REPUBLIC OF SURINAME

MINISTRY OF NATURAL RESOURCES (NH)
Suriname Forest Service (LBB)
Nature Conservation Division (NB)

in consultation with the
Ministries of

AGRICULTURE, ANIMAL HUSBANDRY AND FISHERIES (LVV)
PLANNING AND DEVELOPMENT COOPERATION (PLOS)
REGIONAL DEVELOPMENT (RO)
PUBLIC WORKS (OW)

COASTAL MANAGEMENT PLAN

for the

NORTH CORONIE AREA

in

SURINAME

(FINAL VERSION)

prepared by:

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Environmental Consultant

PARAMARIBO, May 2000

Project sponsered by:

RAMSAR CONVENTION'S SMALL GRANTS FUND (SGF)

EXECUTIVE SUMMARY

In relation to the coastal zone, the Government of Suriname recognizes the multiple values and functions of coastal ecosystems (for comprehensive arguments: see Preamble) .

The North Coronie area (see Map 6) is part of the highly productive estuarine zone of Suriname, and consists of several coastal wetland ecosystems: mudflats, mangrove forest, open lagoons and brackish grass swamps. The area is an important breeding and feeding area for scarlet ibises, egrets and herons. During northern winters, it also serves as an important feeding ground for migratory shorebirds from the North. The ecosystems and their biodiversity offer a range of ecotouristic activities that should be further developed. Next to this (1) the Coronie mangrove forests protect the coast against erosion, enhance sedimentation and stimulate coastal accretion; (2) its ecosystems are particularly important as spawning and nursery grounds for the marine fauna and (3) these ecosystems add value to the nearshore small-scale and offshore industrial fisheries.

On March 18, 1985, the Republic of Suriname became a Contracting Party of the "Convention of Wetlands of International Importance, especially as Waterfowl Habitat", also known as the "Wetland Convention" or "Ramar Convention". The convention's mission is "the conservation and wise use of wetlands by national action and international cooperation as a means to achieving sustainable development throughout the world". Contracting parties commit themselves (among others) to designate wetlands that meet (at least one of) the Ramsar criteria for inclusion in the "List of Wetlands of International Importance" and to "include wetland conservation within their national land-use planning, so as to promote the wise use of all wetlands within its territory" (RAMSAR CONVENTION, 1998)

According to De Jong, Spaans & Held (1984), the North Coronie area (coastal zone between Jenny and Burnside) meets more than one of the Ramsar criteria for being a "Wetland of International Importance" (RAMSAR CONVENTION, 1996, 1997).

Resolution 5.7 of the Conference of the Contracting Parties calls on to develop management plans for each wetland identified as and meeting the Ramsar criteria for "Wetlands of International Importance" (RAMSAR CONVENTION 1993a).

In the North Coronie area, expansions of the existing polder areas with water resevoirs and the development of new polder areas are becoming a serious potential threat to the integrity of the area’s ecosystems (coastline protection, natural productivity, high biodiversity and the capacity to produce goods and services). The need for a management plan for the area became urgent.

This management plan consists of three parts:

Part I is a baseline-study in which the relevant physical (climate, geology, geomorphology, hydrology), biological (vegetation, flora and fauna) and socio-economic features (population, facilities, land and water use) are described and analyzed. Mainly based on the physical and the biological data, the total study area is subdivided in 13 ecological zones. Nine of these zones are situated within the boundaries of the proposed North Coronie Multiple-use Management Area and four in the adjacent areas.

Part II presents an evaluation of the North Coronie area, its values, its threats and the need for management. Then, long-term management objectives are formulated and the factors influencing the achievement of these management objectives are discussed. Finally, realistic recommendations are formulated to achieve the objectives.

Part III presents a realistic short-term action plan for the North Coronie area. Management options are discussed, management tasks described and priority projects formulated regarding awareness, training, warding, monitoring/research and ecotourism.
In case sufficient person power and funds are not yet available for the implementation of the priority projects, this management plan can also be used to facilitate the finding of external funding.

Below, the objectives to realize wetland management in Suriname in general and management of the North Coronie area in particular are presented as recommendations.

Many of these recommendations should be further communicated and discussed on the national level: with the National Environment Council (NMR), the National Institute for Environment and Development of Suriname (NIMOS), the Nature Preservation Commission (NBC), representatives of relevant ministries, non-governmental organizations (NGO's) and with the local land and water users.

Recommendations addressed to the:

1. President's Office and Council of Ministers

* In order to avoid environmentally controversial land allocation and/or granting of concessions, it is recommended to encourage and facilitate institutions and procedures for environmentally sound inter-sectional land use and resource planning, as formulated in Part II, 3.4 and 3.5.

* In order to be better prepared to combat oil spills, it is recommended to designate a national authority to prepare a National Oil Spill Contingency Plan (NOSCP) for major oil spills. NH should take the lead and closely cooperate with the Coast Guard and the State Oil Company. Also locally represented foreign oil companies, main oil consumers such as SURALCO, port authorities, fire brigades and hospitals should be involved.

* In order to increase opportunities to improve the quality of all surface waters in Suriname, it is recommended to enter the CARTAGENA CONVENTION and its Protocols. The convention deals among others with persistent pesticides as one of the most important pollutants to address.

* In order to facilitate the implementation of integrated wetland management it is recommended to establish a National Wetlands Commission (NWC) and a National Wetlands Management Authority (NWMA). See Part II, 3.6. The National Wetlands Commission (NWC) may become a subcommittee (1) of the existing Nature Conservation Commission (NBC, which is at present the Scientific Authority for the Wetlands Convention) or (2) of the National Institute for Environment and Development in Suriname (NIMOS).

* In order to be able to manage the North Coronie area as a Multiple Use Management Area (MUMA) it is recommended to place the state-property lands in the area at the disposal of the Ministry of Natural Resources (NH) based on the "1982 Decree L-2 on the Issuance of State-property Lands" (SB 1982 No 11). Evaluation and/or improvement of this status afterwards is recommended.

2 Ministries with environmental tasks:

2.1 Ministry of Planning and Development Cooperation (PLOS)

* In order to improve inter-sectoral land use planning, it is recommended that the Ministry of PLOS takes the lead in establishing a Planning Council and Resource Use Planning Unit, under the direct responsibility of the President or Vice President. This structure should develop an inter-sectoral land use planning process and an institute to monitor and implement land use planning. The structure should closely cooperate (or even integrate) with (1) NIMOS, (2) the Ministry of NH, especially its Bureau of Lands (DOM) presently responsible for land allocation, and with NH's proposed Institute for Soil and Land Information and Classification (ISLIC) and (3) the Ministry of Regional Development (RO) (see: Part II, 3.4).

2.2 Ministry of Natural Resources (NH)

* In order to improve land allocation procedures, it is recommended that the Ministry of NH takes the lead, working closely together with the Planning Council and Resource Use Planning Unit (PLOS), to develop a simple and transparent land use zoning process which guides land allocations. The Ministry should work closely together with the Ministry of LVV and other ministries and with enforcement agencies to ensure that the zoning ordinances and procedures are respected. NH's proposed ISLIC should be the key institute to improve the land allocation policy and process. See Part II, 3.4.

* In order to prevent reduction of the fresh water flow towards the mangrove zone, it is strongly recommended NOT to issue new lands north of the Coronie Road without an approved Environmental Impact Assessment (EIA) and when lands are granted, the implementation of such developments should be monitored. In case lands are already issued, it is recommended to negotiate conditions to minimize the negative impacts of activities.

* In order to manage the North Coronie area as a MUMA, it is recommended to appoint the Head of LBB cq the Head of NB as the Management Authority of the North Coronie Area.

Recommendations to the State Forest Service (LBB) / Nature Conservation Division (NB):

* In order to ensure the conservation of the coastal black-mangrove and riverine red-mangrove forests to preve forests, it is recommended to give all mangrove forests and the adjacent eastuarine zone along the coast the status of "Special Protected Forests" ("Speciaal Beschermd Bos") based on the Law of Forest Management (SB 1992, No 80).

* In order to further improve the present management of the North Coronie area it is recommended to LBB/NB to take all necessary initiative to implement the Action Plan as presented in Part III of this Management Plan.

2.3 Ministry of Agriculture, Animal Husbandry and Fisheries (LVV)

* In order to prevent overfishing it is recommended to:
  - finalize the Draft Fisheries Act ("Ontwerp Visserijwet") for approval by the Parliament;
  - review the licensing policy of the Fisheries Department and consider limitation of licences for certain types of fisheries;
  - carry out a comprehensive study on alternative fishery methods to minimize the amount of bycatch and/or to collect and use bycatch as a raw material for protein products;
  - cooperate with the Coast Guard in relation to fisheries control (licences, fishing methods, use of Turtle Excluder Devices , etc.).

* In order to prevent entanglement of sea turtles and mammals as dolphins and manatees in fishing nets it is recommended to:
  - replace the Fisheries Ministrial Decree 1992 (SB 1992 No 66) in which the use of Turtle Excluder Devices (TED's) is made obligatory, by the Fisheries Resolution based on article 25, paragraphs 3 and 5 of the Sea Fisheries Law of 1980;
  - develop fishing methods and techniques, such as of setting wide-mesh nets in front of the trapnets.

* In order to minimize pollution of all surface waters in Suriname with pesticides, it is recommended to:
  - facilitate the enforcement of the Pesticide Law (1972, No 151) and to facilitate the approval of all drafted resolutions;
  - add new pesticide related items not yet addressed in the existing or pending pesticide legislation; such as: (1) on the licensing and regulation of aerial spraying (praying during windy hours and "cleaning" of pesticide tanks while in the air); (2) creation of safety zones to protect habitations from aerial spraying; (3) third party certification of imported chemicals to ensure quality control and correct labeling; (4) formulation of pesticide residue standards; (5) banning of the importation of expired chemicals; and (6) formulation of rules and procedures for the disposal of expired, unwanted and dangerous chemicals;
  - make monitoring and control operational by strengthening of the relevant institutions incl. the LVV Department of Pesticides;
  - establish a pesticide and consumer product quality laboratory
  - organize pesticide awareness campaigns.

* In order to prevent damage to riverside swamps, dikes, crops and roads, it is recommended to prohibit free roaming of cattle in the estuarine zone.

2.4 Ministry of Public Works (OW)

* In order to be better prepared for regional climate fluctuations and global warming/sea level rise it is recommended to continue climate studies in the coastal area.

* In order to get a better insight in the process of coastal changes in the Coronie area, it is recommended to continue participation and facilitation of hydrological studies along its coast.

* In order to prevent reduction of the fresh water flow towards the mangrove zone it is recommended to prohibit:
  - construction of dams, roads with an inadequate number or size of culverts, and canals

parallel to the coast;
- extraction of water from seaside swamps;
- to excavate drainage canals from freshwater areas directly into the sea without an approved Environmental Impact Assessment (EIA) and if granted, the implementation should be monitored.

* In order to obtain a better understanding of the hydrological behaviour of the Coronie Swamp, it is recommended to:
  - carry out a comprehensive hydrological study of the Coronie Swamp and to:
  - evaluate the consequences of rice culture on the swamp itself and on the estuarine zone taking into account the availability and quality irrigation and drainagewater.

* In order to get a better insight in water pollution of the North Coronie area, it is recommended to re-establish the WLA water quality monitoring program and to include monitoring of pesticides in that area.

2.5 Ministry of Transport, Communication and Tourism (TCT)

* In order not to disturb coastal wildlife it is recommended to prohibit airplanes to fly over estuarine zones at altitudes lower than 1000 ft (about 300 m).

2.6 Ministry of Defense (DEF)

* In order to protect coastal waters from over-exploitation and pollution it is recommended to include in the task description of the Coast Guard: (1) control of fisheries licences, (2) the use of proper types of fishing nets and (3) the use of Turtle Excluding Devices (TED's) by shrimp trawlers etc; and (4) to assist in clean up in case of oil spills.

2.7 Ministry of Foreign Affairs (BUZA)

* In order to further increase opportunities to prevent pollution of offshore and inland waters, it is recommended to:
  - fully enforce the MARPOL Convention;

  and to enter the:
  - 1983 Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region (CARTAGENA CONVENTION), which includes the Protocol concerning Cooperation in Combating Oil Spills and the Protocol concerning Land-based Activities and Sources of Marine Pollution; the
  - 1989 Convention for the Control of Transboundary Transportation of Hazardous Material (BASEL CONVENTION), and the:
  - 1994 United Nations Convention on the Law of the Sea (UNCLOS).

2.8 Ministry of Health (VG)

- In order to get a better insight in the impacts of water pollution with pesticides, it is recommended to monitor contamination levels in foodfish and shrimp in coastal waters.

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LIST OF ABBREVIATIONS AND ACRONYMS

ABS	Algemeen Bureau voor de Statistiek van PLOS General Bureau of Statistics of PLOS
ADEKUS	Anton de Kom Universiteit van Suriname Anton de Kom University of Suriname
BIZA	Ministerie van Binnenlandse Zaken Ministry of Internal Affairs
BUZA	Ministerie van Buitenlandse Zaken Ministry of Foreign Affairs
BO	Bestuursopzichter van RO Resort Supervisor of RO
BP	Before present Voor heden
CBB	Centraal Bureau Burgerzaken van BIZA Central Bureau for the Population Registration of BIZA
CBL	Centraal Bureau Luchtkartering van NH Central Bureau for Aerial Mapping of NH
CELOS	Centrum voor Landbouwkundig Onderzoek in Suriname van ADEKUS Center for Agricultural Research in Surname of ADEKUS
CMO	Centrum voor Milieu-onderzoek van ADEKUS Center for Environmental Research of ADEKUS
DBK	Dienst Bodemkartering van NH Soil Survey Department of NH
DC	Distriktscommissaris District Major or District Commissioner
DOM	Dienst der Domeinen van NH Bureau of Lands of NH
EIA	Environmental Impact Assessment Milieu-effekt Rapportage
GB	Gouvernementsblad Government Gazette
GIS	Geographical Information Systems
GMD	Geologisch Mijnbouwkundige Dienst van NH Geological and Mining Service of NH
GOS	Government of Suriname
ISLIC	Institute for Soil and Land Information and Classification Instituut voor Bodem- en Landinformatie en Classificatie
IUCN	World Conservation Union

LACOCO	Landbouwcooperatie Coronie
LBB	Dienst 's-Lands Bosbeheer van NH Suriname Forest Service of NH
LVV	Ministerie van Landbouw, Veeteelt en Visserij Ministry of Agriculture, Animal Husbandry and Fisheries
METEO	Meteorologische Dienst van OW Meteorological Service of OW
MINOV	Ministerie van Onderwijs en Volksontwikkeling Ministry of Education
MUMA	Multiple-Use Management Area (Managed Resource Protected Area) Ter beschikking gesteld Bijzonder Beheersgebied
NARENA	Department of Natural Resources and Environmental Assessment
NB	Afdeling Natuurbeheer van LBB Nature Conservation Division of LBB
NBC	Natuurbeschermingscommissie Nature Preservation Commission
NEAP	National Environmental Action Plan Nationaal Milieu Actieplan
NH	Ministerie van Natuurlijke Hulpbronnen Ministry of Natural Resources
NMR	Nationale Milieu-raad National Environmental Council
NGO	Non-governmental Organization Niet-gouvernementele Organisatie
NOSCP	National Oil Spill Contingency Plan (NOSCP)
NZCS	Nationale Zoologische Collectie van Suriname National Zoological Collection of Suriname
OAS	Organization of American States Organisatie van Amerikaanse Staten
OW	Ministerie van Openbare Werken Ministry of Public Works
PLOS	Ministerie van Planning en Ontwikkelingssamenwerking Ministry of Planning and Development Co-operation
RIS	Stichting Rijst-instituut Suriname Foundation Rice Institute Suriname
RO	Ministerie van Regionale Ontwikkeling Ministry of Regional Development
RVM	Raad van Ministers Council of Ministers

SAOC	Stichting Agrarische Ontwikkeling Coronie
SB	Staatsblad State Gazette
SO	Staatsolie Suriname NV State Oil Suriname NV
SPS	Stichting Planbureau Suriname van PLOS National Planning Office of PLOS
SSM	Stichting Surinaamse Musea Foundation Surinamese Museums
STINASU	Stichting Natuurbehoud Suriname Foundation for Nature Preservation in Suriname
SvSS	Stichting voor een Schoon Suriname Foundation for a Clean Suriname
UNEP	United Nations Environment Program Milieu-programma van de Verenigde Naties
VD	Visserijdienst van LVV Fisheries Service of LVV
WB	Wold Bank Wereldbank
WHSRN	Western Hemisphere Shorebird Reserve Network
WLA	Waterloopkundige Afdeling van OW Hydraulic Research Division of OW
WWF	World Wide Fund for Nature (US: World Wildlife Fund) Wereld Natuurfonds

PREFACE

On March 18, 1985, the Republic of Suriname became a Contracting Party of the "Convention of Wetlands of International Importance, especially as Waterfowl Habitat", also known as the "Wetland Convention" or "Ramar Convention".

The convention's mission is: "*the conservation and wise use of wetlands by national action and international cooperation as a means to achieving sustainable development throughout the world*".

Contracting parties commit themselves (among others): "*to designate wetlands that meet (at least one of) the Ramsar criteria for inclusion in the "List of Wetlands of International Importance"* and to "*include wetland conservation within their national land-use planning, so as to promote the wise use of all wetlands within its territory*" (RAMSAR CONVENTION, 1998)

The North Coronie area (coastal zone between Jenny and Burnside) meets more than one of the Ramsar criteria for being a "Wetland of International Importance" (RAMSAR CONVENTION, 1996, 1997) such as:

- the area is a good representative example of the mangrove zone of the biogeographical coastal region between the Amazone and Orinoco river mouth;
- the area is important as spawning ground and nursery area for atlantic food fish and shrimp;
- the area regularly supports over 20.000 (in case of North Coronie over 300.000) waterfowl;
- the area regularly supports over 10.000 individuals and/or over 1% of the biogeographical population of waterfowl species (in case of North Coronie this is true for 7 species).

Resolution 5.7 of the Conference of the Contracting Parties calls on to develop management plans for each wetland identified as and meeting the Ramsar criteria for "Wetlands of International Importance" (RAMSAR CONVENTION 1993a).

In the North Coronie area, expansions of the existing polder areas with water resevoirs and the development of new polder areas are becoming a serious potential threat to the integrity of the estuarine ecosystems. For these reasons, the Head of the Suriname Forest Service (being the Management or Administrative Authority of the Ramsar Convention) requested the Nature Conservation Division (assigned as being responsible for wetland management) to design a plan for integrated coastal management for the North Coronie area.

The production of this management plan was funded by the Ramsar Small Grants Fund of the Ramsar Convention Bureau in Gland, Switzerland (RAMSAR CONVENTION, 1997). This management plan was designed according to the "Guidelines on Management Planning for Ramsar sites and other wetlands" (RAMSAR CONVENTION 1993b).

ACKNOWLEDGEMENTS

The consultant likes to express his sincere thanks to the Suriname Forest Service (LBB) and its Nature Conservation Division (NB), especially to:

- Carlo Julen, Subdirector Forestry and Nature Conservation of the Ministry of Natural Resources (NH) and also Deputy Head of LBB;
- Ferdinand Baal, Head Nature Conservation Division (NB) of LBB; and to:
- Krishnepersad Mohadin, Deputy Head NB and Manager of the Bigi Pan Multiple Use Management Area;

for providing facilities to design this management plan.

Sincere thanks are expressed as well to the Ramsar Convention Bureau at Gland, Switzerland, especially to:

- Montserrat Carbonell, (former) Programme Officer, and to:
- Dwight Peck, Staff Member,

who kindly provided the consultant with the necessary key documents of the Ramsar Convention (RAMSAR CONVENTION, 1993-1998) to design this report according to the Ramsar guidelines.

The consultant gratefully acknowledge the assistance of all who recently shared their knowledge about the North Coronie area and related issues, including the following persons in alphabetical order:

- Shanti Adhin, (former) Head Environmental Planning Department if the Suriname Planning Office (SPS) of PLOS;
- Armand Amatali, Director Hydraulic Research Division (WLA) of OW;
- Tamin Asmo, Central Bureau for Aerial Survey (CBL) of NH;
- Yolanda Babb-Echteld, Staff Member Fisheries Service (VD) of LVV;
- Jos Beerlink, (former) Project Leader Bijenteeltproject 1983-1986, who recently deceased;
- Cor Bekker, Head Meteorological Department (METEO) of OW;
- Sandra Bihari, employee of the Nature Conservation Division of the State Forest Service (LBB-NB) of NH
- Plamen Bosakov, Agriculture Specialist for LAHMEYER INTERNATIONAL;
- Mr. Bottse, Head Census Bureau of the Central Bureau for Population Registration (CBB) of BIZA;
- Gerrit Breinburg, coordinator Department of Planning and Development of LVV;
- Mr. Bruining, Police Commander Coronie
- Ricardo Catalan, (former) Head Department of Natural Resources and Environmental Assessment (NARENA) of the Centre for Agricultural Research (CELOS), University of Suriname (ADEKUS);

- Yvonne Chin A Kiem, Deputy Librarian of the Surinamese Museum (SSM);
- Erwin Demon, up to March 2000: District Major of Coronie and chairman of the District Board, consisting of members of all ministries represented in the district;
- Stewart Doelahasori, between March and April 2000: District Major of Coronie
- Alex Feller: farmer at Plantation Mary's Hope
- Bill Fung Loi, Head Aerial Photography Department of the Central Bureau for Aerial Survey (CBL) of NH;
- Glenn Gemerts, Head Geological Mining Department (GMD) of NH;
- Neville Gunther, (former) Staff Member of the Special Mission of the OAS to Suriname;
- Michael Hiwat, (former) Staff Member of the Nature Conservation Division of LBB, Ministry of NH;
- Rolien Kariembaks-Samsoedin, District Major of Coronie since April 2000;
- Jacques Khodabaks, LVV Beekeeping consultant and Assistent Ressort Leader of the Coronie District;
- Pairan Kromodimedjo, Staff Member of the Soil Survey Department (DBK) of NH;
- Rabindranath Lala, Legal Specialist for BUURSINK International Consultants in Natural Resource Management and Environmental Assessment;
- Wim Leysner, (former) Head Central Bureau for Aerial Survey (CBL) of NH;
- John Lichte, Agricultural and Environmental Economist for BUURSINK International Consultants;
- Della McMillan, Social Science Specialist for BUURSINK International Consultants;
- Marcel Meyer, Director of the SUNECON consultancy firm;
- Benjamin Mitrasingh, Director Cultural Affairs Head Archaeological Department of MINOV;
- Sieuwnath Naipal, (former) Staff Member Hydraulic Research Division of OW, now head of the Department of Infrastructure at the University of Suriname (ADEKUS);
- Mildred Nijhove-Kerssenberg, Head Librarian Surinamese Museum (SSM);
- Dirk Noordam, Freelance Soil and Water Consultant and (former) Advisor to the Foundation for a Sustainable Suriname (SvSS);
- Henri Reichart, (former) Senior WWF Consultant for LBB/NB and the Foundation for Nature Preservation in Suriname (STINASU);
- Riekhnath Sanchit, Head Soil Survey Department (DBK) of NH;
- Johny Sheombar, Field Assistant of the Archaeological Department of MINOV;
- Harrold Sijlbing, Director of the Foundation for Nature Preservation in Suriname (STINASU);
- Badrisein Sital, (former) Chairman of the Board of Directors of the Rice Institute Suriname (RIS);
- Gwendolyn Smith, Agricultural Research and Extension Specialist for BUURSINK International Consultants;
- Iwan Sno, Director General Bureau of Statistics (ABS) of PLOS;
- Mr. Staphorst, advisor of the Major of the Coronie District;
- Rudolf Tolud, LVV Ressort Leader of the Coronie District;
- Frits van Troon, (former) Field Botanist of the Suriname Forest Service of NH;
- Aad Versteeg, (former) Archaeologist of the Surinamese Museum (SSM);

- Ramon Vriesde, rice farmer employee;
- Marga Werkhoven, Senior Curator of the National Herbarium of Suriname (BBS) of ADEKUS;
- Christine Wirokromo, mine inspector construction materials of GMD;
- Mr. Zunder, Member of the Board of the "Parwa imkerscooperatie", better known as "De Bijenvereniging".

Over the years, many of the consultant's teachers and collegues left the country for better opportunities elsewhere. He gratefully refers to their publications on the coastal area of Suriname (see List of References).

The first draft of this report (version November 1998) was discussed with Ferdinand Baal and Krishnepersad Mohadin (LBB). The consultant likes to thank them for their comments which have been resulted in many additions and corrections.

Next, the intermediate draft report (June 1999) of the Management Plan was presented to the Mr Demon, District Major of Coronie and his staff at Totness (August 1999). The Government officials of Coronie recommended to organize a coastal management awareness program via the local broadcasting station “Boskopu” (scheduled September 1999) and an awareness program for school children (scheduled October 1999) prior to organize the public hearing (scheduled November 1999). However the radio progam was delayed, the new school year started with strikes and other problems. Finally it was decided to organize the hearing prior to the awareness activities recommended in this report.

Thanks also to Jacques Khodabaks, LVV Beekeeping consultant and Assistent Ressort Leader of the Coronie District, who perfectly organized the public hearing held at April 12, 2000 at the Cultural Center Coronie at Totness; to Krish Mohadin, Deputy Head Nature Conservation Division (NB), for his introduction and to Sieuwnath Naipal, Head of the Department of Infrastructure of the University of Suriname (ADEKUS) for his assistance in answering participant's questions on climate change and sealevel rise.

Next to this, a Workshop for policymakers was held at May 4, 2000 in Theater Unique in Paramaribo, at which occasion the draft management plan for the Coronie North area was presented. The Workshop was opened by the Minister of Natural Resources, Mr Errol Alibux who promised to establish the recommended Coronie Multiple Use Management Area (MUMA) soon, as a contribution to improve the sustainable development of the Coronie North area.

The consultant likes to thank all participants of the public hearing and the worshop for the encouraging discussions which further contributed to this final version.

Finally the Management Plan will be presented to the Minister of Natural Resources (NH) with the recommendations (1) to achieve that the area will be placed at the disposal of his Ministry, in order to manage the North Coronie area as a Multiple Use Management Area (MUMA) and (2) to appoint the Head of LBB cq the Head of NB as the area's Management Authority.

Paramaribo, May 2000.
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For more information on the RAMSAR CONVENTION please visit the RAMSAR CONVENTION internet website: <http://iucn.org/themes/ramsar/>

PREAMBLE

In relation to the coastal zone, the Government of Suriname recognizes the multiple values and functions of coastal ecosystems, such as:

- Coastal protection

Mangrove forests protect the coast and river estuaries against erosion, enhance sedimentation and stimulate coastal accretion.

- Natural productivity

Biologically, mangrove forests belong to the most productive ecosystems in the world. Their productivity is related to the tidal action and the mixing of ocean and inland waters, both providing the so-called estuarine zone with nutrients, organics, spawn and juvenile fish and shrimp. Estuarine ecosystems are particularly important as spawning and nursery grounds for the marine fauna.

- High degree of biodiversity

Estuarine ecosystems in Suriname form also important nesting sites for local coastal birds, as of several species of herons and scarlet ibises and feeding grounds for millions of migratory birds from the north. Estuarine ecosystems provide food for a number of fish, crab and shrimp species living as juveniles in the brackish swamps, lagoons, tidal creeks and river estuaries, and as adults in the sea or even in fresh water ecosystems. Sand beaches, are important nesting sites for endangered sea turtle species.

- Production of goods and services

Seafood abundance is directly related to the extent of the local mangroves. Up to 90 % of marine fish and shrimp species are found in and near mangrove areas during one or more periods of their life cycle. Offshore industrial fisheries largely depend on mangrove forest. High production of seafood is also found in the nearshore habitats where small-scale fisheries is practiced: in the shallow sea, the river estuaries, tidal creeks, lagoons and brackish swamps. These ecosystems provide the local market with foodfish, shrimp and mangrove-honey. Also large-scale industrial deep sea fisheries benefit from the nursery function of these ecosystems.
Coastal ecosystems may also obtain a more important source for ecotourism, education and scientific research.

The Government of Suriname, aware of its international responsibilities regarding coastal management became a Contracting Party (CP) to the:

- Convention on the High Seas (=Verdrag inzake de Volle Zee). CP since 1959;
- Convention relating to Intervention on the High Seas in cases of Oil Pollution Casualties (= Verdrag inzake Optreden in Volle Zee bij Ongevallen die Verontreiniging door Olie kunnen veroorzaken). CP since 1975;
- Amazon Cooperation Treaty (= Verdrag inzake Amazonische samenwerking). CP since 1978.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora or CITES CONVENTION (= Overeenkomst inzake de Internationale Handel in Bedreigde in het Wild Levende Dier- en Plantesoorten). CP since 1981;
- Convention on Nature Protection and Wildlife Preservation in the Western Hemisphere (= Verdrag inzake Natuurbescherming en Behoud van in het Wild Levende Planten en Dieren in het Westelijk Halfrond). CP since 1985;
- Convention of Wetlands of International Importance, especially as Waterfowl Habitat or RAMSAR CONVENTION (Verdrag inzake Watergebieden van Internationale Betekenis, speciaal als Habitat voor Watervogels). CP since 1985;
- Convention on the Prevention of Pollution of the Sea by Dumping of Waste and other Materials or London Dumping Convention (= Verdrag van Londen ter Voorkoming van Verontreiniging van de Zee tengevolge van het Storten van Afval en andere Stoffen). CP since 1988;
- Convention for Prevention of Marine Pollution from Ships or MARPOL Convention (Verdrag ter Voorkoming van Vervuiling van de Oceanen door Schepen), CP since 1988;
- Agenda 21 of the United Nations Conference on Environment and Development (UNCED)/U.N. Conferentie Milieu en Ontwikkeling). Agenda has been signed in 1992.
- Convention for the protection of the World Cultural and Natural Heritage (= Verdrag inzake de bescherming van 's-Werelds Cultureel en Natuurlijk Erfgoed). CP since 1997;
- UN Convention on Biological Diversity (= Verdrag inzake de Biologische Diversiteit"). CP since 1997;
- UN Framework Convention on Climate Change (UNFCCC) (= UN Raamconventie met betrekking tot Klimaatsverandering). CP since 1998.

The Ramsar Convention

Especially by joining the Ramsar Convention, the Government of Suriname committed itself to:

- maintain the ecological character of (potential) Ramsar sites, through a wise management approach;
- include wetland conservation within its national land-use planning, so as to promote the wise use of all wetlands within its territory;
- establish nature reserves as wetlands, whether or not they are included in the "Ramsar List of Wetlands of International Importance".
- promote training in wetland research, management and warding;
- consult with other Contracting Parties about the implementation of the Convention, especially with regard to transfrontier wetlands, shared water systems, shared species and development projects affecting wetlands.

Agenda 21

In particular Chapter 17 of Agenda 21 ("Agenda Environment and Development 21st Century") deals with national land use planning and management. In this chapter special attention is asked for integrated coastal planning and management and for the establishment of mechanisms to make this planning and management possible.

The Government of Suriname, aware of the fact that wetlands are highly liable to negative impacts from human actions, already established five protected areas along its coast: four Nature Reserves (Hertenrits, Coppename-monding, Wia-Wia and Galibi), and one Multiple-Use Management Area (the Bigi Pan MUMA). On request of the Government, a concept management plan has been designed for the (proposed) Commewijne-Marowijne MUMA (Teunissen, 1997; UNEP, 1997) which concept is now being studied by the Minister of Natural Resources. Simultaneously with this management plan for the North Coronie area, a management plan has been developed for the North Saramacca area (Teunissen, 1999).

