continuous exposure to poor water quality on human health in fast growing economies comprising about half of the world's population. Crucial questions persist:

- Does the economic success of emerging countries translate into improved water management and better human health, or pose additional risks?
- How does population growth, development of agriculture, industrialization and urbanization affect human health in poverty-stricken and undernourished regions?

Though science has contributed in addressing the threat from water-related diseases, solutions to these complex problems are still sought in a simple, one-dimensional 'cause-effect remedy' context. The proposed session aims to move beyond this understanding, to develop a research project to examine the complex links between water and health from a social science perspective. The session invites experts from China and India for an overview of the water and health scenario in the respective countries and to identify areas for priority research with an intention to developing a collaborative cross/country research project under the water and health research theme in the fast growing economies.

Application of an Eco-Bio-Social Approach to Emerging Infectious Diseases in Southeast Asian Global Outreach Hotspots: A Preliminary Baseline Study

Chairs: Pattamaporn Kittayapong and Duane J. Gubler

Mahidol University

The emerging and re-emerging infectious diseases that confront society today are an outcome of the complex interactions that occur within and among entwined natural and human systems. Human activities related to unplanned development (i.e., urbanization and deforestation, and over-exploitation of natural resources and wildlife) are intensively and rapidly occurred in tourist destination areas which are considered as global outreach hotspots. These activities escalate the emergence of vector-borne and zoonotic diseases. Control and prevention of these diseases requires a thorough understanding of the ecological, biological and sociological (eco-bio-social) determinants that fuel disease emergence. In this symposium, we will report the preliminary baseline study focusing in the areas with strong international tourism where natural and man-made systems overlap in four tourist island sites, i.e., Bali, Indonesia; Palawan, Philippines; Koh Chang, Thailand; and Cat Ba, Vietnam, in order to identify and eventually reduce risks to potential vector-borne and zoonotic diseases in these global outreach hotspots. In addition, we will highlight how social science could be applied to use in ecohealth research, especially in EIDs.



Visioning for Abidjan 2013: tools and emerging processes from Sub Saharan Africa

Chair: Édouard Kouassi

Centre de Recherche Hôpital Maisonneuve-Rosemont

This symposium seeks to congregate abstracts relevant to Sub Saharan Africa Ecohealth in order to form a specific workshop discussion around the theme of: Pathways for Sub Saharan African Ecohealth: Self Actualization to Inter-jurisdictional Collaboration - beyond colonial heritage. We wish to take advantage of the participation of key investigators and policymakers from SSA in the Kunming Conference to consolidate ongoing collaborations, and to plan for future activities, including the first Africa Regional Ecohealth Conference to be held in Abidjan (Côte d'Ivoire, West Africa) in 2013.

Pedagogical Approaches to Ecohealth

Chair: Suzanne McCullagh

University of Guelph

The papers in this session analyse a some ecohealth teaching cases and explore the pedagogical approaches adopted. It is frequently claimed that ecohealth teaching should itself model the approach, and should thereby be participatory, action oriented, attentive to issues of equity, etc. When we look to educational theory, however, we are confronted with a myriad of concepts and theories; participatory learning, collaborative learning, situational learning, cooperative learning, problem-based learning, constructivism, adult learning theory, to name only a few. The papers on this panel will bring out some of the key features from a relevant selection of educational theories and show how they can be used to inform and deepen ecohealth teaching praxis. The papers will suggest which pedagogical approaches work well with which features of ecohealth curriculum, and some tips on how to create the right context for ecohealth teaching given institutional constraints.

Scaling up policy influence and interventions in Ecohealth

Chair: Hung Nguyen-Viet

Hanoi School of Public Health

Twenty years after the first UN Conference on Sustainable Development, calls intensify for a paradigm shift from sector-based development to a more integrated global sustainability agenda founded on scientific evidence. Safeguarding the Earth's natural resources and processes and people's well-being are increasingly recognized as interdependent, requiring stronger efforts in reducing poverty and conflict over resources, and enhancing human and ecosystem health. Research is seen as a means for influencing policy and practice through scientific evidence and innovation, but needing to be informed by diverse local conditions and needs.

Site-specific ecohealth research can provide practical guidance in this quest for sustainable change in people's health and livelihoods. However, bringing to scale social and/or technological innovations rooted in ecohealth research is often challenging and far from self-assured. Scaling up implies shifts in interests, visions, constituencies and trade-offs (costs and benefits) that involve interactions across multiple spatial (e.g. field, farm, watershed) and socio-political (e.g. household, community, municipality, region, country) scales.

This symposium brings together diverse examples from ecohealth research in Africa, Asia, Middle East, and Latin America, spanning different topics such as prevention and control of vector borne diseases; soil health, food diversity and nutrition; land use change and public health, with variations on a common theme: experiences, lessons learned and challenges in scaling up interventions from ecohealth research. A poster-aided interactive session with up to 6 project cases will be used to explore different levers and pathways for transforming social-ecological systems into healthier, more equitable and sustainable alternatives for development.



Water, sanitation and health: more integrative approaches needed to address the basic needs of humans

Chair: Hung Nguyen-Viet

Hanoi School of Public Health

The last WHO/UNICEF Joint Monitoring Programme report for Water Supply and Sanitation shows that the MDG on drinking water target was met in 2010, but sanitation target is still off-track. A lot of things remain to be done in terms of drinking water safety and access to sanitation in developing countries particularly in Africa and Asia. Some main reasons for failures in water supply and sanitation interventions are the weakness of the inter-sectoral collaboration, technical solutions without considering socio-economic, cultural and local perspective, political will, lack of maintenance to ensure the sustainability.

Increasing coverage of water supply and sanitation is crucial, but improving the quality of water supply and toilets is also important for health improvement. What is often missing in water and sanitation sector is the issue of maintenance and integrative planning for management of wastes, which would affect health and environment. Recovery and reuse of resources from wastes while ensuring health safety and their effectiveness contribute to the sustainable development. It is largely accepted that new integrated approach to water supply and sanitation is needed to sustainably provide access to water and sanitation for most vulnerable people.

This session will present and debate most recent works across the world on the nexus of water, sanitation and health extended to an inter-disciplinary research taking into account environmental, social and economic perspective. Presentations will be followed by a panel discussion composed by presenters but also key reference in the field of water and sanitation.

Thailand's Ethnic Minority Highlander Communities: An Integrative Health Research Need and Opportunity

Chair: Manoj Potapohn

Mahidol University

Thailand's highlander ethnic minorities (commonly called hill tribes) along the Thai-Myanmar border face a unique set of linked environmental, economic, and health challenges. Represented by numerous distinct ethnic groups (consisting of mostly Akha, Hmong, Karen, Lahu, Lisu, and Yao ethnicities), they number nearly a half million people in the Northern Thailand borderland provinces alone. As with most rural poor, the livelihoods and health of many have been negatively impacted by increasing external pressures from regional development and globalization. Added to these pressures are forced changes in their livelihoods and deforestation originating externally, yet these problems are often blamed on their traditional swidden agriculture. Compounding these difficulties is the lack of land tenure rights, bureaucratic barriers to citizenship, language barriers, and illiteracy. Twenty years ago most hill tribe villages had limited dependence (or needs) beyond themselves and their local ecosystems, and certainly beyond the border region. Today, virtually all hill tribe villages either in the process of becoming socially, ecologically, and economically integrated with the larger region. This is bringing about significant challenges in terms of exposure to new health and disease risks from foods, pathogens, and pesticides, as well as declining water quality and quantity, soil fertility, forests, and biodiversity. This symposium addresses the linkages between ecosystem, livestock, and human health through projects aimed at better understanding these interdependencies as a basis for designing and implementing interventions. Collectively they provide an opportunity to understand the multi-dimensionality of health as considered by Ecohealth and One Health perspectives.

"Ecohealth One": Trans-Regional Networking for Research and Training in Ecohealth

Chair: Johannes Sommerfeld and Pattamaporn Kittayapong

World Health Organization and Mahidol University

Research, training and networking in the field of ecosystem approach to health or ecohealth have grown rapidly around the globe with several funded initiatives, especially those of IDRC, Canada. However, communication and information sharing across the continents are still very limited. In this proposed panel, ecohealth experts and network coordinators from Asia, Africa and Latin America and the Caribbean will join an effort to establish link for trans-regional networking of existing ecohealth networks. Representatives from South and Southeast Asia (EHNA), East-South (ECOHESA) and West-Central Africa (CoPEH-WCA), Latin America and the Caribbean (FBLI-LAC) including CoPEH-LAC representing different regional networks will share their perspectives on the panel. On-going ecohealth activities, i.e., research, training and networking, in each continent will be presented and highlighted. An action plan for establishing trans-regional networking for global communication, information and resource sharing and capacity building in the field of ecohealth will be proposed and discussed. It is expected that linking ecohealth network communities as "Ecohealth One" will promote rapid information flow and global collaboration which should benefit all network members and individuals working in the field of ecohealth across the continents.



Barriers and Bridges to integrating Eco-health into policy applications: A “global reality check” workshop

Chair: Jerry M Spiegel

University of British Columbia

While the ecosystem approach to human health attempts to apply a holistic approach that places the translation of knowledge to promote equity at its heart, documentation of successfully applying this approach to a scale of policy application remains limited. At a meeting of communities of practice occurring at the 2010 EcoHealth conference in London, a working group (Policy Working Group of the International Network of Communities of Practice in Ecosystem Approaches to Health - CoPEH-CoIN) was established to promote a focus on this issue. To take stock of progress in meeting this challenge, we are organizing an interactive workshop that will:

- i) propose and debate a framework for policy analysis for discussion and review, based on a scoping review of literature explicitly addressing the application of ecohealth approaches to policy.
- ii) present case studies drawn from communities of practice operating in different continents (Africa, Latin America, Asia, Middle East) .
- iii) Conduct small working group discussions on the concepts of barriers and bridges, notions that have often been used to reflect on the function of adaptive systems.

In following this interactive session, we hope to stimulate the development of consensus on key questions that can shape a research agenda around key policy-related questions that should receive increased attention prior to the next Eco-Health conference, allowing evidence to be accumulated on effective methods for integrating ecohealth approaches into policy. It is our hope that this can stimulate the creation of a broader network with an interest in this topic area that can take advantage of interactive communication technologies as a follow-up to the workshop.

Eco-Health Assessment on Poultry Production Clusters (PPCs) for the Livelihood Improvement of Small Producers in South-east Asia

Chair: Wang LiBin

China Agricultural University

After the outbreak of Avian Influenza, the governments in South-east Asian countries applied various control measures and posed higher bio-security requirements for poultry producers. This has caused significant changes in the poultry production structure, which has driven small producers out of the expanding markets and resulted in the loss of income and employment of the small producers.

As one alternative, many Asian countries promoted the construction of poultry production clusters (PPCs) as a vehicle to drive small producers into intensive and standardized livestock production. In spite of the fast growth of production clusters, there is very limited empirical evidence from eco-health perspective on the impacts of production clusters and their implications for the control of emergent infectious diseases.

This purpose of this research is to assess the impacts of these PPCs on the socio-economic status of the small producers and their health with specific regards to emerging zoonotic diseases. This research is funded by IDRC, CIDA, and AusAID, and involves 4 Asian countries (China, Indonesia, Vietnam, and Thailand). This research was carried out in a comparative and eco-health approach, assessed the social, economic, human health, control of infectious diseases, and environmental impacts of the PPCs. It also reviewed the origins, development, current status, and future trends of PPCs in each country, explored the ways to improve the PPCs from multiple disciplines through eco-health approach, and made policy recommendations on how to improve PPCs so that the vulnerable small producers can maintain their livelihoods through safe poultry production.

Community-based EcoHealth Intervention

Chair: Xu Jianchu

World Agroforestry Centre

EcoHealth - the transdisciplinary study of dynamic relationships and interactions among peoples, ecosystem and human health - provides both a theoretical framework for understanding the changing human-ecosystem interface and a practical ecosystem approach to health in the context of global change.

The symposium is seeking to actively engage grassroot practitioners, including community facilitators of local NGOs through facilitating inspiring synergies between indigenous and scholars' views on holistic health, equal dialogues between international and local practitioners, and thoughtful interfaces between scholarly researches and community interventions.



Water and Health in China from the Perspective of Non-Government Organizations

Chair: Xu JianChu

World Agroforestry Centre

Over the past decades, the remarkable economic growth and population expansion of China has been obtained at a tremendous cost to the country's environment. Accompanied with booming industrialization and urbanization, China is facing serious challenges from water issue. Water scarcity and water pollution, poor water management and alarming drinking water quality, all have contributed to these widespread problems of water throughout the country. Meanwhile significant outbreaks of illness, including cancers, are being reported in heavily polluted regions, driving up health care costs and public concern.

The water-related problems have encouraged public concern and efforts. Grassroots environmental efforts have grown in China, and have had some success at raising awareness and spurring action. The symposia supported backbone NGOs working on water issues in China targets at creating and sustaining a dialogue on practical approaches for managing socioeconomic integration and transitions in ways that improve resilience of ecosystems and human health.

Workshop on Population EcoHealth Vulnerabilities and Emerging Food-Borne and Zoonotic Parasitic Diseases in Asia

Chair: Zhou XiaoNong

National Institute of Parasitic Diseases (China)

Throughout Asia, a number of food-borne and zoonotic parasitic diseases (FBZPD) such as cysticercosis, taeniasis, trichinellosis, clonorchiasis, echinococcosis and schistosomiasis constitute considerable public health problems. Today, many of these diseases are on the increase due to the interaction of multiple factors, including changing ecosystems, changing food production and distribution systems, culturally determined food preferences, increased preference for (raw) meat consumption and other bio-social factors and factors related to the host-parasite interaction. Overall, the epidemiology reflects rapid economic, environmental and social change in the region.

One Health and Ecohealth: Enhancing convergence

Chair: Jakob Zinsstag

Swiss Tropical and Public Health Institute

The term “One Medicine” coined by Calvin Schwabe focuses attention on the commonality of human and animal health interests. The underlying concept is traceable to the late 19th century, in contributions of the German pathologist and architect of social medicine Rudolf Virchow. Schwabe states that there is no difference in paradigm between human and veterinary medicine and that both medicines have the same scientific foundations. Yet, human and animal health developed into fairly segregated disciplines or ‘silos’, separated at the academic, governance and application levels. In recent decades, the concept of “One Medicine” evolving to “One Health” has gained momentum worldwide, driven initially by fears of a possible pandemic of H5N1 avian influenza, but now more broadly with respect to zoonotic diseases and to food safety.

In considering “One health” to be any form of closer cooperation between human and animal health sectors, it is necessary, but not sufficient, to recognize the inextricable linkage of humans, animals and the environment. In contrast, a sufficient requirement for a “One Health” approach is evidence of better health for humans and animals, or financial savings from such a closer cooperation between the two sectors which could not be obtained if they worked in separation. Recently, “One health” conceptual thinking has evolved towards systemic approaches considering health as an outcome of social-ecological systems. This includes concerns about social equity and the “integrity” of the environment. “One Health” is clearly part of the broader consideration of ecology and health, which is reflected, for example, in the title of a high level technical meeting on health risks at the human-animal-ecosystems interfaces held in Mexico (November 2011). This symposium will explore the conceptual linkages of “One health” and Ecohealth, aiming at enhancing their convergence.



The Economics and Politics of Ecohealth and Watersheds

Chair: Karla Zubrycki

Water Innovation Centre, International Institute for Sustainable Development

Explicit attention to political and economic dynamics is necessary in order to position the social and environmental determinants of health within their wider macro-economic and policy context. This session will draw attention to important political and economic dimensions of the ecohealth concept. Although modern global environmental assessments such as the Millennium Ecosystem Assessment stress the dependence of human well-being on well-functioning ecosystems, the logic of ecosystem management as an efficient public health investment has not penetrated higher levels of public health and environmental policy formulation.

The Network for Ecosystem Sustainability and Health (NESH) and the International Institute for Sustainable Development (IISD) will present their research on watersheds as the elemental environmental unit for improved public health benefits, and will discuss the feasibility of quantifying the economic value thereof as a strategy for asserting policy influence.

Watersheds concentrate water, contaminants, nutrients and sunlight; a well-managed watershed provides its inhabitants with benefits such as cleaner water, increased food and income security (e.g., fishing, farming), employment, recreational opportunities and greater protection from floods and droughts – a key climate adaptation consideration. Managing for health at a watershed scale offers the double dividends of improvements to both social and environmental determinants of health, and provides a powerful complimentary logic to Integrated Water Resources Management (IWRM).

Drawing from case studies and projects from around the world, this session will review methodologies for valuing the health benefits of governance, stewardship and management at a watershed-scale, and strategies for communication and policy influence.



ORAL PRESENTATIONS

Challenges and lessons in educating health professionals about air pollution and climate change in Canada

Alan Abelson

University of Toronto, Toronto, Canada

Air pollution is responsible for a substantial burden of disease in both developed and developing countries, but most clinicians do not recognize this “upstream” factor when they assess patients with exacerbations of respiratory or cardiac disease. The Air Quality Health Index in Canada is a health risk communication tool that indicates the risk to health from multi-pollutant exposure, and helps vulnerable patients reduce their exposure to air pollution. It is used both in population health, with broadcast messages on radio and TV, but also as a clinical tool for primary care health professionals to counsel at-risk patients. I will describe and discuss lessons learned from an inter-disciplinary “train-the-trainer” program, developed by the Canadian College of Family Physicians and Health Canada, to reach out to health professionals, as well as from an accredited educational program for family physicians on broader issues in climate change in Canada.

Effect of climate change on food crop production and vulnerability assessment of Oyo state, Nigeria

Samuel Adewuyi, Luke Okojie, Abiola Folorunso, Rahamon Sanusi

University of Agriculture, Abeokuta, Ogun State, Nigeria

This study assessed household vulnerability to climate change and its effect on yam and cassava production in Oyo state, Nigeria. Primary and secondary data were used for the study. Data on yam and cassava yield between 1990 and 2009 were obtained from the Oyo State Agricultural Development Programme (ADP) while data on climate variables between 1976 and 2010 were obtained from the Nigeria Institute of Meteorology, Oshodi. Primary data on the components of vulnerability that is adaptive capacity, sensitivity and exposure were also obtained from cassava and yam farmers using structured questionnaire to assess their vulnerability to climate change. Multistage sampling technique was employed to select 120 respondents across the three agro-ecological zones of the study area. This was done by purposively selecting five farm villages in each of the three agro-ecological zones in the study area and randomly selecting eight farmers from each of the villages. Trend, regression and principal component analytical tools were used to analyze data collected. The integrated vulnerability assessment approach was adopted using the vulnerability indicator. The result showed that the mean annual temperature and mean annual sunshine hour have been increasing by an average of 0.012oC ($p<0.01$) and 0.004 hours ($p<0.01$) per year respectively. This confirms the occurrence of global warming in the study area. The study revealed that sunshine hour significantly ($p<0.05$) affected yam yield. Household’s vulnerability to climate change in the three agro ecological zones as measured by the vulnerability index (VI) was found to be highest in the derived savannah (VI=-0.99) followed by the savannah (VI=0.46) and lowest in the rain forest (VI=0.53). The derived savannah zone recorded the highest vulnerability with a relatively low proportion of the population having access to quality home (2.5%), insecticide (30%), fertilizer (30%), improved seedlings (30%), road (15%), health services (15%), primary and secondary schools (15%), veterinary services (0.03%), food market (42.5%), and microfinance institutions (0.03%). The study recommended among others that crop-breeding researchers should work towards developing improved varieties of cassava and yam that can cope with future expected change in climate. Also, integrated rural development schemes aimed at increasing access to basic social amenities should be established by the government with the cooperation of the residents as this will improve adaptive capacity and thereby reduce vulnerability of farmers to climate change in the study area.



Eco-Health Assessment on Poultry Production Clusters (PPCs) for the Livelihood Improvement of Small Producers (Case Report in Thailand)

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During the years 2003-2004, avian influenza outbreaks threatened the Asian continent and the disease caused widespread damage to Thailand. To control the outbreaks, the Thai government devised many policies including poultry production clustering (PPC). Economic impacts on poultry production clusters (PPCs) in the early stage after avian influenza outbreaks in Thailand arose from the requirement for farmers to follow the government avian influenza control measures, whereby farmers had to invest in housing, farming system, and biosecurity system. After poultry farming became profitable, a part of the revenue was used to repay the debt and the rest could be kept as retained earnings. With regard to social aspects, it was found that poultry production clusters were developed from various patterns of relationship such as extended family relationship, cooperative group, or network of poultry farmers and large private companies, which joined to promote the contract farming system. As for the control of communicable diseases which could be transmitted to humans and animals was involved, after the measure to promote and support poultry farms in their adoption of farm standard and more rigorous application of biosecurity measures, it was found that the outbreaks of the disease in poultry farms decreased. Finally, poultry production clusters in certain areas encountered pollution problems arisen from farming such as air pollution caused by ammonia odor and flies, and waste released into waterways, which affected the surrounding communities.

The geospatial variation of population genetics and bio-ecosystem patterns related to the transmission of food-borne diseases in China

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Food-borne parasitic zoonoses (FBPZs) cause death and serious diseases in humans and animals worldwide, and are of both public health significance and socioeconomic importance. The FBPZ problem is severe in mainland China, where approximately 150 million people are suffering from FBPZs and more people are at risk. Here, the current status of the FBPZ problem, the geospatial variation of population genetics and bio-ecosystem patterns related to the transmission of these diseases in China are reviewed; strategies and measures for effective control of FBPZs are proposed.

Small dams as Climate Change Adaptation tools in Morocco: options for optimization and challenges in implementation

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Morocco is a vulnerable country to climate change and variability, which affects primarily water availability. In mountainous areas, poor communities are more exposed to climate change effects because of water scarcity that impacts the economy, health and ecosystems. To improve communities' adaptation capacity, many options were implemented, such as small dams. They contribute to rainwater harvesting, replenishment of the water table, flood control and, more importantly, improvement of water availability for rural communities. However, these benefits must be considered in relation to potential health risks. This paper seeks to present and share learned lessons on integrated process to build better adaptation options and community adaptation capacity around small dams in southern mountainous rural Morocco. The work was carried out with three rural communities around small dams in southern Morocco. Data were collected through secondary data, community participatory workshops, surveys, on-field testing of options and laboratory analysis. Beside the description of relationships between various components of the ecosystem and water availability impacts, water access improved household and human hygiene behavior. At community level the learning process, including the testing of various technical and institutional options, highlights the need to involve local and regional stakeholders to optimize results impact. For example adapted drip irrigation can save 35% of irrigation water. On the other hand, agriculture diversification through new cash crop introduction, such as saffron, local product promotion, such as dried cactus pears fruit promotion and thyme marketing improves significantly farm income. At organizational level women's cooperative promoted local products and improved income. Community member's empowerment, through training, provided more capacity to build partnerships to support implementing and disseminating the options tested. Community members paid special attention to health, water borne diseases, as there local organizations were trained and informed about water quality issues. Small dams can thus play their role and contribute more effectively to strengthen local capacity for adaptation to climate change. However, more attention should be given to better design technical, institutional and organizational options that support community to increase income levels for people and then improve their feeding habits and access to healthcare.



Food security, poverty alleviation, women's empowerment and wildlife conservation: the benefits of Newcastle disease control in village chickens in Southern Africa

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Village chickens are an integral component of livelihoods strategies and farming systems in many rural households in Southern Africa. They contribute to income generation, food security, fertilizer, pest control, and social capital. *Newcastle Disease* (ND) is endemic in Southern Africa and outbreaks cause high mortality in village flocks each year. This paper reviews the sustainable control of ND through the use of thermotolerant ND vaccine, which has led to significant increases in village chicken production across a range of agro-ecological zones in Malawi, Mozambique, Tanzania and Zambia. Village chickens are frequently under the control of women and children and improved production promotes the empowerment of women. In rural households affected by HIV/AIDS, they play a particularly important role because they provide a source of high quality nutrition and income without requiring much in the way of labor or financial inputs. The range of benefits provided by improved village chicken production reduces villagers' reliance on bushmeat. The control of ND is the start of dialogue with farmers and community leaders. With increasing flock sizes and a finite scavenging feed resource base, farmers must then decide to increase off-take of chickens or provide locally available supplementary feed. Other challenges such as the control of fowl pox and external parasites also become increasingly important. Changes to village chicken production must be balanced with other farming activities and their impacts on the local ecosystem.

The Plastisphere and Pathogen Pollution: Microbes on plastic marine debris

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Plastic marine debris (PMD), now the most abundant debris in the ocean, is a recent introduction to marine ecosystems first reported only 40 years ago. Oceanographic models demonstrate how quickly human-generated debris can impact the 'pristine' gyre interiors, traversing more than 1000 km from shore in less than 60 days. PMD affects fish, birds, sea turtles, and marine mammals via ingestion and entanglement mechanisms, but studies of plastic-associated microbial communities are lacking, and we know little about the impact of this anthropogenic substrate and its attached community on the oligotrophic open ocean gyres where it is accumulating. Using pyrotag sequencing, we investigated the microbial communities on polyethylene (PE) and polypropylene (PP) plastic from the North Atlantic Subtropical Gyre (NASG). Our analyses unveiled for the first time the breadth of PMD microbes, what we call the "Plastisphere". Because PMD persists longer than natural substrates (e.g. feathers, wood, and macroalgae) and traverses significant distances, it can transport invasive species or animal and human pathogens. Harmful algal species were reported from PMD in the Mediterranean, and *Vibrio* was the most abundant OTU found in our PE sample where it constituted 25% of the community. Although a marine endemic bacterium, the genus *Vibrio* includes human and animal pathogens and this OTU shared 100% identity with sequences from a *V. alginolyticus* isolated from a diseased coral reef fish. Plastic could serve as a vector of infectious diseases since both birds and fishes ingest PMD and a recent study found fishes contain human pathogenic *Vibrio* strains.



Spatial analysis and risk factors of human Toxoplasmosis at special province of Yogyakarta through Ecohealth approaches

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Toxoplasmosis is a public health problem due to high economic social impact in relation to patient care, born defect such as hydrocephalus, mental retardation, and retinochoriditis. Risk factors likely contributing to the spread of Toxoplasmosis in Yogyakarta are the presence of definitive host, altitude, land surface temperature and climate condition that favors the development of oocyst, but also eating habits, use of non chlorinated water, gender and occupation. The aim of this ILRI and IDRC supported research is to study the prevalence of Toxoplasmosis in the population and identify potential risk factors trough the use of an Ecohealth approach. 1050 samples were collected between April to October 2011 using double cluster design. Data on potential risk factors were obtained through interviews and participatory approaches on household level. For serology ELISA (IgG and IgM) was performed. Risk factors analysis was performed and related odds ratio were calculated. Prevalence results were mapped using GIS. Serological prevalence of Toxoplasmosis for the Province of Yogyakarta was 61,5% with highest values for Kulonprogo District (78,6%), followed by Sleman (72,4%), the city of Yogyakarta (69,5%), and the District of Bantul (57,6) and Gunungkidul (29,5%). Identified risk factors significantly associated with prevalence of Toxoplasmosis in the study area were gender, geography, contact with cat, undercooked goat meat, raw vegetable consumption at food stalls, occupation related to contact with raw meat, and activities related to contact with soil. Age, undercooked chicken and beef consumption, and raw vegetable consumption at home were not associated.

Pakistan: Reflections of the loss of the ecological health in some of the natural ecosystems on the socio-economic health of the local people

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Pakistan is home to diverse habitats that support some of the unique biodiversity of global significance. Being one of the nations where a greater chunk of human population lives below poverty line, Pakistan, has to be more conscious of its natural wealth that has overwhelming capacities to provide social services to its people even if economic growth is much lesser than the desired levels. Pakistan is home to the second largest Juniper forests of the world. Besides being a shelter for one hundred thousands of people, the forests provide valuable ecological services in maintaining aquifers, fertile soils, pollinators, and medicinal plants. Medicinal plants alone are the major source of treatments for 98% of the dwellers of mountain forests who cannot afford to travel to cities and get the allopathic treatment for their health problems. However, the forest suffers from severe degradation due to anthropogenic pressures but more so from the lack of adequate natural regeneration that has become the number 1 issue over the past 3 decades. Though elaborated scientific evidence is required to further prove and document it, people do believe that since the *Dark throated Thrush*, a bird, that used to come in hundreds of thousands previously, are reduced to just a few hundred in number, because of hunting in Chitral. The valley of Chitral is almost a thousand miles away from the Juniper forests, which is being visited twice by the thrush during its migration from, and to Central Asia. This bird feeds on juniper berries and since good regeneration of juniper is seen under the trees where the thrush roosts, is thus believed to be a big natural agent helping it. The forest, being largely consisting of predominantly older trees with 2-4 thousands of years in age, does strongly need natural regeneration for it to survive forever to preserve this heritage of global significance and save an important source of living for local people. Climate change is showing up and, coupled with lack of capacities of local community to predict the negative influences of the change and adopt coping strategies accordingly, the people have already started suffering huge economic losses. An example is available of the high altitudinal pastures with *Salix* as predominant species of the grassland that has lost its source of irrigation due to glacier retreat and has turned to a dry land habitat with stunted Juniper as dominant tree. This has forced the local people to reduce their livestock numbers by almost 50%, with significant impact on the local economy of, and availability of dairy products for the growing populations. The people in this area already suffer from malnutrition and their livestock from various diseases linked to less nourishing forage. Several species of dragon- and damselflies are no longer seen in the plains of Pakistan. Common club-tailed dragonfly that is a voracious feeder on mosquitoes has almost been disappeared from the places where it occurred in abundance about 4 decades ago. On one hand, Pakistan has lost a species that is a natural indicator of the health of the aquatic ecosystems, but on the other, it is left alone to fight the mosquitoes causing dengue and malaria. Currently, there are frequent reports of the increase in dengue and malaria in several places of Pakistan. The presentation shall elaborate on these and other examples that link the human health and well being to the health of natural ecosystems in Pakistan.



Strategies for adopting Ecohealth theory and practice: lessons from action-research on zoonotic diseases in Southeast Asia

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This study examines challenges, opportunities, and trade-offs encountered over a one-year period by eight multidisciplinary research teams conducting Ecohealth action-research and outreach on zoonotic diseases in five Southeast Asian countries and in Yunnan Province, China. The teams are a core initiative of the EcoZD project (Ecosystem Approaches to the Better Management of Zoonotic Emerging Infectious Diseases in Southeast Asia). They consist of university, government, and non-government partners who are building institutional capacity for Ecohealth research on linked animal & human health systems. The teams engage in knowledge exchange and peer learning for formulating strategies to fuse conventional biomedical and epidemiological research methods with more integrative methods that focus on socio-ecological system dynamics, community participation, environmental justice and equity, cross-disciplinary learning, and policy action. This study explores lessons learned and best practices experienced by the teams. The study uses qualitative methods such as focus group discussions, key informant interviews, and review of research team communications. The study elaborates best bet strategies for building Ecohealth action-research capacity of learning communities through the following: synergistic partnerships, non-hierarchical knowledge exchange, and focus on innovative organizational or communication methods to stimulate change in knowledge, attitude, practices (KAPs) related to adoption and adaption of Ecohealth theory and practice.

Impact of socio-cultural factors on the management of neurological diseases in Africa

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Cultural and religious issues and beliefs are important in Sub-Saharan Africa. They influence the value placed by society on neurological health, the presentation of symptoms, illness behavior, access to services, pathways through care, the way individuals and families manage illness, the way the community responds to illness, the degree of acceptance (stigma, discrimination) and support experienced by the person with neurological illness. Leading neurological disorders include cerebral palsy, mental retardation and other developmental disorders, epilepsy, peripheral neuropathy, stroke, and, increasingly, the nervous system complications of HIV/AIDS, trauma, and alcohol abuse. The disabling rather than fatal nature of many neurological disorders, the stigma associated with brain disorders, and the enormous difficulty in gathering epidemiologic data have resulted in their being underreported and neglected in Sub-Saharan Africa. Among the hundreds of specific disorders, some common and some uncommon, many are potentially preventable or treatable. For example, most developmental disorders and many strokes are preventable. Epilepsy, a common problem, is potentially treatable with currently available low-cost medications. Disorders such as HIV/AIDS and the dementia that often accompanies HIV infection are currently untreatable, but their prevalence can be drastically reduced with antiretroviral therapy intervention. These cultural and other contextual factors are important considerations in developing locally appropriate health care policies, programs, and services.



Assessing the threat of zoonotic transmission of paramyxoviruses from African fruit bats

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Bats are reservoirs for a variety of zoonotic viruses, including filoviruses that cause highly-fatal hemorrhagic fevers, lyssaviruses that cause rabies and viruses related to SARS-coronavirus. Bats also carry numerous paramyxoviruses capable of cross-species transmission. Hendra and Nipah viruses (collectively known as henipaviruses) are examples of paramyxoviruses harbored by bats that are both lethal zoonoses and agriculturally-devastating pathogens. We studied a large (>1,000,000), urban population of African straw-colored fruit bats (*Eidolon helvum*) suspected of harboring henipa-related viruses that lives in close proximity with humans and domestic animals, roosting directly over a hospital in Accra, the capital city of Ghana. The species is also consumed as bushmeat, increasing the opportunity for contact with human populations. We examined bat urine samples for evidence of paramyxoviruses using a combination of PCR and isolation as a step toward assessing the threat of viral spill over from this species. We have found evidence of highly diverse paramyxoviruses in this population and high rates of infection of the bat population over a long period of time. Additionally, we have found serological evidence of spill over of some of these viruses into the human population. The presence of such a large diversity of paramyxoviruses in this population and the apparent occurrence of zoonotic spillover indicate the importance of targeted surveillance of urban wildlife species.

Henipavirus infection dynamics in a captive population of African straw-colored fruit bats

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Fruit bats are the reservoir hosts for both Hendra and Nipah viruses (collectively known as henipaviruses). These viruses spill over into human and domestic animal populations causing morbidity, fatalities as well as restrictions on trade. There continue to be outbreaks of human infection with Nipah virus in Bangladesh and Hendra virus continues to spill over in Australia causing disease in horses and, sometimes, in humans. There have been 33 spillovers of HeV in Australia with over half of those occurring in 2011. Despite these significant consequences for human and animal health, and irregular spill over patterns, little is known about the dynamics of henipavirus infection in their natural hosts. Results from experimental infections of bats are inconsistent and are complicated by a lack of prior exposure history. Captive studies have been relatively short-lived, comprised of few animals and have utilized laborious serum neutralization testing requiring testing at Biosafety Level 4. Here, we used the African straw-colored fruit bat as a model to explore the dynamics of infection of henipaviruses in their natural hosts, testing for antibodies using sensitive Luminex assays that can be done within standard laboratories. By observing changes in individual antibody levels in a breeding population of approximately 80 bats over a period of 30 months we have made important observations regarding persistence of henipavirus infection in bats. These include: maternal antibody presence and waning; the apparent presence of virus transmission within small populations and fluctuation of antibody levels in females, which have important consequences for the likelihood of spill over to surrounding human populations.



Low noise circulation of West Nile antibodies virus in wild Moroccan Passerine Birds

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The West Nile Virus belongs to the Flavivirus group and is found in animals and sometimes human in the countries of Africa, Europe, West of Asia, Middle East and America. Our objective is to check the hypothesis of the West Nile Virus low noise circulation and to establish the list of wild bird species, which participate at the antibodies circulation. We have worked in six stations whose two where the epidemics West Nile diseases have started in 1996 and 2003 while the other four stations have never registered any death in equine. Blood's samples were taken from 365 captured birds coming from 31 species of Moroccan Birds. The serum was tested by the ELISA-Ab competition technique. All the visited stations revealed the presence of the antibodies West Nile virus with in general low rates of prevalence. The 9 species, which have revealed positive tests among the 31 captured, are forest passerine birds. The presence of the low noise circulation of antibodies during the 2008 to 2009 period is established in all stations. The seroprevalence difference between the stations is in an inverse proportion with the captured species number. The last outbreak occurred in 2010, it shows an emergence of the epidemic every seven years.

Conceptualizing socio-ecological and technical systems: what practical value for global public health?

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The socio-ecological systems framework attempts to holistically evaluate the complex interrelationships existing between different social and biophysical phenomena. However when designing, implementing and monitoring a disease control intervention it is necessary to integrate a more robust understanding of the role and nature of technology and technological adoption with the socio-ecological system. Recent work calls such a framework a socio-ecological and technical system. The assumption is that by conceptualizing the social, ecological and technical components of a system, public health practitioners will be in a better position to create and implement more appropriate interventions since they will better appreciate the existing opportunities and potential barriers for disease mitigation. But how can one delineate this complex system and how practically useful are such conceptualizations? This paper will contribute to this new and emerging theoretical landscape by combining a socio-ecological approach with theoretical perspectives developed by science and technology studies. Based on extensive ethnographic field research conducted in Northern Uganda, Eastern Zambia and Central Tanzania as part of a multidisciplinary research group, this paper will draw upon evidence from three community-based disease control projects for neglected zoonoses (sleeping sickness, cysticercosis and rabies). While these three control interventions focused on different disease dynamics and were influenced by their context-specific socio-cultural and ecological characteristics, they also differed significantly in their application strategies and use of technology. This paper will present a socio-ecological and technical systems framework for each intervention and discuss the practical merits of this approach for use by public health teams.

Exploring asthma “risksapes” with spatially explicit, real-time data: application of a novel health technology to assess the effect of climate change on asthma

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Asthma inflicts a significant health and economic burden globally. Over 235 million people suffer from asthma worldwide, and a quarter of a million people die of asthma every year, placing a major strain on health systems within many countries. Intensifying urbanization has been associated with an increased prevalence of asthma; however, the exact environmental mechanisms remain unclear. With more than 50% of the global population now residing in urban centers, it is essential to clarify these mechanisms. Research has identified a number of environmental triggers of asthma; however, limited data, such as time-lagged counts of asthma hospitalizations or aggregated prevalence, make it impossible to assess these triggers in real-time. We aimed to determine the fine-scale environmental drivers of asthma using novel, spatially explicit asthma exacerbation data. Data were collected by Asthmapolis, a health technology company that has engineered GPS-enabled asthma inhalers, allowing them to record the precise time and location of inhaler use. Using GIS, we extracted georeferenced environmental, climatic, and neighborhood socio-economic data for each inhaler use point. Specifically, we focused on how proximity to green space and traffic pollution was associated with asthma exacerbations. Building upon these data, we predict current and future geographic distributions of asthma “hotspots” with projected climate change. This project will help to improve understanding of environmental triggers of asthma, strengthen surveillance, target interventions and plan for future asthma risk with climate change. Lastly, it serves as an example of an academic-private sector partnership to improve the availability and utility of health data.



Ecohealth assessment on poultry production cluster (PPC): Case of PPC in Subang, West Java Indonesia

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Study on Ecohealth Assessment on Poultry Production Clusters (PPCs) for the Livelihood Improvement of Small Producer is on-going in Subang district, West Java. Subang is a center of poultry industry in Indonesia with a population of 39.5 million head of broilers in 2010. Qualitative survey was carried out with various stakeholders to better understanding of PPC. PPC in Subang was not part of government program, but it was established by partnership between nucleus and farmers. A good economic return for farmers can be seen partly by increasing the demand to increase the scale. Farmers also receive additional income from manure that reduces the cost of urea fertilizer. There is still a disturbed feeling from community and flies are a direct interference perceived by villagers. Chickens are routinely vaccinated against *Newcastle Disease* (ND), *Infectious bronchitis* (IB), *Avian Influenza* (AI) and *Infectious Bursal Disease* (IBD/Gumboro). ND is the most alarming disease and become the priority to manage. Manure application for fertilizer without composting, which could have impacts on public health, especially food-borne illness such as salmonella. There was not encountered gastrointestinal disease, respiratory disorders and skin diseases amongst communities around the PPC. PPC has negative impacts on environment as unpleasant odor and growing population of flies are disturbing villagers. Such negative impacts, especially with regard fly population and annoying odor should become the concern of both industry and farmers. Chicken business in the PPC will continue if industry and farmers manage both flies and odors better and vice versa.

What role do rural doctors have in helping their communities adapt to a climate-changing world? A new tool for making the translation

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Rural communities lie in some of the world's worst climate change hotspots. They also often have fewer resources to conduct assessments of climate change health impacts, risks and adaptation options. What role could rural doctors have in helping their communities make such assessments? This presentation explores the results of a completed Australian project, funded by the Tasmanian Office of Climate Change, which has developed and tested an online community health impact, risk and adaptation assessment (HIRA) tool in three rural communities. It analyses the critical ways that local doctors contributed to the development of adaptation priorities for health services for these three communities, as part of a 'translational research' approach for community planning. That is, the HIRA tool used a set of steps, informed by the literature on knowledge translation, to help translate climate science into best practice community health adaptation priorities. We conclude that doctors will be critical to the future development of the HIRA tool, as we prepare for national and international trials. Climate science is currently developing predictions on smaller municipal-level 'grids', ostensibly for local policy decision-making. This is also in response to accumulating evidence that the now vast body of climate change research is being poorly translated into local community decision-making. However, our study suggests that, particularly in health, local area climate science predictions will only work if local stakeholders, most especially doctors, are involved in sophisticated adaptation assessment exercises that help to bring their local knowledge to bear on those scientific projections.

Foresight and the internal dimensions of Ecohealth

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Ecohealth recognizes the requirement for holistic and integrative approaches to deal with complex real world problems. Ecohealth also recognizes the need to strengthen relationships between the 'hard and soft sciences' and the importance of real collaboration between disciplines. Many different strategies and policies have been embraced to lead to better outcomes for the health of humans and the planet – and yet many committed individuals are concerned that there is inadequate investment in world centric thinking and action. The civilization challenges are manifest at a range of scales. Most attention has been paid to the external dimensions of the technical, economic, environmental and social challenges. An increased focus on the internal dimensions of the world problematique will force us to be more explicit about what is valued and why. Foresight methods can be used to assist us to address these significant challenges. A number of foresight methods help us to describe our preferred futures and expose the assumptions, values, cultures and worldviews that underpin them. We need to continue to examine and nurture the internal dimensions so that we can devise more robust and appropriate strategies to deal with the challenges of the future. Foresight approaches are not a panacea, but they do offer pathways, which can leverage and capitalize on our individual sources of inspiration and hope. This paper will describe some of the relevant foresight methods and how they interact and re-enforce the work within the Ecohealth domain. This work is a critical element of sustainable capacity development.



The effect of conflict on human-animal interactions, the implications for Emerging Infectious Diseases (EIDs) and their control in a changing Karen State, Eastern Burma.

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Karen state in Eastern Burma, in its 64th year of protracted conflict has seen a tentative agreement of ceasefire between the Karen National Union and Burmese government. International and national health organizations are already in discussions to begin tackling the main causes of morbidity and mortality. However, considering the context of Karen state, emerging infectious disease (EID) should not be ignored and neither should existing systems. Currently infectious disease control programs are provided in conflict zones by various community based organizations (CBOs) adopting community based models managed by 'mobile' health clinics, often days walk away via landmine affected routes of mountainous jungle. Decades of guerrilla warfare have influenced human-animal interactions with an increased dependence on bushmeat including non-human primates, restricted farming practices to areas underserved by CBOs, promoted logging in a wildlife sanctuary home to 22 threatened animal species, and mining has polluted waterways killing domestic livestock. Various studies have shown a third of migrants suffering from febrile illness crossing the border into Thailand suffer from leptospirosis, scrub or murine typhus. The impact of zoonotic arboviruses and other EIDs is unknown. As health organizations begin plans to enter Karen state, could improving CBOs simple algorithms used in the diagnosis of febrile illness and field-clinic referral systems, coupled with investment and capacity building in clinic-based diagnostics, animal health and ecological monitoring elucidate the conflicts impact on EIDs among this vulnerable people and ecosystem, suggesting community based solutions?

The role of social participation in habitat management and land occupation in the transmission of Chagas disease with Ecohealth perspective

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In Chagas disease had been established three ways in which disease was transmitted: congenital, vectorial and transfusional. The most important of all was the latter, the vectorial, which was related to poor housing conditions in rural Latin America. However, the discovery of oral transmission of the disease in urban areas and their presence in the Amazon region, has led to the Ecohealth approach to propose a more comprehensive understanding of the disease considering the different patterns as occurs rural and urban land occupation, and as habitat occurs consisting of housing and its natural and social environment. This approach to environmental management has implications for the understanding of social participation, as had previously been restricted to improving the material conditions of the housing to prevent colonization by the vector. But in the perspective of habitat and land occupation patterns that favor the creation of vector-borne conditions and oral urban transmission, social participation mechanisms should be different. This participation is wider than the frame of social action of the family and involves the incorporation of social, economic and political collective actors and requires much more complex and different ways of approaching education and consensus building.

The impact of brucellosis in Albania: a systems approach

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Brucellosis is a zoonotic disease that has considerable impact on human health and livestock productivity, as well as wider socioeconomic consequences. From official records in Albania, 800 people are infected per year and the prevalence in small ruminants is 3%. These are likely to be underestimates as brucellosis is frequently misdiagnosed or unreported. There are known technical solutions to prevent human and livestock infection, including pasteurization of dairy products, livestock vaccination or test-and-slaughter campaigns, and biosecurity measures. Ex-ante economic analysis has predicted societal benefits from livestock vaccination; yet current Albanian government control efforts have been largely ineffective despite the commitment of significant resources. Brucellosis is a complex, dynamic and non-linear problem. Characterizing the disease in humans and livestock, and optimizing surveillance and control options requires interdisciplinary enquiry. Methodologies from different disciplines are needed with an overall framework based on an integrated systems approach. We present a conceptual framework of brucellosis within the Albanian agri-food system, where the biophysical, political and socioeconomic environments are defined. The agri-food subsystems are then identified and related to each other by links and feedback-loops. This approach explicitly models the epidemiology and economics of the disease, and investigates complementary and alternate disease surveillance and control options. An agri-food system consists of the actions and decisions of diverse individuals and groups, each with their own goals and constraints. By modeling human behavior within the system, trade-offs between conflicting interests are investigated.



The causes and consequences of parasite community composition

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Most human and non-human animals are infected concurrently with multiple parasites, and compelling, but limited, evidence suggests that interactions among co-occurring parasites can influence disease dynamics, individual health, and host fitness. Importantly, such individual-level effects may scale up to shape both host and parasite population and community dynamics. Parasites can influence host susceptibility by altering the host environment and making it a more or less hospitable location for other parasite species. Human and laboratory animal studies provide strong evidence of both resource- and immune-based mechanisms driving interactions between parasite species. Although both mechanisms likely operate within single hosts, most studies typically focus on each mechanism independently. We used a factorial experimental design to test the interactions among parasite community composition, immune function, and resource availability, in the form of host diet quality. Laboratory mice (Balb/c) served as a model system to test the mechanisms driving patterns of helminth-bovine tuberculosis (*Mycobacterium bovis*) co-infection in our on-going field research in African buffalo (*Syncerus caffer*). Specifically, mice were given a high or low quality diet, dosed with two species of helminths (alone and in combination), and then challenged with bovine tuberculosis. At each stage, several aspects of immune function, parasite reproduction, and host condition were quantified and large differences among treatments were detected. For example, infection with two helminth species increased parasite reproduction compared to single-species infections, and the effect was exacerbated by a low quality diet. Furthermore, infection with bovine tuberculosis increased helminth reproduction and survival, and effects were strongest in helminth co-infected mice. Helminth reproduction influences the number of infective propagules released into the environment and, consequently, transmission within host populations. This experiment helps to answer broad questions about the causes and consequences of parasite community composition. In the current era of increasing land-use change, frequent species invasions, and global movement of animals for livestock or the pet trade, it is increasingly important to understand how host susceptibility and fitness are shaped not simply by single parasites, but by entire parasite communities.

Characterizing resilience in socio-ecological systems using agent-based modeling: An application to the Maitland River watershed, Ontario, Canada

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The Ecosystem Approach to Health (Ecohealth) is concerned with managing social and environmental contexts to promote human health and well-being. It is underpinned by systems thinking, which provides theory and tools to integrate across disciplines and to deal with complex situations. We demonstrate one such tool, agent based modeling (ABM), which avoids the causal linearity embedded in traditional modeling tools by simulating a set of “agents” that interact with each other and with their environment. Escaping causal linearity is important because complex systems can undergo rapid and surprising transformations. Resilience is an expression of the ability of a complex system to maintain its organization and adaptability in the face of external pressure. Resilience is often viewed in the context of avoiding a “tipping point.” In this paper we present an application of ABM to study resilience in an agricultural socio-ecological system characterized by smallholder farming – the Maitland River watershed in Ontario, Canada. With respect to well-being, we are interested in livelihoods represented by the economic robustness of farm households in the face of climate change impacts (changing moisture regimes) and transitions among conventional and organic cropping (which has lower yields but greater resilience). We have modeled this agroecosystem in the context of changing market prices for various crops, costs of inputs (labor, phosphorus, petrol, etc.), under various governance environments (e.g., supports for transition), and individual and collective characteristics and experiences of farmers. This work has produced scenarios that will inform adaptation strategies at both the governance and farm household levels.



Avian influenza, pandemic influenza, Ecohealth

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Influenza pandemics have occurred every few decades, probably for centuries, but with a case fatality rate rarely exceeding 0.02%. That rate may seem tolerable (for an occasional pandemic) were it not for the major exception of the H1N1 “Spanish flu” following the Great War, which had a global mortality rate of 2.5%. Some scientists have argued that the conditions at that time, especially on the Western Front, created a milieu conducive to the evolution of a strain with both high human-to-human transmission and extremely high human mortality. These conditions do not currently exist. Nevertheless, there seems a dominant perception that the next human influenza pandemic will better resemble that of 1918-19 than other pandemics – even though today public health has other advantages, such as rapid vaccine response capacity, antivirals and antibiotics to treat co-occurring bacterial pneumonia. This presentation will discuss fundamental ecological, evolutionary and Ecohealth factors that make a “Spanish flu” scale epidemic appear unlikely in the near future. It will also argue that the recent focus on this risk, combined with the large number of birds killed prophylactically, has had high opportunity, economic and indirect human costs, especially to uncompensated farmers. Finally, the presentation will discuss theoretical pathways of how a “Spanish flu” scale pandemic might re-occur. This is not likely via “viral engineering” followed by accidental or deliberate viral release, but could conceivably evolve in a future where civilization has regressed, due to resource wars, widespread undernutrition, and a loss of public health knowledge and capacity.

Arising bioclimatic issues for assessing dengue early warnings and related procedures at the southern boundaries of *Aedes Aegypti* in a climate change and variability era

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An Ecohealth research-action project is been conducted in Salto, a Uruguayan town facing an Argentine one with several cases of dengue recently reported. Bioclimatic and human conditions in Salto show a documented threatening background favoring an increase in *Aedes Aegypti* abundance. This vector re-colonizes the country since 1997, matching tis regional and global spread. Dengue wasn't still reported in Uruguay, but government and project teams are conducting diverse and parallel entomological monitoring tasks documenting the situation. The project team also performed urban, behavioral and climatic monitoring and investigations in vue of pointing out new ways to cope with the threat. As the main trunk of the bioclimatic monitoring vector's potential gonotrophic cycles (PGC, Focks 1993a,b) were calculated from September 2006 till the first frost occurrence in late April 2012. The number of infestive days was also determined. Calculations show several PGC summer-maximum decreases because of strong drying periods arising in the core of the warm season. This events - implying strong adult mosquito reduction - occur rarely. One of them happened in December 1999 but the new ones were dated January and February'08 and January'11 suggesting a shift of bioclimatic conditions. The potentially full-infestive summer season show changes in its length according with the year, from four to six months. Accordingly, there are diverse lengths of intermediate situations or "partially infestive months". These findings are actually tested with systematic pupae monitoring that currently are been carried out. Jointly, new urban and behavioral investigations are complementing those conducted in previous experiments. The results will be employed to recommend changes in the health prevention agenda according to climate variability, in order to keep close relationship with to local population, and trying to avoid "saturation", as commonly happens with repeatedly mass media spots, calendar attempts to eradicate breeding mosquito recipients, and improper fumigation. To face these gaps, we plan to promote a more close relationship among prevention health officers and common people. So, role actions are outlined for the project and the public health local staffs within the neighborhood associations, and in the schools, both within the commissions of parents and among the teachers' teams.



Resurgence of schistosomiasis in the context of climate change in the forest region of Guinea: Ecohealth approach for an integrated control strategy

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Schistosomiasis was reported throughout Guinea for many years. Studies from 1995 to 1999 on school children showed rates ranging from 9.8 to 26%, the forest area being the most endemic. The control method recommended by the WHO is chemoprevention. This study conducted in 3 sites (Bendou, Guékédou Diécké) of the forest zone aims to understand the ecosystem factors involved in the resurgence of the disease, and found respectively rates of 82%, 73% and 51%. The surveys were conducted targeting 4 age categories: 0-5 years, 6-14 years, 15-49 years and 50 and older. Malacological surveys and environmental studies have demonstrated the presence of three species of vectors with infection rates over 50% in the dry season and 100% in rainy season, fecal contamination of waters with high lack of latrine and attachment of the villagers to streams and lowlands. These conditions are favorable for a high endemicity. However, Guinea is classified as moderate-risk countries, with an average prevalence ranging between 10% and 49%. The current prevalence we found in the forest zone is much higher. Measures to develop might include the establishment of an integrated control strategy and a support for monitoring.

