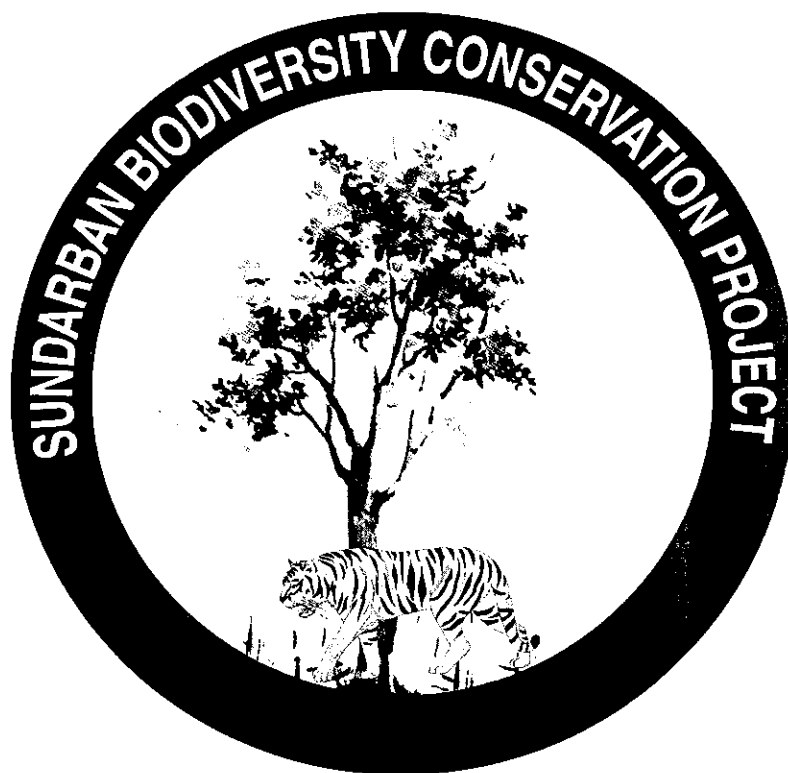


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Towards Integrated Management of Sundarban Resources
INTERNAL NOTES- IN No. 38
By Mr. Hans van Zon, Fisheries Management Specialist
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**TOWARDS INTEGRATED MANAGEMENT
OF SUNDARBAN RESOURCES**

August, 2001

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Summary

This document is written to evoke discussion within SBCP (FD and TAG, but also supervising committees and MoEF) on the meaning and significance of "integrated resources management". At present there is no clear understanding and certainly no consensus of what the objectives of integrated management are, and how they have to be met.

The report summarizes the various concepts of integrated management encountered, and proposes to use the "ecological" one: management of each of the individual resources in a manner that the (functioning of) others are not negatively influenced. Acceptance of this concept would demand for re-statement of the objectives of SBCP, which presently are potentially conflicting.

Management of Sundarban resources cannot continue in the way it was done before. Too many environmental and social changes are taking place, determining the future character of the resources. Most of these changes are beyond the control of the Forestry Department. Future management of Sundarban resources will have to account for these changes, and their dynamics will have to be part and parcel of management plans.

The report provides a general framework for a natural resource management system, of which a resource management plan is the central nucleus. The specific resources in need of management plans are listed, and a general table of content is provided.

Steps are identified for the development of an integrated management system for the Sundarban. The steps include (i) refining of management objectives, (ii) preparation of a set of specific resource management plans, with strong focus on zoning, (iii) identification of relevant change processes, (iv) incorporation of the dynamics of changes into the specific resource management plans, (v) identification and quantification of conflicts and trade-offs between management of different resources, and (vi) incorporate solutions for conflicts and accepted trade-offs in the final integrated Sundarban management plan. Given the speed of environmental change, this resulting plan will be for relatively short-term use only; monitoring will determine the needs for regular adaptation.

The steps are worked out. Among the proposed actions is the organization of a national workshop on Sundarban management.

1 INTRODUCTION

The Forestry Department of Bangladesh is the custodian of the largest uninterrupted mangrove forest in the world, supporting both biodiversity (landscapes, ecosystems, species) and socio-economy (products, employment, national revenue): *the Sundarban*. The Sundarban is neighboured by areas (now called the "Impact Zone") where the natural resource base has been substantially depleted as a result of population pressure and rapidly improving economies. The communities in this neighbouring area are anxious to find resources to meet their growing requirements, and especially to supply their food and energy demands. As a result, the Forest Department (and the Government of Bangladesh as a whole) is in an enormous dilemma: to attempt to sustainably manage the Sundarban resources, while meeting the urgent development (and sometimes survival) needs of the people.

The purpose of this report is to initiate discussion within the SBCP (FD and TAG, but also supervising committees and MoEF) on linkages between the two main purposes of management of the Sundarban resources: *conservation* (biodiversity, landscape) and *production* (continued provision of national revenue, local employment).