Statements of succesive governments

On March 4, 1989, the Coppename-monding Nature Reserve (together with the Wia-Wia Nature Reserve and the Bigi Pan MUMA) received the status of "Hemispheric Reserves" within the Western Hemisphere Shorebird Reserve Network (WHSRN). The areas mentioned were subsequently twinned with two protected areas in the Bay of Fundy, Canada, which are used as breeding area by the same flyway populations of Nearctic shorebirds visiting Suriname during northern winters. The "Dedication Ceremony" was attended by the President of the Republic of Suriname, the Minister of Natural Resources, Members of Parliament, and Ambassadors of Canada and the USA.

Drs Prethaap S.R. Radhakishun, at that time the Minister of Natural Resources (and presently the Vice President of the Republic of Suriname) stated:

> *"The policy of the Ministry of Natural Resources is focussed on the conservation, sustainable development and wise use of our natural resources. The in 1980 formulated goals of the World Conservation Strategy are essential guidelines for a rational preservation and management of our nature and natural resources. These goals are: conservation of our natural resources (including ecological processes), conservation of biological diversity and wise use of species and ecosystems".*
>
> *Ladies and gentlemen, today we pay extra attention to the conservation and management of migratory coastal birds and their habitats within the framework of the Western Hemisphere Shorebird Reserve Network and the Agreement of August 8, 1987 between the Canadian Wildlife Service (CWS) and the Suriname Forest Service.*
>
> *It is for me a great honor to establish as "Hemispheric Reserves": Coppename-monding Nature Reserve, the Wia-Wia Nature Reserve, and the Bigi Pan Multiple-Use Management Area and at the same time to proclaim these areas as twin-reserves of the Bay of Fundy Reserves: Minas Basin, Nova Scotia and the Shepody Bay at New Brunswick, Canada.*
>
> *With this official ceremony, the Government of Suriname reconfirms the obligations of Suriname to dedicate itself to the good management of its natural resources in general, and for nature conservation in particular...."*

In relation to the development of natural resources, the Government Policy Statement ("Regeringsverklaring") 1996-2001 stated that "the Government recognizes the importance of the sustainable use of natural resources. In its policy, measures of nature conservation and protection of forest ecosystems will be seriously taken into account".

During the Opening of the Seminar on the proposed Commewijne-Marowijne Coastal Management Plan (Theater Unique, Paramaribo, March 27, 1997) the Minister of Natural Resources, Drs L.A. Errol Alibux, assured the audience that:

> *"the Ministry of Natural Resources will do all that is possible to optimize the long-term productivity, conservation and sustainable use of the coastal zone".*

Need for integrated coastal management

Within the boundaries of the Coronie "Wetlands of International Importance", expansions of the existing polder areas with water reservoirs and the development of new polder areas are threatening the coastal ecosystem's protection function, natural productivity, high biodiversity and the capacity to produce goods and services.

The call for integrated coastal management is clear.

PART I:

AREA DESCRIPTION

1 GENERAL INTRODUCTION

1.1 Topography

The Republic of Suriname (formerly also known as Dutch Guiana) is situated along the north coast of South America, where it is bounded by the Atlantic Ocean. In the west, Suriname is bordered by (formerly British) Guyana, in the east by French Guiana and in the south by Brazil (Map 1). The coastline has a length of about 375 km. The ocean area in front of the coast, up to the northern boundary of the Exclusive Economic Zone (200 nautical miles offshore) measures approximately 140,000 sq km (see Map 2). The total land area of Suriname measures about 164,000 sq km.

1.2 Major ecological-economic zones of Suriname

The Ocean and Land Area of Suriname may be divided into six major ecological zones:

A The Ocean Area (Map 2)

The Ocean System stretches from the coastline up to the boundary of the Exclusive Economic Zone (EEZ). This system may be subdivided into the:

1. **Deep** Sea from the northern boundary of the Exclusive Economic Zone (EEZ) at 200 nautical miles (370 km offshore) up to the Continental Slope (ca 80 nautical miles or 150 km offshore). This area with depths to over 4000 m measures about 75,000 sq km.

2. **Continental Sea** is found above the so-called Continental Shelf or Continental Flat, between the Continental Slope and the coastline. From the relatively steep continental slope (between the 200 m and 100 m depth contour) the continental sea floor gradually climbs over a distance of 150 km up to the coastline. The Continental Sea measures about 65,000 sq km.

In the Continental Sea three sub-zones, each approximately 50 km wide, are distinguished, the:

- *Outer Zone or Blue Water Zone*: between the continental slope and the 60 m depth contour (25.000 sq km). The water is clear (blue) and sun light penetrates to a depth of about 100 m. Along the edge of the shelf (fossil) coral reefs are found.

- *Middle Zone or Green Water Zone*: between the 60 and 30 m depth contour (20.000 sq km). The water in this zone is colored green by the abundance of green algae as a result of the combination of the availability of nutrients from the land zone (very limited in the Blue Zone) and the still rather deep light penetration compared to the next ("Brown Water") zone.

- *Inner Zone or Brown Water Zone*: between the 30 m depth contour and the coastline (20.000 sq km). The "brown" water is loaded with mud from the Amazon River, brought by the east-west flowing Guyana Current. Light penetration is less than 10 cm. Within the Brown Water Zone, the Surinamese *Territorial Waters* are found: a 12 nautical miles (22.2 km) wide zone along the coast, with an area of about 8,500 sq km. Within the Territorial Waters, the shallower coastal waters (between the 6 m depth contour and the coastline) are knows as the *Shallow Sea Zone*. The zone of the Shallow Sea is 7-18 km wide (about 12 km on the average) and measures about 4,500 sq km. For near shore depth contours see Maps 2 and 3.

B. The Land Area (Map 4)

The mainland system may be sub-divided into the:

3. **Young Coastal Plain**, about 10,000 sq km, mainly consisting of extensive Holocene clay flats slightly above sea level (former coastal mudflats). In the north the area is influenced by coastal changes and tidal action (*Estuarine Zone*). A belt of mangrove forest is bordering the sea. South of this belt, salt to brackish lagoons and brackish herbaceous swamps are found. Farther inland, were rains prevail over tidal intrusions, freshwater herbaceous swamps alternate with swamp scrub, swamp wood and swamp forest. Part of the northern freshwater swamp areas are important as suppliers of the freshwater to maintain brackish water conditions in the coastal swamps, lagoons and mangrove forests.

The clay flats of the Young Coastal Plain alternate with up to 4 m high shell and sand ridges (former beaches) also known as "cheniers", which run approximately parallel to the coast. The climax vegetation of these ridges is known as ridge forest, a poor type of rain forest.

4. **the Old Coastal Plain**, about 10,000 sq km, consisting of a discontinuous belt of dissected Pleistocene sandy ridges and clay flats, situated at elevations between 4 and 11 meters above sea level (remnants of former beaches and mudflats), both covered with rainforest. These higher landscape elements are surrounded by Holocene clay and peat soils with freshwater herbaceous swamps alternating with swamp scrub, swamp wood and swamp forest;

5. **Savanna Belt**, about 10,000 sq km, 10-100 m above sea level, consisting of rolling and dissected plains, with Late Tertiary (Pliocene) unbleached loams and loamy sands and by coarse white sands, both of continental origin. The vegetation consists of rainforest, xerophytic forest, and to a lesser extend of open savannas;

6. **Residual Uplands** (Interior), covering about 80 % (132,000 sq km) of the Suriname land surface. This area is part of the Precambrian Guyana Shield, with hills and mountains up to 1,230 m above sea level. The soils mainly consist of sandy clay loams and clays which are often gravelly or stony. Locally ironstone and bauxite caps occur. The Interior is mainly covered with undisturbed rainforest.

The North Coronie area is located in the the Young Coastal Plain and also include the adjacent shallow sea. The area receives drainage water from the Coronie Swamp covering the Young and Old Coastal plain.

1.3 Population

About 70 % of the approximately 400,000 inhabitants of Suriname are concentrated in and around the capital city of Paramaribo near the mouth of the Suriname River (Map 5). Another 25 % lives mainly in small settlements along the coastal East-West Connection Road between Nieuw Nickerie and Albina, and along the road from Paramaribo to Zanderij Airport. The remaining 5% lives in small villages, mainly along the Marowijne, the Suriname and the Saramacca River and to a lesser extend along the Coppename River. About 90 % of the country is uninhabited.

The multi-cultural population consists for 3% of indigenous Amerindians. Maroons, descendants from early runaway African slaves, are making up 10% of the Surinamese population. Most Amerindians and Maroons live south of the Coastal Plain. Creoles (32%) are the descendants of plantation slaves. After the abolition of slavery in 1863, most of them moved to the capital city of Paramaribo.

To continue plantation-production after emancipation, labor from China, British India, and from the island of Java in Indonesia (formerly Netherlands East Indies) were contracted. Their descendants form now the majority (53%) of the present Surinamese population: Chinese (3%), Indians (35%) and Javanese (15%). These Asian groups settled in the Coastal Plain. The remaining population (2%), mainly living in Paramaribo, has roots in Europe, the Lebanon, Korea, Japan, and the USA.

1.4 Developments after Independence

Suriname became independent from the Netherlands in 1975, without the benefit of a referendum. Between 1970 and 1980, about 40% of the population, among which many highly educated and highly skilled people left the country, mainly for the Netherlands.

A sergeant's coup in 1980 and the execution of 15 opponents in 1982 was followed by the freezing of all agreed development aid by the Dutch Government. On top of this a decline came in the world price for alumina and aluminum (good for 80% of the foreign currency income of Suriname). In addition (in 1986), a civil strife started between the "Jungle Commando" consisting of members of the Maroon-communities in the Hinterland, and the military regime. Although the elections of 1987 brought back a civil government, the strife lasted up to 1992.

Between 1982 and 1999, the exchange rate rose from Sf 1.80 /USD up to Sf 2,000.- /USD. Today Suriname is ranked as one of the poorest countries in the Western Hemisphere.

2 DEFINITION / DELINEATION OF THE STUDY AREA

According to De Jong, Spaans and Held (1984) the total estuarine land zone of Suriname measures about 3,250 sq. km. For the entire coast, this zone may be sub-divided into five sub-areas (see Table 1 and Map 4), each characterized by its own environmental setting, and its own nature and extent of human activities and impacts.

TABLE 1: ESTUARINE SUB-AREAS OF SURINAME

Area name	Sub-area name	Land area in sq. km
Corantijn-Coppename	Bigi Pan MUMA	550
	North Coronie	150
Saramacca-Suriname	North Saramacca	830
	North Wanica	70
	North Paramaribo	100
Commewijne-Marowijne	North Commewijne	650
	North Marowijne	900
Total estuarine land area		3.250

Source: De Jong, Spaans & Held, 1984.

The present study area (North Coronie and upstream and downstream areas) includes the:

a. Deep Sea : described in I.1.2. The Deep Sea is not included in the proposed management area.

b. Continental Sea: described in I.1.2. Only the Shallow Sea zone between the 6 m (low tide) depth contour and the coastline, is part of the proposed management area (see pt. c).

c. Proposed North Coronie management area*:* located at 5,50 N and 56,10 W between Burnside and the mouth of the Coppename River, is part of the administrative District of Coronie. The boundaries of the North Coronie area are proposed as follows (see Map 6):

- in the west: the eastern boundary of the Bigi Pan MUMA: from point (1) (where the Burnside Drainage Canal crosses the East-West Connection Road) a south-north line up to the 6 m depth contour, point (2);

- in the north: a curved line from point (2) following the 6 m depth contour in eastern direction up to point (3), located straight north of the Kumakuma Creek mouth;

- in the east: from point (3) a north-south line to the 2 m depth contour, point (4). From point (4) a curved line following the 2 m depth contour up to the north-eastern corner of the Peruvia Nature Reserve, point (5);

- in the south: from point (5) a line following the northern boundary of the Peruvia Nature Reserve up to its north-western corner, point (6). From point (6) a straight line to the south-eastern corner of the Coronie-East Polder, point (7). From point (7) a line following the southern dam of the Coronie East polder up to it's south-western corner, point (8). From point (8) a straight line to the south-eastern corner of the Coronie-West Polder, point (9). Form point (9) a line following the southern dam of the Coronie-West polder up to its south-western corner, point (10). From point (10) a line following the western side of the Burnside Drainage Canal up to point (1) at the East-West connection Road.

d. Coronie swamp: as far as this swamp provides the North Coronie area with drainage water (excluding the Coronie Swamp areas draining towards the Coppename, the Wayombo and Nickerie rivers).

e. Catchment areas of the Coppename and Saramacca River

The land and water uses in the Coppename and Saramacca catchment areas may affect the integrity of the ecosystems of the North Coronie area. A description of the land and water use of these catchment areas are described in the management plan for the North Saramacca area (Teunissen, 1999).

f. Outside Suriname

World-wide issues such as climate change and ocean pollution will also be (briefly) discussed in the description of the study area.

3 DESCRIPTION OF STUDY AREA

The descriptions concern the major features of the North Coronie area. In case data are not available specifically for the Coronie area, descriptions are made for the entire coastal zone, including North Coronie.

3.1 Physical features

3.1.1 Coastal climate

Suriname is situated in an area in which North-East and South-East trade winds prevail. Twice a year the Inter-Tropical Convergence Zone (ITC-zone or Equatorial Trough) passes Suriname which results in four seasons, the:

- short dry season : early February to late April;
- long rainy season: late April to the middle of August;
- long dry season : the middle of August to early December;
- short rainy season : early December to early February.

At the (former) Light Ship, anchored at about 15 km off the Suriname River mouth (now replaced by a light buoy), the average annual rainfall calculated for the period 1959-1969 amounted only 798 mm (Pons, 1972) which is fairly dry compared to the land zone of Suriname which has a humid tropical climate according to according to the Köppen classification.

In the period 1971-1980 the average annual rainfall measured at 66 land stations all over the country, varied between 1442 and 3054 mm (SPS, 1988).

A narrow strip of land along the coast is significantly drier than the remaining part of Suriname. In the 1971-1980 period, the Coronie coast showed an average annual rainfall of 1442 mm/y, the remaining stations along the coast showed somewhat higher figures up to 2048 mm/y. South of the relatively narrow and drier strip the rainfall in the remaining coastal area was much higher with values between 2022 and 2538 mm/y. Only locally in the farther inland, the average annual rainfall is higher with a maximum of 3054 mm for the Tafelberg airstrip in the center of Suriname. The above is illustrated in Table 2.

TABLE 2: AVERAGE ANNUAL RAINFALL IN THE COASTAL AREA (1971-1980, except for station Light Ship: 1959-1969)	
Rainfall stations	**Average annual rainfall**
Offshore:	
Light ship	
Coastline:	
New Nickerie **Cocos polder Coronie** **Coronie Road** Galibi	1803 **1442** **1952** 2048
Coastal area farther inland:	
Wageningen village Boskamp Carl Francois Tijgerkreek West Groningen Paramaribo Cultuurtuin Nieuw Amsterdam Alliance Tamarin Albina	2226 2411 2338 2022 2370 2243 2074 2414 2551 2538
Interior:	
Tafelberg	3054

Source: SPS, 1988

Consequently, in the narrow strip along the coast, the amount of sunshine hours is higher, the speed of the trade winds stronger, humidity lower and evaporation higher than farther inland. Suriname has no hurricanes.

For extremely dry periods see Part I, 3.2.1.

3.1.2 Geology

The ocean floor and Coastal Plain of Suriname forms an area in which subsidence and sea level movements have greatly influenced sedimentation.

Sediments are overlying the gently northward dipping (ca 1□) Guayana Shield. On the Continental Shelf, sedimentation is more marine, while in the Coastal Plain sedimentation took place in a more lagoonal-marine, fluvial and continental environment.

At the present shoreline the sediment layer on top of the Guayana Shield ranges from 200 meters in the East to near 2,000 meters in the West. At the edge of the continental shelf the layer of sediments may be more than 10,000 meters thick.

In the North Coronie area, Holocene deposits are found at the surface. It is likely that these deposits are not older than 2000-2500 year at the most, while sedimentation is still going on. The Coronie ridge complex belongs to the Young Ridge or Kwatta Landscape. North and south of this complex, the Marine Clay or Nickerie Landscape prevails.

3.1.3 Geomorphology

About 95% of the 375 km coastline of Suriname consists of clays. Nearly all sand beaches, with a total length of about 20 km, are found along the eastern part of the coast, particularly in the Commewijne and Marowijne districts.

The coast of Suriname is part of the very dynamic "Wild Coast" of the Guyanas. In a 50 km wide strip along the coast of the Guyanas, the east-west flowing Guyana Current is loaded with mud from the Amazon River (Brown Water or Inner Zone). As a result of this, huge mudflats are deposited off the coast. Echo-sounding maps of this coast clearly show an undulating pattern of depth contours: (mud)banks are alternating with deep depressions (Map 3). Travelling along the coastline, low tidal mudflats alternate with eroding stretches of clay coast.

The Guyana current, supported by the NE trade winds, is shifting the pattern of mudflats and depressions in the western direction.

Along the coast, accretion of mudflats (and sand beaches) is noticeable at their western fronts and erosion at their eastern ends. As a result of this, mudflats and sand beaches "drift" along the coast with an average speed of 1.5 km a year (Augustinus, 1983; Augustinus et al. 1989).

Once silted up above the mean tide level, the coastal mud flats become overgrown with mangrove forest. In and south of the mangrove zone, shallow and (up to 1 m) deep open lagoons may be formed as a result of subsidence of the soil. The salinity of lagoons may vary considerably and even salt crystals may be formed when shallow lagoons evaporate during dry seasons. Tidal creeks, carrying loads of sediments finally may silt up these lagoons and new mangrove forest may develop. Tidal creeks may be blocked off at their mouth by shifting mudflats and sand beaches and new creeks may develop after passage.

Where depressions are found in front of the coast, wave action may cause severe erosion which may result in the loss of large areas of estuarine land. Over the last 6000 years the Surinamese coast shows an average net growth of 2 m/y in eastern to 10 m/y in western Suriname.

The Coronie coast

Older maps of the Coronie coast shows a quite different coast compared to the present one. The map of Van Keulen (before 1728) shows mudflats in front of the coast but describes the coastline between the Coppename and the Corantijn River as "Langs Heen al Sand Strand" (all along sand beach). The map of Heneman & Van Sijpesteijn (1850) shows an extensive "Sand Bank van Soeweija", east of Bantaskine and Friendship. The names of the present "Coppename-bank" and "Potosi-bank" are first mentioned at the map of Spirlet (1913). Around 1940 when Coronie was still only accessable by sea, coastal accretion (mudflats) hampered boats to reach the coast and tidal creeks and drainage canals were blocked by mudflats. Coastal accretion was followed by polder expansion. A period of coastal erosion started in 1957. The in 1959 constructed Cocospolder was never used because of this erosion process.

Over the years, the distance between the East-West Connection Road and the coastline varied between 1 and 4 km (Bruijning and Voorhoeve, 1977).

Between 1948 and 1992, along the Coronie coast immediately west of the Coppename river (Coppename Bank) about 8 sq km of new land was formed by coastal accretion. During the same period, mainly in the impounded and deforested (cultivated) area between Ingikondre and Burnside, approximately 80 sq km of (polder) land got lost by coastal erosion (NARENA, 1998).

During the spring tide of the end of March 1999, the Coronie sea defence dike, recontructed in December 1998, was overwashed and collapsed over long distances. The lands of about 50 families were flooded by sea water (Rozenblad, 1999). According to Schiereck (1992), construction of a modern sea defence work is too expensive compared to the value of the (brackish) land. Instead, Schiereck recommends to stimulate the regrowth of the natural mangrove forest to help protect the Coronie coastline. Legal regulations should be designed to declare certain areas north of the East-West Connection Road as areas at risk. Such regulations should prevent that land and water users in such areas may claim damage caused by flooding (Texel, 1999).

3.1.4 Hydrology

The North Coronie area is entirely situated along the northern edge of the Coronie Swamp of which the northern part is draining into the Atlantic Ocean. The eastern part of this swamp drains into the Coppename River, the southern part into the Wayambo River, the western part into the Nickerie River.

According to the Hydraulic Research Division of the Ministry of Public Works (WLA, 1978), Sevenhuysen (1984) and Abrahams (1988), the part of the Coronie Swamp which drains into the Atlantic Ocean measures about 1,100 sq km.

Older maps of Suriname (Heneman, 1784; Teenstra, 1835; Heneman & Van Sijpesteijn, 1850; and Loth, 1899), show the original drainage pattern of the Northern Coronie Swamp and how this pattern changed during the time of colonization. From east to west the northern Coronie Swamp drained into the Atlantic Ocean by means of a small number of creeks: from east to west: the “Toeroreijpo Creek” or Santo Creek, the “Arereroema” or “Koemakoema” Creek, the “Soeweija” or Coronie Creek and the “Maurita" or Potosi Creek. Since colonization, the impoundment of the old plantation area, the construction of the East West Connection Road and the recent construction of the southern rice polders gradually changed the drainage pattern.

First, drainage by the Soeweija Creek or Coronie Creek (between the Plantions of John and Bantaskine) was probably taken over by the construction of the so-called Freshwater Canal, now crossing the ridge area between Totness and Friendship and draining by means of a lift-lock into the so-called "Scheepvaart" (Shipping) or "Zoutwater" (Salt Water) Canal which is connected to the Atlantic Ocean.

Right after World War II the Coronie plantation area was made accessable over land by the construction of the so-called Coronie Road, connecting the Coronie plantations with Jenny at the Coppename River. Later this Coronie Road became part of the national East-West Connection Road. The Coronie Road has been build on the northernmost series of ridges. Although 8 culverts under the Coronie Road should drain the Coronie Swamp into the swamps north of the road, during rainy seasons, the southern swamp is dammed up.

In the seventies extensive rice polders were constructed south of the ridges between Ingikondre and Burnside (Map 6). About 1-3 km south and more or less parallel to these ridges a so-called "zwampkerend dam" (swamp retaining dam) was constructed to dam up the swamp water which is used for irrigation of the rice fields. The rice fields are drained by 12 drainage canals which cross the East-West Connection Road by means of culverts with lift-locks. The lift-locks are manually operated via pulleys and chains. The doors of the structures are locked when outside water levels become too high.

Because each high tide brings in silt from the ocean and lacking a strong tidal flow and a budget for maintenance, all main drains between the East-West Connection Road and the Ocean are heavily silted up.

Water quality (Physico-chemical)

No data are available on the water quality of the Coronie swamp and of the swamp areas north of the East-West Connection Road. A proposed monitoring program (Abrahams, 1988) was never executed by lack of means.

3.1.5 Soils

The North Coronie area includes the two youngest phases of the Holocene deposits as distinguished by Brinkman and Pons (1968), from north to south:

- Comowine phase: deposited over the last 1000 years, and the
- Moleson phase: deposited between 1300 and 2500 years BP

(The Wanica phase (deposited between 3000 and 6000 years BP is not represented in the North Coronie area).

In the recently deposited clay sediments along the coast, soil development is still very weak. With age (further inland) clay soils have an increasing degree of ripening. This shows in (1) a firmer consistence; (2) an increasing depth of soil formation; (3) an increasing depth of desalinization; (4) an increasing intensity and depth of mottling and (5) a decrease of base saturation, resulting in a lower pH. Besides this, a layer of peat (locally known as "pegasse") is formed on top of the mineral soil. Part of the organic matter is incorporated in the topsoil.

For the ridge soils the most important soil forming processes are: (1) formation of a humic top layer; (2) weathering of primary minerals; (3) leaching of bases; (4) decalcarization: solution of shells and removal of calcium carbonate from the soil, and (5) podzolization on sites with poor drainage conditions (groundwater podzols).

For the North Coronie area the scale 1: 500 000 "Preliminary very global soil salinity map" of Pons (1964) shows the following five stages of desalinization:

- North of the East-West Connection Road:
  (1) saline soils, and
  (2) saline to brackish soils

- South of the East-West Connection Road:
  (3) nearly desalinized topsoils with a saline to brackish subsoil;
  (4) desalinized topsoils with a brackish subsoil, and:
  (5) completely desalinized soils

For each zone, Pons (1964) characterizes the natural vegetation, the soil suitability and the limitations for crops in relation to salinity.

Brinkman & Pons (1968) show soil types and Holocene deposit classes on their "pedo-geomorphological maps scale 1 : 1 000 000 (Coastal Plain of the three Guiana's)" and scale 1: 300.000 (eastern part part of Coronie District).

- North of the East-West Connection Road these maps show *Comowine phase deposits*, now comprising: (1) saline to brackish clays with a very weak soil development and unmottled; and (2) saline to brackish clays with a weak soil development and brown mottles; and (3) ridges consisting of shells or calcareous fine sands with a weak soil development.

- South of the East West Connection Road, the maps show *Moleson phase deposits,* now comprising: (1) clays with a moderately weak soil development and olive mottles; and (2) ridges consisting of shells or calcareous fine sands with a moderate soil development, seldom podzolised.

- Older deposits of the so-called *Wanica phase* only occur south of the North Coronie area.

Brinkman & Pons (1968) mapped and described also the extensive ombrogenous peat swamp soil occurring in the central part of the Coronie Swamp. Here, a 1 to 4 m thick peat layer is found that already started to grow during the Wanica phase and now reaches heights above sea level. Elswhere in Suriname the peat layer of such swamps may be up to 5 m thick, such as in the Nani Swamp, Nickerie District (Sevenhuysen, 1977). Locally in such swamps, the peat layer may be thinner and floating, such as in the "Great Swaying Swamp" upstream of Buku Creek, Marowijne District (Lindeman, 1953).

The scale 1: 100 000 "Reconnaissance Soil Map of Northern Suriname" (DBK, 1977) shows the same picture although in more detail:

- North of the East-West Connection Road: very poorly drained unripe and practically unripe saline clay (Map legend unit 7);

- North and south of the East-West Connection Road: poorly drained half ripe and ripe clay with brown mottles (unit 4).

- South of the Coronie Road: (1) very poorly drained half-ripe clay with olive mottles, locally silty clay (unit 5) and (2) very poorly drained ombrogenous peat (unit 12)

According to the 1: 300 000 map of the eastern part of the Coronie District (Brinkman & Pons, 1968) all lands north of the Coronie Road are saline to brackish. The DBK soil map (1977), scale 1: 100 000 shows some (narrow) belts of desalinized soils (unit 4) next to the road. However, vegetation studies in this northern area (Teunissen 1978) show that fresh to slightly brackish water vegetation are found up to distances of 1 to 2 km north of the road, approximately half-way between the road and the coastline (see also Map 6). This may indicate that on the DBK soil map (1977), the boundary line between legend units 4 and 7 should be moved further to the north

and that the brown mottled "saline to brackish" profiles as described by Pons (1964) and Brinkman and Pons (1968) should at least have almost desalinized or desalinized topsoils to enable the development of a freshwater vegetation. The lack of morisi (*Mauritia flexuosa*) palms north of the road may indicate the occurrence of brackish to saline subsoils. Further soil studies will be needed to confirm this.

3.2 Biological features

3.2.1 Vegetation

The most recent vegetation map (Teunissen, 1978), is based on aerial photo's of 1971, sill being the most recent photo's that cover the entire North Coronie area. South of the coastal mangrove belt the map shows a narrow belt of brackish grass swamps and south of this an extensive freshwater swamp area. South of the Coronie Road, the northern part of the fresh water swamp area is mainly covered with closed to open palm (*Mauritia flexuosa*) swamp forest while also open grass swamps occur. Further to the south (outside the North Coronie area) the swamp is dominated by an extensive treeless grass swamp.

The vegetation of the North Coronie area was first studied by Lanjouw (1933) whose data are included in the vegetation study of the Coronie area carried out by Lindeman (1953). Additional vegetation records were made in 1975 after which the vegetation was mapped by Teunissen (1978). All now available vegetation records are presented in a vegetation table (Appendix 1).

Table 3 (below) presents an overview of the vegetation types as found in Coronie North area.

TABLE 3: VEGETATION TYPES NORTH CORONIE
Vegetation numbers refer to the legend units as used on ecosystem map of Teunissen (1978); Record numbers refer to the vegetation records presented in Appendix 1: (L= Records no's Lindeman 1953; T= Record no's Teunissen)

Nr	Landscape element and **vegetation type**	Veg no	Rec no
	Swamps		
1	**young coastal mangrove**: early stages of black-mangrove (= "parwa") (*Avicennia germinans*) forest; near the Coppename River mouth preceded by mudgrass (= "sarasara grasi") (*Spartina brasiliensis*) vegetation	5	-
2	**older coastal mangrove**: mature black-mangrove (="parwa") forest with white-mangrove (="akira") (*Laguncularia racemosa*) trees along tidal creeks	6	L 0
3	**dying coastal mangrove**: dying black-mangrove *Avicennia germinans*) forest	7	-
4	**lagoons**: salt to brackish lagoons, locally with submerged vegetation of widgeon grass (="sewar") (*Ruppia maritima*) and/or water lilies (="pankuku-wiwiri") (*Nymphaea ampla)*	8	-

5	**salt marsh**: silted up (shallow) lagoons, covered with halophytic herb vegetation, dominated by sea purslane or "zeepostelein" (*Sesuvium portulacastrum*), saltworth or "krapegrasi" (*Batis maritima*) or Virginia grass (*Sporobolus virginicus*)	9	-
6	**salt and brackish grass swamps:** salt and brackish "short grass" swamps, dominated by spike rush or "drikanti" (*Eleocharis mutata*), or "fini-adrun"-sedge (*Cyperus articulatus*), locally fern swamps dominated by the giant salt fern or "tabaka-tiki" (*Acrostichum aureum*)	10	-
7	**open coastal mangrove**: scattered black-mangrove (="parwa")(*Avicennia germinans*) trees brackish grass swamp	11	-
8	**brackish grass swamp**: brackish short and tall grass swamps, dominated by the short "fini-adrun"-sedge (*Cyperus articulatus*) or the tall "reed mace" (="cat tail", "langa-grasi", "papayagrasi") (*Typha angustifolia*)	13	L 6-8 T 37
9	**"brantimaka" swamp scrub:** brackish swamp scrub, dominated by "brantimaka" (*Machaerium lunatum)*	14	-
10	"**kofimama"** swamp wood: brackish to freshwater swamp wood, dominated by "kofimama" (= "kofimaka") (*Erythrina glauca*)	15	T 37 T 40
11	**freshwater mangrove**: brackish to freshwater black and/or red-mangrove (*Avicennia germinans/ Rhizophora* spec.) forest with "pina" (*Euterpe oleracea)* palms	16	-
12	**riverside mangrove:** brackish to freshwater red-mangrove (="mangro")-forest, dominated by *Rhizophora*-species: *Rhizophora mangle, R. harrissonii and R. racemosa*. White-mangrove (="akira") (*Laguncularia racemosa*) trees may be found along brackish tidal creeks	17	-
13	**freshwater grass swamp**: species-rich freshwater (to oligohalinous) tall grass (graminoid) swamps, locally dominated by the tall "reed mace" (="cattails" or "langa-grasi" or "papayagrasi") (*Typha angustifolia*), "prasorograsi" (*Cyperus giganteus)* and "mokomoko" *(Montrichardia arborescens*); also short swamp ferns (*Blechnum indicum*) may dominate	30	L 42 L 51-55 T 39
14	**"watrabebe" swamp wood**: closed and open freshwater (to oligohalinous) swamp wood dominated by "blood wood" (="watrabebe") (*Pterocarpus officinalis)*	23-24	-
15	**"pruimen-zuurzak" swamp wood:** open to closed (freshwater to slightly brackish) swamp wood characterized by "zwamppruim" (*Chrysobalanus icaco*) and "zwampzuurzak" (*Annona glabra*)	25-26	L 1-3 T 38
16	**"morisi" swamp forest**: open to closed (freshwater) swamp	27-29	L 122-

	forest dominated by "morisi" palms (*Mauritia flexuosa*)		123
17	**"babun-mataki-pina" swamp forest** with "babun" (*Virola surinamensis*), "mataki" (*Symphonia globulifera*) and "pina" palms (*Euterpe oleracea*), locally with "posentri" (*Hura crepitans*)	20-21	L 29-31 T 36-37
	Ridges		
18	**ridge forest:** mixed xero-mesophytic dryland and marsh forest	12	L 33-37 T 41
	Uncorrelated		
19	**secondary forest:** secondary forest of abandoned plantations	66	-

Source: Lanjouw (1933); Lindeman (1953) and Teunissen (1978)

Vegetation dynamics

Succession (numbers between brackets refer to Table 3, first column)

Only in and immediately west of estuaries (in Coronie at the Coppename Bank), mudgrass vegetation develops on bare mudflats before black-mangrove forest establishes. Along the ocean coast however, young mangrove forest is the first vegetation that develops (1). While new mudflats are growing further in the western direction, the established mangrove grows up to mature forest (2). At the older (eastern) parts of mudflats black-mangrove trees sooner or later may be uprooted by erosion processes.

