

# **Ecosystem Approach and Inter-Linkages:**

*A Socio-Ecological Approach to Natural and Human Ecosystems*

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# **Ecosystem Approach and Interlinkages: A Socio-Ecological Approach to Natural and Human Ecosystems**

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## **Introduction**

Abortive or ineffective efforts to respond to environmental change has been attributed to a lack of fit between natural ecosystems and institutions. This ecosystem-institutions mismatch is exemplified by institutions that are unable to understand and interpret ecosystemic processes, unprepared for surprises and uncertainties, and confused with conflicting goals or objectives in human interactions with ecosystems.

This discussion paper attempts to integrate in a theoretical framework, adapted from current researches on ecosystem-institutions fit, two present-day efforts to describe and explain environmental and social systems. It takes off from an ongoing UNU initiative on interlinkages, which stresses research on the interaction of environment and society, in general, and the synergy and coordination of multilateral environmental agreements, in particular.

This paper takes the ecosystem approach and the interlinkages initiative, as it is applied to environmental institutions, and constructs an overarching approach to human and natural ecosystems that is based on the requirements and imperatives of the two approaches.

This paper, thus, goes through the following outline: a conceptual elaboration of the ecosystems approach; interlinkages concept definition and explanation as it is applied to social institutions; the concept of interlinkages as a socio-ecological approach; and the implications of these to regional and local environmental policy design and implementation. The paper concludes with some ethical considerations essential to a socio-ecological framework.

## **Ecosystem Approach**

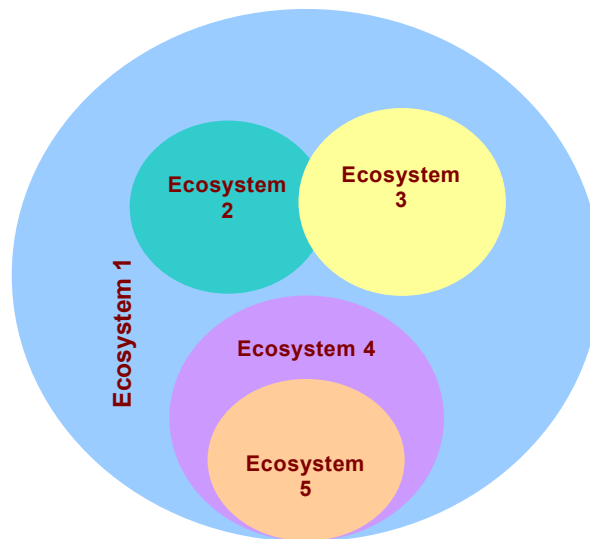
The ecosystem approach is fundamentally the recognition of ecosystem dynamism and complexity. It aims for a description and understanding of ecosystemic processes that will inform human institutions. It requires the reflection of this complexity and dynamism in institutions that deal with environment (and maybe social institutions in general).

According to the CBD: “The ecosystem approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. ... [It] is based on the application of appropriate scientific methodologies focused on levels of biological organization which encompass the essential processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity,

are integral component of ecosystems.” (Ecosystem Approach: Further Conceptual Elaboration, COP 5, Montreal, Jan./Feb. 2000)

### ***What is an Ecosystem?***

CBD, Art. 2: “‘Ecosystem’ means a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.”



**Hierarchical and nested ecosystems**

Source: CBD

According to the WRI: “Ecosystems are communities of interacting organisms and the physical environment in which they live.

- They are systems combined of organic and inorganic matter and natural forces that interact and change.
- They are intricately woven together by food chains and nutrient cycles.
- They are living sums greater than their parts.
- Their complexity and dynamism contribute to their productivity, but make them challenging to manage.

When talking about ecosystems, the matter of scale or size is important.

- A small bog, a single sand dune, or a tiny patch of forest may be viewed as an ecosystem, unique in its mix of species and microclimate -- a microenvironment.
  
- On a much larger scale, an ecosystem may also refer to more extensive communities -- a 100 or 1,000 square kilometer forest, or a major river system, each having many such microenvironments.”