Solving the dilemma is expected to be achieved by "*integrated management*". In discussions and publications, it is clear that this is not a universal concept; the following descriptions may be summarized:

- integrated management of Sundarban means management of resources for the dual purposes of *biodiversity conservation* and *sustainable exploitation*. It might be clear that sound resource management will only be possible after far more accurate definition of the *expected outcome* from each of the two activities. Only then "integration" will be possible: the development of management tools that will serve the best interest of both.
- integrated management of Sundarban means management of the distinguished resources (forestry, aquatic products, wildlife, NWFP, eco-tourism) through a process of information gathering, analysis, planning, consultation, decision-making, allocation of resources, formulation, implementation, enforcement, and monitoring. This kind of description is favoured by technical specialists, who tend to strive for *maximum output* (produce or revenue) from specific resources. It is certainly required to design this kind of resource-specific management systems, since they provide the management platforms from where integration of objectives can commence.
- integrated management of Sundarban means multi-use management of all resources in such a manner that *maximum revenue* is targeted. This description is a slight variation of the previous one. This description is slowly disappearing under pressure of the actual situation, but the past revenue significance of Sundarban forestry and the associated expectations mean this will continue to play a role.
- integrated management of Sundarban means management of each of the individual resources in a manner that takes *sustainability of all resources* into account. This means that sectoral needs and outputs are considered with respect to the variety of goals and objectives, ascribed to the Sundarban. There where mutually exclusive options exist, those most favoured will be selected over others. This means that there might be *negative influences* on the use of one resource in return for something of greater benefit from the use of another resource. This kind of description is favoured by ecologists, who tend to strive for *optimum output* (produce or revenue) from the total resource base. In fact, this

should be the approach for the "***Integrated Management Plan***" that SBCP is expected to put in place, and that will be based upon various specific resource management plans.

SBCP started under the first description, which is more or less stated in project documents, as well as in recommendations from earlier projects. Hopefully, it will more and more move towards the last description, which best guarantees the continued availability of the variety of uses and services provided by the Sundarban.

Professional and sustainable resource management planning may well result in decreased resource exploitation opportunities (in quantities or in time), as is seen in the present draft Fisheries Management Plan. In integrated management, where optimum output from a variety of resources is to be secured, reduction of exploitation pressure might be even more severe. In SBCP project documents this is expected, which resulted in adding a project component on development of ***other/new employment/income opportunities*** for (a part of) the resource users.

At the moment it is too early to determine what kind and level of resource exploitation should be carried out or limited where and when. Therefore, work in the Impact Zone should first focus on development of employment opportunities that are ***not related with Sundarban resources***, and on those people that are ***not yet active in the Sundarban*** (newcomers, especially youth). Limiting people that are now already active in Sundarban resource exploitation in their activities might be too impulsive or premature, since the right messages for improved or adapted exploitation are not yet available.

2 SUNDARBAN RESOURCES MANAGEMENT

2.1 Basic considerations

Management of the resources of the Sundarban is faced with a great paradox. Despite its still abundant natural resources (wood, fuel wood, honey, aquatic products), the populated area around the Sundarban (the Impact Zone) is currently one of the least developed regions of the country. Limited skilled human resources constrain new developments, and as a consequence relying on exploitation of natural resource assets continues and increases, supported by foreign investment.

At the same time, growing environmental conscience and international interest in supporting biodiversity conservation stimulate conservative use of resources, which might result in a socially unacceptable lower availability of resource assets for exploitation. As stated in the Introduction, politics (and donors) have found a solution to this dilemma, which would "save both the goat and the cabbage".

It has been shown around the world that this approach will not be viable in the longer term. However, it provides a saleable solution for short-term continuation of (guided) multi-use of resources. To prevent that the intention of long-term conservation of biodiversity remains lip-service only, this solution is mostly reinforced by declaring a part of an area protected.

Also in the Sundarban nearly a quarter of the area is declared sanctuary area, under full-scale protection. The relation of this sanctuary area with (preservation of) biodiversity is unclear. The remaining parts of the Sundarban might well be of more importance for biodiversity conservation, but continue to be exploited, whereas decreased production levels are sought to be compensated by adding new products. In that way all parties are temporarily satisfied, and international financial assistance is secured as well. Also this approach is called "integrated resources management", but, as said before, this is not an *integration* of management measures, but a *combination* of those measures that safeguard continuation of both development and conservation prospects, albeit in different areas, and albeit short term only.

Also in SBCP no real integrated management is planned as yet, as might be seen from the project statements and objectives hereunder, all distilled from project documents. The statements are placed in pairs, every time highlighting potential management conflicts.

SBCP - STATEMENTS AND OBJECTIVES

- Sundarban is the largest continuous mangrove area in the world, and a World Heritage Site.
- Sundarban is the largest production forest in Bangladesh, providing significant national revenue.
- Biodiversity of Sundarban is considered exceptionally high, justifying conservation management.
- Wood production in Sundarban is considered indispensable for national economy, justifying productive forest management.
- Sundarban is supporting important international common (marine) resources, justifying resource management on the basis of international conventions.
- Fish production in and around Sundarban is considered an important national revenue earner, to be managed by Forestry Department.
- Sundarban resource exploitation proceeds at (or over) optimum (sustainable) levels.
- Large and increasing amounts of people are dependent on Sundarban resources, justifying maximum resource exploitation.

