Assessment of SHIFT-results: Natural resources

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Since the SHIFT-program was established within the framework of the special agreement on cooperation in environmental research and technology in 1989 by a bilateral cooperation between Brazil and Germany, the program's results have been contributing remarkably towards better resources management, leading therefore towards a more sustainable and environmentally sound development. Considering the whole program the projects comprise different physiographic regions and thematic fields, such as Mata Atlântica (air pollution), Pantanal (ecology and socio-economy), Central Amazonia (Manaus region: primary production, fishing biology element fluxes, agroforestry, reforestation, and soil fauna), Eastern Amazon (Belém region: secondary vegetation, small peasants).

Considering that soil-, abiotic and socio-economic assessment is reported elsewhere, this section will focus on natural resources in a broader sense. Nevertheless, some considerations may still overlap with other sections. Understanding that this evaluation is supposed to be an overview with respect to those natural resources, which the program through the different projects has focused on so far, it is not intended to present primary data. These are also reported elsewhere, associated to their respective projects. Here, mainly the topics of the different groups have been considered. Additionally, few comments and suggestions are offered as strategic approaches in order to strengthen the program as a whole.

1. PRESENT SITUATION

In order to summarize as well as to build up a frame structure to the topics been covered by different projects, three questions were asked as following: Which are the natural resources herein considered? How have they been used? And how have they been maintained to assure land sustainability over a long period of management? Trying to answer these questions a hierarchical model is suggested starting from organisms (biological entities/ processes), going to production systems (natural and man made systems), to communities/ micro-watersheds/ ecological niches, and ending finally at the level of habitats/ecosystems.

1.1 Organisms (biological entities and processes)

This is the basic level considered, and mainly focused on plants, animals, and microorganisms, including their interactions. With respect to plants there is the whole range from herbs and herbaceous species to trees, in dry and regularly flooded habitats, in all regions considered (Mata Atlântica, Pantanal and Amazonia) and almost by all projects, as opposed to animals, which are considered only by a few projects, mainly the ones related to fishery. Soil fauna and microorganisms are being considered, as well in, a number of projects. So are to a large extent some of their symbiotic interactions with plants (endomycorrhizal fungi and nitrogen fixing bacteria) herein mentioned as biological processes.

1.2 Production systems (natural and man made)

At this level SHIFT projects are focusing mainly on the understanding of isolated components of different systems, where the production of each component is very important. Since the program is considering habitats and systems of different regions, the components here are to be understood as any annual or perennial crop, fish population and the respective food web, as well as the role and rate of development of a vegetation within the context of shifting cultivation agriculture. This understanding is very crucial, in order to delimit the level of effective costs, to start a process of improvement of such a component (varietal selection, genetic improvement, changes in management processes, introduction of new components into the systems, etc).

Associated to those activities at system level, several studies are conducted to monitor natural resources, such as: above- and below-ground water, above- and below-ground biomass production and nutrient fluxes, light quality at different strata, and levels of biodiversity as a function of anthropogenic (i.e. agricultural) activities. The close monitoring of such variables should guide towards appropriate management practices leading to maintenance of the systems productivity. Consequently an increase in sustainability is obtained by improving the usage of the available resources, making them reach the system more easily or capturing them more efficiently.

1.3 Community/ micro-watershed/ ecological niches

At this level, there are only few projects being carried out and the research activities are more concentrated on the mere monitoring of natural systems, which may also be severely influenced by other ongoing human activities outside the boundaries of the study area, i.e. in the seasonally flooded areas of the Pantanal and Amazonian várzeas. The investigation activities may be very useful for environmental institutes and authorities, in order to set forth appropriate environmental policies. From a production system point of view, looking at a more realistic up-scaled scenario at the community level, the alternative of a slash-and-mulch agriculture can be mentioned as a way out of the current, yet much practiced, slash-and-burn agriculture in the Bragantina Region, where modern colonization took place over a century ago. In this case, the expectation is also, to be able to influence the current agricultural practices, as well as give support to generating and implementing suitable technologies for an appropriate rural development and a sound environmental policy.