Ecosystem processes are predominantly non-linear and complex (webbed). Causes and effects are often characterized by time lags. Seemingly small changes can be magnified wave-like

because of web-like interconnections between ecosystem elements. As such ecosystems display discontinuities, surprises and uncertainties.

### The fundamentals of an Ecosystem Approach

- an integrated approach (this implies comprehensive understanding of ecosystems, the products and services that they ser
- reorients the traditional management of ecosystems
- takes the long view
- includes people
- maintains the productive potential of ecosystems

The following table gives the products and services of two sample ecosystems from the WRI PAGE:

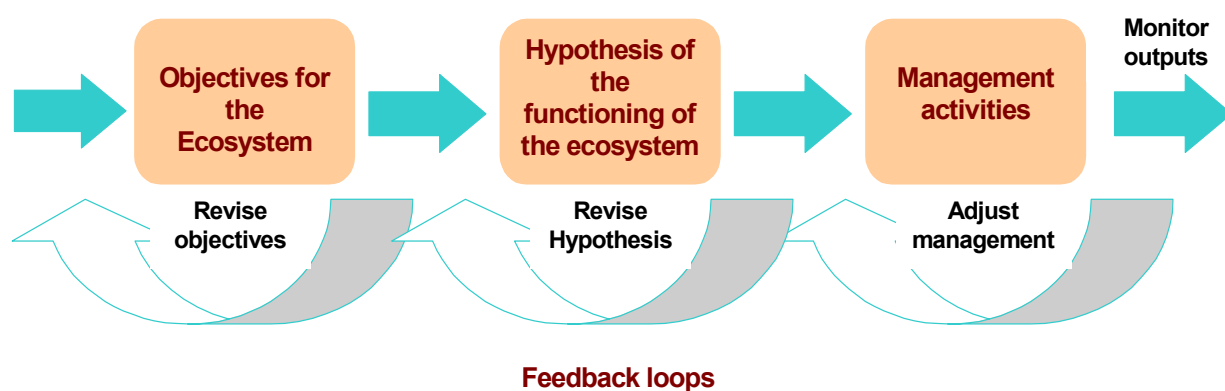
### Goods and services provided by agro-ecosystems and coastal ecosystems

<i>Ecosystems</i>	<i>Goods</i>	<i>Services</i>
<b>Agro-ecosystems</b>	Food crops Fiber crops Crop genetic resources	Maintain limited watershed functions (infiltration, flow control, partial soil protection) Provide habitat for birds, pollinators, soil organisms important to agriculture Sequester atmospheric carbon Provide employment
<b>Coastal ecosystems</b>	Fish and shellfish Fishmeal (animal feed) Seaweeds (for food and industrial use) Salt Genetic resources	Moderate storm impacts (mangroves; barrier islands) Provide wildlife (marine and terrestrial) habitat Maintain biodiversity Dilute and treat wastes Provide harbors and transportation routes Provide human and wildlife habitat Provide employment Contribute aesthetic beauty and provide recreation

Source: WRI

The essentials and requirements of the approach are: identification and description of ecosystems (hierarchy, elements, structure and processes, boundaries); evaluation of ecosystem integrity, products and services (ecosystem potential); identification of ecosystem objectives; adaptive governance, monitoring and management.

## Adaptive Management



Source: CBD

## The Millennium Ecosystem Assessment

The **Millennium Ecosystem Assessment** is a process designed to improve the management of ecosystems and their contribution to human development by helping to bring the best available information and knowledge on ecosystem goods and services to bear on policy and management decisions. The MEA consists of a **global scientific assessment of ecosystems**, as well as **catalytic regional, national, and local assessments**. A primary aim is to build capacity at all levels to undertake integrated ecosystem assessments and to act on their findings. More specifically, the Millennium Ecosystem Assessment will address:

### **Current ecosystem extent, trends, pressures, condition, and value**

The MEA will provide "baseline" information for the year 2000 on the geographic extent of different ecosystems -- including terrestrial, freshwater, and marine -- and the land- or resource-use patterns associated with them. It will present information on trends in ecosystem goods and services, their condition and value, their contribution to human development, and pressures affecting them.