The SBCP was established in this situation of potential and actual conflicting interests, with the objective to develop and introduce a system of INTEGRATED RESOURCES MANAGEMENT, which allows optimum long-term sustainable production in a framework of maximum biodiversity conservation. To be able to design a system with long-term value, however, the relative importance of conflicting objectives will have to be determined and management of conflicts will have to be part and parcel of the final management plan.

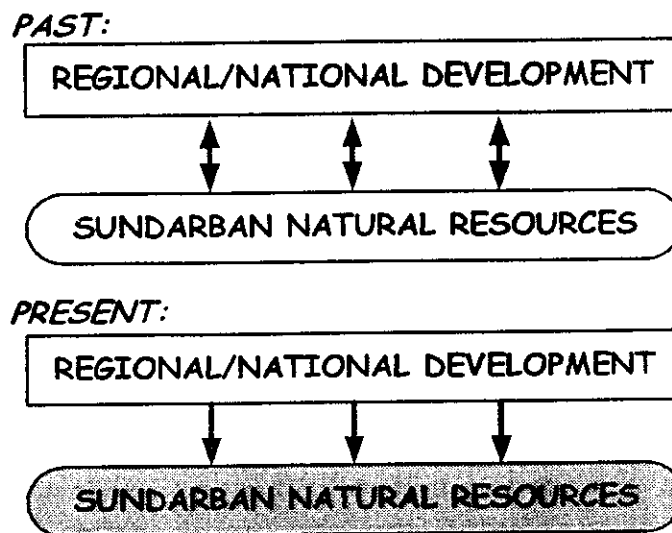
2.2 Traditional and present situation

Since well over a century, the FD exploited the Sundarban successfully through forestry management: a flow of forestry produce and revenue reached the country. Recently, the situation changed: on the one hand a reduction in harvested forest volumes was experienced, and on the other hand other Sundarban management objectives were added to forestry, such as biodiversity conservation. Moreover, there are a number of critical issues affecting the long-term viability of sustainable resource exploitation in the Sundarban. These issues are interrelated, often complex in nature, and largely *beyond the control of the Forest Department*.

- tectonic movements, causing changes in salinity and sedimentation patterns;
- rural development in Bangladesh north of the Sundarban, especially construction of polders, causing decreased availability of fresh water and increased sedimentation;
- hydrological developments in Bangladesh and India, such as dam construction, causing decreased availability of (flushing by) fresh water and increased sedimentation;
- sea level rise;
- pollution;
- political pressure to continue unsustainable activities (e.g. Khulna Newsprint Mill);
- growth of the population in need of forestry (wood and non-wood) and fisheries products, resulting in increased intrusion.

Whatever the nature and magnitude of the issues is, they have one effect in common: *change*. Change in the chemical, physical, and ecological environment, which has an effect on vegetation associations, plant succession, and types and sizes of production. Although much of this change (and of the underlying dynamic processes) is still poorly understood, it is imperative that it has to be translated into changes in traditional management patterns, even before integration of the management of specific resources can be considered.

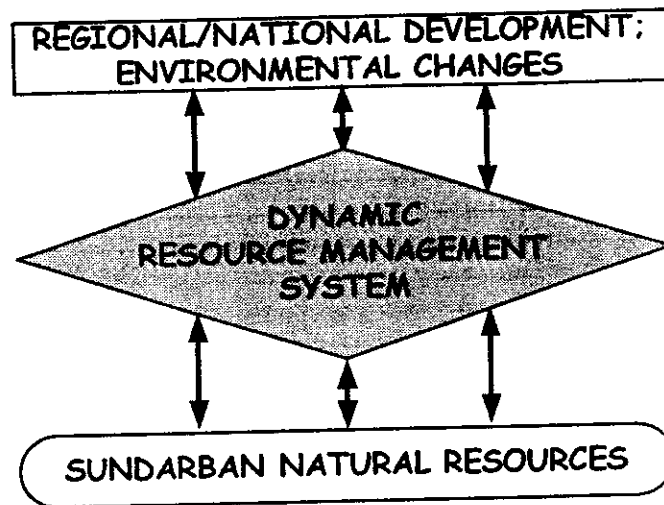
The traditional and present situations are depicted below. Traditionally there was a dynamic equilibrium between the available natural resources in the Sundarban and the requirements of the people in Bangladesh and elsewhere. Because of the earlier mentioned issues this equilibrium disappears. A situation is emerging, where traditional exploitation systems deplete the traditional natural production opportunities.



2.3 Management of change

If the present situation, as shown above, continues too long, it might result in *irreversible damage* to the natural resources, as seen in other places in the world. Neither production, nor biodiversity will benefit. In order to prevent reaching the “point of no return”, it is imperative to change the relation between development (= exploitation) and the resource base into a

designed relation, called *Dynamic Resources Management*. This means that more and more scientifically collected and processed information will be used to determine the levels to which each natural resource may be managed (exploited, conserved, adapted) in order to guarantee continued existence during major processes of change:



The evolution from the present situation towards this new one is not something that is achieved overnight. It requires a process of "adaptive learning", during which the resources and associated ecological functions and attributes are discovered and understood, as well as the manner in which management interventions interact with them.