As the Surinamese coast shows an average net growth over the last 6000 years, some mature black-mangrove forest stays intact and is permanently added to the mangrove belt. Once added, black-mangrove forests may die (3) due to worsened drainage conditions caused by soil subsidence and/or blocked tidal creeks. Then lagoons are formed (4). Deep lagoons never dry out. However, they may silt up with sediments brought by tidal creeks. As soon as lagoons are completely silted up, and drainage conditions improve, black mangrove forest may re-establish. Along rivers, black and mixed red-and-black mangrove forest may develop (12). Locally a freshwater variant of such mangrove forest is found behind river banks (11).

South of the coastal black-mangrove belt, between still standing and scateered black-mangrove trees (6), short and tall grass swamps (7, 8) may develop on firmer and saline to brackish soils on which a peat layer may develop. During dry seasons, grass and peat fires may prevent the development of woody vegetation. In the absence of fire, "brantimaka" swamp scrub (9) may settle.

In the North Coronie area swamps in slightly brackish to desalined soils ,"kofimama" swamp wood (10) is found. Under extreme environmental conditions "kofimama" trees may become dominating. This very vigorously growing tree survives temporary salt intrusions, severe peat fires and even extremely high water levels.

Further inland, grass swamps become gradually fresher and richer in species (13).
Under less extreme conditions and in the absence of grass fires, other tree species invade grass swamps and this announces the succession towards other types of swamp wood.

In the absence of fire, here "watrabebe" swamp wood (14) establishes or, possibly in case of more frequent fires, a more species-rich "fire-resistant" "pruimen-zuurzak" swamp wood (15). The species composition of this swamp wood shows a striking resemblance with that of the undergrowth of fire-resistant "morisi" palm swamp forests. However, north of the East-West Connection Road, “morisi” palms are completely lacking probably because of the palm's intolerance to even traces of salt in surface waters. top and subsoil (Teunissen, 1993).

South of the road, were permanent fresh water swamps with desalinized subsoils are found, "morisi" palm vegetation (16) is very common. "Morisi" palms are fire resistant and may even grow in areas where the grass vegetation is frequently burning. If open "morisi" forests don't burn for a long time, swamp wood may develop in between the palms. In frequently burning swamps, "morisi" palms may become dominating and ultimately they may form pure stands.

It may be expected that during prolonged absence of fire all freshwater grass swamp and swamp wood types and also "morisi" palm forest develop towards species-rich "babun-mataki-pina" swamp forest (17). In the North Coronie area the last remnants of such climax forest are still found in the Jenny area. In case of peat fires, this last climax forest may disappear as well. The development from herbaceous swamps to climax swamp forest may take many hundreds of years or even longer in case thick peat layers have to accumulate first.

Grass and peat fires

During every dry season, many "grass" swamps are burned intentionally, a common practice to keep these areas accessible for men and attractive for wildlife. It is also done to create less favorable conditions for mosquito's or just for fun.

Grass swamps may also start unintentionally when in swamp areas the grassy vegetation along road sides is burned as a way of weed control or when slashed highland vegetation is burned for cultivation purposes. Also camp fires may lead to grass fires.

If rains fail to fall during the Short Rainy Season, the Long Dry Season, starting in the middle of August is extended up to late April and lasts for 8 months, up to the Long Rainy Season. Extremely dry periods were reported from 1745/46, 1767/68, 1797/98, 1845/46, 1898/99, 1911/12, 1925/26, 1939/40, 1963/64 (Bubberman, 1973) and 1997/98 (El Niño).

Extremely dry periods may have serious consequences for all non-tidal wetlands in Suriname as surface waters may dry up and peat layers and mineral top soils may desiccate. During such periods, the salt content of brackish swamps may extremely increase and salt may finally crystallize on the dry swamp floors.

When swamps dry up, also their peaty top soils may desiccate completely and grass fires may become peat fires. Although peat fires may be self-generating by lightening or bacterial heating, there are strong indications that most fires if not all, are human-induced (Bubberman, 1973).

Peat fires may destroy all swamp vegetation including swamp wood and swamp forest as trees rooting in peat layers loose grip and fall over. During extremely dry periods also the leaf litter layer of marsh forest (as on ridges and riverbanks) and even of dryland forest becomes bone dry and flammable. Also litter fires may damage marsh and dryland forest. Ridge forest litter fires may transmit fires from one swamp to another.

Almost 75 % of the swamp areas in the coastal region of Suriname are covered with non-climax vegetation, which means that the original high swamp forest may have been destroyed by fire (Teunissen, 1993).

Once peat layers are burning, it is virtually impossible to extinguish the fire. Only the next rains of the Long Rainy Season (LRS) may stop them. The LRS rains may create open water areas for the following years. On such open waters, floating meadows can develop which form new peat layers with an estimated speed of up to 1 cm a year (Van Donselaar et al, 1965-1975). After the building up a new peat layer, woody swamp vegetation may again develop.

The vegetation of the North Coronie area suggests that burning occurs or has been occurred so frequently that presently the the area is for an important part covered with a "fire-climax" vegetation, specifically "morisi" forest.

Litter fires

Also the forests on the narrow ridges and river banks in the area show serious scars of litter fires: the ridge forest is irregular in height and density, and tree species of which the seeds can only germinate in full sunlight frequently occur. The most obvious is the giant "*kankantri*" (*Ceiba pentandra*), which is very abundant on the higher landscape elements of the North Coronie area.

3.2.2 Ecological zones and Ramsar wetland types (RWT's

By combining and overlaying the maps showing the ocean zone, the soil (DBK, 1977) and the vegetation (Teunissen, 1978) of the North Coronie area, an overview of the ecological zones of that area was composed. Wetland types as classified by the Ramsar Convention (RWT's) were identified.

An overview and descriptions of the distinguished ecological zones is presented below. Most are shown on Map 6.

Overview ecological zones

a. Deep sea* and Continental sea (> 6 m)*
b. Shallow sea (< 6 m)
c. Coastal and estuarine mud flats
d. Coastal mangrove, lagoons and riverside mangrove
e. Brackish swamps
g. Freshwater swamps north of road
h. Ridge complex
i. Dry crop areas (ridges and polders)
j. Rice polders
k. Freshwater swamps south of road (excl. ombrogenous peat swamps)
l. Ombrogeous peat swamp*

(*) Marked ecosystems/areas are located outside the borders of North Coronie area.

Descriptions of ecological zones and Ramsar wetland types

a. Deep sea and Continental sea (> 6 m)

Between northern boundary of the Exclusive Economic Zone (200 nautical miles or 320 km offshore) and the 6 m depth contour.

RAMSAR WETLAND TYPE (RWT): no wetland according to Ramsar definitions.

b. Shallow sea (< 6 m)

Between the 6 m depth contour and the coastal mud flats and estuarine waters.

RWT: Marine wetland type:

- Permanent shallow marine waters less than 6 meters deep at low tide (type A).

c. Estuarine waters

The Coppename River estuary east of the North Coronie area.

RWT: Coastal wetland type:
* Permanent water of estuaries (F)

d. Coastal and estuarine mudflats

Bare coastal mud flats are found along the ocean. The mudflats along the left bank of the Coppename estuary and the Coppename Mudbank are partially covered with mudgrass or "sarasara-grasi" (*Spartina brasiliensis*) on unripe saline and brackish unmottled clay (P1/2-BP8/DBK7)

RWT: Coastal wetland types:
- Bare intertidal mud flats along the coast (G); and
- Intertidal saline to brackish marshes (on estuary mud flats) (H).

e. Coastal mangrove, lagoons and riverside mangrove

Along the Atlantic coast, behind a zone of coastal mudflats, a 1-2 km wide mangrove belt is found consisting of young coastal mangrove, mature mangrove forest, dying mangrove forest, lagoons, open magrove, riverside mangrove, on very poorly drained unripe and practically unripe unmottled saline and brackish clay.

RWT: Coastal wetland types:
- Intertidal forested wetlands: coastal and riverside mangrove swamps (I); and
- Coastal saline/brackish lagoons; saline to brackish lagoons with at least one relatively narrow connection to the sea (J).

f. Brackish swamps

South of the mangrove zone, a narrow belt of brackish grass swamp alternates with "brantimaka" swamp scrub and "kofimama" swamp wood, all on very poorly drained unripe and practically unripe unmottled saline and brackish clay with a peat cover on top

RWT: Inland wetland types:
- Permanent brackish marshes on inorganic soils (with a peat cover) (Sp); and
- Shrub dominated wetlands, in this case shrub-dominated **brackish** marsh on inorganic soils (with peat cover) (type W, but marsh is brackish, not fresh!).
- **Brackish** water, tree-dominated wetlands, in this case **brackish** water swamp wood on inorganic soils (with peat cover) (typr X, but water is brackish, not fresh!).

g. Freshwater swamps north of road

South of the brackish swamps and north of the East-West Connection Road a belt of fresh water swamps is found consisting of "brantimaka" swamp scrub, "kofimama" swamp wood, "pruimen-zuurzak" swamp wood, freshwater mangrove, "babun-mataki-pina" swamp forest, "posentri" swamp forest, open "watrabebe" swamp wood, freshwater grass swamps, all on poorly drained half-ripe and ripe brown mottled clay, with an almost desalinized to fresh topsoil; locally over loam (P3/4-BP7-DBK4) with a peat cover on top;

Very few and narrow (not mapped) ridges are found north of the East West Connection Road (description: see h: Ridge complex).

RWT: Inland wetland types:

- Permanent freshwater marshes on inorganic soils (with peat cover) (Tp); and
- Shrub dominated wetlands: shrub-dominated freshwater marsh (W);
- Freshwater, tree dominated wetlands: freshwater swamp wood and swamp forest on inorganic soils (with peat cover) (Xf).

h. Ridge complex

South of the East West Connection Road an up to 2 km wide and locally interrupted ridge complex is found. Between Jenny and Ingikondre these ridges are covered with mixed ridge forest locally posentri ridge forest, both on well (to poorly) drained shells, shell-grit, shellsand, medium and fine sand to sandy loamy (DBK 1/2).

Between these ridges narrow freshwater grass swamps are found (description: see l: Southern freshwater swamps).

RWT: no wetland according to Ramsar definitions, exept for the poorly drained ridges which may be considered as:
Inland wetland type:

- Freshwater, tree dominated wetlands: seasonally flooded forest on inorganic soils (Xf).

i. Dry crop areas (ridges and polders)

(Formerly) dry crops on ridges: well drained shells, shell-grit, shellsand, medium and fine sand to loamy sand (DBK 1/2); or in polders: (formerly) artificially drained ripe to half ripe clay with yellow, brown and or red mottles, locally clay over loamy sand, and/or sandy clay loam in the subsoil (DBK 17).

RWT: no wetland according to Ramsar definitions.

j. Rice polder areas

Rice (and or cattle) on very poorly drained half to nearly ripe clays of (former) rice fields (DBK 18)

RWT: Man-made wetland type:
Irrigated land: irrigation channels and rice fields. Most polders are in use as:

- Rice fields: "man-made" irrigated wetlands (#3).

k. Freshwater swamps south of road (excl. ombrogenous peat swamps)

South of the ridge complexes the freshwater swamps have vegetation types in common with the freshwater swamps north of the road: “babun-mataki-pina” swamp forest, posentri swamp forest, watrabebe swamp wood, pruimen-zuurzak swamp wood, and freshwater grass swamps. However, “brantimaka” swamp scrub, “kofimama” swamp wood and “freshwater-mangrove” are completely lacking here. “mira-udu” swamp wood is found here for the first time as well as but open “morisi” palm swamp, “morisi” palms in “watrabebe” swamp wood, and closed “morisi palm” swamp forest start to dominate the landscape.

In the north the vegetation types are found on poorly drained half-ripe and ripe brackish clay with brown mottles, probably with an almost fresh to fresh topsoil; locally over loam (P3/4-BP7-DBK4), and in the south on very poorly drained half-ripe clay with olive mottles, and with a fresh topsoil and a brackish to fresh subsoil (P5-BP5-DBK5), all with peat cover.

Very few and narrow (not mapped) ridges are found in these southern swamps (description: see h: Ridge complex).

RWT: Inland wetland types:

- Permanent freshwater "marshes" on inorganic soils (with peat cover) (Tp);
- Freshwater, tree dominated wetlands: wooded freshwater swamps and freshwater swamp forest on inorganic soils (with peat cover) (Xf)

l. Upstream ombrogenous peat swamps

The centre of the Coronie Swamp is dominated by grasses on very poorly drained ombrogenous peat (DBK 12). The few outcrops (remnants of old (Pleistocene) ridges and plateaus) are surrounded by fringes of morisi palm swamp forest.

RWT: Inland wetland types

- Non-forested peatlands: open bogs (U); and
- Freshwater, tree dominated wetlands: wooded freshwater swamps and freshwater swamp forest on inorganic soils (with peat cover) (Xf)

3.2.3. Flora

A flora is a list of plant species present in a certain area. The plant species presently known from the North Coronie area are mentioned in Vegation Tables of Lindeman (1953) and the Vegetation Table attached to this report (Appendix 1).

The majority of plant species found in the brackish area along the coast has a cosmopolitan, a pantropical, an Afro-American, or a Caribbean distribution, probably because most propagules are distributed by sea currents and migratory birds. Farther inland, in the freshwater swamps, the majority of plant species has a distribution which is more confined to the South American continent or even to the Guyana Region (Lindeman, 1953).
Although the flora of the North Coronie area is certainly not yet completely known, up to now, no plant species have been found that can be considered as unique, rare, endangered or biogeographically important. Based on experiences in better studied coastal areas like the Wia Wia Nature Reserve (Sterringa, 1971; Pons, 1972: and Julen, 1974), such species are not expected to be found. However, on the ecosystem level, all plant species contribute to the primary production and protection functions of the mangrove zone along the coast.

3.2.4 Fauna

a. Mammals

In North Coronie, the mammalian fauna was never systematically inventoried. From literature (Husson, 1978; Mittermeier, 1977; Duplaix, 1978, Duplaix & Reichart, 1978 and De Smet, 1990) a list of 54 species of mammals was extracted for the entire estuarine zone of Suriname: 7 species of marsupials, 13 bats, 4 monkeys, 4 edentates, among which the giant ant-eater (*Myrmecophaga tridactyla*); 8 carnivores, among which the jaguar (*Panthera onca*) and the Brazilian giant otter (*Pteronura brasiliensis*); 4 ungulates, as the white-tailed deer (*Odocoileus virginianus*) and 12 rodents. Also the american manatee (*Trichechus manatus*) and the guiana white dolphin (*Sotalia guianensis*) are frequently reported from the Coppename River. Except for the guiana white dolphin, none of the mammals is confined to the estuarine zone. The dolphin is reported to suffocate in fishermen's nets as are manatees. In Suriname the manatee and the giant otter are considered as vulnerable species (Duplaix, 1978; Duplaix & Reichart, 1978).

b. Birds

According to De Jong, Spaans & Held (1984), the Surinamese coastal area, including the North Coronie area is of special importance as feeding and nesting ground for more than 118 species of coastal birds, of which more than 70 species are defined as waterfowl according to the criteria of the Ramsar Convention.
Biodiversity and numbers

As compared to birdlife in rainforest areas, bird-diversity along an unstable coastline may be considered as rather low. On the other hand, as is the case along the Surinamese coast, the

numbers of individuals for certain species may become so extremely high that they reach levels of international importance.

The total number of waterfowl along the Surinamese coast at one time (sum of estimated maximum numbers for each species) may reach to as many as 5 million individuals (De Jong, Spaans & Held, 1984):

** Shorebirds*

The most numerous are the shorebirds (19 species of snipes and sandpipers, 5 species of plovers). The sum of the estimated maximum numbers for each species amounts to 4 million (De Jong, Spaans & Held, 1984).

Besides this, the Surinamese coast may be considered as the principal South American wintering ground for migratory shorebirds from Neartic regions. In the period 1982-1986, by means of aerial surveys, Morrison & Ross counted more than 2.9 million Neartic shorebirds along the entire South American coastline (approximately 28.000 km), including the Surinamese coastline (370 km). Along the Surinames coast alone, they counted 1.5 million shorebirds, being 52% of the total of shorebird populations wintering in South America (Morrison & Ross, 1989).

** Herons, Ibises, Storks and Spoonbills (Ciconiiform birds)*

Less numerous, but present around the year, and much more conspicious, are the ciconiiform birds, consisting of herons (13 species), the scarlet ibis (*Eudocimus ruber*), storks (3 species), and the roseate spoonbill (*Platalea ajaja*). The sum of estimated maximum numbers of individuals for these species is 600,000 (De Jong, Spaans & Held, 1984).

Between the Orinoco and the Amazon River mouths, the coast of Suriname shows the highest density of nesting colonies of ciconiiform birds. For the South American endemic scarlet ibis, the coast of Suriname is of critical importance with up to 35,000 breeding pairs during top years (Spaans, 1974, 1990).

* *Ducks and larids*

Ducks (7 species) and larids (5 species of gulls and terns) are the next numerous groups, each group represented by about 100,000 individuals (De Jong, Spaans & Held, 1984).

* *Other bird taxa*

About 30,000 birds belong to waterfowl groups with smaller numbers. This pertains to a group composed of grebes (1 species), pelicans (1 species), cormorant and anhingas (2 species), flamingos (1 species), limpkins (1 species), rails and gallinules (6 species), finfoots (2 species), jacanas (1 species) and stilts (1 species) (De Jong, Spaans & Held, 1984).

On top of this thousands of orange-winged parrots (*Amazona amazonica*), feeding more inland, use communal roosts in the coastal area (Spaans & Baal, 1990).

* *Species of international importance*

For 21 waterfowl species (Table 4) , parts of the Surinamese coastal area are of international importance (De Jong, Spaans & Held, 1984). The criterion for international importance is: 10,000 or more individuals, and/or at least 1% of the biogeographic population per area (as defined by Scott & Carbonell, 1988).
For the North Coronie area the following bird species are of international importance:

TABLE 4: NUMBER OF WATER FOWL SPECIES OF INTERNATIONAL IMPORTANCE PER COASTAL SUB-AREA

Area name	Sub area name	Number of important birds species
Corantijn-Coppename	Bigi Pan MUMA	19
	North Coronie	**7**
Saramacca-Suriname	North Saramacca	13
	North Wanica	
	North Paramaribo	
Commewijne-Marowijne	North Commewijne	17
	North Marowijne	10
Total Surinamese coast		**21**

Source: De Jong, Spaans & Held, 1984.

From Haverschmidt (1968), Spaans (1978), De Jong, Spaans & Held (1984) and Haverschmidt & Mees (1994) birdlife along the Surinamese coast and its sub-areas is summarized in Appendix 2.

** Birdlife of freshwater areas*

An inventory of the avifauna of the freshwater parts of the Coronie Swamp have never been taken place. It is well known, that the dead "morosi"-palms (*Mauritia flexuosa*) in the almost

English name	Scientific name	Estimated numbers along Coronie coast
semipalmated sandpiper	*Calidris pusilla*	250.000
lesser yellowlegs	*Tringa flavipes*	25.000
short-billed dowitcher	*Limnodromus griseus*	20.000
little blue heron	*Egretta caerulea*	10.000
tricoloured heron	*Eretta tricolor*	10.000
Cayenne tern	*Sterna sandvicensis eurychnatus*	100's
rufous crab-eating hawk	*Buteogallus aequinoctialis*	100's

inaccessable Coronie Swamp are favorite nesting trees for the blue-and yellow macaw (*Ara ararauna*) which frequently feeds on "poison trees" (= "posentri") (*Hura crepitans*) in the Peruvia Nature Reserve.

c. Herpetofauna

Sand and shell beaches of importance as nesting beaches for sea turtles are exclusively located in eastern Suriname (proposed Commewijne-Marowijne MUMA and Galibi Nature Reserve). The few sand beaches in the North Coronie area are of the "overwash"-type.

d. Fishes, shrimps and crabs

Over 300 fish species are known from the near-coastal and estuarine waters (Bruijning & Voorhoeve, 1977) as well as 20 species of crabs and 11 species of shrimps (Holthuis, 1959).

The target catch of shrimp trawlers consists of bigger shrimps (prawns) for export to Europe and Japan: brownies (*Penaeus subtilis = P. aztecus*), (pink)-spotted brownies or hoppers (*Penaeus brasiliensis*), pink shrimps (*Penaeus notialis*) and white shrimps (*Penaeus schmitti*). (Malone-Jessurun, 1995, Heidanus 1996).

Commercially important scaled foodfish species from coastal waters are: "kandratiki" (*Cynoscion virescens*); sea trout or "banban" (*Cynoscion acoupa*); weakfish or "wetweti" (*Cynoscion steindachneri*); butterfish or "botrofisi" (*Nebris microps*); dog trout or "dagutifi" (*Macrodon ancylodon*); bashaw or "kubi" (*Plagoscion surinamensis*), mullets or "aarders" (*Mugil* spp.); "sekubi" (*Micropogonias furnieri*); snook or "snuku" (*Centropomus* spp.); tarpon or "trapun" (*Megalops atlanticus*); triple-tail or "sekrobia" or "papa-uma" (*Lobotes surinamensis*); anchovy or "krafana" or "tri" (species of the *Engraulidae*-family). Sea catfishes (with a lower commercial value) are: "geribaka" (*Arius parkeri*); "kumakuma" (*Arius herzbergii*); "kodoku" (*Arius* spp.); crucifix fish or "kupila" (*Sciadeichtys proops*); gaffop fish or "barbaman" (Bagre bagre) and "lompu" (*Batrachoides surinamensis*). (Malone-Jessurun, 1995; Heidanus 1996).

For trapnet fisheries in the estuaries, the largest and the most common species of shrimp is the seabob or "bigi sarasara" or "redi sarasara" (*Xiphopenaeus kroyeri*), followed by the somewhat smaller white belly or "wetbere" (*Palaemon schmitti*) and the "browny" (*Penaeus aztecus*). Less important are the "trangabaka" (*Hippolysmata oplophoroides*) and the smaller (immature) deep sea species: white shrimp (*Penaeus schmitti*), and (pink)-spotted browny (*Penaeus brasiliensis*). (Holthuis, 1959; Malone-Jessurun, 1995; Heidanus 1996).

For the freshwater swamp (commercial and sport) fisheries the most important catch consists of "kwikwi" (*Hoplosternum* and *Callichthys* spp), "krobia" (mainly *Aequidens* spp.), "pataka" (*Hoplius malabaricus*) and "walapa" (*Erythrinus erythrinus*).

Fishes, crabs and shrimps are also important staple food for coastal birds. The tiny shrimp-like Tanaids are extremely abundant in wet and soft parts of mudflats along the coast and along tidal creeks. They reach densities of up to 13.000 individuals /sq.m and constitute the staple food of many species of shorebirds.

Because of their wide distribution, none of these species is considered to be rare, vulnerable, or endangered at this time.

Fauna dynamics

Young mangrove forests are the favorite nesting places for scarlet ibises and for most species of herons. Young mangrove forest mature while new ones establish elsewhere.

Natural changes in the vegetation, drainage pattern and water quality of the inland coastal wetlands (mangrove forests, tidal creeks, lagoons, brackish grass swamps) may improve or worsen the quality of the feeding grounds of coastal birds. For that reason coastal birds frequently have to move to new feeding grounds and to suitable roosting and nesting sites nearby.

3.3 Cultural and social features

3.3.1 Pre-Columbian history

The earliest inhabitants of Suriname are the Amerindians. According to Versteeg and Bubberman (1992), in the central part of Suriname, between the Suriname and Coppename River, the first inhabitants came from the west (presently Venezuela).

a. Mabaruma Indians

According to Versteeg & Bubberman (1992), dated strata of peat and pollen analysis show that between approximately AD 300 and AD 1000, freshwater conditions occurred in the West Surinamese coastal plain including the area of the present Coronie District. In this area, along the banks of small creeks, Amerindians who produced (Barrancoid) Mabaruma pottery, had raised mounds to build their settlements. In the vicinity of these mounds, in the freshwater swamps, they raised (square-shaped) fields of fertile clay, surrounded by trenches. The fields were raised for permanent cassava cultivation. Three of these mounds are now investigated): Bucklebury-1, Bucklebury 2 and Burnside, all located next (west of) the proposed North Coronie MUMA, in the present Bigi Pan MUMA. Artefacts have been dated between AD 100 and AD 600. (Boomert, 1975; Versteeg 1980b)

b. Hertenrits Indians

Further archaeological data of the area suggest that after AD 600 the "Mabaruma Indians" were chased away by another tribe, producing Arauquinoid pottery, that became known as "Hertenrits style pottery". The new "Hertenrits Indians" did not settle on the Bucklebury and Burnside mounds but on newly raised mounds further to the west at and near places now known as Hertenrits, Wageningen (Wageningen 1, 2, 3 and 4), near Nieuw Nickerie (Nickerie 1 and 2), and the present Prins Bernhard Polder. They also settled on some higher elevated sand ridges further to the east (Peruvia 1 and 2) (Boomert, 1975; Versteeg 1980 and 1993). In the vicinity of their dwellings the "Hertenrits Indians" have also built raised fields in the surrounding freshwater swamps. Artefacts of “Hertenrits Indians” were dated between AD 700 and AD 1200 .

Then, a few centuries before the European colonization a new group of Amerindians, this time coming from the east, invaded the area between the Marowijne River up to the Coppename River. They produced the pottery belonging to the so-called "Koriabo" style group. Datings go back to approximately AD 1200. However, Koriabo pottery has neven been found in the coastal area of Western Suriname between the Coppename and the Corantijn River. Possibly the Hertenrits culture was so powerfull in this area that it was able to resist invasion by Koriabo Indians.

c. Caraibs

However, before the first stage of the Eurpean colonization of South America, the "Hertenrits Indians" also disappeared from the western part of the coastal plain of Suriname. At the time of European colonization, the entire coastal area of Suriname was already inhabited by Caraibs, having their origin in the Caribbean.

In the area between the Coppename and the Corantijn River, decendents of these Caraibs are still living in villages as Kalebaskreek (Coppename), Post Utrecht (Nickerie River) and Cupido (Marataka River).

In 1972 (GB 1972, no 22), the most conspicious mound in Western Suriname, the Hertenrits became protected by the establishment of the Hertenrits Nature Reserve. Since 1986, the most important archaeological sites in Eastern Coronie (Peruvia 1 and 2) are protected within Peruvia Nature Reserve (SB 1986, no 52). Since 1987 the archaeological sites Bucklebury 1 and 2 are (also) protected in the Bigi Pan Multiple-use Management Area.

3.3.2 Colonial and recent history

In the period 1799-1815 Suriname was (with a short interruption) occupied by England. During that period, English and Scottish colonists (also) obtained Amerindian lands known as "Soeweija" along the coast of the "Upper Nickerie District" to establish cotton plantations. The new plantation area got the name of "Colony". In 1808 the first cotton plantation (Burnside) was developed by Mr A. Cameron (Lot # 210) and soon others followed. The front dams of the cotton plantations were build along the sea. The plantations were backed by the first sand ridge in the south.

In 1822 Totness became the first Government "vestigingsplaats" (translated: "settlement place" for free slaves in Suriname. Between 1825 and 1830 peak production of cotton was reached. The map of Teenstra-Mabé (1835) shows 22 cotton plantations, 5 abandoned plantations and a military post. On the map of Heneman & Van Sijpesteijn (1850) the following plantations are pictured and named (from the west to the east):

Plantation name	Area in "Akkers" (A) [1]
Potosi	1,500 A^s
Oxford	1,000 A^s
Hope	1,000 A^s
Burnside	1,000 A^s
Sarah	1,000 A^s
Leasowes	1,000 A^s
Clyde	250 A^s

[1]) 1 Akker = 0,4294 ha

Novar	250 A^s
Johanna Maria	500 A^s
Belladrum	500 A^s
John	500 A^s

Military Post "Coronie", situated along the Soeweija or Coronie Creek.

Bantaskine	(belonging to Friendship)
Friendship	1,500 A^s (incl. Bantaskine)
Totness	1,000 A^s
Mary's Hope	1,250 A^s
Bellevue	500 A^s
Cardrosspark	1,000 A^s
Perseverance	500 A^s
Moy	500 A^s
Hamilton	500 A^s
Inverness	500 A^s

Before 1851 this plantation are formed the "Upper Nickerie" District. In 1851 this name changed into "Coronie" District.

After the abolition of slavery (1863) the Dutch put the slaves under "State supervision" which forced them to stay working on plantations for another 10 years (up to 1873) giving the Dutch the opportunity to look for alternative cheap labor from elsewhere.

After 1873 we see a decline of the cotton culture by (1) lack of labor, (2) decreasing prices of cotton (caused by the recovery of the North American cotton industry after the Civil War 1861-1865), and (3) by coastal erosion. The Surinamese cotton plantations could not further compete, and collapsed. The plantation owners left Coronie and the land was sold to the former slaves.

When the Coronie plantations were sold, the so-called "Coronie Occupation Form" developed (Van Dusseldorf, 1962). The plantations (1-3 km deep between the sea and the ridges and extending over the ridges to the south) were subdivided in "lots" of ½, 1 and sometimes 2 "ketting [2]" wide (10 m, 20 m and 40 m wide respectively) and up to 3 km long or even longer. The lots became collectively owned by groups of families as allodial properties.

Next to the culture of tubers, cacao, corn, bananas, limon etc., the cultivation of cocos was stimulated by the government to produce edible oil for the local market leaving cattle cake (copra) as food for cattle and pig raising. This change was succesfull and in the second half of the 19th century the plantation area was even expanded. On the map of Loth (1889) we see new plantations in the east of Inverness such as Palestina, Penel, Bethel and Bethanie (now Ingikondre?) and Bucklebury at the eastern end of the plantation area.