### **Ecosystem scenarios and trade-offs**

The MEA will present a range of plausible scenarios for how the quantity and quality of ecosystem goods and services may change in coming decades in different regions of the world. It will assess the trade-offs among various goods and services and identify opportunities to increase the aggregate benefits that ecosystems provide.

### **Response options**

The MEA will identify policy, institutional, or technological changes that could improve the management of ecosystems, thereby increasing their contributions to development and maintaining their long-term sustainability.

Source: MEA homepage

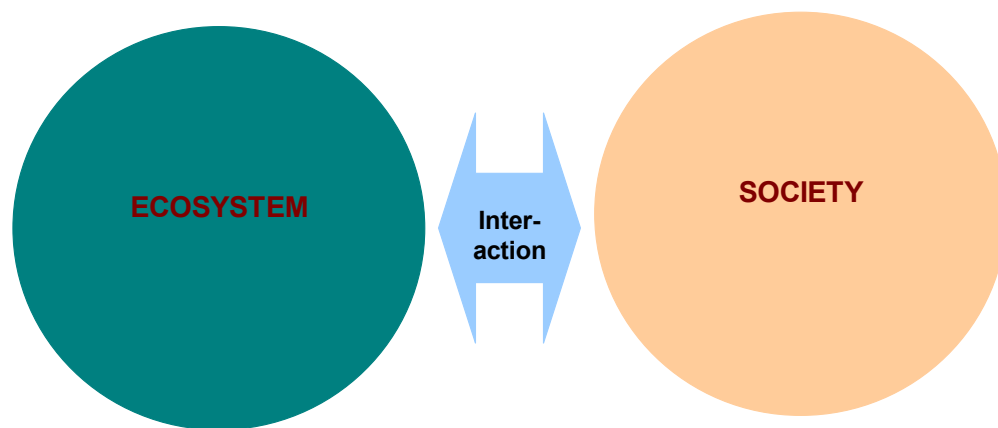
## **Interlinkages and Social Institutions**

Interlinkages highlights the interconnections and functioning within and between ecosystems, and the inter-relation of human institutions with ecosystems in light of the overall functioning of the biosphere.

Thus interlinkages may refer to the interconnections between ecosystem elements which determine the functioning and non-functioning of ecosystems, their resilience and stability, their integrity.

But it primarily refers to the interconnection of human processes and environmental processes at all levels of human and natural ecosystem interaction.

### **Ecosystem-society interaction**



Specifically, and with regards to human action, interlinkage refers to the processes and workings of human institutions, which relates directly or indirectly to the environment. Interlinkage requires social institutions to reflect the systemic characteristics of ecosystems and environmental problems. Adaptive action and reaction on our part must characterize ecosystem and society interaction. But to be fully adaptive, knowledge of both ecosystem and society dynamism and complexity is necessary.

Interlinkages implies several important considerations:

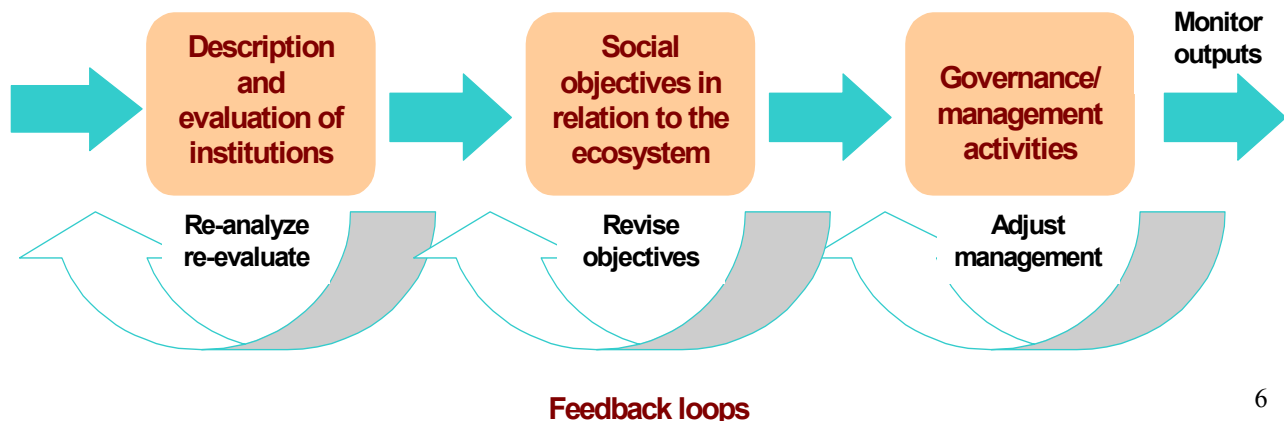
- In the realm of global and regional levels of environmental policy and decision-making, what is stressed is MEA (multilateral environmental agreement) synergy and coordination.