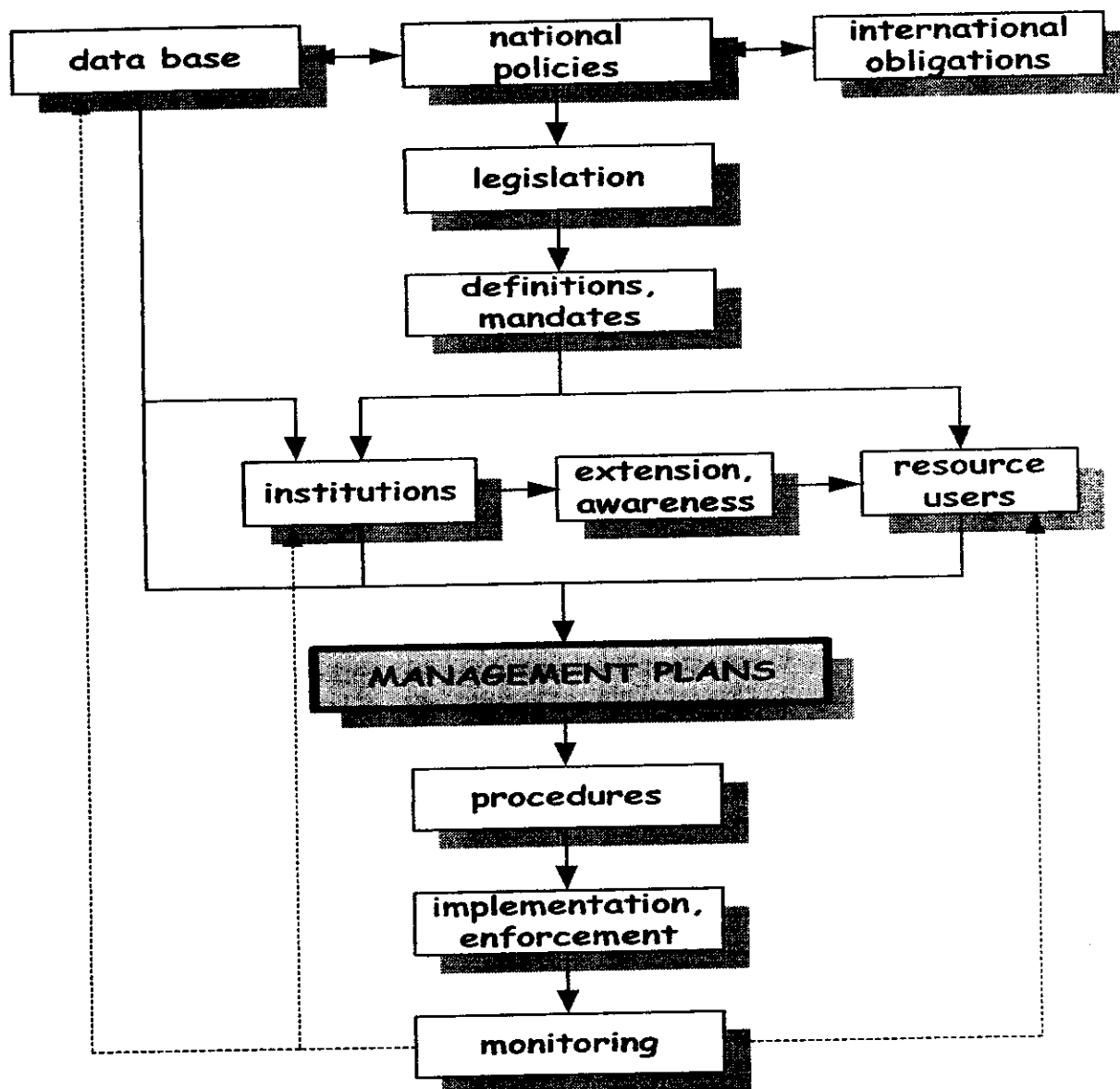
In order to support this learning process (the dynamics of knowledge), a Dynamic Resources Management plan includes specification of what is required in terms of institutional development and capacity building. Knowledge on the significance of major processes of change and on the manner in which management measures may keep pace with them will have to be brought into the Forest Department.

3 RESOURCE MANAGEMENT SYSTEMS

3.1 Systematic

In order to be able to determine resource exploitation levels under present and future circumstances, a basic Natural Resource Management System needs to be developed for each exploitable resource, according to the systematic shown in the chart below.