A transdisciplinary study of the risk of transmission and spread of HPAIV H5N1 in Asian intensive agro-ecosystems

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Agricultural intensification in South China has increased densities of domestic ducks raised on paddy fields, an important factor of the persistence of H5N1 highly pathogenic avian influenza virus (HPAIV) persistence. Some major wild bird congregation wetlands in South China have been partly turned into paddy fields where millions of free-grazing domestic ducks are raised. This may facilitate the contact and the circulation of HPAIV between human, poultry and wild waterbirds. In this transdisciplinary study, we combined epidemiological, ecological, agricultural and virological data to evaluate the potential transmission of HPAIV between domestic and wild ducks in intensive agro-ecosystems. We used new technologies such as satellite tracking of Wild birds, GPS tracking of domestic ducks, remote sensing of irrigated paddy fields, and phylogenetic analysis of H5N1 strains isolated in wild and domestic birds. Our results show: (i) a temporal correspondence between the period of presence of free-grazing domestic ducks and wild ducks in harvested paddy fields, (ii) a spatio-temporal correspondence at the local scale between habitats used by domestic and wild ducks, and at the regional scale between wild ducks migration and H5N1 outbreaks, and (iii) a genetic correspondence between H5N1 HPAIV strains isolated from poultry and the environment in South China intensive agro-ecosystems and strains isolated from wild birds and poultry in South Korea, Russia and Japan outbreaks. By bringing together elements from different fields, this transdisciplinary study demonstrates the role of interface that South China intensive agro-ecosystems may play in the emergence, persistence, and regional spread of H5N1 HPAIV.



Potential breeding sites and urban complexity: An eco-bio-social research on dengue in Fortaleza, Brazil

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Introduction: This research intends to analyze the ecosystem, vector ecology, social-behavioral context and stakeholders in the city of Fortaleza, Brazil, related to the factors predisposing dengue. Methods: 10 grid cells were randomly selected using GIS technology and the Arc View Program. A cluster of approximately 100 households was identified in each grid. In the end, the study area was composed of 1274 households distributed between 10 clusters out from January to May 2011. Result: The clusters are located in different neighborhoods in the city of Fortaleza, with strong differences in terms of geography, population, housing and health, economic, cultural, and social aspects. No efforts on the part of the institutions directly or indirectly influencing the context of dengue were made to carry out an integrated and intersectoral approach. Potential breeding sites were grouped into two categories: 1) useful vessels and 2) natural vessels. In the first entomological survey, 4,045 immature forms were collected. Regarding pupae, 43.6% and 56.4% respectively were sampled in containers used to store water and in vessels not used for storing water. Among these, the most productive places were small vessels, gutter and flowerpots. Conclusion: In Fortaleza, the vessels not used to store water occupy an important place in the production of *Aedes aegypti* larvae and pupae.

Scaling-up of successful health related projects: challenges and opportunities for Ecohealth approach

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The Latin-American initiative for leadership in Ecohealth for vector borne diseases aims to identifying successful experiences that can be scaled-up at national or regional scenarios. However, not always local or small-scale innovative projects may increase their impact and benefits to larger populations or wider geographic areas. In order to be able to support such a scaling-up processes of successful projects on vector borne diseases that have been carried out in Latin America a systematic review was conducted to identify factors that strength or constrain scaling up. Five main categories can be recognized. 1. Political commitment at national, sub-national, and local levels. When scaling-up is included in norms and is included in an institutional frame, the process will be facilitated. 2. Financial aspects should be stated clearly from the beginning in order to warranty the implementation of the process. Sources where resource will be coming from and complete and well-detailed budget ought to be clearly stated. 3. Objectives and goals to be achieved by the implementation of the program should be defined including target population, health indicators, control strategies and activities to be carried out. 4. Community involvement from the very beginning of the process (planning, resource definition, strategies and activities, etc.) as well as participation of other key stakeholders, local leaders, recognized NGOs should be warranted. 5. Management and administration is also a key in the success of a scaling-up process. Planning, implementation, coordination amongst different activities is requisite. Training for all human resources, clear definition of responsibilities and communication within and between teams. Also from the beginning a well-established system for monitoring and follow-up is required. In the implementation of scaling-up based on successful projects for the prevention and control of vector borne diseases in Latin America these factors will be taken in order to achieve the expected success of the Ecohealth approach for reduction or elimination of VBD.



Eco-bio-social approach for the design and implementation of a sustainable strategy for dengue vector control in Colombia

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A cross-sectional study which is part of a multi-country effort with a universal initial core protocol and site-specific objectives is being carried out in a touristic, 120.000 inhabitants town, two hour drive from Bogotá, Colombia's capital. The site-specific objectives are to identify, implement, and assess innovative, effective, appropriate and sustainable tools/strategies for *Aedes*/dengue control- directed at both households and public locations, and to assess its further scaling up to other dengue endemic areas of the country and LA region. In order to achieve the purpose a first phase was oriented towards analyzing ecological, biological, and social factors associated with different levels of vector density. Twenty clusters of 100 households each were randomly sampled from the city map and once identified the following surveys were undertaken: Demographic and Knowledge, Attitude and Practice (KAP) survey and entomological survey (in both wet and dry seasons). A Total of 2002 households were surveyed, obtaining 100% of response. In the entomological survey rates of pupae per person (PPP) that ranged between 0,3 and 1,7, and rates of pupae per hectare (PPH), 4.06-28.2., showing heterogeneity throughout the municipality. Ecological aspects of relative humidity, temperature, precipitation, and vegetation cover have been collected. In 24%-99% of the households in the clusters selected, immature forms of *Aedes* were found in low tanks where water is stored. We compared differences in pupae rates of *Aedes aegypti*, which indicates the clusters that represent greater risk and possibly the foci of transmission of the disease in the town.

Addressing Zoonotic Cutaneous Leishmaniasis in Tunisia's changing climate

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In Tunisia, Zoonotic Cutaneous Leishmaniasis (ZCL) is an emerging vector-borne disease, since 1982. This scarring disease, caused when *L. major* parasite is transmitted by sandfly bites, can cruelly disfigure those infected. A raised skin lesion develops, sometimes months later, at the site of the bite. For women, the lasting marks of the disease can be devastating. The disease is susceptible to changes in climate and other factors that affect soil temperature and humidity, such as farm irrigation and dam construction. New settlements can also bring non-immune populations into contact with the parasites, leading to new outbreaks. Our research team is examining how climate change, and local attempts to deal with water scarcity, may increase exposure to ZCL. Using a multidisciplinary ecosystem approach, the project is testing options to control risk of transmission and to reduce the vulnerability of local populations. To date, the team has made significant progress in understanding the local dynamics favoring disease transmission and in laying the groundwork for an early warning system based on monitoring of climate information, disease epidemiology, rodent dynamic population and changes in the vegetation cover. We have also closely examined how local irrigation systems may affect farmers' exposure to vectors. Recognizing that irrigation practices are a likely risk factor, researchers feel it is critical to work with farmers to find ways to reduce exposure. The team will share and discuss with the participants the lessons learned, the added value and the remaining challenges for Ecohealth approaches to climate change adaptation among vulnerable groups.



Supporting community-based responses to Zoonotic Cutaneous Leishmaniasis in Tunisia through ecosystem approach

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In Tunisia, Zoonotic Cutaneous Leishmaniasis (ZCL) is an emerging vector-borne disease, since 1982. This scarring disease, caused when *leishmania major* parasite is transmitted by sandfly bites of *Phlebotomus Papatasi*, from the parasite reservoir rodent, *Psammomys Obesus*, can cruelly disfigure those infected. For women, the lasting marks of the disease can be devastating. The disease is susceptible to changes in climate and other factors that affect soil temperature and humidity, such as farm irrigation and dam construction. The aim of our project is to achieve improved health outcomes by developing the role of key affected populations and communities and of community-based organizations in the design, delivery, monitoring and evaluation of ZCL control program in the affected area. Using a multidisciplinary ecosystem approach, the project is testing options to reduce the vulnerability of local populations. To date, the team has made significant progress in understanding the local dynamics favoring disease transmission and in laying the groundwork for an early warning system based on monitoring of climate information, disease epidemiology, and changes in the vegetation cover. The team will share and discuss with the participants of the panel on the key strategies we should focus on in order to develop an enabling and responsive environment through dialogue and advocacy, to support core funding for community-based organizations and networks, to develop capacity-building for staff of community-based organizations, to push networking, coordination and partnerships and to insure sustainable financial resources for community interventions implemented by community-based organizations.

An Ecohealth approach to flood recession (Molapo) farming to reduce climate change vulnerability in the Okavango Delta, Botswana

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Flood-recession farming (*molapo* farming) has been practiced in the Okavango Delta, Botswana for many decades. Floods usually arrive in June and start to recede in September. Between October and December flooded areas become ready for cultivation. Alluvial soil deposited during flooding and soil moisture maintained after the flood plus the onset of the rainy season in December make *molapo* farming more productive than dryland farming. Crop yields can significantly exceed those obtained in dryland farms. Clearing of fields may compromise biodiversity and the tillage system used may lead to erosion. Puddles of water left behind as the flood recedes provide potential mosquito breeding sites thus exposing farmers to malaria. *Molapo* farmers generally settle close to the river and some sources of their domestic water are infested with bilharzia transmitting snails, thus posing a risk to users. Government does not give title deeds for *molapo* plots and hence farmers have no incentives to develop the farming system. Livelihoods of families practicing *molapo* farming have been assessed and the area under cultivation and production levels are generally known. However, little work on potential health hazards associated with the farming system has been done. Using the Ecohealth approach we are gathering information on food security, sustainability issues and health hazards in the context of climate change in order to improve the lives of *molapo* farmers and to assist government in formulating policies regarding *molapo* farming. The paper describes the methodological approaches we adopted and present findings obtained from 2 years of project implementation.



Promoting the Ecohealth concept through networking: ECOHESA joins the movement

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The Ecohealth concept, which may be defined as systemic, participatory approaches to understanding and promoting health and well-being in the context of social and ecological interactions, is now widely practiced in Africa. With support of the community of practice on Ecohealth in West and Central Africa (CoPEH-WCA), Central and West African countries have made significant progress towards institutionalization of the concept by including it in university curricula. In eastern and southern Africa, the concept has largely been promoted through projects funded by IDRC, initially through the system-wide initiative on malaria and agriculture (SIMA) and now more directly through the Ecohealth program. While most of the projects implemented in eastern and southern Africa have produced results that have influenced policy and changed the lives of vulnerable populations, there is no platform for networking among the individual projects within and across countries. It is this realization that led to the establishment of ECOHESA, an Ecohealth network for eastern and southern Africa, whose goal is to promote healthy communities through transdisciplinarity and equity. The network was founded in 2011 by 26 members from 8 Southern Africa Development Community (SADC) countries and a representative of CoPEH-WCA from Benin. A 6-member steering committee was elected to further develop the network and recruit more members. The membership has grown significantly since the founding of the network. This presentation will highlight the activities of ECOHESA and how it intends to interact with existing CoPEHs worldwide.

An integrative approach to sanitary and disease prevention for small-scale poultry slaughterhouse in Thailand and Vietnam

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In Asia countries small-scale rural poultry production development can be challenged by food safety policies that limit economic development opportunities. This may limit incentives for improving sanitation and disease prevention. Therefore, a project funded by the International Development Research Centre and implemented by the International Livestock Research Institute was performed. In this study integrative research following an Ecohealth approach was used to elucidate the sanitation and disease prevention practices in small-scale poultry slaughterhouse in rural areas of Chiang Mai and urban areas of Hanoi. Initial steps included the identification of stakeholders associated with poultry meat production chain, development of a research framework, and designing the methodology based on stakeholder consultations. The developed framework combined at least five issue areas corresponding to the following disciplines: 1) public health 2) socio-economic 3) policy 4) veterinary and 5) community and environment. Methods used were questionnaires, observation, focus groups, and interviews. In addition, a microbiological risk assessment approach was employed to identify hazards and critical factors of slaughtering process affecting food safety and emerging food born pathogen risks. Combining this with stakeholder knowledge and attitudes provided the basis for identifying feasible and sustainable interventions. This study revealed that there were complex factors affecting the hygienic management of the slaughterhouse. The study also demonstrated the potential of an integrative, participatory approach for addressing a critical problem at the interface of rural development and public health. It may serve as a useful model as basis for study and intervention for other similar transdisciplinary challenges.



The economic status, hygienic practices and challenges for improvement of small-scale poultry slaughterhouses to meet standard poultry slaughterhouse regulation in Northern Thailand

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In Thailand poultry meat production is challenged by food safety policies especially in rural areas. Therefore, a project funded by the International Development Research Centre and implemented by the International Livestock Research Institute was performed to evaluate possible association between economic status and hygienic practices and opportunities for improvement to meet the existing standard regulation for poultry slaughterhouses in rural areas. Forty poultry slaughterhouses in Northern Thailand were visited during July-December 2011. Data on investment, profitability, debt, and the need for improvement were collected using questionnaire and interviews. Slaughterhouse facilities and hygienic practices were recorded using checklist and observations. Poultry meat samples were collected for *Salmonella* spp identification. Policy and regulation data were gathered through focus group discussion and interview with Department of Livestock Development (DLD) officers. Results showed that the average number of slaughter chicken was 40 birds/day, 57.1% were native chicken. The monthly average slaughterhouse profitability was 1,200 USD/month versus household expenses of 800 USD/month. Additionally, 67.4% had debt, on average 287 USD/month. The facilities and sanitary management were inappropriate, which may have contributed to the documented salmonella contamination in meat. Current DLD policy requires that all slaughterhouses have to get standard certification. However, our study demonstrated that all owners are challenged to improve their plant accordingly due to high standard criteria and required high investment. The study used an integrated problem solving approach to identify feasible and acceptable improvements for small-scale abattoirs and to sensitize policy makers on the economic inappropriateness of the existing standard regulation.

Investing in capacities to predict and detect the emergence of pandemic threats

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Since the beginning of the 20th century, a number of previously unknown zoonotic diseases have crossed-over from their animal hosts to cause regional or global epidemics in human populations. In the past 15 years alone, H5N1 avian influenza, Severe Acute Respiratory Syndrome (SARS), Nipah, and H1N1 influenza have emerged as actual or potential pandemic threats. A common feature associated with all of these threats, and many new zoonotic diseases, is that their initial detection only took place after there was already a significant number of human cases within a region or globally which made it more challenging to limit their economic and social impact. Starting in 2005, the United States Agency for International Development (USAID) began investing in prevention and control of H5N1 Highly-Pathogenic Avian Influenza (HPAI) to decrease the chances that this zoonotic disease threat would become “pandemic ready.” Part of this investment involved strengthening animal surveillance and better understanding the dynamics associated with the circulation and spread H5N1 HPAI virus. In 2009, USAID expanded its investments in zoonotic surveillance to include the PREDICT project, a part of the Emerging Pandemic Threats (EPT) program, that focuses on: developing modeling to predict emergence of new pandemic threats; and monitoring of microbes in key wildlife species in specific parts of the world in order to improve the chances of early recognition of new pandemic threats where there is limited capacity to monitor for new, emerging diseases.



Conservation threats and opportunities of the Chinese giant salamander farming industry

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The Chinese giant salamander (CGS; *Andrias davidianus*) is the world's largest amphibian and is listed as Critically Endangered by the IUCN. In 1988 it was recognized as a Grade 2 protected species in China. The CGS is one of only three cryptobranchids (the others being the Japanese giant salamander (*Andrias japonicus*) and the hellbender (*Cryptobranchus alleganiensis*)), which have evolved as a distinct lineage for over 170 million years. The CGS has been identified by the Evolutionary Distinct and Globally Threatened (EDGE) project (<http://www.edgeofexistence.org/amphibians>) as the amphibian species most in need of conservation action. Endemic to China and once widespread in the tributaries of the Pearl, Yellow and Yangtze Rivers, the CGS has experienced a severe range-wide decline since the 1960s. The main threats appear to be (or to have been) overexploitation and habitat loss. In 2010, the Zoological Society of London and the Shaanxi Normal University convened an International Conservation Workshop for Chinese Giant salamander (ICWCGS). In addition to international experts, this workshop was attended by more than 50 key Chinese stakeholders representing Chinese government, research, conservation, communication, education, and farming interests. During the ICWCGS, it became clear that CGS farming is a young, but rapidly growing, industry about which little is known by the conservation community. Further to the ICWCGS, we conducted a series of multidisciplinary investigations involving social and natural scientific approaches to better understand the development and structure of the CGS farming industry and to better gauge the conservation threats, and potential conservation benefits, of this industry. During this presentation, we will report some of the main outcomes of these investigations and present recommendations for future CGS farming, conservation and research efforts.

Mapping global vulnerability to pandemics, and an economic approach to their prevention.

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Zoonotic diseases tend to emerge from 'hotspots' with high wildlife biodiversity (the origins of most novel zoonotic pathogens) and intense anthropogenic pressure. We used global travel and trade data, and the surveillance and control capacity of countries, to estimate global risk of disease emergence and spread. We show that the highest risk is borne by countries that are rapidly developing, have high biodiversity, and are most connected globally. South and Southeast Asia and parts of central and South America are particularly important hotspots. However, for African countries, the hotspots for EID emergence are reduced when the likelihood of spread is included, probably due to lower international flight capacity compared to South Asia. We used these results to estimate the economic cost of a global strategy to prevent pandemics at source. Policies to address the pandemic threat are largely focused on control of outbreaks after emergence, rather than on mitigating the underlying drivers of disease emergence. We used an optimal stopping model to examine the optimal pandemic prevention policy given recently published data on the background rate and incremental increase of EID events. Our results show that the optimal prevention policy should be implemented within 15 years to reduce the annual rise of EID events by 40% at a cost of approximately \$225 billion per annum. They suggest that, like climate change, efforts to mitigate the pandemic threat will be expensive but cost-effective in the long-term, and must involve the current generation of scientists and policy makers to maximize benefits.



The spread of the invasive tick *R. microplus* and cattle herding practices: A case study in Benin

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The cattle tick *Rhipicephalus* (*Boophilus*) *microplus* has been imported into the south of Benin between 2000 and 2006 and has been spreading northwards over the last years. Apart from Anaplasmosis, this tick transmits *Babesia bigemina* and *B. bovis*, responsible for redwater disease in cattle. There is a serious concern that this tick could spread to the entire West African region because of the favorable environment, high cattle densities, and important cattle movements throughout the entire region, which would result in major economic losses for rural populations largely depending on subsistence farming and livestock. In contrast to the indigenous *R. (Boophilus)* tick species, *R. microplus* seems to be increasingly resistant to commonly used acaricides, and is challenging current control strategies. Where *R. microplus* occurs, it entails a considerable increase in tick burden, tempting farmers into making inappropriate use of acaricides and other chemicals. Moreover, a higher reproductive output combined with a shorter generation length, enables *R. microplus* to outcompete other *R. (Boophilus)* species. This study describes the relation between *R. microplus* presence and herding practice or acaricide use, as well as the interaction between *R. microplus* and indigenous *R. (Boophilus)* tick species. The dataset presented was collected during a countrywide survey in Benin during the autumn of 2011, which consisted of tick collection on cattle hosts and structured interviews with herdsman in 106 villages. The displacement of the three indigenous *R. (Boophilus)* tick species is apparent from a comparison of Maxent models based on their historical (1982) and current geographical distribution.

One Health practices in Bangladesh: Ideas to actions

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The concept of One Health is rapidly gaining recognition and acceptance, internationally, articulated through the official statements being made by governmental agencies and by a range of professional associations and international bodies, and expressed through a number of forums - colloquia, conferences etc. Increasingly, on a number of stages and in variety of ways, this thinking is becoming translated into research and developmental practice. After the emergence of HPAI H5N1 in 2007, a group of interested professionals formed an organization, 'One Health Bangladesh', that provides a forum for discussing the concept of One Health and its relevance for Bangladesh. Over the last four years, a diverse group of professionals from across Bangladesh participated in six conferences and a number of meetings, that discussed scientific and policy issues related to One Health. Presentations in those meetings explored infectious diseases that infect both human and animal and have strong association with environment and wildlife. The forum promoted a process of change towards joint outbreak investigation of avian influenza, Nipah virus, and anthrax. This process demonstrated the linkage between human, animal and environmental health and provided useful examples for multidisciplinary professionals to work together. Through this progression, a consensus has been developed for Bangladesh to benefit from a One Health approach with some degree of institutionalization within the government systems and targeted activities. This view has been strongly endorsed by the relevant Ministries of the government and agencies of the UN including FAO, WHO and UNICEF leading to convening a multisectoral workshop in 2012 to develop a country strategic framework for implementing One Health approach. The agreed framework has nine components that each covers specific requirements and objectives for the implementation process, a vision, goal and attributes of one health approach for Bangladesh. The outcomes of the workshop are now under a process of validation, official endorsement and framing projects for immediate implementation by the government and its different agencies.



An analysis of dengue risk perception in Bangladesh by using Ecohealth approach

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The major cities of Bangladesh have experienced the resurgence of dengue, particularly since 2000. This study aimed to assess dengue disease risk perception and efforts towards mitigation by analyzing entomological, environmental, and socioeconomic risk factors in Bangladesh. The empirical investigation was carried out in 12 wards of the City of Dhaka. The sources of data included: a) two entomological surveys (847 households during monsoon 2011 and 459 households during dry season of 2012); b) a socio-demographic survey of 300 households; c) 12 focus group discussions (FGDs) and 8 key informant interviews (KIIs); and d) constructed Knowledge Models of experts and lay persons. More than 40% of households were found to be positive during the wet season and 12% during the dry season. A significantly higher level (41%) of *Aedes* mosquito is prevalent in households and their immediate surroundings in recent years than in the past, and they are suspected to be primary vector for recent dengue outbreaks in Dhaka. There are significant variations in dengue risk perception between lower (low and medium) and higher socioeconomic groups (SEG); the low and medium SEGs are concerned more about day-to-day issues than dengue whereas the higher SEG are found to be more complacent about dengue risk. Also, females perceive lesser risk with dengue than male. Experts rank dengue risk at a much lower level than laypersons, and they emphasize the need for stronger institutional measures to control dengue outbreaks. In consideration of significant SEG and gender variations, targeted awareness enhancement, vector control and community mobilization programs should be formulated to mitigate dengue disease risk in Bangladesh.

Community-level vulnerability mapping of target sites for dengue control in Seremban and Putrajaya, Malaysia

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Malaysia is one of many tropical countries where dengue is endemic and a major public health concern; the number of yearly reported cases remains very high. The goal of the research was to investigate vulnerability to dengue at a community level in Malaysia, to increase understanding of contributing factors in the social and natural environment and how they differ between two communities situated in southwestern Malaysia near the capital Kuala Lumpur. After receiving ethics approval the project was discussed with community leaders and stakeholders prior to working in the communities. Using focus groups and participatory mapping methods, participants collaborated to describe local vulnerabilities and areas they would target for dengue control. This was carried out by drawing the local environment and highlighting areas of concern to residents. The activity also elicited understandings on knowledge and attitudes towards dengue in the region. Separate focus groups for male and female participants were formed to encourage open discussion and gender equity. Our findings reveal different roots of vulnerability to dengue in the two communities. Through creation of local maps, participants in the planned city of Putrajaya demonstrated concerns such as construction projects and a central artificial lake and wetland. In contrast, Seremban community participants identified vulnerabilities such as disputed land ownership, solid waste accumulation and the influence of new immigrant workers. The findings demonstrate that uniform dengue intervention strategies may not be appropriate, even at a country level. The results of this study provide enhanced understanding of local conditions of vulnerability in Malaysia and can inform evidence-based assessment and integrated dengue control approaches.



Understanding animal diseases in intensifying livestock systems in rural China: perceptions from local stakeholders

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The intensifying livestock systems and the changing patterns of animal diseases (especially emerging infectious diseases, EID) outbreak have led to new risks in China. Together with climate change and changes in international trade, these complex issues challenge the scope of existed knowledge and need new ways to respond. Almost half of world's total pork and poultry products are produced in China, largely by small farm households. Understanding how local stakeholders perceive animal disease and how they frame the issue will help in designing appropriate interventions in managing these challenges. This paper, based on fieldworks in rural China, aims to investigate impact of animal diseases in intensifying livestock systems by understanding and contrasting different perceptions from local stakeholders (producers, street vendors, township officials/regulators responsible for environment, animal and human health). Using a structured interview outline, a qualitative approach is used to collect relevant information for analysis. Different scales of producers have been interviewed, with special attentions being paid to small-scale producers. Perceptions and narratives from different stakeholders, especially among producers and local officials are also contrasted. Perceptions are different among producers and local officials/regulators, as well as among different scale producers. Small-scale producers are largely influenced by large one in terms of input use, disease control, and marketing. Not surprisingly, local officials/regulators responsible for animal health and for human health frame the issue quite differently. These different perceptions and framings certainly have implications for designing further policy interventions.

Ecohealth assessment on Poultry Production Clusters (PPCs) for the livelihood improvement of small producers: An insight into Vietnam

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Over a decade fighting with the Highly Pathogenic Avian Influenza (HPAI) the Vietnam Government has been showing huge efforts, expressed by a wide range of policies including prevention and control measures as well as restructuring initiatives, to enable its poultry industry dealing with not only the challenging HPAI but also other newly emerging infectious diseases (EID). The Government's attempt of clustering (zoning) poultry production and promoting large industrial production to restrict the emergence and transmission of diseases constitutes one of the most remarkable but controversial debates. It is argued that the government policy may marginalize smallholding farmers, who relying heavily on poultry production as a key source of livelihood. In fact, the market uncertainty in the last few years is highlighting the role of small producers in alleviating the turbulence in the market by filling up the shortfall of animal-based products. By applying trans-disciplinary and eco-health approach, this study investigates how the poultry production clusters (PPC), which regroup smallholding farmers in the vicinity of each other and away from residential areas impact the small farmers' livelihood. The evaluation is carried out on multiple aspects: social, economic, human health, environmental, disease control. It is observed that better consensus among farmers within PPC regarding production plan, bio-security and environment measures implementation has considerable significance in limiting the spread and inter-transmission of disease. However, empirical evidences shows that smallholding farmers outside PPC still remain fairly competitive in terms of cost/benefit efficiency and ability to overcome market and disease shocks. So far, the preponderance of poultry production in PPC is still modest compared to the one outside PPC. This implies that further policy improvements and appropriate interventions as well as institutional arrangements need to be considered. Preliminary results suggest that improving the smallholding farmers' livelihood can be accessed through healthier production practices, better integration into high value added product chain and enhanced market information system.



Bats host major mammalian paramyxoviruses

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The ability to predict and prevent viral epidemics has become a major objective in the public health disciplines. Knowledge of viral hosts enables the identification of maintenance populations from which epidemics may emerge. The large virus family *Paramyxoviridae* includes some of the most significant human and livestock viruses, such as measles-, distemper-, mumps-, parainfluenza-, Newcastle disease-, respiratory syncytial virus and metapneumoviruses. Here we identify an estimated 66 new paramyxoviruses in a worldwide sample of 119 bat and rodent species (9,278 individuals). Major discoveries include evidence of an origin of Hendra- and Nipah virus in Africa, identification of a bat virus conspecific with the human mumps virus, detection of close relatives of respiratory syncytial virus, mouse pneumonia- and canine distemper virus in bats, as well as direct evidence of Sendai virus in rodents. Bat viruses were shown to persist on individual and population level over time and space. Phylogenetic reconstruction of host associations suggests a predominance of host switches from bats to other mammals and birds. Hypothesis tests in a maximum likelihood framework permit the phylogenetic placement of bats as tentative hosts at ancestral nodes to both the major *Paramyxoviridae* subfamilies (*Paramyxovirinae* and *Pneumovirinae*). Future attempts to predict the emergence of novel paramyxoviruses in humans and livestock will have to rely fundamentally on these data. The most relevant provision in this field is that epidemic risks emanating from wildlife virus reservoirs should trigger wildlife conservation rather than interference with wild animal populations.

Applying participatory approach to study zoonoses in provinces of South Vietnam: experiences and lessons learned

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An Ecohealth approach is adopted in the study of zoonoses in selected provinces in South Vietnam. As part of this research, a retrospective study using disease surveillance was conducted to identify 'hotspots' for selected zoonoses. Binh Phuoc and Tien Giang provinces were selected as study sites, representing contrasting social, ecological and agricultural characteristics. Participatory rapid appraisal tools were then implemented to identify risk factors for transmission and spread of selected zoonoses. Results show that risk factors for zoonoses likely emanate from differences in geographical and social conditions of the communities. Scale of production, presence/absence of slaughterhouses and markets, and vaccination practices were identified as risk factors and ranked according to importance by local people and commune veterinarians. Analysis of the village map drawn based on the transect walk also indicated the potential role of slope/terrain as a risk factor for disease spread. Using ranking and scoring tools, the villagers also prioritized zoonotic diseases they consider important. This bottom-up identification of priority zoonoses could be compared with the priorities identified through a top-down approach and see where overlaps or inconsistencies exist. Venn diagram analysis also revealed varying perceptions by local communities of the role of social institutions in management and control of zoonoses. In sum, results highlight the importance of local communities in an integrative approach to manage zoonotic diseases. A "shifting paradigm" for effective management and control of zoonoses is needed to engender sustainable change. Ecohealth approach enables joint collaboration by communities, researchers, veterinarian, and public health workers towards this end.



Developing one health practitioners through applied, problem based training: A 'One Health Residency' model

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In the US, a 'residency' is a multi-year specialized training program, typically in a clinical setting, where residents gain practical, hands-on experience resulting in specialty board certification. The University of Minnesota (UMN) expanded the concept of a veterinary residency to Veterinary Public Health and Preventive Medicine. This unique, 2-year practical, hands-on program prepares early and mid-career veterinarians for board certification for the American College of Veterinary Preventative Medicine. Residents spend 25% of their time working on an 'executive' Masters in Public Health tailored towards working professionals, and 75% working on 'real world' projects contracted from industry, government, and academic research programs. In East Africa, an applied residency program can prepare graduate health professionals through practical experience, while meeting government and private sector needs in public health. Makerere University is partnering with UMN in developing a residency model, new to Eastern Africa, aimed at creating One Health professionals with the skills needed to collaborate across disciplines. Feedback from national stakeholders in Uganda resulted in this 'One Health residency' program where nursing, public health, and veterinary residents work together on projects and receive a Masters degree using a similar 25%/75% training model. The first joint resident has started, and stakeholders are initiating projects focused on building core capacities including: Infectious Disease Management, Health Systems, Food Safety, Epidemiology/Biostatistics, One Health Leadership, and Ecosystem/Environmental Health. This program reflects an increasing global awareness of the need for preparing veterinary, medical, nursing and other health professionals to work together in addressing emerging 'One Health' challenges.

Application of an Eco-Bio-Social approach to emerging infectious diseases in Palawan, Philippines: A preliminary baseline study

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Over the past decade the Philippine government has been promoting tourism in the country and Palawan is currently one of the top destinations. Puerto Princesa City, a chartered city located in Palawan, is most frequently visited because of its UNESCO World Heritage Site, the St. Paul Subterranean River. The number of visitors (local and foreign) to the island has increased five times since the start of this century. In Puerto Princesa City, the number has doubled to 247,000 since 2006. This number is small compared to other hotspots in the Southeast Asian region but the signs of a rapidly changing environment, and their possible effects on health of communities and visitors are observed. There are numerous eco-tourism activities in Puerto Princesa City that put people in increasing contact with wildlife, specifically bats and monkeys. Though the number of reported malaria has been decreasing, the first reported cases of *P. knowlesi*, a zoonotic malaria parasite, among local residents of Puerto Princesa City and foreign travellers to Palawan were made in 2008. In addition, the number of suspected dengue cases reported through the health facilities has increased but has still remained below that reported in more urbanized and densely populated cities in the Philippines. To understand the conditions that underpin the transmission of these diseases in global outreach hotspots such as Puerto Princesa City includes an analysis of how economic development related to tourism has affected the environment and way of life of communities in these hotspots. A partial assessment of changes in ecological, biological and sociological determinants due to an increase in tourism that contribute to community vulnerabilities to emerging vector-borne (illustrated by dengue) and zoonotic diseases will be presented.

Feasibility for integration of rift valley fever response and preparedness into existing infectious diseases control interventions at district level in Tanzania

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Rift valley fever (RVF) is a major problem both for humans and animals. Though neglected, RVF is of public health significance to Tanzania and other regions of Africa. Tackling RVF requires data to inform policymakers and communities on mechanisms for timely and coordinated control and mitigating its impact. Due to global climate variability RVF is becoming increasingly unpredictable among community members in high-risk areas including agro pastoral communities Tanzania. Previous evidence points to a lack of coordinated response during RVF outbreaks. Nevertheless, researchers have noted that disease prediction was possible and losses could be reduced if all the indications of an impending disease outbreak were taken seriously and appropriate steps taken. Besides lack of timely and coordinated response, the recent RVF outbreak in Tanzania highlights lack of institutional collaboration in risk assessment and management of the outbreak from the national to the district level. The main objectives of this study are to determine the feasibility of integrating RVF response activities into existing disease interventions at district level in Tanzania, to determine knowledge, risk perception and practices related to RVF. We will present findings from an on-going baseline study conducted to inform design of interventions to improve timely response and preparedness for imminent/future RVF outbreaks among practitioners and local populations.



Land use change and human health in Eastern Himalayas-an EcoHealth research and the challenges for scaling up

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Driven by population growth, economic development, globalization and the advances in agricultural technology, land use change has been widely taking place in eastern Himalayas in the last decades. This has profound implications for mountain ecosystems and the livelihoods of local people. However, little is known about the impact of this change on human health. Using an EcoHealth approach, we undertook an action research to understand the land use changes and their impact on human health in this region. Three study sites, namely Tibet autonomous region, Yunnan province of China and the middle hilly areas of Nepal were selected for this in-depth research. The major land use changes identified in the study sites are sedentarization of nomads, agricultural intensification and modernization, and the major health problems that the research teams chosen to work on are malnutrition in Nepal study site, endemic fluorosis and pesticide-related health issues in Yunnan study site, and zoonotic diseases in Tibet study site. The result reveals that there are multiple, direct and indirect links between land use changes and the identified human health issues in the three study sites. A systematic and holistic framework is required in order to understand the complexity and the socioeconomic drivers embedded in those links. We also tried to scale up our research findings through influencing local health and agricultural policies. The major challenges include the vertical and sector-oriented structure of government administration; the discipline-based training curriculums in the education systems that produce personnel who tend to think and behavior narrowly within defined arenas and have little interaction with people from other sectors; and the current scientific research system that funds and supports research projects according to disciplines. The effective scaling up of EcoHealth research projects needs change not only in the arenas of how we train the human resource and support research projects but also changes in people's mind-set. Strategic thinking and innovative approaches are badly needed in scaling up EcoHealth research.

Using an EcoHealth project to train master students of public health: the experience of Kunming Medical University

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Several professors/teachers in Kunming Medical University (KMU) participated in an EcoHealth project entitled "land use change and human health in eastern Himalayas". The project was supported by IDRC and coordinated by ICIMOD. Seven master students of those professors in the school of public health, KMU were directly involved in the project by participating in project design, data collection and analysis, project intervention activities and even taking a leading role in sub-components of the project. These students also used the data from the project to write their theses. So far, two students graduated last year and 5 students will be graduated in this coming June. A Large number of other master and undergraduates have been also involving in the project in one way or another. The participation of students has produced the following positive results: engaging students to the multidisciplinary research team and expose them to perspectives of other disciplines that they would not learn without this project; informing other teachers and thesis reviewers about EcoHealth approach; a selected course on EcoHealth for undergraduate students in KMU that use the data from the project as teaching materials. There are also challenges that constrain the sustainable involvement of students in EcoHealth practices. First, all students belong to the discipline of public health or medicine that has certain criteria for thesis evaluation that may not fill well with transdisciplinarity. Second, difficulties for students to write and publish papers from an EcoHealth perspective. Third, it is also difficult to find teachers who can do EcoHealth teaching in medical universities. We need to discuss with others to find out solutions to overcome the constraints.

EcoHealth capacity building programs in Asia

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EcoHealth is an integrated and holistic approach that promotes transdisciplinarity, systems thinking, stakeholder participation and social equity including gender equity in the context of socioeconomic development aiming at sustainable development. This approach has great potential to be applied for in Asia where economic development is the main task and rapid social changes are occurring. In order to promote EcoHealth approach in Asia, several capacity building projects/programs were undertaken and are still on-going that include two EcoHealth resource centre set up by LIRI in Chiangmai University, Thailand and the Gadjah Mada University, Indonesia; the project entitled "Building EcoHealth Capacity in Asia" led by Veterinary Without Border, Canada, and the training course developed by the program "Field building leadership initiative: advance EcoHealth in Asia". There are also EcoHealth course developed for graduate students in Mahidol University, Thailand, and the selected course developed for undergraduates in Kunming Medical University, China. However, there is little communication between those capacity building programs, which may cause overlapping but also gaps, thus we call for mutual sharing, exchange and leaning among those programs so as to better use the resources and to produce better result.



Faculty and curriculum development for environment, health and development in China

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It is widely acknowledged that the relationship between development, environment and health is multi-directional and dynamic, and that professionals and citizens need an understanding of these issues that goes beyond the confines of disciplinary-based learning. Yet, interdisciplinary approach in education remains the exception rather than the norm. In order to provide the basis for interdisciplinary faculty and curriculum development programs on environment, health and development in China, the Forum on Health, Environment and Development (FORHEAD) has conducted an assessment of existing programs and needs in four institutional settings in Beijing, Guangzhou, and Kunming. The needs assessment will make recommendations for building capacity within institutions for on-going collaboration and innovation, including 1) the creation of curriculum materials tailored to the Chinese context which can be adapted for use in a variety of university-level courses relating on health, environment and development; 2) the development of cross-disciplinary networks of faculty and staff within and across institutions of higher education that can provide a basis for on-going sharing of teaching materials and experience; and 3) the development of innovative, locally-grounded approaches to environment and health problems through campus-community collaboration.

Community-based research on adaptation to climate change (poverty reduction) West of the High Dam Lake, Aswan, Egypt

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This 2-year funded action-research project explores the impacts of climate change on agriculture that may lead to challenges of ensuring food security and poverty reduction. Project aimed to derive and test possible relations between climate change, water management issues, and health conditions, for the benefit of marginalized people living in new resettlement communities around High Dam Lake and for more informative and responsible policy actions on new resettlement communities at the national level. To achieve the project's objectives, the team investigated potential effects of climate change and its impacts on human health, build the settlers capacity to enable them to adopt more efficient and sustainable technological response to climate change and derive adaptation strategies in participation with all stakeholders concerned with climate change for better resettlement and development policies. The economic conditions of nations and groups clearly are determined of adaptive capacity (Bulton et al., 1998). The socio-economic study showed that 29% of the sample has monthly income less than 35.08 \$, 21% has 35.08 \$, 12% has 70.1 \$, 10% has from 70.1 – 105 \$, 5% from 105.2 – 140.3 \$, and 2% has more than 140.3 \$. The community main spending was in farming, food, and medication. Results showed extra vulnerability points including lack of technology, infrastructure, energy resources such as solar energy and electricity, insufficient primary school, no safe drinking water, no toilets, poor drainage system, and lack of medical services and adaptation capacity. Vulnerable groups included farmers, women, and children who are suffering from insufficient nutrition and health problems among the community. The most common human diseases in the area were common cold, upper and lower digestive system diseases such as intestinal worms, diarrhoea, heat burns, colic, anaemia, and pinworms. Health conditions, however, improved through health convoys and medical treatment. Agriculture intervention leads to increase production, reduce post harvest loss, and increase income. 80% of farmers use organic fertilizers - 20% increase of good fruits, 65% use crops resistant to high temperature - increase of feddans productivity by 21 – 40 ton, 20% use agricultural intensification - increase of production by 10 – 25%, 15% use crops that give shadow - increase of production by 5 – 8%.



Promoting the EcoHealth in West and Central Africa

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The Community of Practice of EcoHealth in West and Central Africa (COPEH-AOC) invests itself in the integration of ecohealth approach in the universities and the environments of practice in West and Central Africa. Universities and institutions in West and Central Africa are where the barriers between sciences are broken up and where the ecohealth approach is taught and practiced for sustainable development. In West and Central Africa, the promotion of ecohealth approach is realized by the following universities and high schools: University of Abomey-Calavi in Benin, Universities of Cocody and Abobo-Adjame in Ivory Coast, The University of OUAGADOUGOU and the 2IE Group in Burkina-Faso, the Polytechnic of Yaounde University in Cameroon and the Swiss Centre of Scientific Research (Ivory Coast). They organized a community of practice named COPEH-AOC, which is a network of teachers and researchers engaged in the promotion of the ecosystem approach and human health in West and Central Region of Africa. From 2003 to 2008, we organized training courses of 74 young researchers (Ph.D. and Master's degree students) in ecosystem approach and human health coming from the countries named above. In February 2009 and May 2012, we organized the workshop for the lecturers training on the ecosystem and human health approach coming from COPEH-AOC and ECOWAS member countries. In conclusion, we hope the continuation for the realization of the ecosystem approach and human health institutionalization by the generalization of the teaching of ecosystem and human health courses in other training programs.

Teaching teachers to teach ecohealth in Costa Rica, 2006-2012: a nation-wide interuniversity in-service professional development program for public elementary and secondary school teachers

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Public educational policy in Costa Rica includes mandatory ecohealth themes with a trans disciplinary, value-driven and attitudinal-oriented approach. But implementing such an advanced policy is a practical challenge: pre-service higher education for public elementary and secondary school teachers is not specifically addressing this policy, the Ministry of Education's professional development institute does not yet include such continuing in-service programs for teachers, and there are no specific incentives for efforts from teachers to go beyond their disciplinary curricular obligations. In 2006, the University of Costa Rica began to develop such an in-service program for elementary and secondary schools, first in the immediate vicinity of its central campus (2006-2007), then expanding in 2008 to other educational circuits in the Great Metropolitan Area of San Jose, and in 2009 to other regions. This year it was joined by two other public universities, and by 2010, all four public universities in the National Council of Rectors (CONARE) were receiving competing grants from CONARE to work together in several educational regions throughout the country. By the end of 2012, 1000 teachers in Costa Rica from 400 primary and secondary schools will have received a one-year modular course on educational innovation for integrated management of health and the environment (IE-GISA), representing up to five continuing education units out of a maximum of 20 which are acknowledged by the Civil Service through short courses for salary purposes. The course (at <http://mgau.odd.ucr.ac.cr/>) includes modules on extracurricular and curricular planning, pollution, and biodiversity, with facilitators and joint field-supervision from the Ministry of Education. In 2012-2013 the program is expanding to include more specialized second-year modules (monitoring and restoration, gardens, systematization), and a pilot bimodal continuing learning platform with three educational bureaus in the southern region, one of the largest, poorest and most isolated in the country. Our paper discusses this experience from both public policy and pedagogical perspectives, including survey-based impact assessments on teachers' progress in the field, and social network analyses on the evolving ecohealth teachers' community of practice in Costa Rica.



Collaboration and field building for Ecohealth education in Southeast Asia

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The overall objective of the Field Building Leadership Initiative in Southeast Asia (FBLI) is to build the field of Ecohealth by integrating research, capacity building, policy and networking to focus on solving human health problems associated with agricultural intensification. The initiative attempts to embody the principles of Ecohealth in building sustainable, institutionalised nodes for Ecohealth research and education. The research will be trans disciplinary, multi-country, multi-institutional, gender-sensitive and participatory. Strengthening of capacity for ecohealth research and practice will be addressed by developing institutional capabilities to deliver ecohealth training, the development and dissemination of teaching materials, and mentoring of early-career professionals. The FBLI has thus aimed to create a context and the necessary conditions for Ecohealth training to be embedded in wider capacity building approaches for research and education. The development of course materials and of a Training of Trainers workshop encouraged stakeholder and end-user engagement early on, and promoted collaboration from institutions and actors across regions. The participatory nature of the training development was considered an integral part of learning to build the field by those involved. The resulting Ecohealth Trainer Manual has been piloted and will be disseminated to other institutions after its final review.

Understanding the relevance of “Community Health Days” to community members in the Xaythany District of Laos: A mixed-methods study of knowledge, attitudes and practices

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Livestock are critical to rural livelihoods in Laos by supplementing diets, providing fertilizer and draught power, and acting as a safety net when crops fail. However, regular outbreaks of disease occur due to limited knowledge of animal health and access to veterinary care, which constrain production and increase economic hardship among households. Since 2009, Veterinarians without Borders/Vétérinaires sans Frontières (VWB/VSF) and the National University of Laos have worked to increase livestock production and veterinary capacity in 11 villages of the Xaythany District with the aim of improving incomes and household food security. Regular hands on training and mentoring have been provided to community volunteers. In 2012, the second series of “Community Health Days” (CHDs) are being held to increase awareness of local animal health skills and encourage health-promoting behaviors related to human, animal, and environmental health. This exploratory, mixed-methods study examines how relevant the CHDs and their health messages are to the needs of local populations through an “Ecohealth” lens, which involves investigating the human, animal, social, and environmental dimensions of health. Using a quantitative survey, the knowledge, attitudes, and practices of CHD participants are being compared to those of non-participants. Focus groups with CHD participants help identify their activity preferences at CHDs and barriers to application of health messages. The results of this study are informing VWB/VSF programming and will guide improvements in the design and delivery of CHDs the following year, shedding light on practical approaches available to organizations for conveying Ecohealth messages in practice.

Hendra Virus in Australia - ecology and health perspectives

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Increasingly, emerging infectious diseases threatening human health have a wildlife origin; in recent years, bats have represented a source of multiple lethal viral infections. In Australia, Hendra virus has increasingly been reported since it was first recognised in 1994. This highly lethal zoonotic paramyxovirus has a case fatality rate of 80% in horses and 60% in humans. The first recognised spillover, in the Brisbane suburb of Hendra (after which the virus was named) resulted in the death of 20 horses and one of two human cases. A single equine and associated human case occurred in 1999, and from 2004 onwards, single or multiple spillovers involving equine and sometimes human mortalities have been recorded. In 2011, an unprecedented cluster of cases - 18 separate spillovers involving 23 equine cases in a single twelve week period - more than doubled the total number of recorded incidents, and extended the Hendra geographic ‘footprint’ by hundreds of kilometres. Have we reached an ecological ‘tipping point’ with Hendra virus, with an increased frequency of incidents set to become the norm, or was 2011 an alarming epidemiological anomaly. The investigation of bat-associated emerging infectious diseases requires a comprehensive cross-disciplinary approach that includes an understanding of the ecology of the wildlife species, threats to the ecological balance, and an understanding of human behaviors that increase risk of exposure.



Vectors of Chytridiomycosis in Chinese pet and food trade

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A fungal pathogen, *Batrachochytrium dendrobatidis* (*Bd*), which causes the disease chytridiomycosis, has been associated with the declines of over 200 amphibian species worldwide. One of the potential vectors of the pathogen to naive populations is hypothesized to be the transport of live amphibian hosts via trade for human food consumption and pet trafficking. China, and its growing economy, is known to be a major consumer and exporter in the live trade of amphibians. Species harbouring high-levels of the *Bd* infection (e.g. *Lithobates catesbeianus* and *Xenopus* sp.) are common in the food and pet trade, and established populations of these invasives have already been documented across the country. Infected with the fungus, but showing no clinical signs of the disease, these species can act as vectors and pose great risk towards China's highly diverse native amphibians. Previous opportunistic, widespread surveys of *Bd* reveal the fungus is in Asia (e.g. China, Japan, Philippines), but at a relatively low prevalence (~2.35%). These results contrast sharply from data collected from other areas of the world (e.g. Central America ~40%). These findings suggest that *Bd* is either a newly emerging disease in Asia, is endemic to the region, or some ecological factor is preventing *Bd* from fully invading Asian amphibians. Using a standard *Bd* qPCR assay, I analyzed skin swab samples collected from ~300 amphibians from 20 different food and pet shops in China and Hong Kong and found prevalence of the pathogen in the trade. Though the presence of *Bd* has previously been documented in the region, little work has focused on the susceptibility of native Chinese amphibians to chytridiomycosis. Determining the distribution of *Bd* prevalence and infection intensity on amphibians from China will aid in understanding how amphibians from the region will react when exposed to a pandemic strain of this deadly pathogen. The transmission efficiency of amphibian vectors common in Chinese trade towards China's native amphibians will also be discussed.

Food insecurity is compounded by increased mercury and lead exposure among Inuit in the Canadian Arctic

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Background: Food insecurity is high in the Canadian Arctic, and has been related to poor nutrient status among adult Inuit. Food safety issues such as exposure to environmental contaminants, such as mercury (Hg) and lead (Pb) is another concern but the relation between food security status and contaminant exposure is unknown. Objective: To study the relationship between exposure to Hg and Pb and the status of food security in a Canadian adult Inuit population. Methods: A cross-sectional survey was conducted among 2 595 Inuit adults from 36 communities from Inuvialuit Settlement Region, Nunavut and Nunatsiavut in Canada. Data on household composition, traditional food harvesting and consumption, socio-economic indicators was collected. Food security was assessed using the 18-item USDA questionnaire. Blood Hg (B-Hg) and Pb (B-Pb) levels were measured. ANOVA and multiple regressions were used to explore the relations between exposure and food security. Results: B-Hg and B-Pb levels were higher in participants living in food insecure households and answering positively to the question "In the last 12 months, were there times when the food for you and your family just did not last, and there was no money to buy more?". When controlling for age, sex, smoking, drinking, country food preference and the presence of an active hunter, there was a positive association between B-Hg and B-Pb and increasing household food insecurity. Discussion: As food insecurity, poor nutrient status and exposure to contaminants are public health concerns in the Canadian Inuit, there is a need to understand the interdependent dynamics behind these issues in order to promote food security and safety.

Global spread of emerging swine pathogens

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In recent decades, many of the infectious diseases emerging in human populations have originated in domestic swine. With increasing globalisation of the trade of pigs and pig products, the risk of spread of emerging swine pathogens raises a major concern for the swine industry and public health. The aim of this study was to assess pathogen emergences in domestic swine over the last 25 years, and to explore the impact of the rapid growth and structural changes experienced by the swine industry on the potential for global spread. New pathogens found to infect domestic pigs under natural transmission conditions during the last 25 years were identified through a systematic literature review. Emerging swine pathogens encompassed around 100 species of viruses and bacteria, of which one third were zoonotic. Two thirds of emergences were reported in only 7 countries located in East Asia, Europe and North America. An individual-based model of swine pathogen transmission between countries was developed. A susceptible country could become infected through the trade of live pigs and pig products, or by sharing a border with an infected country. The model was fitted to epidemiological data. An increase in trade was the main factor responsible for wider pathogen spread. The countries in which the most recent pathogen emergences were reported were those with the highest potential for initiating global spread. These findings could allow more effective targeted monitoring of emerging swine pathogens, and implementing interventions to minimise trans boundary spread and transmission at the animal-human interface.



Urbanization, agricultural intensification, and habitat alteration in Vietnam: Modeling transitional development and emerging infectious diseases

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Our overarching hypothesis is that new risks, in this case the H5N1 strain of avian influenza, emerge during transitions between stages of development. Moreover, these risks are not coincidental but occur precisely because of the in-between nature of the coupled human-natural system at the point when things are neither traditional nor modern but resemble the state of chaos, release and reorganization. We are testing this hypothesis in Vietnam using demographic, social, economic, and environmental data collected in national censuses and analyzed at commune and district levels to identify communes and districts that are traditional, modern, and transitional (peri-urban). Using data from the 2006 agricultural census we created a national scale urbanicity map for Vietnam based on variables that capture both the changing nature of the built environment (types of building materials, and water and sanitation systems) and the loss of and diversification of agriculture systems (percent of households whose major source of income is from agriculture, agricultural population density, poultry density). Fieldwork in the summer of 2011 showed this map to be an accurate (approximately 85%) approximation of traditional (rural), transitional (periurban), and modern (urban) communes. Preliminary results suggest that over 8% of the country's land area and roughly 13% of its population reside in periurban neighborhoods, and that these areas do have a statistically significant greater incidence of AVI as measured in chicken deaths than traditional and modern communes. Transitional neighborhoods such as these force planners to ask two questions. To what extent does the dichotomy of urban/rural makes sense in the context of Vietnam, when large areas and parts of the population are caught between the two? Second, how can planners and policy makers effectively provide for basic public goods and services in these contexts?

Integrating environment, health and development studies: an analysis of programs in the UK and the Netherlands

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Rapidly developing countries such as China and India face mounting health risks related to rapid industrialization and urbanization. There is an urgent need to increase capacity for research and the generation of other knowledge that can inform responses to these new and complex environmental health risks. This paper provides an analysis of how a number of programs at leading institutions in the UK and the Netherlands incorporate material on these three issues and the extent to which integrated frameworks for considering environment, health and development are offered. It discusses how relevant the approaches taken are to the challenges faced in rapidly industrializing countries such as China.

Rift valley fever epidemics and its socio-economic impacts in Tanzania

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Rift Valley Fever (RVF) is an acute, febrile viral disease accompanied by abortion in livestock (cattle, camel, goats and sheep) and a febrile illness that can be associated with a severe fatal haemorrhagic syndrome in humans. It is caused by an RNA virus genus *Phlebovirus* and associated with periodic outbreaks, mostly on African continent. Recent reports have revealed that certain wildlife species are susceptible including African buffalo (*Syncerus caffer*) and Springbok (*Antidorcas marsupialis*). It is a trans boundary disease and occurs in periodic cycles of 4-15 years associated with flooding from unusually high precipitations in many flood-prone drylands. *Aedes* and *Culex* spp and other mosquito species are important epidemic vectors. Because of poor living conditions and lack of knowledge on the pathogenesis of RVF, nomadic pastoralists and agro-pastoralists are at high risk of contracting the disease during epidemics. RVF is a professional hazard for health and livestock workers because of poor biosafety measures in routine activities including lack of proper Personal Protective Equipment (PPE). An outbreak of RVF in animals frequently manifests itself as a wave of unexplained abortions among livestock and may signal the start of an epidemic. RVF outbreaks in Tanzania from 1930's to 2007 with its socio-economic impacts are discussed.



