



# Biodiversity

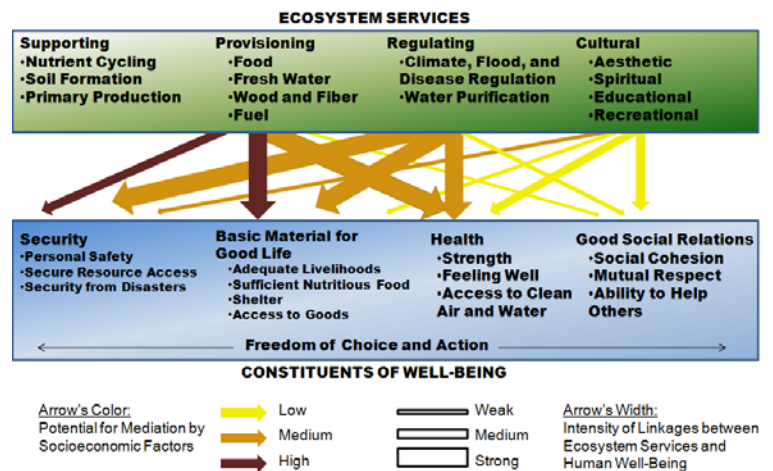
# factsheets

## Biodiversity, Ecosystem Services, and Human Well-Being<sup>2</sup>

Biodiversity, or biological diversity, is the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part.<sup>1</sup> Biodiversity shapes the ecosystem services that contribute to human well-being – material welfare, security, social relations, health, and freedom of choice.<sup>2</sup>

### Species Diversity

- Approximately 1.6 million species have been described.<sup>3</sup> Estimates of global species diversity vary between 5 and 30 million species.<sup>4</sup>
- 244,000 marine species have been identified, and more than a million marine species are estimated to exist.<sup>5</sup>
- Freshwater habitats account for less than 1% of the world's surface and only 0.01% of the world's water,<sup>6</sup> but support 25% of all described vertebrates, over 126,000 animal species, and 2,600 macrophyte plants.<sup>7</sup>
- Biodiversity hotspots are areas with exceptional concentrations of endemic species that face extreme loss of habitat. 25 hotspots cover 1.4% of the Earth's land surface (810,000 square miles; see map, right), and contain the remaining habitats of 44% of all plants and 35% of all vertebrates. 38% of the aggregate hotspot land area is protected within parks and reserves.<sup>8</sup>
- U.S. has 468 known mammal, 888 known bird, and 19,473 known plant species, with 40, 71 and 240 threatened species, respectively.<sup>9</sup>



### Biodiversity Hotspots<sup>8</sup>



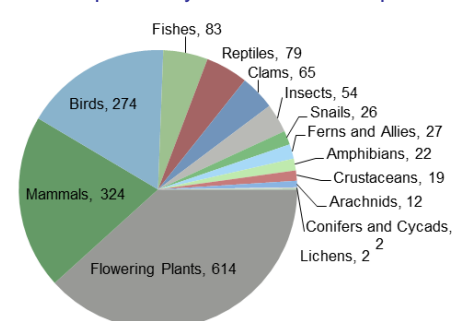
### Genetic Diversity in Agriculture

- 30 mammalian and bird species are used extensively for agriculture, with half accounting for over 90% of global livestock production.<sup>10</sup> Genetic diversity within breeds is declining and 20% of 7,616 livestock breeds are classified as at risk.<sup>11</sup>
- Of about 30,000 wild edible and 7,000 cultivated flowering and cone-bearing plants, 30 crops provide 95% of dietary energy or protein. Wheat, rice, and maize provide more than half of the global plant-derived calories.<sup>12</sup>
- In the last 100 years, about 75% of the genetic diversity of agricultural crops was lost.<sup>13</sup>

### Loss of Biodiversity

- Species extinction rates have increased by as much as 1,000 times typical rates over the Earth's history. In the last 50 years, alteration of biodiversity related to human activities was greater than at any time in human history, and this trend is projected to continue.<sup>2</sup>
- Agriculture is the largest driver of genetic erosion, species loss and habitat conversion.<sup>4</sup>
- Habitat change, climate change, invasive alien species, overexploitation and pollution are the most significant direct drivers of biodiversity loss and change in ecosystem services.<sup>2</sup>
- Ecosystem degradation increases vulnerability to invasive species, putting native species at risk.<sup>15</sup> Climate change is an especially pervasive threat to biodiversity because it even affects areas that are uninhabited by humans.<sup>16</sup> Climate change such as increased drying could result in dieback of the Amazon, which has the highest biodiversity of all forests.<sup>17</sup>
- Over-fishing and harvesting contribute to a loss of genetic diversity and relative species abundance of individuals and groups.<sup>18</sup>