- In terms of environmental policy implementation and management, it highlights multilevel and inter-level (global, regional, national and community levels) interconnection and interaction.
- Interlinkages asserts, as well, not only systemically dynamic responses to environmental problems but also a cooperation between societal institutions (government, laws, attitudes and behaviors, civil society), which catalyze such responses, that reproduce the complexity and dynamics of ecosystems functioning or their failure.

The UNU explains Interlinkages as “a strategic approach to managing sustainable development that seeks to promote greater connectivity between ecosystems and societal actions. On a practical level this involves a greater level of cohesiveness among institutional, environmental issue-based, and development focused responses to the challenges of sustainable development as well as the range of international, regional and national mechanisms that share this challenge. The inter-linkages approach to sustainable development is comprised of two fundamental elements: synergism and coordination. It is believed that a synergistic approach to sustainable development will lead to more effective and resource efficient assessment, negotiation, decision-making, planning, and implementation of policies. Similarly, improved coordination at the international, regional, and national levels, and between institutions, will minimize inadvertent conflicts between environmental policies and measures and between different international regimes. The key to developing a strong integrated approach to sustainable development is the identification of the inherent *synergies* that exist between different aspects of the environment and an exploration of the potential for more effective *coordination* between sustainable development issues and their responses.”

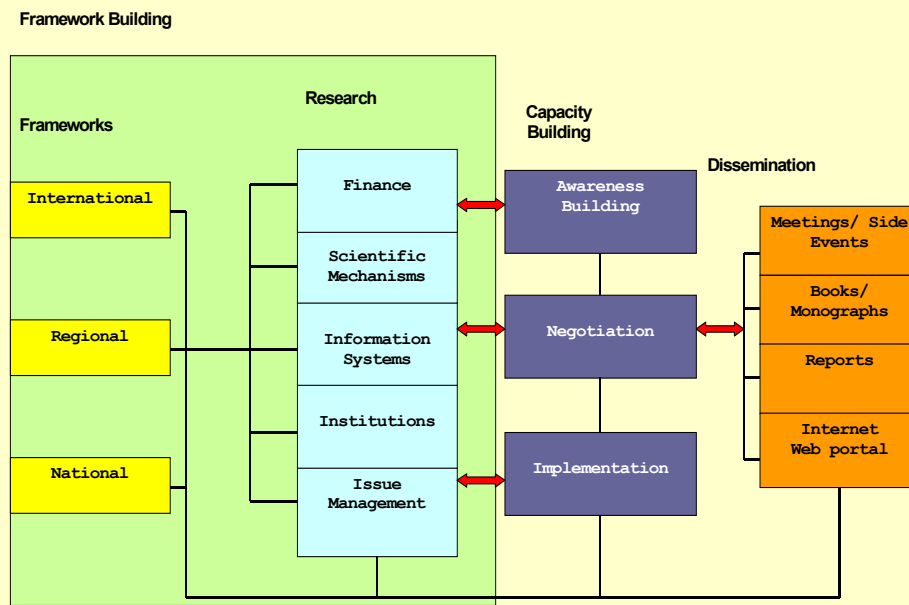
Thus, essential to interlinkages within social institutions are a description of current governance; explication of institutional arrangements and their evolution; the evaluation or assessment of these institutions (formal /informal) and other instruments that deal with the environment; the identification of stakeholders and actors; the identification of issues and their analyses; a consensus of social goals and objectives; and continuous flexible governance, reassessment, and management.