1.4 Habitats, ecosystems

The elements considered at this level of study are the following: vegetation cover at different physiographic conditions such as: Mata Atlântica, Amazonian primary and secondary forest on the „terra firme“ and Amazonian „várzea“ forests; nutrient fluxes; limnological and biological characterization of water bodies, and air pollution. The studies results generated at this level are very important, since they can contribute to changes in development and environmental policies, provided that the institutions in charge of those policies are willing to consider technical and scientific background.

Considering that this is the third SHIFT-Workshop (after Belém-PA, in March 1993 and Cuiabá-MT, in July 1995), the overall retrospective reveals that the results generated in this program represent an extraordinary body of scientific and technical information related to natural resources. Undoubtedly there is a significant contribution to the Agenda 21, as well as to other conventions such as Biodiversity, Global Change and Forestry. A considerable

number of contributions also correspond with the major goals of the Pilot Program for the conservation of the Brazilian rain forest.

2. STRATEGIC APPROACHES FOR THE FUTURE

Given the fast speed of changes and dynamics of interests for social, environmental and economical sustainability at the global level, some suggestions are listed at different levels, supposing that they will be crucial not only for the strengthening of this program, but, what is even more important, to enhance its contribution towards a more equitable development process as a whole.

2.1 Research themes

2.1.1 Valuation of natural resources

This is a very important segment of research. Looking at the here utilized hierarchical structure to describe the ongoing research in the SHIFT program, there are components, which monetary or non-monetary values can be attributed to at different levels. The analyses have to go beyond the social and economical consideration. Although, some initiatives into this direction are already under way within specific projects and discussions are taking place at program level, it is important that valuation of natural resources is made an officially part of the SHIFT research agenda.

2.1.2 Functional analyses of biotic components

A continuos progress is needed for the understanding of each component, or of a group of organisms within a production system or higher level (i.e. primary forests as emphasized by the previous lecturer with respect to the sparse work done in such ecosystem), in order to open up alternatives for land-use practices leading to a more sustainable natural resources management.

2.1.3 Upscaling of the monitoring level

Since trial plots are relatively small in most experimental studies, or tests are conducted in very few places, only, it becomes increasingly relevant to consider monitoring at higher levels such as community or small watersheds in order to secure representativeness of the generated data.

2.2 Organizational and structural aspects

2.2.1 Within, and between projects in the program

It is important to have a minimum of coherence of methodologies applied for related studies, within and among the projects. Periodical meetings should be a forum to discuss and exchange information of this sort, which will facilitate data to be comparable due to standardized methodologies.

2.2.2 Data base formation

The information generated at different projects after been published should be part of a data base, which could be the basis for modeling work (already discussed at the panel session). Standardized data entry formats should be defined and utilized. A respective workshop with project leaders and coordinators as well as specialized and experienced consultants (i.e. from a CG center or others) should be considered.

2.2.3 Interaction with other scientific-technical, environmental programs

Considering the high convergence of the goals of SHIFT-program, and others such as the Pilot Program to protect the Brazilian rain forest (PPG-7), as well as The Large Scale Biosphere-Atmosphere Experiment in Amazonia (LBA), a better interaction may represent a short-cut to achieve required information. Provided the strong unbalanced proportion of well trained researchers operating mainly in Amazonia, and given the high demand of their collaboration by these projects, a close interaction between them certainly would be very beneficial to the whole development process.

2.3 Human resources qualification

The program since its beginning has been operating with personnel in process of obtaining their academic degree (Brazilians and Germans), at different levels such as undergraduate, „diploma", masters, and doctorate students, as well as researchers supported by different kinds of assistantships provided by CNPq, which along those years have contributed enormously to the projects outputs. Given the high qualification, reached by the majority of these „trainees", it is important to look for a way (mainly for the Brazilian ones, usually the Germans return after their field work) to fix those qualified professionals into the respective regions, where their expertise is needed. This aspect of personnel qualification has always been a very strong contribution of the program and it should be continuously supported.