### Number of Federally Listed Endangered Species by Taxonomic Group<sup>14</sup>



## Implications of Loss of Biodiversity

- Habitat loss can result in increased greenhouse gas emissions – 8% of global emissions derive from tropical deforestation.<sup>19</sup>
- Ecosystems with healthy, functioning biodiversity provide many services, including: food, water, carbon storage, fiber, fuel, climate and water regulation, spiritual enrichment, recreation, education, and support for primary production.<sup>19,2</sup> While controversial, an early estimate set the total value of global ecosystem services at \$33 trillion/year, or 1.8 times GNP.<sup>20</sup>
- Biodiversity disruption has significant implications for the rural poor whose livelihood depends on local ecosystem services.<sup>21</sup>
- Loss of biodiversity in ocean habitats greatly reduces ecosystem stability and productivity, which also reduces fishery output.<sup>22</sup>
- Loss of ecosystems such as salt marshes, mangroves and coral reefs increase vulnerability to sea level rise and storms and exacerbate natural disaster impacts. Functioning coastal wetlands may have reduced the impact of Hurricane Katrina, estimated at \$150 billion.<sup>19</sup>
- Loss of biodiversity can result in a loss of known and undiscovered chemicals valuable to human health. Chemical compounds such as quinine, antibiotics including erythromycin and neomycin, and taxol (a cancer treatment) are important pharmaceutical agents derived from other life forms.<sup>23</sup>

## Sustainable Actions

### Local Planning

- Landscaped corridors aid in preventing the extinction of local species and maintaining biodiversity.<sup>24</sup>
- Landscaping with native plants enhances biodiversity and improves soil, air and water quality.<sup>25</sup>
- Local government action can significantly influence biodiversity through land use decisions, sustainable development and education of residents. See <http://www.iclei.org/index.php?id=6238>.<sup>26</sup>

### Policy

- Examples of global treaties to protect species include The International Convention for the Regulation of Whaling (1946); The International Convention for the Protection of Birds (1950); The Convention on Wetlands of International Importance (1971); The Convention of International Trade in Endangered Species (1973); The Convention of the Conservation of Migratory Species of Wild Animals (1979); and the Convention on Biological Diversity (CBD) (1992).<sup>27</sup>
- The CBD, an international treaty signed at the Rio Earth Summit by 168 signatories, has 3 objectives: to conserve biodiversity, to enhance its sustainable use, and to ensure an equitable sharing of benefits linked to the exploitation of genetic resources.<sup>28</sup>
- The Endangered Species Act (1973), administered by the Interior Department's U.S. Fish and Wildlife Service and the Commerce Department's National Marine Fisheries Service, aims to protect and recover imperiled species and the ecosystems they depend on.<sup>29</sup>
- 166 parties have National Biodiversity Strategic Action Plans for the conservation and sustainable use of biological diversity.<sup>30</sup>
- Over 100,000 protected areas (such as national parks and reserves) have been established, covering around 12% of the Earth's surface; these areas are still under threat due to factors including poor management, lack of habitat representation, climate change, over extraction and diversion of river water, and lack of support from governments, business and industry, and local communities.<sup>31</sup>

### Global Initiatives

- The 2010 Biodiversity Indicators Partnership is a global initiative to significantly reduce the rate of biodiversity loss by broadly implementing a set of biodiversity indicators and generating information for decision makers.<sup>32</sup>
- The World Wildlife Fund's 2050 Biodiversity Goal is to conserve the integrity of the most outstanding natural places. The 2020 Goal is to restore populations of the most ecologically, economically and culturally important species.<sup>33</sup>
- The International Union for the Conservation of Nature (IUCN) Species Program and the IUCN Species Survival Commission assesses the conservation status of species, subspecies, varieties, and subpopulations on a global scale to identify threatened and endangered species and promote their conservation.<sup>34</sup>
- Global Action for Biodiversity has seven steps: 1) protect a minimum of 10% of each ecosystem type; 2) improve farming practices; 3) harvest fish sustainably; 4) implement environmentally conscious urban and rural development; 5) fight climate change; 6) reduce alien species invasions; and 7) integrate biodiversity into all areas of policy making.<sup>35</sup>

### Agriculture with Wildlife Corridor Habitat



Photo courtesy of USDA NRCS ([www.nrcs.usda.gov](http://www.nrcs.usda.gov))

<sup>1</sup> United Nations Treaty Series (1993) Convention on Biological Diversity. Vol. 1760, I-30619.

<sup>2</sup> Millennium Ecosystem Assessment (2005) *Ecosystems and Human Well-being: Biodiversity Synthesis*. World Resources Institute, Washington, DC.

<sup>3</sup> World Conservation Union. (2008) IUCN Red List of Threatened Species. Summary Statistics for Globally Threatened Species. Table 1 (1996–2007).