### **Adaptive Governance and Management Interlinkages within Social Institutions**



## The UNU Interlinkages Initiative

The UNU has initiated a three-year Inter-linkages Initiative consisting of yearly phases that will culminate in a review in the year 2002. This strategy document serves to outline the goals and activities of Inter-linkages Initiative. Within this material a series of research activities aimed at developing comprehensive understanding of each of the five areas identified at the *International Conference on Inter-linkages* are identified. Initiative, activities have also been designed to contribute to the development of model implementation frameworks for use at regional and national levels, and between issues that overlap and possess the potential to cause conflict between the objectives of differing MEAs. Capacity building efforts, including measures to enhance awareness building, MEA negotiation and implementation, is also key to the strategy. This document outlines measures to support the Initiative through a comprehensive series of dissemination activities.



Source: UNU (“The Way Forward” strategy document)

### Interlinkages: the Socio-Ecological Approach to Natural and Human Ecosystems

Taking WRI’s large scale ecosystems, which were the basis for the PAGE (Pilot Assessment of Global Ecosystems), we have:

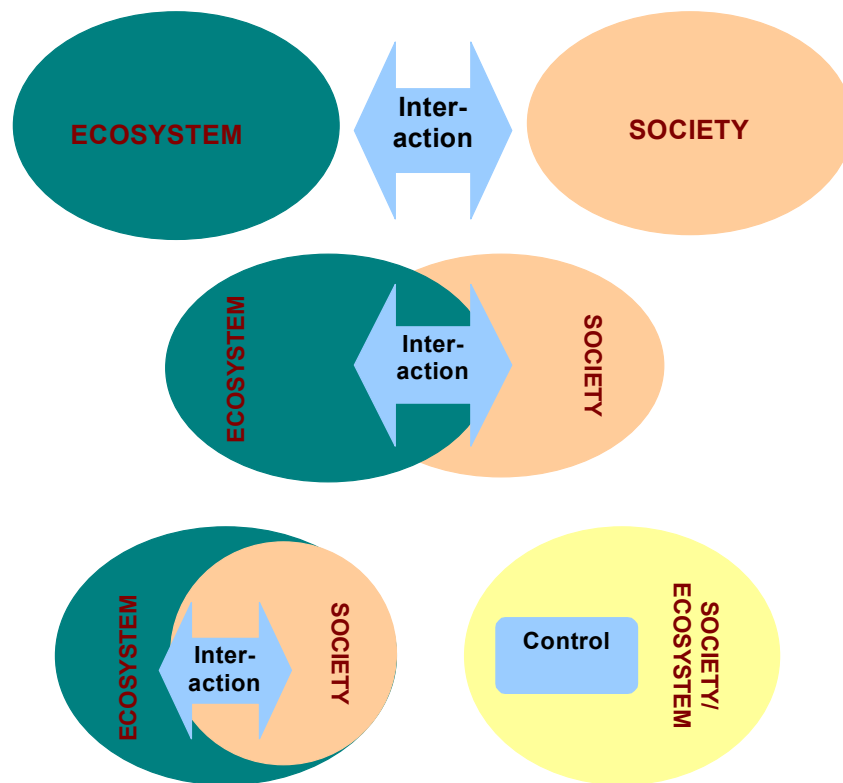
- Forest
- Coastal
- Grassland
- Freshwater

- Agro-ecosystem

Research in universities and research institutions has also identified cities or urban areas as ecosystems.

Based on human manner and extent of interaction with these ecosystems, we can identify four basic types of ecosystem-society interaction. Urban and agro-ecosystems, for example, are controlled or influenced by human action to varying degrees. Human society in general, however, is external to the functioning of natural ecosystems such as forest, freshwater, or coastal ecosystems.