2) 1 ketting = 20 m

Up to World War II Coronie could only be reached over sea by sailing boats and later by steamers of the Colonial Shipping Company. In front of the coast passengers and load had to trans-shipped into smaller row-boats to reach the Shipping Channel of Totness. As coastal accretion hampered such activities, during the forties, the Coronie Road was constructed from Ingikondre up to Jenny after which Coronie became accessable by road.

Between 1853-1939, contract labor was recruited in China (1853-1870), British East India (1873-1916) and up to World War II from Java (1890-1939), an island of the former Dutch East Indies, now the Republic of Indonesia.

Many of the Asians repatriated after their 5 years contract, others preferred to stay but established as independent farmers practicing small-scale agriculture. For the Javanese contract laborers who decided to stay in Suriname, the Government established new "vestigingsplaatsen" (translation: "settlement locations") at abandoned plantations. Then, at the southern part of plantation Totness, a Javanese settlement was established with the name of Soeberredjo.

After 1950 the cocos culture gradually declined by aging of the trees (passing the age of full bearing), pests (such as *Castnia* borers) and diseases (such as "heartrot") and the lack of interest by the younger generation to continue this form of agriculture. Trials of the Foundation for the Improvement of the Cocos Palm Cultivation in Suriname (STICOS) to revive cocos cultivation by (1) polder rehabilitation, (2) polder expansion (Cocos Polder), (3) the introduction of dwarf palms, and (4) the establishment of a Cooperative Cocos Press at Totness, were not succesfull. Revival was hampered also by (6) the confused land-ownership of estates resulting in the neglect of plantations and (7) by severe coastal erosion that started 1957 and lasts up to the present.

After the extension of the East-West Connection Road up to Wageningen in the sixties, rice cultivation was started als in Coronie (see Agriculture).

3.3.3 Population and population changes

Since 1950, the population of the Coronie Disctrict is decreasing (SPS, 1988) probably because of emigration caused by unfavorable oppertunities in the agricultural sector. Many people in the labor productive age group (15-59 years) left for alternative employment opportunities in Paramaribo, Wageningen and Nieuw Nickerie. Recently, the population is slightly increasing, possibly not by immigration, but just by excess of births over deaths.

The table (below and Appendix 3 illustrate the depopulation of the Coronie District between 1964-1980 and the next stabilisation.

year	number of inhabitants
1922	2700
1950	4000
1964	3800
1971	3100
1980	2756
1996	2922

About 80% of the Coronie District is uninhabited since most of the district is part of the Coronie Swamp that stretches as far south as the Wayambo River. There is a sparsely populated area along the East-West Connection Road. Some 100 people live in the Coppename-Jenny region, while most inhabitants of the district (94%) live between Ingikondre and Burnside. The ribbon development pattern is characteristic, and only in Totness-Friendship there is a concentration of the population (50%). However, even there, the population density doesn't exceed 28 inhabitants per sq. km. In the vicinity of Burnside, the density is approximately 9 per sq. km., and in Welgelegen and surroundings, approximately 5 per sq. km. (SPS, 1988).

Most inhabitants (90%) of Coronie are descendents of former African slaves, the second important group are of Javanese origin and live south of Totness at Soemberredjo (about 325 in 1973).

3.3.4 Socio-economic facilities

a. Transportation

Primary Road: East-West Connection Road between Jenny and Burnside. Secondary roads: Cocospolder Road to Soemberredjo and roads to the southern rice polders.

b. Power and water supply

Along the East-West Connection Road electricity is provided by the 2 MW power plant of the Power Supply Company of Suriname (EBS) at Totness. At Burnside a 50 KW power plant is provided by the Power Supply Department (DEV) of the Ministry of Natural Resources (NH).

Piped drinking water is distributed by the Water Supply Department (DWV) at Totness.

c. Education

There are four public six-grade elementary schools: one "Openbare School" or "OS" ("Public School") Totness, two in the Coronie East area and one in the Coronie West area. Next to these,

a private six-grade elementary schools exists at Mary's Hope (RKBO St. Anthoniusschool) and at Clyde (EBGS Salem school). There is only one public secondary school: the Tata Colin school (LBGO) at Soemberredjo. For higher education children of Coronie depend on facilities in Paramaribo.

d. Health care

One physician is available at Friendship. Three Regional Health Service (RGD) clinics serve people at Wegelegen, Totness and Johanna Maria.

e. Administrative centre

As for each district, the District Major (translated: Districts-commissaris or "DC") of Coronie is the head of administration. Although Totness is the district's capital, the DC office is based at Friendship.

The DC is assisted by one or more District Secretaries (SEC's). Districts are sub-divided into "resorts". The Coronie District is subdivided in three resorts: Welgelegen, Totness and Johanna Maria. Each one is supervised by an administrative supervisor (translated: Bestuursopzichter" or "BO").

Since the elections of 1987 peoples' representatives are elected at three levels. Members for the National Assembly were already elected before 1987. In order to decentralize the government administration and to improve peoples' participation in policy and decision making, since 1987 also members for the "District Advisory Council" ("Distriktsraad") and members for the "Resort Advisory Council" ("Ressortsraad") are elected. However, up till now these newly introduced structures do not function very well as their members do not yet report to the National Assembly but to the appointed DC, just as Ressort Supervisors and District Secretaries do.

The District Advisory Council of Coronie counts five members, assisted by the Advisory Councils of the resorts of Welgelegen, Totness and Johanna Maria.

Since 1996, the District Major is also the Head of the "District Board", its members being representatives of ministries active in the district.

Although DC's are aware of the complaints and wishes of the local communities, they are appointed by the central government, have little power and a poor budget and therefore they almost completely depend on the discretion of the central government in Paramaribo.

f. Other facilities

Most other socio-economic facilities are concentrated near Totness and Friendship: an agricultural extension service, a population registration bureau, a police station with prison, a fire brigade station, a social security office, a tax office, banking facilities ("Landbouwbank"), a savings and credit cooperative ("De Bijenkorf"), a post office, a telephone centre, a local radio station, sport facilities, a hotel, a government guesthouse and a few restaurants.

g. Agricultural interest groups

Interest groups related to agriculture are:

- LACOCO Landbouwcooperatie Coronie
- CCB Cooperatie van Coroniaanse Boeren
- SAOC Stichting Agrarische Ontwikkeling Coronie (Soemberredjo), a parastatal foundation established in the frame of the EC-financed Coronie West rice polder rehabilitation.

3.3.5 Land allocation

In Suriname all lands belong to the state and user's rights are only recognized when the land is allocated. Five types of user's rights exist:

1. Formal property of the using right ("Allodiaal Eigendom");
2. Hereditary long term lease: ("Erfpacht"): allocated before 1982 for a period of 75 years, mortgageable, freely transferable and renewable and;
3. Land lease ("Grondhuur"): allocated after 1982 for 40 years, mortgeageable, transferable and renewable upon request;
4. Simple rent (“Huur”): 1 year, renewable for 10 years and thereafter upon request.
5. Simple use (“Gebruiksvergunning”): rihgt of lansuse without legal title.

Before user's rights are officially allocated, the government can provide the user with a Written Agreement (“Bereidsverklaring”).

Wild occcupied lands are illegal but may be recognized and afterwards legalized (as 3, 4 or 5) if occupied and cultivated for a certain period.

After 1863 between Ingikondre and Burnside, the the so-called "Coronie Occupation Form" developed (see History). Small lots are collectively owned as "Formal Properties”.

According to LAHMEYER et al (1993), the majority of the present smallholdings and larger farms in the district of Coronie are Formal Properties. In general, these lands are reffered to as "undivided estates with dubious borders". The ownership collectives may range from a few hundred to a few thousand co-owners, of whom the majority have permanent residence outside rather than within the Coronie area. Next to this, a substantial number of the co-owners is living abroad.

Between Jenny (Km 89) and Ingikondre (Km 125), along the Coronie Road, most lands along the Coronie Road (see Map 6) are issued as Land Lease, Simple Rent, Simple Use or Written Agreement.

South of the Coronie Road, between Km 94 and Km 118, most land is divided in 100 m wide lots with an average depth of 700 m. However, between Km 109 and Km 125, three lots exceed 100 ha: NV AGRO V.I.C. (400 ha, up to the Peruvia Nature Reserve), Verwey (120 ha), VEPO (525 ha) and Vriesde (1000 ha) [3]. North of the Coronie Road, in the narrow strip of land along the sea, in recent years many land is issued in recent years. At least nine lots reach into the brackish swamp area or even into the coastal mangrove zone: NV Waroda (250 ha), Foundation "Volksopbouw Suriname" (500 ha), Ramsaran (100 ha), Foundation "Wederopbouw Coronie" (240 ha), Roseval (120 and 90 ha), Verwey (80 ha), Krak (140 ha) and "Foundation De Stam" (140 ha). Very probably the intension is to impound these wetlands for rice cultivation. Although not found on the BLO 1998 maps, aerial photo's also show large developments between Km 106 and 108.

3.4 Human activities

3.4.1 Shipping and navigation

Shipping and navigation along the Surinamese coast is not intensive. Offshore dumping of hazardous materials and ship-generated waste may take place in front of the Surinamese coast but no data are available.

3.4.2 Fisheries

a. Continental sea fisheries

Speaking in Surinamese fisheries terms, all fishing in waters deeper than 6 m is known as "deep sea", "industrial" or "large-scale" fisheries. This fishing is limited to the Continental Sea Zone in waters between 6 m and 200 m deep.

3) In the future, these lands may be cultivated with rice and then drain pesticide-contaminated water into the downstream estuarine area.

The following types of industrial fisheries are practiced (SPS, 1988): foodfish trawling (at depths between 6 and 20 m), shrimp trawling (at depths between 10 and 200 m), snapper longlining (between 30 and 50 m) and snapper trawling (between 30 and 50 m and between 90 and 200 m).

A fleet of almost 200 boats is involved in these operations, almost all sailing under Korean, Japanese, Surinamese, Panamanian, Venezuelan and US flags. These boats use Paramaribo harbour facilities. Also all fish processing industries are confined to the Paramaribo area.

b. Shallow sea and bank fisheries

Small-scale fisheries is practiced from fishermen's villages all along the coastal area. For the Coronie area, fisheries activities are concentrated at Totness, but the most important fishermen's village is Boskamp (Saramacca area) where also fisheries facilities are concentrated. Both, fishermen from Totness and Boskamp practice drift net fisheries in front of the Coronie coast (Coppename Bank) at depths between 6 and 1.5 m. Bank net fisheries is practiced on tidal mudflats.

Once, sea and bank fisheries was an important source of income also in the Coronie area itself. At this moment, a new deep freezer is installed at Friendship to stimulate sea fisheries activities.

c. Mangrove, lagoon and swamp fisheries

Small-scale mangrove and lagoon fisheries is mainly practiced in the Burnside area (Bruijning and Voorhoeve, 1977). Between Burnsdide and Ingikondre swamp fisheries is concentrated around trenches and ditches. Swamp fisheries (including sport fishing) is also practiced along te Coronie Road between Ingikondre and Jenny.

3.4.3 Agriculture

According to LAHMEYER et al (1993), a total number of over five hundred farms (including rice-farms) are registred in the North Coronie area.

a. Rice

Since 1957 the polder area north of the East-West Connection Road decreased because of coastal erosion, flooding and consequent salinization.

In 1978, the Hydrological Department (WLA) of the Ministry of Public Works (OW) estimated that the total irrigation capacity of the Coronie swamp was sufficient to irrigate between 4,000 ha and 9,400 ha of riceland south of the Coronie ridges. Then the Government decided to build a swamp retaining dam south of and parallel to the Coronie Ridges. The thus reclaimed Coronie polders were partioned and the land was allocated in Land Lease to individual farmers and farmer

groups. For the Coronie West Polder there are 17 associations (RON HAWKER & PARTNERS, 1992) and for the Coronie East Polder 79 rice growers grouped in 14 associations. The Laraco Polder near the Fresh Water Canal is leased by 39 rice growers (LAHMEYER et al 1993). See Appendix 3.

Since 1978 an autonomous development of rice polders took place. Up to 1987 the area under rice cultivation increased from a few hundreds of hectares up to the present 5,650 ha (4,000 ha in the Coronie East Polder and 1,650 hectares in the Coronie West Polder).

Irrigation problems

Soon after the development of the rice polders it appeared that irrigation was a limiting factor for the second growing season (dry season) as the water level in the swamp and the swamp vegetation appreared to limit the flow of irrigation water towards the extraction points.

Recent economic and marketing problems

According to RON HAWKEY & PARTNERS (1992) and LAHMEYER et al (1993), in both the Coronie West and East polders, the areas sown with rice, cropping intensity and paddy production declined since 1985 for economic reasons. As main economic reasons are mentioned: shortage of machinery, spare parts and imputs as agrochemicals, lack of means to maintain irrigation and drainage systems which causes flooding during the rainy season and lack of irrigation water during the dry season. Between 1985 and 1993, the cultivated area of the Coronie East Polders again fell from 1655 to 1410 ha (which is only 35 % of the total area of 4000 ha), while in the same period, the sown area fell from 1065 to 624 ha and the harvested area from 1012 to 565 ha. The total paddy production decreased from 4100 tons to 1925 tons/year while the average yield/ha fell from 4.1 tons to 3.5 tons.

Use of agrochemicals

To give an impression of the use of agrochemicals (persticides and fertilizers) in Surinamese rice fields, Table 6 (below) shows the amounts per crop per ha per year: Lacking data from Coronie, figures are presented from two other rice areas in Suriname: the Saramacca - Lareco and Saramacca - Jarikabe rice areas (both located in the Saramacca District).

TABLE 6: USE OF AGROCHEMICALS IN RICE FIELDS (SURINAME) PER CROP PER HA PER YEAR		
AGROCHEMICALS	**Saramacca - Right Bank area**	**Saramacca - Jarikaba area**
Fertilizers		
Urea 45%	300 kg/ha	220 kg/ha
TSP 40%P	-	40 kg/ha
Pesticides		
	Molluscicides	
Brestan	0.5 l/ha	2.0 l/ha
	Insecticides	
Propanil	0.5 l/ha	-
Azodrin	0.3 l/ha	-
Monocrotophos	-	1.0 l/ha
	Herbicides	
Grammoxone	1.0 l/ha	
Karate	0.3 l/ha	0.2 l/ha
2-4D Amine	0.4 l/ha	0.75-1.0 l/ha
Propanamide	-	2.0 -4.0 l/ha
Roundup	-	1.0 /trench

Source: LAHMEYER et al, 1993.

b. Dry crop farming and animal husbandry

Since cocos became an important crop, several farmers in Coronie are involved in pig breeding, feeding pigs on copra cake. Nowadays, most Coronie farms (usually 20 ha) are mixed dry crop farms associated with animal husbandry (cattle, pigs and poultry) as well as vegetable and fruit production. There are also several smaller vegetable farms ranging from 1 to 5 ha. The vegetable farms are presently not irrigated but producers wish to have access to fresh water for irrigation from the swamps. However, the pesticides-contaminated water from rice field drains cannot be used (LAHMEYER et al, 1993).

Due to the shortage of irrigation water and the economical decline, recently, several rice farmers changed to extensive cattle breeding.

3.4.4 Beekeeping

Compared to other coastal areas, Coronie was and still is very favorable for beekeeping. Forests of black mangrove or "parwa" (*Avicennia germinans*), with bee pollinated flowers are situated close to the populated, ribbon builded East-West Connection Road. Next to this the black-mangove forests are very accessable by (former) plantation dams. Other common bee pollinated plants in the Coronie area are: cocos (*Cocos nucifera*), rice (*Oryza sativa*), “kankantri” (*Ceiba pentandra*), “jamun” (*Syzygium cumini*) and *Citrus* trees, as well as freshwater swamp trees such as: “watrabebe” (*Pterocarpus officinalis*), “mira-udu” (*Triplaris surinamensis*), and “nyamsi-udu” (*Ilex jenmanii*).

In the Coronie District, traditionally several species of stingless bees ("blaka" and "redi oni") of the genus *Melipona* were exploited for honey production.

Since the early thirties, the stinged Italian honeybee (*Apis melifera*) was introduced and honey production increased up to 1953 (top year). Between 1953 and 1983 beekeeping declined for several reasons: (1) alternative job opportunities, (2) competition (import allowed since 1965), and since 1975 (3) the arrival of the hybrid Italian-African honey bees from Brazil ("brazilian killer bees" or "africanized honey bees" or "AHB's"): *Apis melifera, var. sutifera*). In 1982, when little was left over of the industry, a beekeeping promotion project was started in Coronie. After promising pilot results, a nation wide promotion program was started. The result was the estabishment of the "Parwa Beekeepers Cooperation". In the entire coastal region, the number of hives increased from 290 (1983) to 1750 (1988). However, because of the following economical crisis (lack of supplies and lack of credits for beginning beekeepers) beekeeping again declined, also in Coronie. The beekeeping extension service "Oni Masange" is still based at Soemberredjo near Totness.

Table 6 shows the growth and decline of the beekeeping industry in Suriname

TABEL 6: BEEKEEPING IN SURINAME 1948 - 1998

Year	Number of beekeepers	Number of hives	Production x 1000 kg	Export x 1000 kg
1948	99	3340	100	60
1953	?	?	?	150
1965	?	?	?	import
1975	50	910	?	import
1977	55	842	?	import
1979	32	391	?	import
1982	19	294	?	import
1984	29	516	?	import
1985	50	977	?	import
1988	50	1750	20	import
1994	36	1016	12	import
1998	?	?	?	import

Sources: Beerlink 1985, 1986

3.4.5 Hunting

Hunting is a common practice along the Coronie coast. Some illegal hunting takes place, particularly on scarlet ibises and shore birds (Scott & Carbonell, 1988). The prevention of poaching is limited because of lack of means of transport, personpower and funds.

3.4.6 Oil exploration

Two bore holes have been drilled respectively at Totness and at Burnside, without any oil indication. Offshore, three bore holes have been drilled on the Continental Flat at depths between 15 and 50 m, all indicating the presence of oil. The results so far are encouraging and the Surinamese State Oil Company will continue exploration in this zone (Jharap, 1988).

3.4.7 Salt works

Because of the dry climate along the Coronie coast, saltwork were already established during colonial times but were of minor importance to the economy. Also recently (1988-1992) salt work activities have been tried again in the Totness Polder (Coronie Salt Works). Due to coastal erosion, water intake became a problem and the salt works are abondoned now.

3.4.8 Excavation of shells

South of the Coronie Road, between Km 93 and 96, the NV GRASSALCO is excavating shells and sand from ridges.

3.4.9 Tourism and recreation

(Eco)tourists staying overnight in Coronie usually pay visits to the coast (birdwatching), cocos plantations and the freshwater swamps (sport fishing).

Some Coronie buildings are examples of fine Surinamese architecture, such as (from east to west) the:
- EBG church at Hamilton (not dated)
- RK church at Welgelegen (1883)
- RK church at Mary's Hope (1892) build by Father Harmes (also the architecture of the Kathedral in Paramaribo)
- EBG (Moravian Brotherhood) church at Totness
- Government's guesthouse at Totness (former house of commerce of C. Kersten & Co),
- Residence of the District Major at Friendship (1860)
- EBG church (Salem church) at plantation Clyde (1840)
- RK (Roman Catholic) church at Burnside (1869)
- traditional houses mainly at Totness and Friendship

At Totness, a statue of Tata Colin was erected. This former slave from the plantation Leasowes planned a revolt in 1836 (see Helman, A. 1995).

3.5 Worldwide climate change and ocean pollution

In the above paragraphs, processes and activities have been described that (may) have (had) an impact on the ecosytems of the North Coronie area. These processes and activities were described from the North Coronie area itself as well as of its uptream land and sea areas. These processe and activities included: extremely dry periods, coastal changes, soil ripening and soil subsidence (see 3.1), vegetation succession and fires, fauna succesion and mirfration of birds and marine life (see 3.2), demographic changes and land allocation (see 3.3), and all kinds of human activities (3.4). Next to these local (internal) and regional (external) environmental factors, also worldwide

factors may have an impact on the ecosystems of the Nort Coronie area, such as worldwide ocean pollution and climate change / sea level rise.

3.5.1 Activities causing worldwide ocean pollution

Worldwide ocean pollution is caused by:

- land-based sources of pollution such as effluents of agriculture, and urban and industrial areas and

- ocean-based sources of pollution such as oil spills, dumping of ship-generated waste and hazardous materials as well as offshore incineration of hazardous waste.

3.5.2 Activities causing worldwide climate change

Whether climate change is caused by the increasing production of greenhouse gasses (and as such "human-induced") or not (and therefore "natural"), worldwide concern is growing on the possibilities and consequences of climate change (global warming) and subsequent sea-level rise

The concern led among others to the 1994 UN Framework Convention on Climate Change (UNFCCC). The ongoing project: Country Study Climate Change Suriname includes a Vulnerability Assessment for the coastal area of Suriname in case of climate change and sealevel rise.

4 NATURE CONSERVATION

4.1 Natural resource management

Since 1947, the Government of Suriname is working in the area of nature conservation and natural resource management. The Timber Law (GB 1947, No 42), the Game Law (GB 1954, No 25), the Nature Preservation Law (GB 1954, No 26), the Fish Protection Law (GB 1961, No 44), the Law on Sea Fisheries (SB 1981, No 158), and the Law on Forest Management (SB 1992, No 80, replacing the 1947 Timber Law), and laws on the environmental aspects of agriculture, mining and oil extraction, all with numerous resolutions and amendments, provide up to now for the management of forests, land fauna and aquatic resources including those of the coastal zone and the atlantic ocean.

In 1966 by Resolution (GB 59, 1966) two nature reserves were established along the coast: the Wia Wia Nature Reserve and the Coppename-monding Nature Reserve, followed in 1969 by the Galibi Nature Reserve (GB 47, 1969) and in 1972 by the Hertenrits Nature Reserve (GB 22, 1972). As for all nature reserves, they were established for the purpose of research, education and tourism.

4.2 Coastal changes and nature conservation

As a result of research / monitoring programs (Augustinus, 1978, 1983, Augustinus et al, 1989; Westerink, 1989), coastal changes became better understood, also in relation to nature conservation. Coastal changes has been described in 3.1.3 and vegetation and fauna dynamics in 3.2.1 and 3.2.4.

Young mangrove forests are the favorite nesting places for scarlet ibises and for most species of herons. Young mangrove forest become mature while new ones establish elswhere. Natural changes in the hydrology and water quality of the coastal wetlands may improve or worsen the quality of the feeding grounds of coastal birds which frequently have to move to new feeding areas and nesting sites. The nature reserve Coppename-monding was established in 1966. Due to coastal changes in that same year, its breeding colony of scarlet ibises moved to the "unprotected" Gandoe bank-area outside (east of) the nature reserve (ffrench and Haverschmidt, 1970). Sand beaches, the nesting sites for sea turtles, are moving westward along the coast. The Wia Wia Nature Reserve (established in 1961) was extended westward in 1966 because at that time its turtles beaches had been moved out of the reserve. Already in 1973, the turtle beaches again had passed the western boundary of the extended reserve.

So, soon after the establishment of the first coastal reserves, it became already clear that nature conservation along the very dynamic coast of Suriname is not adequate by establishing reserves with fixed boundaries: sooner or later vulnerable populations move to unprotected areas as a result of the changing shoreline.

4.3 Management research

In order to develop a coastal management system for the entire estuarine zone, research / monitoring programmes have been carried out since the early seventies, focussing the biological functioning and natural production of estuarine ecosystems (Panday-Verheuvel, 1976; Reseda 1985, Swennen et al, 1982); the flora and vegetation (Sterringa, 1971; Pons, 1972; Julen, 1974; Teunissen, 1978a, 1978b, 1980); on sea turtles (Schulz, 1975, 1980; Reichart & Fretey, 1993), coastal birds (de Vries 1966, Haverschmidt, 1967, Spaans 1974, 1975a and 1975b, 1978a, 1978b, 1984; De Jong, Spaans & Held, 1984; Swennen & Spaans, 1985) and fish resources (Engel, 1981; Charlier, 1988).

Most research programmes were carried out, supervised and coordinated by the Nature Conservation Division (NB) of the Suriname Forest Service (LBB) and by the Foundation for Nature Preservation in Suriname (STINASU) in co-operation with the Fishery Division (VD) of the Ministry of Agriculture, Animal Husbandry and Fisheries (LVV), the Hydraulic Research Division (WLA) of the Ministry of Public Works (OW), the University of Suriname and several regional and international research organisations.

4.4 Environmental impacts of development projects

Next to management research, also studies of the environmental impacts of development projects added to the knowledge of the functioning of estuarine ecosystems. These studies focussed on: (1) construction of drainage diversion dams (ILACO et al, 1976; Teunissen, 1976; HASKONING et al, 1993); road construction (Teunissen, 1973; Sevenhuijsen, 1984; Buijs, 1985; Lubbers et al, 1985; Van der Steege, 1985); polder construction (De Jong, 1982) and others (Pareyn, 1985; Teunissen, 1995).

4.5 Towards MUMA's

New opportunities for nature conservation and the sustainable use of coastal ecosystems came with the (not yet operational) Planning Law of 1973 (GB No 89). This law opens the possibility to establish Special Management Areas "Bijzondere Beheersgebieden") which are defined as "areas where integrated management by or on behalf of the Government is needed for a rational use of its natural resources", which includes the conservation of the protective and productive functions of vulnerable ecosystems. Then the idea was born to create "Special Management Areas" along the entire coast and to design management plans for integrated coastal management, also to the benefit of nature conservation.

In 1974 the initiative to convince the Government of the need to establish a "Special Management Areas" along the entire Surinamese coast, was taken by the Suriname Forest Service (LBB). Under the umbrella of the Nature Conservation Division (NB), an ad-hoc inter-departmental working group was formed. The working group consisted of representatives of the Nature Conservation Division (NB), the Foundation for Nature Preservation in Suriname (STINASU),

the Department of Fisheries (VD) and the National Planning Office (SPS). The proposal-report "Establishment Special Management Area Coastal Zone" (WERKGROEP ESTUARIENE KUSTSTROOK, 1976) was presented to the Minister of Natural Resources. In 1981, the issue was again brought to the attention of the Minister (Baal, 1981).

Since the Planning Law of 1973 didn't become operational, the establishment of "Special Management Areas" was not possible. New possibilities to create management areas were created by the "1982 Decree L-2 on the Issuance of State-proparty Lands" (SB 1982, No 11). In December 1987 the Minister of natural Resources (after approval by the the Board of Ministers) placed 684 sq km of coastal state-property lands along the Nickerie and western Coronie coast at the disposal of the Ministry of NH to manage that area as a Multiple-Use Management Area (MUMA) in the sense of a Special Management Area as defined in the Planning Law 1973. The Suriname Forest Service was appointed as the Management Authority of that MUMA which became known as the Bigi Pan MUMA. By doing so, it is possible to urge owners of surrounding lands to manage their lands and waters in a way that does not conflict with the management objectives of the Bigi Pan wetlands. Water extraction from the Bigi Pan area is no longer allowed and also draining into the Bigi Pan areas is since then prohibited.

4.6 Importance of the North Coronie area

According to De Jong, Spaans & Held (1984), the North Coronie area meets more than one of the Ramsar criteria for being a "Wetland of International Importance" such as:

- the area is a good representative example of the mangrove zone of the biogeographical coastal region between the Amazon and Orinoco river mouth;
- the area is important as spawning ground and nursery area for Atlantic food fish and shrimp.
- the area regularly supports over 20.000 waterfowl: in Coronie North over 300.000 individuals;
- the area regularly supports over 10.000 individuals and/or over 1% of the biogeographical population: in Coronie North this is true for 7 species of water fowl.

4.7 Threats in the North Coronie area

Since 1957, the seaside parts of several plantations along the Coronie coast got lost because of coastal erosion. As a compensation, the existing plantation areas were extended southward to develop large-scale rice culture along the northern edge of the Coronie Swamp.

Impact studies of rice pesticides on the fauna of rice field surrounding and downstream wetlands (Vermeer et al, 1974; Spaans, 1982; Fyffe, De Jong and Mohadin, unpublished report; Van der Steege, 1988; Zekhuis, 1992 and Hicklin & Spaans, 1993) decribe former and current threats.

Recently new rice polder developments were initiated at both sides of the East-West Connection Road (section Coronie Road between Jenny and Ingikondre).

4.8 Towards a North Coronie MUMA

In 1997 the Suriname Forest Service and its Nature Conservation Division submitted a request for the funding of the "Preparation for the development of a rational management system for the North Coronie Wetlands" to the Ramsar Convention's Small Grants Fund, which request was granted.

PART II:

EVALUATION AND OBJECTIVES

1 EVALUATION

The evaluation concerns the major features of the North Coronie area as described in Part I. In case data are not available specifically for the Coronie area, the evaluation is made for the entire coastal zone, including North Coronie.

1.1 Size and position coastal wetland zone

The North Coronie area is bordered by the Atlantic Ocean in the north, the Burnside Drain in the west, and the Coppename River-mouth in the east. In the south-east, the area is connected to the Peruvia Nature Reserve. In he south-west the border is formed by the swamp retaining dikes of the Coronie rice polders. Between the Peruvia Nature Reserve and the Coronie rice polder, the boundary is formed by a line south and parallel to the Coronie Road. In case of future activities in the upstream Coronie Swamp, the southern border should be reconsidered.

Internal and external factors which may significantly influence or even prevent the achievement of long-term management objectives, are discussed in the next Chapter 3.

1.2 Biological diversity and typicalness

Compared to the Surinamese rain forest area, the biodiversity along the unstable coastline may be considered as rather low. On the other hand, the distribution of many species of waterfowl, fish and shellfish is confined to the relatively narrow coastal zone of Suriname (1% of the land area of Suriname).

The estuarine zone of the North Coronie area is a good example of the mangrove zone of the biogeographical coastal region between the Amazon river mouth and the Orinoco river mouth (Cintron-Molero, 1986). Between these river mouths, the coast of Suriname contains the most important feeding and nesting sites for residential coastal birds and the most important feeding grounds for migratory birds from the north (see Part I, 3.2.4).

1.3 Rarity and fragility

In the eighties, when the results of comprehensive studies of the coastal birds were evaluated in relation to the situation in the region and in the western hemisphere, it appeared that the coastal area of Suriname was of outstanding international importance (see Part I, Chapter 4).

Since the role and functions of coastal mangrove ecosystems became better understood, it also became clear the mangro forests (among others) depend on the undisturbed flow of freshwater supplied by upstream areas.

1.4 Social and economic values

1.4.1 Production of goods and services

The primary value of coastal vegetation, particularly of mangrove forests lies in the production of organic matter (leaf litter) which forms the basis of a complex foodweb. Biologically, mangrove forests belong to the most productive ecosystems in the world. Their productivity is related to the tidal action and the mixing of ocean and inland fresh waters, both providing the so-called estuarine zone with nutrients, organics, spawn and juvenile life. For this reason, estuarine ecosystems are particularly important as spawning and nursery grounds for marine fauna.

Seafood abundance is directly related to the extent of the local mangroves. Up to 90 % of marine fish and shrimp species are found in and near mangrove areas during one or more periods of their life cycle. Therefore, high production of seafood is found in nearshore habitats where small-scale fisheries are practiced: the shallow sea, the river estuaries, tidal creeks, lagoons and brackish swamps. These ecosystems provide the local market with foodfish, shrimp, honey and wildlife.