Using information and communication technology (ICT) to enhance adaptive capacity of communities to climate-related water challenges in Uganda

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In Uganda, climate change poses great risks to the well being of the population. Studies show that climate changes are threatening Uganda's ecosystems and the livelihoods of the population (Hepworth 2008). Climate change is increasing the frequency and intensity of severe weather events such as droughts and floods; and possibly the incidence and spread of human and animal diseases. Inadequate water for agriculture, animal husbandry, and domestic uses is the primary cause of reduced productivity and breeds socio-political conflict among communities. Research on the use of Information and Communication Technology (ICT) for improving adaptive capacity of communities in developing countries is scarce but has started providing important indications of the potentials of ICT for enhancing adaptive capacity (Heeks 2010). A coalition of institutions and researchers from Uganda, USA, Canada and Kenya are conducting research on the use of ICT for strengthening the adaptive capacity of rural communities to climate-induced water stress and hazards in Uganda. An exhaustive appraisal of four pilot districts' vulnerability to climate related impacts on water resources involving assessment of climate trends, projections and risks will inform the development of adaptation responses blending indigenous knowledge with scientific responses. ICT tools including mobile technology, community radio, and GIS will be used for the dissemination of seasonal forecasts, advisories, early warning, market information, water management and other adaptation responses. The research methodology involves the use of quantitative and qualitative methods including remote sensing and GIS. A comparative study involving intervention and control districts will be conducted to assess the changes in adaptive capacity of individuals and communities. Research findings will inform national adaptation policy and practice.

Ecosystem approaches to the better management of zoonotic emerging infectious diseases in SE Asia (EcoZD): Inputs, throughputs and outputs

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EcoZD was the second initiative to be supported by the EcoHealth Programme at IDRC in the SE Asia region (2008); complementing the pre-existing 'Asia Partnership for Avian Influenza Research' (APAIR), and followed by Vets Without Borders Canada 'Building EcoHealth Capacity in Asia (BECA), EcoHealth Emerging Infectious Diseases (EcoEID) and the nascent 'Field-building Leadership Initiative (FBLI). EcoZD's focus is on emerging zoonotic diseases, but also on those zoonoses with significant animal and public health burden, which are perceived as a national priority. The project endorses a 'learning by doing' approach. Six trans-disciplinary teams and two 'EcoHealth Resource Centres' have carried out research on a diverse range of topics: zoonotic causes of acute human diarrhoea, food safety; as well as specific pathogens such as rabies, brucellosis and leptospirosis. Some of the highlights will be presented during this symposium; further presentations and posters of EcoZD work form part in other sessions at the IAEH conference. During this session – after the presentations by EcoZD researchers – there will be opportunity to question a panel of EcoZD and ILRI researchers on such aspects as: their perceptions of EcoHealth after 'hands-on' application, how it has helped (or hindered!) their research, on the dynamics of 'trans-disciplinary' teams, the added value of EcoHealth, sustainability, future EcoHealth projects, and implications for the new CGIAR international agricultural research program on human nutrition and health.

Comparative study of health impact of water access in urban China and India

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This interdisciplinary comparative study of urban water use in Darchen, Tibet and Leh, India analyses the relation between water management, health issues, and urban design in the context of fast expanding and globalising tourism-based economies. Both case studies are small towns in semi-arid ecologically vulnerable mountain regions of the Himalayas. The towns have been expanding steadily over the last decade through the growing influx of pilgrims and tourists, which is expected to increase exponentially in the next few years due to new transportation infrastructure. Concomitant economic growth is causing significant lifestyle changes for the local population. However, both towns, situated in semi-arid regions, are already facing serious environmental issues due to lack of water and sanitation infrastructure, and the way the society is utilizing limited water resources. Challenges include inadequate supply of drinking water, water pollution, lack of wastewater and solid waste management, and rubbish dumping in rivers. These are mapped using Geographic Information Systems. It is found that drinking water is being polluted by lack of adequate sanitation infrastructure, causing health issues. The study seeks to suggest urban design solutions appropriate to tackling the water management issue. In policy terms, the study aims to visualize to decision makers the advantages of urban infrastructure investment enabling clean drinking water access. The research can inform Eco-town models for the development of other towns in the region as a visioning of alternative water futures.



Agriculture for nutrition and health

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The Consultative Group on International Agricultural Research (CGIAR) was born in the 1960s amidst widespread concern of a Malthusian crisis looming in poor countries. In the last 40 years, the world has managed to feed its growing population (some too much and some too little) thanks to many initiatives and actors, not least international agricultural research. The last 4 decades have also seen concerns about agriculture widen from food quantity to food quality and safety, from farms to the whole value chain, from productivity to environmental impacts, and from profits to poverty and gender equity. This paper describes how, in response to changing demands, the CGIAR transitioned in 2010 from an informally managed, academically oriented system to a more structured model emphasizing impact, accountability and collaboration. As part of this change, a major new program was launched in 2012 on leveraging agriculture to improve human nutrition and health. Three of the program components focus on nutrition and one component focuses on human disease problems where agriculture contributes to the problem and potentially the solutions. The agriculture and health priorities have been identified as foodborne disease, zoonoses, and emerging diseases. Ecohealth/One Health provides an over-arching framework for this component and we describe the focus, activities, partnership strategy and impact pathway situated in an Ecohealth/One Health conceptual framework. We also cite examples from recently completed projects showing how CGIAR research could have a key role in improving the management of health risks that have their origin on farms and in food chains

Mapping the interface of poverty, emerging markets and zoonoses

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Mapping and measuring burden and risk of zoonotic diseases is important for effective targeting and resource allocation. A study commissioned by the Department for International Development, UK brought together veterinarians, medics, geographers and economists to map systems where investment in control of zoonotic diseases could bring greatest benefit to poor people. The study had several elements: we updated global maps of the number and density of poor livestock keepers; we used a macro-economic model (IMPACT) to predict and map the livestock systems undergoing most rapid change in response to market demand; we updated the map of emerging disease events by Jones et al. (2008); we conducted a literature review identifying over 1,000 studies to map the burden of endemic zoonoses; and, we extracted data on zoonotic disease from the World Health Organisation Global Burden of Disease. The resultant portfolio of maps and underlying data allowed us to map zoonoses at the interface of poverty and emerging markets. We identified 13 zoonoses responsible for most of the health and economic burden to poor people and also identified 22 countries, which bear most of the burden of zoonotic diseases. Finally, we identify regions and countries where investments in zoonoses control are most likely to pay off for the poor (South Asia followed by East-Central Africa followed by South East Asia in terms of regions.) This study demonstrates how trans-disciplinary teams can bring together knowledge from different disciplines to answer bigger questions of practical importance to decision-makers.

'Ecohealth and LM mosquitoes: Integrating public health and biosafety assessments'

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Land use modification and species invasions have been linked to recent re-emergence of some major diseases carried by mosquitoes. It is important that public health protection is ecosystem-based and contributes to multispecies biodiversity conservation. Integration of ecohealth knowledge and methods are needed for a holistic biosafety and public health assessment of using living modified mosquitoes (LMMs) for reducing the burden of mosquito borne diseases. Links between land use and health need to be incorporated into comparative risk assessment and cost-benefit analysis of using genetically modified vectors (such as mosquitoes, also termed as transgenic mosquitoes or LMMs) to inhibit transmission of vector-borne diseases. Production, release into the environment, and sustainable use of LMMs is a high-tech, high-cost health technological intervention being promoted globally by the WHO and Tropical Diseases Research (TDR). Trans disciplinary linkages and advances in disciplines of ecology, entomology, environmental, land use, health geography, and climate change can be further strengthened in WHO and TDR decision support systems, for example, by developing an ecohealth assessment framework and decision support systems for integrating public health and biosafety assessments of LMMs. It is important to integrate ecosystem and environmental data in the WHO TDR decision support systems for public health and biosafety assessments of transgenic/LM mosquitoes. For this purpose, a trans disciplinary and multilevel ecohealth assessment framework suitable to local ecology, land use patterns, climate change, and long-term health risks can be developed, thereby also providing an opportunity for trans disciplinary scientific expertise in mosquito population biology, ecology, invasiveness, coexistence, coinfection, sequelae, and other important trans disciplinary public health and biosafety requirements for holistic and sustainable global policies and practices regarding prevention and control of mosquito borne diseases.

Ecohealth learning by doing in the MENA region

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In the Middle East and North Africa (MENA) Region, Ecohealth is still in its early gestation, as it goes both unused and relatively unknown among researchers and health and environment practitioners. Educating these communities of practice about the central tenets of the Ecohealth approach--generally sound concepts like transdisciplinarity, community participation, systems thinking, and social equity--can help bridge the divide between those who practice Ecohealth and those who don't. Our group led by researchers at the American University of Beirut (AUB) aims to bridge this gap by establishing an Ecohealth working group comprised of teams of practitioners from the region who will receive training in the theoretical and pragmatic elements of the approach. This network will provide skills training through workshops, hands-on learning at an Ecohealth project site, and online discussion forums that foster ideas sharing and other forms of professional collaboration. Participants in this program will learn Ecohealth from start to finish through a hands-on, learn-by-doing program. Those engaged in the working group will be encouraged to develop their own projects and will receive financial (through grants) and technical support (through consultation) to see their work through. This project will focus its energies on a number of teams of practitioners in the region, equipping them with the skills and resources develop successful interventions that prove the value of the approach in their communities of practice, setting the grounds for its widespread adoption by researchers and interventionists.



Health research and policy in the Arab world: Dealing with a changing political landscape

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Communities of Practice help link producers and users of research based on an ecosystem approach to health and generate better scholarship. Conventional wisdom also holds that such communities promote evidence-based interventions among policy makers, allowing for an impact on larger than local scales. Communities of practice face enormous challenges given the current regional climate of unrest, turmoil, and change in the Arab world. The recent spate of national and regional crises present unique obstacles to researchers, who when confronted with a rapidly changing social, economic, and political environment must hastily adapt their research agendas to ensure they reflect current societal needs. Moreover, the situation here showcases the limitations of a 'policy' approach to community health, as more and more people are popularly protesting state failures to legislate and implement effective policies. Our proposed project with farmers in northern Lebanon offers a relevant foil for the specificities of research conducted in this historic moment. Where our first intent was to focus on occupational hazards, household living conditions, and the political economy of farming in the town of Bebnine, recent flare-ups of violence and instability in nearby cities and across the border in Syria promise to shape the course of study more so than any of these initial pursuits. In this paper, we share perspectives on lessons being learned from this initiative; we also reflect on the many challenges faced.

Unusual waterfowl mortality due to highly pathogenic avian Influenza A/H5N1 clade 2.3.2.1 in Netrokona, Bangladesh, June-July 2011

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Despite the circulation of highly pathogenic avian influenza (HPAI) A/H5N1 in Bangladesh since 2007, mortality in domestic ducks and geese has not been reported previously in this country. We investigated a cluster of high mortality in duck and geese with suspected HPAI A/H5N1 etiology in a northeastern district of Bangladesh in June-July 2011 to identify the cause and extent of the outbreaks. We surveyed the outbreak communities and collected cloacal and/or oropharyngeal swab specimens from sick birds and tissue samples from dead poultry. We tested all swab samples by rRT-PCR, sequenced cultured viruses, and examined tissue samples by histopathology and immunohistochemistry to detect and characterize influenza virus infections. We studied six communities in Netrokona district where 61% (n=1789) of chickens, 36% (n=1425) of ducks and 83% (n=220) of geese died within 14 days preceding the date of investigation. Of the 72 poultry sampled, 75% (n=56) were positive for influenza A/H5, including ducks (49/54), geese (3/8), and chickens (4/10). Infections were caused by clade 2.3.2.1 influenza A/H5N1 viruses that were recently introduced into Bangladesh. Influenza virus antigen was detected in hepatic sinusoidal lining cells of ducks and geese by immunohistochemistry. Chicken and duck tissues revealed multifocal necrosis of pancreatic acinar cells and focal necrotizing enteritis consistent with HPAI infection by histopathology. The newly introduced clade 2.3.2.1 HPAI A/H5N1 viruses caused high mortality in ducks and geese. The pandemic potential of this virus and its high mortality rate in domestic waterfowl warrant enhanced surveillance to support disease control and pandemic preparedness.



Building Ecohealth capacity in Asia

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The Building Ecohealth Capacity in Asia (BECA) project is funded by the International Development Research Centre (IDRC), Ottawa, and the Australian Agency for International Development (AusAID). The three year project, begun in January 2010, is being implemented by Veterinarians without Borders/ Vétérinaires sans Frontières-Canada. The vision of the BECA project is to build an effective network of practitioners in ecohealth within six countries of focus in Southeast Asia. The project contributes to development of ecohealth research capacity aimed at reducing the threat of emerging and re-emerging infectious diseases (EIDs) within SE Asia through: workshop training; focused discussion of and intellectual input to current field research; policy brief development; and input to and coordination with other related initiatives in the region. BECA activities and outputs have been driven by Principal Investigators (one PI, four Co-PIs), a Project Manager, and six country Focal Points. More than 100 individuals have benefitted from direct participation at BECA activities. Many of these persons have continued to use their new knowledge in teaching, project, and research related activities such as proposal development and applied field research. Participation at medium sized workshops (40+ participants) has yielded modest results in terms of continued knowledge transfer. Smaller more focused meetings with directed tasks (e.g., development of a policy brief) have been more productive in the short term. Projects that aim to develop intellectual or research capacity but without tangible outputs such as schools built or laboratories equipped are difficult to evaluate. One of the aims of the BECA project has been to develop a monitoring and evaluation framework to achieve this for ecohealth related projects. The framework is still being refined but initial application shows simple short evaluations draw more information than longer detailed semi-structured interviews, for example.

Common themes and missed opportunities of One Health and Ecohealth case studies in Asia and the EU.

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Objective: The purpose of this study was to examine One Health and ecohealth case studies from Asia and the EU in order to identify common research themes as well as themes that may be considered important but are not well researched. **Methods:** The authors relied on One Health and ecohealth case studies reported through peer-reviewed publications, institutional reports, documentation available online, and personal communication. Themes were pre-identified by authors of reports or extracted from these sources. In the latter case a combination of key word identification, examination of case study objectives, and personal communication was used. More than forty case studies were examined; importance of research themes was ranked subjectively. **Results:** Transdisciplinarity, disease prevention, zoonoses, complexity, and community level responses were identified as highly important elements of all case studies. Fewer case studies addressed improved risk management, training, community participation, and preparedness. Themes least addressed included association with wildlife, involvement of the environment, barriers to adoption, and private sector involvement. **Conclusions:** It was not surprising to find zoonoses and disease prevention as common themes, and it was gratifying to see transdisciplinarity and complexity accorded attention. However, it was somewhat alarming that the role of wildlife and interaction with the environment were not commonly addressed by the case studies given the theoretical and management importance of these factors in a One Health and ecohealth approach to disease prevention and management. Case studies generally did not suggest clearly recommendations for policy formulation, suggesting a loss of opportunity to influence governance.



Controlling Rabies in Bali, Indonesia: Developing Solutions through Understanding of Complexity

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Prior to November 2008, there were no known cases of rabies in Bali, Indonesia. Since that time more than 100 human deaths and hundreds of canine deaths have resulted from rabies. We report on a method to examine and identify elements of the rabies response and how this improves understanding of the problem and identification of control options. The Building Ecohealth Capacity in Asia project, implemented by Veterinarians without Borders/Vétérinaires sans Frontières-Canada, met in October 2011 and April 2012 to apply business management principles to zoonotic disease problems, including rabies in Bali, Indonesia. Application of the Cynefin Framework approach helped identify and assessing complexity with respect to controlling rabies in Bali. The process involved: 1) understanding elements of the problem; 2) framing the problem as simple, complicated, complex, or chaotic based on characteristics; 3) identifying implications of the framework for situational response; and 3) developing appropriate options for problem management. From analysis and discussion we concluded that the rabies control problem in Bali had gone through cycles of problem framing and response. Inappropriate methods may have been chosen that inadvertently prolonged the epidemic. Initially the problem was chaotic (no clearly defined relationships were identified; thus, no appropriate response could be developed. By mid-2009, the problem was identified as “simple” with the solution to kill the dogs (unsustainable for cultural and social reasons). Further stakeholder involvement yielded a more complicated etiology with changes to control policy (canine vaccination and community participation). Recent advances in understanding epidemiology and social issues make it clear that the response efforts now view the problem as complex (cause and effect are interrelated with complex adaptive systems including social dimensions). Clearly, understanding the context of a zoonotic disease is important to developing appropriate response strategies. Rabies control policy in Bali has been influenced by this, which we outlined through application of the Cynefin Framework. We anticipate this will continue to influence rabies control policy in Bali.

The role of Ecohealth in reducing risk of emerging infectious disease in Bangladesh.

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Introduction: Landless and ultra-poor inhabitants of the island Chars area of northern Bangladesh face severe food shortages exacerbated by flooding and drought. Livestock management patterns result in exposure to pathogens from livestock waste, increasing the risk of zoonotic and emerging infectious diseases (EIDs). Severe constraints include limited education, low employment, high poverty rates, illiteracy, and protein and energy insufficiency, particularly in children. We report activities that reduce the risk of EIDs by reducing human exposure to zoonotic pathogens and by increasing food security. **Methods:** We collected data representing human and veterinary health, economic, and agricultural production from 1500 villagers in 300 households in Bogra, Jamalpur, and Sirajganj Districts of N Bangladesh to determine the impact of increased veterinary care of dairy cows, behaviour change to reduce exposure of villagers to manure and other sources of zoonotic disease, and improved agricultural production to increase household income. **Results:** Changes contributing to significant reduction of exposure to EID hazards included: removal of livestock from one in three households; improved manure management in all villages; improved water and human waste management through use of latrines in all villages; and increased access to human and veterinary health services for most villages. Average household income increased more than 100% resulting in higher household consumption of purchased protein and energy sources. These results did not capture how villagers understand the concept of adaptation to complex systems. **Conclusions:** This research reflects five of the six pillars of ecohealth (transdisciplinarity, community participation, gender and economic equity, sustainability, and knowledge to action). Risk of emerging infectious disease in poor villages can be reduced through changes in household and village behaviour including removal of livestock from households, increased agricultural production yielding higher household incomes directed at improved food security, and improved delivery of animal and human health services. However, future research needs to address resilience in a vulnerable ecosystem to capture understanding and response to complex adaptive systems.



‘Til death do they part’: host-parasite relationships of New World monkeys and the anthropogenic disturbances that influence them

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Novel human pathogens have been hypothesized to emerge from primates as a result of anthropogenic disturbances such as human encroachment upon tropical forests, agriculture, deforestation, and climate change. The pathway by which pathogens emerge is still not fully understood despite a growing body of research. Indicators of ecological change, host and pathogen attributes were evaluated in mantled howler monkeys, *Alouatta palliata*, and people living near a forest reserve in northwestern Ecuador, in order to assess their associative role in pathogen spill-over. This study therefore aims to: 1) chronicle the full scale of primate parasitism (i.e. abundance, prevalence, and diversity) using morphological and genetic methodologies, 2) address the impact of environmental degradation on primate parasitism, and 3) compare species specific sequences from pathogen populations in human and howler populations. In howler monkeys, six genera of protozoa, four nematodes, one platyhelminth, and two Apicomplexan were detected across 96 faecal samples. Humans had reduced parasite diversity and abundance when compared to monkeys, harboring 1 protozoan species, 2 platyhelminths, and 1 apicomplexan. Results indicate no significant association between forest structure and parasite richness, yet human-howler distance had a weak effect. Prevalence of specific pathogens did vary significantly across human households and howler groups. Further genetic analysis using *Blastocystis* (and other species) as an indicator species suggest mixed subtypes do exist in neighboring communities of howlers and people. These results along with our other work on primate stress levels associated with ecological disturbances will be used to better understand possible pathways by which anthropogenic disturbance is involved with pathogen spill-over.

New approaches to environment, health and development in China and India

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This paper provides a theoretical context for the case studies that follow and suggests a new approach for analyzing the environment-related health challenges facing transitional countries such as China and India. These are usually cast in terms of a ‘double burden’ of disease, which includes both the communicable diseases common to poor countries, and the non-communicable diseases prevalent in affluent societies. But this categorization obscures a third type of health risk common to rapidly industrializing countries from air, water and soil pollution. Although industrialization brings pro-poor benefits, generating additional individual and collective resources that contribute to overall well being, it also brings long and short-term health costs that can undermine gains in poverty alleviation and threaten long term sustainability. The paper argues that despite growing recognition of these problems, priorities and resources are not yet aligned to meet the challenge. Development goals continue to focus attention on drivers of disease related to rural livelihoods and lifestyles, overlooking and in some cases exacerbating those linked to industrialization and urbanization.

Building interdisciplinary networks and knowledge for environment and health in China: Challenges and opportunities

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This paper reflects on the experiences of the Social Science Research Council's China Environment and Health Initiative and the Forum on Health, Environment and Development. Since 2007 we have been working to build an interdisciplinary network to generate a knowledge base to inform government and civil society responses to environment and health problems in China. This paper reflects on this experience with a focus on the challenges and opportunities relating to education and capacity building. This will include an evaluation of our four-year summer institute program as well as other activities focused on NGOs and local government..

Household water management as a critical point to conserve drinking water quality

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Background. Drinking water quality must be monitored from the supply source to the point where it is consumed. This is essential to identify the points at which intervention is necessary to correct problems on the water distribution system. The aim of this study was to assess drinking water quality in terms of biological contamination. Methods. As part of an integrative ecohealth project in Alpuyeca, Mexico, two water supply sources (wells), 20 household tap water, pools and purchased bottled water were sampled and analyzed for faecal coliform (FC), faecal enterococci (FE), coliphages (Ph), enterovirus (EV) and adenovirus (AdV). The study was performed during dry and rainy seasons of the year 2011. The results showed presence of faecal enterococci in groundwater extracted from both wells; inside homes stored water supplies were frequently positive to CF and EF (87% of the samples), while purchased bottled water was positive in 39% of the samples and 45% for Ph. EV detection in groundwater was very low (3%), however it is an important indicator to improve the surveillance of potential contamination sources of groundwater. The families have particular habits to store and to consume water but some of these practices can represent a hazard for the water quality. Discontinuous water distribution forces families to store water at least for several weeks. This is an aspect that can be contributing to water contamination, due to the water recharge frequency, deposits cleaning and lack of deposits cover.



Poultry Production Cluster (PPC) and its Ecohealth assessments in small-scale farmers in Indonesia

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Indonesia as other Asian countries generally face problems of poverty and employment. One option to address this problem is to develop small-scale poultry farms with the help of government's interventions. The Government had set out policies and infrastructures to develop small-scale producers. However, small-scale poultry enterprises are particularly vulnerable to economic changes and are suspected as a source of AI outbreak in 2004, which has led to 70-80% of small-scale collapse. Community have questioned to the existence of small-scale farms as AI outbreak has killed 152 people in Indonesia and it gives a severe lesson for the government. Government policy after AI outbreak is still maintaining a small-scale enterprise, but how eco-health approach should be implemented? The government has restructured the development of small-scale enterprise with a program called Village Poultry Farming (VPF). VPF also aims to encourage the development of the rural economy, however it is not successful, because of lack of focus and facilitation is not provided in a sustainable manner. In the meantime, partnership between small-scale producers and large-scale enterprises has resulted PPC that developed much faster than VPF even with limited government intervention. Limited information is available on the welfare of farmers also on eco-health impacts on PPC. One initial recommendation for the government is to reform VPF, so that AI outbreaks can be prevented.

Genetic characterization and quantitative microbial risk assessment of bioaerosols generated during the land application of livestock manure

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Land application of livestock manure is a traditional means of returning nutrients to agricultural soil, yet as animal feeding operations have become increasingly concentrated their manure production has often outpaced agronomic value. Documented implications of this waste and associated management techniques on water, soil, and food-crop quality emphasize the risks of zoonotic pathogen transfer into both environmental matrices and the public health domain. The goal of this study is to extend this understanding to include the fate and transport of zoonotic pathogens and genetic traits through aerosolization and airborne dispersion, and ultimately to characterize the public health risk posed by these bioaerosols. Edge-of-field aerosol samples will be collected following manure application at two dairy CAFOs to determine the ambient concentration, size distribution, and deposition rates of total and fecal indicator bacteria immediately downwind of their source, based on both cultivation and molecular techniques. Samples and source manures will also be screened for bacterial pathogens, antibiotic resistance genes, and host-specific biomarkers for the source tracking of fecal pollution using real-time quantitative PCR (qPCR). Gaussian plume modeling will be applied to estimate emissions factors for bacterial targets from field data, and then to model their transport away from the field. Projected downwind bioaerosol concentrations will be used to assess the human health risk associated with a range of application scenarios through quantitative microbial risk assessment. These results will lead to an improved understanding of the air quality implications of manure application, including the risk posed to public health by these activities.

Two docs, global medic, and a systems approach to community health in Cambodia

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EcoHealth encourages a systems approach to health that requires a multidisciplinary array of perspectives to provide a robust picture of the factors affecting health in a particular community and eco-region. However, amidst these myriad interdisciplinary contributions, what can a medical doctor's perspective provide?

As two Family and Community Health physicians, we travelled under the auspices of Global Medic – a disaster-response organization founded by Canadian Paramedics – to conduct a two week capacity-building mission in Siem Reap, Cambodia. In this very short period, great strides were achieved in capturing a clinical snapshot of the community in and around Siem Reap, and subsequently in organizing a number of NGOs around identified community health issues. In our intense experience in Cambodia, it became clear to us that physicians can contribute vitally towards: 1) providing a clinical perspective of community health issues to the existing network of social, health, and environmental organizations; 2) organizing existing NGOs around these identified health issues and thus creating a synergistic network of civil society to augment the work of the local government; 3) educating civil society groups around a systems approach to assist in the understanding of and intervention in community and environmental health issues. The overall experience in Cambodia validated our belief in the bridge between Family Practice and Community Health, demonstrated the effectiveness of an Ecosystem Approach to Health, and identified several educative and networking roles that a physician can have in the multidisciplinary milieu of Global Health issues Worldwide. Through these lessons, it became clear to us that medical education must have an Ecosystem Approach component in its curriculum in order to prepare future physicians for the challenging and interdisciplinary work that awaits them around the Globe.



Relating dog ecology to disease transmission: Rabies in Bali, Indonesia

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Over 130 human rabies deaths have occurred during an ongoing epidemic in Bali, Indonesia. We investigated ecological factors affecting rabies transmission and spread in Bali. Household surveys (n=8588) confirmed the high dog densities on Bali (mean: 150/km², range: 20-930/km²) and that most owned dogs are free-roaming particularly in rural and suburban areas (8%, 15% and 71% were confined in rural, suburban and urban areas respectively, and these were confined mostly during the day only; vaccination coverages were also 10% higher in confined dogs). We randomly selected and observed 69 free-roaming dogs continuously for 48 hours to quantify behaviour and movement during a period similar to the rabies infectious period. Most observed activity and contact occurred between 6-10am and 4-8pm, when dogs were less likely to be restrained. Home ranges were small (90% kernel, median~0.6km², mean=3km²), but some displacements exceeded 4km and most movement was markedly constrained to roads. This skewed movement distribution was similar to reports of transmission by rabid dogs, which is mostly localized (<1km), but a small number disproportionately carry the disease further (>3km). Despite the relatively small home ranges of Bali dogs, the high densities and frequent contact opportunities demonstrate potential for sustained transmission. Close correlation between dog movement and road networks suggests rabies is likely to spread faster than naïve diffusion models would suggest. These data should be further examined to investigate the impact of density on transmission and findings used to inform epidemiological models and develop strategic measures to contain rabies spread.

Mobile health demographic surveillance of pastoralists and their livestock in Chad

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Pastoralists in the Sahel are adapted to the special conditions of semi-arid ecosystems using mobility as an effective way to manage the uncertainty related to spatial patchy and timely limited resources availability. However, mobility often hinders access to social services and, subsequently, there is a lack of basic demographic and health indicators of human and livestock populations. In the south-eastern Lake Chad area, the demographic composition of mobile pastoralists' camps and villages was assessed before and after the rainy season in two consecutive years using random coordinates to define sample areas. Additionally, a cohort of 20 camps was equipped with mobile phones and a pilot "mobile Health and Demographic Surveillance System" established with 600 people and their livestock during one year. Interviews with the heads of camp (concerning livestock) and their wives (concerning families) were conducted regularly by mobile phone. Mobile health and demographic surveillance of pastoralists was shown to be feasible in this setting and can improve data quality and access to care. In the same area, livestock slaughtered in 3 slaughterhouses was examined during one year for presence of *Fasciolola gigantica*, one of the reported animal health priorities. For all animals, data of origin and grazing locations were collected to investigate the effects of seasonality, the movement of pastoralists and grazing habits on the prevalence of *F. gigantica*. The results show a clear correlation of grazing in the water of Lake Chad and *F. gigantica* infections in cattle, goats and sheep.



The role of trade in live wild animals in the evolution and emergence of infectious diseases

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Every time a hunter traps a wild animal in the forest, it creates an interface between wildlife and people across which viruses or bacteria can pass. This effect multiplies as that animal moves along the market chain, changing hands through rural markets and often across international borders. Trade does not take place in isolation; it enables the transfer of pathogens between wild and domestic species, whose natural ecology would normally inhibit such spread of disease. It was these same processes that led to the emergence of new viral strains such as SARS coronavirus that emerged from the wet markets of Guangdong, involving bats and small carnivores, and ultimately lead to over 8,000 human cases in 37 countries worldwide and the death of almost 800 people. Similar processes have contributed to the emergence of highly pathogenic avian influenza H5N1, which has spread on an intercontinental scale, impacting food security, inducing billions of dollars of economic losses through control measures and disruption to trade, as well as the deaths of 300 people. Approximately 30 million people are currently living with and almost 2 million people die each year from HIV/AIDS in what is perhaps the largest epidemic of animal origin in human history. This presentation discusses the history of zoonotic disease emergence and the potential role of the wildlife trade in disease emergence.

Epidemiology of important vectors and vector-borne diseases in the rangeland ecosystem of Uganda

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Epidemiological study was undertaken on important vectors and vector-borne diseases in Nakasongola and Nakaseke districts, Uganda as a basis to develop effective control measures. The study used ecohealth and standard epidemiological approaches. Mosquitoes were collected by pyrethrum spray catches method (PSC) and malaria prevalence in children under 5 years old was assessed by collecting whole blood in EDTA tubes and making thin and thick blood smears. Questionnaire was administered to assess fever cases; use of mosquito nets; animal species kept; types of ticks and tick-borne diseases; signs and symptoms; seasonal occurrence and outbreaks; indigenous and modern management practices and their effectiveness. Tick challenge on cattle was assessed *in situ* and the prevalence of tick-borne diseases was assessed by collecting whole blood in EDTA tubes following vein puncture. Thin and thick blood smears were made to assess the parasitaemia of haemoparasites. The predominant malaria vectors was *Anopheles funestus* group (62.9%), followed by *Anopheles gambiae* sl (29.8%) and other *Anopheles* (1%). Malaria vectors caught per house averaged 21.0 and 10.0 in Nakasongola and Nakaseke districts, respectively. Households which had fever cases one week prior to data collection were 83%. However, only 9.38% of them were positive, and were from resource-limited families. On cattle, *Rhipicephallus appendiculatus* tick species was the most abundant, followed by *Amblyomma variegatum* and lastly *R. evertsi evertsi*. East Coast Fever was the most prevalent tick-borne disease. Most farmers relied on the modern methods of tick control, using chemical sprays and treatment.

Ecosystem approach to Japanese Encephalitis (JE) control in Nepal

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JE has been occurring in the South-East Asia. The annual incidence of the disease is 30,000–50,000 cases worldwide with 10,000–15,000 deaths. In Nepal, during the year 1978 to 2003, total JE cases reported were 26658 and death cases were 5370 and mortality rate was 5 to 25% of which below 15 years age group the infection rate was 50%. Japanese Encephalitis (JE) is a vector borne viral zoonotic diseases, transmitted by Culex mosquitoes. Pigs are the reservoir hosts for JE virus. To study the prevalence of Japanese Encephalitis in Pig and Human, to study prevalence of JE mosquito vector, to carryout JE patients case control study in different hospitals. To develop the national policy for JE control in Nepal. Descriptive cross-sectional study was carried out from October to January 2011. To carry out JE mosquito vector survey study, household survey study, pig farmer survey study and collection of human and pig serum from the project area and to carryout laboratory ELISA test. A total 80 pig serum samples were tested by using rapid test kits (Porcine encephalitis B virus antibody rapid test kit- All - Biotest Co. Ltd.). Out of 80 samples, positivity rate was found to be 11.25%. Similarly, 16 human serum samples were collected and tested by using JE rapid kits (SD). Out of 16 serum samples, the positivity rate was found be 6.25%. For further confirmation, JE IgM capture ELISA (SD Company) was performed for all samples. The prevalence rate was the same. Out of 56 respondents (pig farmer household survey), 27% said living near pig farms and 7.1% said that paddy fields increased JE risk factors. IgM capture ELISA is a reliable expensive method for the diagnosis of JE in case of human and pig. This study confirmed that pig farmers in Nepal are surrounded by multiple JE risk factors. High cost intervention methods for Japanese encephalitis control are not feasible at present and the best cost effective method will be ecosystem health approach like awareness generation, participatory approach and behavioral changes for use of preventive measures.



Establishing link for trans-regional networking of the existing Ecohealth Networks in South Asia

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Approximately 75% of all new, emerging, or re-emerging diseases affecting humans at the beginning of the 21st century have originated in animals they are called zoonotic diseases. Notable reminders of how vulnerable the increasingly interconnected world is to the global impact of new emergent diseases include HIV/AIDS, severe acute respiratory syndrome (SARS), H5N1 avian influenza, and the 2009 pandemic H1N1 influenza virus. USAID, WHO, OIE and FAO have launched an Emerging Pandemic Threats (EPT) program that seeks to aggressively pre-empt or combat diseases that could spark future pandemics. The EPT program consists of four projects known as PREDICT, RESPOND, IDENTIFY and PREVENT. The EPT program draws on expertise from across the animal and human health sectors to build regional, national, and local capacities for early disease detection, laboratory-based disease diagnosis, rapid disease response and containment, and risk reduction. These efforts target a limited number of geographic areas, known as “hot spots”. USAID/IDRC partnership with WHO, FAO, and OIE has launched the project aiming to help developing laboratory networks and strengthen diagnostic capacities in geographic areas. There are on-going research activities, training and existing networks in ecohealth in South Asia region. These include the IDRC-funded ICIMOD project on “Land use change and human health in eastern Himalaya”. The EID projects in South Asia that funded by IDRC are dengue project in Bangladesh, Chikungunya and leptospirosis project in Sri Lanka, and Japanese encephalitis project (JE) in Nepal and India. SA and SEA have already established link by our new Ecohealth Network in the region. We could further establish and benefit from trans-regional networking. Plan for establishing trans-regional network link will be proposed and discussed at the panel.

An insect nidovirus emerging from a primary tropical rainforest

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Tropical rainforests show the highest level of terrestrial biodiversity and may be an important contributor to microbial diversity. Although logging of tropical forest can be linked to a decline in organismic biodiversity, its impact on pathogens is poorly understood. Between February and June 2004, 7,067 mosquitoes were trapped along an anthropogenic disturbance gradient in the area of the Taï National Park, Côte d'Ivoire. The gradient comprised primary and secondary forest, agriculturally exploited forest edge areas, and adjacent human settlements. We discovered a novel virus, termed Cavally virus (CAVV), representing the prototype species of a novel family within the order Nidovirales, named Mesoniviridae. CAVV was found with a prevalence of 9.3% and isolated from various mosquito species belonging to the genera *Culex*, *Aedes*, *Anopheles*, and *Uranotaenia*. Examination of the evolutionary divergence of 39 CAVV isolates along the disturbance gradient indicated an increase in virus abundance from natural to modified habitat types. CAVV was found in all sampled habitat types but with highest prevalence in human settlements. Analysis of habitat-specific virus diversity and phylogeny-based reconstruction of habitats of ancestral viruses demonstrated an origin of CAVV in primary rainforest. Critically, virus diversity decreased and prevalence increased during the process of spreading from the rainforest into human settlements, suggesting the existence of a dilution effect on the virus in its modified habitat, the mosquito community.



Identification of the sylvatic origin of St. Louis encephalitis virus and phylogeographic mapping of the exodus of cosmopolitan strains to North and South America

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St. Louis encephalitis virus (SLEV) is the major representative of the Japanese encephalitis serocomplex of flaviviruses in the Americas. In its known cosmopolitan form, the virus is transmitted between *Culex* mosquitoes and birds in North- and South America. However, its geographic and ecological origins remain obscure. As for other arboviral flaviviruses, there must exist (or have existed) ancestral strains in sylvatic amplification cycles. Here we investigated 3.491 mosquitoes in and around the Palenque National Park, Mexico, and identified the first representatives of sylvatic SLEV. Phylogenetic analyses placed the SLEV Palenque strains in basal position to all presently known SLEV strains, differing from all other strains by 4.3 – 5.8% on amino acid level (p-distance). Times of existence and geographic locations of phylogenetic ancestors were modelled by continuous ancestral reconstruction in a Bayesian relaxed random walk approach, indicating that the most recent common ancestors of extant SLEV existed ca 1500 years before present in an area comprising southern Mexico and Panama. Expansion of the cosmopolitan lineage occurred in two waves, the first of which marking the evasion of viruses from resident sylvatic viruses nearby the area of origin, followed by almost parallel appearance of a southern hemisphere clade in the area of the Amazonas delta and a Northern hemisphere in the lower Mississippi area.

Visceral leishmaniasis vector control assessment in Bihar, India – an Ecohealth approach

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Visceral leishmaniasis (VL) is a neglected tropical disease affecting vulnerable populations worldwide, requiring an ecohealth approach to better understand disease transmission to humans via the sandfly. VL in the state of Bihar accounts for two thirds of total VL burden in India, which contributes to two-thirds of South Asia's VL burden. The 2015 goal of elimination remains elusive, with Indoor Residual Spray (IRS) with DDT as the primary control strategy in India. Limited evidence exists on the association between quality of IRS operations and DDT resistance levels in the vector. We propose the first systematic assessment of the performance of vector control operations in Bihar using an ecohealth approach. The study will be conducted in 15 randomly selected villages from 3 of the 11 highest burden districts in Bihar. We will begin with a policy and implementation study that will directly inform government interventions. We will also develop a validated index to measure quality and coverage of IRS operations and conduct micro-experiments to test DDT residual activity on different surfaces in this context. Quality and coverage of IRS will then be assessed through entomological and household surveys. Eco-environmental factors affecting DDT resistance in the sandfly will be studied geospatially. A qualitative study will focus on community and spray team perceptions of vector control. The identification of key eco-environmental, social, demographic and systemic factors associated with VL vector control using a holistic ecohealth approach will provide evidence to inform policy and help eliminate VL in India by 2015.

Assessing hill-tribe zoonotic disease risk associated with livestock production

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Livestock systems worldwide are changing rapidly in response to the increasing demand for animal-based protein, institutional changes, urbanization, and globalization. In spite of the limited scale of their livestock production, these changes are having substantial impact on highlanders in the upland areas in Northern Thailand. These hill-tribes, as they are often called, are among the most disadvantaged groups in Thailand since most are poor, uneducated, unskilled, and socially excluded. Livestock production is a source of nutrition and cash income. Accordingly, animal health can have a substantial impact on their livelihoods, yet hill tribe villagers have limited capital to invest in livestock production, including technology and practices to mitigate disease risk. Moreover, the range of factors including illegal cross-border livestock trade and deforestation are among many apparent disease risk determinants. This presentation describes the transdisciplinary framework developed and employed, and the initial results from data gathered on set of villages categorized into three groups including traditional, transitional, and modern. We employed an elicitation technique for the conditional probability tables within a Bayesian network model. The framework we found most useful integrates elements of sustainable livelihoods theory, the environmental health transition risk model, and disease ecology. We describe findings with regard to how institutional factors and changing regional and local environmental and economic conditions affect hill tribe livelihoods, livestock production, and zoonotic disease risk.



An environmental disease: Disease mediated by environmental alteration by humans

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While pathological studies confirm the effectiveness of disease treatment, studies of disease ecology, including the interactions between pathogens, hosts and human actions that may create or eliminate “fertile” disease environments, are necessary to predict and prevent disease outbreaks. Research objective is to verify the hypothesis that anthropogenic environmental changes mediate disease outbreaks and spread by analyzing the lakeshore degradation- koi herpesvirus (KHV)-human linkage as a case study. We intensively examined the ecological causes and effects of KHV disease in Lake Biwa, Japan. Although we previously had no methods to detect KHV and common carp (*Cyprinus carpio carpio*) in the natural environment, we have developed novel detection methods for them. Spatial and temporal changes in water temperature in human-degraded littoral zones without a slope gradient are more homogenous than in natural littoral zones. This has the potential to affect carp behavior, stress, and immunity to KHV. We found that breeding habitats can become hot spots for transmission of KHV disease. We showed with a mathematical model that temporally high local densities of carp because of decreasing breeding habitats caused by human activity resulted in outbreaks of KHV disease. Combining these data, we found that anthropogenic environmental changes mediate disease outbreaks and spread. We will discuss how we can describe the link between the environment, pathogens, and humans for other infectious diseases based on the conceptual infectious disease model derived from KHV disease in order to understand their outbreaks and spread.

Ecosystem approach and human health and development tools in West Africa

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The Community of Practice of EcoHealth in West and Central Africa (COPEH-AOC) invests himself in the approach EcoHealth integration in the universities and the environments of practice in West and Central Africa. The COPEH-AOC promotes the training and research in EcoHealth for sustainable development. This training based is composed of three courses. The first is a basic module of training EcoHealth for ten hours. Students in any programme at all levels train with basic elements in the ecohealth approach so as to sensitize them on the unavoidable link between health and the environment. The second is 60-hours intensive training in EcoHealth which aims at familiarizing learners with the concept of Ecosystem approach in order to apply it. This training is build capacity of health sector, sustainable development, environmental professionals, students and the grantees of the EcoHealth contest in the foundations and methodologies of the Ecohealth approach for them to be able to integrate the approach in their practices and to conduct research focused on the approach. The last course relates to the public health interuniversity doctoral school (major: Environment and Health) aims to enable potential researchers and qualified professors to specialize in the EcoHealth interdisciplinary field. This training will be given in four universities (Benin, Burkina Faso, Ivory Cost, and Senegal). In conclusion, the development of three training levels contributes to the training adaptation to different targets and consequently to attract new learning. Thus, the basic module of EcoHealth training was easily integrated into the doctors training curriculum in West Africa thanks to collaboration with WAHO. The training in approach EcoHealth of professionals, researchers, teachers and students in West Africa is effective means of perpetuation of its institutionalization.

Health of vulnerable populations and community knowledge on human and animal diseases including zoonoses in the Serengeti ecosystem, Tanzania

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This study aimed to determine health of vulnerable communities, animals and community knowledge on human and animal diseases including zoonoses in the Serengeti ecosystem. A total of 790 respondents were interviewed in 12 villages of Ngorongoro and Serengeti Districts. Results showed good community knowledge on common diseases of humans and livestock. Malaria was the most common disease (49.4%) followed by Tuberculosis (27.6%), pneumonia (13.3%), diarrhoea/ dysentery (9.8%) and typhoid (6.2%). Maasai pastoralists who are semi-nomadic had more knowledge on livestock diseases than the more sedentary agro-pastoral communities. Agro-pastoral communities had more knowledge on common diseases affecting humans. Common livestock diseases mentioned were East Coast Fever (44.7%), helminthosis (29.4%), trypanosomosis (15.8%), anthrax (11%), brucellosis (7.9%), Malignant Catarrh Fever (8.8%) and coenurosis (6.1%). Some pastoral people preferred to eat raw meat (13.3%), drink raw milk (30.1%) and raw blood (25.2%) on reasons that raw products are tasty, increases energy as well as due to socio-cultural reasons. Most households in Maasai and Sonjo communities lacked latrines. In-depth interview with key informants indicated an increasing interaction of people, livestock and wildlife mainly due to human population growth and encroachment to protected areas and that communities had poor knowledge on zoonoses. The implications of increased human-livestock-wildlife interaction in relation to vulnerable populations and ecosystem health are discussed.



Assessment for prevention and control of zoonotic causes of acute bloody diarrhoea in rural Cambodia through an EcoHealth approach

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A field survey to determine potential associations of acute human diarrhoea with livestock was conducted by a multidisciplinary research team in two rural provinces in Cambodia. Sites were selected using SMS reports to the Ministry of Health: areas of both high (H) and low (L) incidence of acute diarrhoea. Questionnaires and focus group discussions collected household information on livestock health, the habit and behaviour of food and water consumption, and the environment that precipitates human diarrhoea. Among our study population 85% raise animals and 80% cultivate rice, - the latter providing the most important contribution to household income. More than 50% of interviewed households reported disease events in their livestock in the previous month. 53% of households reported sickness in 'high' villages and 42% in 'low' villages. Commonest was acute diarrhoea (H=22%; L=6%), followed by fever (H=17%; L=11%). 90 out of the 400 households surveyed admitted consuming sick or dead livestock (indeed in several villages more than 50% of those interviewed followed this practice) with >20% attributing illness following this practice. Respondents' opinions on the causes of sickness were too hot' (ambient temperature; 35.7%), from food (23.8%) and source of drinking water. With respect to food source 63% of respondents blamed vegetables as the important cause of illness compared to meat (10%). The presentation will elaborate on these and provide detailed results; additionally presenting the rationale for an on-going and second phase to elucidate further key risk factors - particularly consumption of sick/dead livestock, and the determination of specific zoonotic pathogens.

“EcoHealth Student Club”: A model of inter-professional collaboration to strengthen surveillance, preparedness, and response to infectious zoonotic threats

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EcoHealth approaches encourage collaboration of animal, human and environmental health professionals in response to emerging and re-emerging infectious threats. Challenges to institutionalizing a EcoHealth approach include silo-based practices and minimal incentives to engage cross-sectorally. A key solution involves students; instilling in these future professionals---the value and importance of multi-disciplinary collaboration---is critical to institutionalizing a Eco Health approach and changing traditional thinking. We describe a EcoHealth Student Club formed by undergraduates in Rwanda as a mechanism for strengthening cross-sectoral collaboration. A hundred undergraduate students from East of Rwanda participated in a EcoHealth workshop in spring 2012, generating ideas for cross-disciplinary opportunities to gain outbreak surveillance and response knowledge and skills. One idea was formation of a “EcoHealth Student Club”, as a community resource that can be deployed in an outbreak occurrence. This rapid response capacity relies on ongoing engagement activities within the community through developing innovative solutions to tackling existing problems where human-animal-ecology intersect. These activities are grounded in evidence-based research with multi-disciplinary faculty guidance. The Club Mission: “To minimize the risks of zoonotic disease emergence and the spread of existing and new pandemic diseases.” Future Club-initiated activities include use of social media to foster student involvement, and faculty-facilitated collaboration with community partners to implement surveillance/response field exercises. Involving students in EcoHealth, through Clubs, will encourage sustained progress as future generations enter the workforce and advance cross-sectoral solutions for preventing zoonotic disease threats.



Value of information in decision-analytic modeling for malaria control

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Malaria is a major global health issue in the tropical world with millions of cases every year. While there has been progress in its control, the re-emergence of insecticide resistance is a major threat to the sustainability of programs for controlling malaria-transmitting mosquitoes. Additional research into insecticide resistance, the environmental and health damages from insecticide use, and alternative methods of mosquito control can thus be valuable to decision makers. MDAST (Malaria Decision Analysis Support Tool) is a model-based but practical decision support tool designed to facilitate evidence-based and multisectoral malaria control policy decisions. MDAST provides a platform for decision-makers to enter information about the malaria control situation in their country, to combine this with peer-reviewed scientific research, and to estimate the potential health, social, and environmental impacts of proposed malaria control policies. In developing MDAST, information gaps were identified regarding insecticide resistance, environmental and health damages from insecticides, and the effectiveness of larvicide alternatives. We therefore use MDAST to estimate the value-of-information (VOI) from research which can reduce the uncertainty surrounding these aspects of malaria control. The preliminary results indicate that there would be substantial reduction of uncertainty for malaria control policy decisions based on MDAST, compared to those without such information. This will provide MDAST users with an expected return-on-investment (ROI) into these research areas, which can in turn improve collaboration between researchers and policymakers.

Is hunting healthy? Emerging lessons from the Nunavik Inuit health survey: *Qanuippitaa?*

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The Arctic People, Culture, Resilience and Caribou (ACRC) project, funded under the International Polar Year Program, sought to answer the question: How will Arctic Aboriginal communities continue to be resilient and healthy in relation to the social and environmental changes which threaten important human-ecological relationships now and in the future? One component of this project is a detailed analysis of the Nunavik Inuit Health Survey: *Qanuippitaa?* to investigate the health benefits of various forms of relationship between Inuit and their local environment. This survey included over 1000 participants in each collection in 1992 and 2004 in the fourteen communities of Nunavik, Arctic Quebec Canada. The survey provided comprehensive data on individuals' psycho-social well-being and biomedical health, and key environmental health concerns in the region. An aspect of the data that is only now being analysed is the relationship between Inuit participation in land-based practices and human health outcomes. Preliminary findings from this analysis indicate that older men are the only regular hunters in a population where 40% are under the age of 15 years; only 16% of dietary energy intake is derived from country foods with many in the population preferring store bought foods; contamination of country foods is an ongoing problem, hunting/fishing is not always practiced safely; some country food species are declining, and time available to be on the land to hunt/fish is declining as well. Climate change literature in the region identifies increasing risks of participation in land-based practices due to unpredictable environments. These combined findings point to a complex picture of human health-land interrelationships in the region. They also raise some interesting questions about the capacity of epidemiologically-focused data collection to elucidate the nuances of these complex interrelationships. This paper explores these preliminary findings from the Nunavik Inuit Health Survey: *Qanuippitaa?*, and places them in the broader context of land-health understandings in the international literature, then discusses some of the emerging, and challenging, questions raised by this analysis.



“If the land is healthy ... it makes the people healthy”: Applying the connection between country and health for Aboriginal Victorian people into practice and policy

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The following abstract is based on eight peer-reviewed publications, undertaken as part of a PhD by Publication, reviewing the health and wellbeing benefits of contact with traditional land for Aboriginal Victorian people. It involved ethnographic qualitative research reviewing the health and wellbeing benefits of Indigenous land management, how this can be applied at a policy level and the development of theoretical and methodological approaches to measure the health benefits of contact with nature. Such an overarching approach to this research allows for a more rounded understanding of the EcoHealth field, specifically focused on human perceptions of the natural world. Using qualitative mixed method approaches this research identifies the great health and wellbeing benefits of contact with nature. Through increasing the evidence base identifying the health and wellbeing benefits of contact with nature the author of this PhD delivers recommendations, which increase knowledge in the Ecological health field and allow for its learning's to become applied into practice. Such recommendations allow for greater application of this topic not only within the academic arena but at a community and policy level.

Surveillance for various pathogens and lead in American Black Ducks (*Anas rubripes*) from the northeastern and mid-Atlantic United States

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American black ducks (*Anas rubripes*) are an important game species of waterfowl in North America, but populations have been declining since the 1950's due to hunting, hybridization with Mallards (*Anas platyrhynchos*), and loss of habitat. This study aimed to determine prevalence of various pathogens in black ducks. We sampled 206 black ducks from wintering grounds in Connecticut (n=20), Maine (n=37), Maryland (n=43), Ohio (n=8), Rhode Island (n=6), Virginia (n=5), and breeding grounds in Maine (n=87). We tested blood lead levels and infection with hematozoan parasites, avian influenza viruses (AIV), avian paramyxovirus viruses (APMV), duck viral enteritis (DVE) virus, and *Pasteurella multocida*. The average blood lead level was 170 ppb (SE=355) and two ducks had blood lead levels >2000ppb. Some of these levels are high enough to cause clinical signs, although none of the birds sampled exhibited any clinical signs. Avian influenza viruses were isolated from 3% (6/206), APMV-1 from 3% (6/206), and APMV-4 from 0.5% (1/206). Partial sequence analysis of five APMV-1 isolates indicated they were low pathogenic viruses. Antibodies to AIVs were common (41%). Infection with AIVs and APMVs were expected and occurred at low prevalences. *Haemoproteus/Plasmodium* and *Leucocytozoon* were detected in 72% and 52%, of birds, respectively. No duck was infected with DVE or *Pasteurella multocida*, both of which are known to cause mortality in ducks. Future research is needed to evaluate the affects these pathogens, especially hematozoa, may have on the fitness of black ducks.

Ecohealth in Southeast Asia: Research, training, networking and proposed trans-regional movement

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Southeast Asia (SEA) has been considered a global hotspot of infectious disease emergence. Therefore, most ecohealth research in the region has primarily focused on EIDs and was funded mainly by IDRC. Two initiatives were launched from 2006 to 2011; one on multi-country Eco-Bio-Social (EBS) approach to dengue research in Asia in collaboration with WHO/TDR, and another on multi-country Avian Influenza research through Asian Partnership for EID Research (APEIR). Another initiative, the EcoZD project emphasizing zoonotic diseases had been initiated in multi-countries in SEA. The multi-donor EcoEID initiative supports three multi-country research projects in SEA, i.e., parasitic diseases emphasizing schistosomiasis, poultry production zones, and EIDs in global outreach hotspots. More recently, FBILI-SEA has launched research projects in four countries focusing on agricultural intensification and health. Ecohealth training has recently been initiated in SEA. "Building Ecohealth Capacity in Asia" (BECA) project organized series of workshops to build capacity in the Region. The EcoZD-funded Ecohealth Resource Centers, Universitas Gadjah Madah and Chiang Mai University, organized training and seminar series in ecohealth. The transdisciplinary graduate course of Mahidol University, which has been offered since 2007, forms the basis for development of Ecohealth Degree Program as part of FBILI-SEA. In addition, Ecohealth Training of Trainers (ToT) and Future Leader Programs have been launched at the same time by this FBILI-SEA. These proposed activities aim to generate more systematic training to build capacity in ecohealth in the SEA Region. Networking in ecohealth was established in Asia through multi-country research initiatives. These research initiatives provided the foundation for recently established "Ecohealth Network" in Asia. Through FBILI-SEA, a web-portal could be developed and served as a communication channel for trans-regional networking.