NATURAL RESOURCE MANAGEMENT



3.2 Resource management systems in SBCP

The specialists in SBCP (FD + TAG) will design resource management systems, as depicted on the previous page, for the various natural resources of the Sundarban. Given the common objectives of resources management, viz. (on the one hand) to at least maintain, but preferably increase exploitation opportunities, and (on the other hand) to conserve resources which are already nearing exploitation limits, the design of management systems will not be limited to known exploitable resources, but also include new resources, as well as adding value (= employment) to existing ones. This results in the following table of expected resource management systems:

"Traditional" resources: <ul style="list-style-type: none">> forestry products> fisheries products (marine, brackish and fresh)> traditional non-wood forest products
"New" resources within Sundarban: <ul style="list-style-type: none">> wildlife (aquatic and terrestrial) biodiversity> eco-tourism activities
"New" resources within or outside Sundarban: <ul style="list-style-type: none">> plantation forestry products> aquaculture products> apiculture
"New" resources outside Sundarban: <ul style="list-style-type: none">> new non-wood forestry products> processing and value-adding of various products

3.3 Dynamic Resource Management Systems

As was seen in the chart earlier, a management system for a certain natural resource requires collection of various kinds of data, setting of management mandates, and preparation of management plans. The *management plans* are the most important outputs, since they describe in detail how management has to be implemented:

1 HOW MAXIMUM SUSTAINABLE EXPLOITATION OF THE SPECIFIC RESOURCE CAN BE ACHIEVED:

- types of products to be harvested (species, size, etc.);
- total amount of each product to be harvested within a certain year;
- areas where harvest and no-harvest have to take place;
- timeframe in which harvests have to take place;
- who are allowed to harvest.

2 WHAT HAS TO BE DONE TO SECURE THIS ACHIEVEMENT:

- procedures to guide the proposed management measures;
- monitoring systems;
- ways and level of data management;
- enforcement of rules and regulations;
- required manpower capabilities and way to reach them;
- required equipment, funds.

3 HOW ONGOING AND EXPECTED CHANGES IN THE PHYSICAL AND CHEMICAL ENVIRONMENT WILL HAVE TO BE ACCOUNTED FOR:

- relations between main change processes (salinity, sedimentation, changing produce needs, pollution, sea level rise) and resource exploitation;
- data collection requirements (what and by whom, new research needs);
- needs and systems of monitoring;
- resulting institutional needs (capacities, knowledge).

4 WHERE INTERFERENCE IS EXPECTED FROM THE MANAGEMENT OF OTHER SPECIFIC RESOURCES, AND SUGGESTIONS TO COPE WITH IT:

- potential conflicts (what, where, socio-economic significance);
- trade-offs.

Especially the components “3” and “4” upgrade resource-specific management plans towards *Dynamic Resource Management Plans*: they set conditions to production outputs based upon change scenarios, which are substantiated through specific monitoring.

So far, the following Management Plans are prepared:

- a Forestry Resources Management Plan under FRMP, 1999 (including some of the NWFPs);
- a (draft) Fisheries Management Plan under SBCP, 2001;
- an Apiculture Management Plan under SBCP, 2001.

Management plans have still to be prepared for (components of) wildlife, for potential new products (NWFP and others), and for eco-tourism development.

4 TOWARDS INTEGRATED RESOURCES MANAGEMENT

4.1 Steps for the Sundarban

From the sections before, we may distil a number of steps that are required to finally achieve an Integrated Resource Management Plan for the Sundarban. These steps are repeated in the following table, and worked out in the following sections.

STEP 1	REFINE AND RESET OBJECTIVES OF SUNDARBAN MANAGEMENT In order to prevent continuation of confusion, and in order to obtain political authorization for selected objectives
STEP 2	PREPARE RESOURCE MANAGEMENT PLANS FOR SELECTED RESOURCES On the basis of maximum output, and including procedures and monitoring
STEP 3	IDENTIFY AND ASSESS ENVIRONMENTAL CHANGES And their relation with the (functioning of the) resource base
STEP 4	INCORPORATE ENVIRONMENTAL CHANGES INTO DYNAMIC RESOURCE MANAGEMENT PLAN In order to link management measures to area and time
STEP 5	IDENTIFY AND QUANTIFY TRADE-OFFS AND CONFLICTS BETWEEN SPECIFIC MANAGEMENT PLANS
STEP 6	CONSOLIDATE DYNAMIC RESOURCE MANAGEMENT PLANS INTO AN INTEGRATED MANAGEMENT PLAN FOR SUNDARBANS With shorter-term and longer-term perspectives

Above is shown that the process of INTEGRATION OF MANAGEMENT OF (MULTI-SECTORAL) RESOURCES (STEPS 5 and 6) cannot take place before all specific plans (STEPS 1 - 4) are prepared and approved. Before that, total Sundarban management will have to follow the practical approach of implementation of the sum of the resource-specific management plans.