2.4 Impacts of the program on natural resources management

The SHIFT-program can contribute significantly to improve the management of natural resources, as well as to improve their sustainability over a long period of time. This major contribution may be achieved through several effective and well focused target documents to different stakeholders, such as:

- **Scientific papers**
  for scientific and academic purposes and the advancement of scientific knowledge
- **Environmental education documents**
  for schools and general public, and
- **Public policy documents**
  for decision makers at different natural resources responsibilities (water, mining, forestry, agriculture, environmental in general) or through tangible outputs, such as:
- **Technological development processes**
  for the development of goods and services beneficial to the society as a contribution to a more equitable and sustainable development.

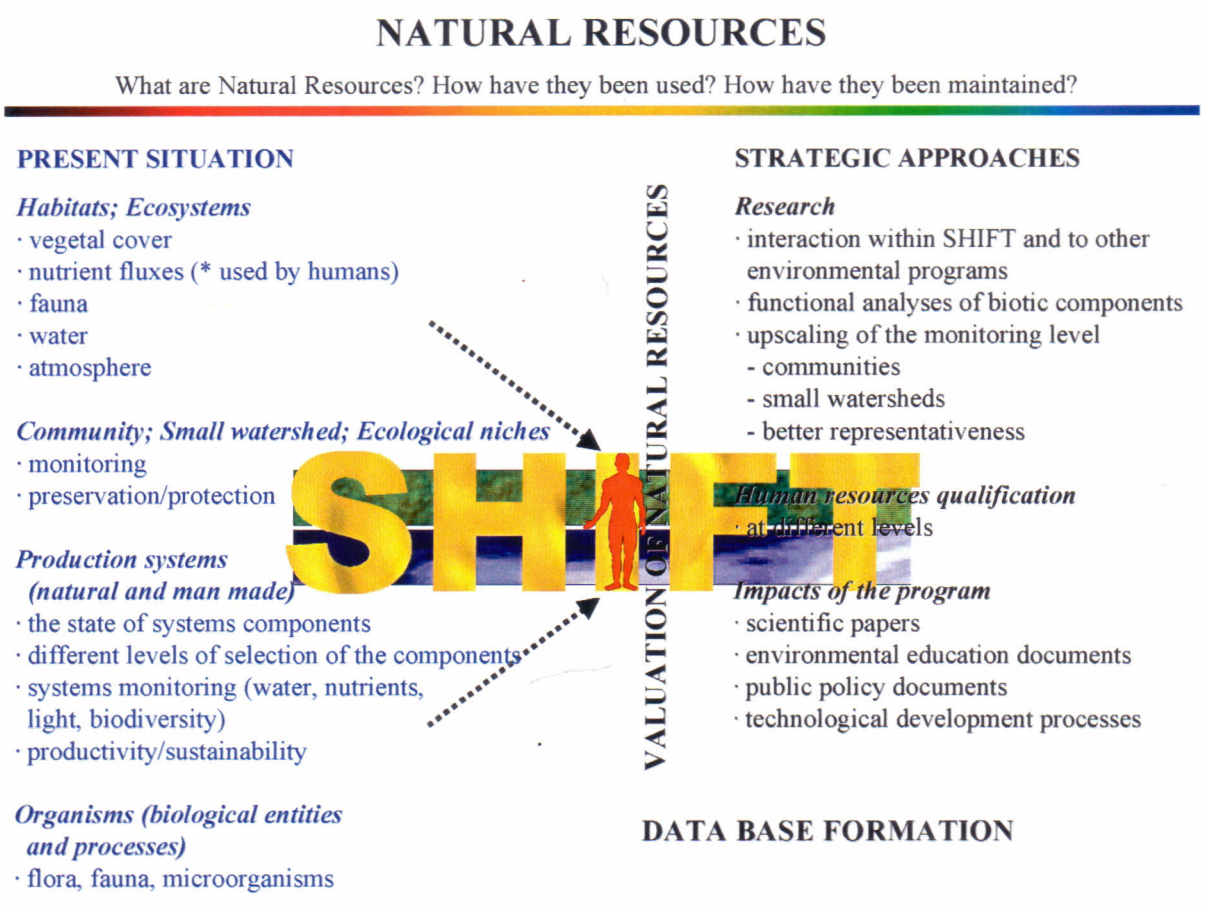

Figure 1: Schematic diagram of SHIFT action with respect to natural resources

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