Also large-scale industrial sea fisheries (continental sea) benefit from the nursery function of estuarine ecosystems. In Suriname, sea fisheries products are mainly exported.

1.4.2 Coastal protection

Mangrove forest protects the coast and river estuaries against erosion, enhances sedimentation and stimulates coastal accretion.

Conversion of mangrove forest also means loss of free coastal protection. Recently, in the "Weg naar Zee" area (Paramaribo District), mangrove forest conversion (for agricultural purposes) resulted in severe coastal erosion and a significant loss of coastal land. Along the Coronie coast and at "Zeedijk" (Nickerie District) as well as along the entire east coast of the Republic of Guyana, costly construction and maintenance of sea defense works is required to substitute the mangrove forest.

Since 1948, the coast North Coronie has lost approximately 80 sq. km of land. This may have been stimulated by the human activities in the area, like large scale impoundments north of the East-west Connection road and by improvement of the drainage of the upstream Coronie Swamp.

1.5 Recreation, tourism, research

The coastal ecosystems of the North Coronie area may certainly become a more important source for outdoor recreation, nature tourism, and research.

2 LONG-TERM MANAGEMENT OBJECTIVES

In his handbook "Coastal ecosystem management, a technical manual for the conservation of coastal zone resources", Clark (1983) presents the "general environmental coastal management rules" in his chapters on the "coastal ecology and managing for optimum carrying capacity". As far as applicable to the Surinamese situation these management rules may be summarized as follows:

- the higher the degree of coastal and riverine shoreline development (including polders), the higher the reduction of the coastal zone's natural benefits;
- any alteration of the flow of tidal ocean water (including nutrients, organics and breed) in or to seaside drainage basins is presumed to be adverse and should be avoided;
- any alteration of the natural supply of fresh water (including nutrients and organics) to seaside drainage basins is presumed to be adverse and should be avoided;
- discharge of pathogens, excessive amounts of organic matter, low oxygen effluent and toxic substances into coastal and estuarine waters is adverse and should be avoided.

To these rules we may add:

- over-exploitation of natural resources such as by over-fishing, over-logging, and over-hunting and the disturbance of wildlife should be avoided.

The main long-term management objective for the coast of Suriname, including the North Coronie area, is to maintain the area's "optimum carrying capacity" by "wise use", which may include strict protection of certain areas as well as sustainable utilization of others.

For the mangrove zone and other wetlands north of the East-West Connection Road and the bordering shallow sea, wise use means optimizing its long term natural productivity and conservation. This can be achieved by preventing further land allocation and maintaining or enhancing the quantity, quality and diversity of its natural ecosystems and of the formerly cultivated and now abandoned estuarine areas.

For the area south of the road the specific management goal is to promote sustainable production (as of agriculture, animal husbandry and aquaculture), taking into consideration the demands of the downstream estuarine ecosystems.

3 FACTORS INFLUENCING ACHIEVEMENT OF LONG-TERM MANAGEMENT

OBJECTIVES

In Part I (Area Description), human activities and natural forces in the North Coronie area and surroundings are presented. These activities and processes have been summarized in Appendix 4.

In this chapter, the actual and potential negative impacts of these human activities and processes will be discussed as far as they may prevent the full achievement of the long-term management objectives. Next to this, also other factors which may hinder the achievement will be discussed such as accessibility, legislative and institutional limitations and availability of financial and human resources.

3.1 Human activities

3.1.1 Shipping and navigation

a. (Potential) accidents with oil tankers

In 1976 Suriname became a contracting party of the 1959 "Convention on the High Seas" and of the 1969 "International Convention relating to Intervention on the High Seas in cases of Oil Pollution Casualties.

b. (Potential) pollution by hazardous material and ship generated waste

Governments in the Wider Caribbean have been approached by private enterprises getting permit to dump or incinerate hazardous waste materials in their territorial waters. As far as traceable Suriname was never approached. The territorial waters of Suriname (up to 12 miles or ca 22 km offshore) are very shallow (< 25 m), the ocean floor consists of soft mud and is intensively fished by fish and shrimp trawlers.

Dumping of hazardous waste by vessels of international registry has never been reported. Suriname (400,000 inhabitants) is producing minor quantities of toxic and/or radiological material. Information about possible dumping at sea has not been found.

In 1980 Suriname became a contracting party of the 1972 "London Dumping Convention", followed in 1988 by entering the 1973/1978 International Convention for Prevention of Pollution from Ships (MARPOL). MARPOL and its five annexes is covering the various sources of ship-generated pollution, and is designed to preserve the marine environment worldwide by preventing and reducing pollution from ships at sea and at rivers. In 1993, the Wider Caribbean Region was designated as a "special area" under MARPOL Annex V. With this designation, strict regulations controlling the discharge of garbage from ships will become applicable in the Wider Caribbean Region.

Although Suriname did not yet enter the 1983 Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region (CARTAGENA CONVENTION), Suriname is already participating in the convention's Caribbean Environmental Programme (CEP). The Protocols of the Cartagena Convention deal among others with the cooperation in combating oil spills in the Wider Caribbean region.

3.1.2 Fisheries

a. Over-fishing the continental sea zone > 6 m

Just as the destruction of near-coastal and onshore nursery grounds may have a negative impact on the shrimp and fish populations of the continental sea, also the unlimited harvesting of aquatic resources of the continental sea will certainly have a negative impacts on the shrimp and fish populations of the nursery grounds and on the birdlife of the North Coronie area.

In Suriname, shrimp trawler licences are issued unlimited. In 1993, 187 requests for licences for shrimp trawling were granted. In 1988, 2,690 tons of shrimps were brought ashore (Charlier, 1988). However, in the last decade catches decreased to about 1,500 tons in 1994 and 1000 tons in 1998. This trend indicates that shrimp is over-fished (Tjon and Dwarkasing, 1990; Anonymus 1995b, Daan, 1999).

In the absence of an adequate Coast Guard (now being established) , surveillance at sea is still insufficient which stimulates illegal fishing.

b. By-catch of shrimp trawling

During shrimp trawling a very high percentage of 'by-catch' is brought on board (up to 60 tons/day/trawler). For a catch of 30 kg of shrimps, about 1 ton of dead fish is dumped overboard. Reasons to bring ashore only shrimps are the high cost of fishing trips, the limited amount of storage capacity of trawlers, the high value of shrimps and the relatively low price of fish. An ocean trip is therefore only feasible, if all storage capacity is used for shrimp.

c. Shallow sea fish trawling with shrimp nets

In the shallow sea zone the abundance of breed of fish and shrimp indicates the presence of spawn and nursery grounds. Fishing by trawlers with fine-mesh (shrimp)nets in the shallow coastal waters endangers the small-scale commercial driftnet and banknet fisheries.

d. Estuary trapnet fishing

In the estuaries (as well as in the shallow sea and mangrove forests) abundant spawn and juveniles of shrimp (post-larvae) and fish is found, which indicates the presence of spawn and nursery grounds for the marine fauna. Trapnet fishing focuses on shrimp and fishes migrating from the estuarine zone towards the ocean. This may have a negative impact on the shrimp and fish harvest at sea.

According to the (draft) Fisheries Act, each year a Fisheries Management Plan has to be produced to set quota and principles for concessions based on monitoring data of commercial fish and shrimp stocks and inventories of their nursery grounds. Yearly management plans better guarantee sustainable use of fish and shrimp stocks than the current fisheries legislation (Sea Fisheries Decree C-14, 1980). The (draft) Fisheries Act will be applicable to all Surinamese waters, including the shallow sea, estuaries and rivers, lagoons and swamps.

e. Drowning of sea turtles and coastal mammals

Sea turtles may not escape from shrimp trawls, driftnets and banknets. Mortality levels are high but unquantified (Reichart and Fretey, 1993). Static nets in estuaries have proven to be fatal to dolphins and manatees (Husson, 1978; Duplaix and Reichart, 1978; De Smet, 1990). Mortality levels are not quantified.

To prevent the entanglement of sea turtles in shrimp nets, the Fisheries Resolution 1992 (SB 1992 No 66) prescribes the use of Turtle Excluder Devices (TED's), but this resolution was never enforced until May 1999, when the USA-Government prohibited the import of shrimps from Suriname (Anomtaroeno, 1999).

3.1.3 Agriculture

a. (Former) mangrove deforestation

Impoundment followed by clearing of coastal mangrove forests during colonial times may have stimulated subsidence and coastal erosion: many near-shore plantations in the districts of Nickerie, Coronie and Commewijne washed away. See 1.4.2.

Between 1948 and 1992, along the uninhabited Coronie coast west of the Coppename river (near Coppename Bank) about 8 sq km of new land was formed by coastal accretion. During the same period, in the impounded, deforested and subsidenced clay area between Ingikondre and Burnside, approximately 80 sq km of (polder) land got lost by coastal erosion (NARENA, 1998).

b. Drainage canals to the sea

The almost uninterrupted bundle of Coronie ridges between Ingikondre and Burnside have always minimized the drainage of the Coronie Swamp in northern direction. Only a small number of narrow creeks pass the ridge bundle and provide the mangrove belt with (essential!) fresh water. Lack of fresh water may explain why the mangrove belt of Coronie is rather narrow, not very well developed and rather vulnerable to coastal erosion.

Since the seventies, the fresh water supply of the mangrove belt was further minimized: the small creeks, once mixing with seawater in the northern swamps and mangrove forest were canalized or replaced by 12 south-north running drains crossing the ridges and underneath the East West Connection Road, draining Coronie Swamp (and rice field) water directly into the sea.

c. Pesticide use

The use of large quantities of pesticides is particularly characteristic for the rice and banana sub-sectors.

Much of the spraying is done from airplanes using highly concentrated Ultra-Low Volume (ULV) applications. If there is any wind, the spray has a tendency to drift to neighboring areas not intended to be sprayed such as built-up areas, settlements, dry crop farmland, cattle ranges and wetlands. Next to this, waterfowl from neighboring wetlands also feed in rice fields and contaminated irrigation water is drained into the estuarine zone and shallow sea.

Such practices have already been affected the estuarine fish and wildlife of the lower Nickerie River, the Bigi Pan and the Hertenrits area as described by Vermeer et al (1974), Dintheer et al (1985), Fyfe et al (mnscr), Van der Steege (1988), Zekhuis (1992), Hicklin and Spaans (1993) and Spaans (in press). Residues of pesticides were found in mammals, birds, caimans and fish, and consequently they may be expected to be found in humans. For the North Coronie area, such studies has never been carried out.

Formerly, farmers on the Coronie ridges used to irrigate their crops with Coronie Swamp water from creeks and canals that cross the ridges. Cattle used creek water for drinking. Swamp fishes were safe to eat. Since rice polders were constructed south of the Coronie ridges, the drains are contaminated with agrochemicals including pesticides.

Pesticides can be rather “safe” but not in all cases the quantity and quality of the applied pesticides is according to standard. Many people in Suriname wonder if it is safe to eat fish and vegetables of certain areas or farms near rice field.

The Pesticide Act of 1972 is of high quality, but the executive resolutions still await approval by Parliament. BUURSINK (1998), an international consultancy for natural resource management and environmental assessment, identified issues which are not yet covered by the existing and already drafted pesticide legislation such as:

- on the licensing and regulation of aerial spraying (praying during windy hours and "cleaning" of pesticide tanks while in the air)
- creation of safety zones to protect habitations from aerial spraying;
- third party certification of imported chemicals to ensure quality control and correct labeling;
- formulation of pesticide residue standards;
- banning of the importation of expired chemicals; and
- formulation of rules and procedures for the disposal of expired, unwanted and dangerous chemicals.

The import of pesticides needs approval by the Ministry of Trade and Industry (HI) which strictly follows the advise of the Pesticide Department of the Ministry of LVV. In this way all chemicals listed in the annually revised FAO list of prohibited chemicals are already banned.

With regard to pesticides, BUURSINK (1998) recommends to:

- draft pesticide regulations not yet addressed in the existing or pending pesticide legislation;
- facilitate the approval of all drafted resolutions;
- strengthen the LVV Department of Pesticides; and
- establish a pesticide and consumer product quality laboratory

The consultant also designed a project for the improvement of agricultural extension services which includes information services in relation to pesticide use.

d. Improving the irrigation capacity of the Coronie Swamp

Because of the disappointing irrrigation capacity of the Coronie Swamp (see Part I.3.4.3), on request of the Ministry of LVV & B, a preliminary study of the hydrology of the Coronie Swamp was sponsered by the European Development Fund and executed by Abrahams (1988). The study mentions several options such as minimizing the resistance of the swamp vegetation by the construction of collector drains (extraction canals), the construction of a drainage diversion dam (raising the existing southern retaining dam), and the construction of a waduk. Abrahams (1988) recommended a comprehensive study of the hydrology of the Coronie Swamp to get a better understanding of its behaviour and its potential irrigation capacity.

On request of the Government of Suriname (National Planning Office and the Ministry of LVV) an evaluation of the Coronie West Polder was executed by RON HAWKEY & PARTNERS (1992). Also this evaluation ascertained the need of a swamp study to obtain a better understanding of the hydrological behaviour of the swamp and to fix its irrigation capacity as well as to evaluate the possible consequences of rice culture on the swamp itself and on the downstream estuarine coastal zone, taking into account the water quantity and quality.
However, a swamp study has never been carried out due to lack of funds and person power.

Then, the Government of Suriname requested a feasibility study for the improvement of several polder (sub)areas in Suriname among which the Coronie-East Polder. The feasibility study, carried out by LAHMEYER et al (1993) recommended minor reconstruction of the existing eastern swamp retaining dam and the construction of a impounded water reservoir ("waduk") south of this dam. The proposed waduk dike should run from the eastern end of the 14.5 km long retaining dam up to a ridge 5.7 km to the south, from there the dike should follow the alignment of this ridge up to its western end over a distance of 10.2 km. From the end of the ridge an 8.7 km long dike should run in a NW direction up to the Lareco Polder (see Map 6). The total surface area of such a waduk would be approximately 90 sq km, while the net volume available for irrigation would then be approximately 90 million cubic meters. This volume should meet the requirements for irrigation of both the Coronie East and West Polders, allowing also the expansion of the rice polders in the future. In order to improve the extraction of water from the shallow waduk towards the polder inlets, a series of collector drains should be excavated through the waduk swamp vegetation. By means of two projected outlets (sluices) the water level of the waduk could be set according to water demand and excess water could be spilled downstream.

According to studies of vegetation changes along the Eastern Nani drainage diversion dam (Teunissen, 1976) and along the MCP Canal (Playfair, 1992; HASKONING, 1993 and Van Maren, 1994), any woody swamp vegetation will certainly drown in case of water level rise. This is also true for the "watrabebe" swamp wood and "morosi" palm swamp forests in the projected (90 sq. km) Coronie waduk area.

e. Improving the drainage of the rice Coronie areas

During dry seasons, the waterlocks of the existing rice polder drains are kept closed to prevent seawater to enter the ridge and rice polder area. Once locked, in the seaside part of the canal, seawater is going up and down, more than in and out. Each high tide every cub.m. of seawater brings in 1 kg of silt to settle. For that reason, the seaside part of the drainage canals soon silt up. As removal of this silt is costly, there is a lack of maintenance. In the rainy season gravity draining becomes impossible, resulting in flooding of upstream areas.

Abrahams (1988) recommends to excavate one large east-west drainage canal along the soutern edge of the ridge bundle which should be connected to the Burnside Drain. LAHMEYER et al (1993) recommends to improve the existing drainage system by deepening and widening all existing drainage canals. To improve agriculture on the Coronie ridges, LAHMEYER recommends separate irrigation canals for the ridges, running parallel to the existing irrigation and drainage canals which serve the rice areas.

The minimum (polder infrastucture) rehabilitation program for the Coronie-West Polder as recommended by RON HAWKEY & PARTNERS was calculated at ECU 331,000; the swamp study at ECU 660,000. No funds were found for these projects.

The minimum rehabilitation project for the Coronie-East Polder area as recommended by LAHMEYER et al, was calculated at 6.3 million USD. However, the economic evaluation of the study concluded that rehabilitation "will certainly be profitable for the individual point of view of rice growers, but the use of public funds for the project cannot be justified as answering any objective of national interest".

f. Future of the rice sector in Suriname

According to BUURSINK (1998) the major constraints with respect to the further expansion of rice polders are structural:

- the most important trend in the world economy affecting Suriname's rice sector is the phasing out of the European Union trade preferences for agricultural goods including rice. Loss of these trade preferences will likely cause the price received by Surinamese rice export producers to decline sharply. It is estimated that the price received by rice farmers will fall by nearly 50% by the year 2009. Other problems addressed are:

- rice production costs in Suriname are high by world standards as heavy mechanization has to compensate for the scarcity of agricultural labor;

- lack of sufficient irrigation water in most rice areas (including in the Coronie District);

- due to the recent economic recession in Suriname interest rates of the banks are still very high, the creditworthiness of the farmers has decreased to such an extend that most have no access to further loans, while the properties of others has been confiscated by the bank;

- the present state of organization of the agricultural productions reveals signs of technical obsolesce and structural retardation;

- the weak structure of the Ministry of LVV: the agricultural statistics are only recorded to a limited extent. The extension services are only symbolic and other activities very limited. Due to low salaries most region and resort staff members have second occupation, very often in agriculture;

- the main farmer's cooperatives and interest groups are politically and/or ethnically influenced.

According to LAHMEYER et al (1993) in Coronie (Ingikondre - Burnside) the situation is even more complex:

- only limited authority that can be exercised upon the land by the individual landusers, as most of the presently utilized farmlands constitute part of collectively allodial (undivided) properties which make land ownership diffuse;

- the majority of the economically active labour force in smallholdings, seems also to be employed by the Government. The importance (dependence) of income from agricultural production is not clear;

- the main farmer's cooperatives and interst groups are politically and/or etnically influenced. CBB in Coronie was founded under Government guidance for the development of rice polders and LACOCO was immediatly founded as a rival cooperative, motivated by local political positions and conflicts. Etnically speaking, most interest groups are creole, others pure javanese, only a fews are mixed. Few groups seem to be healthy, showing good results. Most are facing serious problems;

- the present state of organization of the agricultural productions reveals signs of technical obsolency and structural retardation.

For all these reasons, for the near future, the government policy should be to increase agricultural production through elimination of the above mentioned limiting production factors, and stimulation of the rehabilitation of the existing infrastructure rather than through expanding the present production area.

It seems likely that in the Coronie rice production rice will (further) decline over the next decade and intermediate term and may stabilize at a level much smaller than the present area.

However, new agricultural developments, particularly the expansion of rice polders by the few who still have access to land and inputs are still going on: south of the East-West Connection Road between Burnside and Wageningen (outside the North Coronie area) and on both sides of the East-West Connection Road between Ingikondre and Jenny (See part I 3.3.4).

Further polder expansion along this road will certainly lead to:

- changes in the water hydrology of upstream areas;
- increasing use of agrochemicals;
- destruction of the soil structure, leaving limiting options for other alternative landuse in the future in case the rice sector will collapse.

3.1.4 Recreation

Ecotourism, hunting and poaching, air-boats and low-flying airplanes may disturb wildlife, especially roosting and breeding colonies of coastal birds.

3.2 Natural processes

3.3.1 Coastal changes

The impacts of coastal changes on nature conservation have been described in Part I, 4.3.

3.2.2 Vegetation dynamics

Vegetation dynamics are described in Part I, Paragraph 3.2.1. In general, vegetation succession increases biodiversity. Vegetation degradation/destruction by coastal changes, soil subsidence, grass and peat lead to a decrease of biodiversity. On the other hand, such destructive forces may create open water areas and deeper swamps, which does not dry up during dry seasons. Such new wetlands may be favorable for wanted waterfowl.

3.3 Human activities and natural processes outside Suriname

3.3.1 Regional climate fluctuations

Regional climate fluctuations, especially prolonged or severe dry seasons may cause salinization of inland wetlands or may cause wetlands to dry up, having a negative impact on the natural production of mangrove forests, on estuary, lagoon and swamp fisheries and forces waterfowl to feed in rice areas.

3.3.2 Global warming and sea level rise

It is predictable that sea-level rise will result in impacts on natural ecosystems, polder areas and economic activities all Surinamese lowland areas (Fung 1993; Amatali and Baldew 1994).

One of the commitments made by international organizations and individual developed countries signing the United Nations Framework Convention on Climate Change (UNFCCC) in Rio de Janeiro, has been to promote and support so-called "country studies". The Dutch Government has offered assistance in the execution of country studies in 10 developing countries. On request of the Government of Suriname, a Dutch formulation mission was fielded from 24 July to 7 August 1995, which resulted in the Draft Mission Report and Draft Project Document, both issued in September 1995 (Resource Analysis, 1995). In 1997 a second formulation mission finalized the Project Document and in the same year Suriname commenced to design its Climate Change Country Study, consisting of a Description of the Coastal Profile, a Vulnerability Assessment and an Inventory of Greenhouse Gas Emissions.

In January 1998, Suriname became party of the Climate Change Convention.

As scheduled, the results of ongoing the Climate Change Country Study will become available in mid 1999. The identified impacts of sealevel rise for the North Coronie area should be included in the 1999 review of this management plan.

3.3.3 Ocean pollution

Ocean pollution outside Surinamese waters may lead to the pollution of Surinamese waters.

3.4 Factors arising from insufficient land use planning and intransparant land allocation procedures

Many the above mentioned human-induced factors that may influence the achievement of long-term management objectives could have been and can be prevented by proper land use (resource) planning.

The Ministry of Planning and Development Cooperation (PLOS) is in charge of the preparation of the national development planning and the integration of sectoral and regional planning into the Multi-Annual Development Plan. The executive aspects of this task is assigned to the National Planning Office (SPS) of the Ministry of PLOS.

Already the Planning Act of 1973 announces the establishment of a pro-active form of inter-sectoral planning, through the establishment of a Planning Board, comprised of representatives of all Government planning departments. The Planning Act however, never came into force.

According to the 1992 Suriname Country report to the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Suriname (as many other developing countries) admits its lack of an overall national policy that deals with integrated land use planning and environmental management. In this Country Report it is also admitted that efforts at integrated land use planning and environmental management are "weakly conceived and uncoordinated". "Several ministries, departments, offices, committees and commissions are involved. The exchange of information and interactions within and between ministries is poor". This insufficient coordination of activities results in "reactive, ad hoc, piecemeal and inadequate development projects and programs" in which the environmental dimension does not get the proper attention.

Up to now most land use planning is still done on a sectoral basis. Individual ministries formulate their own plans, which are insufficiently coordinated by the Ministry of PLOS. At the moment, the SPS may invite representatives of several sectors to discuss planning issues on an ad-hoc basis, but there is still no official forum or process in Suriname to address inter-sectoral planning.

When planning is done primarily on a sectoral basis, consideration of the potential impacts of large-scale projects on other sectors and on the people and environment tend not to be an equal part of the planning process. Lack of inter-sectoral planning often results in problems, such as in case of:

- development of new irrigated agriculture in areas where the irrigation capacity of upstream waters is already fully utilized (Commewijne, Saramacca, Lower-Coesewijne, Coronie and Nickerie);

- construction of freshwater extraction canals, and/or polders (for rice, animal husbandry and oilfield development) and the construction of roads and dikes, in ocean drainage basins, interrupting the natural flow of freshwater towards the brackish nursery grounds for fish and shrimp (Commewijne, Saramacca, Coronie, Nickerie);

- development of rice fields with its heavy discharge of pesticides into and upstream of areas extremely sensitive for water quality: nursery grounds for fish and shrimp (along the entire coast) and upstream of areas destined for aquaculture (Commewijne)

- construction of poorly designed swamp roads, drainage diversion dams and swamp retaining dikes damming up swamp areas and killing upstream production swamp forests (Coronie, Nickerie);

- development of small-scale gold mining with its discharge of mercury into areas extremely sensitive for water quality: areas with subsistence and commercial fisheries and aquaculture (Marowijne, Commewijne, Suriname, and Saramacca River catchment areas).

Recently a number of new institutions are being developed which may become important tools to improve inter-sectoral land-use planning (including watershed management planning), such as the:

(1) Department of Natural Resources and Environmental Assessment (NARENA) of CELOS (University of Suriname) developing Ecological-Economic Zoning techniques supported by GIS;

(2) National Environment Council (NMR) and the Institute for Environment and Development of Suriname (NIMOS), see Part II, 4.2, and:

(3) -proposed- Institute for Soil and Land Information and Classification (ISLIC) of the Ministry of Natural Resources (NH).

However, none of these institutions is in the position to take decisions regarding inter-sectoral land use planning. The nascent NIMOS (see Part II, 3.5) has the advantage of being directly under the President, but the planning mandate of NIMOS is also limited to environmental planning, one of the aspects of inter-sectoral land use planning.

BUURSINK (1998), recommends that the Ministry of PLOS should take the lead in establishing a Planning Council and Resource Use Planning Unit, under the final responsibility of the President or Vice President. This structure should develop an inter-sectoral land use planning process and an institute to monitor and implement land use planning. See also Part II, 4.2.1.

BUURSINK (1998), also recommends that the Ministry of Natural Resources (NH) should take the lead, working closely together with the land use (resource) planning structure, to develop a simple and transparent land use zoning process which guides land allocations. NH should work closely together with the Ministry of LVV and other ministries and with enforcement agencies to ensure that the zoning ordinances and procedures are respected. NH's proposed ISLIC should be the key institute to improve the land allocation policy and process.

3.5 Factors arising from insufficient environmental planning and management including lack of environmental legislation

During seminars and workshops since 1985 (INTERDEPT.COMM. MILIEU-AANGELEGEN-HEDEN 1985; NATIONALE MILIEU-COMMISSIE 1990; WERKGROEP MILIEU EN DUURZAME ONTWIKKELING 1993; STUDINAME 1995; WERKGROEP NATIONAL ENVIRONMENTAL ACTION PLAN, IDPM, 1997; and the WERKGROEP BIODIVERSITEIT 1998 [1)] local environmental experts, discussed Suriname's environmental problems and designed policies, strategies and action plans to improve environmental management in Suriname.

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1) translations: Inter-departmental Commission Environmental Affairs, National Environmental Commission, Working Group Environment and Sustainable Development, Association of Surinamese Students (Studiname), Working Group National Environmental Action Plan, Working Group Biodiversity.

Insufficient environmental planning and the lack of environmental legislation has always been felt as a hinder to achieve proper environmental management. This, however, may change in the very near future as the required institutions are now being established.

a. The National Environment Council (NMR)

On June 9, 1997, by Presidential Decree PB 017/97, the President of the Republic of Suriname took the initiative to install a National Environment Council (NMR), an advisory council within the President's Cabinet. The NMR has the responsibility to advice the Government of Suriname with regard to the preparation and implementation of overall environmental policies and to guide the National Institute for Environment and Development of Suriname (NIMOS) in setting priorities for environmental action.

b. National Institute for Environment and Development of Suriname (NIMOS)

The President of Suriname invited the IADB to support the Government in the establishment and institutional strengthening of a National Institute for Environment and Development of Suriname (NIMOS). This invitation resulted in an IADB Environmental Management Technical Co-operation program. By State Resolution of the Council of Ministers (RVM) of 17 March 1998, NIMOS was established as an autonomous government entity (a "Foundation"). The General Director of NIMOS reports to the NMR. In May 1998, the Plan of Operation of NIMOS was approved by the Board of the IADB. Since May 1999, NIMOS has been operating with a General Director and a staff being trained by IADB contracted experts.

NIMOS is the operational arm of the National Enviromental Council and is the organization responsible for the preparation of national policy and legislation designed to protect the environment, and also to monitor compliance with national environmental laws and regulations. If necessary, NIMOS may be authorized to implement certain tasks with regard to environment and development.

The General Director of NIMOS implement his/her responsibilities through four Offices, one being the Director's and Administration Office, the other three being technical offices of a cross-sectoral nature: (1) Environmental and Social Assessments; (2) Legal Services and (3) Environmental Monitoring and Enforcement;.

c. The Inter-ministerial Advisory Commission (IMAC) of NIMOS
(currently being established)

The General Director of NIMOS will chair an Inter-ministerial Advisory Commission. NIMOS will collaborate with line ministries on the basis of Cooperation Agreements (Memoranda of Understanding (MOU's).

d. The Inter-ministerial EIA Commission of NIMOS
(currently being established)

The EIA Legislation is scheduled to be submitted to the National Assembly before the end of the year 2000. Until the environmental act is approved, NIMOS will start to work, via the Cooperation Agreement with a commission of Ministerial experts on the EA process. The commission will also consist of an outreach specialist or anthropologist/sociologist and the project proponent.

3.6 Factors arising from insufficient wetland management

According to the "Resolution Task Descriptions Departments" (SB 1991, No 58), currently many ministries (see Part II, Chapter 4) are responsible for certain aspects of management of coastal areas and other wetlands.

To implement an integrated management planning process, a high level inter-ministerial institute is needed.

An institute that should play an important future role in coastal zone management is the already existing Nature Preservation Commission (NBC). Based on GB 1954 no 26, this commission is appointed by the President and consists of high level representatives of the Ministry of Natural Resources (NH), the Ministry of Agriculture, Animal Husbandry and Fisheries (LVV) and the Ministry of Regional Development (RO). The NBC advises the Government with regard to nature conservation affaires, such as site selection and management of nature reserves and with regard to wildlife management. The NBC is already officialy appointed as the Scientific Authority for the Ramsar Convention, the CITES Convention and the Western Hemisphere Convention.

The recently established NIMOS may play a very important role in future coastal zone management as well.

In the Coastal Management Plan for the proposed Commewijne-Marowijne MUMA (Teunissen, 1997) it is recommended to establish a National Wetlands Commission (NWC) and a National Wetlands Management Authority (NWMA).

a. National Wetlands Commission (NWC)

This policy-making commission should consist of:

- representative(s) of the Nature Preservation Commission (NBC) or of the National Institute for Environment and Development of Suriname (NIMOS);
- high level representatives of the Ministries involved in the management of estuarine areas an other wetlands (PLOS, RO, NH, LVV, OW);
- representatives of the National Wetlands Management Authority (see below);
- representatives of relevant NGO's;
- users of marine/coastal and inland wetlands representing the fisheries, the agriculture and the mining and oil sector)

It should be considered to invite representatives of other ministries (with environmental tasks) on an ad-hoc basis.

The National Wetlands Commission (NWC) should be established as (1) a subcommittee of the Nature Preservation Commission (NBC), which is at present the Scientific Authority for the Ramsar Convention and the national advisory commission for nature conservation and wildlife management affairs, or (2) as a subcommittee ot the National Institute for Environment and Development of Suriname (NIMOS). RECOMMENDATONS TO THIS REGARD SHOULD COME FROM A NATIONAL DISCUSSION.

After reaching consensus within the National Wetlands Commission (NWC) on strategies and action plans, and after approval of such strategies and action plans by the Government, the NWC members, representing the involved ministries will give directions to their division managers (such as DOM, LBB, WLA, VD, DC's, SPS etc.) to implement management decisions.

b. National Wetlands Management Authority (NWMA)

The Head of LBB cq. Head NB should be the management authority responsible for the management of coastal MUMA's and other wetlands. The Management Authority should also be a member of the National Wetlands Commission. The Management Authority may present wetland management plans for approval to the Commission.

The Head of LBB cq. Head NB cq. MUMA Manager (see PART III, 2.3.1) will create for each MUMA an Area Wetlands Commision for the purpose of a structured consultation and cooperation with regards to the conservation, the sustainable ("wise") use and the management of each MUMA.