4.2 Steps for the Impact Zone

As far as the Impact Zone is concerned, activities will have to be synchronized with the above steps, as follows:

DURING STEPS 1-6	FOCUS ON DEVELOPMENT OF NEW EMPLOYMENT OPPORTUNITIES OUTSIDE THE SUNDARBAN AND ESPECIALLY FOR NEW PARTICIPANTS IN THE WORK FORCE
	CREATE AWARENESS ON LIMITATIONS OF NATURAL RESOURCES AND ON IMPACTS OF EXPLOITATION
DURING/ AFTER STEP 6	FOCUS ON ADAPTATION OF PRACTICES OF TRADITIONAL RESOURCE USERS ON THE BASIS OF COMMON PROPERTY USE AGREEMENTS

5 ACTION PLAN

5.1 Step 1: Refinement of objectives

As described in section 2.1, SBCP was established to develop and introduce a system of Integrated Resources Management. In none of the project documents, however, a clear-cut and straightforward objective of Integrated Sundarban Conservation Management is provided; sometimes the overall objective is vague, such as “to secure the integrity of the environment” (PP). Mostly, however, objectives are thought to be synonymous with (a series of) actions, that are partly incompatible.

In summary, the project is working in an environment that intends to serve two conflicting interests (if not more): *achieving long-term sustainable production and maximum biodiversity conservation*. In this situation development of effective integrated management measures will not be possible: they will either serve one interest only, or both in a sub-optimal manner. Also project steering and evaluation will be difficult: evaluators may have very justified indicators, but these might well be biased towards one of the objectives only. *Without unambiguous objectives, linked to verifiable indicators of achievement, Sundarban resource management will never achieve acceptable results.*

Final documents from preceding projects do emphasize the need for integrated resources management, but also they are not clear on the final products of that management.

According to IRDP (Final Report FAO, 1998) the main objective of integrated resource management is “to formulate scientifically sound options for improving the sustainable management of the Sundarban Reserved Forest”. FAO mainly provides recommendations for management to decision makers “for practical biodiversity conservation with emphasis on the potential for income and employment generation”, but does not define indicators for success or minimum levels to be achieved. Although IRDP did a marvellous job in collecting basic data, its opinion on the future fate of the Sundarban remains hidden behind walls of terminology. One thing is clear: FAO classifies the Sundarban as “forestry land, which provides 45% of the sector’s revenue”. As a consequence, the final report gives a strong impression that the only management objective is the “*sustained production of timber, fuel wood, and other products*”. This resulted in a strong focus on (recommendations for) forestry management only: enrichment planting and plantations, without clear zoning. The FAO interpretation of integration is limited to an institutional component: “setting and agreeing common goals between forestry managers and forestry users, and determination of areas of mutual concern”.

The IRMP (Final Report WB, 1998) started even more forestry-directed; its project objective was the design of “forest management for production and regulation of timber resources (equals determination of sustainable harvest levels)”. But after a thorough analysis of the field situation, the project considered the main objective of management “*to maintain the area and its resources, so that social, environmental, and economic benefits will continue to be generated*”. This management objective resulted in the final report in a series of recommendations for improvement of the regenerative capacity of *all* natural resources, accompanied by development of strict harvesting rules and regulations, as well as by zoning. Many of these recommendations should be worked out and implemented under SBCP; in fact

SBCP is fostering this set of recommendations as its "draft forestry resources management plan".

From the final IRMP report, one gets the impression that zoning is more or less synonymous to integration. The report recommends, for example, to aim at wildlife preservation and eco-tourism management in the (enlarged) sanctuaries, whereas the purpose of most of the remaining Sundarban area is production of a variety of forestry and NWF products.

In one aspect all earlier reports agree: *wood removal at existing levels would lead to forest depletion*. In spite of moratoria, ongoing processes (environmental change, top-dying of Sundri, land erosion, poles harvesting, timber smuggling, etc.) ask their toll, especially in a situation where the regeneration capacity of the natural mangrove stand is poor. The WB presents as worst-case scenario the virtual disappearance of Sundri in some 50 years, and of Gewa (with continued KNM operations) in less than 15 years.

From the above it may be clear that SBCP will have to clarify its objective or objectives. Decisions are needed on what SBCP is working for, and what it will intend to reach. Given the past importance of the resources these decisions will not be easy, since they will require the bravery to confront politicians with messages they do not like to hear. In order to reach consensus on Sundarban management objectives, followed by their political authorization, it is recommended to organize a two-day *national-level workshop*, with the following sessions:

action: TL,
PD

(first session, first morning)

a History and future of Sundarban forest resources

- Products, production levels, economic values;
 - Role FD, national revenue, significance for Impact Zone employment;
 - Comparison before 1980 with 1980-2000;
 - Expectations for near and far future; minimum levels.
- (to be prepared by FD/SMU staff, TL, mangrove specialist)*

b The significance of other resources

- Direct use values (food, fuel, building materials, medicines, etc.) and indirect use values (nursery area, nutrient recycling, coastal protection); Economic and social values and minimum acceptable levels for fisheries, wildlife/biodiversity, NWFP, eco-tourism;
 - Significance of biodiversity;
 - International obligations;
 - Expectations for near and far future.
- (to be prepared by FD/SMU staff, IUCN, TL, economist, fisheries specialist, mangrove specialist, wildlife specialist, NWFP specialists, tourism specialist)*