Application of an eco-bio-social approach to emerging infectious diseases on Koh Chang, Thailand: A preliminary baseline study

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Koh Chang, is the second largest island of Thailand, situated in Central East a distance of 315 kilometers from Bangkok. It has been dubbed “the eastern Andaman” and reported as one of the most beautiful natural attractions in the Gulf of Thailand. A variety of tourism resources including local people’s way of life and abundant natural resources accompanied with tourism development within the area attracts high number of tourists every year. Distinctively, traditional life style of indigenous people has been changing while natural resources are gradually altered. One of the environmental problems is an increase of garbage along seaside or roadside. In addition, an increase in the number of tourists leads to an increase in water consumption on the island which will lead to an increase in water storage and breeding sites of dengue vectors. As many tourism activities on this island is mainly eco-tourism, peoples are exposed more to disease vectors and hence a high rate of dengue confirmed cases within the area. In 2011, the number of dengue suspected and confirmed cases on Koh Chang were 156.38 and 42.66 per 100,000 populations respectively. With approximately 75% of forested area and a long-lasting rainy season which creates suitable breeding sites for malaria vectors, Koh Chang has also been reported as an area of great risk for malaria infection. According to the fact that both Thai and foreign migrant workers move in and out of the island following seasonal work, introduction and distribution of infectious diseases are enhanced. We will report the preliminary baseline study on Koh Chang in term of disease and vector surveillance and its relationship with life style, land use and climatic factors. Our finding will form the basis for development of an improved system for disease surveillance as well as best practice for disease preparedness, prevention and control on this vulnerable tourist island.

Is industrial husbandry an ecosystem disservice driving pathogen emergence? And can sovereign conservation agriculture fix the problem?

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Our hypothesis is that monoculture (industrialised agriculture and focus on selection for production traits in livestock, and resulting loss of biodiversity in livestock and nature) is providing an environment conducive for pathogen emergence in the domestic animal and human communities. This emergence is through transmission of pathogens (or raw genetic material for pathogen evolution) from wildlife species at the interface, involves evolution of pathogens in the domestic animal community and zoonotic transmission from domestic and peridomestic species to humans directly or through the food chain. This argument is set against the dogma that separation of humans and domestic animals from each other and from hosts of pathogens (wild animals and the environment) is the optimal pathway to control disease and prevent its emergence. We present a conceptual model that demonstrates that short-term gains increasing biosecurity and food production are lost over the longer term from declines in the adaptive host potential and agro-ecological resilience that block pathogens from spreading in the first place. We offer a number of examples, mostly from within a poultry sector undergoing unprecedented global expansion. We demonstrate that epizootic control at the community level can be efficiently and effectively achieved by a return to a more traditional sovereignty over food, and production systems that are in greater harmony with the ecosystems in which they are situated. Such an approach also reduces overall environmental degradation and provides more sustainable livelihoods for rural communities.



Rapid urbanization, waste management and health in Côte d'Ivoire: The case of the district of Yopougon

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Due to a rapid urbanization process, the city of Abidjan becomes a megalopolis of more than four million persons in 2012. Abidjan is characterized by intense industrial activities and important solid and liquid waste production. Unfortunately the management of those wastes is not appropriate and poses environmental and health problems. From 2003 to 2008, a study was conducted in Yopougon, the western district of Abidjan, to assess the health risk linked to the pollution of the lagoon by waste for lagoon shore communities. We used a multidisciplinary approach including chemistry, microbiology, cartography, epidemiology and socio- anthropology. In spite of a solid waste collection system, a lot of solid waste still mixed to liquid waste and throw into the environment. Those wastes arrived in the lagoon and the solid ones are thrown back on the shore. The waste water physicochemical and microbiological quality does not respect international standards for rejection in surface recreational water. For a two week recall period, fever, diarrhoeal diseases and acute respiratory infection (ARI) were prevalent and seems to contact with lagoon water for fever (OR = 2.2; IC95% =1.30-3.72) and ARI (OR = 0.13; IC95% =0.02-0.99). The spacial distribution of diarrhoea cases was close to that of refuse deposit and stagnant water in the lagoon shore area and influenced by duration of conservation in households of drinking water. The study leads to the formulation of prospects and of recommendations for actions to protect the environment and to mitigate health risk by integrative research-action.

Integrating Eco-health into policy applications: A West and Central African perspective

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Following the Ecosystem approach to health (Ecohealth) forum of Montreal in 2003, the West and Central African Community of Practice was established the same year to link producers and users of research based on Ecohealth, with a view, among others things, to promote its application by policy makers so that impact on larger than local scales could be achieved. To contribute to this particular objective, an emphasis was made on Ecohealth institutionalization within training and research institutions of West and Central Africa. A three-year (2007-2010) project for Ecohealth institutionalization was implemented and renewed for three additional years (2011-2014). Around this essential and particular project, others using Ecohealth methodology were conducted in the region, including (1) solid domestic waste management, (2) diarrhoeal diseases management and (3) water and health management for adaptation to climate changes. In this paper, we share information on progress made, lessons being learned from these initiatives and challenges that remain. Those case studies will be specifically discussed, addressing the “barriers” and “bridges” that we are observing. In particular, attention will focus on the complexity of both the researcher-policy maker relationship and environment and health issues and also on institutional instability as possible barriers but also on the strength of transdisciplinarity, community participation and equity observation in making bridges for Ecohealth application by policy makers. Suggested methodological and process recommendations will be presented for further consideration, including establishment of an information system identifying key fields of implementation information.



Adaptation to climate change in water and health sectors in 4 secondary cities in West Africa: Ecohealth approach in face of flooding events

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In 2007, floods affected 13 West African countries with more than 600,000 people affected, among these, Côte d'Ivoire, Togo, Senegal and Mauritania. Drought and flooding represent more than 90% of all natural disasters in Africa. A 3 years project titled "Ecohealth approach in the management of water and health in relation to climate change: adaptative strategies to drought processes and floods in 4 countries in West Africa" was launched in 2008. In each country, one secondary city has been targeted, respectively: Korhogo (Côte d'Ivoire), Kaedi (Mauritanie), Kara (Togo) and Ziguinchor (Senegal). The general objective of the project is to reinforce by ecohealth approach, communities' capacities to adapt to processes of drought and flooding in two climatic context (semi arid and tropical humid) of West Africa. Launching workshops have been organized in all locations, allowing to involve at an early stage the different stakeholders and to launch the establishment of the platform of collaboration between researchers on climate change, water and health issues at regional level. Baseline vulnerability assessment was undertaken at both household and community levels through environmental and social data collection (rainfall data collection, household transversal survey by questionnaire, geographical survey and semi structured interviews). Some main conclusions are that we observe a global decrease and shortness of rainfall in the four cities since the 1970s. Increasing flooding events in face of vulnerabilities will threaten water quality and health. This situation calls for appropriate adaptive management strategies for similar secondary cities in Africa.

Pedagogical value of the position of young researchers on ecohealth training and research

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Drawing on the experiences of 28 young researchers who have participated in ecohealth training and/or research in Canada (n=12), Africa (n=8) and Central America (n=8), we make the case that the successful implementation of ecohealth's pillar of community participation remains limited by the disciplinary context of academia, and that greater success in the field depends on our ability to push the pedagogy behind the teaching of ecohealth further in the direction of a democratic, participatory approach. First we present a brief overview of the background to the ecohealth awards and training. Then we develop a discussion about the relationship between disciplinarity and community participation in which we identify certain contradictory tendencies pertaining to the role of the researcher, on the one hand pulled toward disciplinary measures of success while on the other hand attempting to address the needs and issues of non-academic communities. We suggest that the challenge of practicing community participation in the field can be better addressed somewhat paradoxically through an anti-disciplinary approach to the pedagogy of ecohealth training and research, and we offer three points that might help push in this direction. The first point suggests that the realization of ecohealth does not require insisting upon the health-environment link but rather depends on providing researchers and communities with the opportunity to investigate their own predicaments. Secondly, we argue that the position of young researchers within the existing power-relations of the university offers pedagogical insights that can be used to better implement the practice of ecohealth research. Finally, we suggest that the communities of practice in ecosystem approaches to health in many regions of the world help achieve a more collective praxis by providing a platform for the integration of interests in issues of environment and health, including those of academic and non-academic groups.



Environmental issues and health literacy in the control of schistosomiasis in the Philippines

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Schistosomiasis is endemic in 76 countries 46 of which are in Africa. 207M people are infected with 120M people symptomatic and 20M severely ill. The Philippines has 28 endemic provinces out of 81 where 12 million are exposed. The disease is found in the tropics and subtropics characterized by continuous rainfall throughout the year. Infection levels are determined by site-specific factors namely internal potential, gating effects and connectivity. Understanding these factors is essential in developing wide-ranging strategies to complement chemotherapy adding environmental alterations that may be more sustainable and cost-effective in the long run. Control and eventual elimination of schistosomiasis requires long-term planning, intersectoral government coordination, protracted commitment and integrated schistosomiasis control strategies. Health education and sanitation are crucial in reaching this elusive goal and could provide more effective opportunities to obtain long-lasting results. Health literacy, presented as a new concept, involves a more participatory and more locally empowering approach to health education and communication different from the past. There are three types namely basic, functional and critical health literacy. The latter is preferred since it enables people to search for and examine health information to advance self-management and improved health outcomes. Health education should not be simply the dissemination of health information but presentation of information on social, economic and environmental determinants of health as well as evaluation of opportunities to advance policy and organizational change. Guided by an educator, the people should decide what important knowledge and skills mirror the experiences in their environment and bring about changes for healthier lifestyles.

Landscape heterogeneity and tick-borne disease: Understanding the spatial dynamics of vector-borne zoonoses using cellular automata models

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Using cellular automata models is beneficial for understanding complex vector-borne zoonotic transmission system as it can be combined with either real world landscapes for exploring direct spatial effects or artificial representations for outlining possible empirical investigations. Tick-borne diseases are the most prevalent vector-borne zoonoses in Europe. These diseases have strong links to the environment, particularly in forested and agricultural landscapes, where ticks and their hosts are found and where human risk activities are carried out. Therefore, a spatially explicit understanding of how landscape fragmentation can impact the spatial dynamics of tick-borne zoonoses is crucially needed for the development of disease management programmes. To this end, a cellular automata model was developed, incorporating a heterogeneous landscape with three interactive components: an age-structured tick population, a classical disease transmission function, and hosts. Effects of various landscape configurations on Lyme disease risk (density and infection prevalence of nymphs) were simulated and compared. Our results show strong correlations between Lyme disease risk and the density, shape and aggregation level of forest patches. These findings implicate a strong effect of the spatial patterns of local host population and movement on the spatial dynamics of Lyme disease risks, which can be shaped by landscape configurations. This model can be further integrated with agent-based models to study the health impact of human activities. An example is then given on how footprint of human recreational use of the landscape can be modelled, and where the human may encounter infectious ticks.



Ecosystem approaches for better management of *Toxoplasmosis* in Yunnan province, China

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Toxoplasmosis is a zoonosis widely prevalent in humans and animals in China. A serological survey carried out in human from 2006 until 2008 showed that prevalences rise over this period from 5.2% to 12.3% in south China. Transmission to humans is mainly via consuming contaminated food (including meat) or water and may vary greatly with different culture, ethnic, geographical location and consumption habits. Traditionally some ethnic group in Yunnan prefer to eat raw or half-raw meat or internal organs. For instant 'sour-meat' (raw fermented pork), the 'Shengpi' (a cooking method which keeps pork half-raw), and raw pig liver are all their favorite food. Such behaviors can potentially increase the prevalence of *Toxoplasmosis* and reports have demonstrated already higher prevalence in certain ethnic groups of South China. *Toxoplasmosis* is also of concern in Yunnan. For a better control of *Toxoplasmosis* an Ecohealth project funded by IDRC was implemented in selected regions of the Yunnan Province using an Ecosystem approach through trans-disciplinary participation, bringing together veterinary, public health, social science experts, practitioners, farmer and villagers. Survey tools targeting perception and behavior of respondents include questionnaire, in-depth interview and focus group discussion combined with serological sampling in animals and human. Own preliminary investigations demonstrated antibody prevalence of 30.8%, 16.9%, and 50.0% in pig, cattle and cat, respectively, which can pose a serious threat to human. Outcome mapping is used to monitor changes in stakeholder practices towards measures which can reduce the prevalence rates of *Toxoplasmosis* in selected regions.

Interdisciplinary research linking climate change and health: Learning across theory and practice

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This research project investigated the interdisciplinarity of climate change and health (CCH) research in theory and practice. Two case studies of 'successful' CCH research teams in Australia and the USA were explored. A mix of primary and secondary qualitative data was applied to an adaptive theory 'research map' approach to analyse barriers and enablers to CCH research. The case studies confirmed that the field of CCH research is inherently challenging historical traditions and power structures embedded in conventional academic disciplines, but has not yet systematically drawn on the range of scholarship in interdisciplinary theory that could inform and strengthen the field. It also identified that CCH researchers feel they face issues in gaining respect, reputation and credibility. There is, however, optimism that funding and publishing are evolving towards facilitating interdisciplinary research. Team structures, organisational support and organisational culture contribute to research success, particularly through issues of research framing, communication and time commitments. Personal motivation, sense of identity/belonging and individual learning have influence at the individual scale. Overall, these elements interlink to form a complex system of interdisciplinary practice. This research confirms that there is a clear mandate for CCH researchers to undertake effective interdisciplinary research, learn from experience and build a shared methodological knowledge base. It also highlights that there are funding and publishing synergies between CCH research and interdisciplinary theory which could strengthen research design and practice, open resource opportunities and broaden the CCH scholarly community.



Citizens' responses to pollution: Patterns of social and political embeddedness in two Chinese villages

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China's environmental pollution preoccupies academia, policy makers and the wider public alike. Yet, how Chinese people themselves manage pollution remains relatively little debated and far less understood. Given the government's recognition of the importance of citizen participation, this paper will focus on their potential role in decreasing pollution, but also in maintaining the status quo. It will ask: How do ordinary people understand pollution and act to protect themselves? Why, in some cases, do they apparently refuse to do so? When and how might this change? Current literature on China often assumes that, if only citizens were freer to participate in the political process, they would oppose pollution. Conversely, it is typically expected that when citizens do not oppose pollution, it is due to their ignorance of its effects or to structural barriers to change. Based on participant observation and semi-structured interviews in two Chinese villages, this paper examines the ways in which mining, industry and pollution become embedded within the local context. This paper looks at the complex positions citizens inhabit in relation to pollution and how they evaluate the costs and benefits of the developments it is often coupled with. It focuses on local residents' own discourses, practices, and what is at stake for them when they face pollution and its health damages. The settings compared are Baocun (a phosphorous mining and processing village) and Qiancun (a lead mining village). Where in Baocun the presence of mining and industry has created an increasingly divided community, in Qiancun locals have been more united in confronting the local state-owned mine and its workers. The paper examines under what circumstances citizens unite to oppose pollution, how they act and what their ultimate aims are. Both local communities and their cadres have complex and shifting relationships with the local mining and industry, and they draw unequal benefits from them. The patterns of action and their effects in Baocun and Qiancun are rather diverse, as are the ways in which mining is integrated within the local community. Where Baocun residents have become relatively acquiescent towards pollution and content to draw compensation and high land fees, such land fees are not available to Qiancun villagers. Many of them, however, after incessant fights with the SOE mine, have been able to start small mining operations of their own. This creates different pathways of cost and benefit. Villagers' respective attitudes towards pollution's effects on health also differ starkly. Qiancun villagers are more militant about health, more outspoken about health effects, and more demanding of tests that confirm their suspicions. While in Baocun the fact that illnesses are caused by many factors served to weaken beliefs that pollution affected health, Qiancun residents stressed that illnesses derived from water pollution are typically chronic and slow in developing (*manxing bing*). They were aware of the difficulties of proving that particularly illnesses are caused by water pollution, but still believed it to be the cause. The comparison between these two contexts will shed new light on existing academic research on environmental health policy and activism in China. It will produce important suggestions on why citizens accept pollution, under what circumstances they might oppose it, and what conditions need to be in place for them to be successful in their opposition.

How do villagers defuse environmental health risks?

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Incomplete information resulted from the unclear scientific relationship between pollution and disease, and the institutional arrangements coupled with the lack of related scientific knowledge constitutes the obstacle for the villager's perception on environmental health risks. However, villagers were not as usually presupposed as to be in the state of "waiting to die". In rural communities, the villagers fully utilized the limited information taking the advantage of the social structure and cultural mechanisms of acquaintance society. Therefore, the plight of incomplete information was effectively addressed. Facing the external source pollution and realizing that they could not reverse the situation of pollution, the villagers defused health risks strategically according to their life experience and common sense. The social relation network based on blood and geographical relationships and the elites-mass structure also helped avoid the risks for the villagers. Therefore, despite that villagers were lacking in scientific instructions to defuse the risks, they possessed their own unique logic in practice.

Outbreaks of food-borne helminthiasis related to the social-ecosystem in China

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The transmission of food-borne helminthiasis typically involves a complex network of social and ecosystem factors, such as eating habits and environment change. Many minor outbreaks of food-borne helminth infections based on families were reported in China. However, rare food borne helminthiasis are recognized to occur in major outbreaks due to long and irregular incubation period and mild symptoms. This presentation showed several major outbreaks due to some histozoic nematode (*Trichina spiralis* and *Angiostrongylus cantonensis*) and trematode (e.g. *Fasciola* spp.) to reveal their characteristics. All of these major outbreaks are associated with local cultures, special eating habits and production styles. We also note that the change of local climate and environment might play a role in the recent outbreak of fascioliasis. The change of ecosystem components, such as invasive snail species, is involved in the transmission of helminthes. The outbreaks of food borne helminthiasis often consisted of many family clusters. Unfortunately, the whole profile of outbreaks was not full understood. We recommend a surveillance system of symptom of helminthiasis for response to the emerging outbreaks.



Education, Training and Skills Building Platforms Towards Realization of One Health Concept in East and Central African Region

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The broad economic, social, medical and environmental consequences of emerging infectious diseases as evidenced by haemorrhagic fevers and influenza pandemics demand interdisciplinary solutions. One such solution, is “*One Health Approach*”, a growing global strategy that is being adopted by international health organizations and policy makers in response to this need. It recognizes the interconnected nature of human, animal, and environmental health in an attempt to inform health policy, expand scientific knowledge, improve healthcare training and delivery, and address sustainability challenges. For instance, most of the countries in the East and Central African Region, with over 40% of the land area protected for wildlife, the health challenges resulting from interconnectedness of human, animal, and environmental health are increasingly expanding. This has created a new demand for paradigm shift in training of human, animal and environmental health professionals. In essence, education, training and skill building with support from the International and National organizations have shown a significant role in the realization of the One Health concept by various health sectors. Citing experiences from activities carried out by “*One Health Central and Eastern Africa (OHCEA)*” a network of fourteen Public Health and Veterinary Higher Education Institutions located in six countries in the Eastern and Central Africa region, this paper highlights the role and challenges of academia in designing and offering education, training and skill building platforms for a new generation of one health professionals. Solutions to unlock challenges that impede progress in realization of One Health in the changing world are discussed.

Towards developing a System Framework for Causes of Foodborne Disease in Thailand 2003-2011

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Concurrent with economic development, consumers around the world are now expecting higher standards of food safety. Foodborne disease occurrence is determined by a complex system of interacting factors, including poverty, environment, food consumption habits, cultural perceptions and beliefs. This study represents a subcomponent of the ILRI/IDRC support “kitchen of the world” project which follows the Ecohealth approach. Foodborne disease outbreak data was extracted from official reports of the Thai Bureau of Epidemiology, Ministry of Public Health for the period 2003-2011 as a baseline for defining the framework for investigating the underlying ecological, epidemiological and sociological system associated with foodborne disease occurrence in Thailand. A total of 47 food poisoning investigations were identified. More than half of the reported food poisoning incidents during that period (57.5%) were associated with meat products, with red meat accounting for 36.2%, followed by fish and seafood (14.9%), and chicken (6.4%). The majority of pathogens identified were bacteria (59.6%). Chemicals (14.9%), toxins (8.5%), parasites (6.4%), and viruses (6.4%) were reported, while other etiology including mushroom poisoning and hypersensitivity were 4.3%. When interpreting this data, it needs to be taken into consideration that official reporting data is usually subject to an unknown level of underreporting bias, but the relative importance of the different sources of food poisoning should still be broadly accurate. This data together with the system framework developed using extensive literature review will be used to conduct a study based on transdisciplinarity aimed at identifying the mechanisms influencing foodborne disease risk associated with meat consumption.



Building EcoHealth Capacity in the South East Asia Region through Resource Centers in Thailand and Indonesia

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Climate change, natural disasters and emerging diseases have been recognized as visible examples of the complex situations facing the world. In Southeast Asia, the situation is further complicated by the need to integrate local social and economic factors and the limited capacities of existing institutions. In response, through the cooperative efforts of various faculties and support from ILRI/IDRC EcoHealth Resource centers were established at Chiang Mai University (CMU), Thailand, in October 2010 and at Universitas Gadjah Mada (UGM), Indonesia in January 2011, initially led by their veterinary faculties. Recent experiences of both institutions with emerging zoonoses and their control have made them aware of the need for holistic approaches such as EcoHealth. Since their establishment, activities of the centers to help achieve sustainable improvements in health, well-being, and social equity through research, capacity building, and communication have included exchanges between the universities, development of EcoHealth courses, EcoHealth student service, preparation of EcoHealth handbooks, special lectures, and a regional leadership training program. Both centers have also sought appropriate capacity building strategies for using EcoHealth concepts to deal with “wicked” health problems. Initial attempts focus on building up EcoHealth capacity at university level, and further expansion targeting local policy makers is envisioned. Diverse strategies for encouraging engagement with the centers have been implemented however, promoting transdisciplinarity and ensuring sustainability has remained the most challenging area for both centers.

Transdisciplinary Collaborative Network Structures in the Field of Ecohealth and Vector Borne Diseases in Latin America and the Caribbean (LAC)

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The Initiative “Leadership in Building the Field of Ecohealth and Vector Borne Diseases (VBDs) in Latin America and the Caribbean - ETV’s”, launched in 2011, aims at building a collaborative alliance among key actors and institutions, as a strategy to promote Ecohealth research and capacity building in the prevention and control of VBDs. We applied social network analysis in a longitudinal study of the structural and functional properties of the collaboration network among ETV’s participants and investigate how network characteristics can contribute or hinder the attainment of the initiative’s objectives. Data on collaborative relationships were collected before the beginning of the project among the founders of the initiative and then a second time a year later among ETV’s participants (n>100). In this paper, we address the evolution of the collaboration network. Our analyses are based on the hypothesis that the network will have evolved from a small collaborative group, to a transdisciplinary configuration that would include 1. three groups of researchers sharing specific interest in the three main themes of the initiative (research, teaching and social participation) and 2. bridging structures composed mostly by individuals from the civil society and political sectors, that are directly involved in applying an Ecohealth perspective to address concrete health issues associated to VBDs in their region. In the discussion, we will explore the implications of transdisciplinary network structures, in providing linkages between Ecohealth research and effective measures of prevention and control of VBDs from the local to the regional level in LAC.



Scaling up the Implementation of an Ecohealth Approach for the Control of a Native Vector of Chagas Disease in Central America.

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Chagas disease (American trypanosomiasis) causes a high incidence of illness among poor populations of Central America. Elimination of the vector *Rhodnius prolixus* allowed a native species, *Triatoma dimidiata*, to occupy an empty niche, making traditional vector control difficult and prone to house re-infestation, given the pattern of vector seasonal migration from sylvatic or peri-domestic environments. Ecohealth research is going on to address this emerging threat in border regions of Honduras, Guatemala and El Salvador. Earlier research results from Guatemala are being used to transfer and scale up low-cost and sustainable vector control interventions through community-based replication. This includes a baseline survey of entomological, environmental and serological indicators, and post-intervention evaluation in 15 border communities. The aim is to assess and document changes in housing and peri-domiciliary conditions, entomological infestation indicators, vector feeding practices (e.g. human versus animal blood meals), cost-benefit trade-offs, and social practices. Replication levers include a mix of technology and social innovations linking better livelihoods, gender equity, and health (individual and community level), such as house improvements (floors and walls) with local materials, better poultry husbandry, management of peri-domestic environments, and tailoring interventions to different environmental and social conditions (e.g. community strategies for acquiring local materials). Challenges encountered relate to capacity building in rural communities and for stakeholders from health and environment institutions, development of new (holistic) mindsets on disease prevention and control, inter-institutional coordination, and sustainability of community participation. An overall expected result is a model for inter-country collaboration for Chagas disease control in border areas of the region.

Ethical Issues and Experience in Global North-South Population Health Research: Implications for Ecohealth

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The objective of this study is to assess the ethical issues and experiences of North (developed)-South (developing) team-based population health research efforts, with a focus on researchers' complex and dynamic network of moral relationships. The study uses an innovative, interdisciplinary, mixed methods approach that engages both the humanities and the social sciences. It draws on empirical data and an applied ethics methodology to explore the ethical implications of the experiences of the fourteen North-South teams (funded by the Canadian Global Health Research Initiatives' Teasdale-Corti Team Grant program) over the past five years. The results of two on-line surveys (of researchers and research ethics board members), two case studies, and the applied ethics investigation will be presented and discussed. The study highlights that ethical issues prevalent in North-South population health research do not typically arise because the fundamental ethical values and principles are problematic. Instead, many researchers refer to the constraints of the complex institutional settings and diverse geographic domains in which global health research is conducted. Differing interpretation of values and principles, however, do contribute to North-South ethical conflicts, and procedural justice can be an obstacle to N-S researchers acting in ways that are morally appropriate. The findings have implications for inter- and transdisciplinary approaches to ecohealth research, including the design and execution of ethical polycentric and collaborative research projects.

Ecohealth Pedagogy at the Ontario Veterinary College: Three Examples, Future Plans

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In 2012, ecosystem approaches to health was adopted as one of five strategic initiatives guiding the development of the Ontario Veterinary College (OVC), 2012 - 2017. This presentation will present and explore three ecohealth themed courses currently being offered by the OVC - including graduate courses on "Ecology and Health" and "Wicked problems', interdisciplinarity and mixed methods" (a 2 week intensive course), and a fourth year pan-Canadian veterinary school rotation on ecosystem approaches to health, that has been running for almost twenty years and has informed current work on ecohealth in Canada. Each course takes a different pedagogical approach, and is complemented by the activities of the University of Guelph Ecohealth Club and the Canadian Community of Practice in Ecosystem Approaches to Health.



Ecohealth and Watersheds: Results from a Study of Watersheds as Settings for Health and Well-being in Canada

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Human health and well-being are largely determined by “upstream” environmental and social factors. These factors can be usefully viewed within the physical construct of watersheds (catchments) at various scales. This paper presents the results of the pan-Canadian *Watersheds as Settings for Health and Wellbeing Project*. The project explored connections between watershed governance and human health in five watershed organizations serving a variety of scales across Canada. The application of a systemic framework known as the Watershed Governance Prism informed the development of case studies of these five watershed organizations. Watershed partners undertook a self-assessment and participated in a collaborative workshop that explored a variety of dimensions of their programs. The range of health implications of watershed-based activities, ranging from source water protection and flood management, to the health promotion benefits of engagement with environmental stewardship was recognized by the study partners. Despite these converging objectives, participating watershed organizations identified a lack of capacity to optimize synergies and interact with partners in the health sector. Watersheds can serve as a linking or integrative mechanism to foster intersectoral action across many domains. However, there are jurisdictional and inter-sectoral gaps that need to be addressed. Collaboration, interaction and integration through watersheds is a necessary step toward improving, and achieving the “double dividend” of both effective watershed management and public health.

Looking to the Future

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The emergence of “novel” infectious diseases through cross-species transfer continues to increase. As discussed by the previous speakers, the critical drivers of emergence have been identified and are increasing worldwide, creating greater global vulnerability. Disease emergence results from disturbance to the ecological relationships between humans and the environment. The PREDICT project works to anticipate these disturbances, conduct targeted surveillance in the hotspots and develop capacity for pandemic prevention. Technological advances are enabling more rapid identification of pathogens and reporting of emerging diseases, even detecting previously unknown pathogens in the environment (“pathogen discovery”). However, determining which few of these innumerable pathogens have pandemic potential remains a major challenge. There are no general models for predicting transmissibility and virulence from molecular data, and surveillance capacity remains fragmented. To develop true predictive capacity will require developing a sustainable unified surveillance and risk assessment framework, and applying this within an Ecohealth framework to the countries where capacity is least developed.

Application of Outcome Mapping to Assess Eco-health Projects: Theory and Practices from the Zoonotic Diseases Project in the Uganda Cattle Corridor

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This paper describes how Outcome Mapping is being used by the project to track key outcomes beyond quantified states, for example the prevalence rates of the Zoonotic diseases and other research based measures. The method does this through the involvement of local communities and demystifying the science to ensure research information impacts the lives of communities. Outcome mapping approach helped the researchers move from producing research knowledge to doing research for development. Outcome mapping faces several challenges despite its strengths. It deals with quantitative measurements identified in the project Log frame rather than with qualitative changes described through Outcome Mapping. It expects the users to predict a change pathway which is not easy as circumstances during project implementation may change. In developing the Progress Markers Journals it is difficult to figure out the 'love to see' outcomes of the project. Outcome Mapping expects one to think ahead to a change pathway that is difficult to predict. Significant lessons have been learned from using outcome mapping which include but are not limited to the need for academic researchers to shift from strict adherence to basic research to the intervention phases of development. The approach also helps researchers to identify key Boundary Partners that will support the realization of a targeted vision. Project outcomes should be reflected in behavioral changes in project stakeholders as well as the researchers' perspectives. The process requires the researchers to be flexible and accommodative as they work with the local communities.



Antibody Prevalence Study for Human Pathogenic Viruses in Bats and Rodents

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Within mammals, bats and rodents are the most speciose and globally wide-spread orders. Both are discussed to be reservoir hosts for a multitude of highly pathogenic zoonotic agents. Most data are based on virus isolation and nucleic acid detection both relying on timely sampling of viraemic animals shedding detectable amounts of virus. Serologic assays serve to identify long-term detectable antibodies and allow observing cross-reactivity with closely related viruses giving a far broader image on virus abundance in host species. In this study we screened 1136 bat (16 species) and 475 rodent (13 species) serum, blood or transudate samples by a mosaic chip-based immunofluorescence assay. We assessed antibody reactivity with 14 different viruses covering five virus families (Coronaviridae, Flaviviridae, Bunyaviridae, Paramyxoviridae, Togaviridae). The average bat sera reactivity ranged from 2% for Bunyaviruses to 44% for paramyxoviruses. In particular the African flying foxes *Rousettus aegyptiacus* and *Eidolon helvum* had cross-reactive antibodies with viral antigens from Yellow Fever virus (YFV) and Dengue 2 (up to 80%) and the paramyxoviruses Mumps and parainfluenza virus 2 (up to 89%). The overall rodent sera/transudate reactivity ranged from 1% for Alphaviruses and peaked for paramyxoviruses especially Mumps virus reaching 11%. This is the first global broad-range serologic survey indicating that bats and rodents have cross-reactive antibodies against a multitude of human pathogenic viruses. The data can be used for targeted sampling of seropositive species.

Type I Interferon Reaction to Viral Infection in Interferon-Competent, Immortalized Cell Lines from the African Fruit Bat *Eidolon helvum*

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Bats harbor several highly pathogenic zoonotic viruses including Rabies, Marburg, and henipaviruses, without overt clinical symptoms in the animals. It has been suspected that bats might have evolved particularly effective mechanisms to suppress viral replication. Here, we investigated interferon (IFN) response, -induction, -secretion and -signaling in epithelial-like cells of the relevant and abundant African fruit bat species, *Eidolon helvum* (*E. helvum*). Immortalized cell lines were generated; their potential to induce and react on IFN was confirmed, and biological assays were adapted to application in bat cell cultures, enabling comparison of landmark IFN properties with that of common mammalian cell lines. *E. helvum* cells were fully capable of reacting to viral and artificial IFN stimuli. *E. helvum* cells showed highest IFN mRNA induction, highly productive IFN protein secretion, and evidence of efficient IFN stimulated gene induction. In an Alphavirus infection model, O'nyong-nyong virus exhibited strong IFN induction but evaded the IFN response by translational rather than transcriptional shutoff, similar to other Alphavirus infections. These novel IFN-competent cell lines will allow comparative research on zoonotic, bat-borne viruses in order to model mechanisms of viral maintenance and emergence in bat reservoirs.



Ecohealth Control Approach may help to eliminate *Schistosoma mekongi* in Cambodia

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Mekong schistosomiasis is endemic in two provinces in Cambodia. In the 1990s *Schistosoma mekongi* led to high infection prevalence and severe disease outcomes, including death, in high risk communities along the Mekong. A vertical control program using annual large-scale distribution of praziquantel treatment and health education reduced the infection prevalence to below 5% levels. In efforts to further reduce transmission in villages that remain endemic for *S. mekongi*, an integrated control approach using ecohealth principles is currently being tested. The study includes two interventions and two control villages. Baseline surveys include data from cross-sectional surveys on infection status and related risk factors, health perceptions in humans and possible control options. Data on the presence and infection status of intermediate snail hosts *Neotricula aperta*, and infection in dogs and cats with *S. mekongi* was also collected in the four study villages. In addition, leaders and key informants were interviewed on their knowledge of *S. mekongi* infection and possible sustainable/locally relevant control options. Individuals found to be infected with *S. mekongi* were treated with Praziquantel (40mg/kg single dose). In this presentation we shall report on the findings of the baseline survey, present the proposed interventions and discuss the difference between the study's integrated ecohealth approach and the vertical disease control interventions conducted in previous years. We will also discuss whether elimination of *S. mekongi* is feasible with an integrated ecohealth approach to disease control.

An Ecosystem Approach to evaluate the Health Status of Saidpur Village Community in Islamabad

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There is a trend for understanding health and quality of life of human beings in the context of the environment and ecosystems to which they are directly and indirectly connected. This ecosystem–health nexus in the context of Social–Ecological Systems requires evidence-based research to devise effective ecosystem approaches to health. This study meant to evaluate environmental impacts on the health status of Saidpur village community near Islamabad the livelihood of which directly depends on the Margalla Hills ecosystem. Using structured questionnaires and interviews, 129 households were surveyed to understand health symptoms and to estimate hygiene conditions associated with exposure to socio-ecological stress factors. Our findings show occurrence of flu and diarrhoea significantly higher ($P < 0.05$ and $P < 0.01$ respectively) in poor families compared to well-off ones. The logistic regression fits sickness and overall dissatisfaction with limited access to health services and environmental hygiene conditions. There exists a strong correlation between family size and poverty ($r = 0.59$, $P < 0.001$) and their interactive effect was significant on diarrhoea ($r = 0.43$, $P < 0.01$). We identified a reciprocal relationship between people and their environment where dependency on natural resources (for fuel wood and grazing) has become a limiting factor for peoples' well-being. Poverty has increased manifold as wood cutting and grazing is now prohibited due to the declaration of Margalla Hills area as National Park. The complicated link between Margalla Hills ecosystem and community health of Saidpur village exhibited in this study accentuates the need to investigate both these parameters simultaneously where ecosystem services and human health are in focus.



An Intervention Study to reduce the Faecal (*E. coli*) Contamination of Household Drinking Water in a Mountainous Area, Lao Cai Province, Vietnam

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Drinking water in mountainous areas of Lao Cai province is mainly from springs with no treatment and its faecal contamination is of public health concern. We studied intervention options to mitigate water faecal contamination. 100 households with children less than 5 were selected in this longitudinal study. Fifty households were chosen as a control group where boiling water for drinking was common. The intervention group 1 had 50 households (re-selected from control group) that chlorinated drinking water by AQUATAB tablet and stored in 20L plastic narrow-necked containers. The intervention group 2 consists of 50 households storing drinking water after boiling it in 20L plastic narrow-necked containers. Treated drinking water samples were collected biweekly during four months of intervention, totally 400 samples per each group. Water samples were analyzed to detect *E.coli* concentration using the filter membrane method. *E.coli* contamination level of household drinking water from the intervention 1 (GM: 1.17 *E.coli*/100mL) was significantly lower than that from the intervention 2 (13.95) and the control group (11.38) ($P<0.001$). While 92% of samples from intervention 1 households met WHO guidelines for 0 *E.coli* in drinking water, only 41.5% and 32.8% samples in the intervention 2 and control households met such a benchmark. Results showed that ethnicity, drinking water treatment methods, types of storage containers and cleaning practices of the storage containers were the main factors influencing the *E.coli* contamination of the drinking water. Thus the use of AQUATAB combined with plastic narrow-necked containers can be a good option to improve drinking water quality.

Case Study of Health and Environmental Sanitation in Hanam, Vietnam: Identifying the Enablers and Impediments of Ecohealth

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Research to-date has shown an increasing use of the term “ecohealth” in the literature, but many researchers claiming to use an ecohealth approach did not explicitly describe how it was used. We investigated a project of health and environmental sanitation in Hanam, Vietnam, the conceptual framework of which included the pillars of ecohealth, in order to identify impediments and enablers of ecohealth and investigate theory-to-practice. A case study approach was used, along with key informant interviews and focus groups involving researchers, members of local institutions, and community participants, as the tools for data collection; questions used related to the nature of interactions and sharing of information between stakeholders. Ecohealth enablers, impediments, and other themes that were identified pointed to the need to address issues of sustainability of research efforts and communication among stakeholders and revealed that research that only uses disciplinary methods limits participation. Our research emphasized the importance of negotiating indicators for success of the research, within a participatory approach, since they may differ among different stakeholder groups. Furthermore, ecohealth practice involves collection of data from multiple scales and sectors. The challenge of how to integrate these must be considered at the design stage and throughout the research. We recommend that ecohealth research teams include a self-investigation of their process in order to facilitate a comparison of theory-to-practice. This may serve as a best practice for ecohealth research and may also offer insights into how to evaluate the process.



Scenario Building for Community Development in Vietnam – A New Tool for Ecohealth?

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Asia has been a hotspot for emerging infectious diseases and it is often forgotten that, in the past, this emergence has been linked to water sanitation and solid waste management issues under crowded conditions. In Vietnam, there has been a large population and economic growth, but sanitation services have not caught up with this growth. As an entry point into such development initiatives, the development of participatory scenario building may offer a way forward in mobilizing local interest and support. Scenarios are stories about possible futures and are used as a long-term planning tool. The objective of this research was to adapt and test scenario building to address what a discouraged peri-urban community in Northern Vietnam could do locally to begin a first step towards improvement of their serious and complex sanitation problem. The first phase of research consisted of living within the community to identify which research tools should be used to collect data and which group of stakeholders to work with. Focus groups were the main research tool and took place weekly over one month. The research outputs included: ranked driving forces influencing sanitation in the future, a “best” and “worst” case scenario, issues and options identified for the “best” case, and feedback on the tool and process. As a potential outcome, the scenario tool offered options to identify first steps that could be made towards improvement in the sanitation situation, but the limitation lies with the group that owns the process.

South East Asia One Health University Network (SEAOHUN): A Regional Network for One Health Capacity Building

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The South East Asia region is considered as a hot spot for emerging zoonotic diseases (EZD) that could present serious socio-economic, environmental and development consequences. Due to the complex nature of disease emergence and control, the region needs strong capacity to respond to future EZD challenges. Strengthening the capacity of professionals working in the human, animal and environmental health sectors to respond to, control and prevent outbreaks of EZD is vital. To achieve this, the South East Asia One Health University Network (SEAOHUN) has been established with the support of RESPOND - one of the components of the USAID-funded Emerging Pandemic Threats Program. SEAOHUN aims to foster sustainable trans-disciplinary capacity building to respond to EZDs through leveraging the training, education, and research capacities of the network to build the skills, knowledge and attitude base for future One Health leaders. Fourteen faculties of medicine, public health, veterinary medicine and nursing from 10 universities in Indonesia, Malaysia, Thailand and Vietnam are core members of SEAOHUN. In addition, national One Health University Networks have been founded in the four countries to disseminate the benefits of the network at the national level, and to coordinate with the regional body on activities. With the support of two US-based universities, SEAOHUN members are implementing a series of priority activities focusing on development of One Health core competencies for the region (tailored to national needs), improving the capacity of One Health professionals and building a One Health evidence base through research.



Framing the Problem of Emerging Zoonotic Disease Risk Using a One Health Approach

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Integrative research approaches, such as that offered by One Health, are believed to be more effective for tackling the complexity associated with emerging infectious diseases than is employing a single- or multi- disciplinary approach. Risk-based approaches have been widely used in environmental health and epidemiology to identify critical points where hazards can be controlled and hence risks to human health reduced. While formal risk assessment can be an effective science-based tool for informing decision-making, conventional risk-based approaches have limitations when applied to emerging infectious diseases. This is due largely to the myriad possible determinants and factors operating at different spatial and temporal scales, and the uncertainties resulting from both the lack of data and unpredictability of the dynamics involved in the disease emergence process. We describe a new risk assessment framework based on integrative methods consistent with One Health, that expands on that of Codex Alimentarius and OIE Animal Health framework. It includes assessing the risk of zoonotic emerging hazards in particular, identifying critical control points in the system and communicating the risk to different stakeholders. The novel characteristics include placing risk assessment in an ecosystem context. The framework includes assessment of ecosystem vulnerability and resilience as a component of risk assessment. Risk assessment becomes interactive, including categorising and ranking hazards, vulnerable, population, and ecosystems, prioritizing risk issue in terms of funding, politic driven- versus reality and societal needs using participation. We argue the framework will provide insights on disease emergence prediction and thus prevention.

Landscape Change and Mercury Movement in the Tapajos River Region of the Brazilian Amazon: A Historical and Mixed-Methods Approach

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In the Tapajos River Region of the Brazilian Amazon, land-management practices and extensive deforestation have been identified as factors leading to the transport of naturally formed mercury compounds from the pedosphere to the hydrosphere. In this same region, river-dwelling populations are exposed to elevated levels of mercury through frequent consumption of fish that bioaccumulate the toxic organometallic compound. Given this context, the present study examines the relationships between long-term historical landscape changes, driven primarily by global and local socio-economic dynamics, and mercury deposition patterns measured in sediment cores of eight lake catchments. Landscape changes were assessed through a variety of data sources and data types to gain information on the changing socio-ecological system, including Landsat satellite imagery analysis, coupled with historical document analysis and interviews with community elders. A geochronology of mercury deposition records, using radioactive isotope analysis (²¹⁰Pb), was constructed for six sediment cores. Preliminary results suggest that deforestation and fragmentation of riparian zones during the rubber boom era (1890 – 1920's) correspond to the first major increases in mercury deposition across all catchments. Further, the extensive clearing of floodplain forests and upland forests that followed in the subsequent decades correspond to the continued and mounting mercury deposits in sediments. Our data also suggests that natural floodplain dynamics of the river-basin have important influence on mercury fluxes. As such, it is dubious to attribute mercury increments solely to anthropogenic disturbances. The implications of these results are discussed in light of human vulnerability to mercury exposure and historical development of the region from a socio-ecological systems perspective.



Ecohealth and resilience thinking: Trading lessons for human health research and practice

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In answer to the wicked problems that we face, new approaches to research and practice have emerged that view complexity as the departing point to understand social-ecological systems and that can offer socially appropriate responses to wicked problems. In this article we consider two such frameworks: resilience thinking and Ecohealth. There is richness in comparing these two frameworks when their differences are highlighted as complementarity. Although Ecohealth is oriented primarily towards health and resilience is oriented primarily towards ecosystem management, the fact that they both deal with complex systems suggests that there are opportunities for mutual learning. Such is the goal of this paper: to explore similarities and differences between resilience thinking and Ecohealth in order to identify opportunities for cross-pollination and propose areas for further research. The paper is organized as follows: First, we present the Ecohealth and resilience frameworks, focusing on the work and experiences of the Resilience Alliance and the Communities of Practice in Ecosystem Approaches to Health. Second we present the lessons from each framework that can be enlightening and useful for the other. We concentrate on the role of health, participation, equity and knowledge-to-action in Ecohealth, and on adaptive management, regime shifts, social learning and scales in resilience thinking. Last we conclude with some suggestions for a future research agenda for those interested in the intersection of environment and health.

Ecosystem Approach to Vector Control of Malaria in the North Coast of Peru: Challenges for Scaling Up Intermittent Rice Irrigation and Sustainable Agricultural Practices

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Peru's arid north coast is the highest rice-growing area of the country with 130,000 hectares under traditional paddy cultivation. Malaria is the most important vector-borne disease. Its main transmission vector is *Anopheles albimanus* that breeds in irrigated rice fields. Epidemiological research (late 1990s to 2005) demonstrated a clear correlation between increasing acreage in rice cultivation and malaria cases. Follow up research (2005-2010) in Pítipo, Lambayeque Region validated the application of intermittent rice irrigation for controlling mosquito populations and showed positive effects on rice yields and overall agricultural productivity. Comparative studies were carried out with 60 local farmers using 312 ha under intermittent irrigation and 103 ha under traditional paddy cultivation. Intermittent irrigation practices led to reductions in malaria mosquito populations by 86%-93%, lower irrigation water consumption (24%-60%), and increased rice production (21%-25%) per hectare. Significant reductions (by over a third) in pesticide and fertilizer use were observed. Research is on-going (2012–2015) on scaling up adoption of intermittent irrigation and associated sustainable agricultural practices to a watershed level (Valle de Jequetepeque, La Libertad Region). A scaling-up model and strategy are presented along with lessons on pre-conditions for scalability, levers and challenges. The aim is to generate scientific evidence for assessing the impact on malaria control through mass adoption of sustainable agricultural practices, as well as the social, environmental and economic trade-offs in technology uptake. This in turn will help establish the needed policies and multi-sector institutional support for promoting replication across rice-growing watersheds of the country's North Coast.

Climate Change, Rain Fed Maize Productivity and Malnutrition in Mexico

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This paper estimates the impact of climate change on rain fed maize productivity and its association with child malnutrition in Mexico. We use panel data for 2,196 municipalities to assess the effects of temperature and rainfall on maize yields from 2003-07. We then incorporate scenarios of temperature and rainfall changes by 2030-2039 into the estimated coefficients to explore the effects of climate change. Our estimates suggest that climate change will modify maize yields per hectare by 2030-39 between -25.2 and +24.6% on average (depending on the agricultural season, the municipality and the ensemble model used to project climate change scenarios). We then investigate whether such drops on maize yields are associated with increased children malnutrition both in rural and urban areas. On average, children malnutrition appears to face limited reaction to climate change (changes as a whole go from -1.0% to +0.3% by 2030-2039 relative to baseline stunting in 2005). Nevertheless, averages can be deceiving. The study indicates tremendous heterogeneity between rural/urban areas and regionally.



Trading in Pathogens: Wildlife as a Driver of Disease Emergence

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The wildlife trade has contributed to the emergence of a suite of diseases including SARS, highly pathogenic H5N1 avian influenza, and monkeypox virus. Animal movement, crowding, and dietary and behavioral changes are conditions inherent to the wildlife trade that align with known drivers of disease emergence. These types of trade and market conditions alter natural contact rates and transmission pathways among individual animals, species, and the commensal and pathogenic organisms they carry, thus artificially creating new opportunities for both pathogen evolution and pathogen range expansion (geographic and host species). Pathogen evolution and persistence within the trade is not well understood, but it is generally perceived as less important than pathogen range expansion as basic ecology and evolutionary principles dictate that pathogens should not kill their hosts prior to infecting other individuals. The problem with that perception is it does not take into account the turnover rate of new potential hosts in the wildlife trade, which may provide a compensatory mechanism to allow for higher prevalence and pathogenicity of pathogens. Here we modify a classic SIR compartment model to show that turnover rates in market settings alter disease prevalence and select for more pathogenic viruses. We found that the prevalence of both background viruses and introduced, more pathogenic, viruses increased during market simulations with turnover rate of less than a month. High turnover rates also allowed these invading viruses to expand into niches that were occupied by the background viruses at low turnover rates. Our results suggest turnover in the wildlife trade disrupts patterns of pathogen evolution and persistence and may be a strong driver of zoonotic disease emergence.

Status of Rubber (*Hevea brasiliensis*) Plantations as Ideal Ecosystems for *Aedes*-borne Diseases in Asia: Evidence from Kerala, India

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Asian countries contribute to more than 94% natural rubber production in the world. In Kerala, Rubber Plantations were found to be major ecosystems for the proliferation of *Aedes albopictus*, the rural vector of Dengue and Chikungunya. In a study spanning 5 years (2005 to 2010) in three Northern districts tapping was found to be suspended in 28-91% of rubber plantations during South-west monsoon season (June to September). Mosquito breeding was observed in 15531 (87%) out of 17856 latex-collecting cups with rain water collection. One of the 12 species was *Aedes albopictus*. The phenomenon was observed only in holdings (area 20 hectares and less); not in estates (area more than 20 hectares). Out of 517475 hectares of rubber plantations 480240 (92.80%) are holdings in the state. Since one hectare contains 500 trees the number of potential breeding habitats in the state was estimated to be approximately 240 million. Human dwellings, both within the plantations and within a perimeter of 100 meters from the periphery of the plantations, were potential sources for food and disease agents for the vector mosquitoes. The rubber plantation areas in the state experienced major outbreaks of Dengue in 2007 and that of Chikungunya in 2007 and 2008. The paper would further discuss in detail various ecological, economic and biological factors that would contribute to the formation of disease transmission systems in rubber plantations. Since the rubber producing countries in Asia are climatologically and geographically similar to Kerala, the conclusions of the study have the possibility of extrapolation.



Coastal Ecohealth Strategies: Forging Partnerships between Barangay Health Workers and Fisherfolk in Aurora, Philippines - healthy seas for a healthy population

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Village or Barangay health workers (BHWs) and fisherfolk leaders have played key roles in marine protected areas (MPAs) and other coastal resource management efforts. We suggest that best practice transfer can be optimized through strategic interventions. In Bohol Province Philippines, effectiveness indicators were identified through BHWs. Through household census and perception surveys with coastal families, important indicators for effectiveness of MPAs were identified. Expectations for MPA outcomes included human health, education and food security, improved habitat health and fish populations, an increase in fish catch and incomes. These findings highlighted the need for human health workers to work *hand in hand* with environment health workers. BHWs have more advanced skills and systems for monitoring human health and obtain support through local government and the Department of Health. Similar efforts focused on Barangay fish wardens could improve ecosystem services, reducing both poverty and malnutrition. In Aurora Province recent efforts have focused on best practice transfer through an established group of Ecohealth Practitioners; PAMANA - the Philippine alliance of fisherfolk MPA managers. In collaboration with the Department of Health, considering a wide range of ecohealth issues in coastal fisherfolk communities; resource workers provide and develop parallel support for fisherfolk on environmental health. The current presentation reports on the continued development of coastal resource management effectiveness indicators and related strategies. These components of coastal Ecohealth engagement occurred through two provincial Ecohealth Workshops, efforts to integrate Ecohealth within a bioregional profile and related College science programming.

Encouraging Responsible Environmental Behavior within the Family Unit in Vietnam

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Vietnam has traditionally held the family as the basic unit, with age and status determining the level of authority of each individual member. Conventional logic would suggest that in these types of cultures, pro-environmental campaigns would be best targeted with a top down approach with a focus on the head of the family to foster household-level sustainable changes in pro-environmental behavior. The strict authority lines that normally exist in Confucian cultures would mean that these campaign ideas and messages could potentially be transferred to all generations through the process of consumer socialization. However the phenomenon of reciprocal consumer socialisation; bi- or multi-directional communications and influence, is often overlooked in campaigns. Families in Vietnam are evolving, in many cases becoming smaller, and nuclear families households are becoming commonplace as a result of various social and economic changes. Whilst patrilocality, the preference of married couples to co-reside with the husband's parents, is still prevalent particularly in rural areas, extended family households are also evolving. There is also evidence that in these intergenerational households the household head is increasingly from the younger, usually working, generation rather than the traditional older generation. In this study we discuss the ramifications of reciprocal socialisation for pro-environmental campaigns. How can these campaigns be best targeted to maximize their effect within the modern Vietnamese household? Which generation, or combination of generations, is best to target? This paper contends that a more holistic approach may be needed when fostering environmental change within the family framework.



A New Generation of Intersectoral Approaches to Health: Getting our Hands ‘Wet and Dirty’ in Watersheds as Settings for Health in Northern BC, Canada

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A new generation of intersectoral issues is challenging the health sector and health researchers to get their hands ‘wet and dirty’ in a range of new conversations with unfamiliar allies - including agriculture, forestry and environmental sectors, through to watershed and land stewardship initiatives. This presentation will share insights from a ‘Knowledge to Action’ project in northern British Columbia (BC), Canada, focused on intersectoral watershed governance as a vehicle to improve social and environmental determinants of health. Northern BC is an area that represents 64% of the area but only 6% of the population of the BC, with watersheds and landscapes facing rapid social-ecological change – ranging from mining and oil and gas development to changing priorities for forestry, agriculture, and rural-urban planning. This presentation will present initial findings from a collaborative process focused on including health as an explicit consideration among the range of disciplinary, community and sectoral concerns of watershed governance. Insights will be shared regarding the importance of shared leadership and common language within a project aimed at bridging research, policy and community interests. Insights will be shared from the different approaches to boundary-crossing, including new tools to guide integrated and intersectoral work, and collaborative development of a Health Authority policy position focused on the environment as a context for health. Including watersheds as part of an integrated settings approach to health has created a range of opportunities for future intersectoral work. Specific attention will be given to the roles of the health sector in convening and supporting new types of intersectoral learning and actions that promote the converging goals of public health, social equity and ecosystems sustainability.