<sup>4</sup> UNEP (2007) *Global Environment Outlook: environment for development (GEO-4)*

<sup>5</sup> Census of Marine Life. (2010) First Census of Marine Life 2010, Highlights of a Decade of Discovery. <<http://www.coml.org/highlights-2010>>

<sup>6</sup> David, D., et al. (2006) "Freshwater biodiversity: importance, threats, status and conservation challenges" *Biological Reviews*. 81 (2), 163–338.

<sup>7</sup> IUCN (2008) "Freshwater Biodiversity-A Hidden Resource Under Threat" Species Survival Commission.

<sup>8</sup> Myers, N. (2000) "Biodiversity hotspots for conservation priorities" *Nature*. 403, 853–858.

<sup>9</sup> UNEP EarthTrends Data Tables: Biodiversity and Protected Areas. Biodiversity 2005.

<sup>10</sup> UN Food and Agriculture Organization (2009) *Biotechnology in Food and Agriculture* Conference forum <http://www.fao.org/biotech/c13doc.htm>.

<sup>11</sup> UN Food and Agriculture Organization (2007) *State of the World's Animal Genetic Resources for Food and Agriculture, in brief*.

<sup>12</sup> UN Food and Agriculture Organization. (1997) "State of the World's Plant Genetic Resources for Food and Agriculture."

<sup>13</sup> Shand, Hope (1997) "Human Nature: Agricultural Biodiversity and Farm-based Food Security" Rural Advancement Foundation International.

<sup>14</sup> U.S. Fish and Wildlife Service (2009) Species Reports.

<[http://ecos.fws.gov/tess\\_public/pub/adHocSpeciesCountForm.jsp](http://ecos.fws.gov/tess_public/pub/adHocSpeciesCountForm.jsp)>.

<sup>15</sup> IUCN (2009) International Biodiversity Statement "Biological Invasions and Climate Change."

<sup>16</sup> Malcolm, J.R., C.R. Liu, R.P. Neilson, et al. (2006) "Global warming and extinctions of endemic species from biodiversity hotspots" *Conservation Biology*. 20, 538–550.

<sup>17</sup> Stern, N. (2007) "The Stern Review: The Economics of Climate Change." Cambridge Univ. Press.

<sup>18</sup> EPA (2009) Aquatic Biodiversity, Overexploitation of Species

<<http://www.epa.gov/bioindicators/aquatic/overexpl.html>>.

<sup>19</sup> UNEP FI Biodiversity & Ecosystem Services Work Stream (BESW) (2008) *Biodiversity and Ecosystem Services, Bloom or Bust?*

<sup>20</sup> Costanza, et. al (1997) "The value of the world's ecosystem services and natural capital." *Nature*. 387, 253.

<sup>21</sup> Secretariat of the Convention on Biological Diversity (2006) Global Biodiversity Outlook 2. Montreal, 81 + vii pages.

<sup>22</sup> Worm, B. et al., (2006) "Impacts of Biodiversity Loss on Ocean Ecosystem Services" *Science* 314: 787–790.

<sup>23</sup> Chivian, E., (2001) "Environment and health: 7. Species loss and ecosystem disruption- the implications for human health." *CZMA*. 164 (1), 66–69.

<sup>24</sup> Damschen, E.I., et al. (2006) "Corridors Increase Plant Species Richness at Large Scales" *Science*. 313, 1284–1286.

<sup>25</sup> EPA (2009) Green Landscaping: Greenacres "Landscaping with Native Plants." 2004.

<sup>26</sup> ICLEI Local Action for Biodiversity (2009) Lab Perspectives #1. "Nature and biodiversity: perceptions, importance, and the urban context."

<sup>27</sup> Pierce, D. (2007) "Do we really care about biodiversity?" *Environmental and Resource Economics*. 7 (1), 313–333.

<sup>28</sup> The Convention on Biological Diversity (2006). About the Convention. <<http://www.cbd.int/convention/articles.shtml#a=cbd-01>>.

<sup>29</sup> U.S. Fish and Wildlife Service (2009) "More than 20 Years of Conserving Endangered Species."

<sup>30</sup> UNEP (2009) Convention on Biological Diversity National Biodiversity Strategies and Action Plans.

<sup>31</sup> WWF (2009) *A Roadmap for a Living Planet*.

<sup>32</sup> 2010 Biodiversity Indicators Partnership (2011) <<http://www.bipindicators.net/about/biodiversityindicatorspartnership>>.

<sup>33</sup> WWF (2009) WWF's Mission, Guiding Principles and Goals

<[http://www.panda.org/mission\\_principles\\_goals.cfm](http://www.panda.org/mission_principles_goals.cfm)>.

<sup>34</sup> IUCN (2009) The IUCN Red List of Threatened Species <<http://www.iucnredlist.org/>>.

<sup>35</sup> IUCN (2009) "Biodiversity and cities: the role of municipalities for achieving the 2010 biodiversity target." Countdown 2010 Save Biodiversity.