3.7 Accessibility

Between Jenny and Ingikondre, the North Coronie area is rather inaccessable. Accessability between Ingikondre and Burnside is much better especially between West Moy and Friendship, where polders are still in use: Cocos Polder, St Jozef Polder and Totness Polder. The northern polder area is attractive for eco-tourists but also for hunters and poachers.

Mudflats along the remaining coast prevent wardening during low tide. Mangrove forest grows on unripe (soft) mud and clouds of mosquito's prevent staying too long in the area.

3.8 Available resources

Due to the economic situation, (also) nature conservation faces a general lack of person power and budget:

- lack of qualified people, mainly caused by the very low government salaries, lack of financial incentives to stimulate fieldwork in remote and inhospitable areas;

- inadequate housing facilities in the field and lack of transport (vehicles, boats, outboard motors).

3.9 Summary of factors influencing achievement of long-term objectives

Summarizing, the following factors are (negatively) influencing or may potentially (p) negatively influence the achievement of the long-term management objectives:

a. Institutional and legal:

- insufficient environmentally sound inter-sectoral land use and resource planning and environmentally-sound land allocation criteria
- lack of environmental legislation and enforcement procedures
- lack of institutions to implement integrated wetland management
- insufficient person power and budget for nature conservation and management.

b. Human-induced factors (arranged from north to south):

- global warming and sea level rise (p)
- ocean-based water pollution: oil, hazardous waste and garbage from the ocean (p)[1)]
- over-exploitation of shrimp resources
- vegetation, peat and litter fires
- land-based water pollution with pesticides
- area drained by canals running straight into the sea
- ongoing rice polder expansion (despite lack of irrigation water) and the uncertain future of the rice sector

- "undivided" properties between Ingikondre and Burnside and the fact that "the main farmers cooperatives and interest groups are politically and/or etnically influenced and motivated by local political positions and conflicts" will make it difficult to motivate the local communities to cooperate in coastal management.

4 IDENTIFICATION OF IMPLEMENTABLE RECOMMENDATIONS

In this chapter the objectives to realize wetland management in Suriname in general and management of the North Coronie area in particular are presented as recommendations.

Many of these recommendations should be further communicated and discussed on the national level: with the National Environment Council (NMR), the National Institute for Environment and Development of Suriname (NIMOS), representatives of relevant ministries, non-governmental organizations (NGO's) and with the local land and water users.

Recommendations addressed to the:

4.1 President's Office and Council of Ministers

* In order to avoid environmentally controversial land allocation and/or granting of concessions, it is recommended to encourage and facilitate institutions and procedures for environmentally sound inter-sectional land use and resource planning, as formulated in Part II, 3.4 and 3.5.

* In order to be better prepared to combat oil spills, it is recommended to designate a national authority to prepare a National Oil Spill Contingency Plan (NOSCP) for major oil spills. NH should take the lead and closely cooperate with the Coast Guard and the State Oil Company. Also locally represented foreign oil companies, main oil consumers such as SURALCO, port authorities, fire brigades and hospitals should be involved.

* In order to facilitate the implementation of integrated wetland management it is recommended to establish a National Wetlands Commission (NWC) and a National Wetlands Management Authority (NWMA). See Part II, 3.6. The National Wetlands Commission (NWC) may become a subcommittee (1) of the existing Nature Conservation Commission (NBC, which is at present the Scientific Authority for the Wetlands Convention) or (2) of the National Institute for Environment and Development in Suriname (NIMOS).

* In order to be able to manage the North Coronie area as a Multiple Use Management Area (MUMA) it is recommended to place the state-property lands in the area at the disposal of the Ministry of Natural Resources (NH) based on the "1982 Decree L-2 on the Issuance of State-property Lands" (SB 1982 No 11). Evaluation and/or improvement of this status afterwards is recommended.

4.2 Ministries with environmental tasks:

4.2.1 Ministry of Planning and Development Cooperation (PLOS)

* In order to improve inter-sectoral land use planning, it is recommended that the Ministry of PLOS takes the lead in establishing a Planning Council and Resource Use Planning Unit, under the direct responsibility of the President or Vice President. This structure should develop an inter-sectoral land use planning process and an institute to monitor and implement land use planning. The structure should closely cooperate (or even integrate) with (1) NIMOS, (2) the Ministry of NH, especially its Bureau of Lands (DOM) presently responsible for land allocation, and with NH's proposed Institute for Soil and Land Information and Classification (ISLIC) and (3) the Ministry of Regional Development (RO) (see: Part II, 3.4).

4.2.2 Ministry of Natural Resources (NH)

* In order to improve land allocation procedures, it is recommended that the Ministry of NH takes the lead, working closely together with the Planning Council and Resource Use Planning Unit (PLOS), to develop a simple and transparent land use zoning process which guides land allocations. The Ministry should work closely together with the Ministry of LVV and other ministries and with enforcement agencies to ensure that the zoning ordinances and procedures are respected. NH's proposed ISLIC should be the key institute to improve the land allocation policy and process. See Part II, 3.4.

* In order to prevent reduction of the fresh water flow towards the mangrove zone, it is strongly recommended NOT to issue new lands north of the Coronie Road without an approved Environmental Impact Assessment (EIA) and when lands are granted, the implementation of such developments should be monitored. In case lands are already issued, it is recommended to negotiate conditions to minimize the negative impacts of activities.

* In order to manage the North Coronie area as a MUMA, it is recommended to appoint the Head of LBB cq the Head of NB as the Management Authority of the North Coronie Area.

Recommendations to the State Forest Service (LBB) / Nature Conservation Division (NB):

* In order to ensure the conservation of the coastal black-mangrove and riverine red-mangrove forests to prevent shoreline erosion and to maintain the natural production function of these forests, it is recommended to give all mangrove forests and the adjacent eastuarine zone along the coast the status of "Special Protected Forests" ("Speciaal Beschermd Bos") based on the Law of Forest Management (SB 1992, No 80).

* In order to further improve the present management of the North Coronie area it is recommended to LBB/NB to take all necessary initiative to implement the Action Plan as presented in Part III of this Management Plan.

4.2.3 Ministry of Agriculture, Animal Husbandry and Fisheries (LVV)

* In order to prevent overfishing it is recommended to:
  - finalize the Draft Fisheries Act ("Ontwerp Visserijwet") for approval by the Parliament;
  - review the licensing policy of the Fisheries Department and consider limitation of licences for certain types of fisheries;
  - carry out a comprehensive study on alternative fishery methods to minimize the amount of bycatch and/or to collect and use bycatch as a raw material for protein products;
  - cooperate with the Coast Guard in relation to fisheries control (licences, fishing methods, use of Turtle Excluder Devices , etc.).

* In order to prevent entanglement of sea turtles and mammals as dolphins and manatees in fishing nets it is recommended to:
  - replace the Fisheries Ministrial Decree 1992 (SB 1992 No 66) in which the use of Turtle Excluder Devices (TED's) is made obligatory, by the Fisheries Resolution based on article 25, paragraphs 3 and 5 of the Sea Fisheries Law of 1980;
  - develop fishing methods and techniques, such as of setting wide-mesh nets in front of the trapnets.

* In order to minimize pollution of all surface waters in Suriname with pesticides, it is recommended to:
  - facilitate the enforcement of the Pesticide Law (1972, No 151) and to facilitate the approval of all drafted resolutions;
  - add new pesticide related items not yet addressed in the existing or pending pesticide legislation; such as: (1) on the licensing and regulation of aerial spraying (praying during windy hours and "cleaning" of pesticide tanks while in the air); (2) creation of safety zones to protect habitations from aerial spraying; (3) third party certification of imported chemicals to ensure quality control and correct labeling; (4) formulation of pesticide residue standards; (5) banning of the importation of expired chemicals; and (6) formulation of rules and procedures for the disposal of expired, unwanted and dangerous chemicals;
  - make monitoring and control operational by strengthening of the relevant institutions incl. the LVV Department of Pesticides;
  - establish a pesticide and consumer product quality laboratory
  - organize pesticide awareness campaigns.

* In order to prevent damage to riverside swamps, dikes, crops and roads, it is recommended to prohibit free roaming of cattle in the estuarine zone.

4.2.4 Ministry of Public Works (OW)

* In order to be better prepared for regional climate fluctuations and global warming/sea level rise it is recommended to continue climate studies in the coastal area.

* In order to get a better insight in the process of coastal changes in the Coronie area, it is recommended to continue participation and facilitation of hydrological studies along its coast.

* In order to prevent reduction of the fresh water flow towards the mangrove zone it is recommended to prohibit:
  - construction of dams, roads with an inadequate number or size of culverts, and canals parallel to the coast;
  - extraction of water from seaside swamps;
  - to excavate drainage canals from freshwater areas directly into the sea without an approved Environmental Impact Assessment (EIA) and if granted, the implementation should be monitored.

* In order to obtain a better understanding of the hydrological behaviour of the Coronie Swamp, it is recommended to:
  - carry out a comprehensive hydrological study of the Coronie Swamp and to:
  - evaluate the consequences of rice culture on the swamp itself and on the estuarine zone taking into account the availability and quality irrigation and drainagewater.

* In order to get a better insight in water pollution of the North Coronie area, it is recommended to re-establish the WLA water quality monitoring program and to include monitoring of pesticides in that area.

4.2.5 Ministry of Transport, Communication and Tourism (TCT)

* In order not to disturb coastal wildlife it is recommended to prohibit airplanes to fly over estuarine zones at altitudes lower than 1000 ft (about 300 m).

4.2.6 Ministry of Defense (DEF)

* In order to protect coastal waters from over-exploitation and pollution it is recommended to include in the task description of the Coast Guard: (1) control of fisheries licences, (2) the use of proper types of fishing nets and (3) the use of Turtle Excluding Devices (TED's) by shrimp trawlers etc; and (4) to assist in clean up in case of oil spills.

4.2.7 Ministry of Foreign Affairs (BUZA)

* In order to further increase opportunities to prevent pollution of offshore and inland waters, it is recommended to:
  - fully enforce the MARPOL Convention;

  and to enter the:
  - 1983 Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region (CARTAGENA CONVENTION), which includes the Protocol concerning Cooperation in Combating Oil Spills and the Protocol concerning Land-based Activities and Sources of Marine Pollution;
  - 1989 Convention for the Control of Transboundary Transportation of Hazardous Material (BASEL CONVENTION),
  - 1994 United Nations Convention on the Law of the Sea (UNCLOS).

4.2.8 Ministry of Health (VG)

* In order to get a better insight in the impacts of water pollution with pesticides, it is recommended to monitor contamination levels of foodfish and shrimp in coastal waters.

PART III:

ACTION PLAN

1 MANAGEMENT OPTIONS

1.1 Habitat management

The North Coronie area should be managed to:

- protect the existing mangrove ecosystem between Jenny and Ingikondre;
- stimulate growth of mangrove and maintain a mangrove belt as a corridor between the Bigi Pan MUMA and the Ingikondre-Jenny area;
- utilize the economic values of the shallow sea and the upstream brackish and freshwater swamps in a sustainable way , taking into consideration the special demands of the mangrove ecosystem.

Such management will be possible if the North Coronie area will be placed at the disposal of the Ministry of NH to be managed as a MUMA.

LBB/NB should be actively involved in future land use planning and the design, approval and monitoring of Environmental Impact Assesssments (EIA's) for future developments as far as they may have a negative impact on the protective and productive functions of the North Coronie mangrove belt.

1.2 Species management

The plant and animal populations in the North Coronie area should be managed by non-intervention, which still implies monitoring and warding to prevent poaching and disturbance of roosting and nesting sites of coastal birds, such as by fishermen, ecotourists and researchers, low flying airplanes and air boats.

The plant and animal populations in the proposed bufferzone should be managed according to the forestry, hunting and fishing legislation and by additional measures such as to increase public awareness to prevent possible unwanted vegetation and peat fires.

1.3 Usage

The North Coronie are should be managed according to the "wise use" principle: preventing over-fishing, deforestation, uncontrolled burning of vegetation and peat, over-hunting, alterating the flow of ocean water and freshwater towards the mangrove zone, and water pollution such as by pesticides. Alternative developments should be stimulated such as investments in less pesticides demanding dry crop farming, animal husbandry and beekeeping, fisheries and aquaculture, and ecotourism.

1.4 Access

Access to the North Coronie area should not be restricted but guided by environmental awareness campaigns to prevent unwanted activities.

1.5 Education

To stimulate the "wise use" of the North Coronie area, environmental awareness should address:

- government policy and decision makers:
- residents of the North Coronie area and surroundings (especially school children);
- land and water users (farmers, fishermen, oil company employees and contractors) and
- visitors (sport-fishermen, hunters, ecotourists, researchers).

Local inhabitants should be stimulated to develop ecotourism in cooperation with the Foundation for Nature Preservation in Suriname (STINASU). STINASU has quite some experience in this field and should train local guides to start their own business.

1.6 Research and monitoring

Nature and nature conservation research in the area should primarily be directed to benefit the management and awareness program. Requests for research should be granted under the condition that results should be communicated with the Nature Conservation Division.

A data base of the area, including monitoring data should be set up for the area. This to measure changes in environmental quality and to adapt management policies and procedures in time.

2 MANAGEMENT TASKS

2.1 Minister of NH

It is recommended to the Minister NH to:

- communicate this management plan to the National Environmental Council (NMR);
- stimulate the establishment of a National Wetlands Commission and National Wetlands Management Authority (see Part II, 3.6);
- communicate this management plan to the Board of Ministers and apply for approval;
- stimulate the North Coronie state-owned property lands to be placed at the disposal of the Minister of NH (based on the "1982 Decree L-2 on the Issuance of State-property Lands", SB 1982 No 11) to be managed as a Multiple-Use Management Area;
- appoint the Suriname Forest Service as the Management Authority of the North Coronie MUMA;
- request the inclusion of the North Coronie MUMA into the RAMSAR list of Wetlands of International Importance;

2.2 Head LBB/NB

The tasks of the Head of the Suriname Forest Service (LBB) should include:

- communication of this management plan to the Minister of NH
- acting as the National Wetlands Management Authority as soon as this institution is established and/or act as the Management Authority of the North Coronie MUMA as soon as this MUMA is established
- communication of this management plan to the National Wetlands Commission as soon this institution is established and/or communication of this management plan to relevant ministries and land and water users;
- appointing a MUMA Manager.

2.3 MUMA Manager

A full-time manager will be required to effectively implement the management of all coastal MUMA's including the North Coronie MUMA.

2.3.1 Management tasks

Management of protected areas will have no success without the full support of local authorities, inhabitants and the full participation of the local land and water users. Therefor management should include:

- creation of Area Wetlands Commisions for each MUMA, including one for the North Coronie (North Coronie Wetlands Commission) for the purpose of a structured consultation and cooperation with regards to the conservation, the sustainable ("wise") use and the management of the Area.

- communication of this management plan with the North Coronie Wetland Commision;

- increasing awareness among Coronie communities on coastal values, wise use, the need for nature conservation and the long-term benefits for all inhabitants;

- clear demarcation of the North Coronie MUMA;

- stimulation of "wise use" of the area with full participation of the local communities.

- warding the area to demonstrate dedication and to prevent illegal actions;

2.3.2 Research, recording and monitoring tasks

The research, recording and monitoring tasks of the MUMA manager should include (but not be limited to):

- programming of research, recording and monitoring projects in cooperation with responsible ministries and third parties

- creation and updating of a MUMA data bank (also accessible for NIMOS) concerning:

  physical features:
  - coastal changes
  - hydraulic data
  - water quality data
  - climatic data
  - fires (vegetation and peat)

biological features:
- vegetation succession
- fauna inventories
- densities of selected waterfowl species
- fish catches
- hunting bags

human activities:
- numbers of inhabitants
- land ownership and land use
- oil spills and clean-up results
- pesticide use (quantity, quality)
- pesticide/mercury contamination levels of foodfish
- densities of raptors (birds of prey) as a reflection of the area contamination

2.2.3 Administrative tasks

The administrative tasks of the MUMA manager should include (but not be limited to):

- promotion and implementation of training of field assistant in all aspects of coastal management;

- solicitation for local and international funds.

2.4 MUMA field assistants/wardens

The MUMA manager will need to be supported by field assistants/wardens. Their tasks can be derived from those described for the MUMA manager.

3 PRIORITY PROJECTS

3.1 Financing program

First of all, nature conservation is the responsibility of the Government. As a party of the Ramsar Convention, the Government of Suriname should have a budget for salaries and training of MUMA-officers and field assistants/game wardens. Next to this a budget is needed for their housing, and transportation.

Next to the Government input, technical assistance and development funds may be applied to (programs of) United Nations Agencies (such as UNDP, UNEP and UNCED-GEF), international and regional intergovernmental organizations (such as IUCN, WHSRN, OAS and ACT), bilateral donor agencies (such as CWS and NEDA), international non-governmental organizations (such as CI and WWF) and funds made available by Conventions (such as RAMSAR).

Such technical assistance and development funds should be used for projects with the highest priority. Priority projects are described in the next paragraphs. According to lessons learned over the last 25 years, the order in which these projects should be implemented will mainly be determined by the order in which funds become available and when. Therefore it has little sense to produce an order of priorities and a time schedule.

3.2 Strengthening of management team

For the North Coronie area there is an immediate need to empower the present management. There is a need for:

- 1 Full time MUMA Manager (for the entire coastal area)
- 1 Assistant MUMA Manager (for the North Coronie area)

of which tasks are described in III.2.3 and 2.4. These managers should be adequately trained, preferably in the Caribbean.

For the recording, monitoring and research tasks, a budget should be available for the purchase of:

- satellite images
- aerial photos
- thematic maps
- a PC with GIS software

3.3 Warding

At this moment the North Coronie area is far from sufficiently patrolled and monitored. As long as wardens are not visibly present in the area, illegal activities such as wild occupation of land and poaching will continue.

After establishing of the North Coronie MUMA and the execution of an awareness campaign (see III.3.3), signs should be erected at strategic points along the borders of the North Coronie MUMA.

For the North Coronie area, there is a total need for 2 full-time MUMA Field Assistants and/or Game Wardens to be stationed at Totness or Friendship where a house should be build, bought or rented.

Needed means of transportation and equipment:

Transportation:
1 Sea-worthy boat (piaka) and 2 outboard motors (40 HP)
1 Swamp boat and 1 outboard motors (10 HP)
1 Four-wheel drive vehicle

Equipment:
1 Sets radio-telephone connections
2 Binoculars

3.4 Awareness

When the North Coronie MUMA has been established, an awareness campaign should be organized for government officials in Paramaribo and for the inhabitants and land and water users of the North Coronie MUMA.

3.5 Ecotourism

Environmental friendly ecotourism in the North Coronie area should be stimulated in which the local communities should play a major role.

4 WORK PROGRAMS

Once the North Coronie Multiple Use Management Area is esablished and this plan is approved, the MUMA manager prepares a yearly programme based on a realistic budget. Field assistants and wardens should prepare their own yearly working programs to be approved by the MUMA manager. The final working program needs approval by the MUMA Management Authority. Quarterly progress reports are produced by the MUMA manager in collaboration with his assistants and wardens.

5 REVIEWS

Integrated management planning involves continuous recording, evaluation and planning. In time, political, economic and ecological conditions related to the proposed MUMA change. Ramsar guidelines prefer (1) annual reviews to confirm the site is being managed in accordance with the requirements and less frequently (2) major reviews to ensure that the operational objectives are being achieved and that they continue to be relevant.

The results of the ongoing "Suriname Climate Change Country Study" will become available, results should be included in the first review of this management plan.

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APPPENDICES

APPENDIX 1: VEGETATION NORTH CORONIE

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VEGETATION TYPE >		**BEGROEIINGSTYPE >**	2	8	8	8	8	10	10	10	10	10	10	10	11	11	13	13	13	13	17	17	18	18	18	18	18	18	19	19	19	19	19	19						
North or South of Coronie Road >		Noord / Zuid van Coronieweg >	N	?	N	N	N	S	S	S	S	S	S	N	N	N	N	N	S	N	S	S	S	S	S	S	N	N	S	S	S	S	S	N						
Record numbers (L = Lindeman, T = Teunissen) >		Opname-nummers>	L0	L6	L7	L8	T37	L42	L51	L52	L53	L54	L55	T39	T35	T40	L1	L2	L3	T38	L122	L123	L29	L30	L31	L32	T36	T42	L33	L34	L35	L36	L37	T41						
Lindeman (1953) Tabel No I or II or Text (T) >			T	I	I	I		I	I	I	I	I	I		II	II	II	II	II		II	II	II	II	II	II			II	II	II	II	II						
Scientific name	GF*	Local name																																						
AVICENNIA FOREST		**PARWA BOS**																																						
Avicennia nitida	T	Parwa (Black-mangrove)	D																																					
Laguncularia racemosa	T	Akira (White-mangrove)	X																																					
Batis maritima	H	Krapegrasi	X																																					
Sesuvium portulacastrum	H	Zeepostelein	X																																					
Iresine vermicularis	H	Zeepostelein	X																																					
BRACKISH HERBACEOUS SWAMPS		**BRAKWATER GRASZWAMPEN**																																						
Typha angustifolia	H	Piyagrasi		D	D	X	D	X						X		X																								
Acrostichum aureum	F	Tabakatiki	X		X	X	X								X	X	X																							
Mikania micrantha	V				X	X	X							X																										
FRESHWATER HERBACEOUS SWAMPS		**ZOETWATER-GRASZWAMPEN**																																						
Montrichardia arborescens	H	Mokomoko						X	X	X	X	X		X	X	X		X	X		X	X				X	X	X												
Lasiacis ligulata	G															X																								
Leersia hexandra	G	Rijstgras						X					D			X																								
Panicum mertensii	G				X																																		
Panicum grande	G																																						
Sacciolepis striata	G														X																								
Cyperus articulatus	G	Fini adrungu						D																															
Cyperus ferax	G														X	X				X																		
Cyperus giganteus	G	Prasorograsi												X																									
Cyperus haspan	G								X																														
Eleocharis plicarhachis	G																																						
Fuirena robusta	G								X	X																													
Rhynchospora cyperoides	G																																						
Rhynchospora corymbosa	G								X		X	X	D																										
Scleria eggersiana	G	Babunefi													X																								
Acrostichum daneifolium	F	Tabakatiki												X														X											
Blechnum indicum	F								X	D	X	X		X		X	X	X	X	X	X	X						X											
Dryopteris gougloides	F								X	X	X	D																											
Nephrolepis biserrata	F								X	X	X	X																												
Aeschynomene sensitiva	H				X										X																								
Cissus parkeri	V	Bun-ati-mama		X	X	X																																	
Crinum spec.	H							X																															
Heliconia psittacorum	H	Popokaitongo													X	X	X			X																				X
Hydrocotyle umbellata	H	Waternavel			X					X																														
Ludwigia affinis	H																																						
Ludwigia leptocarpa	H				X																																		
Ludwigia nervosa	H											X																											
Polygonum acuminatum	H																																						
Ipomoea tiliacea	V					X																																	
Jacquemontia velutina	V								X			X																											
Ludwigia hyssipifolia	V														X	X																							
Paullinia pinnata	V	Boter, melk en kaas			X											X	X										X	X		X								X
Phaseolus trichocarpus	V				X																																		
Phaseolus campestris	V													X																									
Philodendron jenmanii	V	Taya-tete (Perica)																									X												
Bactris raphidacantha	P	Nanaimaka																	X																				
Solanum stramonifolium	S	Bolomaka																									X												
Paliconria crocea	S	Zwamp-pangapanga							X	X					X	X					X									X									
Hibiscus bifurcatus	S	Watra-okro			X	X																																	
Tabernaemontana siphilitica	S	Kapuwatiki																							X					X									
Machaerium lunatum	S	Brantimaka												X	X																									

VEGETATION TYPE >		BEGROEIINGSTYPE >	2	8	8	8	8	10	10	10	10	10	10	10	11	11	p	p	p	p	17	17	18	18	18	18	18	18	19	19	19	19	19	19
North or South of Coronie Road >		Noord / Zuid van Coronieweg >	N	?	N	N	N	S	S	S	S	S	S	N	N	N	N	N	S	N	S	S	S	S	S	S	N	N	S	S	S	S	S	N
Record numbers (L = Lindeman; T = Teunissen) >		Opname-nummers>	L0	L6	L7	L8	T37	L42	L51	L52	L53	L54	L55	T39	T35	T40	L1	L2	L3	T38	L122	L123	L29	L30	L31	L32	T36	T42	L33	L34	L35	L36	L37	T41
Lindeman (1953) Tabel No I or II or Text (T) >			T	I	I	I		I	I	I	I	I	I		II	II	II	II	II		II	II	II	II	II	II			II	II	II	II	II	
Scientific name	GF*	Local name																																
SWAMP WOOD		**LAAG ZWAMPBOS**																																
Erythrina - swamp wood		**Kofimama bos**																																
Erythrina glauca	T	Kofimama													D	D																		
Chrysobalanus-Annona - swamp wood		**Pruimen-Zuurzak bos**																																
Chrysobalanus icaco	T	Zwamppruim							X	X							X			X	X	X												
Annona glabra	T	Zwampzuurzak													X	X	X			X														
Ilex guianensis	T	Nyamsi-udu					X								X	X				X				X		X								
Tabebuia insignis	T	Zwamp-panta					X									X	X	X	X	X	X	X	X	X		X	X	X		X	X			
SWAMP FOREST		**HOOG ZWAMPBOS**																																
Mauritia flexuosa forest		**Morisi - bos**																			X	X												
Mauritia flexuosa	P	Morisi							X	X																								
Virola-Symphonia-Euterpe swamp forest		*Babun-Mataki-Pina bos*																						X		X	X	X			X			
Virola surinamensis	T	Babun-udu																									X	X						
Symphonia globulifera	T	Mataki																									X	X						
Euterpe oleracea	P	Pina														X		X					X	X	X	X	X	X		X	X			X
Hura crepitans	T	Posentri																						X	D	D			X						D
Pterocarpus officinalis	T	Watrabebe									X							X									X	X		X		X		
Calophyllum brasiliensis	T	Kurahara																									X	X						
Andira inermis	T	Rode zwamp-kabbes															X			X												X		
Carapa guianensis	T	Krapa																									X							X
Alexa wachenheimii	T	Neku-udu															X										X		X		X	X	X	X
Diospyros guianensis	T	Blaka-una																		X										X		X		
Genipa americana	T	Tapuripa																					X									X		
Triplaris surinamensis	T	Mira-udu							X	X	X						X	X							X	X				X		X		
Ficus maxima	T	Grootbladige ficus																									X							
Ficus ernestiana	T	Grootbladige ficus													X	X				X														
Ficus pertusa and F. spp.	T	Ficus soorten													X	X	X			X			X	X	X	X	X		X	X	X	X	X	
Inga bourgoni	T	Swit'bonki muserki																										X						
Inga ingoides	T	Swit'bonki																									X							
Inga leptingoides and I.spp.	T	Swit'bonki																										X		X		X	X	X
Cecropia obtusa	T	Bospapaya													X	X									X		X			X			X	
Tapirira guianensis	T	Weti-udu														X				X							X	X						
Rapania guianensis	T	Rapanea																		X						X								
Maytenus spec.	T	Sowtumeti-udu																		X														
Guapira guara and G. spp.	T	Prasara-udu													X					X							X	X			X			X
Clusia nemerosa	T	Sabana-mangro													X					X							X							
Ilex ovalifolia	T	Nyamsi-udu																									X							
Myrcia pyrifolia	T	Zwampguyave																										X						
Protium neglectum	T	Tingimoni																										X						
Ocotea puberula	T	Kraspisi																										X						
Coccoloba latifolia	T	Bradilifi																								X						X	X	
Sapium obtusilobium	T	Gomhout																					X	X								X	X	
Cordium tetrandra	T	Tafraboo																												X			X	
Copaifera guianensis	T	Hoepelhout																															X	
Subgrowth		*Ondergroei*																																
Nephrolepis biserrata	F														X	X				X								X						
Thelypteris serrata	F														X	X												X						
Scirpus cubensis	G															X																		
Carludovica bipartitus	V																			X								X						
Costus arabicus	H	Witte sangrafu																		X										X				
Denstaedtia adiantifolium	F																			X														
Polybotria caudata	F																			X														
Piper divaricatum	H																			X														
Centropogon cornutus	H	Diyaklarun																										X						
Cassia fruticosa	S	Jorkapesi													X	X				X							X	X						X
Piper hispidum	H	Anesiwiwiri														X												X						X
Renealmia exaltata	H	Masnsa														X											X							X

VEGETATION TYPE >		BEGROEIINGSTYPE >	2	8	8	8	8	10	10	10	10	10	10	10	11	11	p	p	p	p	17	17	18	18	18	18	18	18	19	19	19	19	19	19
North or South of Coronie Road >		Noord / Zuid van Coronieweg >	N	?	N	N	N	S	S	S	S	S	S	S	N	N	N	N	S	N	S	S	S	S	S	S	N	N	S	S	S	S	S	N
Record numbers (L = Lindeman; T = Teunissen) >		Opname-nummers>	L0	L6	L7	L8	T37	L42	L51	L52	L53	L54	L55	T39	T35	T40	L1	L2	L3	T38	L122	L123	L29	L30	L31	L32	T36	T42	L33	L34	L35	L36	L37	T41
Lindeman (1953) Tabel No I or II or Text (T) >			T	I	I	I		I	I	I	I	I	I		II	II	II	II	II		II	II	II	II	II	II			II	II	II	II	II	
Scientific name	GF*	Local name																																
Lemna minor	A	Doksiwiwiri					X									X											X							
Spirodela biperforata	A	Doksiwiwiri					X									X				X							X							
Wolfiella lingulata	A	Doksiwiwiri					X									X											X							
Wolfiella oblonga	A	Doksiwiwiri														X				X							X							
Azolla caroliniana	A	Kroosvaren													X	X																		
Salvinia auriculata	A	Vlotvaren														X											X							
Pistia stratiotes	A	Nijlsla													X	X				X							X							
Nymphoides indica	A	Kleine pankuku							X						X																			
Nymphaea ampla	A	Pankukuwiwiri																		X														
Nymphaea amazonicum/rudgeana	A	Pankukuwiwiri			X																													
MARSH AND DRYLAND RIDGE FOREST		**DRAS- EN DROOGLAND RITSBOS**																																
Crataeva tapia	T	Crataeva																																X
Annona montana	T	Ritsbos-zaurzak																											X		X		X	X
Margaritaria nobilis	T	Blawkrala																																X
Ximenia americana	T	Takdoornboom																																X
Vitex compressa	T	Vierkante boskalebas																															X	X
Guapira olfersiana	T	Nyamsi-udu																															X	
Spondias mombin	T	Mope															X			X									X	X	X	X	X	X
Andira surinamensis	T	Rode rits-kabbes																																X
Trichilia trinitensis	T	Witte sali (tritri)																									X		X		X	X	X	X
Cedrela odorata	T	Ceder																										X						X
Chaetocarpus schomburkianus	T	Foman																																X
Talisia mollis	T	Jankrapa																																X
Psychotria carthagenensis	T	Penpen																											X		X		X	
Licania apetala	T	Kwepi																															X	
Ceiba pentandra	T	Kankantri																											X	X	X	X	X	X
Bombax globosum	T	Boskatoen																													X			
Couroupita guianansis	T	Kanonskogelboom																											X	X		X	X	
Eugenia wulschlaegeliana	T	Kromoko																					X											X
Quassia amara	T	Kwasibita																														X		
Attalea maripa	P	Maripa																									X							X
Acrocomia lathiospatha	P	Ingi palm																																X
Coccoloba latifolia	T	Bradilifi																																X
Inga spp.	T	Swit'bonki																																X
Guarea guidonia	T	Doifisiri														X																		X
?	P?	Arawarang																											X	X	X	X		
Subgrowth		*Ondergroei*																																
Randia formosa	S	Alata-shit																														X	X	X
Tabernaemontana grandiflora	S	Merkitiki																																X
Securidaca diversifolia	V	Sukrudyani																									X							X
Wulfia baccata	V	Sukrutanta																																X
Costus scaber	H	Rode sangrafu																									X							X
Syngonium vellozianum	V	Taya tete (bodem)																																X
Bactris spp.	P	Kiskismaka																											X	X	X			
?	H	Bosananas																														X		
LEGEND																																		
	GF	Growth Form																																
D = Dominant	T	tree																																
X = present	P	palm																																
	S	shrub																																
	G	graminoid (grass-like)																																
	H	non-graminoid herb (forb)																																
	F	fern																																
	V	vine																																
	A	aquatic plant																																
SOURCES:																																		
L = Lindeman (1953): fieldwork December 1948																																		
incl. records Lanjouw (1936): fieldwork 1933: nrs L 6, 42 and 55																																		
T = Teunissen (unpubl.): fieldwork March 1975																																		

LOCATIONS VEGETATION RECORDS		
North / South of Coronie Road	N / S	
T042: Jenny, km 90	N	
T036: Jenny, km 95	N	
T037: Jenny-Ingikondre, km 100	N	
T038: Jenny-Ingikondre, km 100	N	
L001: Jenny-Ingikondre, km 104	N	
L002: Jenny-Ingikondre, km 104	N	
L007: Jenny-Ingikondre, km 104	N	
L008: Jenny-Ingikondre, km 104	N	
L029: Jenny-Ingikondre, km 104	S	
L037: Jenny-Ingikondre, km 104	S	
L122: Jenny-Ingikondre, km 104	S	
L051: Jenny-Ingikondre, km 104	S	
L052: Jenny-Ingikondre, km 104	S	
L030: Jenny-Ingikondre, km 105	S	
L031: Jenny-Ingikondre, km 105	S	
L032: Jenny-Ingikondre, km 105	S	
L033: Jenny-Ingikondre, km 105	S	
L034: Jenny-Ingikondre, km 105	S	
L036: Jenny-Ingikondre, km 105	S	
L123: Jenny-Ingikondre, km 105	S	
L053: Jenny-Ingikondre, km 105	S	
L054: Jenny-Ingikondre, km 105	S	
T039: Jenny-Ingikondre, km 110.5	N	
T040: Jenny-Ingikondre, km 110.5	N	
T041: Jenny-Ingikondre, km 110.5	N	
T035: Ingikondre, km 125.5	N	
L006: W of Coronie, km ?	?	(Lanjouw)
L003: Totness Freshwater Canal	S	
L042: Totness Freshwater Canal	S	(Lanjouw)
L055: Totness Freshwater Canal	S	(Lanjouw)
L000: Totness coast	N	(Lindeman, text 1953)

APPENDIX 2: BIRDS OF THE ESTUARINE ZONE OF SURINAME
(De Jong & Spaans, 1984)

TAXONOMY SCIENTIFIC NAMES	ENGLISH NAMES	LOCAL NAMES (SURINAMESE AND DUTCH)	STATUS		NICK I	COR II	SAR III	COM IV	MAR V
			LEGEND BR = Breeding resident NBR = Non-breeding resident NBM = Non-breeding migrant		LEGEND x = present 10.000+ = more than 10.000 10.000s = tens of thousands				
ORDER (=O) PROCELLARII-FORMES		**STORMVOGELS**							
Family Procellariidae	**Shearwaters and Petrels**	**Stormvogels**							
Puffinus gravis	Greater Shearwater	Grote pijlstormvogel	NBM	incidental	.	.	.	x	.
Family Hydrobatidae	**Petrels**	**Stormzwaluwen**							
Oceanites oceanicus	Wilson's Storm-petrel	Wilson's stormvogeltje	NBM	incidental	.	.	x	x	.
Oceanodroma leucorhoa	Leach's Storm-petrel	Vaal stormvogeltje	NBM	incidental	x	.	.	x	.