Universities as One Health/EcoHealth 'Game Changers': Demonstrating How Public-Private-Academic Partnerships Can Advance Transdisciplinary Approaches

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Emerging infectious diseases of zoonotic origin have had huge economic, social and health costs. This underscores the importance of professionals working effectively across health and environmental sectors and disciplines to solve complex health challenges (EcoHealth or One Health). Universities are the primary source of training for health professionals throughout the world, making them ideally suited to produce One Health leaders across human, animal and environmental health.

In recent years, universities have shown leadership in working with both public and private partners to advance One Health in four key areas:

1. Building cross-disciplinary applied training programs to develop a professional workforce skilled in One Health approaches;
2. Working with governments and private sector partners to support their missions by strengthening collaboration across disciplines and sectors;
3. Building trans-disciplinary and trans-sectoral research teams towards improved understanding and control of complex disease systems; and
4. Providing outreach to key One Health constituents to strengthen cross-sectoral engagement in communities.

Anticipated outcomes of these approaches include:

- Improved capacity across sectors to manage health threats that cross human, animal and environmental disciplines including emerging pandemic disease;
- Improved ability of graduates to meet workforce needs;
- A closer synergy between government and country needs and university-based research, education and outreach activities.

The USAID Emerging Pandemic Threats Program has advanced One Health approaches through partnerships with universities in Africa, Asia, and the US that exemplify university leadership in each of the key areas. These programs present evidence of universities role in advancing One Health worldwide.



Interdisciplinary Approach to Environmental Health Research related to Wastewater and Excreta Use in Agriculture in Vietnam

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We conducted an integrative assessment of the impact on health, environment and society of excreta and wastewater use in agriculture in Hanam, Vietnam. Health impacts focusing on diarrhoea were assessed using epidemiology and microbial risk assessment (MRA); Material flow analysis (MFA) was used to simulate environmental impact. Awareness and motivation of people to prevent health risks were assessed by Protection motivation theory (PMT). Diarrhoea incidence in adults was 0.28 episodes per person per year (pppy). Risk factors for diarrhoea were exposure to wastewater and excreta, lack of protective measures at work, and never washing hands with soap. The annual diarrhoea risks varied from 10^{-2} to 5×10^{-1} , much greater than the WHO threshold values of 10^{-3} pppy. The sanitation system is an important nutrient source entering into the surface water. The PMT study showed that people lack knowledge about the health risks related to wastewater reuse and safe reuse practices to prevent diseases, and their motivation to act for risk mitigation depended on increasing fear of disease, self-efficacy, response-efficacy, and severity. From an integrative perspective, epidemiology and MRA are complementary in identify health risk quantitatively related to wastewater and excreta use in agriculture. MFA helped identify the critical control points (CCPs) of nutrient discharge in the environment and PMT explore the reasons to improve farmers' perception on risk and their motivation to change their practices. Therefore, integrative assessment is important to identify relevant CCPs from different perspectives in an environmental sanitation system to propose comprehensive and effective interventions.

Birth Seasonality as a Response to a Changing Rural Environment (Kayes' region, Mali)

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Subsistence agricultural populations, which are vulnerable to fluctuations in climate, resources and stressors, often exhibit a birth seasonality pattern related to agricultural work cycle and food availability. The present study was carried out to quantify the seasonal variations in institutional birth rates in rural Mali between 2007 and 2010 and to attempt to link climatic and agricultural cycle dependent factors with birth seasonality. Lagged regression analysis based on time series analysis techniques were used to investigate seasonality of births and its association with climate, labour migration, agriculture workload, malaria infection, and food supply at the conception time. There was a clear bimodal pattern in month-to-month institutional delivery rate variation, and this seasonal pattern repeated each year over the study period. Our results showed that malaria infection, labour migration, and agricultural workload exerted a negative effect on conception rate and thus on delivery rate, while reliability of food supply exerted a positive effect. Our findings support an ecosystemic model of conception/birth seasonality relating climatic variables to variation in fecundity through a series of causal chains linking annual rainfall, on one hand, with malaria transmission and fetal loss, and on the other, with agricultural cycles and thus with food production, agricultural workload and socio-cultural events, which in turn are linked with energy balance and fertility. Seasonal labour migration exerted a strong influence on fertility. With increased climatic uncertainty, resulting in growing unreliability of food and increasing labour migration, changes in birth seasonality are to be expected and thus planning strategies are needed.

A 'Transdisciplinary Research-Methods Loop' in an Iterative Process of Research for Development

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A challenge of designing a transdisciplinary research methodology in ecohealth studies is to strike a balance between the complex nature of interactions between environmental systems, social systems, and human health and the uniqueness, the time and limitations of each research project. Vulnerability and social equity concerns make methodological practices even more challenging while the diversity of perspectives and interests from the participation of multiple actors (researchers, different stakeholders including policy makers and communities) may take the research into uncharted territory. Thus a negotiated balance is needed in the interplay between methodological rigor and openness to transcend the boundaries of disciplinary knowledge and the boundaries between inquiry and action. Our suggestion is that the design of the ecohealth study be approached as a research-method loop in a dynamic iterative and evolving process of learning, revisiting, adaptation and action that evolves at different scales through the engagement of different disciplines and different actors. A sequence of interconnected cycles (two-way cognitive walkthroughs) of increasing complexity is proposed for visualizing and approaching the maturity of the research methodology in ecohealth studies. Driving this development of methodology is not only the progressive clarity to the research issues, but is also bringing clarity to its complexity and actionable levels of change to improve equity, health and environmental sustainability. Finally, this series of reflective phases engage through science, to navigate uncertainty, as opposed to attempting to resolve uncertainty.



A Participatory Ecohealth Study of Smallholder Pig Systems in Upland and Lowland Lao PDR

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A cross-sectional study was carried out to determine baseline seroprevalence of key pig zoonoses and some priority pig production diseases and to evaluate public health risks of pig-raising and pork consumption in one upland and one lowland province, Lao PDR. The surveys were conducted in two provinces, Louangphrabang representative of 'upland' and Savannaket province for 'lowland'. The selection of villages is weighted by village human population derived from the 2005 National census and GIS data. Participatory questionnaire development and data storage was enabled by a new web based programme called SurVet. Humans were tested for exposure to *Taenia/Cysticercosis*, *Trichinellosis*, Hepatitis E virus and Japanese encephalitis virus (pigs: *Trichinella*, HEV, JEV, Erysipelas, CSF, FMD and PRRS). The training and field activities were done with integrated transdisciplinary approaches involving district and provincial staff, as well as students. Provisional seroprevalence and relevant odds ratios show that the viral diseases Hepatitis E and Japanese Encephalitis are widespread in both provinces, but that the parasitic diseases cysticercosis and trichinellosis are more sporadic, the latter apparently associated more with educated males of certain ethnicities. There are also results pertaining to pig health diseases and associated management risks. Further potential for multivariate statistical analysis exists. Through the identification of the spatial patterning of seroprevalence and risk factors associated with exposure to these diseases, we hope to be able to better target public health interventions and control, as well as guide future research and policy

Application of an Eco-Bio-Social Approach to Emerging Infectious Diseases on Cat Ba Island, Vietnam: A Preliminary Baseline Study

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Cat Ba (belongs to Hai Phong Province) is the biggest island of the UNESCO World Heritage Site, Halong Bay. With an area 356 km² wide, Cat Ba encompasses forested zones, coastal mangroves, and freshwater swamps, beaches, caves, and waterfalls. The island is commonly used as an overnight hotel stop on tours to Ha Long Bay run by travel agents from Hanoi. It supports a population of over 20,000, most of whom live off fishing or farming in the South, in and around Cat Ba Town. In 1986, the Northeast side of the island was designated a National Park, including a protected marine zone. It was recognized by UNESCO in December 2004 as a Biosphere Reserve of the world. At present, the National Park is at risk from a too rapid increase in tourism. There are numerous eco-tourism activities in National Park that put people in increasing contact with wildlife, specifically bats and monkeys. These animals could be reservoirs of some vector-borne diseases such as dengue, malaria and etc. The more than 300,000 visitors (local and foreign), who come and stay in the more than 100 hotels, resorts annually, are a vulnerable group for dengue fever transmission. In the year 2009, an extremely high morbidity was recorded in Cat Ba town (600 times higher than the figure of Hai Phong City). To understand the conditions that underpin the transmission of these diseases in global outreach hotspots such as Cat Ba town, we will investigate how economic development related to tourism has affected the environment and way of life of communities in this hotspot area. A partial assessment of changes in ecological, biological and sociological determinants due to an increase in tourism that contribute to community vulnerabilities to emerging vector-borne (illustrated by dengue) and zoonotic diseases will be presented.



Borderland Highlander Ethnic Minorities of Northern Thailand in Transition: Livelihoods, Livestock and Human Health

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Until recently most Northern Thailand borderland highlander villages were isolated and outside the reach of the modern world. Most were virtually entirely dependent on traditional knowledge, local resources, and agriculture production systems largely disconnected from the regional market economy. The recent installation of a road and telecommunication infrastructure has changed all this, bringing new opportunities, new threats, and increased social and ecological vulnerability. We present findings based on a review of existing knowledge assessed from the standpoint of highlanders' linked livestock, human and ecosystem health challenges. Prominent among these are changing health profiles, which have included incidences of HIV infection which are among the highest in the region, reflecting exposure to both traditional as well as modern hazards in addition to highlander marginalization. Highlander's agricultural production and environmental management systems are challenged by the need to improve crop and livestock production while conserving and in many cases restoring their natural resource base and biodiversity (including their local cultivars). Yet the lack of Thai citizenship and effective land ownership and control limit sustainable livelihood strategies. Reduction in access to natural resources including grazing and browsing area in many villages has limited the number of cattle (which serve as reserve capital), while zoonotic disease threats are exacerbated by illegal cross-border livestock trade. Intensification of pig production presents other challenges, including potential zoonotic disease. These and other issues need to be addressed to improve livestock production while mitigating emerging zoonotic disease risk.

Zoonotic Diseases and Livestock Waste Programmes based on Peri-urban Community Empowerment through *kuliah kerja nyata (kkn)*

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People around the world are aware of and concerned about zoonotic diseases. For example: 154 casualties of avian influenza (AI) in Indonesia prompted the government to give this zoonoses high priority. Beside this, livestock waste is not only a potential medium for the diseases' spread, but can also contribute to greenhouse gas emissions. Consequently, the EcoHealth Resource Center (EHRC) at Gadjah Mada University (UGM) selected the peri-urban Nanggulan District as an important activities area. The chosen location is categorized as a high incidence area for leptospirosis causing casualties, and of Toxoplasmosis as well. A possible cause is that farmers deposit livestock waste close to their dwellings. In order to solve the problem, the EHRC empowered the community via two programmes, the zoonotic diseases' awareness and the waste processes into organic fertilizer and biogas. Both UGM and EHRC synergize to empower UGM students as facilitator and motivator of the programmes. The students participating through *Kuliah Kerja Nyata (KKN)* stay with the community for two months. The KKN is held in three cohorts: October-December 2011, March-April 2012, and July-August 2012. Students analyze the data and are required to write a report at the end of each cohort. The first and the second cohort have already been performed and the last cohort is planned for July to August 2012. The monitoring and evaluation of this program is using "Outcome Mapping".

Mobile phone base stations – a health risks

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Health effects of mobile telephone use have focused mainly on the risk of brain tumours in users of mobile phones, but other types of illness have also been linked with the technology. In particular, several epidemiological surveys have suggested associations with non-specific complaints such as headache, tiredness, sleep disturbance, loss of memory, and dizziness. These findings, which echo reports of illness associated with other types of radiofrequency (RF) radiation, relate not only to use of mobile phones, but also to residence near to mobile phone base stations. Illness symptoms such as headache, fatigue, and difficulty in concentration were more common in people with higher potential exposures to radiation from nearby base stations. The question is how strong is the evidence that residential proximity to mobile phone base stations causes illness. A perceptual survey has been adopted for the present study, both exposure and symptoms were ascertained by questioning participants. Risk estimates may have been inflated through biased recall. An more important limitation is the possibility that some associations occurred by chance. An illness occurs as a psychologically mediated response to a perceived hazardous exposure. In this respect, it is notable that similar symptoms have also been reported in relation to a diverse range of chemical exposures, again without any demonstrable underlying toxicological mechanism. This study possibility by adjusting risk estimates for individual beliefs about health risks from base stations. Meanwhile, decisions on the siting of base stations must be made in a context of uncertainty. This study proposes that as a precautionary measure, base stations should be positioned in a way that minimizes the exposure of neighbours.



Transdisciplinarily approach using ARIMA modelling to link health and ecosystem and its implications for policy regulations.

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Health practices in response to ecosystem degradation are often based on long-term monitoring strategies. However, lack of ecosystem knowledge and research gaps restrict policy makers to link health and environment into practice. In this perspective, we analyzed 12 months data that are considered essential to identify relationships between respiratory problems and variations in air pollution in an urban ecosystem based on climate driven factors. The modeling tool used in this study identifies air pollutants that are susceptible to climate change and have adverse health effects. We observed a strong correlation between respiratory responses (shortness of breath, irritated cough and inflammation of submucosa) with that of air quality. Our results further demonstrate that life cycle of air pollutants which includes oxides of nitrogen, sulphur, ozone, particulate matter and pollens are affected by chemical as well as meteorological factors, such as temperature, humidity, wind, solar radiation and precipitation. Based on ARIMA model from “time series expert modeler” category, four strong climate predictors were identified in the final model (Ljung-Box statistics=81.78; stationary $R^2=0.69$; $p<0.000$). Since environmental regulations are not properly followed in developing countries such as Pakistan, therefore spatial variability of most of air pollutants and their emission are influenced by climate-change signals. Hence changing climatic conditions induced by anthropogenic emissions of greenhouse gases may be expected to have significant effects on air quality and subsequent health outcomes especially at the regional to local scales. Modeling based on ARIMA ascertain that current transdisciplinary approach can be used as an effective tool to study temporal relation of exposure to air pollution, climate change and adverse health as an environmental outcome. In conclusion we strongly stress the need to create multidisciplinary research teams where skills of geographers, GIS experts, meteorologists and modeling experts could be integrated to estimate likely health impacts of global environmental change.

Eco-health reflection for petroleum hydrocarbon pollution in urban environment and related health impacts

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The global burden of environmentally-related disease substantially foresees acute and chronic exposures to chemicals as prime public health issue. Naphthalene exposure in urban environment is one good example. The significance of urban habitat as exposure route for naphthalene and associated health risks were examined in Rawalpindi city. Petrol pump workers (n=72) and control subjects (n=84) were studied for health symptoms and naphthalene body burden. Physical health disorders (skin lesions, eye redness, dryness of tongue/lips, appetite loss) and neurasthenic symptoms (body aches, fatigue, fainting, twitching, sleeplessness, irritability) were recorded. Serum naphthalene concentration (median) among petrol pump workers was 161 $\mu\text{g L}^{-1}$. Results showed that a 25 to 100-fold increase in serum naphthalene corresponds to work-hours in outdoor environment. Multinomial logistic model fitted a number of neurasthenic symptoms with work hours as significant predictors and gave mean parameter estimates for $t_{1/2}$ of 4 hours and t_{max} of 8 hours. We found employment duration and daily work-hours having significant effect on serum naphthalene levels. High prevalence of physical disorders among workers was attributed to 6 h/day or more (OR=2.89, 95% CI=1.05–7.96). Occupational work for 15 years or more at petrol pumps attributed most for neurasthenic symptoms development (OR=2.92, 95% CI=1.17–7.19). We rated overall health and functional capacity of subjects having naphthalene exposure significantly poorer than that of general population. The study concludes that disease burden due to chemical exposure in urbanization context must be given priority while examining other sources of exposure.



Linkages between avian-associated pathogens and human health in wetland and recreational water environments of Lake Erie

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Avian species are capable of carrying protozoan, bacterial, and viral pathogens over vast distances, especially during annual migrations. These pathogens can then be dispersed into the environment via fecal contamination of soil and water. Consequently, wild and domestic animal and human health hazards can emerge. Although these general concepts are accepted, appropriate and robust data are lacking and needed to provide adequate, timely, and improved information about the fate and transport of avian-carried pathogens through the environment. The specific aim of this study is to characterize and differentiate pathogen shedding across selected avian genera (*Branta* spp., *Anas* spp., *Larus* spp.), and to determine their transport patterns via soil and water at sampling sites within Ottawa National Wildlife Refuge and Magee Marsh Wildlife Area along the southern shore of Lake Erie (Ohio, USA). It is hypothesized that quantitative and qualitative data will show that pathogen composition, levels, and distribution differ across selected avian genera. This will be accomplished through spatiotemporally integrating maps that include results from molecular laboratory analyses (e.g. qPCR) with environmental parameters (e.g. turbidity, temperature, pH, etc.). Initial data collection will coincide with the summer swim season and will be used to characterize human health hazards that may arise as a result of exposure to recreational water. This poster will present preliminary findings regarding pathogen movement and presence gathered from weekly sampling results from May through September 2012, and will detail ongoing and future sampling being done to examine seasonal shifts in microbial communities among selected avian genera.

Zoonotic Disease Threats in the Greater Mekong Subregion: An Ecological Perspective

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As societal development rapidly advances in the Greater Mekong Subregion (GMS), changes in land use, animal husbandry and increasing trade and transport result in a growing number of ecological opportunities for zoonotic pathogens. Increased contact rates among humans, livestock, and wildlife in these areas may result in increased interspecies transmission and opportunities for pathogen spillover and disease emergence. Concurrently, zoonoses that had formerly been regionally eradicated are re-emerging. A variety of risk factors may affect the emergence of zoonotic diseases in this region including dramatically changing ecological conditions and wildlife-livestock interactions, pathogen evolution, and lack of commitment among stakeholders/ineffective public health infrastructure and policy. Therefore, this study investigates regional developmental circumstances associated with a high potential for zoonotic disease emergence and reemergence, while estimating the size of the population at risk per infectious agent inspected. Based on data for known wildlife, livestock and human pathogens that potentially represent a public health threat, we attempt a coarse-grained spatial assessment of emerging zoonotic disease risk aimed at identifying high risk geographic zones and population groups within the GMS. The results suggest how zoonotic disease emergence risk mapping could be further developed for potential use in prioritizing surveillance and mitigation efforts.



Impact of an efficient biomass stove (patsari) intervention on children's respiratory health

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One approach to decrease the health burden related to indoor air pollution due to domestic solid fuel use, has been the intervention with efficient wood-burning chimney stoves. The aim of this study is to assess the impact of the introduction of Patsari stoves on the respiratory health of young children in highlands Michoacán. A total of 668 households in six rural communities in a fuel wood using region were selected and randomized to receive an improved stove (Patsari) early on or keep their traditional wood fire until the end of the follow up including 10 monthly visits. During each home visit, a questionnaire was applied to the mother asking for a two week recall of signs and symptoms of the index child. Longitudinal data was analyzed using population averaged modified Poisson regression. Adherence to the intervention was low (50%). Children whose mother reported using the Patsari stove most of the time compared with those using the open fire, had slightly lower risk of respiratory symptoms (nasal secretion RR 0.90, 95%CI 0.79, 1.04) adjusting for relevant confounders. The intention to treat analysis showed no impact of the improved stove intervention on children respiratory outcomes, but considering the stove use reported by the children mothers' a small effect was observed

Exposure to dioxins/furans associated to genotoxic damage in pregnant women in Puebla Mexico and their risk perception

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Background. An industrial corridor in the municipality of Huejotzingo Puebla has arised concern from the population due to the presence of different pollutants. The local social organizations demanded an integral study to assess the risk of cancer. Objective. To assess the association between exposure to dioxins and furans and early DNA damage as well as to characterize the social perception. Methods. Longitudinal study in 320 pregnant women in two communities with different distance to the industrial corridor. Micronucleus and comet assay were performed as well as exposure to 7 dioxins and 10 furans. In depth interviews were performed in a subsample to learn about social perception of risk. Results. Mean DNA migration was 24.4µm (range 0 a 75). Mean Micronucleus number in the subsample was 5.8 (range 0 a 22). In the umbilical cord, mean DNA migration was 27.7µm, (range de 12.5 a 85) and Micronucleus 3.8 (range de 0 a 14). No significant differences were found for this parameters between localities. Preliminary results showed a significant correlation between 12378-Hp-furan and comet assay (p=0.0089). Women from the closest community to the industrial corridor referred that they have lived their pregnancy period with fear because they know several cases of children with malformation and birth prematurity. Conclusions. Significant DNA damage was found in both communities. Women report a high risk for the children due to industrial pollution.

The Impact of climate variability and change on human health in Central America: state of the art.

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Background and aims: Central America has a high incidence of diseases vulnerable to climatic factors and hidrometeorological events, but the amount of information generated during the last years is unknown. In this study we made a bibliographical research to have an idea of the documents created of the effect of hidrometeorological events and climatic factors on the emergence of diseases. Methods: Using web searchers, we looked for indexed and not indexed literature published between 1960 and 2010 concerning to diseases with high vulnerability to climatic factors and hidrometeorological events in Central America. Results: We found 285 documents from which 80% were scientific articles. Most documents found a relationship between hidrometeorological events and the incidence of diseases, but also the impact of socioeconomical factors are described. There was a lack of information about future scenarios projections and their impact on human health. Almost no information was found about denge, Chagas and acute diarrheal disease and their relationship with climatic variables. In the same way, there were few studies of the effect of air pollution in large cities and their impact on population health. Conclusions: Although we found extensive bibliography, few of them investigated the effect of climatic variables on the incidence of diseases and future scenarios projections with their effect in the incidence of diseases. The results were presented to the Central America health ministries to give them recommendations for future research projects.



Association between temperature, ozone and hospitalizations for respiratory diseases in children from Mexico City

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Background and aims: Studies have documented associations between temperature and mortality or hospital admissions. Impacts may be exacerbated in cities with high levels of air pollution like Mexico City (MC). Because of the concern about potential impacts of climate change, the objective of this study was to evaluate the association between increased temperature and pediatric hospital admissions in MC due to respiratory diseases during: dry-cold, dry-warm, and humid season adjusting for air pollution. **Methods:** An ecological study was conducted using a retrospective time series analysis of daily admissions records from 11 pediatric hospitals in MC from 2000 to 2002. The accumulated risk of hospital admissions due to temperature was evaluated using generalized additive models (GAM) with Poisson regression, adjusting for seasonal trends, holidays, humidity, 8-hr maximum moving average of O₃ and average PM₁₀. Time trends and seasonality were adjusted with natural splines with different degrees of freedom (df) per year. Models were stratified by season. **Results:** A total of 37,018 hospital admissions were evaluated for all causes of illness, of which 9,067 corresponded to respiratory illnesses. During the study period, the maximum average temperature was 23.7°C, 27.5°C and 24.8°C during the dry-cold, dry-warm and humid period, respectively. The O₃ mean concentration was 165.25 ppb in the dry-warm period. For this same period, the overall effect for lag0 to lag5 for every 1°C increase in maximum temperature, showed 1.66% (95% CI: 0.26, 3.08) increased risk of hospital admissions due to respiratory causes for children 1 to 14 years old, and 1.32% (95% CI: -0.15, 2.82) for children 1-5 years. **Conclusions:** There is an increased risk of hospitalizations for respiratory disease associated with the increase in maximum daily temperature during the warm period in children all ages (1-14 years). High ambient ozone concentrations were found during the same period.

Environmental Health in Alpuyecá, México. An Ecosystem Approach

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We conducted a participatory action research (PAR) with environmental health (environmental sampling, biomarkers, risk assessment) and health promotion methods (coalitions buildings, participative evaluation, PRECEDE-PROCEED model) to identify, quantify and propose solutions to a complex environmental problematic in Alpuyecá. Results: A participative space was created (CASITA), involving community members, authorities and a multidisciplinary research team, for collaboration, activities planning, participatory prioritization, intervention proposals and PAR evaluation. Baseline study showed that the three primary causes of morbidity are dengue, respiratory and gastrointestinal diseases; there were also high blood lead levels in a sample of 216 children from 6 to 12 years of age, the average was 7.3 µg/dl (range 1.5-36.5), 65% above 5 µg/dl. 48% of the participating homes use cooking lead-glazed pottery and 37% has dirt floor. Fecal contamination evidence (bacteria, enteric virus) were found in two wells, 3 river sampling points (recreational areas) and 20 houses. Finally, previous studies documented high levels of polychlorinated biphenyls (PCBs) in agricultural and habitational soils (range 41 mg/kg-34,710 mg/kg). After prioritization, the accomplished interventions were: a participatory management plan according to potable water flow chart critical point, reduce lead effects workshops, children with lead levels ≥ 10 µg/dl visits; dengue control and good solid waste management integral intervention (reducing house index from 40% to 6.7% and Breteau index from 50% to 13.3%). Future actions: lead sources reduction, capacitors containing PCBs disposal and treatment, PAR evaluation and CASITAS's survival plan. Conclusion: Greater impact is achieved using an ecosystem approach on a complex environmental health scenario.



Uncovering the Origin of Pathogenic Fungus *Batrachochytrium dendrobatidis*: The First Retrospective Historical Survey of Amphibian Disease Chytridiomycosis in Asia

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One of the most ancient and diverse groups of organisms on the planet, amphibians, is undergoing one of the largest vertebrate declines ever recorded in our human history. In 300 million years, amphibians have survived four global mass extinctions only to experience pandemic declines in the last few decades with little explanation as to why. Recent assessments by the IUCN international species watch has listed one third (32%) of the taxon are now threatened summing up to 1,856 species. Experts suggest amphibians are on the frontline an emerging global biodiversity crisis and may be an indicator of the anthropogenically driven sixth mass extinction event on Earth. The globally emerging amphibian disease, chytridiomycosis or chytrid, caused by the fungal pathogen *Batrachochytrium dendrobatidis* (hereafter “Bd”) has devastated amphibian populations on multiple continents. Worldwide amphibian population crashes, due to chytridiomycosis, have resulted in critically low regional population level drops and in some cases species extinctions however not all species are susceptible. There has been much debate on the origin and mechanism of the spread of Bd. To understand and contain the propagation and expansion of a disease it is essential to understand its origins. Areas of endemism should reveal mechanisms for host survival and reveal low susceptibility to the disease. Previous studies for origination of Bd show strong evidence for an endemic lineage in Japan. Amphibians in Japan have not shown the types of mortality rates and crashing population events as in other areas of the globe, suggesting a host pathogen history of coexistence and endemism. In this study we used a retrospective analysis on 720 archived amphibian museum specimens collected across the archipelago of Japan from 1900 to 2011. We used a PCR assay developed in our lab to test museum specimens and found that Bd was not extensively prevalent across a spatial and temporal scale. Detection of low Bd prevalence in the past suggests the disease may be an emerging pathogen even in Japan and other Asian countries.

Transdisciplinary communication: impacts on health and vulnerability of highland ethnic communities in thailand

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For centuries, ethnic groups, known as hilltribes, practiced shifting cultivation in isolated highland villages in northern Thailand. Some earned small amounts from growing opium. Communication was almost exclusively with other hilltribe villages; access to government services, including health care, was extremely limited. Beginning in the 1970s, opium eradication efforts and changes in land use regulations increased the vulnerability of the communities. Clearing of new land for agriculture and periodic relocation of villages were prohibited resulting in a decline in agricultural productivity as soil fertility dropped. Forest products, including food items, were soon locally exhausted exacerbating health problems such as under nutrition and vitamin deficiency. Attempts by some families to earn cash income resulted in increased prostitution and consequent HIV/AIDS infection. Effectiveness of development agencies and other government institutions was initially limited due to language barriers and cultural communication gaps which also affected patterns of tribal leadership. Beginning around 1990, a *de facto* transdisciplinary approach to communication was embedded in development activities. Extension of electricity to highland areas facilitated access to radio and television broadcasts, accelerating the flow of information, including health issues. Introduction of telephones aided interpersonal communication, motivating exchange of information outside the community. Construction of roads, schools, and health facilities encouraged improved Thai language ability and facilitated adoption of crop and livestock technologies to increase yields and reduce zoonotic infections. The transdisciplinary communication efforts synergistically improved the health and reduced the vulnerability of hilltribe communities.



An Initiative to Build Leadership in Ecohealth for Vector-Borne Diseases Control and Prevention in Latin America and the Caribbean

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The ecohealth approach for human health, supported by IDRC, promotes public health interventions from a social, ecological, economic and cultural perspective. An initiative to consolidate the ecohealth approach as an innovative strategy in education, research and social participation for the prevention and the control of the VBD in Latin America and the Caribbean is currently being conducted by a strategic alliance of social and public health institutions leaders and a network of Communities of Practice for the Ecohealth Approach. We present the conceptual and operational frameworks in four strategic areas: research, education and training, social participation, monitoring and evaluation based on knowledge management. The preliminary results will be presented in a participatory action research framework: 1) a regional research program to develop models and methodologies -based on transdisciplinary and multi-sectorial approaches- to promote the scaling-up of interventions for VBD prevention and control; 2) a training program on ecohealth and VBD, directed to key target groups (strategic, academic, operative and community) to construct a critical mass of interlocutors for the adoption of the approach; 3) a communication strategy to promote the appropriation of the approach, and 4) a knowledge management based scheme that favors the incidence in policies and VBD prevention and control programs. This Initiative is already strengthening the existing institutional networks in LAC and promoting the incorporation of academic and research groups, social institutions and key social actors in Mexico, Colombia, Brazil, Venezuela, Peru and Central America as a starting point to construct a regional network.

Prevalence of zoonotic disease agents shed by free-ranging white-tailed deer is spatially correlated to manure and human waste biosolids applied to land

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In this study, we investigated zoonotic enteric pathogens and antibiotic resistant genes (ARGs) in the feces of wild white-tailed deer (*Odocoileus virginianus*) as related to proximity of deer to land that regularly receives livestock manure or human waste biosolid fertilizers. Deer feces were collected on public land in the St. Lawrence River Valley and the Adirondack State Park of New York State. *Campylobacter* spp. 16S rDNA was detected in 12 of 233 fecal samples (8 of 34 sample sites). Salmonellae were cultivated from 2 of 182 fecal samples (2 of 30 sample sites). *Escherichia coli* O157 were cultivated from 38 of 295 fecal samples (21 of 38 sample sites). Genetic markers for shiga-like toxin I (stx1) were detected in isolates of *E. coli* O157 from one fecal sample; three fecal samples from two sites contained *E. coli* O157 bearing the genetic marker for enterohemolysin (hlyA). Genetic markers for shiga-like toxin II (stx2), intimin (eaeA), and flagella H-antigen (fliC) were not detected in any *E. coli* O157 isolated from fecal samples. Antibiotic-resistance genes (ARGs) detected in deer feces included ermB (erythromycin resistance; 6 of 295 fecal samples, 8 of 38 sites), vanA (vancomycin resistance; 75 of 287 samples, 27 of 38 sites), tetQ (tetracycline resistance; 9 of 296 samples, 25 of 38 sites), and sul(I) (sulfonamide resistance; 112 of 294 samples, 28 of 38 sites). Prevalence of select disease agents in deer feces were positively correlated to collection within 10 km of biosolid amended lands (sul(I)), and 1.6 km of a concentrated animal feeding operation (Salmonellae, tetQ). These results suggest that deer in proximity to land-applied manure and human waste biosolids may pose increased risk to nearby produce and water quality.



Food Safety and Emerging Foodborne Disease in Thailand and Vietnam

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Food safety and the emergence of foodborne diseases are closely linked and critically important to public health, animal health, and livestock production worldwide. Although significant progress such as disease risk management related to food chain components has been made recently in the global food safety framework, the conditions in developed and developing countries are highly contrasting so some of the key aspects of the framework do not transfer directly to the latter. As the two most rapidly developing countries in mainland Southeast Asia, Thailand and Vietnam are undergoing dramatic transformations in food and agriculture systems despite much of the population retaining traditional, culturally-based knowledge, attitudes, and practices towards food preparation and consumption, especially in rural areas. In addition to cultural practices of eating raw meat dishes, other important issues include illegal cross-border animal trade, contaminated feed, uncertified slaughter, lack of knowledge and practice in sanitization, and lack of consumer knowledge to identify quality meat, food processing, and hygiene. This study considers the applicability of the current food safety framework to Thailand and Vietnam, providing specific examples and recommendations for tailoring it to the characteristics and needs of Southeast Asia, one of the world's focal regions for emerging foodborne pathogens. With proper education of the producers, processors and consumers, as well as a modified food safety framework that is relevant to the socio-economic, cultural, ecological, and economic factors of Thailand and Vietnam, foodborne disease prevention and intervention plans will be much more effective.

Transforming an Ecohealth Graduate Short Course into a Modular Teaching Manual, by Community of Practice for Ecohealth in Canada (CoPEH-Canada)

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This presentation will introduce the Ecosystem Approaches to Health Teaching Manual recently developed by the Canadian Community of Practice in ecosystem approach to Health and share the relevant features of its history, rationale and development process. The manual is a collaborative project amongst researchers around Canada and course alumni within CoPEH-Canada. It is the result of four years of collective teaching experience designing and facilitating a ten day intensive Short Course in Ecosystem Approaches to Health for graduate students and professionals. The intensive courses emphasize transdisciplinary, collaborative learning by incorporating frequent group discussion, and complex problems or cases that participants work on in small groups throughout the course, enabling ample opportunities for actively working with the course material, and experimenting with applications. The rationale behind the teaching manual was to transform materials from the intensive courses into a pilot manual that could be tested, refined, and developed in collaboration with others working to develop the field and build capacity. The manual captures the key elements from the courses in a series of modules to assist facilitators in the delivery of ecohealth courses, workshops, or seminars. The modules are modifiable and adaptable to different contexts, and the modular structure offers a robust guide for the development of further modules. Currently the manual consists of six teaching modules; Health, Introduction to Ecohealth, Complexity, Social Networks, Gender, and Participation and Research. Also included is a guide for designing and teaching ecohealth case studies, and some transversal activities to support transdisciplinarity, collaboration and reflection.



Diversity of enteric pathogens causing diarrhea in forest-borne water used for consumption for indigenous communities at Apolo-Bolivia.

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In the region of Apolo-Bolivia, strongly affected by deforestation and lack of water supply, there is a widespread perception of the indigenous communities that forest is a key factor for maintenance and provision of quantity and quality of water. Moreover, in the past years, water supplies strongly declined with deforestation, concomitant with an increase of water contamination with pathogens that cause diarrhea. At six LECO communities (Chirimayo, Tupili, Muiri, Atén, Munaypata and Irimo), along an altitudinal transect from 950 m.a.s.l. to 1900 m.a.s.l., a total of 36 samples of 12 water bodies coming out of relict forest in critical conservation state and destined for human consumption, were filtered, concentrated and analyzed by nested PCR, targeting multiple enteropathogens. In most samples 12 pathogenic genes were detected indicating presence of bacteria (*Salmonella* sp., ETEC, EPEC, EAEC) parasites (*Giardia lamblia*, *Entamoeba* sp., *Cryptosporidium parvum*.) and virus (rotavirus, norovirus) associated with diarrheal diseases. In addition, a considerable circulating pathogenic load was found in fecal samples taken randomly from children less than 5 years of age. Pathogenic bacteria isolated from waters sources and from humans were sensitive to most of tested antibiotics, which may suggest zoonotic origin. In contrast, presence of specific genes of rotavirus A group may indicate human fecal contamination. These data indicate that both intestinal parasites of large size as well as small pathogens (bacteria and viruses) can be introduced in water sources and transported through existing aquifers representing a potential risk of pathogens transmission through water in the region.

The student adoption of ecohealth concept through student study-service activities in Universitas Gadjah Mada

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Student Study-service Activities (SSA) has been a part of Universitas Gadjah Mada undergraduate curriculum for more than 30 years, serving as a vehicle for connecting students and institutions to communities, and instilling in students the values of community and social responsibility. This 3-credit subject is compulsory for all undergraduate senior students. Groups of students from different disciplines work, study (under a certain program) and live in the community for 2 months. The program requires the aspects of 1) interdiscipline, 2) sustainable and 3) community-based problem solving and participatory approach. With technical support from ILRI and funded by IDRC an SSA program of 'Better Animal Farming Using Ecohealth Approach in Nanggulan District has been run in 2 cohorts (October-December 2011 and March-April 2012) and another cohort is planned for July 2012, with total of 150 participating students. Concepts of Ecohealth such as system thinking, transdisciplinary, participation, sustainability, gender and social equity, and knowledge to action are in line with the principles of SSA. Ecohealth knowledge is delivered to the program through different tools, i.e. 1) specific Ecohealth lecture only (L), and 2) L + the use of an Ecohealth handbook + trainings. Data collection is still in progress. The full paper aims to determine the student's adoption to the Ecohealth concept. Outcome mapping is used as a tool to measure behaviour change of students participating in the program (as boundary partner).



How can an ecohealth approach improve control of schistosomiasis and opisthorchiasis in Lao PDR

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Schistosoma mekongi is endemic in two districts (Khong and Mounlapamok district, Champasack province) of the most Southern province of Lao People's Democratic Republic (Lao PDR). As early as the 1980ties, its public health importance was recognised and large scale administration of praziquantel combined with health education was carried out to reduce schistosome-related morbidity. In 1998 after several treatment rounds the prevalence of *S. mekongi* in both districts was very low level (Khong 2.1% and Mounlapamok 0.4%). However in 2006, *S. mekongi* infection prevalence re-emerged rapidly after interruption of intervention reaching *S. mekongi* prevalence as high as 68.0% in villages of an endemic Island of Khong district (Donlong Island). Co-infections with *Opisthorchis viverrini* (liver fluke related to fatal bile duct cancer) is also highly endemic in both districts with infection rates above 90.0%. The re-emergence calls for further sustained control. Hence, an integrated control approach using eco-health principles is currently being tested. This study includes two intervention and two control villages. To better understanding of the transmission dynamics of infection, a baseline surveys was carried out in human, animal reservoirs (dog, cat and pig), and animal intermediate hosts (*S. mekongi*: *Neotricula aperta* snails; and *O. viverrini*: *Cyprinoid* fish and *Bythinia* snails) including related risk factors, health perceptions in human and environmental data. In this presentation we will present the *S. mekongi* and *O. viverrini* control programme conducted in previous years, report on key findings of eco-health approach baseline survey, propose interventions using ecohealth approach and discuss their impact on infection and transmission of *S. mekongi* and *O. viverrini*.

Rift Valley Fever: Prevention and control options from transdisciplinary and multi-sector processes

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The last two Rift Valley Fever (RVF) outbreaks in Kenya led to severe socio-economic consequences for the country, for livestock-owning-families, and all those involved in livestock market chain. We provide more evidence on benefits of better concerted future actions between sectors in planning and control. A stakeholder analyses showed that the 28 relevant agencies in prevention/control of RVF go beyond the line livestock and public health sectors, indeed, resource management projects and institutions rooted in the communities are as important. The baseline mortalities and RVF-attributable mortalities per production system (stratified in pastoral, agro-pastoral and small holders) were retrieved as proportions of livestock species (age/sex-stratified) and with data from focused group discussions in each 8 village and with an individual-based transmission model. The numbers of infected slaughtered and sold animals - representing the highest risk of human infections - showed the key role of small ruminants in the disease spread through livestock trade. Slaughtered infected sheep are an important risk factor to human RVF infection. Based on official records we estimated 4036 disability adjusted life years (DALYs) during the 2006/2007 outbreak in Kenya (or 340 / 100'000 corresponding to one fifth of TB DALYs), but underreporting is central (at least 1:5). Our first economic cost-benefit analysis for two consecutive livestock vaccination campaigns (one year prior to an outbreak) in high-risk-RVF-infection areas for livestock in high RVF risk areas shows that vaccination is highly beneficial in terms of return to investment. We assume that also the other prevention and control scenarios (combinations of vaccination, sanitary measures, surveillance, vector-control and awareness campaigns) will be cost-beneficial and cost-effective. The transmission model considers normal and drought periods, which is more realistic for Sahelian livestock production systems. It also can estimate expected immunity levels years after a previous outbreak since it is based on recorded livestock demographics. Our results assist intersectoral contingency planning for prevention and control of RVF outbreaks in East Africa- that must consider key actors beyond the human and animal health line ministries, notably the resource management projects.



Changes in the Microbiome and Potential Pathogens along an Ornamental Pet Fish Trade Route

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Between 2000-2005 over half a million shipments containing >1.4 billion live wildlife animals were imported to the U.S., 25% of which were ornamental fishes intended for the pet industry trade. Today, >12 million U.S. households own more than 150 million ornamental fish pets. Despite growing ecological and economic interest in disease spread through wildlife trade, empirical research on biological factors and industry practices governing microbial community and pathogen diversity along supply chains is nonexistent. This is almost entirely due to proprietary barriers that prevent direct access to animals in trade. In 2010/2011 we had the novel opportunity to overcome this hurdle by capitalizing on industry collaborations by partnering with a Los Angeles-based marine ornamental fish wholesale distributor and a pet shop in Massachusetts that sells ornamental fish, to survey the microbial communities associated with ornamental fishes and their carriage water along the U.S. leg of an international supply chain. We used high-throughput sequencing of 16S ribosomal RNA gene hypervariable regions from water and tissue samples collected prior to departure in L.A., upon arrival in Massachusetts and after 2 weeks in the retail store's tanks. Our preliminary findings reveal significant changes in microbiome diversity, relative abundance and composition of potential pathogens associated with a popular marine ornamental fish at different stages of the supply chain. However, our data also suggest another possible scenario wherein seemingly "healthy" fish that arrive at the end of the trade route (e.g. a pet store), may become infected with potential pathogens already in tanks awaiting them.

Climate change and rural child health: Results and new directions from an international collaboration

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Climate change is one of the biggest threats to human health in the 21st Century. It is known that rural communities, who already experience unequal outcomes and access to health services, are especially vulnerable to the health effects of climate change. Within these vulnerable communities, rural children are a very 'at risk' group that has received little attention in the climate change and health research. This presentation describes the lessons from a 2011 international edited collection of evidence (a book and a special issue of a journal) that aimed to build the evidence base for understanding climate change effects on rural child health. It brought together some of the world's leading climate and health researchers and asked them to describe the evidence for the health effects of climate change on rural children. The presenter is a rural general practitioner with postgraduate qualifications in paediatrics and one of the collection's editors. He discusses the evidence the project delivered in terms of his practical 'first hand' experience of the kind of research needed to make a difference to such climate-vulnerable regions. The presenter first describes the value of theory for understanding climate and rural child health effects and the usefulness of a social determinants of health model. He then discusses the importance of evidence contributing researchers provided for disease-specific climate effects on rural children: flooding and infectious diseases, diarrhoeal disease, trematode and nematode diseases, allergic respiratory disease, as well as mental health. He further details the implications of evidence international contributors presented for health effects on indigenous children and children living on pacific islands. He concludes with specific directions for developing a better evidence-base for climate effects on rural child health, emphasising the importance of considering local-level dynamics and research methods that capture such dynamics.



Will climate severity ever lead to climate action? Implications for adaptation policy and practice

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The assumption that if climate change is a real and immediate threat the world will take action has been part of a 'wait and see' approach in countries such as the USA. Is this expectation right? What role have rising social impacts from extreme weather events had in shaping country-level mitigation action? What does this all mean for adaptation efforts? This presentation of a completed 2011 international study uses a novel quali-quantitative approach (Qualitative Comparative Analysis) to apply the logic of Boolean algebra to the task of combining large international databases (the disaster database EM-DAT, the BBC World Survey of climate belief, the Climate Change Performance Index for country-level climate action). It concludes that expectations that the world will somehow unite in global climate mitigation action in response to climate severity itself, before a catastrophic situation is reached, are not evidence-based. This finding has important implications for adaptation policy and practice, especially if recent work by the Intergovernmental Panel on Climate Change, which some media have interpreted as conveying uncertainty over the role of global warming in extreme weather events, triggers a resurgence of 'wait and see' approaches. Showing with evidence, not simply telling, community stakeholders about the extent of likely future country and global-level mitigation policy failure may be more important for adaptation efforts than has been previously understood. Previous analyses have suggested that stakeholders who realise little can be expected from national and global policy elites may increase efforts, including for adaptation, at local and subnational levels. Accordingly, the results of this study could help create a much needed sense of urgency around not only global agreement for mitigation, but also adaptation efforts at the local community level.

Say No to Plastic Bags...

Hamza Shabbir

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Often it takes decades for a newly introduced product in the world of science to unfold its consequences on the face of the earth. The consequences are not always positive and in severe conditions they may ring the alarm of a catastrophe. But even worse occurs when humanity is aware of the bleak culminations of a product, yet the determination to alleviate the use of this product is never observed. Plastic bags introduced in 1957, made with the help of low density polymers brought a revolution in the world of science. But their inability to get decomposed by bacteria created a huge problem in their disposal which makes the situation adverse both for humans and wildlife. According to a recent article in National Geographic News, 44 percent of all seabirds eat plastic, apparently by mistake, sometimes with fatal effects. And 267 marine species are affected by plastic garbage – animals are known to swallow plastic bags, which resemble jellyfish in mid-ocean. The ongoing devastation to the oceans and our environment caused by plastic trash in all its forms continues at an alarming rate. Our oceans are becoming little more than sewers for the world's refuge. Being non-biodegradable these bags will continue to haunt several generations to come over centuries. While much is being thought and done about this menace all over the globe, very little attention is paid on this problem in underdeveloped countries. It is high time that we as a community rise against this menace and work tirelessly towards winning this arduous battle. The wild life is awaiting a vehement response of the policy makers to safeguard their future which is at gamble through the rigorous use of plastic bags. The community and the governments of these countries must respond to this call in the wake of time to eradicate the negative consequences of this menace. Otherwise, the survival of wild life will become nothing but impossible.



Ecology and characterization of a novel *Babesia* found in the endangered Florida puma (*Puma concolor coryi*)

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The Florida puma (*Puma concolor coryi*) is an endangered subspecies of *Puma concolor* which has a remnant population (estimated 100-150) in southern Florida. In 2006, a novel *Babesia* species was detected in numerous Florida pumas. In the current study, we provide new biological, serologic and molecular data on the *Babesia* species which will be used to characterize the new species. Prevalence in adult pumas is high (>90%) and infected pumas have no evidence of anemia. Testing of over 900 bobcats from other parts of the US indicates that this *Babesia* is likely restricted to southern Florida and pumas, although screening of domestic cats from the region is pending. No evidence of congenital infection in kittens of *Babesia*-infected females was noted. Genetic analyses revealed high diversity in the ITS1 rRNA region, which suggests that the parasite is endemic in the Florida pumas. Serologic cross-reactivity (1:256) was noted between serum from *Babesia*-infected pumas and antigens of *B. odocoilei*, *B. canis*, and *B. bovis*. Ixodid ticks are known vectors for many *Babesia* species, but no vector has been identified for any felid *Babesia*. Ectoparasite surveys conducted for the past 18 years indicate that both *Dermacentor variabilis* (81% infested; Avg. 6 ticks/infested puma) and *Ixodes scapularis* (75% infested; Avg. 13 ticks) were common. Currently, studies are underway to determine if either of these two species are competent vectors. Although *Babesia* infections in wildlife are usually asymptomatic, catastrophic events such as viral outbreaks or severe stress may allow the parasite to become pathogenic.

Agroecological approaches to improving human health, food security and addressing climate change through farmer-led research: Lessons from Malawi

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In northern Malawi farming families are faced with the challenge of poverty, low soil fertility, increased unpredictability of rainfall and high HIV/AIDS prevalence. A long term project aimed at building farmer capacity to address food security and nutrition through agroecological approaches is reviewed in this presentation. Farmers have experimented with doubled-up edible legumes as a means to improve both soil fertility and child nutrition. We have also tested innovative educational approaches to use discussion and idea sharing as a means to address sensitive gender and community barriers to improving health and nutrition. The presentation gives evidence of improved food security and health, but also of increased farmer and community capacity to address systemic problems, through farmer-led participatory research. In the last two years, 400 farmers are doing experiments on climate change adaptation strategies, including crop diversification, integrated small livestock, community tree nurseries and construction of fuel-efficient stoves. Farmers demonstrate increased knowledge of climate change and possible adaptations. At the policy level, however, we face multiple challenges, including difficult politics around fertilizer that influences government decision-making on agricultural policies, limited links between agriculture and health, and a more top-down approach to extension, which hinders farmer innovation. We discuss the challenges faced in our work and the potential for scaling out in this context.

Internet and Free Press Reduce Global Lags in Outbreak Reporting

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Global outbreak detection and reporting have generally improved for a variety of diseases and geographic regions in recent decades. Nevertheless, lags in outbreak reporting remain a threat to the global economy. In the time between first occurrence of a novel disease incident and public notification of an outbreak, infected individuals have a greater possibility of traveling and spreading the pathogen to other nations. Shortening outbreak reporting lags has the potential to improve global health by reducing spread. Analysis of 318 outbreaks since 1996 indicates that free press and Internet usage reduce the time between the first record of an outbreak and public report. 'Smart surveillance' is underway to survey key wildlife for potential zoonoses in emerging disease hotspots. Smarter surveillance would wed these initiatives with improved outbreak reporting, most effectively achieved through increased Internet usage, to better prevent local diseases from becoming global threats.



The Geography of HIV/AIDS in Highlander Ethnic Minorities in Chiang Rai, Thailand

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Subsequent to the Thailand's first epidemic wave its urban center (Bangkok) the rural Northern Thailand province of Chiang Rai (bordering Myanmar and Laos) reported among the highest levels of HIV/AIDS incidence in the country. Following successful disease control efforts among these lowland populations, a new epidemic wave emerged among the highlander ethnic minorities, which only recently peaked. Up until the past two decades, the relative isolation of most highlander villages and their traditional livelihoods limited their exposure. The past two decades have brought significant changes in both these factors, which apparently vary in their impact depending on a village's geographic location, ethnic composition, and associated social and ecological circumstances. Ethnicity is known often be associated social and behavioral risks factors for HIV exposure. To investigate the association of these and other factors with HIV/AIDS, data was compiled for highlander ethnic minority patients beginning with the first reported case in 1990. Here we report on a coarse-grained analysis of the geographic distribution of socioeconomic indicators, ethnic composition, and HIV/AIDS incidence and trends associated with the patients' villages and districts. Villages, sub-districts and districts were found to vary markedly in the degree of geographic isolation, modernization as well ethnic composition. The reported cases (3130) represent more than half of all ethnic minority villages (367/651) in the province with the spatial density of cases non-randomly distributed. Spatial analysis revealed distinct differences in incidence and trends among villages according to ethnicity and several geographic variables.

Social science research for eco-health: Issues, challenges and perspectives for capacity building and trans-disciplinarity

Johannes Sommerfeld

WHO-TDR, Geneva, Switzerland

Social research plays an important role in understanding and managing dynamic social-ecological systems. Elucidating the complex dynamic between society and the environment and developing partnership-based and community-driven ecosystem management interventions necessitates appropriate and applied social science research skills. This presentation provides an overview of issues, methods and frameworks in social science research applied to eco-health. First, a framework for eco-bio-social issues in eco-health is being developed. An overview of contemporary social methods is then provided and new methodological and theoretical approaches discussed. The presentation will use examples and insights from collaborative TDR/IDRC research and capacity building initiatives communicable diseases in Asia, Latin America and Africa.

Vector-Borne Diseases: Opportunities and Challenges for Trans-disciplinarity through Eco-Bio-Social Research

Johannes Sommerfeld

WHO-TDR, Geneva, Switzerland

Vector-borne diseases (VBDs) emerge and persist in dynamic “eco-bio-social” contexts. To reflect this complex reality, research on vector-borne diseases demands collaboration of investigators from different disciplinary backgrounds. Consequently, trans-disciplinarity has, for a long time, been claimed as one of the key ambitions in eco-health. Such research involves communicating and bridging perspectives that originate from the medical, public health, biosciences and/or social sciences. While current ecosystem approaches to health theorize the complex dynamics between social, economic, political (“social”), and physical, biotic (“ecological”) dimensions of health, bridging disciplinary perspectives in “eco-bio-social” research represents a challenge. This presentation will highlight conceptual frameworks for combining ecological, biological (entomological) and social research using examples from TDR/IDRC research initiatives in Asia, Latin America and Africa on dengue, Chagas disease and the control of climate-sensitive vector-borne diseases in Africa. It will discuss basic opportunities and challenges to integrating and, eventually transcending disciplinary perspectives in eco-health research aimed at reducing and controlling vector-borne diseases. In addition, the presentation will highlight contextual issues that facilitate or hinder trans-disciplinarity in eco-bio-social research, i.e., different epistemological traditions, academic environments and institutions, power and status within research teams, career opportunities for trans-disciplinary researchers and uptake in public health policy and practice.

Eco-bio-social perspectives on food-borne parasitic zoonoses (FBPZ) in Asia

Johannes Sommerfeld

WHO-TDR, Geneva, Switzerland

The emergence and persistence of food-borne parasitic zoonoses (FBPZ) in Asia is linked with the interaction of multiple ecological, biological and social (i.e., “eco-bio-social”) factors. Investigating the multi-dimensional dimensions of food-borne parasitic diseases necessitates multi- and trans-disciplinary perspectives. This presentation will first provide a framework and an overview of eco-bio-social issues in emerging FBPZ. It will then present contributions from within the health social sciences instrumental for eco-bio-social research on FBPZ. Finally, the presentation will discuss the heuristic utility of perspectives emanating from the anthropology of food and eating to the understanding of emergence patterns of FBPZ and the population health vulnerabilities associated with this group of diseases.