### Ecosystem-society levels of interaction

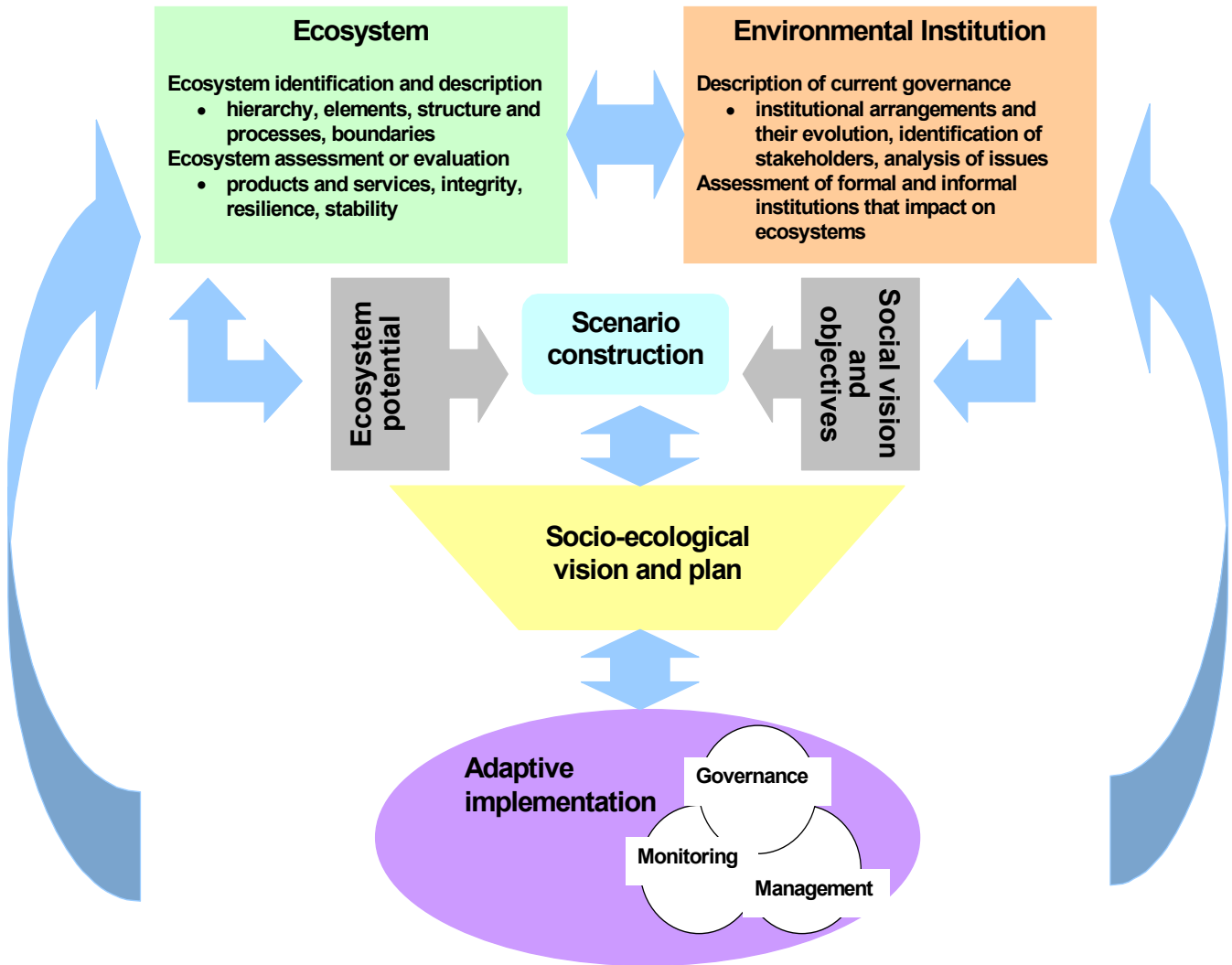


The identification of ecosystem type indicates human role in ecosystem functioning: varying degrees of influence and control with human ecosystems, and interaction with natural ecosystems. This defines how integral human society is to the biosphere as a whole; that is, consisting of ecosystems and processes whether natural or human.

With these considerations, there are two major sources of inputs to designing policy and implementing them: the social and the ecological. Socio-ecological policy-making and policy implementation requires ecosystem and social system understanding. Thus parallel to ecosystem description and evaluation is the consensus and description of social processes and goals. The

resulting knowledge of ecological potentials and social visions is necessary in scenario construction from which we choose a specific socio-ecological vision that in turn is the basis for an adaptive program of action. Implementation is adaptive, consisting of adaptive governance, continuous monitoring and adaptive management.

