



MADAM



The Mangrove Dynamics and Management Program

zmt Center for Tropical Marine Ecology



UFPA

Background

Mangrove forests are intertidal wetlands which cover more than 100.000 km² of tropical coastlines worldwide. These ecosystems are unique in their structure and are characterized by a variety of plants, animals and microorganisms, which have adapted to the dynamic environmental conditions. Mangrove estuaries function as a nursery for many fish species, mussels and crabs and support fishery yields. In many parts of the world, these ecosystems have been increasingly disturbed by urbanization, tourism, increased resource extraction and conversion to shrimp ponds. This has led to more than a 50% reduction in mangroves worldwide. The Rio Declaration, »Agenda 21«, of the United Nations Conference for Environment and Development in 1992, promotes a worldwide policy of sustainable development and cooperation on environment and development and draws attention to the ecological functions of mangroves. In response, the "Mangrove Dynamics and Management" (MADAM) research program was initiated as a long-term Brazilian-German co-operation in 1995. It is carried out in a mangrove area close to the mouth of the Amazon River in North Brazil.



Projekt Objectives

The MADAM program has two main objectives: to research the dynamics of mangrove ecosystems and to support the formulation of management recommendations based on this knowledge. An integrated approach is used which is characterized by:

1. the generation and integration of physical/ecological, economic and social knowledge about the natural and social processes operating in relation to the mangrove system.
2. the development of models for describing the mangrove system under specific scenarios, in order to promote understanding of the functions and structure of this ecosystem and its resources.
3. the formulation of coastal zone management solutions based on ecological, social, cultural and economic sustainability indicators.

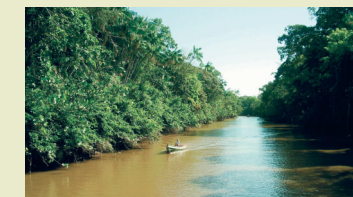
The Research Area

The research area of the MADAM Project is the Caeté estuary in Pará state in North Brazil, roughly 200 km South of the mouth of the Amazon River. This area includes a 180 km² large, mangrove-covered peninsula, bordering the Atlantic Ocean. Twenty-one rural communities which directly utilize the mangrove resources are located adjacent to these mangroves. Coastal tourism along the North coast of the mangrove peninsula is gaining increasing importance.



This area is well suited for interdisciplinary research on mangroves since:

- All typical features of a mangrove ecosystem are present
- The peninsular shape of the estuary clearly defines the geographical boundary of the research area
- Mangrove fisheries dominate as economic activity
- Small-scale agriculture provides only limited impact from the hinterland to the mangrove area



Projekt Structure

The MADAM project involves various scientific disciplines, such as Ecology, Biogeochemistry, Meteorology, Geography, Socio-economics and Modeling. The progression of the MADAM project occurred in three different stages:

MADAM Phase I (7/95-6/99)

Collection of the necessary baseline data for each participating discipline.

MADAM Phase II (7/99-6/02)

Cooperation on jointly decided topics. This approach allowed for the disciplinary methodologies to complement each other.

MADAM Phase III (7/02-12/05)

Establishment of cooperation with non-academic local stakeholders, in which jointly defined target problems are addressed.

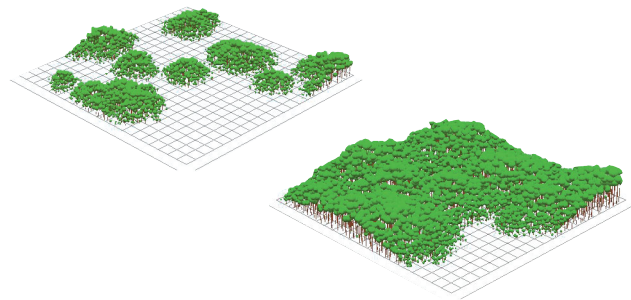


The Scientific Program

Based on the concept of integrated coastal zone management, several research areas have emerged as central focus during the phases of the MADAM project. These are:

Dynamics of the Mangrove Forest

Little is known about the main driving forces which influence the growth and distribution of mangroves. Tools such as botanical surveys, aerial photography and satellite imagery analysis are used to assess the present forest structure. This is combined with biogeochemical analyses of soil parameters in relation to flooding frequencies. The vegetation history of the last 7.000 years is also investigated through analysis of fossil plant remains in sediments. All of this data is then combined into a dynamic mathematical model, aiding the interpretation of the processes which affect mangrove structure. In addition, the influence of human utilization, e.g. selective cutting of mangroves, is included in this research topic. This knowledge will support the development of sustainable mangrove utilization schemes for the area.



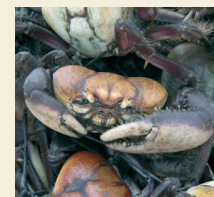
Mangrove Crab Population Dynamics

The large mangrove crab *Ucides cordatus* is a major protein and income source for the local rural population. Major attention of the biologists is given to the life cycle and population dynamics of the crab population, including genetic studies. The harvest of this crab has been monitored daily since 1997, providing information on the number and sizes of commercially landed crabs and the economic returns to the crab collectors. Combined with studies on the socio-economic situation of crab collectors, this provides the scientific basis for the development of a plan for the sustainable management of this species.



Development of Co-management Schemes for Local Rural Communities

Mangrove resources centrally support rural coastal livelihoods. This provides the incentive for user participation in coastal management, a recent legal option in Brazil. Analyzing the formation of co-management schemes in mangrove areas, and facilitating participatory planning and monitoring in coastal communities is therefore a main focus. In conjunction with academic and non-academic stakeholders, the aim is to generate verifiable targets for sustainable management and to strengthen the institutional base for effective co-management. Scientific results, such as the rate of reproduction of commercially important fish stocks, as well as local priorities play complementary roles in this transdisciplinary process.



Training

Partnerships in training and education constitute an essential component to the MADAM program. Scientists are involved in the academic training program of the Universidade Federal do Pará in Belém and Bragança, as well as at the Bremen Center for Tropical Marine Ecology. Brazilian and German Master and PhD students collaborate with the planning and implementation of scientific projects, fieldwork, data analysis, and publication of the results. Annual workshops on the current stage of the project are held in Brazil, in which all members and students of MADAM have the opportunity to present and discuss their work in an interdisciplinary environment.

These young scientists are thus equipped with the necessary knowledge to assist and consult local decision-makers in planning and realizing sustainable management concepts. In this manner, MADAM is contributing to capacity building on the regional level.



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