Application of an Eco-Bio-Social Approach to Emerging Infectious Diseases in Vang Vieng, Lao PDR: A Preliminary Baseline Study

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Vang Vieng, a district of Vientiane, is one of the worldwide tourist destinations with more than 2.000 tourist visits per year and where natural and man-made system overlap. The lack of proper disease surveillance and improper tourist education may increase the risk of disease transmission of not only dengue, but also other zoonotic diseases. Therefore, an effort to reduce risks to potential vector-borne and zoonotic diseases in this tourist area is very important. Dengue Hemorrhagic Fever has become increasingly important public health problems during the last years in Lao PDR. In 2006 and 2010 cases increased to a high level. In 2010, a total of 22,912 cases were reported nationwide and 12% (2,863 cases) in Vientiane Province, in comparison to the year 2009. The National Dengue Prevention and Control Strategy to reduce dengue mortality (CFR of DHF/DSS <1% countrywide by 2012) by: 1) Improve programme management at all levels; 2) Improve case management of DHF/DSS; 3) Improve community-based vector control; 4) Improve surveillance system. Our project explores the determinants of vector-borne and zoonotic diseases in Vang Vieng, one of the global outreach hotspots, using ecosystem approach to human health and dengue and a proxy. The main goal is to demonstrate an increase in health risks due to rapid development/tourism in Vang Vieng and eventually to improve the surveillance and prevention system for vector-borne and zoonotic diseases. We will collect data and present preliminary results on the impact of rapid development, change of environment and the life style of local populations due to tourism, water storage and solid waste disposal practices, including the correlation of these factors with disease risk.

CoPEH-LAC: Tailoring EcoHealth Training to Country Expertise and Educational Contexts in Latin America and the Caribbean Region

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The Community of Practice in Ecosystem Approaches to Health in Latin America and Caribbean Region (CoPEH-LAC) aims to promote the incorporation of Ecohealth (concepts, methods, tools) in different settings, linking research with policy and community outreach in the LAC region. This has been done by reinforcing the cooperation between scientists and educators from different countries and research capacities within LAC institutions. Curriculum development being one of the most ambitious and challenging activities of CoPEH-LAC, members of several countries from the six nodes participated both in separated groups and plenary session discussions focussed on the inclusion of Ecohealth in university curricula and community outreach programs, all of this in the context of a General Meeting of the community in Brasilia (Brazil, October 2010). As a result of such discussions and exchanges, a transversal technical committee at a trans-nodal level has been set, and since then four working thematic groups (undergraduate studies, graduate studies, community leaders, decision makers) have been acting in different fronts in order to create and implement different types of Ecohealth educational/training activities, in such diversified settings as university classrooms both at undergraduate and graduate levels, community meetings, workshops specifically conceived and designed to involve decisions makers, among others. So far, the creation of a website has been completed - <http://www.una.ac.cr/copehlac/> - in order to promote CoPEH-LAC and inform about its activities and results, including a repository with a considerable number of didactic materials built and used in numerous educational/training activities throughout LAC region.



Integrating Eco-health into policy applications: A framework for considering Barriers and Bridges

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The *EcoHealth* journal Editorial Board has called for greater emphasis to be devoted to “policy issues”, i.e. processes of making and implementing decisions related to the complexity of factors related to applying an *Ecosystem Approach to Health*. Policy analysis recognizes that consideration of the political, management, financial, and administrative dimensions of the options for meeting goals requires not only a comprehensive examination of all relevant knowledge, but also must take into account the interests of diverse stakeholders. In doing so, it delineates the processes that are involved – from “issue/problem identification”; to “being placed on an agenda”; to “identifying policy options”; to “evaluating alternatives”; to “decisions on action and implementation”; to “consideration of the effects of government policy”. To date, *EcoHealth* initiatives have predominantly focused on case study applications to demonstrate the value of applying such an approach to understanding and addressing complexity, as will be illustrated by the findings of a scoping literature review. To enable more systematic application of ecohealth-relevant policy options, however, additional factors must be considered. This paper elaborates upon the value of applying the concepts of “Barriers” and “Bridges” to effective policy formulation and implementation, drawing on an approach that historically has been pursued to explore the feasibility of adaptive systems to overcome the failure of linear modes of understanding and their policy prescriptions. It suggests that emerging communities of practice are especially well positioned to undertake this, to stimulate a transformation of how social institutions are responding to challenges of equity and sustainability.

Strengthening analysis of social determination of health within an Eco-Bio-Social approach: Lessons from a dengue study pilot application in Machala, Ecuador

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Introduction: To strengthen social analysis within an EBS investigation of dengue risk, our team adapted previous work of Jaime Breilh for field-testing social position as a blend of class, social control and other factors.

Materials and Methods: In conducting the 2001 Situation Analysis for the “Meeting capacity-building and scaling-up challenges to sustainably prevent and control dengue in Machala, Ecuador” study as part of a network of TDR/IDRC-funded projects in the Latin America and Caribbean Eco-Bio-Social region (EBS-LAC), we adapted a Social Insertion Index [INSOC] and Housing Quality Index [HQI] by coding responses from a randomized survey of 2000 families in 20 Machala clusters conducted. We then compared insights gained from using these indices with observation using the impressionistic social class designations of other studies.

Results: Greater validity of INSOC in providing an evidence-based means for examining the social ecology (stratified as “high”, “medium” and “low”) was revealed when associations with education (often considered as a proxy for class in the absence of other information) was analyzed. Education was consistently associated ($p < .001$) with INSOC, while that based purely on “perceived” class showed no consistent pattern. Distinct relationships by INSOC social class designations (in contrast to impressionistic categorization) were then also observed with regard to housing quality and the type of water containers at greatest risk for dengue infestation.

Conclusion: This information is now being used to appropriately target the social character of the neighbourhoods for the dengue control interventions being carried out in Phase 2 of the study



Social Scientists in the Trans-disciplinary Team: Experiences and Lessons Learned from Koh Chang's EcoHealth Project, Thailand

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Integrative and cross-disciplinary approaches are essential to understand the complex relationships between nature, society and health. The EcoHealth project in Koh Chang has been started in 2011 responsible by a trans-disciplinary team comprising of biologist, GIS specialist, veterinarian scientists and anthropologist. This paper presents, from an anthropological viewpoint, experiences how different paradigms travel across disciplines in a research space. Emphasized in the paper is also the contribution of anthropological approach in elucidating the complex relationships between tourism-related activities and vulnerability to disease infection in the area.

Lawa model: Integrated Opisthorchiasis Control in Northeast Thailand

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Opisthorchiasis caused by the carcinogenic liver fluke, *Opisthorchis viverrini*, is a major public health problem in northeast Thailand. It is associated with several hepatobiliary diseases including cholangitis, hepatomegaly, cholelithiasis, cholestasis, and cholangiocarcinoma (CCA), a fatal liver cancer. Thailand has reported the highest incidence of CCA in the world. Current status of *O. viverrini* infection is approaching 85% prevalence in certain endemic areas. Control strategies conducted over the past 30 years in Thailand involved parasitic treatment, sanitation improvement and health education. However, a high prevalence of *O. viverrini* infection remains. A new strategy for controlling liver fluke infection using the EcoHealth approach was introduced to Lawa Lake area in Khon Kaen province called "**Lawa model**". The model uses a bottom up policy for sustainable control. The model involves 3 pillars: 1) transdisciplinary, 2) stakeholder participation, and 3) equity. "**Lawa model**" was implemented in Lawa village 3 years ago. The prevalence of liver infection was a high 67% at baseline survey, but was reduced to 24% prevalence in the second year after praziquantel treatment and intensive education (IEC). The prevalence reduced to 16% in the third year with minimal re-infection. People in the village gained more knowledge of liver fluke and liver cancer. Therefore, we extended "**Lawa model**" to other nearby villages with a more intensive EcoHealth approach. The ultimate goal is to control liver fluke infection and reduce liver cancer incidence in this endemic area. The Lawa Lake area will be a model site for liver fluke control program in the future.

Fish, contaminants and health : How are exposure to contaminants and local ecosystems linked?

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In many coastal communities, fish and seafood are indispensable resources and important cultural symbols. Fish and seafood are important to a healthy diet, as they are high in protein, omega-3 and other essential oligo-elements. However, they are also one of the main source of exposure to metals which even in low concentrations can have deleterious effect on human health. Since the 1970's, high concentrations of lead, cadmium and mercury have been reported in sediments and aquatic biota sampled near industrial sites of the Baie des Chaleurs, New Brunswick, Canada. Using an ecosystem approach, we looked at the regional state of metal contamination of the Baie des Chaleurs and found that cadmium concentrations are higher than in other regions. To get a better understanding of the risks posed to local population, and the possible exposure to metals in these coastal communities, we need to understand food sources and provenance. In the context of the globalization of food systems, we looked at the origins, the species and the metal concentrations of fish and seafood bought in the Baie des Chaleurs area. We worked with different fish vendors. Our results show that 36% of species sold come from the Baie des Chaleurs. Our next step is to determine diet patterns, in particular for vulnerable groups such as fishermen, pregnant women and children. We are also looking at social determinants and network analysis of communities. Results from this study will allow to develop risk analysis tools that are adapted to the local context.



Developing a “Web of Action” for Children’s Environmental Health

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The inherent complexities of children’s environmental health issues call for a concerted effort between the different stakeholders at play. The New Brunswick Children’s Environmental Health Collaborative (NBCEH), created in 2005, produced Canada’s first province-wide strategy to reduce children’s exposure to environmental contaminants. Led by a planning group of seven key agencies, this collaborative effort has grown since 2005 to involve approximately 300 people from nearly 100 agencies including government, NGOs, academia, private sector and communities. Illustrating that effective collaborative action for children’s environmental health can occur in spite of the diverging perspectives and competing interests, this unique collaborative brings all stakeholders together in a spirit of mutual cooperation and encourages each agency to contribute in whatever way possible. This broad scope of influence acts as a “web of action” by intertwining everyone’s efforts. Agencies participating in the NBCEH pool resources, expertise, knowledge and experience and, through building upon each other’s strengths, have developed and are implementing a coordinated action strategy. We will outline how stakeholders developed a common purpose and a coordinated action strategy to reduce children’s exposures, highlight steps taken to achieve consensus on key strategies and present the networking structure designed to maintain stable communication among the widely diverging agencies involved. We will focus on values, principles and activities which illustrate the differences between a ‘collaborative’ model and traditional organizational models. The NBCEH serves as a model of the inclusive development and implementation of a complex strategy and has borne results on the ground and in children’s lives.

Microbial risk assessment and management for urban environments and vegetable farmland in Thailand

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Rapid urbanization in several developing countries in the past decades causes inadequate basic facilities including water and sanitation, resulting in deterioration of water quality and increased human health risks on microbial contamination. Microbial Risk Assessment (MRA) is presently used with epidemiological evidences to predict human health risks but not capable to well describe contamination sources for proper development of mitigation measures. This paper illustrates the applications of Pathogen Flow Analysis (PFA) and Quantitative Microbial Risk Assessment (QMRA) tool in a peri-urban community of Pathumthani province, Thailand by considering primary or secondary contact activities e.g. drinking of water supply, swimming in canal, fishing in canal, fishing in aquaculture farm, irrigation in vegetable farm. Results revealed that the highest concentrations of *E. coli* and *Salmonella* in Khlong Neung were 1.6E+06 and 1.7E+02 MPN/100mL and in Khlong Rangsit at 1.2E+04 and 9.0E+01 MPN/100mL, respectively. In which, activities or contacts in these areas showed high risks in swimming in canal > fishing and irrigation > drinking of water supply activity. Sensitivity tests suggested that dose of pathogen, exposure intensity and duration of infection were key factors. Level of acceptable health risks of 10/100,000 or 1/100,000 or 0.1/100,000 were adopted in this study for the low to high thresholds. The intervention options to reduce pathogen at source and enhance the risk reduction from effective onsite sanitation to personal hygiene were proposed. With the extrapolation of risk models, for example, 1,000 times reduction at exposure dose could achieve 1,000 folds of risk results.



Water, sanitation and health in Sahelian semi-arid urban context: eco-health approach in Nouakchott (Mauritania)

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Access to safe water and adequate sanitation is a major issue of public health in semi-arid Sahelian cities like Nouakchott in Mauritania where households develop diverse alternatives of water supply and hygiene practices with high exposition of population to health risks linked to waterborne and fecal diseases (diarrhea, cholera, typhoid, parasitoses, skin diseases) particularly in precarious areas. This proposition contributes to understanding the health impact of water quality and sanitation by developing socio-environmental, microbiological and epidemiological demarches highlighting eco-health approach issues. On the whole, results show that only 25.6% of households have improved sources of drinking water at a time when the majority of the population still uses precarious supply sources with a daily allocation that is below the standard of 20 liters per person. Bacteriological analysis showed that 93% of water sources supplying about 74% of households are contaminated with values ranging from 10 to 80 fecal coliforms per 100 ml. Regarding sanitation, approximately 69.8% of households have adequate toilets with a large variability according to urban areas and heterogeneous hygiene practices. This lacking of basic hygiene corroborates with the prevalence rate of diarrhea (9.3%) but morbidity appears as unequal as variability of water quality and sanitation according to the municipalities. With the real public health problem poses by water and sanitation, an eco-health approach was implemented in Hay-Saken district with participation demarche in order to develop a strategy to reduce health risks in precarious areas based on a guide of appropriate practices on basic hygiene at community level.

Application of an Eco-Bio-Social Approach to Emerging Infectious Diseases in Bali, Indonesia: A Preliminary Baseline Study

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Dengue was endemic in all big cities in Indonesia, including Denpasar City, Bali. The Dengue Haemorrhagic Fever (DHF) incidence rate was 784.9/100,000 population in 2010 (compared to 620.3/100,000 in 2006) and Case Fatality Rate was 0.54% in 2010 (compared to 0.73% in 2006). Bali is one of the worldwide tourist destinations with more than 2.5 million tourist visits per year and where natural and man-made system overlap, therefore efforts to reduce risks to potential vector borne and zoonotic disease is very important. An ecosystem approach to dengue was launched in Asia in 2005 with the collaboration of WHO TDR-IDRC via the multi-country eco-bio-social initiative. This abstract contain the hypothetical model of the determinants of dengue transmission in Bali, which is based on ecosystem approach to human health. The objective is to demonstrate an increase in health risks due to rapid development/tourism in Bali. By using dengue as proxy, explore changes in ecological, biological and sociological determinants which contribute to human population vulnerability to emerging vector borne disease. The development of the tourism industry by the opening of Ngurah Rai International Airport encouraged rapid development and deforestation. The rapid growth of the transportation industry led to massive migration, which increases population density. The extreme natural resources exploitation by large numbers of accommodation and housing increase the demand for clean water and can exaggerate solid waste generation. The increasing breeding site potential, together with the lack of community participation, is likely to increase the pupae production and increase vector density. One example of deforestation resulted on the migration of macaques to human settlements. The lack of proper disease surveillance and improper tourist education may increase the risk of disease transmission of not only dengue, but also other zoonotic diseases. We will collect data and present preliminary results on the impact of rapid economic development to population change, water storage and solid waste disposal practices, vector control programs and related policies and human-animal interaction to improve the understanding as to whether such dramatic environmental change and pressure are correlated with an increased risk of dengue infection in defined vulnerable groups.



Lawa Model: Eco-Health Impact of Fascioliosis on Livestock Production and Economic Loss

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Fascioliasis or fasciolosis is a threatening food-borne trematodiasis of human and animal health. In Thailand, *Fasciola gigantica* (*F. gigantica*) is probably the only causative parasite of this disease. Completion of its life cycle requires wet land and various intermediate hosts. Thus, Kang Lawa or Lawa Lake having appropriate geography and prosperous intermediate hosts for the fruitful parasitic propagation was chosen for the study with aims of investigating the prevalence of *F. gigantica* in animals (cattle and buffalo), intermediate hosts (lymnaea or radix snails), water plants, and villagers' awareness upon its economic impact. Methods: During 2008-2009, fecal samples from 380 cattle and buffaloes, being raised in 11 villages surrounding Kang Lawa of Khon Kaen, Thailand, were collected. *F. gigantica* infection was determined by formalin-ether sedimentation techniques. Lymnaea snails were monthly collected for the determination of cercariae using cercarial shedding technique. Grazable water plants were microscopically investigated for metacercariae. Interviewing of farmers or butchers upon animal raising system, health status, and socio-economic impact was performed. Results and Discussion: Fifty six of 380 (14.74%) animals were infected with *F. gigantica* with prevalence of 15.38% (40/106) in cattle and 14.53% (42/289) in buffaloes. Only 61.6% of cattle and 47.9% of buffaloes were given anthelmintic drugs against fascioliosis. Although some farmers satisfied the increase of body condition score of their cattle after receiving fasciolicide drug, various reasons were being raised to support the reluctance or ignorance of most farmers, such as unable to restraint animals, cannot afford for the cost of the drug, believe to be the cause of abortion of their pregnant animals, not necessary to continuously control, unapparent clinical sign, and wait for the governmental services. High season of lymnaea snails was during February - March and June - August, but very low number during October - January which is flooding season. Regards, very least number of the collected snails was found to shed cercariae in the laboratory investigation except in March. There were at least 21 water plants were found to be grazed by the animals and some of these were also human food of which could be potential sources of human fascioliasis. The economic loss was directly affected by the diminishing of health, immunity, fertility and performance of the animals. Cattle and buffaloes from this endemic area were frequently refused to purchase or purchased in a lower price than the market price by most local butchers who usually complained about the damaged liver being condemned at the slaughterhouses. Conclusion: Eco-health impact of fascioliosis would be considered through livestock production, human health and economic loss. Thus, appropriate prevention and control measures, including awareness and self-operation of farmers in the endemic area should be established.

The Lessons Learned from a Journey of Outcomes: a capacity building process through the application of Outcome Mapping in an EcoHealth Project.

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The Ecosystem Approach to the Better Management of Zoonotic Infectious Diseases in Southeast Asia (EcoZD) project supported six multidisciplinary teams and two EcoHealth Resources Centres to carry out research, as well as other capacity building activities. Outcome Mapping (OM), a tool for participatory monitoring and evaluation, was included in the design phase. However there were additional benefits beyond using it as a M&E tool. This presentation will illustrate how OM assisted all teams to improve working relationship with their 'boundary partners' – adding an extra dimension in the EcoHealth approach. A series of interventions to influence positive changes in their boundary partners' behaviour and practices, which is contributing to the project's objective towards control and prevention of zoonotic diseases will be described.

Application of an Eco-Bio-Social Approach to Emerging Infectious Diseases in Siem Reap, Cambodia: A Preliminary Baseline Study

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Siem Reap town, which is located approximately 200km to the North-West of Phnom Penh in Cambodia, is a major tourist destination as it is located close-by Angkor temple complex world heritage area. As a result of increased tourism development and migration, the populations in this area are increasing and causing socio-economic and environment problems. The recent rapid tourism development creates a wide range of jobs. Change in employment and its structure, from agriculture to manufacturing and services would contribute to changes in livelihood and thus well-being of local people. Water demand in Siem Reap is expected to increase which lead to water resource depletion. Personal wells which had poor water quality were used, and this resulted in the increase in water-borne diseases. Waste and rubbish are also a problem in Siem Reap with the indirect effect on flooding in the city due to drainage blockage by huge amount of garbage. Information collected by JICA in 2000 reported that dengue fever was one of the disease identified in the households of Siem Reap. The province was facing a serious threat from dengue fever during the rainy season in 2007 and the case incidences are increasing. In addition, Siem Reap are defined as malarial areas with low rates of transmission. Commonly reported diseases included malaria, dysentery, diarrhea and typhoid. Our baseline study in Siem Reap will be reported. These include the climatic factors, population growth and urbanization, change in way of life of local residents due to tourism and the relationship with disease incidences. The baseline information collected will be used to improve disease reporting system and to plan the strategies to prevent and control of potential diseases in this tourist destination.



Spatio-temporal occurrence modeling of Highly Pathogenic Avian Influenza subtype H5N1: A case study in the Red River Delta, Vietnam

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Highly Pathogenic Avian Influenza (HPAI) subtype H5N1 poses severe threats to both animals and humans. Investigating where, when and why the disease occurs plays an important role to help animal health authorities develop effective control policies. This study takes into account temporal and spatial occurrence of HPAI H5N1 in the Red River Delta of Vietnam. A two-stage procedure was used: (1) logistic regression modelling to identify factors influencing the occurrence of HPAI H5N1 and to estimate probabilities of the disease occurrence; and (2) geostatistical kriging to develop monthly predictive maps predicting the space-time distribution of HPAI H5N1 occurrence. The results demonstrated that high average monthly temperature, low precipitation, and low humidity were critical factors explaining the probability of HPAI H5N1 occurrence and spread in the Red River Delta, Vietnam. Higher average monthly temperatures in combination with lower precipitation and drier conditions in the dry season, roughly from November to April, contributed to the higher occurrence of HPAI H5N1. The monthly predictive maps suggested that in the period from November to February, the higher probability area mostly occurs in Hanoi and surrounding provinces to the East such as Hung Yen, Bac Ninh, Hai Duong and Hai Phong. The situation starts to change in March when the higher probability areas expand South into provinces near the Gulf of Tonkin, including Thai Binh, Ha Nam, Ninh Binh and Nam Dinh where rice farming and poultry production are the main agricultural activities, and reach maximum probability of HPAI H5N1 occurrence in April.

Implementing one health in gombe national park, tanzania

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Many chimpanzee populations are threatened by loss of habitat due to human encroachment. This results in 1) genetic and spatial isolation of endangered chimpanzee populations, and 2) increased human-wildlife contact. Genetic isolation leads to a potential decrease in long-term viability of the population, while increased human-wildlife contact leads to an increased risk of disease transmission between chimpanzees and humans. Wildlife managers in parks containing great apes perceive that disease outbreaks have been, and continue to be, a significant threat to conservation goals for wild apes. Many documented or perceived disease outbreaks in chimpanzees are suspected to be the result of close contact with humans, but definitive evidence is scarce. On the other hand, there is at least one well documented emerging infectious disease of humans transmitted from chimpanzees – HIV-1. Gombe National Park, Tanzania currently hosts the longest continuous study of wild chimpanzees (Jane Goodall Institute), spanning 52 years. It is Tanzania's smallest National Park (35Km²), and is surrounded by a high-density of humans. These characteristics make Gombe both the perfect storm for human – non-human primate disease transmission, as well as the perfect wild laboratory for the creation and implementation of the One Health paradigm. A 10-year review of the design, implementation and results (including the discovery of pathogenic SIV) of a One Health program in/around Gombe follows.



Learning to Do Ecohealth Research: the Experience of the Asian Partnership on Emerging Infectious Diseases Research

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The Asian Partnership on Emerging Infectious Diseases Research (APEIR, www.apeiresearch.net) was established in 2006 and provided a platform for collaboration of researchers from over thirty institutions in five Southeast Asian countries and China. APEIR research started with multi-country five studies on aspects of avian influenza, including backyard poultry, socio-economic impacts, policy formulation, the role of wild migratory birds, and effectiveness of control measures. In recent years, new work on poultry production clusters and on small-scale slaughterhouses has been initiated. While most of the researchers were new to ecohealth research, they were exposed to the approach during project development and in some cases had expert support during implementation. Thus, each of the studies strived to employ an ecohealth approach to the research. The paper uses the six “ecohealth principles” of Systems Thinking, Transdisciplinary Research, Participation, Sustainability, Gender and Social equity, and Knowledge to Action as a loose framework to explore how the seven APEIR studies applied the ecohealth approach to pressing public health threats in SE Asia. Data were collected in a self-reflection exercise involving all lead researchers of the country teams of the studies (in total 19 teams, across five countries), who explored how they had strived to follow the principles in the research, what challenges they met and what creative solutions they developed.

Outdoor Air Pollution (SO₂, NO₂, Ozone) and Childhood Asthma in Jakarta: a GIS-Based Ecological Approach

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Background: Asthma is the most common chronic disease in childhood. Several studies have observed that outdoor air pollution, such as Nitrogen Dioxide (NO₂), Sulfur Dioxide (SO₂), and ozone (O₃) have been consistently shown to exacerbate existing asthma. Consequently, an asthma intervention program must be started from environmental factor, especially outdoor air pollution.

Objective: The objective of this study is to identify the risk area of childhood asthma in Jakarta after controlled by outdoor air pollution variables including NO₂, SO₂, and ozone.

Method: systematic air pollution data (NO₂, SO₂, and O₃) was carried out from Meteorology, Climatology and Geophysics Agency (BMKG) in Indonesia. On the other hand, monthly childhood asthma data was carried out from asthma Non-Government Organization (*Yayasan Asma Indonesia*) in Indonesia. After that the data was processed on GIS platform to develop some maps for identifying the risk areas of asthma in terms of risk and non-risk area.

Result: Some maps for malaria transmission areas were created and stratified into different spatial entities, high risk, risk, and low-risk area.

Conclusion: GERM method is the best way to prevent not communicable disease such as asthma in Jakarta because it can help the decision maker to make an intervention program. Furthermore GERM is the most effective method because it can cover all of environment factor which correlated with asthma such as outdoor air pollution.

Water Resources Institutions and water-related Diseases in Ahmedabad City, India

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Integrated Water Resource Management (IWRM) has remained polarized between two approaches. The first looks at 'how to integrate', while the second documents through critique 'how there is no integration in practice'. The research presented offers a way of bringing these two theoretical paradigms together to examine how different institutions (global to local) integrate to influence water-related diseases in an urban region. Water-related diseases are associated with rapid urbanization, industrialisation, technology of agricultural practices, climate change, conflicts associated with competing water users and socio-cultural factors, comprising a complex system. The research conducts an intensive study in two comparative administrative wards to understand how global and local institutions integrate to influence water-related diseases in the rapidly urbanizing context. In this paper, the research spatially analyzes the water-related diseases and the role of socio-economic and institutional factors influencing the spread of the diseases. This will help in identifying the significant drivers of water-related health diseases and predict the probability of their occurrence given the existing information. The combination of GIS and Bayesian network mathematically describes the environment-institutions-health relationship.



Community of Practice in Ecosystem Approaches to Health in Latin America and the Caribbean (CoPEH-LAC): building on existing capacities

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Starting in 2006 with 13 action-orientated multi-disciplinary researchers from 7 countries, the Community of Practice in Ecosystem Approaches to Health (CoPEH) in Latin America and the Caribbean (LAC) now represents a trans-disciplinary group of about 150 researchers from 16 countries in LAC, and Canada. CoPEH-LAC has a nodal structure with coordinators in each of its six regions: Mexico, Central America and the Caribbean, Andean node, Brazil, Southern Cone and Canada. CoPEH-LAC contributes to the process of transforming social, economic and environmental issues that affect health of the LAC population, by using relevant knowledge, capacity building and exchange of experiences in ecosystem approaches to human health. CoPEH-LAC focuses on strengthening existing capacities, is inclusive and uses a participatory approach. Its members apply ecosystem health approaches in their own field of interest, either related to research, education or outreach. In addition to nodal structures, thematic inter-nodal work committees have been formed on gender, social network analysis, concepts of ecohealth, metals and neurotoxicity, and curriculum development. The latter includes both university curricula and community outreach programs for community leaders, as well as policy makers. A website, www.una.ac.cr/copehlac, has been created to facilitate interchange of information and to store products. CoPEH-LAC members have incorporated ecosystem health approaches into their research projects. The members have created 6 modules at pre/post grade level and 1 module for labour union workers as well as 9 courses at pre/post graduate level. Workshops on ecohealth have been organized for university teachers and policy makers. CoPEH-LAC members have been invited to lecture in regional courses, workshops, and to participate in scientific and project formulation meetings. This interchange allows us to disseminate ecosystem approaches and establish new alliances. Within CoPEH-LAC, general assembly meetings have been organized every two years to discuss concepts, progress and planning of the CoPEH-LAC's activities. CoPEH-LAC evaluates its progress using social network analysis and knowledge management.

Pregnant women living in banana areas with aerial mancozeb spraying are exposed to ethylenethiourea and manganese: results from the infants' environmental health study (isa)

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In Costa Rica, at multinational banana companies, aerial mancozeb applications occur weekly, a practice that has been banned in the European Union (EU) since 2009. Mancozeb is an ethylene bisdithiocarbamate (EBDC) fungicide containing 21% manganese. Ethylenethiourea (ETU), the main degradation product of mancozeb is a proven carcinogen in animals. Manganese is an essential element but in excess is neurotoxic. The aim of our study was to evaluate pregnant women's ETU and manganese exposure in banana growing areas with aerial mancozeb spraying. As part of a birth-cohort study, we enrolled 452 pregnant women from the Matina County, where bananas are produced on a large scale. Women's urine, blood, hair, and drinking water were collected during the first to third trimester of pregnancy. In a subset of 256 women, samples were analyzed for ETU and manganese concentrations. Pregnant women's urinary ETU concentrations ranged from 0.4 to 209 µg/g creatinine. Median concentrations (3.2 µg/g creatinine) were similar to levels reported for agricultural workers in Italy, whereas about 5% of the women had concentrations as high as Mexican applicators. Women who worked at banana plantations during pregnancy had two-fold higher urinary ETU levels than those who did not ($p < 0.001$). Women whose husbands worked on banana plantations had 1.6 times higher urinary ETU levels ($p < 0.01$). Women's Hair Manganese (HM) and Blood Manganese (BM) concentrations were high in comparison with other studies. Urinary ETU concentrations correlated with HM (Spearman's $r = 0.20$, $p < 0.01$) but not with BM (Spearman's $r = -0.04$, $p = 0.53$). Urinary ETU concentrations varied more between days than between women, reflecting influence of aerial spraying activities. HM varied more between women than between days, while BM varied similarly between women and days. In part of the drinking water samples, low concentrations of ETU and high concentrations of manganese were detected, and correlated (Spearman's $r = 0.24$, $p = 0.01$). Our findings suggest that aerial mancozeb spraying exposes pregnant women to both ETU and manganese. Exposure levels may cause health problems in newborns.



The concept of landscape as a framework for investigating vector-borne and zoonotic diseases

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Vector-borne diseases persist as a major public health issue worldwide. In many such transmission systems, the landscape plays an important role as provider of habitat for vectors and wild hosts. This is readily related to known associations between organisms and specific types of environments. Many elements of the landscape are also important features of daily life of human societies. Human activities have a spatially heterogeneous distribution that reflects the mutual influences between humans and the environment. The concept of landscape is rich and multi-faceted, and can frame investigations of vector-borne and zoonotic disease distribution. It allows studying the overlap between the distributions of infected vectors and susceptible humans, where infections will occur, and therefore the relationship between disease risk and landscape features. It inherits a long history of use in the field of geography, and has been used in the field of epidemiology for a long time. Because of its intuitiveness, the landscape concept can facilitate the interactions between the experts of various disciplines that can contribute to the understanding of vector-borne disease risk in relation to the environment, such as physicians, epidemiologists, biologists and geographers. We illustrate the relevance of this concept in quantitative studies that use modern data sources and methods, and that answer contemporary questions related to the risk of vector-borne diseases. Cases presented will cover tick-borne diseases in Europe and mosquito-borne diseases in the tropics.

Anthrax in Animal and Human in Indonesia

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Anthrax is zoonotic disease caused by *Bacillus anthracis*, and a mayor problem because the *B. anthracis* can form spores and the spores can survive for a long time in the soil. At any time, spore capable of causing outbreak especially in endemic areas. The organism is typically found as metabolically inert spore and this form it is highly resisten to extremes of pH, desiccation, temperature and chemical denaturation. Incidence of anthrax in animal in Indonesia is often known precisely when thre are incidences in human. Until now, 23 provinces of Indonesia have been infected of anthrax disease and eleven provinces was endemic. From the data the animal fictims by anthrax are: cattle, buffalo, goat, horse, pig, ostreich, dog and deer. Ruminant (cattle, goat and buffalo) are highly susceptible, while carnivore are less susceptible. Ostrich, are susceptible too and it is believe that the case as the first reported anthrax outbreak in ostrich inIndonesia. Anthrax in cattle and sheep are ussualy septicaemic and rapidly fatal. Althought most animals are found dead without premonitory sign, pyrexia with temperature up to 420C, depression, congested mucosa and ptecheciae may be observed antemortem and sometimes bloody fluid exuding from natural holes. The number of cases of anthrax in humans tends to fluctuate over the 5 years later, and highest in 2007 and 2010. From the year 2006-2011 a number of human anthrax are 211 cases and 12 are fatalities. Cutaneus anthrax is the most common form and was characterized by dry ulcerate and balck.

Eco-Health Assessment on Poultry Production Clusters (PPCs) for the Livelihood Improvement of Small Producers: Policy Review in China

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After the outbreak of Avian Influenza in China since 2004, the small poultry producers were criticized for lacking of bio-security and spreading infectious diseases. Then the government issued a series of policies and regulations to promote the construction of poultry production clusters (PPCs) as an approach to enhance the bio-security for small producers. This research applied eco-health approach to assess the multiple impacts of PPCs on the livelihoods of small producers with the implications for control of infectious diseases. This research also reviewed the origins, development, current status, and future trends of PPCs in China. This research found out that the PPCs are important for the livelihood of the small producers, and it reduced the pollution, risks of spreading diseases, and the intension between the non-producers and producers in the villages regarding the smells and pollutions. However, the PPCs were not successfully applied in China, since the small producers in PPCs can not take collective actions to control animal diseases so that the bio-security is still questioned. As a consequence, the government favors to support the development of large scale poultry farms which has driven the significant amount of small producers out of the market. The research concluded that the PPC development in China did not follow the eco-health approach which caused the failure. This research explored the ways to improve the PPCs in eco-health approach, and made policy recommendations on how to support PPC development so that the small producers can stay in poultry sector.



Lung Cancer Incidence is Changing in Health Area Ningbo , China

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A previous study demonstrated that lung cancer incidence in Ningbo area had increased in the past years. We expanded the original data set to determine if this increase had continued between 2007 and 2010. Objective of this study is to identify incidence, mortality rate and characteristic of diagnosed lung cancer, and to estimate whether it develop work load to health organizations and influence health benefit. A retrospective observational study based on hospital admission/discharge records and pathological department data on lung cancer was brought to Ningbo No.2 Hospital during 01/01/2007 to 31/12/2010. The number of diagnosed lung cancer carried to Ningbo No.2 Hospital was 1605 according to the hospital data during study period. Of all malignant tumor (10139) collected, 15.8% were lung cancer which ranked the first in every study year. Average age of the sample was 62.2 years .The incidence of lung cancer was fluctuated from 367 (2009) to 440 (2008) in the hospital records, 371(2007) and 427 (2010) respectively. Mortality rate was from 20.8% (2010) to 35.9% (2008) .General bed occupancy of lung cancer were 32597 days which possessed 14.78% among all hospitalized patients during study years. Referring the pathological department data only 822 cases were diagnosed as lung cancer which represents just 51.2% of the admission/discharge data (1605) at the same period. Proportion of diagnosed cases was unbelievably low .The main reason for the above difference between hospital admission/discharge data and pathological department is found to be that the number of post operated patients from other health organizations and chemotherapy cases were not taken into account at pathology departments. Regarding pathological department data, the incidence between Male and Female ratio was 2.2 (567) : 1 (255). A significant rise was observed in women in 2010(83) comparing those diagnosed in 2007(38) , men patients were increased 1.88 times from first year (109) to fourth year(202).Of all ages the most popular group happened to 50-60 years (278/33.8%) and 60-70 years (269/32.7%) . There was no significant difference in average age in each study year. According to the pathological analysis, the most frequent histological characteristics were Adenocarcinoma (50.3%/413) and squamous cancer (28.4%/233) and only 22 females in squamous within 4 years, however, in Adenocarcinoma cases ,the number in females (168)were close to males(132). Lung cancer is a health problem of the first order in Ningbo area, results reveal that lung cancer remains to be the leading cause of cancer death in both men and women, female victims increased dramatically in malignant tumors. Lung cancer has resulted in a big workload of Ningbo No.2 hospital. Mean age of the appearance of the disease was within the national range, the majority of the cases being more than 50 years. The most common histology type was Adenocarcinoma cell carcinoma. With a sustained burden of lung cancer projected for the coming years, a method of early detection that could effectively reduce incidence and mortality from lung cancer would potentially have an enormous public health benefit.

Impact of Urbanization on Health Care Delivering Systems in Ningbo Area, South East China

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The changing health status of population has mirrored the population growth that has shaped the urban health landscape. Aim of this study is to explore the current health condition in Ningbo area and to figure out the impact on local health system as the consequence of accelerating urbanization. Cost of health service increases as the increase of urban population. Health care providers are demanding especially the demand of specialists for the certain types of diseases. Measures of effective distribution of health resources and urban population health seeking behavior need to be reconsidered in the next phase of urban health development. Urbanization is one of the most important demographic shifts worldwide and represents a significant change from how most of the world's population has lived for the past years. The overall effects of urbanization are reviewed using all the available research with heavy emphasis on access to health services. Ningbo Area experiences the same transition in the past years with its urban population shifts from 215.82 million in 2006 to 223.35 million by 2010. From the Ningbo Health Bureau annual statistics records, the average speed of hospital bed per thousand population in urban area increased nearly 109.58% from 2006 to 2010 which was found to be 5.38beds/1000population/2006 to 7.18beds /1000population /2010), in which there was a big increase in 2010 (114.14%). The increasing rate of health care workers was nearly 108.4%, which was ranked from 9.96HCW/1000population /2006 to 11.05 HCW/1000population/2010 with a marked rise in 2007 (111.97%). Objective of this study is to identify the main change of health care delivering system which includes out patient flow, workload of health care providers and the distribution of increasing health care service followed by the consequence of urbanization during the past five years. A retrospective observational study was used based on a cohort of health care providers and urban populations were brought about in Ningbo No.2 Hospital during 01/09/2006 to 01/09/2010. Relevant data was collected from hospital information department. The overall amount of outpatient flow was 576478 in 2006 according to the hospital documents, which was almost increased by 45.8% in 2010 (725744). Regarding the physician distribution, it was recorded that 376 physicians worked in turn at out patient department in 2006, the highest record of patient flow for one physician was 17020 (72 patients /day) at one year period. By the time of Sep 1st 2010 the general physician number was 426 in Ningbo No.2 Hospital and the biggest patient flow happened to the same doctor was 24634 (104 patients/day) in the hospital documents, increased almost 44.7%. There were 37 registry workers in 2006 in the hospital, according to the total out patient number, the average registry rate was 15580.4 patients /register worker/year, which means each registry worker registering 63.6 patients/day. (73.38/2007, 77.8/2008, 73.82/2009,74.46/2010). In 2010, the hospital adopted five auto-registry machines and ensured 46 registry workers to prevent long period of waiting time at peak flow, still each registry worker has average 74.46 registries per day. While, the peak out patient flow was viewed at first 1 to 2 hour both in the morning which means 60% of the patients register at this time duration. Therefore every registry worker had to register 46.68 patients within one hour in 2009. We may have a look at the shifts of disease distribution in the study that Facility clinic experienced the highest increase in the study period which was nearly doubled in rising from 89332 /2006 to 55386 /2010. Main function of Facility clinic is just to prescribe common medicine for the out patients. The following risen diseases were listed to be started from ENT disease, increased by 42%, Stomatological department with 34.1%, gastro Enterology disease by 29%, Ophthalmopathy in 21% and Emergency Internal medicine in 19.7%. General internal medicine was just 10%. Considering the specialist profile, the Director specialist was 161291 in 2006 which dashed sharply to 85307 in 2010 (increased almost 89%). The number of Vice director specialist was from 146157/2006 to 34427/2010 (with 30.8% growth). General Physician was in 46.5%. The proportion of Ningbo Area population in urban areas is growing in the recent five years. The pace of growth in urban populations makes an identified impact on health delivering system in Ningbo No.2 Hospital. Management measures in the current phase are to provide a certain group of health care workers which includes General Physicians, Specialists and out patient registry workers to cope with the immediate needs of rapidly increasing health populations. Health care workers may have low satisfaction with the increasing work load especially in Physicians in the study cohort. ENT disease, Stomatological disease, Gastro Enterology disease and Ophthalmopathy disease are in the main growth in urban health populations during 2006 to 2010. Specialists are in serious demanding as to satisfy the urban populations' health seeking pattern and the certain attitude towards General Physicians and Specialists. The uneven demand of physicians, especially in out patient departments can lead to a reduced access to health care and increased workload of specialists, predominantly in urban areas. Health care organizations in urban areas may need to take reasonable arrangements of health care providers with the seen types of increasing diseases and uneven use of health resources into the next phase of the development of health care delivering systems.



Marine ecological footprint of the Canadian Inuit: a call for university level ethnoecology programming on food security

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The Canadian Arctic coastal region is primarily inhabited by Inuit with strong cultural linkages into other jurisdictions including Greenland and the State of Alaska. The Canadian Inuit are united both by the Canadian governance system and also by the creation of the territory of Nunavut. The area is challenged by limited economic growth and the high cost of transportation. As a result, local food sources and other environmental resources are central to the Canadian Inuit culture and difficult to replace. The current work reports on a summary of all major marine resource use for the Canadian Arctic marine environment for the calendar year of 2000. This first marine ecological footprint for the Canadian Inuit provides insight on both the significance of local resources and also clarifies the need for specific ecohealth educational programming. Consideration is given to specific aspects of the United Nations declaration on the rights of indigenous peoples. Further, the status of post secondary education through Nunavut Arctic College is assessed relative to present and future food security needs. The freeze on cash transfer increases to Nunavut and the relevance of ecological training provided by universities in Southern Canada are considered relative to the design of development education in less developed countries. Quantitative aspects of marine ecosystem use are summarized from a wide range of individual reports with harvest statistics analyzed and projected using standard fisheries approaches that are globally used to determine the status of marine ecosystems. Further engagement of culturally based inputs on harvest science are considered through suggestions for a format on Nunavut Arctic College university collaboration.

Findings on the Use of Soft Systems Methodologies for Increased Understanding on the Impacts of Urban Environmental Change on Individual Health and Well-Being in Shanghai

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Within nested social hierarchies of cities, issues of power, health, well-being and injustice emerge. The social hierarchy is nested within a rapidly changing ecosystem, creating complex, reciprocal interactions between the two systems, leading to unique experiences of change within the emergent issues. The primary goal of this research is to uncover the ways in which lives of Shanghai residents have been impacted, positively and negatively, by the interactions of these two systems and within the areas of emergence, with a specific focus on health and well-being. Approaching the problem from an Ecohealth perspective, while employing soft systems methodologies (SSM), fosters an interdisciplinary learning cycle that engages with the participants in a culturally sensitive and open format, and continuously considers the dependence of health and well-being on the changing environment. This will be done by first inviting participants into an open interview that allows for their personal experience about how their lives within the evolving Shanghai landscape have changed over the past three decades compared to today. Rich picture development and transect walks will further the comparison. Analyzing the participants' experience with a systems view of nested social hierarchies will demonstrate the role of power, environmental injustice and interconnectivity between the social realms from the individual to the state, while acknowledging the complexity of the hierarchies and importance of the historical context. This research, which has been completed over the summer of 2012 in Shanghai, will be in the preliminary stages of analysis for the Ecohealth conference.



State-wide collaborative wildlife health program based at a Veterinary Faculty

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Our objectives are to improve understanding of baseline wildlife health in our state, Victoria, Australia, to detect changed patterns, and to identify factors involved in a One Health framework. Wildlife Health Surveillance Victoria, a collaborative program based at the Faculty of Veterinary Science of The University of Melbourne, has investigated reports of sick and dead free ranging wildlife (mammals, birds, reptiles, amphibians) in the state of Victoria during the last four years. Reports by phone or email came from the public, wildlife carers, veterinary practitioners, bird observers, field naturalists, and colleagues in the Victorian Departments of Primary Industry (DPI), Sustainability and Environment, and Parks Victoria. Carcasses were shipped overnight for necropsy, histopathology, bacteriology, virology, and parasitology, and reports provided to key stakeholders and the Australian Wildlife Health Network (wildlife surveillance data base) and Australian Registry of Wildlife Health (wildlife pathology data base). Investigations involved collaboration with colleagues at the DPI veterinary laboratory, CSIRO Australian Animal Health Laboratory, Victorian Infectious Disease Reference Laboratory, Australian Rickettsial Reference Laboratory, and Zoos Victoria. Coordination and communication was provided by a dedicated person using the Wildlife Health Surveillance Victoria website, email and telephone, a three-monthly one-page newsletter for circulation to anyone interested, talks to groups (community organisations and governmental institutions) and a three-monthly two hour Wildlife Health meeting with reports of investigations to strengthen links between key people and institutions involved in wildlife health in the state. The Faculty of Veterinary Science provided significant in-kind support and expertise and veterinary students were involved with necropsies. Sustainable funding is challenging.

Spatial analysis of leptospirosis in yogyakarta province, indonesia based on participatory approach

Dyah Ayu Widiasih, Wayan Tunas Artamajavascript:submitForm(), Bambang Sumiarto, Adiheru Husodo, Guntari Titik Mulyani

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Outbreaks of leptospirosis in Yogyakarta Province, Indonesia cause serious problems in humans and animals. In human high mortality due to renal failure can be observed whereas in animals loss of production (i.e. due to abortions) is prominent. Therefore observed high prevalence and related health impacts need to be better understood. The re-emergence of this disease seems to be caused by multifactor components, and highly linked to environmental factors. Thus a successful control and prevention requires an integrative health research approach. The aim of this ILRI supported and IDRC funded study is to explore potential risk factors for leptospirosis in human and animals. To assess the leptospirosis prevalence in human and animals (cattle, goats and sheep, dogs and rats) serological sampling was done using the combination of multistage and cluster sampling. Spatial analysis of prevalence data using GIS and incorporating information based on participatory approaches from veterinarians, physicians, ecologist, demographer, social sciences, others stakeholders (government and public sector) has been applied to map the disease among the riverside of Progo at Bantul, Kulon Progo and Sleman Districts, Yogyakarta Province. Questionnaire data indicated decreasing productivity of farmers, economic loss and community health problems as major socio-economic impact of leptospirosis. Analyzed cattle sere (MAT) indicated a prevalence of 10%. Conducted spatial analyses of leptospirosis for the three districts using serological and participatory gained data will contribute to an integrated, interdisciplinary understanding of leptospirosis emergence and the basis for addressing public health policy concerns in order to prevent spreading of this disease.



Impact of the socio-cultural context on Ecohealth programs: case of cutaneous leishmaniasis in two homes in Algeria

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In proposing ecosystem actions involving local actors, the Ecohealth method is an interesting development lever. The model used is that of cutaneous leishmaniasis in two homes, with contrasting natural and socio-cultural ecosystems, Draa El Mizan, semi-rural common in coastal mountain, and Ain Skhouna, rural community steppe characterized by sheep farming. Our work aims to compare the response of local actors in Ecohealth project. After restituting knowledge on the disease, preventive measures related to natural and social ecosystem, have been identified in each site, in consultation with local communities. After a year of implementation, the project saved different advances in both sites. At Ain Skhouna, the project met with a strong reluctance of local actors and the number of proposed interventions was reduced to a minimum. At Draa El Mizan, the measures identified have been supported by local authorities with the support of the community who requested actions to preserve environment. So, many local initiatives have been developed, contributing to promote eco-citizenship. In the first case, the community of settled nomadic origin, works on a patriarchal mode and local institutions are led by a former Conservative generation. In contrast, Draa El Mizan is characterized by a sense of resistance in the population, dynamic NGO's and democratic political authorities. If a good knowledge on a health problem and the ability to intervene on its determinants exist, several elements contribute to the results of an Ecohealth project, including the collective consciousness and the will of the public authorities.

Agroforestry and Health: Principles, Problems and Prospects

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The meaning of health in everyday usage is relatively simple and not contentious. This is not the case in science, and particularly in its usage outside biomedicine and public health. In this paper we review different meanings of health, and the feasibility and limitations of applying them in different contexts including human and animal, but also landscape and ecosystem. We examine these in the light of recent efforts in agroforestry to incorporate health conceptually and practically, e.g. through the concept of land health. The applicability and limitations of “health” in this context are described using case examples from the literature and our own experience with particular reference to the Greater Mekong Subregion. We argue that while “health” used in a program name or a by-line can have great appeal, especially when its philosophical and conceptual meanings are well developed and comprehensible, the scientific, policy and practical applications of “health” in conservation, land improvement and agriculture [agroforestry] can be more difficult. Difficulties arising from the attempt to apply the concept of health in these areas are often mirrored by those historically encountered in biomedicine and public health. Lessons learned here and in the development of the concept of ecosystem health can guide its application in agroforestry. A framework is suggested drawing on these lessons and on theories underlying sustainable livelihoods, vulnerability and risk to provide a reliable basis for employing “health” not just as a new buzzword, but as a workable conceptual focus on human’s relationships with landscapes and ecosystems through agroforestry.



Climate change and eco-health approach to the control of onchocerciasis in the River Volta Basin of Ghana

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This DfID/IDRC-funded project is using eco-health approaches to investigate how climate and environmental changes will impact on onchocerciasis transmission patterns and on socio-economic development of endemic communities could be reduced through sustainable control measures. Specifically, it sought to identify factors explaining why some areas in the R. Black Volta Basin Ghana are developing resistance to the drug ivermectin, identify vulnerable zones and predict probable changes in vector ecologies, distributions and transmission, and evaluate and recommend more effective adaptation strategies under different climate change scenario. To achieve these aims, we related outputs from climate change prediction models to hydrological processes, entomological parameters and socio-economic determinants of health. Stakeholders in afflicted communities provided inputs through one-on-one and focus group discussions and stakeholders' workshop. Factors including non-compliance, irregular drug supply and social structures were negatively associated with sustainability. The blackfly vectors' biting nuisance was of concern and the urgent need for alleviation was expressed. To create awareness for sustainable long-term administration of ivermectin and for the impact of climate change we tested the use of local FM station information dissemination and key messages to communities and took phone-ins. To alleviate the biting nuisance we conducted field experiments and found a repellent called NO MAS to offer 5-7 hours of complete protection and over 80% mean overall protection. More than 80-90% of 1745 respondents expressed willingness to pay for services and the drug. The relationships between entomology, hydrology and climate change predictions data will be presented.

Impact of climate change and water transferring project on schistosomiasis transmission in China

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There is growing consensus among climate modellers that the unusual global warming observed in the last decades of the 20th century is primarily forced by human activities, namely greenhouse gas increases in the atmosphere. Global warming will trigger alterations in physical and biological systems, including shifts in the spatio-temporal distribution of disease vectors, but the nature and extent of these changes are poorly understood. The purpose of the present study was to assess the potential impact of climate change and water resource development on the distribution of *Oncomelania hupensis*, the intermediate host snail of *Schistosoma japonicum*. We employed two 30-year composite datasets comprising average monthly temperatures collected at 623 observing stations throughout China, spanning the periods 1961-1990 and 1971-2000. Temperature changes were assessed spatially between the 1960s and 1990s for January, as this is the critical month for survival of *O. hupensis*. Our database shows that January temperatures increased at 590 stations (94.7%), and that China's averaged January temperature in the 1990s was 0.96°C higher than 30 years earlier. The historical 0-1°C January isotherm, which was considered the approximate northern limit of *S. japonicum* transmission, has shifted from 33°15' N to 33°41' N, expanding the potential transmission area by 41,335 km². This translates to an additional 21 million people at risk of schistosomiasis. Two lakes are located in this new transmission area that form part of the proposed 'South-North water transfer project'. Climate change, coupled with water resource developments in China, may pose additional challenges for the control of schistosomiasis.



Steps to overcome institutional challenges when implementation of an Eco Health for the control of zoonosis in Yunnan Province, China

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Brucellosis and toxoplasmosis are both concerned zoonosis in the Yunnan Province of China. Like for other parts of China, in Yunnan a top-down administrative approach (from central, provincial, prefecture, county, township to village) is used for the prevention and control of zoonoses that is usually sector or discipline focused. Animal and human health has its own independent system. However, 'Horizontal' co-operation between various disciplines is thus have to be enhanced. Here we present first-hand experiences and challenges in development and implementation of a transdisciplinary, Eco-health approach in an attempt to achieve better management of zoonoses. This includes bringing together veterinary, public health, social science experts, and practitioners from four different research institutes of Yunnan. It required overcoming institutional barriers and silos and different research interest. Another challenge was related to the limited EcoHealth capacity of participating partners. Challenges were overcome through new collaboration with potentially interested partners, enforced continued communication throughout the entire project by the coordinating institute and a common research topic, here Brucellosis and Toxoplasmosis. Crucial for the success was the provided support by Department of Agriculture and Health of Yunnan. Steps and mechanism towards the implementation of this project, such as jointly developed project framework, research proposal and implementation were documented and will be presented. It is anticipated that this project can help to guide other partners in China to further recognize EcoHealth as a concept and how to implement it.

The globalization in the transmission of food-borne diseases in China

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Food-borne diseases can cause death and serious diseases in humans and animals, and are of both public health significance and socioeconomic importance. There are approximately 150 million people suffering from food-borne diseases and more people are at risk. The fast economic development in China, increase the rapid movement of people and financial transactions across national borders. With the international translational trade, travel, and migration, the greater risk of cross-border transmission of food-borne diseases is also increasing. Here, the current status of the food-borne diseases problem in China are reviewed, and strategies / measures for effective control of food-borne diseases are proposed.

An Integrated Approach to Control Brucellosis in Yunnan Province, China

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Brucellosis has been increasingly being an important zoonosis in China since 2007, with the highest prevalence in northeastern, northern and northwestern China. Distribution of Brucellosis in human is geographically related to the distribution in animals. Recent survey results from Centre for Disease Control (CDC) have also shown an increasing trend for human cases by 12.45% from 2010 to 2011, which greatly resulted in public concern. Results of surveillance in Yunnan indicate prevalences of 2.55% for goat/sheep and 0.76% for cattle respectively. National Brucellosis control which is mainly top-down, consists of several measures including targeted vaccination currently being applied in 12 provinces, however, excluding Yunnan. Apart from this a national animal disease surveillance scheme is undertaken for all breeding and dairy cattle and goat in the whole country. Concerns exist also as the dairy sector is expanding in Yunnan due to government promotion which possibly leads to import of dairy cattle from other higher infected areas. Current control measures mainly focus on epidemiological measures. We are implementing an Ecohealth project to test innovative approach of controlling Brucellosis, and a field survey was partly implemented in 2 townships in Yiliang County, Yunnan by an interdisciplinary team from animal science, public health and animal health sectors. Participatory approaches were used to get information on perception and behavior of risk groups through tools including questionnaire, in-depth interview and focus discussion group, combined with sampling of serum in human at risk and milk in dairy cattle. The preliminary findings reveal that there is still lack of basic knowledge among local farmers for recognition and control of brucellosis.