### Interlinkages: The Socio-ecological approach



Adapted from Kay, J. et al. “An Ecosystem Approach for Sustainability: Addressing the Challenge of Complexity” Futures Vol. 31 No. 7 September 1999.

Finally, what is being managed is human action in relation to ecosystems. Specifically, in human ecosystems (urban, agro-ecosystem) consisting in varying degrees of human activity, management takes the form of varying degrees of influence. Natural ecosystems, however, function independently of human activities. In this instance management is directed towards

human activity that interconnect with ecosystems and their functioning. What is managed is the interaction and not the ecosystem.

## **Implications to Regional and National Environmental Policy Design and Implementation**

Concretely in the UNCED documents (see Annex for a cognitive map of the UNCED documents): Immediately, the implication of the socio-ecological approach (as ecosystems approach and interlinkages) manifests in its potential to consolidate the multi and inter-level social visions vis-à-vis a clearer picture (ecological potential) of the environment. Specifically:

- The concept of sustainable development is often characterized as vague. Here the concept gets clarified but in a tentative and adaptive manner; that is, the socio-ecological vision based on ecosystem potential and social objectives or visions. The concept adapts based on ecosystem and social grouping hierarchy; e.g. biosphere-humanity; the Himalayas-regional entity composed of Bhutan, Nepal, Tibet, India and Pakistan; a small lake-the outlying community interacting with it. It also adapts in consideration based on particular ecosystem potential and social vision at those hierarchical levels. (clarification: hierarchy does not imply importance. It is utilized as a tool.)
- The concept of sustainable development also evolves from simple economic development and environmental protection to sustainability of human and natural systems.
- The emphasis on individual state right and responsibility (contained in Declaration of Principles) gives way to multi-level collaboration at local, regional and global levels.

### ***Other implications***

- As ecosystems transcend boundaries, policy and management requirements also transcend boundaries. Thus the importance of a regional approach.
- Policy and management becomes ecosystem-specific and social grouping-specific. Thus national implementation consists in inter-community level collaborative efforts, as regional efforts are inter-country collaborative efforts.
- Scientific capacity and knowledge sharing becomes of primary importance in defining ecological potential. This emphasizes the need to support ecosystem assessments such as the ongoing Millenium Ecosystem Assessment of the UN.
- Collaborative processes in the form of partnerships and participation become of prime importance in determining societal as well as socio-ecological visions.

## **Some Ethical Considerations**

The ecosystem approach and inter-linkages are unclear or unenlightening in terms of ethical principles. In some instances they become too calculating, such as in explicit valuing of

ecosystem products and services to better inform social objective trade-offs, that ethical considerations become paramount.

In an article by Paul Wapner in *Current History*: He characterized "... environmental issues [problems] as fundamentally moral failings."

Our interactions with ecosystems highlight the importance of ecosystems as life support systems. All ecosystems sustain humans and human relations in varying degrees. The integrity of ecosystems and of the biosphere as a whole is therefore of prime importance.

Here Aldo Leopold's land ethic (contained in the 1949 *A Sand County Almanac and Sketches Here and There*) applies: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."

Thus, two ethical stances can be identified:

- To ecosystems and the biosphere – an ecocentric ethical principle. The assertion is ascription of moral status to ecological wholes as we are part or dependent on these ecological wholes. The goal is not to ascribe moral status to individual trees or animals but to protect the integrity of the system in which these trees or animals (or we) belong.
- Within human activities that interconnect with ecosystems – anthropocentric based ethics. John Dryzek in *Rational Ecology* described environmental issues as instances of "displacement." Human beings, instead of solving environmental problems displace or transfer them in space and time. Thus, harm befalls other people in the place where the problem is transferred or the time when it is displaced. Unsustainable interaction with forest ecosystems with the short-term goal of timber extraction transfers a number of potential problems to future generations who will interact with the same forest including wood shortage, soil erosion, loss of biodiversity etc. Similarly, the export of toxic waste from one country to another or the dumping of city waste to another municipality displaces waste-related problems to the recipient.