(second session, first afternoon)

c The significance of management

- Assessment of what would happen without planned management (loss/ modification of habitats; unsustainable use of resources; depletion of wildlife; loss of wider benefits; conflicts resource users);
 - Management options (single resource or multiple resource);
 - Zoning and other tools;
 - Institutional aspects.
- (to be prepared by FD/SMU staff, TL, resource specialists)*

d Environmental change

- Hydrology, salinity, sedimentation, sea level rise; future scenarios;
 - Produce requirements (fuel wood, others);
 - The use of GIS.
- (to be prepared by FD/SMU staff, RIMS, TL, MIS/GIS specialist, SWMC, EGIS, sociologists)*

(third session, second morning)

e Maximum versus optimum revenue

- Sustainability;
 - Making choices;
 - Alternatives for product users;
 - Improvement of longer-term returns through sustainable management and conservation, including eco-tourism;
- (to be prepared by FD staff, TL, economist, lawyer sociologists)*

f Integrated resource management

- Establishment of minimum requirements;
 - Integration of future scenarios;
 - Conflicts, trade-offs, exploitation agreements;
 - Zoning; what management where;
 - Procedures, enforcement, and monitoring;
 - Adequate staff and means
- (to be prepared by FD staff, TL, MIS/GIS specialist, economist, lawyer sociologists and resource specialists)*

(fourth session, second afternoon)

g Discussion session

- To define objective(s) of management;
- To define targets and indicators;
- To select minimum/maximum scenarios.

(discussions in groups, on the basis of discussion papers prepared by workshop committee)

h Definitions, objectives and targets

- Selection of definitions, management objectives, targets and indicators on the basis of reporting by the discussion groups.

(plenary session; to be prepared and managed by workshop committee)

It is recommended to organize this workshop during SBCP's mid-term review in early 2002. A workshop committee will prepare and guide the workshop process; the committee could exist of the Project Dy-PD, one or two CF's, and TAG specialists (Project Management, Awareness). Contributions will have to be prepared before the workshop as hand-outs; they will be published as Proceedings after addition of the results from the final session.

**action:
committee
(see text)**

5.2 Step 2: Preparation of resource-specific Management Plans

Already earlier, the systematic (page 7) and main components (page 9) were indicated. To increase the opportunities for later integration of plans, it is recommended to design very specific (and *phased*) management measures for a 10 - 15 year period (say up to 2015), and to describe for the period thereafter which adaptations in management might be required on the basis of change scenarios. The following set-up of a management plan is recommended:

action: all specialists

chapter	basic title	main contents
01	data	present; to be collected; where, how and by whom
02	policies	national, local; international obligations
03	legislation	as far as relevant for management; gaps
04	operations	zoning proposal; types of products; maximum sustainable quantities/carrying capacities per product and per (sub-)area; timeframes; beneficiaries (who, how many)
05	procedures	measures to assure sustainability; licences; monitoring; data management
06	responsibilities	planning, implementation, monitoring, enforcement, extension/awareness
07	implementation	phasing; institutional arrangements; manpower; capabilities/training; facilities; equipment; funds
08	monitoring	warning systems and their relation to management

The draft fisheries management plan contains most of the elements and can be adapted to the above schedule when it is made final. The forestry management plan of FRMP, which will be basic for future Sundarban forestry management, will have to be adapted to the present situation, especially since it considers the Sundarban too much as a single management area. Also the FD realized that it is difficult to find reasons to maintain the single-area concept for forestry. Because of changes in the environment, there is a clear trend from pure Sundri stands towards mixed Sundri/Gewa stands, and from the latter towards multi-species vegetation, which is at the same time a trend from high value forest to lower value forest. At present, different forestry areas can be distinguished in the Sundarban, as illustrated on the next page. Optimum forestry planning needs to take account of the existing physico-chemical situation and of ongoing dynamic processes, and should be based upon a set of *future scenarios*, of which the one for the coming decade should be the most specific.

action: fisheries

action: forestry

The same holds for other resources: also for NWFP, wildlife and eco-tourism the Sundarban should be divided in sets of sub-areas where specific products are to be found or developed. Integration does not mean "everything everywhere"; it means that in each sub-area only selected resources will have to be managed.

WESTERN SECTOR Vol./ha: 11 m ³ Characterized by 12% Sundri 25% Gewa 64% Goran/ other spp.	NORTHERN SECTOR Vol./ha: 43 m ³ Characterized by 75% Sundri 5% Gewa 21% other spp.	EASTERN SECTOR Vol./ha: 11 m ³ Characterized by 76% Sundri 8% Gewa 17% other spp.
	SOUTHERN SECTOR Vol./ha: 17.2 m ³ Characterized by 63% Sundri 7% Gewa 30% Goran/others	
SANCTUARY SECTOR No harvesting of forest products		
MARINE SECTOR No forest production		

In order to be able to integrate management plans, it is essential that all resource planners use the same area compartment codes in their detailed management descriptions. The easiest is to use the existing forestry compartments and blocks system, which is also already included in the GIS at RIMS. The compartments (55) are generally too small for general management planning purposes, the compartment grouping system in blocks might be more suitable. For later integration of management objectives and actions, the resource management specialists have to determine whether the block system is suitable for management specification of other resources than forestry as well. If this is the case the block identification should be used in all sectoral plans, and if not the GIS group will have to design a new or adapted compartment grouping system, acceptable for all parties.