Prevention and Control of Zoonotic Diseases in Yunnan Province, China – Current Status and Challenges

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Yunnan Province is historically an endemic region and natural focalization of variety of zoonosis. Till today, although the prevalence of infectious diseases has been under control and is lower than the national average level, the situation is still severe. In 2011, the prevalence rates of Leptospirosis, anthrax, schistosomiasis, rabies and brucellosis were still ranks the first, eighth, fourth, fifth and fourteenth in China, respectively. Sharing a border of 4060 km with Laos, Myanmar and Vietnam, the prevention and control of zoonotic diseases in Yunnan Province faces not only the diseases coming from the province itself but also the imported diseases from neighbouring countries. Therefore, zoonosis prevention and control faces greater challenges and pressures. To meet these challenges, we need to enhance our capacity to prevent and control the outbreak of major diseases and respond to public health emergencies, strengthen coordination and collaboration between public health, animal disease control center so as to effectively control the incidence of zoonosis and hazards. It has proved from practice that, in control of zoonosis and disposal of outbreak, cooperation between organizations of animal husbandry, veterinary station and public health is still not enough. There is a need for widen cooperation leading by government which involves public health, animal husbandry, veterinary station, police station, urban management, mass media, education, agricultural sectors and water affairs, under a mode of multi-sectoral participation, interdisciplinary and cross-sector joint action, and cooperation between related countries is also very important. Concepts, technologies and methods that we have used in routine zoonosis disease prevention and control are consistent with the approach of EcoHealth, but we should pay more attention to participation in health and health promotion.

Community-based training for antibiotic stewardship: A Canadian-Ecuadorian collaboration to sustainably control infectious diseases using an ecosystem approach

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Low and middle-income countries face severe problems due to antibiotic resistance, driven by social and environmental factors. We devised a training program to train health professionals and community leaders to apply an ecosystem approach, comprising a four-day workshop, followed by six weeks of community-based work, then a final workshop with findings presented to decision-makers. The 34 participants consisted of 7 university professors, 13 community-based physicians, 4 nurses, 3 dentists, 3 lawyers, and 4 community leaders. Our evaluation employed a post-program participant survey; we also assessed the projects for proper implementation and evaluation. The program met the objectives of most participants (64.7%) with great satisfaction; 12 project-teams formed- one group failed to complete. Most projects employed pre-versus-post project surveys, one with a comparison group. In all, more than 570 individuals (in schools, community centers, daycares, a hospital ward and a senior citizen care center), were trained by the program participants, with markedly positive results. Key to the success was the adoption of an ecosystem approach, in which bacteria are not seen as “evil and must be eliminated” but as playing an important role in the ecosystem. Community leaders, municipal and provincial officials, and leaders of the dental, medical and nursing schools, committed to addressing problems identified and continue capacity-building. Community-based learning is complicated, requiring navigation of complex political, cultural and environmental factors. Given the importance of antibiotic stewardship, our experience illustrates that an eco-health initiative such as ours is well worth replicating.



EcoHealth Approach: Methodology to build sustainable strategies to solve surface water pollution. The case of the dam of Yitenga in Burkina Faso

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Pouytenga is a mid-size city located in Burkina Faso. The city is upstream of the dam of Yitenga that is used for supplying drinking water and for farming. Because of the lack of sanitation, the dam is polluted by human activities upstream. The objective of the study is to develop strategies for preventing the dam pollution. The approach which is used for conducting the study is the EcoHealth. This research project inherently involves three groups of participants: researchers' team, decisions makers and other specialists; NGOs, community members. Surveys, focus groups, interviews and workshops are used as participatory tools. The study showed that during the rainy period, solid waste and liquids from Pouytenga are carried down to the dam of Yitenga (61,800 tons per year of matter and 36 tons of nitrogen) and contribute to pollute the water body. About 12 stakeholders involve in the field of water supply, sanitation and hygiene promoting. The study enabled them to have a framework for consultation. This framework will allow them to have more synergy in the actions for greater effectiveness in interventions. Therefore, a shared plan of actions was elaborated and adopted by stakeholders. This plan action emphasizes on (i) the capacity building for resources mobilization for sanitation and hygiene, (ii) the increase of the awareness of the local community of the lack of sanitation consequences (iii) the empowerment of their capacity to address sanitation issues (iii) the promotion of sanitation in the dam upstream by developing and implementing a Strategic Sanitation Plan.

Ecohealth to the rescue: Emerging food-borne parasitic diseases in Southeast Asia

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With the globalization and economic development, the emerging food-borne parasitic diseases occurred much more frequent in Southeast Asia. For example, more than one tenth of liver fluke infections occurred in SE Asia, and it was found the increasing pattern is parallel with the output of fishery in the region. In addition, more food-borne parasitic diseases, including angiostrongyliasis, gnathostomiasis, paragonosis, trichinosis, cryptosporidiosis, cyclosporiasis, anisakiasis, fascioliasis, etc were recored to be occurred as outbreak which pay attentioned to the society as an important food safty issue. In order to understand the combate the food-borne parasitic diseases sustainably by using ecohealth concept and approaches, the following three aspects were reviewd. And two recomendation were put forward. Three aspects on sustaiblely combating the food-borne parasitic diseases in SE Asia were discussed. First, the ecosystem of the food-borne parasitic diseases in SE Asia need to be classified by multi-levels, in order to correctly understand the relationship between ecosystem and burden of disease. Therefore, we propose two classes of zoons is able to identified, e.g. ecozones and epizones. The former classification is mainly based on the ecosystem, and later one is based both epi-transmission patterns and social-economic elements. Second, the risk factors of the food-borne parasitic diseases in SE Asia need to be identifeid at multi-levels, including ecozone, epizone, community level, household level and individual levels. In particularly, different risk facors in each level could be the basis to desing the intervention strategy by transdecipilary approaches. Third, the sustainable intervention strategy to be tailored into local setting is important to reduce the burden of the food-borne parasitic diseases, by involvement of multi-stakeholders and following the food chain which invoved the complcated factors in bio-social-ecosystem. Moreover, the translation of study results into policies through local government channel are another factor which impact the efficacy and sustainability of the national program, involving political and culture factors. A model of multi-country study on combating the food-borne parasitic diseases by ecohealth approach is introduced to present a demonstration of abovementioned theory. Finally, in order to reach the goal to designe the implementalbe strategy, two recommendations were put forward. One is the designe team has to be consisted of multi-decipilary scientists in order to better translate the ecohealth concept into the national control program by multi-stakeholders. The another recomendatoin is that the ecohealth approach which is the evidence-based intervention need to take action by two-steps, or pilot study first, followed by scale up in larger areas in different zones.



POSTERS

Biosecurity Evaluation of Poultry Production Clusters (PPCs) in Thailand

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The objective of this study was to evaluate the biosecurity levels of poultry production cluster (PPCs) in Thailand. Biosecurity levels of poultry farm in PPCs were determined by using biosecurity scores in 3 provinces i.e. Maha Sarakham (contract farm with company), Nakhon Phanom (cooperative farm), and Nong Khai (individual farm) in northeast part of Thailand. Each province, biosecurity levels were evaluated both in control (15 farms) and cluster (15 farms) group. Biosecurity scores were compared between control and cluster group, and among 3 provinces. The results found that scores of attractive to wild bird, measures for visitor and trader, measures for equipment and vehicle of poultry farm, local environment management, measure taken at entrance to poultry shed, and biosecurity plan of farmer in Maha Sarakham was significantly higher than in Nakhon Phanom and Nong Khai ($P < 0.05$). Scores of measures related to farm staff of poultry farms in Nakhon Phanom was significantly higher than in Nong Khai ($P < 0.05$). Scores of feed quality in Maha Sarakham and Nong Khai were significantly higher than in Nakhon Phanom ($P < 0.05$). In Maha Sarakham, scores of local environment and biosecurity plan of farmer of the control group was significantly higher than in cluster ($P < 0.05$). In Nakhon Phanom, scores of attractiveness to wild bird, measures for incoming poultry, measures for visitors, measures taken at entrance to poultry sheds and biosecurity plan of farmer in control group was significantly higher than in cluster group ($P < 0.05$). This phenomenon demonstrated that biosecurity levels of contract farm with company were better than cooperative and individual farm. Finally, biosecurity scores of poultry farms between control and cluster group was different.



Microbe and parasite spillover and spillback between domestic and wild canines at the wildland-urban interface on Colorado's Front Range

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The long relationship between humans and domesticated dogs deserves a new look from the inside out. Dogs are documented reservoirs for infectious diseases that can impact wildlife species as well as zoonotic diseases that can impact human health. Thus, the study endosymbionts carried by dogs and wildlife in areas of highly overlapping habitat use is important for the health of humans, dogs, and wildlife alike. This study will compare the intestinal endosymbiont communities (pathogenic and non-pathogenic bacteria, protists, and metazoan parasites) of wild canines such as coyotes and foxes and domestic canines using scat samples from Colorado's Front Range, an area of suburbanization adjacent to open spaces with rich wildlife populations. The sample design involves collecting scat samples from areas of high overlap with dogs (e.g., popular hiking trails and residential areas) to areas with restricted dog access. We will use barcoded pyrosequencing to identify a broad range of microbial taxa using targeted bacterial and eukaryote primers. Additionally, zinc sulfate fecal floats will be used to evaluate parasite loads using microscopy for comparison with next-generation molecular screening methods. Significant advances have been made in characterizing the intestinal microbes of domestic dogs in the realm of veterinary medicine. We seek to expand this knowledge base by investigating bacteria and eukaryotic organisms of wild and domestic canines in a context that informs how suburban encroachment may affect spillover and spillback of microbial organisms that are relevant for the health of humans, domestic animals, and wildlife.

Climate change and indigenous knowledge: identifying for indigenous knowledge-based adaptation management guidelines

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This research will examine constraints over Nisga'a Nation (Northern British Columbia) generated by forest transformation and potential climate changes impacts. To do so, it will be implemented an Indigenous epistemological framework in order to include at each stage of the research the Nisga'a people's voices. This research seeks to improve knowledge about the effects of climate change on Nisga'a traditional practices, and the inclusion of this knowledge as a guide in policy and practice development in British Columbia. Thus, the study objectives are: a) Identify the main concerns of Nisga'a People related to Climate change effects on forest ecosystems in general, and traditional practices in particular; and b) Develop an Indigenous knowledge-based adaptation management guideline for Nisga'a Nation forest. This study is respectful of and includes Nisga'a protocols, values, and beliefs. Thus, both the Wilp Wilxo'oskwahl Nisga'a and the UBC Research Ethics Board have approved this study. In addition, the method that will be used to gather the stories of participants in this study is participatory interviews. Intensity and snowball or chain would be used to select respondents to the interviews. Regarding the data analysis, this study will integrate individual research stories, presented as much as possible in their own voice, and thematic coding. Finding from Indigenous research must make sense to the general Indigenous community; having this in mind, the study considers a workshop to be held in the communities, in order to get back to them and present the results, and at the same time validate them.

Leptospirosis in Malaysia: A model disease for the One Health Concept

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Leptospirosis is one of the important zoonotic diseases in Malaysia. It has been under-reported and often been mis-diagnosed in humans. The disease is endemic in the country and outbreaks have been frequently reported. Rats are the main maintenance host for the infection and humans would indirectly come in contact with rat urine-infected environment, particularly in recreational areas. Leptospirosis is a beautiful model for the *One Health Concept* where interfaces between animals, humans and the environment would evolve outbreaks of the disease. The emergence of the disease has been closely reported with human lifestyle. Many occupational and recreational activities: swimming, jungle trekking, mountain climbing, soldiers on jungle operations, logging, fishing would expose humans to infected environment and these people could come down with leptospirosis. The signs and symptoms of leptospirosis are very similar to influenza, dengue, malaria or any of the febrile infections and it has often been quickly misdiagnosed as influenza. It is imperative that leptospirosis be treated with antibiotics in the early stage of infection. Every outbreak apparently has caused mortalities in the affected population which could be avoided if a simple history of have been to infected environment is noted and prompt antibiotic treatment given. As leptospirosis involves wildlife (rats), it will be difficult to control and eradicate the infection but appropriate precautions could be taken to prevent infection.



Socio-cultural study of perceptions towards dogs, patterns of dog ownership and practices for rabies control in Bali, Indonesia

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Since the first occurrence of rabies on Bali in 2008 to the present (2012), the disease continues to circulate. Ecohealth is a potential approach for developing sustainable Rabies control measures to resolve the problem. As part of a project on the "Ecohealth Approach for Optimizing the Rabies Control Program in Bali", a socio-cultural study was conducted to assess the perception and behavior of Balinese related to dog ownership and rabies control. The study was conducted in 10 banjars (sub-villages), covered 5 banjars that had experienced rabies cases and 5 banjars that remained free of rabies. Data were collected by direct interviews using structured questionnaires in 30 households stratified as low, moderate and high social status groups. The questions relating to dog-owning behavior used a multiple-choice format and the questions related to attitude used a series of statements scored by using a Likert scale. In general, Balinese have relatively similar behaviors in the banjars, which had experienced rabies cases and those which had not. Most of the Balinese prefer male dogs because they will not produce offspring; let animals roam during the day and restrain them at home at night; provide food consisting of a mixture of rice; and, allow dogs to sleep around the house. Most of Balinese also have positive attitude towards dog ownership and rabies control in general and very similar in banjars, which had experienced rabies cases (97.3%) and those that had remained free of human rabies cases (96.7%).

Connections between the land and wellbeing: Perspectives of First Nations Youth in Central Interior British Columbia (BC), Canada

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Guided by decolonizing methodologies and community based participatory research, the objective of this study is to explore the perspectives of the connections between the land and well being for First Nations Youth in the Central Interior of BC. Youth (13-30) participated in a participatory photography process and their experience and photos were discussed through the Indigenous method of sharing circles, guided by community Elders. The research process was developed in liaison with a locally based community advisor designated by the Chief and Council. Qualitative data collected in the group discussions were analyzed using thematic analysis. Findings were shared with participants who then explored options for a youth-led process of sharing their work with a wider audience. This poster presentation will share initial insights about using participatory photography and sharing circles in this community setting. Pathways for (re) connecting to the land will be explored along with potential strategies for reducing health inequities by prioritizing the land as an important determinant of health for First Nations youth. Also discussed, will be the potential for such approaches to overcome dichotomies between biophysical and social environments while contributing to a growing body of work that aims to inform and improve the design of programming and interventions that promote the health and wellbeing of Aboriginal youth in Canada.

A baseline description of the dietary diversity of sentinel households in the Santa Rosa sub-watershed area, Laguna Lake, Philippines

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Assessing food security is important because it helps identify population subgroups with unusually severe living conditions, especially those who are affected by the consequences of land use and climate change. Though the Radimer/Cornell measure attempts to represent in a single index the state of food security, an assessment of dietary diversity has the advantage of providing information on the variety of diets and serving as a proxy indicator for food access. This study attempts to describe the food items most commonly consumed in sentinel households in the Santa Rosa sub-watershed area. To assess dietary diversity, an adult and a child in each of the sentinel households in selected barangays are asked to record food diaries in two non-consecutive 24-hour periods per month for 3 months. The results of the study revealed a combination of rice, fish and vegetables complemented with occasional servings of meat in the diet of adult and child respondents. Most of the food items consumed by the respondents are obtained from stores and markets found within the community. Major meals (lunch and dinner) typically consist of fresh food items while breakfast and snacks typically consists of processed food items. Complemented with findings from a parallel focus group discussion with market vendors, the results of the food diaries seem to indicate that sources of foodstuffs have shifted from within the watershed area to outside the Laguna Lake region, owing to the diminishing variety, quantity and quality of lake produce.



The geospatial distribution of soil-transmitted helminth infections in public elementary school children in two villages in the Santa Rosa sub-watershed area, Laguna Lake, Philippines

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Soil-transmitted helminth (STH) infections remain as one of the persistent public health problems in the Philippines despite the availability of low-cost and effective interventions. This study seeks to describe the spatial distribution of STH infections according to elevation, geological formation and land use as surrogates of environmental factors, which may affect STH infection rates. STH infection rates were compared for two areas in a sub-watershed area based on differences in geospatial variables. The cumulative prevalence of STH infections is higher in a midstream village (37.9%) compared to a downstream village (36.9%), though the difference is not significant. However, the prevalence of heavy intensity *Trichuris* infection is significantly higher in the downstream village (8.4%) compared to a midstream village (3.4%). Moreover, geometric mean egg counts for *Ascaris lumbricoides* (9.0 eggs per gram) and *Trichuris trichiura* (3.8 eggs per gram) are significantly higher in the downstream village compared to a midstream village (5.2 eggs per gram for *A. lumbricoides* and 3.2 eggs per gram for *T. trichiura*). The observed differences may be mediated in part by temperature, humidity and rainfall, which are functions of topographic elevation, and predominant soil type, which is a function of geological formation. Moreover, an urban – rural transition is associated with increased prevalence of STH infections, which may be mediated, in part, by changes in vegetation cover, temperature, humidity, rainfall and predominant soil type. It is recommended that further investigations be conducted to measure environmental conditions and correlate these with STH prevalence measures.

On the origin of hops (*Humulus*, Cannabaceae): Ethnobotany, phylogeny, and next-generation hops in China

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Hops, the female flowers of the hop plant (*Humulus*, Cannabaceae), are used in traditional medicine to alleviate migraines, inflammation, insomnia, bladder problems, uro-gynecological infections, symptoms of menopause, and many other central nervous system and skin problems. Today, the common hop (*H. lupulus* L., 啤酒花 pi jiu hua) is cultivated in many temperate areas; the Yunnan hop (*H. yunnanensis* Hu, 滇葎草 dian lü cao) is endemic to the Yunnan province of China; and the Japanese hop (*H. scandens* (Lour.) Merr., 葎草 lü cao) is found naturally in East Asia and has been introduced elsewhere as an ornamental. After thousands of years of wild harvesting, only the common hop is commercially farmed on a worldwide basis as an important preservative and flavor in ales and lagers. Drought and disease events are detrimental to the sustainability of wild hop plant populations and to cultivars used by the brewing and medicinal industries, respectively. As a consequence, it is imperative that the genetic diversity present in wild populations of hops be preserved, and the relationships among the three species be understood. New drought and disease-resistant varieties of hops could be developed once the origins of today's putative wild varieties are genetically known. The main research goal was to clarify the distribution of wild hops in China, as well as to shed light on the endemic *H. yunnanensis*. Research outcomes include collections and observations of specimens at the Herbarium of Kunming Institute of Botany, CAS and the National Herbarium of China, Institute of Botany, CAS. Sequence analysis from nuclear DNA (ITS2) supports three species of hops, while chloroplast DNA (petL-psbE) supports a four taxa model. To support or refute potential applications of *H. yunnanensis* to the brewing and medicinal industries requires additional molecular and agronomic analyses. Therefore, sequencing the hop plant's genome allows researchers the opportunity to study the origins, mechanisms of evolution, and domestication events in an important economic plant family. Hops, with secondary metabolites that flavor and bitter beverages and with multipotent, bioactive, and antibiotic/bacteriostatic effects, are beneficial to human health and agricultural livelihoods.



Comprehensive spatial assessment of urban health risk: A case study of Nanjing, China

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With the rapid urbanization in China, various and complex health risks have occurred widely in urban ecosystem. Conventional urban health risk assessments are divided into two categories-the human health risk assessment (HRA) and the ecosystem health risk assessment (ERA), which are not suitable enough to panoramically analyze the whole urban health risks (UHR). In this paper, an indicator framework is developed to integrate the HRA and ERA at a spatial level. Firstly, typical risk factors from different sources, such as heavy metals (soil pollution), PM_{2.5} (air pollution) and urban heat-island effect (urbanization), have been chosen to measure the environmental stresses to human health. Flood disaster and landscape degradation are used to measure natural and artificial stresses to ecosystem health. Based on the data of remote sensing (RS), geographical information system (GIS), literature survey (LS) and official statistics (OS), a fuzzy overlay method is employed to evaluate the overall urban health risk. Secondly, the regional health risk-bearing capacity (RBC) is calculated by taking the risk vulnerability and risk acceptance into consideration. Finally, an UHR-RBC conflict matrix is analyzed in order to find out the districts that need urgent risk control policy. The results show that 12.18% of the areas of Nanjing are at the highest level of urban health risk, most of which are located in downtown areas and Qixia District. 78.01% of these areas have higher ecological health risk than human health risk. Conflict analysis shows that Luhe District need to take effective measures to improve regional vulnerability and help public make rational judgment of risk acceptance.

Occupation-related health risks and effects on farming practices of environmental changes in selected lakeshore villages in the Laguna Lake Region, Philippines

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The degradation of the Laguna Lake watershed area has been extensively studied in the past; however, its impact on the health and practices of local farmers remains to be established. This study aims to describe the effects of environmental changes in the Laguna Lake watershed area on occupational practices and health risks of local farmers. Focus group discussions with farmers from lakeshore villages of Santa Rosa City, Laguna and Taguig City, Metro Manila were conducted. Local farmers reported that, presently, the lakeshore is mostly littered with non-biodegradable wastes, which they associate with diminishing soil fertility and the obstruction of water drainage resulting in frequent floods. They also noted a decrease in the quantity and quality of their harvest necessitating an increasing reliance on pesticides and fertilizers. Farmers only use double layers of clothing, ordinary facemasks, cloth gloves, and boots to protect themselves from agro-chemicals. Despite exposure to toxicants, the respondents reported no previous episodes of diarrhea, anemia or signs and symptoms related to kidney diseases.



A One Health approach to the ecology of zoonotic diseases in Togo

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Neglected zoonoses impact on the health and livelihoods of rural, marginalized communities, requiring a One Health approach to prevention and control. In northern Togo, cross-border livestock movements from trade and semi-nomadic practices could play important roles in zoonoses spread. These movements are largely unregulated and little data is available for West Africa. The epidemiology of brucellosis and Q fever, zoonoses of global and regional importance, has never been described in most West African countries. A serosurvey was conducted simultaneously in people and livestock in 2011-2012 in northern Togo. Local and transient, semi-nomadic populations originating from Burkina Faso were both sampled. Sera were tested for brucellosis (ELISA, Rose Bengal) and Q fever (IFA, ELISA). Interviews with cattle traders in markets were undertaken to spatially and quantitatively capture the flow of livestock through trade routes. Sera were obtained from 601 cattle, 692 sheep/goats, and 683 people from 25 villages, as well as 464 semi-nomadic cattle. Brucellosis seroprevalence was slightly higher in village cattle (9.2%, 95%CI: 4.7-18.6%) than in semi-nomadic cattle (6.5%, 95%CI:3.2-12.8%), and <1% in people and small ruminants. This serological profile suggests *B. abortus* as the predominant circulating strain, and culture of bovine hygroma fluid is underway. Q fever seroprevalences were higher in people (25.3%, 95%CI: 20.1-31.4%) than in cattle (16.1%, 95%CI:11.8-21.5%), sheep (16.2%, 95%CI:11.1-23.0%) and goats (8.8%, 95%CI:4.3-16.9%). Traders in Togolese cattle markets frequently moved animals between markets in neighboring countries (Ghana, Burkina Faso, Benin, Nigeria, Niger). Analysis of the market network and recommendations for disease control within this mobile context are underway.

An interdisciplinary approach to assess the social and economic constraints related to avian influenza surveillance at local level in Vietnam and Thailand

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In resource scarce countries the need to assess the efficiency and sustainability of surveillance systems is of primary importance. So far, only the financial component has been subject to scientific interest, leaving out the social aspects. The purpose of our study was to estimate the social and economic factors that contribute to local actor's decision to disclose sanitary information. The study was conducted in two countries, Vietnam and Thailand, facing different socio-economic and avian influenza epidemiological contexts. An inter-disciplinary approach was used to define an integrated research framework between economy, sociology and epidemiology to answer a common research goal. Participatory tools were used to highlight the social and economic constraints faced by farmers and local animal health professionals linked to their willingness to report animal diseases (mainly in pigs and poultry) to veterinary services and/or higher level authorities. Stated preference methods, widely used in the field of economics, were then applied to quantify the relative contribution of each of these factors in their choice to report the disease situation. Major differences were observed between the efficiency of poultry and swine disease surveillance at local level. This is consistent with the critical contribution of economic considerations in the decisions of the local actors. Indeed their choice is essentially driven by comparing the financial benefits obtained if they report or hide the information. However, social factors were also found to play a significant role in the decision to report animal diseases with different implications according to the group of actors involved.



Amplification of emerging RNA viruses associated with formation and parturition in a bat maternity roost

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Bats host important viral pathogens, including RNA viruses like *Coronaviridae* (CoV) and *Astroviridae* (AstV) as well as DNA viruses like *Adenoviridae* (AdV). Knowledge on the ecology of reservoir-borne viruses is critical for preventive approaches against zoonotic epidemics. We examined a maternity colony of the vesperilionid bat *Myotis myotis* in a private house's attic in a suburban neighborhood over three years from 2008 to 2010. One CoV, six AstV and one novel AdV were identified and monitored quantitatively. Strong and specific amplification of the RNA viruses but not of the DNA virus occurred upon colony formation and following parturition. The breeding success of the colony was significantly better in 2010 than in 2008, in spite of stronger amplification of CoV and AstV in 2010, suggesting little pathogenic influence of these viruses on bats. However, the general correlation of virus and bat population dynamics suggested that bats control infections similar to other mammals, and that they may well experience epidemics of viruses under certain circumstances. Viral host switching is probably determined by the chances of interspecies contact, as well as by the concentration and prevalence of virus in the donor species. These data indicate a feasible and ecologically sensible means of prevention. Bat maternity roosts should be left undisturbed by humans, and kept inaccessible for domestic cats and dogs.

Cryptococcal meningitis in Pune, India: Season and gender matter

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An estimated one million infections and 600,000 deaths occur annually due to AIDS-associated Cryptococcal meningitis (CM). Seasonal patterns of exposure to *C. neoformans* have been surmised but have not been well characterized. Furthermore, while clinical characteristics of CM are well known, sex-specific differences in mortality have not been well studied. We performed a retrospective analysis of clinical records between April 2008-June 2010 from hospitalized HIV-infected patients diagnosed with Cryptococcal meningitis from a large tertiary government hospital in Pune, India to investigate the epidemiology of CM and factors associated with mortality in CM cases. Among 94 laboratory-confirmed CM cases (either India Ink or cryptococcal antigen positive), the median age was 36 years, 26% were female, median CD4 = 50, and mean duration of hospitalization = 14.5 days. Cases of CM were inversely correlated with the amount of rainfall (IR=0.95 (95%CI 0.89, 0.99); p=.049). A 37% mortality was observed with women having a 2.5 times greater risk of death (HR=2.67 (95%CI 1.29, 5.50); p=.008) and decreased mortality among patients presenting with headache (HR=0.30 (0.13, 0.70); p=0.005) and those receiving fluconazole (HR=0.27 (0.12, 0.59); p=0.001). Although women accounted for fewer cases, they had an unexpectedly higher mortality than men. Furthermore, fewer cases of CM occurred during the rainy season, corroborating prior studies indicating decreased prevalence of *C. neoformans* in the environment during periods of heavy rainfall. Further exploration of the role of gender and ecological factors in CM is needed.

Responses of rangeland ecosystems and pastoralists to climate change on the Tibetan Plateau

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Tibetan Plateau has experienced extraordinary warming in recent decades. As the main vegetation type on the Tibetan Plateau, grassland is undergoing great changes. Spring phenology started retreating in the mid-1990s in spite of continued warming. Together with an advancing end of the growing season for steppe vegetation, this led to a shortening of the growing period. Temperatures in both winter and spring had strong effects on spring phenology. Although warm springs led to an advance of the growing season, warm conditions in winter caused a delay of the spring phases. The delay of spring phenology will affect the growth of grass and eventually influence the grazing regime, animal husbandry and livelihood of local people. In Baxiao County of Tibetan Autonomous Region, Tibetan pastoralists have perceived shortened "summer" (i.e. shortening of the grass growing period) since the 1990s. They have managed to adapt to risks induced by changing climatic and socioeconomic conditions, through employing refined mobility, improved storage and communal sharing, and increased diversification. Local Ecological Knowledge (LEK), community-based resource management institutions, and higher-level institutions and policies are key factors during these adaptation processes. LEK and community-based institutions support adaptation for Tibetan pastoralists through shaping and mobilizing resource availability to reduce risks. Higher-level institutions and policies contribute by providing resources from outside communities. There are dynamic interrelationships among these factors that can lead to support, conflict, and fragmentation. Government policy could enhance local adaptation through improvement of supportive relationships among these factors. While central government policies allow only limited room for overt integration of local knowledge/institutions, local governments often have some flexibility to buffer conflicts. In addition, government policies to support market-based economic development have greatly benefited adaptation outcomes for pastoralists. Overall, in China, there are still questions over how to create innovative institutions that blend LEK and community-based institutions with government policy making.



Building resilience in vulnerable populations in ayacucho, Peru through a transdisciplinarity focused organization (Equipo Peruano de Anthropologia Forense (EPAF))

Leana Garraway

University of Northern British Columbia, Prince George, Canada

How do vulnerable populations that have been marginalized by their society, recently subjected to a 20 year violent internal armed conflict (1980-2000), and currently having their traditional lifestyle affected by globalization and climate change build their resilience? This poster will explain my experiences and observations around this question as part of the University of Northern British Columbia's (UNBC) interdisciplinary field school to the rural Ayacucho region of Peru, and as a volunteer researcher undertaking an internship with the Peruvian Forensic Anthropology Team (Equipo Peruano de Anthropologia Forense (EPAF)). EPAFs objective is to assist the vulnerable communities in Ayacucho overcome the consequences of the prior 20 year internal armed conflict in Peru. Much of EPAFs work follows transdisciplinarity approaches, and their aim is to assist the communities to develop social capital, develop sustainable economic initiatives, all intended to empower people who are vulnerable as a result of poverty and exclusion, and help individuals claim and voice their rights as citizens. This poster will explain EPAFs activities, how they successfully use transdisciplinary approaches in Peru, as well as my experiences as a part of the field school and as a volunteer researcher. I am undertaking this field school and internship as an observer to watch and learn, and bring new knowledge with me back to Canada. With this poster I hope to inform and encourage others to engage with EPAF and their work.

Knowledge to action: Using research with first nations for community benefit

Leana Garraway

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There is no separation between the health and wellbeing of a community and their environment. This basic understanding has been a fundamental part of the traditional belief system of the Takla Lake First Nation (TLFN) since time immemorial. The TLFN is a rural First Nations band from the interior of British Columbia, Canada. Industrial activity began encroaching on the TLFN's traditional territory starting in the 1950s. In this context, a multitude of community-based environmental health research projects have recently been undertaken with members of the TLFN in response to community concerns about environmental contamination from decades of industrial activity. Using a participatory research approach, the purpose of my master's research was to learn from the community how they would like past research knowledge mobilized into actions for community benefit. In this poster I will explain the methods I used, the research results and research conclusions. Suggestions for next steps, projects, programs and strategies participants would like to see in the future in the community of TLFN were centred on holistic views of the interconnection between all things in the ecosystem. Research conclusions indicate participants want to focus on strengthening the health and wellbeing of the community, specifically through culturally relevant knowledge translation strategies that incorporate traditional knowledge and cultural revitalization. In this poster I aim to demonstrate that the previous research emphasis on environmental health and current focus on community health are all part of the same interconnected whole.

Influence of N-fixing trees on soil health in monoculture systems

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Soil plays an integral role in maintaining ecosystem function, adaptability and productivity, thus helping to sustain ecosystem health after exploitation by humans. As a means of measuring soil health, soil microbial communities can act as indicators of the overall health of the system as they are sensitive to changes in the soil as well as above ground vegetation. Additionally, it is of value to investigate the effect of N-fixing trees on soil health, as these trees are known to influence the soil environment. Thus we chose *Alnus nepalensis* (Alder) as a model N-fixing tree. It is widely distributed throughout the eastern Himalayan region and has been used in agricultural settings for centuries. We established long-term field sites in Baoshan County, Yunnan in order to evaluate the effect of the Alder on alleviating the negative impacts that monoculture tea plantations have on the soil environment and biodiversity. Monoculture tea plantations were compared against tea plantations interplanted with Alder trees and soil community analyses were carried out along with crop production monitoring. Field sampling included root, nodule and leaf sampling as well as soil sampling for nutrients and soil-microbes. Soil microbial analysis included denaturing gradient gel electrophoresis (DGGE) and phospholipids fatty acid (PLFA) profiling. Initial results indicate that the Alder increased crop productivity as well as below ground biodiversity, allowing for a more sustainable production of tea within this monoculture landscape. This would also allow for diminished use of chemical fertilizers.

National water related policies and its implications for the health of farmers, animals, and the environment.

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Objective: To critically review the Vietnam national water policies with respect to impact on human, animal and environmental health at the level of small-scale livestock production (SSLP) farmers. Methods: Systematic review of literature and other available information (i.e., published national water policies). Results: SSLP farmers and the veterinary services do not appear to be actively engaged in broader water initiatives to ensure water quality and sustainability of supply. SSLP farmers remain at high risks for WBDs, and their livestock can be impacted by these diseases and can also contribute to contaminating water with its faeces. There are increasing reports of polluted water sources due to both chemical and organic substances. Linkages between water and SSLP are not explicitly addressed in the national water policies. Water service and management policies are important factors with direct impact on SSLP farmers (i.e., ensuring sustainable agricultural activities and healthy SSLP). The roles and responsibilities of various government agencies are not well defined with respect to the design and implementation of policies for water and health. Conclusions: Given the vital role and potential impacts to the health of both humans and animals, the predominant SSLP, and the environment, national water policies need to be revised using an ecohealth approach. More end-user's participation and both horizontal and vertical collaboration are needed to address the interconnected issues of water, health, and SSLP explicitly therefore maximize the utilization of the water resource and reduce the negative socio-economic and health impacts on SSLP farmers, animals and the environment.



Dog behavior and ecology in Bali, Indonesia and implications for rabies transmission and spread

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Since 2008, more than 130 human rabies deaths have occurred during an ongoing epidemic in Bali, Indonesia. The concerted effort of government and stakeholders to combat this disease is progressing well, but additional data on the ecology and behavior of Bali dogs, could improve ongoing rabies control efforts. As part of a project “Ecohealth Approaches for Optimizing the Rabies Control Program in Bali”, funded by IDRC and led by ILRI, 69 dogs were followed and observed continuously for 48 hours (a period consistent with the infectious period of rabid dogs) to quantify behaviour and movement of the free-ranging dog population in Bali. From these observations the average home range for juvenile dogs (≤ 12 months) was estimated to be 0.23 km² and 0.49 km² for adult dogs (p-value 0.87), but some animals travelled up to 2.7 km in the 48-hour period. This heterogeneity in healthy dog movement is similar to reports on rabid dog movement whereby most transmission is localized (< 1 km), but a small proportion of dogs transmit the disease further afield (> 3 km). Bali dogs were active and had most contacts with other dogs between 6-10am and 4-8pm, when dogs were less likely to be restrained. *Caeteris paribus*, if animals were confined during this time, then contact rates would be reduced by 59%. The average number of dogs contacted was 0.9 dogs/hour/day (juvenile 1.21 dogs/hour/day and adult 0.70 dogs/hour/day). While the relative home range of dogs was small (< 1 km²), the high densities of dogs in local communities and opportunities for contact as shown by these observations, demonstrate the potential for sustained rabies transmission. Furthermore dog movement was markedly tied to roads and paths, suggesting that spatial spread would be more rapid than predictions from diffusions models. Further analyses of these data will be used to understand the behaviour of dogs and the transmission of rabies among dogs on Bali, in order to provide recommendations to improve the rabies program in Bali

Human outdoor defecation in endemic area of liver fluke: A case study in a village in Savannakhet province, Lao PDR

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Human feces containing embryonated eggs released outdoors play an important role in liver fluke transmission. To determine outdoor defecation sites and its relationship with time-spatial patterns of human activity in endemic area, we invited 59~63 villagers aged from 18 to 65 years old to participate in a seven consecutive day survey in June, September, December 2010 and March 2011. Data collection and process included: (1) using portable GPS recorded activity paths of each participant; (2) recording self-reported activity log between the hours of 6:00 and 18:00; (3) using self-reported defecation times to obtain defecation sites from GPS records; (4) geo-relating activity paths and defecation positions with land use map. (1) Percentages of males' outdoor defecation were 39.6% in June, 32.7% in September, 21.0% in December 2010 and 30.0% in March 2011, those were more frequently than 14.6%, 14.0%, 21.8%, 15.0% of females; (2) males spent 6.0, 4.8, 4.2, 4.3 hours of day times outdoor, those were longer than 3.4, 1.6, 2.3, 1.8 hours of females in each survey period; (3) the longest hours spent outdoors for male were recorded in June, which falls during the farming season, this pattern however was not observed among females. Overall, we think differences in times spent outdoors influenced outdoor defecation. To alleviate potential pollution of embryonated eggs from human feces, it is necessary to intervene in villagers' outdoor defecation, especially among males. We suggest an intervention in June, since it is a farming and rainy season in target area.



Variations in malaria incidence by household positions within a community in a high risk region

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Spatial and remote sensing technology data are widely used in malaria research and control efforts by applying various ecological indicators to mapping risks. To overcome the need for sophisticated devices and software in resource limited settings, this study tested a simple mathematical computation to demonstrate association between relative household positions within a community and malaria infection. Observing how the houses are dispersed within a community is important to ensure delivery of limited control measures to targeted households in high risk areas. Urine and blood samples from 860 school aged subjects were collected in June and July of 2011 in 35 communities (population of approximately 4,195) of Xepon District, Savannakhet, Lao PDR to determine present malaria infection. Using coordinates of participants' houses, three types of variable were calculated within a distance from 50m to 2000m (with a interval of 50m): number of neighboring houses (N), largest angle between vectors draw from the participant's house to neighboring house (D), and spread of neighboring house (R). Using General Linear Model (GLM), the relationship between malaria positive and independent geometric variables was estimated. Our results show that the GLM adding R (within 150m) and N (within 550m) provided best estimation for malaria incidence. Results suggest that malaria infection risk is associated with population size and position of house with respect to other houses within a community. When planning malaria control measures, our observation presents the importance of targeting homes located especially in marginalized positions within the community.

Changes in the quantity, quality and variety of fishes and vegetables sold in markets in lakeshore villages in the Philippines

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Several studies have indicated that water from the Laguna Lake contains toxic and hazardous substances as well as other organic pollutants. Hence, it is important to determine the possible effects of the degradation of the watershed area on food obtained or harvested from the lake from the perspective of vendors who sell these produce directly to consumers. The study aims to describe trends in the variety, quantity and quality of fishes and vegetables sold in community markets over the preceding 10-year period. A focus group discussion with community market vendors in the lakeshore villages of Sta. Rosa City, Laguna is conducted to describe changes in the variety, quantity and quality of produce obtained from the lake. The results of the study indicate that the variety, quantity and quality of produce obtained from the lake is deteriorating – changes which the participants attribute to environmental degradation as a result of poor waste management and changing patterns in land use. Because of the deteriorating variety, quantity and quality of the produce obtained from the lake, community market vendors find it necessary to obtain foodstuffs from outside the Laguna Lake watershed area even though these products are more expensive.



An Ecohealth approach to understanding Japanese Encephalitis transmission in an epidemic-prone Indian district

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Japanese encephalitis (JE), a vector-borne zoonotic disease causing neurological infection in humans, is transmitted within complex ecosystems, requiring multi-sectoral players to adopt an ecohealth approach to understand this disease. The disease causes frequent outbreaks in rural India with high morbidity and mortality in children, specifically in eastern Uttar Pradesh, where transmission patterns and risk drivers remain under-explored. We designed an ecohealth study focusing on micro-ecosystems in the JE-endemic district of Kushinagar to understand human-animal-vector-environment interactions determining JE transmission. Using a cross-sectional descriptive study design, we will focus on domestic and peri-domestic biotopes in Kushinagar. Twelve randomly selected villages will be studied from one high, medium, and low burden block each in the district. Half of these villages will have pigs. Household surveys and blood samples of children under 15 will be performed in 5% of households. Vector samples will be collected in and around all study villages, and pig blood will be sampled from villages with pigs. Geospatial data on land use/land cover and vector breeding sites, combined with virus detection in blood samples and household survey data will be linked to identify statistically significant risk associations. Focus group discussions and in-depth interviews in communities will further inform and explain the quantitative risk profile within the socio-cultural and behavioral context of Uttar Pradesh. This ecohealth study emphasizes a unique, inter-sectoral approach, resulting in a comprehensive risk profile of JE transmission in Kushinagar. Results will create a strong evidence base to inform interdisciplinary interventions for JE prevention and control in India.

Community and Health System Perceptions Influencing Japanese Encephalitis Transmission in an Endemic Region

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Examine the perceptions of communities and the health system affecting risk of Japanese Encephalitis (JE) transmission among JE/ Acute Encephalitis Syndrome (AES)-endemic rural communities. Socio-cultural dynamics and interaction between communities and health system can strongly influence disease transmission and outcomes. Despite repeated outbreaks of JE, a vector-borne zoonosis causing high morbidity and mortality in children under age 15, limited information exists on these risk drivers. A qualitative study was conducted in a medium-JE burden block of Kushinagar district, UP in two types of villages reporting JE cases: those with pigs (the primary amplifying host for JE) and those without pigs. Non-probability purposive sampling was used for village and participant selection. Focus group discussions using participatory rural appraisal methods and in-depth semi-structured interviews were conducted with community members and health providers. Data were recorded, transcribed and analyzed using Atlas.ti. The health system's reported efforts for JE prevention/control were rarely corroborated by community perceptions of such activities across all villages. Furthermore, we found limited knowledge among communities on JE's route of transmission. While JE was perceived as the most dangerous disease, water, sanitation and hygiene, rather than mosquitoes, were of primary concern to most communities. Our study provides a detailed backdrop of potential socio-demographic, behavioral and operational risk drivers affecting JE transmission in an endemic area. These factors may affect JE control measures, and their understanding is critical for further success. Upcoming mixed-methods phases of this study will provide evidence-based recommendations to policymakers.



Seroprevalence and risk factors of *Toxoplasmosis* and neosporosis in domestic carnivores and women received in antenatal consultation in the region of Kaolack, Senegal

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The aim of the study was to determine the seroprevalence of neosporosis and toxoplasmosis and the risks of infection of domestic carnivores and women received in antenatal consultation in the town of Kaolack (Senegal). It involved 170 women received in consultation in health centres, 100 dogs and 100 cats of the town of Kaolack. Investigations helped record information via interview of animal owners and women in antenatal consultation. They related to the age, sex, lifestyle and medical condition of the animals. Among women, the parity, level of education, profession, contact with carnivores and dietary habits were taken into account. A blood sample was taken with the prior consent of subjects, for the research of anti *Neospora caninum* antibodies (LSIVET Blocking ELISA - all species) and anti *Toxoplasma gondii* (modified direct agglutination and the Enzyme Linked Fluorescence Assay). Analysis of the investigation forms of women shows that 84% have an age ranging between 15-34 years, 62% are unemployed and 31% presented miscarriages of which, 85% are unexplained. The prevalence recorded among women was 24±6.4% (toxoplasmosis) and 17±5.6% (neosporosis). It stood at 23% (toxoplasmosis) and 13% (neosporosis) for those who had previously experienced miscarriages. In the dog, it stood at 58±9.7% (toxoplasmosis) and 26±8.6% (neosporosis) whereas in the cat, it was 78±8.1% (toxoplasmosis) and 55±9.8% (neosporosis). No risk factor was identified among women, whereas the age was the infection risk factor for dogs (OR=4.2; 95% CI=1.4-13.2; p=0.05) and cats (OR=3.8; 95% CI=1.1-12.7; p=0.05) with *Toxoplasma gondii*.

Seroprevalence and risk factors of Toxoplasmosis and neosporosis in domestic carnivores and women received in antenatal consultation in the region of Saint Louis – Senegal

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The aim of the study was to determine the seroprevalence of neosporosis and toxoplasmosis and the risks of infection of domestic carnivores and women received in antenatal consultation in the town of Saint Louis (Senegal). It involved 86 women received in consultation in health centres, 100 dogs and 100 cats of the town of Saint Louis. Investigations helped record information via interview of animal owners and women in antenatal consultation. They related to the age, sex, lifestyle and medical condition of the animals. Among women, the parity, level of education, profession, contact with carnivores and dietary habits were taken into account. A blood sample was taken with the prior consent of subjects, for the research of anti *Neospora caninum* antibodies (LSIVET Blocking ELISA - all species) and anti *Toxoplasma gondii* (modified direct agglutination). Analysis of the investigation forms of women showed that 98% have an age ranging between 15-36 years, 63% are illiterate and 13% presented miscarriages. The prevalence recorded among women was 33±9.2% (toxoplasmosis) and 24±9.1% (neosporosis). It stood 46% for both toxoplasmosis and neosporosis for those who had previously experienced miscarriages. It stood at 68±9.1% (toxoplasmosis) and 48±9.7% (neosporosis) in the dog; from 75±8.4% (toxoplasmosis) and 67±9.2% (neosporosis) in the cat. The presence of a cat in the home and the level of education respectively influenced the seroprevalence of the toxoplasmosis and the neosporosis ($p=0.05$). Bitches are 2.5 times more positive for *Toxoplasma gondii* (95% CI=1.1-7.7; $p=0.05$) while the seroprevalence of neosporosis is higher in adult cats ($p=0.05$).

Seroprevalence of bovine brucellosis and human infection risk in Senegal

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Our investigation recorded information by interview of farmers from suspect farms with brucellosis. It related to the interval of reintroduction for breeding after calving, milk production of the animals and the dietary habits of the human population in particular the mode of consumption of milk (fresh or pasteurised) and meat (well or insufficiently cooked). The total seroprevalence of brucellosis was 39.5% (95% CI=34.8-44.4). Intensive farms were less infected (4.9%; 95% CI=2-10.9) than the semi-intensives (53.5%; 95% CI=47.7-59.3) ($p < 0.05$). Biotypes 2 and 6 of *Brucella abortus* were isolated from the hygroma contents and cow's milk respectively. The positive cows were reintroduced for breeding much more later and required several unsuccessful inseminations ($p < 0.05$). These cows also seemed to be good milk producers. This constitutes a real risk of human contamination because (i) of the cohabitation between the farmer's family and herds of cattle (ii) and above all, the preferential consumption of fresh milk by most of the rural population.



Royal Veterinary College student research team 2010-2012: Better management practices in Indonesian shrimp farming

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The Royal Veterinary College Student Research Team (SRT) is a student-led group interested in researching the effect of animal disease in developing countries by working with farmers to support sustainable farming. The SRT 2011 team focused on sustainable shrimp farming in Asia, an industry that has boomed over the last decade creating worldwide concerns over responsible aquaculture. To target these issues, key organisations developed 'Better Management Practices' (BMPs), a series of practical measures that can be adopted by shrimp farmers to improve productivity and farm responsibly. The team visited a cluster of 50 extensive shrimp farms during a month-long stay in South Sulawesi, Indonesia, interviewed over 30 farmers and assessed the pond water quality. The goals of the project were to evaluate the current level and barriers to further BMP adoption, to determine whether BMP compliance was associated with reduced disease occurrence and to establish whether extensive shrimp farming had an effect on local water quality all within the farmer population investigated. The preliminary findings did not support the impact of social background or variable costs in shrimp production to account for the low levels of BMP status farms observed in the investigated area. There is a need for a structured means of promoting BMPs and further development of farmer groups. Our results also showed a number of factors were associated with fewer disease occurrences such as overall BMP compliance, certain farming practices and perplexingly less years of farming experience. Compliance with certain components of BMPs were found to be important in the farmer population investigated. Environmental findings concluded the waterways and ponds had a sub-optimal water quality, with evidence of eutrophication. Quality of water in BMP farms was shown to be higher which correlated well with the aim of water monitoring practices used on these farms. The findings will help to ascertain the support still required by smallscale shrimp farmers of South Sulawesi and provide a stepping stone to further research in this field.

Agricultural skills development training for remote and marginalized community in Nepal as a tool to strengthen local ecosystem health

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The notion of global thinking and local action is never so relevant as it is today. Nepal, a fragile yet rich in bio-diversity has its local ecosystem maintained by a balance in the inextricable interactions among the underlying socio-economic factors of the people, local environment, and the bio-diversity. It is now established that ecological concepts are applied to better understand human health. Among its many applications, it has helped to protect human health in many culturally and geographically different settings around the world. This poster recognizes capacity-building as one of the fundamental tool of addressing ecosystem health in one of the most remote part of Nepal which face perpetuating and disrupted ecosystem. It aims to bring to the knowledge of ecohealth practitioners that poverty stricken, poorly resilient and marginalized people can be empowered with capacity-building training in their need-based fields. Capacity-building training including growing crops, vegetables, fruits, livestock farming in backyard and marginal lands has improved nutrition of family, access to the market, value addition of their products and continuous source of income. Increased household income has also increased their access to education, health and information. Through our work in remote and marginalized community in Nepal we saw agricultural skills development training as a viable and non-negotiable basis of long term human health and ecosystem conservation. This approach recognizes the role of capacity-building in bringing the structural change in the community to utilize the resources and develop resilience. We intend to learn from experience to fine tune our approach.



Socio-ecological determinants of Japanese Encephalitis in mid and higher hills of Nepal: Ecosystem understanding

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Research has identified climate-related changes on a global scale. One example is the movement of pathogens carrying vectors into areas previously thought unsuitable for vector survival, such as higher elevations and latitudes further from the equator. In Nepal, Japanese Encephalitis Virus (JEV) has recently been identified in the high hill districts of the country, where elevations were previously assumed unsuitable for the primary vector, *Culex tritaeniorhynchus*. Japanese Encephalitis (JE) is an important disease in Asia, responsible for thousands of deaths and chronic neurologic conditions in human beings. In Nepal, human cases are being identified in the mountain districts patients having no history of traveling to known endemic regions. Studies of pigs in the districts where human cases were identified found evidence of anti-JEV antibodies in pigs, the amplifying host. A history of abortions in pigs was found to be associated with the pigs having anti-JEV antibodies. This suggests that the ecological range of JEV appears to be expanding as a result of climate change and vector migration to higher elevations. In this context, it is important to understand the socio-ecological determinants in the high hills landscape ecosystem responsible for the emergence JEV and spread of JEV vectors. Livestock keepers in these regions are probably unaware of potential threats of JE associated with climate change placing them at risk. Further research designed to advance the understanding of socio-ecological determinants associated with disease emergence will be important for JE surveillance and improving ecosystem-health as a whole for the hills populations of Nepal.

Mosquito vector diversity, blood meal preference and flavivirus infection across different ecotopes on Koh Chang, Thailand, a global outreach hotspot

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Koh Chang is one of the popular tourist destinations in Thailand. So far there has been no information on the composition and biology of mosquitoes on this island. The objectives of our studies are 1) to investigate the diversity of mosquitoes, 2) to assess their blood meal preferences, and 3) to detect Flavivirus infections in mosquitoes, across different ecological settings on the island of Koh Chang. Mosquitoes were collected in 5 ecotopes located throughout the island, i.e., forest, rubber plantation, fruit orchard including urban (hotels and resorts), and rural (villages) settings. A variety of collecting tools, including BG traps, CDC light traps, mosquito magnets and portable vacuum aspirators were used in order to increase species diversity of mosquitoes. The total number of collected mosquitoes was 808, which represented 5 genera and 11 species including *Aedes aegypti*, *Ae. albopictus*, *Ae. desmotes* (*W-albus* G), *Anopheles* spp., *Culex quinquefasciatus*, *Cx. vishnui*, *Cx. fuscocephala*, *Cx. gelidus*, *Cx. nigropunctus*, *Armigeres* spp., *Uranotinia* spp. The most abundant species on the island was *Cx. quinquefasciatus* (72.90% of total catch), followed by *Aedes albopictus* (11.26%) and *Aedes aegypti* (10.64%). Of 808 mosquitoes caught on Koh Chang, 111 blood engorged female mosquitoes were analyzed by RT-PCR technique to detect Flavivirus. Two *Cx. quinquefasciatus* were positive to Flavivirus. One mosquito was caught in a house located at Khong Son (northern part of the island), accounting for 14.29% (1/7) of total *Culex quinquefasciatus* populations collected in the house. Another mosquito was captured in a fruit orchard located at Saluk Khok (eastern part of the island), accounting for 4.35% (1/23) of the total *Cx. quinquefasciatus* populations collected in this orchard. The blood meal sources of *Ae. aegypti* and *Ae. albopictus* were mainly from human and monkey and the blood meal from an individual mosquito was taken from a single host. *Armigeres* spp. and *Cx. quinquefasciatus* preferably fed on dogs and their blood meals were taken from multiple hosts. Genome sequencing of the Flaviviruses detected from the household and the orchard was in progress to assess potential risk of vector-borne diseases in this tourist destination.