TAXONOMY	ENGLISH NAMES	LOCAL NAMES		STATUS	NICK	COR	SAR	COM	MAR
O. PODICIPEDI-FORMES		**FUTEN**							
Family Podicipediae	**Grebes**	**Watra-en / Futen**							
Tachybaptus dominicus	Least Grebe	Watra-en / Amerikaanse dodaars	NBM?	rare	.	.	.	x	.
Podylimbus podiceps	Pied-billed Grebe	Watra-en / Dikbekfuut	BR	un-common	100s	x	x	x	x
O. PELICANI-FORMES		**ROEIVOETIGEN**							
Family Fregatidae	**Frigatebirds**	**Fregatvogels**							
Fregate magnificicens	Magnificent Frigatebird	Amerikaanse fregatvogel	NBR	rather common	x	x	x	x	x
Family Phalacrocoracidae	**Cormorants and Darters**	**Aalscholvers and Slangenhalsvogels**							
*Phalacrocorax olivaceus	Olivaceus Cormorant	Fisman / Duikelaar / Bigua Aalscholver	NBM	rather common	2 000+	,	,	x	,
Anhinga anhinga	Anhinga / Darter	Fisman / Duikelaar / Amerikaanse Slangenhalsvogel	BR	rather common	x	,	,	10s	,
Family Sulidae	**Boobies**	**Rotspelikanen**							
Sula leucogaster	Brown Booby	Bruine Gent	NBM	incidental					
Family Pelecanidae	**Pelicans**	**Pelikanen**							
Pelecanus occidentalis	Brown Pelican	Kodyo / Erdal / Bruine pelikaan	NBM	not un-common	x	x	100s	x	x

TAXONOMY	ENGLISH	LOCAL NAMES		STATUS	NICK	COR	SAR	COM	MAR

	NAMES								
O. CICONIIFORMES	**Ciconiiform birds**	**OOIEVAARVOGELS**							
Family Ardeidae	**Herons an Bitterns**	**Reigers en Roerdompen**							
Ardea cocoi	Cocoi Heron	Kumawari / Sokoireiger	BR	fairly common	5 000	x	x	5 000	x
Egretta ibis	Cattle Egret	Sabaku / Koereiger	BR	nume-rous	x	x	x	x	x
Casmerodius alba	Great Egret	Galin / Grote zilverreiger	BR	nume-rous	5 000	x	x	5 000	x
Egretta tricolor	Tricolored Heron	Sabaku / Witbuikreiger	BR	nume-rous	20 000	10 000	20 000	10 000	25 000
Egretta caerulea	Little Blue Heron	Sabaku / Kleine blauwe reiger	BR	nume-rous	25 000	10 000+	25 000	x	30 000
Egretta thula	Snowy Egret	Sabaku / Amerikaanse kleine zilverreiger	BR	nume-rous	10 000+	x	10 000+	10 000 +	10 000+
Egretta garzetta	Little egret	Sabaku / Kleine Zilverreiger	NBR?	rare	.	.	x	.	
Butorides striatus	Striated Heron	Tyontyon / Mangrovereiger	BR	quite common	x	x	x	x	x
Nycticorax violacea	Yellow-crowed Night-heron	Dikkop / Geelkruinkwak	BR	quite nume-rous	7 500	x	7 500	x	7 500
Nyctinassa nycticorax	Black-crowned Night-heron	Dikkop / Dikhalzige kwak	BR	common	x	x	x	x	x
Cochlearius cochlearia	Boat-billed Heron	Arapapa / Schuitbekreiger	BR	nume-rous	x	x	x	x	x
Ixobrychus involucrus	Stripe-backed Heron	Ston-tyontyon / Gestreept woudaapje	BR	rare	.	.	x	x	.
Ixobrychus exilis	Least Bittern	Ston-tyontyon / Amerikaans woudaapje	BR	fairly common	x	x	x	x	x
Botaurus pinnatus	Pinnated Heron	Ston-tigrifowru Zuid Amerikaanse roerdomp	BR?	fairly common	x	x	x	x	x

TAXONOMY	ENGLISH NAMES	LOCAL NAMES		STATUS	NICK	COR	SAR	COM	MAR
Family Ciconiidae	**Storks**	**Ooievaars**							
Mycteria americana	Wood Stork	Nengrekopu / Houtooievaar	BR	nume-rous	1 750	x	x	2 500	.
Ciconia maguira	Maguari Stork	Eri / Redifutu / Magoeari-ooievaar	NBM	rare	x	.	x	x	x
Jabiru mycteria	Jabiru	Blaasman / Jabiroe	BR	un-common	70	x	x	45	x
Family Plataleidae	**Ibises and Spoonbills**	**Ibissen en Lepelaars**							
Eudocimus ruber	Scarlet Ibis	Flamingo / Korikori / Rode Ibis	BR	common	10 000s	1 000s	10 000s	10 000+	10 000s
Mesembrinibus cayennensis	Green Ibis	Korokoro / Groene ibis	BR	rather common	x	x	x	x	x
Ajaia ajaja	Roseate Spoonbill	Lepelbek / Rode lepelaar	BR	rather common	x	x	x	x	x
O. PHOENICOPTERI-FORMIS		**FLAMINGO'S**							
Family Phoenicopteridae	**Flamingos**	**Flamingo's**							
Phoenicopteris ruber	American Flamingo	Segansi / Zeegans / Rode Flamingo	NBM	common	x	x	200	x	2 400

TAXONOMY	ENGLISH NAMES	LOCAL NAMES		STATUS	NICK	COR	SAR	COM	MAR
O. FALCONIFORMES	**RAPTORS**	**STOOTVOGELS (ROOFVOGELS)**							
Family Cathartida	**American Vultures**	**Amerikaanse gieren**							
Cathartes aura	Turkey Vulture	Redi-ede tingifowru / Roodkopgier	BR	common	x	x	x	x	x
Coragyps atratus	Black Vulture	Blaka-ede-tingifowru / Zwartkopgier	BR	common	x	x	x	x	x
Family Accipitridae	**Kites, Harriers an Hawks**	**Wouwen, Buizerds en Haviken**							
Pandion haliaetus	Osprey	Fisi-aka / Visarend	NBM	rather common	x	x	x	x	x
Rostrhamus sociabilis	Snail Kite	Pakro-aka / Slakkenwouw	BR	common	1 000+	x	1 000+	x	x
Circus buffoni	Long-winged Harrier	Aka / Buffon's kiekendief	BR?	common	x	x	x	x	x
Geranospiza caerulescens	Crane Hawk	Langafutu-aka Langpoot kiekendief	BR	rather common	x	x	x	x	x
Buteogallus aequinoctialis	Rufous Crab Hawk	Krabu-aka / Krabbenbuizerd	BR	common	1 000+	100s	100s	1 000+	100s
Buteogallus meridionalis	Savannah Hawk	Aka / Savannebuizerd	BR	common	x	x	x	x	x
Buteolgallus urubitinga	Black Hawk	Blaka-aka / Zwarte arendbuizerd	BR	fairly common	x	x	x	x	x
Busarellus nigricollis	Black-collared Hawk	Babun-aka / Moerasbuizerd	BR	common	x	x	x	x	x
Buteo magnirostris	Roadside Hawk	Doifi-aka / Wegbuizerd	BR	nume-rous	x	x	x	x	x

TAXONOMY	ENGLISH NAMES	LOCAL NAMES		STATUS	NICK	COR	SAR	COM	MAR
Family Falconidae	**Falcons and Caracaras**	**Valken en Caracaras**							
Milvago chimachima	Yellow-headed Caracara	Tingifowru-aka / Geelkop-caracara	BR	nume-rous	x	x	x	x	x
Falco peregrinus	Peregrine	Aka / Slechtvalk	NBM		x	x	x	x	x
O. ANSERIFORMES		**EENDVOGELS**							
Family Anatidae	**Ducks**	**Doksi / Doksen / Eenden**							
Dendrocygna bicolor	Fulvous Whistling Duck	Koneya / Rosse boomeend	BR?	rare	x	.	.	x	x
Dendrocygna viduata	White-faced Whistling Duck	Katun-skurki / Wet'ede Wiswisi / Witwangboomeend	BR?	un-common	x	.	x	.	.
Dendrocygna autumnalis	Black-bellied Whistling Duck	Skurki / Wiswisi / Zwartbuikboomeend	BR	common	10 000s	x	x	10 000s	x
Cairina moschata	Muskovy Duck	Busdoksi / Muskuseend	BR	fairly common	x	x	x	x	x
Anas americana	American Wigeon / Baldplate	Doksi / Amerikaanse smient	NBM	very rare	.	.	.	x	.
Anas acuta	Pintail	Doksi / Langhalzige pijlstaart	NBM	very rare	x	.	.	.	.
Anas bahamensis	White-cheeked Pintail	Anaki / Stildoksi / Bahama-pijlstaart	BR	common	10 000s	x	x	10 000s	x
Anas discors	Blue-Winged Teal	Blue-wing / Blauwvleugeltaling	NBM	common	10 000s	x	x	10 000s	x
Netta erythrophthalma	Southern Pochard	Doksi / Bruine krooneend	NBM	very rare	.	.	.	x	.
Aytha affinis	Lesser Scaup	Doksi / Kleine toppereend	NBM	very rare	x	.	.	x	.

TAXONOMY	ENGLISH	LOCAL NAMES		STATUS	NICK	COR	SAR	COM	MAR

	NAMES								
Oxyura dominica	Masked Duck	Doksi / Maskerstekelstaart	BR?	very rare	x	.	.	x	.
Family Anhimidae	**Screamers**	**Hoenderkoeten**							
Anhima cornuta	Horned screamer	Anhima / Anioema	BR?	rare	.	.	.	.	x
O. GRUIFORMES		**KRAANVOGELS**							
Family Aramaidae	**Limpkins**	**Koerlans**							
Aramus guarauna	Limpkin	Krawkraw / Koerlan	BR	fairly common	x	x	x	x	x
Family Rallidae	**Rails and Gallinules**	**Rallen,**							
Rallus longirostris	Clapper Rail	Anamu / Mangrove-ral / Klapper-ral	BR	common	x	x	x	x	x
Pandirallus maculatus	Spotted Rail	Anamu / Gevlekte ral	BR	faily common	x	x	x	x	x
Aramides axillaris	Rufous-necked Wood-rail	Anamu / Roodnekbosral	BR	faily common	x	x	x	x	x
Aramides cajanea	Grey-necked Wood-rail	Kriko / Cayenne-bosral	BR	common	x	x	x	x	x
Porzana albicollis	Ash-throated Crake	Anamu / Witkeelporseleinhoen	BR?	not un-common	x	x	x	x	x
Poholimnas flaviventer	Yellow-breasted Crake	Anamu /Geelbuikporseleinhoen	BR?	not un-common	x	x	x	x	x
Laterallus exilis	Grey-breasted Crake	Anamu / Amazone-dwergral	BR	quite nume-rous	x	x	x	x	x
Laterallus melanophalus	Rufous-sided Crake	Anamu / Braziliaanse dwergral	BR	not un-common	x	x	x	x	x
Arunolimnas viridis	Russet-crowned Crake	Ston-kriko / Roodkruinral	BR	quite common	x	x	x	x	x

TAXONOMY	**ENGLISH**	**LOCAL NAMES**	**STATUS**	NICK	**COR**	SAR	COM	MAR

	NAMES								
Neocrex erythops	Paint-billed Crake	Anamu / Roodsnavelhoen	BR?	rare	.	.	.	x	.
Porphyrula martinica	American Purple Gallinule	Blawkepanki / Blauw Kemphaantje / Amerikaanse purperhoen	BR	nume-rous	x	x	x	x	x
Family Heliornithidae	**Sungrebes**	**Fuutkoeten**							
Heliornis fulica	Sungrebes	Watra-en / Kleine fuutkoet	BR	un-common	x	x	x	x	x
Family Eurypygidae	**Sunbitterns**	**Zonnerallen**							
Eurypyga helias	Sunbittern	Sonfowru / Zonneral	BR	scarce	x	x	x	x	x
O. CHARADRII-FORMES		**PLEVIERVOGELS**							
Family Jacanidae	**Jacanas**	**Jacana's**							
Jacana jacana	Wattled Jacana	Kepanki / Kemphaantje / Lel- jacana	BR	nume-rous	x	x	x	x	x
Family Recurvirostridae	**Stilts**	**Steltkluten**							
Himantopus mexicanus	Common Stilt	Tyalita / Langa-futu-kronbeki / Marowijne-snip / Steltkluut	BR	not uncommo n	x	x	x	x	x
Family Charadriidae	**Plovers**	**Plevieren**							
Pluviales dominica	American Golden plover	Snepi / Snip / Amerikaanse goudplevier	PM	rather common	x	x	x	x	x
Pluviales squatarola	Grey plover	Snepi / Snip / Zilverplevier	NBM	common	2 000	2 000	2 500	2 000	2 000

TAXONOMY	**ENGLISH**	**LOCAL NAMES**	**STATUS**	NICK	**COR**	SAR	COM	MAR

	NAMES								
Charadrius semipalmatus	Semi-palmated Plover	Snepi / Snip / Amerikaanse bontbekplevier	NBM	nume-rous	4 000	2 000	2 500	3 000	4 000
Charadrius wilsonia	Wilson's Plover	Snepi / Snip / Diksbekplevier	BR	rather common	x	x	x	x	x
Charadrius collaris	Collared Plover	Snepi / Snip / Kraagplevier	BR	quite common	x	x	x	x	x
Family Scolopacidae	**Snipes and sandpipers**	**Snippen en strandlopers**							
Limosa haemastica	Hudsonian Godwit	Snepi / Snip / Rode grutto	NBM	very rare	.	.	x	.	.
Bartramia longicauda	Upland Sandpiper	Snepi / Snip / Bartram's-ruiter	NBM	rather common	x	x	x	x	x
Numenius phaeopus	Whrimbrel	Kronbeki / Krombek / Regenwulp	NBM	un-common	1 000	1 000	1 500	1 000	1 000
Tringa melanoleuca	Greater Yellowlegs	Snepi / Snip / Grote geelpootruiter	NBM	nume-rous	12 000	5 000	10 000	20 000	6 000
Tringa flavipes	Lesser Yellowlegs	Snepi / Snip / Kleine geelpootruiter	NBM	nume-rous	50 000	25 000	50 000	100 000	50 000
Tringa solitaria	Solitary Sandpiper	Snepi / Snip / Amerikaanse Bosruiter	NBM	nume-rous	1 000s	x	x	1 000s	x
Actitis macularia	Spotted Sandpiper	Snepi / Snip / Amerikaanse Oeverloper	NBM	common	10 000+	1 000+	1 000s	10 000+	1 000s
Catoptrophorus semipalmatus	Willet	Snepi / Snip / Willet	NBM	nume-rous	15 000	5 000	10 000	10 000	15 000
Arenaria interpres	Ruddy Turnstone	Snepi / Dassnip / Steenloper	NBM	nume-rous	5 000+	5 000+	5 000+	5 000+	5 000+
Steganopus tricolor	Wilson's Phalarope	Snepi / Snip / Grote franjepoot	NBM	nume-rous	x	x	x	x	x
Gallinago gallinago	Common Snipe	Snepi / Rijstsnip / Watersnip	BR		x	x	x	x	x
Limnodromus griseus	Shot-billed Dowitcher	Snepi / Snip / Kleien grijze snip	NBM	nume-rous	30 000	20 000	50 000	15 000	50 000

TAXONOMY	**ENGLISH NAMES**	**LOCAL NAMES**	**STATUS**	NICK	**COR**	SAR	COM	MAR

Calidris canutus	Red Knot	Snepi / Snip / Kanoet-strandloper	NBM	not common	100s	100s	x	1 000+	x
Calidris alba	Sanderling	Snepi / Snip / Drieteen-strandloper	NBM	not common	100s	100s	x	1 000+	x
Calidris pussila	Semi-palmated Sandpiper	Snepi / Snip / Grijze strandloper	NBM	very nume-rous	1 000 000	250 000	750 000	500 000	2 000 000
Calidris mauri	Western Sandpiper	Snepi / Snip / Alaska-strandloper	NBM	common	1 000s	x	x	x	x
Calidris minutilla	Least Sandpiper	Snepi / Snip / Kleine strandloper	NBM	nume-rous	10 000	x	x	10 000s	x
Calidris fuscicollis	White-rumped Sandpiper	Snepi / Snip / Bonaparte's strandloper	PM	rather common	10 000	x	x	10 000s	x
Calidris bairdi	Baird's Sandpiper	Snepi / Snip / Baird's strandloper	NBM	very rare	.	.	.	x	.
Calidris melanotos	Pectoral Sandpiper	Snepi / Snip / Gestreepte standloper	NBM	not common	x	x	x	x	x
Macropalama himantopus	Stilt Sandpiper	Snepi / Snip / Steltstandloper	NBM	rather common	1 000s	x	x	10 000+	x
Tryngites subruficollis	Buff-breasted Sandpiper	Snepi / Snip / Blonde ruiter	PM	rather rare	.	.	.	x	.
Family Stercorariidae	**Skuas**	**Jagers**							
Stercorarius skua	Great Skua	Grote jager	NBM	incidental	x	.	.	.	.
Family Laridae	**Gulls and Terns**	**Meeuwen and Sterns**							
Larus atricilla	Laughing Gull	Sedoifi / Fisman / Lachmeeuw	NBM	common	1 000	1 000	1 500	1 000	1 000
Chlidonias niger	Black Tern	Fisman / Zwarte Stern	NBM	scarce	x	x	x	x	x
Phaetusa simplex	Large-billed Tern	Fisman / Grootsnavelstern	NBM	rather common	x	x	x	x	x
Sterna nilotica	Gull-billed Tern	Fisman / Lachstern	NBM	nume-rous	1 000s	x	x	100s	x

TAXONOMY	**ENGLISH NAMES**	**LOCAL NAMES**	**STATUS**	NICK	**COR**	SAR	COM	MAR

Sterna hirundo	Common Tern	Fisman / Visdiefje	NBM	rather nume-rous	.	.	100s	.	.
Sterna fuscata	Sooty Tern	Fisman / Bonte stern	NBM	incidental	x	.	.	.	.
Sterna superciliaris	Amazon Tern	Fisman / Amazone-stern	NBM	quite common	1 000+	x	x	100s	x
Sterna antillarum	Least Tern	Fisman / Amerikaanse dwergstern	NBM	nume-rous	x	x	x	x	x
Sterna maxima	Royal Tern	Fisman / Koningsstern	NBM	rather common	x	x	x	x	x
Sterna sandvicensis	Cayenne Tern	Fisman / Grote stern	NBM	common	x	100s	x	100s	x
Anous stolides	Noddy	Fisman / Noddy	NBM	incidental	.	.	x	x	.
Family Rhynchopidae	**Skimmers**	**Schaarbekken**							
Rhynchops niger	Black Skimmer	Fisman / Sleepmannetje / Amerikaanse schaarbek	NBM	common	10 000	5 000	10 000	1 000s	10 000+
O. COLUMBIFORMES		**DUIVEN**							
Family Columbidae	**Pigeons and Doves**	**Echte duiven**							
Columba cayennensis	Rufous Pigeon	Mangro-doifi / Grun-ede-doifi / Rosse duif	BR	rather common	x	x	x	x	x
Leptotila verreauxi	White-tipped Dove	Pasi-doifi / Paska-doifi Verreaux duif	BR	common	x	x	x	x	x

TAXONOMY	**ENGLISH NAMES**	**LOCAL NAMES**	**STATUS**	NICK	**COR**	SAR	COM	MAR
O.		**PAPEGAAIEN**						

PSITTACIFORMES

Family Psittacidae	**Parrots and Parakeets**	**Papegaaien**							
Amazona pertinax	Brown-throated Parakeet	Karuprakiki / Korenparkiet / Maisparkiet	BR	common	x	x	x	x	x
Amazona amazonica	Orange-winged Amazon	Kulekule / Oranjevleugel-amazone	BR	nume-rous	x	x	x	x	x

O. CUCULIFORMES **KOEKOEKVOGELS**

Family Cuculidae	**Cuckoos**	**Koekoeken**							
Coccyzus minor	Mangrove Cuckoo	Pikan / Mangrovekoekoek	BR	rather common	x	x	x	x	x
Piaya cayana	Squirrel Cuckoo	Pikan / Eekhoornkoekoek	BR	?	?	x	?	?	
Crotophaga major	Greater Ani	Bigi Kawfutuboy / Grote Ani	BR	common	x	x	x	x	x

O. STRINGIFORMES **UILEN**

Family Stringidae	**Owls**	**Echte uilen**							
Bubo virginianus	Great Horned Owl	Owrukuku / Amerikaanse oehoe	BR	rather common	x	x	x	x	x
Pulsatrix perpicillata	Spectacled Owl	Krabu-owrukuku / Briluil	BR	rather common	x	x	x	x	x

TAXONOMY	**ENGLISH NAMES**	**LOCAL NAMES**	**STATUS**	NICK	**COR**	SAR	COM	MAR
O. CAPRIMULGI-FORMES		**NACHTZWALUW-ACHTIGEN**						

Family Caprimulgidae	**Nighthawks and Nightjars**	**Nachtzwaluwen**							
Caprimulgus maculicaudis	Spot-tailed Nightjar	Jorkafowru / Butubuta / Vleksnavel-Nachtzwaluw	BR	rather common	x	x	x	x	x
O. APODIFORMES		**GROOTVLEUGELIGEN**							
Family Trochilidae	**Hummingbirds**	**Kolibries**							
Amazilla leucogaster	Plain-bellied Emerald	Korki / Kownubri / Kolibri / Gmelin's amazalia	BR	nume-rous	x	x	x	x	x
O. CORACIIFORMES		**SCHARRELVOGELS**							
Family Alcedinidae	**Kingfishers**	**IJsvogels**							
Ceryle torquata	Ringed Kingfisher	Fisman / Amerikaanse reuzenijsvogel	BR	common	x	x	x	x	x
Chloroceryle americana	Green Kingfisher	Fisman / Groene ijsvogel	BR	rather common	x	x	x	x	x
Chloroceryle inda	Green-and-rufous Kingfisher	Fisman / Groenbruine ijsvogel	BR	common	x	x	x	x	x
Chloroceryle aenea	Pigmy Kingfisher	Fisman / Groene dwergijsvogel	BR	quite common	x	x	x	x	x

TAXONOMY	**ENGLISH NAMES**	**LOCAL NAMES**	**STATUS**	NICK	**COR**	SAR	COM	MAR
O. PICIFORMES		**SPECHTACHTIGEN**						

Family Picidae	**Woodpeckers**	**Spechten**							
Melanerpes candidus	White Woodpecker	Timreman / Timmerman / Witte specht	BR	not uncommon	x	x	x	x	x
Melanerpes rubricapillus	Red-crowned Woodpecker	Timreman / Timmerman / Roodkruinspecht	BR	fairly common	x	x	x	x	x
Veliniornis sanguineus	Blood-collared Woodpecker	Timreman / Timmerman / Bloedrugspecht	BR	quite common	x	x	x	x	x
Colaptes punctigula	Spot-breasted Woodpecker	Timreman / Timmerman / Vlekborst-grondspecht	BR	rather common	x	x	x	x	x
O. PASSERIFORMES		**ZANGVOGELS**							
Family Furnariidae	**Ovenbirds**	**Ovenvogels**							
Certhiaxis cinnamomea	Yellow-throated Spinetail	Fityo / Geelkeelstekelstaart	BR	very nume-rous	x	x	x	x	x
Family Dendrocolaptidae	**Woodcreepers**	**Muisspechten**							
Xiphorhynchus picus	Straight-billed Woodcreeper	Priemsnavel muisspecht	BR	common	x	x	x	x	x
Family Formicariidae	**Antbirds**	**Miervogels**							
Sakesphorus canadensis	Black-crested Antshrike	Pepre-fowru / Mira-fowru / Zwartkuif-mierklauwier	BR	quite common	x	x	x	x	x
Sclateria naevia	Silvered Antbird	Mira-fowru / Mangrove-miervogel	BR	common	x	x	x	x	x

TAXONOMY	**ENGLISH NAMES**	**LOCAL NAMES**		**STATUS**	NICK	**COR**	SAR	COM	MAR
Family Tyrannidae	**Tyrant-Flycatchers**	**Vliegenvangers**							
Sublegatus	Scrub-	Popyo / Struikvliegenvanger	BR?	not un-	x	x	x	x	x

modestus	Flycatcher			common					
Inezia subflava	Pale-tipped Tyrannulet	Popyo / Bruinkop-inezia	BR	common	x	x	x	x	x
Todirostrum maculatum	Spotted Tody-flycatcher	Popyo / Gevlekte schoffelsnavel	BR	quite common	x	x	x	x	x
Tolmomyias flaviventris	Yellow-breasted Flycatcher	Titri / Geelbuik-breedbektiran	BR	nume-rous	x	x	x	x	x
Fluvicola pica	Pied Water Tyrant	Katun-fowru / Gotromotyo / Katoentje / Bonte watertiran	BR	quite nume-rous	x	x	x	x	x
Fluvicola leucocephala	White-headed Marsh-tyrant	Soeur / Witkopwatertiran	BR	common	x	x	x	x	x
Attila cinnamomeus	Cinnamon Attila	Coufleur / Kaneelattila	BR	quite common	x	x	x	x	x
Myiarchus tyrannulus	Brown-crested Flycatcher	Tyarman / Titiyari / Cayennetiran	BR	quite common	x	x	x	x	x
Pitangus lictor	Lesser Kiskadee	Swampu-grikibi / Kleine kiskadie	BR	common	x	x	x	x	x
Pitangus sulphuratus	Great Kiskadee	Grikibi / Grote kiskadie	BR	nume-rous	x	x	x	x	x
Myiodynastes maculatus	Streaked Flycatcher	Tigri-grikibi / Getsreepte tiran	BR	common	x	x	x	x	x
Family Hirundinidae	**Swallows**	**Zwaluwen**							
Tachycineta albiventer	White-winged Swallow	Witbuikzwaluw	BR	quite common	x	x	x	x	x
Notiochelidon cyanoleuca	Blue-and-white Swallow	Blauwwitte zwaluw	NBM	quite common	x	x	x	x	x
Hirundo rustica	Barn Swallow	Boerenzwaluw	NBM	quite common	x	x	x	x	x

TAXONOMY	**ENGLISH NAMES**	**LOCAL NAMES**		**STATUS**	NICK	**COR**	SAR	COM	MAR
Family Parulidae	**Wood-warblers**	**Woudzangers**							
Dendroica petechia	American	Koprofowru / Gele zanger	NBM	common	x	x	x	x	x

	Yellow Warbler								
Seiurus noveboracensis	Northern Watertrush	Noordse waterlijster	NBM	quite common	x	x	x	x	x
Conirostrum bicolor	Bicoloured Conebill	Tweekleurig spitssnavel	BR	quite common	x	x	x	x	x
Family Icteridae	**American Orioles**	**Troepialen**							
Cacicus cela	Yellow-rumped Cacique	Geelrug-banabeki / Geelstuitbuidelspreeuw	BR	quite common	x	x	x	x	x
Icterus nigrocollaris	Yellow Oriole	Bana-fowru / Fransman-kanari / Slabriki-fowru / Gele troepiaal	BR	quite common	x	x	x	x	x
Agelaies icterocephalus	Yellow-hooded Blackbird	Ger'ede / Geelkop / Geelkap-troepiaal	BR	quite common	x	x	x	x	x
Leistes militaris	Red-breasted Blackbird	Rediborsu / Roodborstje / Geelkop-soldatenspreeuw	BD	quite common	x	x	x	x	
Quiscalus lugubris	Carib Crackle	Bootstaart-karufowru / Caribische troepiaal	BR	common	x	x	x	x	x
Molothrus bonariensis	Shiny Cowbird	Putter / Glanskoevogel	BR	common	x	x	x	x	x
Total number of species of International Importance:					**19**	**7**	**13**	**17**	**10**

Western Suriname	20
Middle Suriname	13
Eastern Suriname	19

APPENDIX 3: POPULATION AND LANDUSE NORTH CORONIE

RESORT Census area	Plantation / Area	Km	NUMBER OF INHABITANTS 1964	1971	1980	1996	RICE ENTERPRISE	AREA (HA)	NUMBER OF FARMERS	LANDUSE NEXT TO RICE
RESORT WELGELEGEN										
1. Coppenameweg	**Jenny**	95	?	?	?	?	Jenny			Jenny Project?
		105	?	?	?	?	Hooplot	?1000		
		110	?	?	?	?	Vriesde			
		111	?	?	?	?	STIVOS			cocos
		115	?	?	?	?	?			?: cattle
		120	?	?	?	?	Groep Riedewald	150		
		122	?	?	?	?	VEPO Trading Co (Verwey)	500		
		124	?	?	?	?	Vriesde	800		
TOTAL CENSUS AREA 1			318	?	163	?				
2. Ingikondre	**Ingikondre**	125	?	127	?	?	Blackson-Walker	60	1	
							Ingikondre I (= Coronie)	40	6	
							Arbeid	60	2	
							Ingikondre II	100	4	
	Inverness (Ibrinesi, Emenesi)	128	?	145	?	?	Wederopbouw Ingikondre	80	5	
							Bangun Muljo	160	8	
	Hamilton (Amerton)	130	?	?	?	?	Bethel	56	3	
	Welgelegen (Wegilegi)	131	?	?	?	?	Welgelegen	110	8	
TOTAL CENSUS AREA 2			386	?	315	?				