All resource management plans will have to include a *zoning proposal*: an indication of:

action: all
specialists

action: all
specialists/
GIS group

action: all
specialists/
GIS group

- which blocks (or other groups of compartments) will optimally accommodate the various conservation or production purposes of the sector; which blocks less, and which blocks not at all;
- grouping of blocks with comparable importance into zones
N.B.: there should be a relation between the minimum size of zones and the purpose of their management. For example, small zones will generally not result in effective management of large animals; at the moment 23% of the area is set aside for that purpose (the sanctuaries). On the other hand, specific purposes might require specific small areas, with specific management, such as breeding biotopes for aquatic species, habitats of rare plant species, or places for eco-tourism activities (high-use zones, according to IUCN terminology).
- establishment of management objectives and production targets for each zone, as specific as possible;
- design of implementation and enforcement tasks for each zone, as specific as possible;
- identification of a management monitoring system, including verifiable indicators for management success, for each zone.

5.3 Step 3: Identification of changes

Assessment of relations between (the functioning of) the resource base and changes in the environmental and social environment, requires a process with the following steps:

- **Expert opinion on the significance of changes.** Resource specialists will indicate in their sectoral management plans which processes of change are of relevance for future management of the various resources, and what data (type, time frames, accuracy) they require to be able to account for them.
- **Collecting of existing knowledge.** On the basis of the identified requirements. Knowledge on changes beyond the control of the Forest Department has mostly to come from outside the Forest Department, either specifically, or in the form of models, e.g.:
 - level and speed of tectonic movements: from SPARSSO, geological departments, and relevant Indian authorities;
 - rural infrastructure development: from LGED, national planning authorities;
 - hydrological development (including resulting changes in salinization and sedimentation): SWMC, BWDB, national planning authorities;
 - sea level rise: international data;
 - pollution (especially oil): to be determined;
 - future of special demand (Khulna Newsprint Mill, match factories): FD, Ministry of Industry, factory boards;
 - Population growth: census data (Bureau of Statistics).

action: all specialists

action: TL, PD

- **Expert opinion on the adequacy of data.** Resource specialists will prepare future resource management scenarios on the basis of available data (best case and worst case types). They specify:
 - research needs to be able to refine scenarios;
 - monitoring systems to evaluate scenario evolution;
 - institutional development required within FD to evaluate and process new data from research and from monitoring.
- **New research on change dynamics.** As specified above.
- **Monitoring and evaluation.** As specified above.

action: all specialists

action: all specialists

5.4 Step 4: Preparation of Dynamic Resource Management Plans

All resource management specialists will adapt their specific management plans in order to accommodate:

action: all specialists

- the outcomes from the national workshop (see section 5.1);
- specification of relations between main change processes (salinity, sedimentation, changing produce needs, pollution, sea level rise) and future resource availability;
- impacts from the change processes (as far as possible);
- identification of specific data collection and change monitoring needs from the point of view of resource production/exploitation;
- resulting institutional needs (capacities, knowledge).

5.5 Step 5: Identification of conflicts and trade-offs

After the previous step, finally the various specific resource management plans come together. In the first place, the zoning proposals can be included in the Sundarban GIS system in order to identify in which zones overlaps are expected.

action: GIS specialist

Subsequently, the sectoral specialists and their FD counterparts will have to come together in an in-house workshop to decide on the future for each of the zones, on the basis of questions such as:

action: TAG/SMU

- what interference is expected from the management of one specific resource on the management of another;
- which zones have one clear management objective;
- which zones have more than one management objective, and are these conflicting;
- are expected management conflicts in certain zones of a level that objectives are mutually excluding each other; which one is to be eliminated; assessment of the trade-offs in environmental and socio-economic terms;
- are expected management conflicts in certain zones of a level that they might be prevented by adaptations in management objectives or tools; assessment of the trade-offs;
- are trade-offs and exclusions acceptable in relation to the overall management objective.

5.6 Step 6: Preparation of Integrated Management Plan

The results from the workshop under step 5 would allow the preparation of the final Integrated Management Plan for Sundarban resources, consisting of: **action: TL, specialists**

- Unambiguous objectives of Sundarban management, for the short (10-15 years) and the longer term (as set in step 1);
- A zoning plan;
- Detailed management objectives for each of the distinguished zones, based upon the sectoral dynamic management plans, and accounting for adaptations made under step 5;
- Detailed descriptions of management measures for each of the zones, including procedures;
- Detailed description of monitoring activities to be carried out, both for management evaluation and to keep track of ongoing environmental changes;
- Identification of requirements for personnel, equipment, materials, and operational funds in order to be able to implement the management plan;
- Identification of future institutional requirements, both in terms of capacity building and in organizational respect (need for a single management agency).