Probiotics as an emerging tool to prevent and mitigate the impacts of infectious disease

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A new paradigm is emerging for the role that symbiotic microbial communities play in host fitness and health. In this paradigm, microbial community structure and composition is related to risk of infection by pathogens and resulting disease states. While the use of beneficial microbes to improve host attributes, referred to as probiotics therapy, has been increasingly applied to industries including aquaculture, agriculture, and human medicine, there is a general lack of knowledge regarding the ecological processes that underlie host-microbe interactions. Probiotics have been developed specifically for preventing and treating particular infectious diseases in the aforementioned industries as an alternative to antibiotic treatments and chemotherapy, which are rendered ineffective by resistant pathogen strains. Presently, probiotic therapies have not been developed for managing infectious diseases that affect wildlife, but may provide novel tools for wildlife conservation. We synthesize and review research on probiotics developed for mitigation of infectious disease, ranging from food production to human health, to gain insight into how probiotics may be effective in reducing disease risk for vulnerable wildlife populations. We identify characteristics of probiotic therapies that share common objectives to reduce intestinal pathogens, decrease vector transmitted and sexually transmitted disease, inhibit skin pathogens, and serve as environmental prophylaxis. We examine probiotic methodologies such as timing of probiotic application, host age effects, effective delivery mechanisms, specificity of probiotic strains, and variability of scenario-dependent outcomes. We conclude by highlighting the frontier of probiotics research and identifying knowledge gaps where research is needed.

The effects of global climate and local weather on the incidence of enteric diseases in New Zealand

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Evaluating the influence of global climatic and local weather parameters on enteric disease incidence may improve our ability to predict disease specific responses to climate change. Using monthly notifications of campylobacteriosis, salmonellosis, cryptosporidiosis and giardiasis from national surveillance data, monthly Southern Oscillation Indices (SOI) and monthly national average temperature and rainfall, associations between global climate, local weather and enteric diseases in New Zealand were examined using Seasonal AutoRegressive Integrated Moving Average (SARIMA) models. Models were developed on data from 1997-2007 and validated using data from 2008. No climatic factors were significantly associated with campylobacteriosis and giardiasis, with similar predictive power for univariate and multivariate models. Cryptosporidiosis was positively associated with average temperature of the previous month (β 0.130; SE 0.060; $p < 0.010$) and inversely related to SOI two months previously (β - 0.008; SE 0.004; $p < 0.050$). Temperature (β =0.110, SE=0.020, p -value<0.001), SOI of the current (β =0.005, SE=0.002, p -value<0.050) and previous month (β =0.005, SE=0.002, p -value<0.05) were positively associated with salmonellosis. Forecasting accuracy of the multivariate models for cryptosporidiosis and salmonellosis were significantly higher. The lagged effect of temperature and warmer, wetter El Niño like conditions on cryptosporidiosis suggest that climate mediated transmission pathways such as waterborne spread may influence incidence. For salmonellosis, positive associations with temperature indicate that climate could affect pathogen ecology and subsequent spread. Negligible associations of climate with campylobacteriosis and giardiasis imply that, in New Zealand, other factors primarily drive disease patterns. Temporally lagged relationships between climate variables and communicable diseases can be used as the basis for disease prediction models and early warning systems.



Microbial contamination patterns in irrigation waters: towards optimized monitoring and risk prediction strategies

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The frequency and severity of recent U.S. produce outbreaks highlights the need to better understand pathogen dynamics in agricultural ecosystems. Irrigation water is a key potential carrier of pathogenic microorganisms to crops. However, irrigation water monitoring is not mandated in the U.S., and little is known about microbial contamination patterns in irrigation waters and associated risk factors. This study aims to: 1) identify microbial occurrence patterns in irrigation waters in California agricultural regions, and 2) devise optimal water monitoring strategies, based on such patterns and other risk factors. Water concentrations of indicator *E. coli* were obtained for the major California produce-growing regions (N=41,083 samples over four years). Water sources included groundwater, canals, and reservoirs. Concentration patterns were assessed at different resolution levels in space and time. Monitoring strategies varying in sampling frequency, assay sensitivity, and sample volume were simulated by resampling concentration distributions, accounting for time/space concentration patterns, water source, and climate variables. *E. coli* concentrations were highly variable, and significantly higher in surface than ground water. Concentrations differed significantly over months and seasons, and were not autocorrelated over weeks. Concentrations exceeding 200 MPN/100ml were sporadic, and not clustered in time or space. In simulated monitoring, sample numbers needed to correctly classify water quality with probability >80% varied from tens to hundreds, depending on location, season, and water source, endorsing monitoring schemes customized to specific risk profiles. These results, integrated with remote or ground observations of ecological risk factors, can help predict contamination likelihood, and inform risk-based management practices.

Ecosystem approach to strengthen climate resilience a case of agrarian communities in Xishuangbanna BCI site

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Xishuangbanna (XSHBN), as with other regions in the Greater Mekong Subregion (GMS), is undergoing habitat fragmentation, and biodiversity loss, which is worsened by climate change. The study selected two corridors established by the Biodiversity Conservation Corridors Initiative (BCI) to develop robust and replicable local level vulnerability assessment tools within the context of policy assessment, climate change trend analysis, ecosystem climatic vulnerability, and community climatic vulnerability analysis, to analyze climatic vulnerability, and to explore the ecosystem approach to strengthening climate resilience. The results show that the temperature has increased in XSHBN significantly over past 50 years, with a significant decrease in relative humidity and number of foggy days. The ecosystem is increasingly sensitive to climate change, dramatically shown in the by the increase of the climate sensitivity index and disaster sensitivity index over the past 50 years. There was relatively low adaptation to climate change, although the infrastructure and socio-economic indices show an increasing trend. At the community level, farmers are highly vulnerable with low resiliency to climate change because of huge monoculture plantations, weak basic infrastructure, poor education, and frequent natural disasters. Some climate change adaptation measures are therefore recommended. In terms of agriculture, research and training, and plant disease prevention and control technologies should be strengthened and agricultural systems should be optimized. In terms of capacity building, basic community infrastructure (i.e. irrigation systems, and transportation facilities) should be improved, renewable energy options should be developed, and disaster prevention and control mechanisms should be implemented. Finally, awareness among communities and the public should be raised, and the indigenous knowledge should be utilized and promoted.



The effect of chronic stress on the gut microbial community of wild-caught House Sparrows, *Passer domesticus*.

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Acute stress causes a shift in vertebrate gut microbial communities, independent of the immune system. This leads to the increase shedding of microbes, an up-regulation of pathogenicity factors in these microbes, and a decreased ability of the host to gain energy from food. Chronic stress, the maladaptive response to prolonged stress, is an inherent part of conservation programs that involve population translocation, or rehabilitation. These hosts, due to the immunosuppressive effects of chronic stress, are particularly susceptible to pathogens shed by conspecifics. Despite this understanding, it has not been established if chronic stress leads to a continued microbial gut dysbiosis and continued increase in microbial shedding. To assess the effect of chronic stress on the abundance and diversity of microbiota within a wild-caught host system, we investigated the microbiota of house sparrows, *Passer domesticus*. Following capture and acclimation to captivity, half the birds underwent a standardized chronic stress protocol. Throughout four weeks, the cloaca of each bird was swabbed once and the chronic stress treatment was validated by measuring host weight change and blood corticosterone levels. Using culture-dependent methods of selective plating to measure community abundance shifts, paired with culture-independent assessments of the bacterial diversity by high-throughput 16S rDNA sequencing, we determined the effect of chronic stress on the microbial cloaca community – simultaneously providing one of the first assessments of the gut microbial community of a wild-caught passerine. Our results will ultimately lead to a greater understanding of how chronic stress impacts vertebrate gut microbiota and dispersal of potential pathogens.

Monitoring of Fish Pathogenic Viruses in Freshwater Environments

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Outbreaks of infectious diseases among freshwater fish damage not only aquaculture, but also whole ecosystems. The long-term / wide-ranging monitoring of pathogenic organisms are essential for disease control or risk management, however, it has been difficult to monitor the pathogenic viruses in natural environments. Recent advances in molecular biological techniques enable us more easily to detect or quantify pathogenic organisms from water bodies. Here, we performed monitoring of fish pathogenic viruses to understand the dynamics of pathogens using Cyprinid herpesvirus 3 (CyHV-3) as a model. We established the quantification method of CyHV-3 in environmental freshwater samples to investigate where / how much of the CyHV-3 exists in natural environments. A nationwide survey of all national class-A rivers (109 rivers) was conducted, and 5-years monitoring in a natural lake (Lake Biwa) and river (Yura River) was performed to clarify long-term dynamics. The virus was concentrated by the cation-coated filter method, and the virus genomic DNA was amplified and quantified by realtime PCR. About 90% of rivers in Japan were contaminated with CyHV-3, although only 5 years have passed since its initial detection in Japan. Our results indicate that virus invasion does not consistently cause an outbreak and that several environmental factors may be involved in its occurrence. The patterns of seasonal dynamics of CyHV-3 differed between lake and river, possibly affected by the different patterns of temperature fluctuation. Our study showed that virus detection with molecular biological techniques is a powerful tool for monitoring the pathogenic organisms in natural environments.



Occupational Health Surveillance of Waste Management Unit Merdeka 2 Depok in 2011

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Waste management involves the processes in which workers and the workplace are mutually interacting with each other. Interaction between workers, machinery and equipment as well as the workplace can cause risk to the health and safety of workers. A way to minimize hazards and risks is identifying and collecting information collection activities by Occupational Health Surveillance. Occupational Health surveillance in Waste Management Unit Merdeka 2 Depok was developed through data collection, analysis & dissemination/communication.. Promotive and preventive activities were carried out immediately. It is expected that the cost of healthcare can be lowered through this activity. The methods used for the implementation of Occupational Health Surveillance are to identify risk factors in the workplace and the identification of workers in at risk populations. Work Surveillances consist of Health Effect Surveillance and Health Hazard Surveillance. Health Effect Surveillance is carried out with collection, analysis & dissemination/communication of health data for specific populations of workers at risk by systematic & continued planning, execution & evaluation. Health Hazard Surveillance is performed through identification, exposure measurement, analysis & dissemination to workers who are at risk. Direct observation was conducted in April-May 2011 in Waste Management Unit Merdeka 2 Depok regarding physical condition and hazards in the workplace that can cause disease and accidents such as trash which can cause diseases such as diaorrhea, dengue fever, and other infectious diseases or contain sharp objects that can cause injuries. Moreover, Waste Management Unit Merdeka 2 Depok uses machinery that can damage hearing through excessive noise, and has no toilet or other hygiene or health-related facilities.

Nopal, *Opuntia* spp, a Useful Vegetable with Options for Achieving Climate Change Adaptation and Mitigation as well as Human Health Benefits

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The average terrestrial surface temperature has risen above 0,6°C since last century. It will be rising between 1,4°C and 5,8°C by 2100. The world population will reach 9 billion by 2050, and agriculture will face the challenge of nearly doubling food production to feed people. Both, climate warming and overpopulation can affect agriculture, food production, nutrition, security and human health. Nopal, *opuntia* spp has several benefits in Mexico: it has good nutritional values; resists extreme climate conditions; captures CO₂; has minimal greenhouse gas emissions; and is healthy. It decreases overweight and obesity and aids diabetes control. A nutritional product made of Nopal and guava, *psidium guajava*, mixed with sucralose sweetener was developed in 2011. A candy factory was visited in Morelia city to develop this idea. The industry requested nopal farmers from Milpa Alta in Mexico City Southern. Besides, students from the nutrition school of "Vasco de Quiroga" University were incorporated to conduct nutritional analysis. An enterprise, Pirhuan, TM, was interested. Several candy products were made with nopal, guava and sucralose. Academia, environmental and health government, agriculture, science and industry were linked in this project. More international research is needed to support the nopal agriculture in adaptation and mitigation of climate change. Also, clinical research trials are required to evaluate human health benefits from nopal consumption



***Vibrio parahaemolyticus* and Seafood-borne Illness in 2009-2011 linked with Temperature and Rainfall during April 1950-2000 and 2030, 2050 Climate Scenarios in Michoacan, Mexico.**

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Climate change may impact rates of seafood-associated bacterial gastroenteritis. Several species of *vibrio*, naturally occurring marine bacteria, are sensitive to changes in ocean temperature and climate variability. *Vibrio parahaemolyticus* infects shellfish and its human consumption increases the risk of foodborne diseases. Reviews of historical atmospheric temperature and rainfall data together with future models 2030, 2050 are presented. Besides, *vibrio parahaemolyticus* seafood surveillance during 3 years is analysed. Seafood samples were obtained and sent to a laboratory for analysis from 2009 until 2011. Counts of *vibrio parahaemolyticus* were made with the most probable-number procedure. An outbreak on April 2010 was reviewed through the state weekly epidemiological surveillance system. Temperature and precipitation data were obtained from the Global Historical Climatology Network of April 1950-2000 to produce the 2030 and 2050 climate change scenarios. Positive *v. parahaemolyticus* in shellfish were higher in April in these 3 years. Highest temperatures occurred in April. Also, we found a diarrheal outbreak in a coastal place with 12 cases in April, 2010 by seafood consumption. Average temperatures in April, 1950-2000 were in the range of 15°C to 30°C. Average rainfall was 3mm to 32mm in that period. Average temperature and rain scenarios, MPI ECHAM 5, A2, on April 2030 and 2050 will be from 18°C to 31°C and 19°C to 33°C, respectively. Average precipitation will be 4mm to 12mm and 2mm to 16mm in the scenario years. These results show that an examination of *vibrio parahaemolyticus* in seafood and climate data can provide an appropriate basis for aggregate seasonal and regional predictions. Epidemiological studies in Mexico demonstrate that people living in coastal states are especially at risk of contracting disease.

Tourism and Vulnerability of Disease Emergence: A Preliminary Anthropological Study on Koh Chang, Thailand

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Tourism and migration of humans are a powerful force in the emergence of diseases. Koh Chang, known as the “eastern Andaman” has become a popular tourist attraction with thousands of visitors a year. Changes in terms of increase of tourist business, hotel and resort construction as well as land use patterns have created vulnerable contexts for disease emergence. This paper presents preliminary results of anthropological fieldwork on tourism-related phenomena, especially tourist’s socio-demographic backgrounds, behaviors, daily activities and life styles on Koh Chang and their implications for ecological changes and vulnerability of disease infections in the study area.

Post Natural Disaster Emergency Pest Control In Thailand: an Academia-Private-Public-NGO Effort

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Due to un-precedented Monsoon rain activity in Thailand in 2011, vast areas on the central plain were flooded and have remained flooded for periods up to 3 months in certain areas. Here, we describe the multi-institutional and trans-disciplinary effort targeting mosquito control in Ayuthaya and Nontaburi provinces, their challenges and results. As NICCO initiative, a Kyoto-Japan based NGO, an multi-institutional team was formed from academia (Mahidol University) and private (Thailand Pest Control Association) in consultation with and support from the district health authorities. Pursuing the emergence control of mosquito vectors a Insect Vector Management (IVM) approach was carried out during 3 months post flooding. The initiative was aimed at post flood pest control, focusing on mosquito vectors. For this purpose, chemical control, environmental management and social measurement approaches were carried out. Chemical control consisted of insecticide space spraying (Deltamethrin 2.5%EC) and larvicide (Pyriproxifen); whereas as environmental management and social measurements consisted in cleaning of the drainage system, removal of natural and artificial breeding sites, and in educative programs. Overall, 20-97% reduction of the adult mosquito fauna was achieved up to 2-3 weeks post operations, while 70-98% reduction of the mosquito larvae up to 3 weeks post operations. A taxonomic description of the mosquito species was performed which can be useful as baseline data of the mosquito fauna of Ayuthaya and Nontaburi provinces. In the presentation, the mosquito species composition of the flooded areas will be presented and the importance of a multidisciplinary and multi-institutional approach to the management of the emergency pest control will be highlighted.



Instituting Ecohealth at the Regional Level: Structure, Findings and Recommendations of the Caribbean Ecohealth Programme (2007-2012)

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The Caribbean EcoHealth Programme (CEHP) is a Canadian-funded initiative focused on the integration of environment and health research in the Caribbean Community (CARICOM) region (2007-2012). The goal of the CEHP is to foster a community of researchers and research users interested in science-based decision making to improve management of the environment and human health in the region. In keeping with the emphasis of ecosystem approaches to health on collaboration and participation, the CEHP from its beginning was structured to be a partnership between Canada and Caribbean environmental and health agencies, regional universities, and CARICOM member states' Ministries of Health. The CEHP research programme was designed to fill priority knowledge gaps in the region using a decentralized multi-disciplinary, team-based approach. This presentation will provide an overview of the results of the programme's major research projects, as well as the recommendations for Caribbean health policy emerging from the research findings. This includes the Caribbean Epidemiology Centre's Burden of Foodborne Illness (BOI) studies in eight CARICOM countries, as well as the first ever study of human exposures to zoonoses, heavy metals and persistent organic pollutants (POPs) as measured in maternal blood samples collected in ten countries. Finally, the implications of the CEHP's research results for encouraging an ecosystem approach to health at a regional level will be discussed.

Field Building Leadership Initiative: Advancing Ecohealth in Southeast Asia

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Ecohealth is useful for addressing health and environmental issues in developing countries, in particular in South East Asia (SEA) where agricultural intensification processes have profound implications for ecosystems and health. However, using the ecohealth approach to comprehensively tackle complex issues requires individual, institutional and country capacity in understanding and applying this approach within the context of the region. The newly developed program Field Building Leadership Initiative: advancing ecohealth in SEA (FBLI) aims at building the field of ecohealth by integrating research, training, policy and networking to focus on solving human health problems associated with agricultural intensification in SEA countries. Using a diverse range of methods and activities – including the “site-based research” concept – supported by national and regional networking events, the FBLI will implement three interlinked components: i) research – serving as the backbone of the initiative for other components and employing ecohealth approaches to address ecosystem and health issues related to agricultural intensification; ii) capacity building – strengthening ecohealth capacity and leadership through university degree training, training-of-trainers activities, and future leaders training and development; and iii) knowledge translation – promoting dialogue between the research and policy communities, and building capacity to translate research evidence to inform and influence policy decisions. A Regional Core Group – comprising representatives from a consortium of seven partner institutions from Thailand, Vietnam, Indonesia and China with solid experience in ecohealth – will implement the program in close collaboration with national partners, other regional and global ecohealth networks, and International Development Research Center (IDRC).



GIS Mapping of Vector-Borne Disease Incidences in Relation to Land Use Settings on Koh Chang, Thailand, A Global Outreach Hotspot

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Vector-borne diseases, i.e., dengue and malaria, generally occur on Koh Chang, one of the popular tourist islands in eastern Thailand. From 144 reported cases of dengue (2001-2011), 77.78% occurred in the northern part (Koh Chang Subdistrict) and 22.22% in the southern part (Koh Chang Tai Subdistrict) of the island. One hundred and five cases of dengue (72.92%) were found in Koh Chang Subdistrict area especially in the north-western part. Klong Prao was the village with the highest incidence of dengue followed by Klong Son and Bang Bao representing 43.75%, 15.28% and 13.89% respectively. Most reported cases were in residential areas (65.97%) followed by resorts (25.69%) and commercial zone (4.17%). Jek Bae, the village situated in the south-eastern part of the island was the village with no dengue cases reported since 2001. Based on 476 malaria reported cases (2001-2011), the three villages, i.e., Klong Prao, Klong Son and Bang Bao, were also the villages with highest incidences of malaria on Koh Chang. Two hundred and fifty-nine cases of malaria (54.41%) were recorded in these villages with 133 cases reported in Klong Prao followed by Bang Bao (84 cases) and Klong Son (42 cases). The distribution of malaria cases was highly concentrated in households (68.91%) followed by unknown types of residence (21.64%) and resorts (3.78%). In 2010 there were approx. 7,211 peoples living on Koh Chang, 52.96% were located in the western part, with a total number of 2,969 households in the three mentioned villages, accounting for 65.95% of total registered households. The distribution of both dengue (68.91%) and malaria (65.97%) cases seemed to occur in the households or residential areas especially in the western part where it was mostly populated. It is interesting to note that both dengue and malaria incidences were found less in resorts and commercial zones where there were many tourism activities (pubs, bars, restaurants, etc.). The GIS mapping of both dengue and malaria incidences in relation to land use settings on Koh Chang should be useful for planning prevention and control strategies by relevant public health authorities.

Vulnerable Population in Chennai City – a Focus on Health Risk

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The rapid growth of population in the CMA has been causing a strain on the existing urban services and infrastructure, for want of expansion and better management. The transport sector is vital and needs carefully planned expansion to meet the demands of the increasing population. The need to take an integrated long- term view of transport needs of CMA and to plan road development, public transport services and suburban rail transport as a part of the urban planning process have been well recognized as essential for the efficient functioning of the urban system. The urban population in Chennai city is expected to increase tremendously by 2030. The City faces severe problem of congestion due to runaway growth of personalized vehicles. The traffic management in the City is marked by introduction of a series of one-way traffic system. The one-way traffic system has, however, implications on pedestrian safety and fuel consumption. One-way traffic is generally desirable when there are complementary roads and the additional traveling distance is not more than 300m as per IRC. Hence whenever such systems are introduced, the interests of public transport modes and pedestrians are duly addressed. Traffic control devices, traffic signs and road markings are not adequately maintained to retain their legibility and visibility. Inadequate enforcement of traffic rules, lack of road sense and restraint by road-users and insufficient regulatory measures characterize the present situation. Pollution due to vehicular emission has done a lot of harm to the environment. The total number of fatal accidents as well as related fatality in the city has been increasing over the years. Persons killed per 100 accidents are alarmingly high, as high as during the year 2000. Pedestrian deaths as a percentage of all road fatalities are also extremely high. During recent years, they constitute more than 90% of all road fatalities. The present study provides spatial-information on transport and traffic flow, demographic and socio-economic characteristics of Chennai; household living conditions; and health care and health risk of Chennai city. The perceptual study has been adopted for the future planning of urban health/living conditions. This study shows that the problem of deaths and injuries as a result of road accidents in Chennai city is serious enough to demand attention of respective administrative authorities.



Hygienic Practices and Microbial Contamination of Small-scale Poultry Slaughterhouses in Peri-urban Areas, Hanoi, Vietnam

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Small-scale poultry slaughterhouses are popular throughout Vietnam and provide the largest part of poultry meat for national consumption. However, slaughterhouses are also the critical point farm to fork chain, which might represent health risks if not properly managed. We conducted a study on small-scale poultry slaughterhouses in peri-urban areas in Hanoi to assess the status of microbial contamination and hygienic practices of these slaughterhouses. A total of 720 samples of broiler carcasses and coecal swabs were collected from 20 family slaughterhouses and 16 slaughterhouses in wet markets. Tap water and utensils used for, and wastewater discharged from slaughtering were sampled to analyse *Salmonella* spp. contamination. Socio-economic conditions of the slaughterhouse owners and their hygienic conditions were recorded by interview and questionnaires. The prevalence of *Salmonella* spp. contamination was 40.6% for broiler carcass, 29.2% for coecal swab, 30.6% for holding pen, 63.9% for ground, 22.2% for utensils, 80.6% for wastewater, and 2.9% for tap water. Broiler carcasses in the wet market slaughterhouses were less contaminated by *Salmonella* than in the family slaughterhouses (OR = 0.66, 95% CI: 0.43 - 0.99). None of the hygienic and socio-economic factors of the slaughterhouses was significantly associated with *Salmonella* contamination of broiler carcass. Thus the study shows an overall high prevalence of *Salmonella* contamination of carcass and poor hygiene of the small-scale slaughterhouses. While the link between socio-economic factors and microbial contamination were not clear, improved hygiene of the slaughterhouses appears as an important condition for better quality of poultry meat.

Undocumented Migrants and Vulnerability of Disease Emergence: A Preliminary Anthropological Study on Koh Chang, Thailand

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Increasing population mobility which characterizes today's globalizing world has led to new experiences in disease epidemiology. Cross-country migration of workers due to economic disparity and many other factors poses challenges to control and prevention of disease emergence. Thailand, as a receiving country of hundreds of thousands of migrant workers from its neighboring countries, has been facing similar threats. In Koh Chang, an unknown number of migrant workers from Cambodia and Myanmar lives illegally, working in rubber and fruit orchards as well as in tourist industries. This paper presents a preliminary result of the anthropological fieldwork of undocumented migrants' lives and their vulnerability to infectious disease on Koh Chang. Implications for eco-health research methodologies are also discussed in this paper.

Perception and Prevention of Vector-Borne Diseases among Tourists Visiting Koh Chang, Thailand

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The incidences of vector-borne diseases occur in many tourist destinations and are increasingly imported by tourists to their home countries due to increase in global travel. The infection rate of dengue and other vector-borne diseases among tourists remains high and is growing. Despite the increase in incidences, there is a lack of research and intervention focusing in tourist destinations. The purpose of this study is to assess the knowledge of tourists on vector-borne diseases and planned prevention measures with emphasis on dengue. The study was conducted through a cross-sectional survey of tourists using one stage cluster sampling in the area of Koh Chang, Trat Province, Thailand, where dengue is endemic. Through Likert-scale, multiple-choice and open-ended questions, disease prevention knowledge, perceived disease susceptibility and severity, level of compliance, and the specific knowledge on dengue such as means of transmission, signs and symptoms, were assessed. Four hundred eighty-five tourists from various countries, mainly Europe, who entered the island of Koh Chang, were surveyed. Inclusion criteria were tourists at the age of 18 and older, spoke English or Thai, and able to give verbal consent. Most of participants had a high school degree or higher. Our findings showed that the number of times tourists visited Thailand had an inverse relationship with a doctor visit prior to the trip. The greatest concerns that tourists had were on food-borne and water-borne illnesses followed by mosquito-borne diseases. Nevertheless, the most common prevention tool brought by tourists was insect-repellent, which was also believed by them to be an effective preventive tool against dengue. It can be concluded that even though tourists expressed their concerns over contacting diseases such as food-borne and water-borne illness during their trips, they lacked the perceived susceptibility to vector-borne diseases, i.e., malaria and dengue. The results of this study can potentially be applied to design health education materials concerning vector-borne diseases and prevention measures for tourists travelling to Koh Chang, Thailand.



A Dynamic Model of Japanese Encephalitis Virus to Improve Surveillance Strategies

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Japanese Encephalitis Virus (JEV) is an emerging flavivirus endemic to South and Southeast Asia. JEV is the most commonly identified cause of encephalitis within vulnerable populations in these regions, and is an important public health concern because most clinical cases lead to death or long-term disability. JEV is sustained in a complex enzootic cycle between *Culex* mosquitos, birds, and swine with humans as dead-end hosts. In this study, we developed a dynamic model to describe the amplification cycle between mosquitos and swine. The model reflects the basic transmission ecology of the virus in areas of intensive pig farming, including the course of infection in domestic pigs and mosquitoes as well as host and vector demography. We demonstrate that these features of the natural history of the virus are sufficient to reproduce the 'cyclic' patterns of swine seroprevalence and human risk described in the classic study of a JEV outbreak in Myagi Prefecture, Japan in 1964. We then used the model to evaluate the efficacy of abattoir-based JEV surveillance. Surveillance strategies are characterized by the frequency of sampling, number of samples taken at each sampling time and the threshold number of positive samples required for a public health response. Alternative strategies are compared based on the expected reduction in human risk, accounting for potential delays between detection and response. This model will contribute to the pragmatic design of surveillance strategies based on swine serology by optimizing sample collection to provide adequate time for the implementation of interventions, particularly mosquito control.

Role of Integrated Agriculture-Aquaculture in Environmental Dissemination of Avian Influenza in Vietnam

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Based on extensive literature review and analysis of agricultural census data we hypothesize that integrated agriculture-aquaculture systems in Vietnam play a significant role in the environmental persistence of the Highly Pathogenic Avian Influenza (HPAI) virus. This is based on the realization that aquaculture ponds have high organic loadings of nutrients, making them attractive to wild birds which are HPAI carriers. We highlight the complex feedback mechanism of transportation of HPAI viruses between the aquaculture ponds and pigs due to traditional practices. Hence we raise the novel hypothesis that pigs too are a significant risk factor in the spread of HPAI in poultry. We raise the concern that pigs acting as 'mixing vessels' are capable mutating Low Pathogenic Avian Influenza viruses into HPAI.

Challenges in Changing the Traditional Culture of People Residing in Javanese Island Suburbs to Improve Health

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Environmental and family health issues have become a serious problem for the farming communities of the suburbs of Java Island, as the incidence of emerging diseases related to environmental health and human behavior has been progressively rising. Culture and traditions guiding human behavior are passed on from generation to generation, regardless of changes to the environment and lifestyle, so the problem becomes increasingly more complex and significant. Many programs have attempted to mitigate this problem but have failed due to short timelines, so the objective of this program is to educate and sensitize people, enabling them to understand and accept lifestyles modifications resulting in a healthier life. Through education, community members will gain an understanding of communal system livestock management, environmental and waste management, as well as the benefits of positive thinking and healthy living habits. As past failed programs have demonstrated, persuasive approaches from experts in multiple disciplines must be utilized, enabling the system and approaches to work synergistically for an optimal outcome. For this reason, the project team leaders include a veterinarian, dentist, psychologist, environmentalist, and policy maker. As it will be challenging to change multigenerational mindsets and traditions, the greatest expectation is for the youth, who understand and adapt to new concepts much easier. Through a community based approach with ongoing support, it is hoped this program will empower and inspire the community members to practice new, healthier living habits resulting in a better life in the future.



Vaccination – a key tool in public health, animal and wildlife health – but there should be more exchange on failures and successes

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Large and increasing populations such as displaced people, mobile, migratory populations and, more generally, remote rural communities are often excluded from human and animal health services including vaccinations. In public health, these populations are called 'hard-to-reach populations' given the logistical and financial difficulties to reach them. The majority of hard-to-reach communities (e.g. in Africa and Asia) keep livestock - 75% of the poorest 2 billion have livestock contributing important incomes to their livelihood. Vaccination remains a key community-effective health interventions in human and animal health, and is increasingly an important tool in wildlife health management – wild life nowadays in contact to livestock. There are several historical parallels of vaccination campaigns in the public health and veterinary medicine. The more evident parallels are in the small pox and rinderpest eradication programs. Both benefited from committed (international) financial and personnel investments. Next there are the ongoing polio- and contagious bovine pleuropneumonia-eradication programs – the latter with a bit lesser financial means and vaccines (e.g. requiring a cold chain). Still, these vaccination programs - either rooted in the public health and veterinary sectors - have hardly exchanged in the past, although they target to a large extent the same populations: the most vulnerable to exclusion to any health services. Many communities have longer (good) experience with livestock vaccination – fewer vice versa – and the programs should capitalize on any good experiences. Culturally adapted communication based on the experiences of the targeted hard-to-reach populations remain important mobilization and access to services of these communities (good experiences as an entry point). We report on our transdisciplinary processes in Africa and Central Asia and discuss future research with vaccination as a part of integrated health services to communities that can benefit of cross-financing, but importantly also in health communication at local, regional and international levels. In view of more community- and equity-effective health interventions in people, livestock, pets and wildlife living in their ecosystems, a fostered exchange between vaccination programmes warrants better to not repeat errors and failures but to build-on on success stories.

Expansion of Dengue Virus in Western Terai Region of Nepal

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Background: Dengue fever (DF) is an emerging mosquito borne disease and important public health problem in low land of Terai region of the Nepal. **Objectives:** The general objective of the study is to determine the seroprevalence of dengue virus by the IgM capture ELISA. **Methods:** Serum samples were collected from 283 patients visiting hospital with history of fever, headache & clinically suspected DF. The 283 samples were examined for dengue virus specific IgM capture ELISA. A cross-sectional study was conducted to determine anti-dengue virus IgM positive rate in Nepal (Mahendranagar, Dhangadi and Dang) from 2008 August to November 2009. **Results:** The anti-dengue IgM positivity was found to be 9.8%. The dengue positive cases were higher in female (10.9%) as compared to male (9.0%). The highest positive cases (10.7%) were from age group above 50 years. The positive rate was highest in Mahendranagar (13.3%) followed by Dhangadi (9.8%) as compared to Dang (1.6%) ($P < 0.05$). When compared to Ethnic group Brahman/Chherti (13.1%) followed by Janajati (5.6%). The highest numbers of dengue positive cases were in occupation group in agriculture (12.0%) followed by student (11.5%) ($P > 0.05$). **Conclusion:** The findings of this study showed that dengue virus is firmly established in low land of Terai region of the Nepal. This Study also Providing necessary information to concerned authority for implementing prophylactic measures, monitoring and planning for surveillance of the dengue virus (DV) cases in Nepal.



Knowledge, attitude and risk factors associated with JE among pig farmers in Kathmandu, Nepal

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Japanese Encephalitis (JE) is a vector borne viral zoonotic diseases, transmitted by Culex mosquitoes. It is main public health problems in Asian Countries including Nepal, engendering poverty and intellectual standard of nation hampering prosperity and misfortune of economy of life. People generally migrate from rural to urban areas for sustaining economy. To alleviate poverty, they rear pigs. Pigs are the reservoir hosts for JE virus. But, they have lack of knowledge about JE. Hence, the study was conducted with aim to study knowledge, attitude and risk factors associated with JE among pig farmers in Kathmandu, Nepal. A cross sectional study was conducted in Kathmandu during December, 2011 to March 2012. A total 56 pig farmers were selected randomly from four communities namely Dharmasthali, Gothatar, Manahara and Gokarna. Verbal consent was taken and questionnaires were administered to each farmers associated with JE knowledge and risk factors. Out of 56 respondents, 23.2% of farmers had JE knowledge and 76.8% had not known. Out of 45 pig farmers, 16.1% and 6% respondents were known about JE transmission and treatment respectively. For the level of importance of factors for fever, 85.7% farmers underscored garbage as very important factors for fever. Only 73.2% respondent's highlighted mosquitoes is very important factor for fever; 14.3% respondents highlighted food as somewhat important factors for the disease. For the knowledge of risk factors associated with JE, 28.6% farmers responded mosquitoes bite increase JE; 1.8% responded no effect; 69.6% were unknown. Out of 56 respondents, 26.8% responded living near pig farm increase JE risk; 7.4% responded no effect and 66.1% were unknown. ; 7.1% pig farmers responded JE increases living near paddy fields; 25% responded no effect and 67.9% were unknown; 14.3% pig farmers responded wild bird increases risk; 16.1% responded no effect and 69.6% were unknown. Out of 56 pig farmers, 16.1% farmers responded rainy in summer increases JE risk, 16.1% responded no effect and 67.9% were unknown. In conclusion, pigs are reservoirs source of JE and it was found that JE knowledge and risk factors associated with JE among pig farmer was very low. Hence, awareness programme about JE knowledge and preventive measures should be conducted.

Establishing a community of practice of researchers, practitioners, policy-makers and communities to implement an ecosystem approach to health in a network of Ecuadorian universities

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Background: The Sustainably Managing Environmental Health Risk in Ecuador project was launched in 2004 as a partnership linking a large Canadian university with leading Cuban and Mexican institutes to strengthen the capacities of four Ecuadorian universities for leading community-based learning and research in areas as diverse as pesticide poisoning, dengue control, water and sanitation, and disaster preparedness. Methods: To assess progress in achieving desired outcomes, we review results associated with the logic framework analysis used to guide the project, focusing on how a community of practice in ecosystem approaches to health has strengthened implementation, including follow-up tracking of program trainees and case study presentation. Results: By 2009, a train-the-trainer project involved 27 participatory action research Master's theses in 15 communities with 1200 community learners participating in interventions. This led to establishing innovative Ecuadorian-led master's, doctoral and certificate programs. Building on this network, numerous initiatives were subsequently initiated, including internationally funded research projects to strengthen dengue control in the coastal community of Machala, a 5 year research program on food sovereignty and health equity, and a community eco-health centre focusing on determinants of health. Discussion: Strengthening capabilities through direct engagement with affected populations and decision-makers provides a fertile basis to act on a larger scale, capturing benefits from "top down" (consolidating institutional commitments) and "bottom up" (achieving local results). Conclusions: Alliances of academic and non-academic partners from the South and North provide a promising orientation for learning together to address negative trends of development. Longer-term monitoring is needed to ascertain sustainability.



A case study on the influence of community participation on reporting and control of Avian Influenza epizootic in backyard chicken

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In order to assess the level of community participation and success of Avian Influenza (AI) surveillance and control in backyard chicken in Northern Thailand, in depth interviews and focus group discussions were conducted between 2006 and 2007. The targeted informants consisted of different stakeholders which included local veterinarians, public health officers, local government, but also villagers in communities, experiencing AI epizootics during the first outbreak wave. At rural communities an avoidance to report AI outbreaks and failing to comply with control regulations to eradicate the disease were observed. This included not reporting of sick or dead chicken, mainly to escape mass culling of birds. Some villages compromised the culling measure by letting only half number of chickens to be destroyed. Some owners ignored the restricted movement area and moved their chickens out of the zone. In one place the authority had to relocate the burial site to a new area following protest from villagers. These finding demonstrated how community cooperation could influence success of surveillance and control measures implemented by the government. The integration of public health volunteers into the AI surveillance and control in backyard poultry encouraged community participation. This strategy was crucial not only resulting in an increasing area of coverage for surveillance, but also enhancing cooperation from villagers leading to efficiency improvement in controlling the disease.

Access to safe water in remote Andean communities: Complementing water testing and treatment with participatory water management

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Tucayta is an indigenous agricultural cooperative that manages an irrigation system for 15 member communities in Cañar, in the Ecuadorean Andes. Concern about safety of drinking water emerged due to use of agrotoxics and insufficient information about the municipal quality control. A team of community leaders and university researchers assembled to conduct capacity building to sustainably manage environmental health risks. We therefore conducted water testing for agrotoxics and supplemented this with accessible water testing tools that the community could use to monitor microbiological contamination. Specifically, we delivered inexpensive Portable Microbiology Lab kits for 250 tests to the Tucayta community council. Community representatives were trained to take samples, prepare and incubate them, and analyze and interpret results. We were able to engage community members, from children to grandparents, in the simple steps involved in conducting a drinking water analysis. Results indicated where careful measures must be taken to ensure household delivery of disinfected water and where current practices work well. Testing for other contaminants, for which simple field test kits are lacking, was performed at our laboratory in Quito. Although quantities were low, agrochemical residues were detected (Propoxur in water and potato crops; Propoxur, Oxamyl and Malathion in soil sediment). Sustained protection of the water supply will require engaging agrarian households and local fertilizer and pesticide suppliers. When local communities are connected with methods of water quality assessment they are empowered to make changes and lead dialogue about the quality of water that affects their families' sustained health.



Improvement of biosecurity and poultry health on broiler farms through the use of district livestock service advisors in subang, indonesia

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Sector 3 farms in Subang, Indonesia have lower levels of biosecurity and a resulting greater potential risk for acquiring and transmitting infectious diseases, including Highly Pathogenic Avian Influenza. Poultry farms in sector 3 are generally located in residential areas, increasing the potential for zoonotic disease transmission to humans. Therefore, the improvement of biosecurity was essential in order to prevent disease transmission both to and from the farms. For this project, district livestock services staff served as advisors to assist farmers with biosecurity improvements from October 2010 through June 2011. In preparation for this duty, the advisors participated in a Training of Trainers at the beginning of the program, along with weekly then monthly meetings with experts, to improve their skills and knowledge of biosecurity and poultry health management. Every farmer was visited weekly by the advisory team for the first seven months to assist with improving biosecurity and poultry health management, as well as performing surveillance. In addition, the advisors assisted the farmers with shed preparation, vaccination, and harvesting. The advisor's visits were decreased to two visits per production cycles (about 21 – 30 days) for the last two months. All farm visits were recorded in a farm logbook which included a biosecurity checklist and a farm recording sheet. The results showed that the uptake of advice given was good; almost all of the 32 biosecurity measures which were recommended saw an increase and 16 biosecurity measures were applied by over 90% of the farms at the end of the program.

A view of bogor's weather related to the emerging diseases anthrax and avian influenza from january 2004 to february 2005

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In the region of Bogor, Indonesia, frequent outbreaks of anthrax and avian influenza (AI) occur, posing serious public health risks and causing significant social-economic impacts. To determine the impact that weather patterns have on anthrax and AI, climatology parameters were collected monthly from January 2004 to February 2005 in and around Bogor. The dates of anthrax and AI outbreaks as reported in the news and by reporting institutions were also collected for the same time period. An anthrax outbreak occurred from September to October 2004 and was followed by an ongoing AI outbreak from December 2004 to June 2005. Anthrax is a well-known soil-borne disease, so seasonal changes could result in the spread of anthrax spores from the top soil layer into either the air by wind or across land and water by flooding during the rainy season. Therefore, a possible reason for the anthrax outbreak could be the reported change in weather conditions from the dry season to the rainy season between August and September 2004. The AI outbreak in the region occurred during a cooler (25.2-25.8°C), humid (86-90%) period, which may have provided the most favorable conditions for its emergence due to the biological characteristics of the AI virus, which has longest survival in relatively high humidity and low temperature conditions. The changing weather patterns illustrated here influence the emergence of both diseases in the region, so better understanding this complex relationship increases the ability to anticipate and mitigate anthrax and AI outbreaks.

From conceptual to effective interdisciplinarity: a mercury research network case study

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Mercury contamination of ecosystems is considered a wicked problem because of the complex and conflicting nature of available information and their multiple dimensions (environmental, social, human health, economic). Mercury is known as a global pollutant due to its long-range transport in the atmosphere. It is persistent in the environment, able to bioaccumulate and biomagnify through the food chain and can affect human health depending on the level and type of population exposure. **An important challenge** for scientists is to be able to develop a **usable decision making tool for communities and stakeholders** regarding the mercury issue. It is essential to adopt an interdisciplinary approach in order to have real world understanding and to put in place concrete actions. In the last few decades, interdisciplinary research teams have been emerging to address the complex links between ecosystem and health. However, the implementation of effective interdisciplinarity research requires teams to overcome serious challenges. The objective of this presentation is to analyse and discuss how to foster effective interdisciplinarity when implementing and carrying out ecosystemic research dealing with environmental contaminants that affect human health. Using the Collaborative Mercury Research Network (COMERN) as a case study, we will present the elements that allowed a problem-based integrated view of the issue at all levels of the research process and show how it helps to propose real-world understanding and actions. To do so, we will identify obstacles and challenges that occurred, and argue the key structural and human factors that allow effective interdisciplinarity to emerge.



Prevalence of *Opisthorchis viverrini* infection in *Bithynia* snails in opisthorchiasis endemic areas, Khon Kaen province, northeast Thailand

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Liver fluke infection caused by *Opisthorchis viverrini* remains a major public health problem in Southeast Asia including Lao PDR, Cambodia, Vietnam and Thailand, especially Khon Kaen Province, Northeast Thailand. *Bithynia siamensis goniomphalos* serves as snail intermediate of *O. viverrini* in Northeast, Thailand. This study aimed to survey current status of *O. viverrini* infection in *Bithynia* snails collected from opisthorchiasis endemic areas in Khon Kaen Province. Surveyed sites in opisthorchiasis endemic areas were mapped using a geographical information system (GIS). *Bithynia* snails were collected from 40 water bodies and examined for trematode infection by cercarial shedding method. The cercariae were identified by their morphological characteristics, external and internal organ under stereomicroscope and confirmed by PCR. A total of 9,828 *Bithynia* snails were collected. There were 9 types of cercariae identified in these snails including *O. viverrini*, Virgulate, Amphistome, Mutabile, Longifurcate, Brevifurcate, Xiphidio and 2 unknown. The prevalence of *O. viverrini* infection in the *Bithynia* snails was 0.48% (47/9,828) which was found only in the snails collected from Chi Kok Kor Village, Lawa Lake complex, Khon Kaen Province. PCR analysis confirmed *O. viverrini* specific amplification. The prevalence of Virgulate, Amphistome, Mutabile, Longifurcate, Brevifurcate, Xiphidio and 2 unknown cercariae were 1.76%, 0.40%, 0.04%, 0.12%, 0.04%, 0.18%, 0.13 and 0.18%, respectively. This survey provides baseline data to guide better targeted control of opisthorchiasis in Khon Kaen Province. More surveys should be undertaken in other endemic areas in Northeast Thailand in aid of better prediction of human infection.

Map creation for evaluation of risk from liver fluke infections using DEM and satellite imageries

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Thai liver fluke infections due to *Opisthorchis viverrini* (*Ov*) have been widely seen in Lao PDR. As part of the measures to reduce liver fluke infections, a risk map was created using the satellite imageries and DEM (Digital Elevation Model), focusing on Savannakhet Province, Lao PDR. The risk of liver fluke infections to humans was analyzed based on the spatial distribution of the snails (*Bithynia* sp.) that serve as intermediate hosts. They are generally said to be distributed widely in the slow or still water region including paddy field, not in the fast watershed like river, but no data and previous study was found concerning about actual distribution of snail, or determined environmental properties (land-cover, micro-topography, etc.) of its distribution for this area. To identify the habitats of the *Bithynia* sp. and determine its population density, a total of 57 ponds were surveyed using AVNIR-2 (Advanced Visible and Near Infrared Radiometer -2) satellite imageries captured during the dry season. We used also DEM to calculate the flow direction and accumulation of water region and other land-cover region (mainly forest) in the dry season. We analyze the correlation between land-cover distribution which is surrounding, total flow accumulation value, and the field data in each research ponds. Further analysis showed snail population density to correlation with total flow accumulation site, which resulted in the final risk map.

Sustaining a regional EID research network through a trust based approach

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The objective of this poster is to elaborate how the **Asia Partnership on Emerging Infectious Disease Research (APEIR)** as a research network was initiated, developed and maintained to deal with Emerging Infectious Diseases (EID) based on Ecohealth principles in Asia. The formation and development of the Partnership were evolutionary process, starting from the conceptualisation of research projects based on country priorities, to the development of joint projects based on regional priorities and finally the development a regional partnership using a unique working process. The partnership engages a wide range of stakeholders, including researchers, policy makers, officials, practitioners and community. The poster will elaborate how the partnership was developed among people from multi-country, multi-sector and multi-disciplinary backgrounds through joint projects development and implementation. The poster will also demonstrate how this partnership manages its day-to-day work and draw lessons. The poster will highlight why and how APEIR is a unique EID research network emphasizing how to keep it simple, practicable, scalable and sustainable. Research partnership has become a strategic approach for inspiring researchers to increase research quality and international recognition. Partnership is advocated as a means to develop regional collaborative research, increase potential to obtain funding, strengthen links to all related sectors, build capacity for researchers and policy makers, and perform as a key mechanism to disseminating research findings for policy advocacy.



Farmer's management of tree biodiversity to optimize the delivery of desired ecosystem services in shade coffee agroecosystems

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Traditional shade coffee agroecosystems are the archetypal example of sustainable agricultural practices. Studies in the last 20 years have documented its importance for arthropods, amphibians, birds, and mammals. But how important is this agroecosystem for the well-being of coffee growing households? In this study, I investigate the use of secondary products obtained from shade trees in coffee agroecosystems. I hypothesize that tree biodiversity in coffee agroecosystems is managed to obtain the desired tree composition that will deliver the services desired by coffee growers. These include supporting services for the production of coffee and provisioning services for secondary products such as timber, firewood, fruit, and medicinal products. This study takes place in La Sepultura Biosphere Reserve in Chiapas, Mexico, where I conducted interviews among coffee growers and tree richness inventories in coffee farms and forests. Fieldwork and interviews reveal that farmers manipulate tree biodiversity by managing the adult and sapling communities to meet the primary objective of optimizing coffee production. As a secondary objective, farmers are interested in secondary products such as timber and firewood. Tree inventories reveal that tree biodiversity in farms is much lower than in forests; trees in farms are dominated by useful species, in particular by *Inga* spp., the preferred shade tree for coffee cultivation; other useful trees for timber and firewood are present at higher frequencies than in forests. Over time, non-useful trees are replaced by useful trees in a regeneration process managed by farmers. In conclusion, tree biodiversity is simplified and the composition, compared to forests, is transformed to enhance the delivery primarily of supporting services and secondarily of provisioning services.

Participatory Curriculum Development for Marine Ecohealth scaled to a Philippine Marine Bioregion

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Marine spatial planning has evolved into the world's leading approach to maritime development and management and is generally based upon marine bioregions. However, applications of this strategy are rare to non-existent within SE Asia and Asia in general. This is perhaps due in part to limitations in the communication and coordination infrastructure. As a result, there is an inability to encompass the large number of small-scale fisherfolk that dominate marine use within the individual countries. The fisherfolk are generally isolated from each other, and also from educational programs and the broader marine science world. In the Philippines, College level fisheries programs have evolved primarily without significant marine science capabilities and been focused upon bringing college level programming to fisherfolk communities. Although the country is highly dependent upon marine resources marine science is significantly under developed and not applied at the primary governance level of nearshore fisheries, which is the local government units. The current work is focused on one marine bioregion, the Northern Philippine Sea and outlines the ongoing process to conduct participatory curriculum development that spans 10 provinces and is aimed at providing enhanced marine science capabilities to educational institutions in each of these provinces. The curriculum development approach is also designed to consider areas where educational program is specifically focused on indigenous peoples, such as the Batanes Islands. A developmental approach to marine science is outlined through the establishment of a bioregional consortium with an annual and electronic base for regular curriculum development and enhancement.



Social Process and an Ecohealth Practitioner network in Kenya: response to food security challenge and images of the future

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Food security and related climate change challenges of Kenya are examined to define specific challenges and related social process opportunities. Process design for a national Ecohealth community of practice is discussed with consideration of indigenous knowledge, and the three aspects of food security: availability, access and utilization. Emphasis is placed upon the potential for using positive images of the future to define directional community transformation and institutional programs. The presentation will consider separately: the Beach Management Units of Lake Victoria; modification of agricultural systems and; actions within the coastal communities of the Somali Current. Maclanahan et al. (2009) suggested for coastal Somali Current communities that interventions consider three planes of challenge: environment (susceptibility), ecology (pristineness) and society (adaptive capacity). The current work will take a broad look at these considerations for the Lake Victoria shoreline, agricultural and coastal communities in terms of their role and potential in the development of a national food security strategy. The analysis will be used to outline the potential development of an Ecohealth Practitioner Network intervention that builds social capital and local capacity. Further, strategies will be outlined regarding how facilitation needs to proceed in a manner where values are expressed by all sectors of the community and as well combined with professional assessments. The current work is intended as a blueprint for the development of an integrated national food security strategy that is also responsive to impending climate change challenges.

Dog Demography in Relation to the Persistence of Rabies on Bali - Indonesia

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Over 130 human rabies deaths have occurred during an ongoing epidemic in Bali, Indonesia, since November 2008. Concerted rabies control efforts are progressing well, but additional data on fecundity and population dynamics of Bali dogs could support the ongoing control program. As part of a project "Ecohealth Approaches for Optimizing Rabies Control in Bali", funded by IDRC and led by ILRI, data were collected on 100 female fertile dogs selected randomly from sub-districts and monitored longitudinally for 12 months. Of these dogs, 78% were local Bali breeds, 5% were exotic and 17% mixed breeds. Female ages ranged between 1-12 years, but were mostly 1-5 years (86%). During the observation period, 83 females gave birth (average of 1.14 litters/ female \pm 0.682). Mean litter size was 4 pups (range: 1-7) with a male-biased sex ratio of 1.05:1. Of 479 pups born, 59 died (12.3%), 212 were kept (44.3%), 189 given away (39.5%), 6 sold (1.3%), 10 (2.1%) thrown away and 3 were lost (0.6%). Of the pups that were kept, 115 survived (54.2%). Censored survival analysis of these data should enable calculation of growth rates and provide insight on causes of the highly skewed sex ratio in the general dog population (2.3:1). The preference for males may contribute to increases in unowned dogs which are less accessible for vaccination and population control. Movement of pups could increase rabies spread, especially if pups are not vaccinated. Further analysis should provide guidance for rabies control particularly with regard to population management and movement control.



The association between medication use and direct heat-related hospitalizations in Adelaide, Australia

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Background: A 14-day extreme heatwave occurred in Adelaide in the summer of 2009, which was associated with a 14-folds increase in direct heat-related hospitalizations (DHRHs). This study aimed to examine the risk of pre-hospital medication use for the DHRHs. Methods: A case-series study was conducted. Data of the patients from the heatwave exposure period and referent periods, before and after the heatwave, were collected from seven major public hospitals in Adelaide. Descriptive analysis and multivariate logistic regression were applied to quantify the association between the medication use and DHRHs. Results: There were 759 patients included with a median age of 73. Patients from the exposure period were older and fewer living in aged residential care. Being older (OR=1.02, 95%CI: 1.01-1.02), living alone (OR=1.9, 95%CI: 1.09-3.33), using community services (a surrogate of weakness) (OR=2.05, 95%CI: 1.16-3.62), having more co-morbidities (OR=0.94, 95%CI: 0.89-0.99), and taking more medicines (OR=0.88, 95%CI: 0.82-0.90) were significantly associated with DHRHs. Conclusion: We did not detect a particular medicine that may increase the risk of DHRHs in the study population. Patients taking more medicines could be less likely to have DHRHs during the heatwave period, which may be due to more concerns of their own health status and more frequently seeking health services.

Genetic differentiation of disease vector populations along an urban-rural gradient

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Anthropogenic disturbances in the form of deforestation, agricultural land use, habitat fragmentation, and increased urbanization result in an alteration of wildlife communities, loss of biodiversity, and emergence of wildlife diseases. This study explores the effects of urbanization on population structure and connectivity of the blacklegged tick (*Ixodes scapularis*), the primary vector of Lyme disease in the United States. We examined the population composition of these ticks along an urban-rural habitat gradient extending 120 km northward from New York City (the largest urbanized and most densely populated region in the United States). Twelve forested parks along the gradient were sampled during June and July 2011, corresponding to peak seasonal activity for the nymphal stage of this tick, which is responsible for transmitting most cases of Lyme disease to humans. Tick population density measurements at each site were recorded and genetic differentiation between sites was compared using microsatellite markers. First year data sets indicate a trend of higher tick densities in more rural areas and decreased density with increasing urbanization. This is important from a human health standpoint since Lyme disease risk is positively correlated with tick density. Preliminary microsatellite data demonstrate differences in tick populations between rural and urban sites. While results are suggestive, these data support the need to explore the phylogeography of this species further. Future work will focus on comparing patterns of tick populations with those of two major host species along the urban-rural gradient.

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