RESORT Census area	Plantation / Area	Km	NUMBER OF INHABITANTS				RICE ENTERPRISE	AREA (HA)	NUMBER OF FARMERS	LANDUSE NEXT TO RICE
3. Hague	**Hague**	132	?	20	?	?	Bangun Redjo		4	
							Vooruitstrevend	120	6	coconut
	Moy (Moi)	133	?	?	?	?	Moy Oost: Comaco	150	2	
							Moy Oost: Vliet/Mase	30	0	
							Moy West: Blackson?	60	3	coconut
	Perseverance (Pos Berensi)	134	?	17	?	?			3	coconut / cattle
	Cadrospark (Kadrosu)	135	?	?	?	?	Oost Moy	70	3	coconut / cattle
	Bellevue (Bervyu)	136	?	20	?	?	Span Makandra	110	7	coconut / cattle
	Cocospolder		?	?	?	?				
	Mary's Hope (Mesopu)	137	?	48	?	?	Wroko Makandra	100	1	coconut / cattle
	Coroniepolder		?	?	?	?				
	Soemberedjo	138	?	?	?	?	Lareco-polder	222	38	
TOTAL CENSUS AREA 3			339	?	553					
RESORT TOTNESS										
	Totness Polder		?	?	?	?				
4. Totness	**Vestigingsplaats Totness (Frimangron)**	138	?	?	?	?				
TOTAL CENSUS AREA 4			1281	1497	702	?				

RESORT Census area	Plantation / Area	Km		NUMBER OF INHABITANTS				RICE ENTERPRISE	AREA (HA)	NUMBER OF FARMERS	LANDUSE NEXT TO RICE
RESORT JOHANNA MARIA											
5. Friendship	**Friendship (Frensipi)**			?	260	?	?	O. Th. Wolf	20		
	Bantaskine (Bantaksi)			?	118	?	?	Bantaskine	70		
	John (Dyan)			?	140	?	?	John Oost	50		
								John West	48		
TOTAL CENSUS AREA 5				561	518	390					
6. Belladrum	**Belladrum (Beladron)**			?	?	?	?	Gebr. Rozenblad	33		
								Oryza	150		
	Johanna Maria (Sagon, Nyun Gron)			?	?	?	?	Johanna maria	80		
	Groot en Klein Novar (Nofari)			?	?	?	?	Nyun Libi	78		
								Novar	part 205		
TOTAL CENSUS AREA 6				586	576	430	?				

RESORT Census area	Plantation / Area	Km	NUMBER OF INHABITANTS				RICE ENTERPRISE	AREA (HA)	NUMBER OF FARMERS	LANDUSE NEXT TO RICE
	Clyde – Salem							part		
7. Clyde	**(Dikre)**	144	?	25	?	?	Novar	205		dry crops
										dry crops
							John West	48		
	Leasowes						Clyno (Clyde-			
	(Lisowsu)	145	?	1	?	?	Novar)	200		dry cops
							NV Sara			
	Sarah (Sara)	146	?	1	?	?	Leasowes?	400		
							Bamboe Rijst	60		
							Wolf en Zonen	40		
							Lamsberg/Vroom	55		
							Burnside Oost	70		
	Burnside (Bonse)	147	?	224	?	?	Coronie Vooruit	190		dry crops
										samp
							Burnside West	200		fisheries
TOTAL CENSUS AREA 7			311	251	203	?				
WEST VAN BURNSIDE										
	Hope	148	0	0	0	?	Sidodadi	200		
	Oxford	150	0	0	0	?				
	Potosi	151	0	0	0	?				
	Bucklebury	152	0	0	0	?	Bucklebury NV	500?		
	Waltonhall	153	0	0	0	?				
	Total Hope – Waltonhall		0	0	0	?				
TOTAL CORONIE DISTRICT			3800	3100	2756	2922				

Sources:CBB (1964-71-80); Encyclopedie van Suriname (1977); Feurich (1986); Planatlas Suriname (1988); Ron Hawkey & Partners (1992); Lahmeyer et al (1993); LVV; Resort Coronie; Noordam (1997); Sanshiet (pers. comm.)

CORONIE
1980:
Source:
Planatlas
(1988)

	Land and water use (ha)
Rice	3,740
Coconut	632
Citrus	10
Cattle (heads)	737
Pigs (heads)	4,023
Beekeeping (hives)	1,750
Fisheries	small scale

APPENDIX 4:

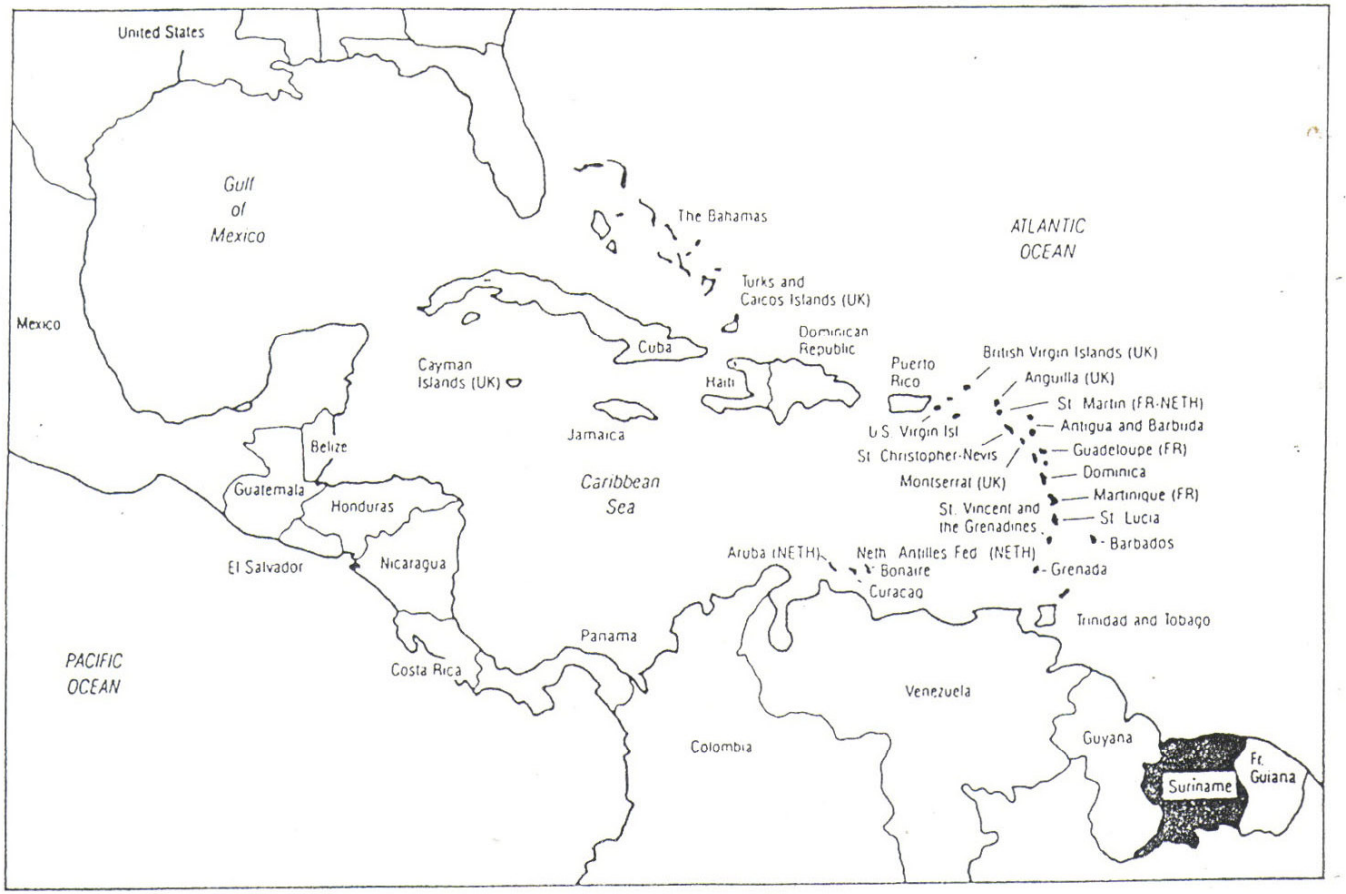
IMPACTS OF HUMAN ACTIVITIES AND NATURAL PROCESSES ON THE ECOLOGICAL ZONES OF NORTH CORONIE AND SURROUNDINGS

EXTERNAL HUMAN ACTIVITIES	ECOLOGICAL ZONES													
	dcs	shs	mfl	cma	lag	bra	frn	rbf	rid	frs	dla	ric		ups
World wide														
ocean pollution	A	A	A	A	A	A	.	.	.	.	.	.		.
production of climate change gasses .	A	A	A	A	A	A	A	A	A	A	A	A		A
Deep Sea and Continental Sea (> 6 m)														
shipping and navigation	A	A	.	.	.	.	.	.	.	.	.	.		.
shrimp trawling	A	A	a	a	a	a	.	.	.	.	.	.		.
snapper long-lining and trawling	A	.	.	.	.	.	.	.	.	.	.	.		.
foodfish trawling	A	a	a	a	a	a	.	.	.	.	.	.		.
EXTERNAL NATURAL FORCES														
coastal accretion	.	.	A	A	a	a	.	.	.	.	.	.		.
coastal erosion	.	.	A	A	a	a	.	.	.	.	.	.		.
INTERNAL NATURAL FORCES														
vegetation annex fauna succession	.	.	A	A	A	A	A	.	.	A	.	.		.
soil ripening and subsidence	.	.	A	A	A	A	A	.	.	A	.	.		.
INTERNAL HUMAN ACTIVITIES														

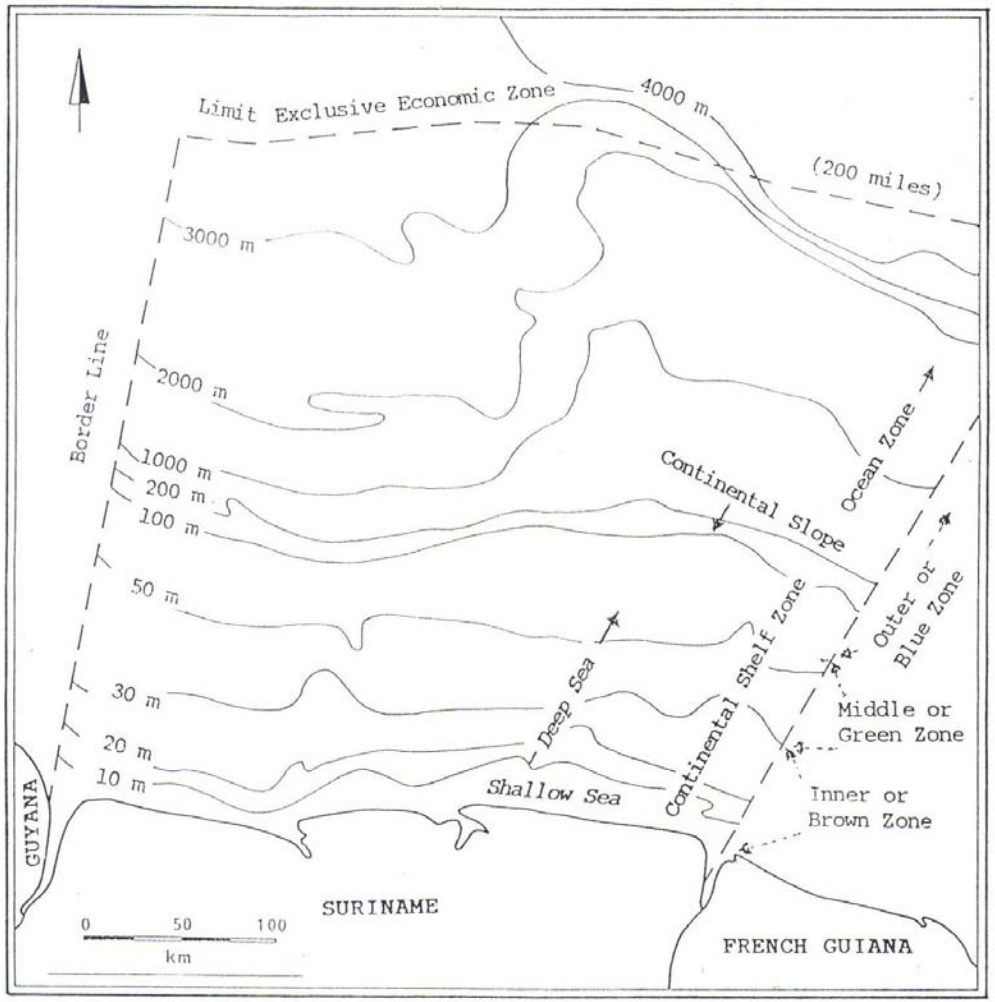
shipping and navigation	**a**	**A**	**a**	**a**	**a**	**a**	**.**	**.**	**.**	**.**	**.**	**.**		**.**
driftnet fisheries	**a**	**A**	**a**	**a**	**a**	**a**	**.**	**.**	**.**	**.**	**.**	**.**		**.**
bank fisheries	**a**	**a**	**A**	**a**	**a**	**a**	**.**	**.**	**.**	**.**	**.**	**.**		**.**
mangrove and lagoon fisheries	**a**	**a**	**a**	**A**	**A**	**a**	**.**	**.**	**.**	**.**	**.**	**.**		**.**
swamp fisheries (ditches)	**.**	**.**	**.**	**.**	**.**	**A**	**A**	**.**	**.**	**AP**	**A**	**.**		**.**
vegetation and peat fire	**.**	**.**	**.**	**.**	**.**	**A**	**A**	**a**	**a**	**AP**	**.**	**.**		**a**
large-scale rice farming	**.**	**.**	**p**	**p**	**p**	**P**	**P**	**p**	**.**	**P**	**.**	**A**		**.**
extraction irrigation water from swamps	**.**	**.**	**.**	**.**	**a**	**a**	**a**	**.**	**.**	**AP**	**.**	**.**		**a**
polder expansion	**.**	**.**	**ap**	**ap**	**ap**	**AP**	**AP**	**.**	**.**	**AP**	**.**	**.**		**P**
dry crop farming	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**A**	**AP**	**A**	**.**		**.**
animal husbandry	**.**	**.**	**.**	**.**	**.**	**P**	**P**	**.**	**A**	**.**	**A**	**A**		**.**
shell and sand excavation	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**.**	**A**	**.**	**.**	**.**		**.**
ecotourism	**.**	**.**	**.**	**P**	**P**	**P**	**P**	**.**	**P**	**P**	**.**	**.**		**.**
hunting and poaching	**.**	**.**	**A**	**A**	**A**	**A**	**A**	**.**	**A**	**AP**	**A**	**.**		**.**
sport fishing	**.**	**.**	**.**	**A**	**.**	**A**	**A**	**.**	**.**	**AP**	**.**	**.**		**.**
LEGEND														
ECOLOGICAL ZONES AND IMPACTS														
Ecological zones														
dcs = deep and continental sea (outside MUMA)														
shs = shallow sea (< 6 m)														
mfl = coastal and estuary mudflats														
cma = coastal + riverside mangrove forest and lagoons														
lag = lagoons														
bra = brackish swamps														
frn = freshwater swamps north of road														
rbf = river bank forests														
rid = ridge forests														
frs = freshwater swamps south of road														
dpo = dry polder areas: dry crops and livestock														
ric = rice polder areas														
ups = upstream swamp area														

Impacts														
A = actual direct impacts														
a = actual indirect impacts														
P = potential direct impacts														
p = potential indirect impacts														
external = forces from outside proposed management area														
internal = internal forces														

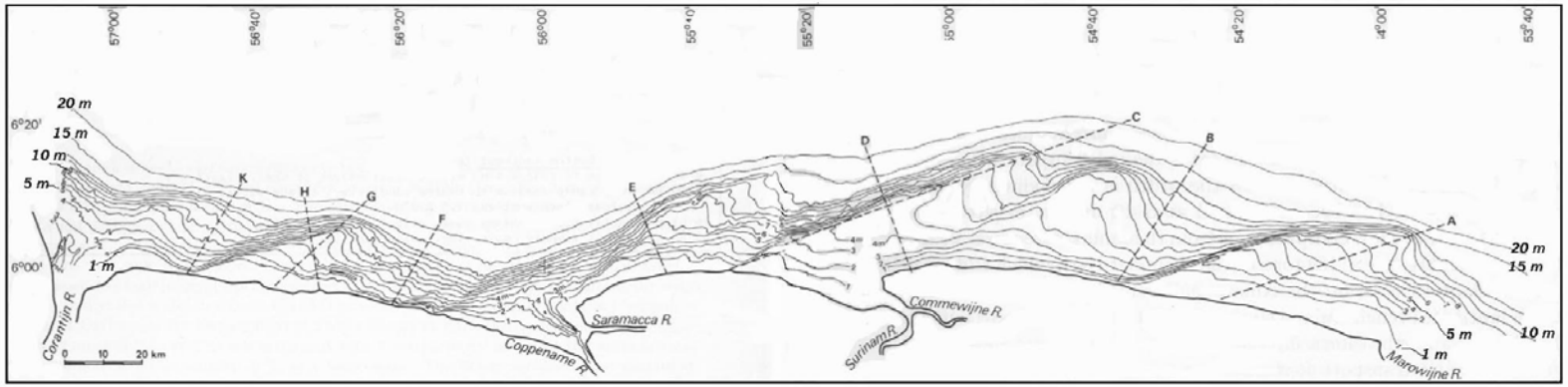
MAPS



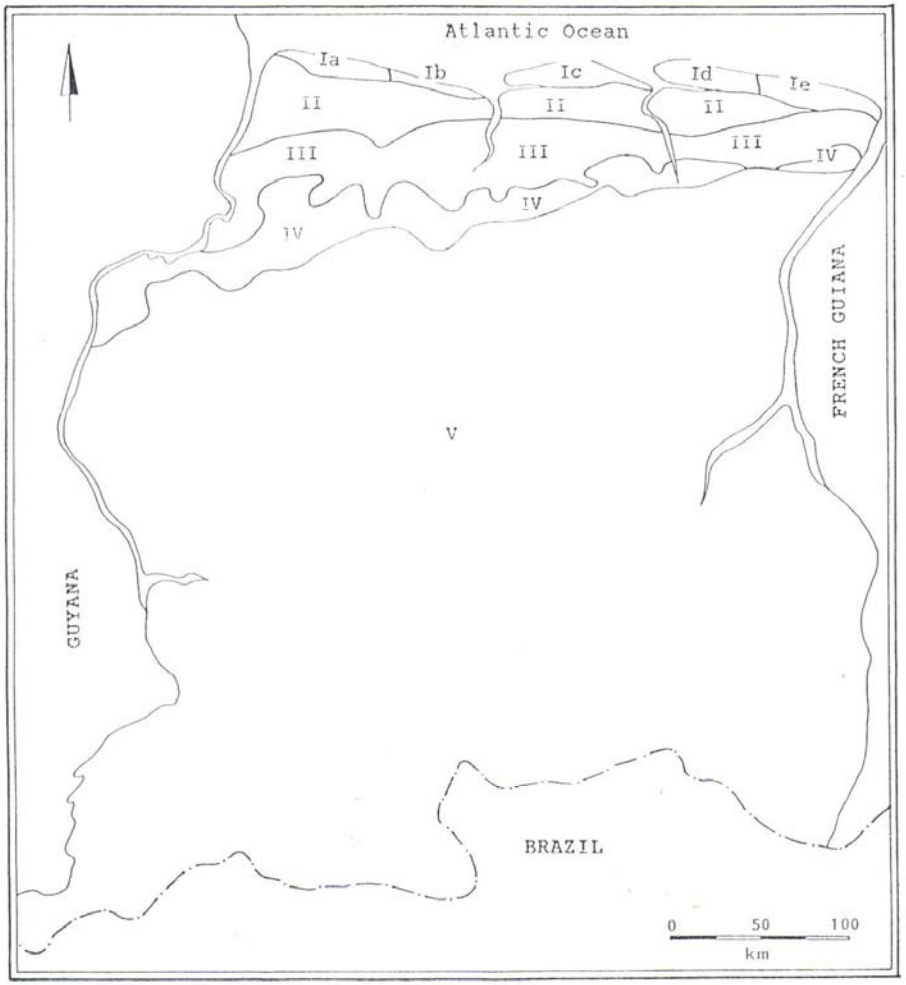
- MAP 1: Location of the Republic of Suriname in the Wider Caribbean (source UNEP, adapted)



- MAP 2: Atlantic Ocean
(Baseline Map: Jharap, 1988)

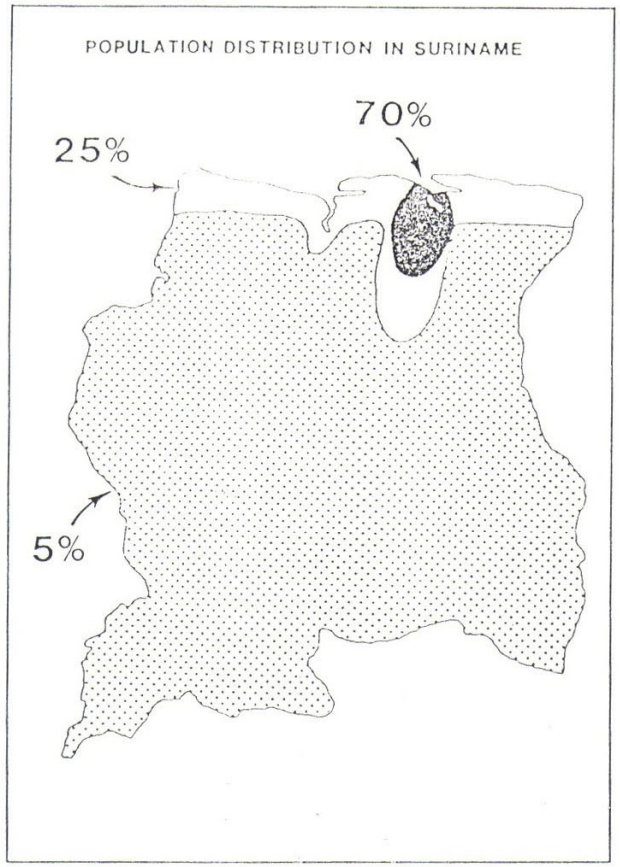


Map 3: Depth contours of the nearshore part of the Surinam shelf. (After data received from SNELLIUS and the Hydrographic Department of the Royal Netherlands Navy. Fair sheets H.Nl. M. S. LUYMES, 1966–1968).

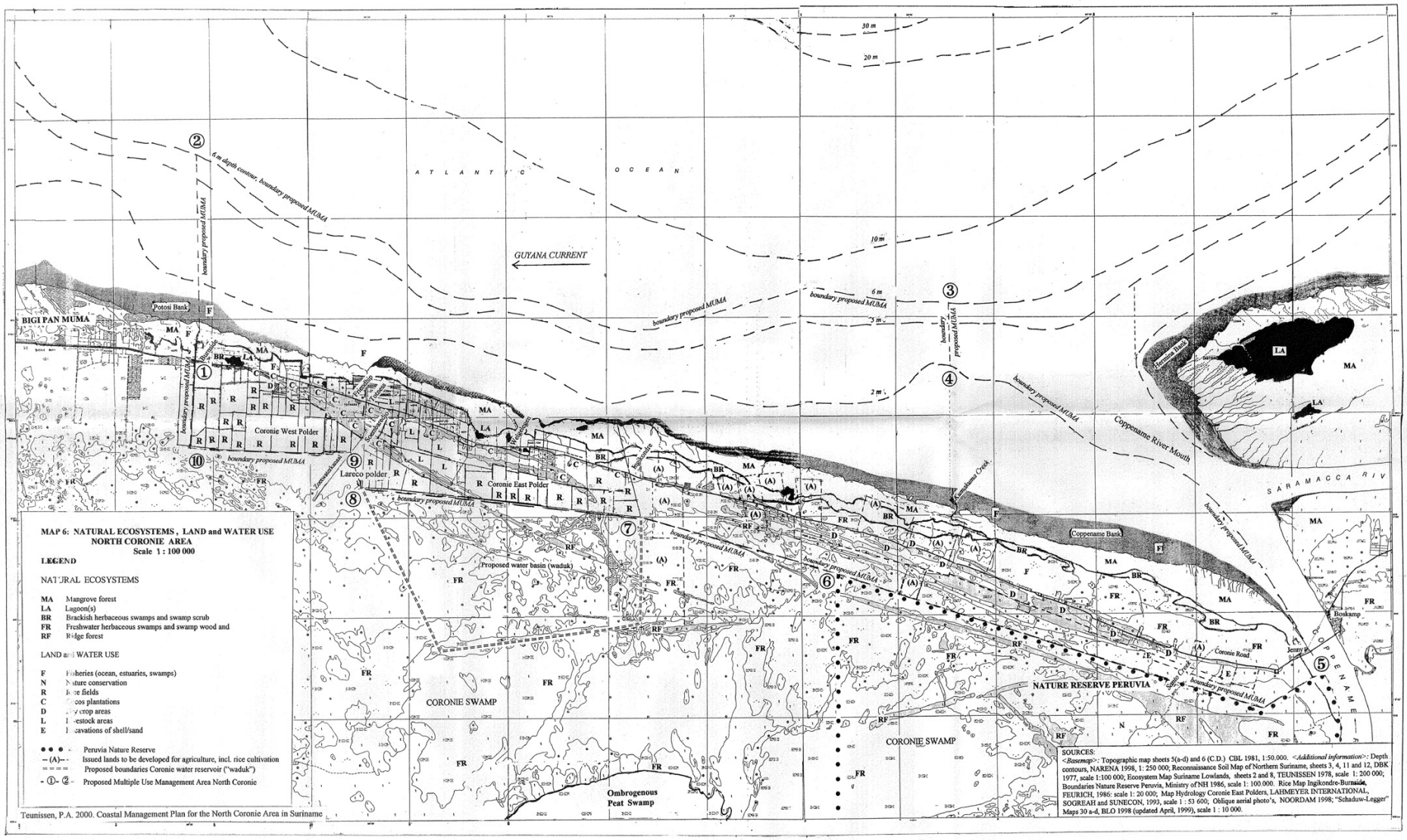


- MAP 4 The mainland zone of Suriname.

I/II Young Coastal Plain: I Estuarine Zone and subzones (a. Nickerie; b. Coronie; c. Saramacca-Wanica-Paramaribo; d. Commewijne; e. Marowijne); II Freshwater Zone; III Old Coastal Region; IV Savanna Belt; V Upland Region (Interior). Source: De Jong and Spaans, 1984)



- MAP 5: Distribution of the human population of Suriname
(source: Mittermeier et al. 1990)


MAP 6: NATURAL ECOSYSTEMS , LAND and WATER USE
NORTH CORONIE AREA
Scale 1 : 100 000
LEGEND
NATURAL ECOSYSTEMS
MA Mangrove forest
LA Lagoon(s)
BR Brackish herbaceous swamps and swamp scrub
FR Freshwater herbaceous swamps and swamp wood and
RF Ridge forest
LAND and WATER USE
F Fisheries (ocean, estuaries, swamps)
N Nature conservation
R Rice fields
C Cocos plantations
D Dry crop areas
L Livestock areas
E Excavations of shell/sand
Peruvia Nature Reserve
(A) Issued lands to be developed for agriculture, incl. rice cultivation
Proposed boundaries Coronie water reservoir ("waduk")
Proposed Multiple Use Management Area North Coronie
Teunissen, P.A. 2000. Coastal Management Plan for the North Coronie Area in Suriname
ATLANTIC OCEAN
GUYANA CURRENT
30 m
20 m
10 m
6 m
5 m
2 m
6 m depth contour, boundary proposed MUMA
boundary proposed MUMA
BIGI PAN MUMA
Potosi Bank
Coronie West Polder
Coronie East Polder
Larreco polder
Proposed water basin (waduk)
CORONIE SWAMP
Ombrogenous Peat Swamp
Hermina Bank
Coppename River Mouth
Coppename Bank
SARAMACCA RIV
NATURE RESERVE PERUVIA
Boskamp
Jennyre
Coronie Road
SOURCES:
<Basemap>: Topographic map sheets 5(a-d) and 6 (C.D.) CBL 1981, 1:50.000. <Additional information>: Depth contours, NARENA 1998, 1: 250 000; Reconnaissance Soil Map of Northern Suriname, sheets 3, 4, 11 and 12, DBK 1977, scale 1:100 000; Ecosystem Map Suriname Lowlands, sheets 2 and 8, TEUNISSEN 1978, scale 1: 200 000; Boundaries Nature Reserve Peruvia, Ministry of NH 1986, scale 1: 100.000. Rice Map Ingikondre-Burnside, FEURICH, 1986: scale 1: 20 000; Map Hydrology Coronie East Polders, LAHMEYER INTERNATIONAL, SOGREAH and SUNECON, 1993, scale 1 : 53 600, Oblique aerial photo's, NOORDAM 1998; "Schaduw-Legger" Maps 30 a-d, BLO 1998 (updated April, 1999), scale 1 : 10 000.

Map 6