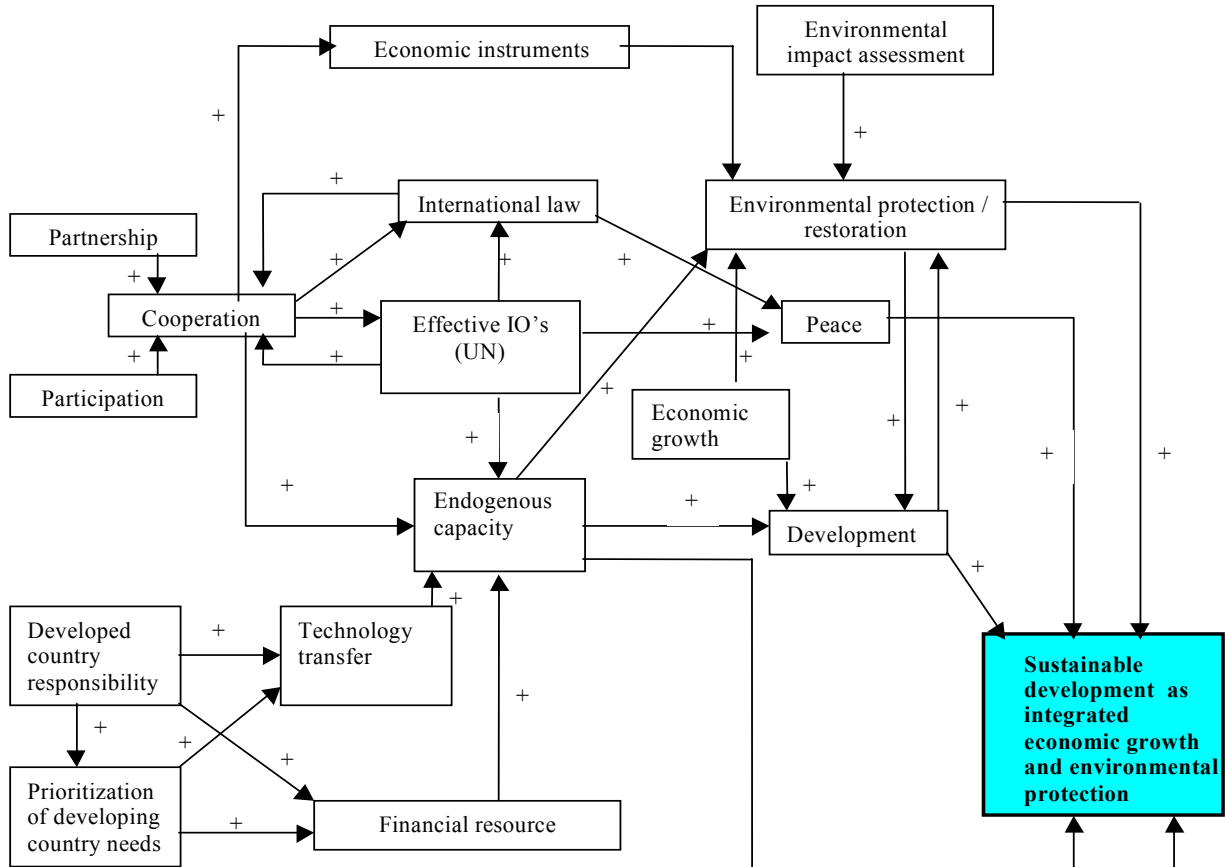
The point in these ethical considerations is that our interaction with the environment is replete with human activities that not only damage nature but harm people as well. The socio-ecological approach must thus be ethically tempered and informed.

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**Annex**

**Cognitive Map: UNCED Documents**



- Agents**
- States
    - Local authorities
  - Peoples
    - NGOs
    - Women
    - Youth
    - Indigenous people
    - Trade unions
    - Scientific community
    - Business & Industry
- Level / Extent of Intervention**
- States
    - All
  - Peoples/ NGOs, etc.
    - Activities dependent on participation. e.g.: info. sharing, local environmental protection and poverty eradication
  - Business / Industry
    - Participation/ partnership
    - Env. Impact assessment, econ. instruments
    - Economic growth
    - Unsustainable production & consumption
  - Scientific Community
    - Partnership / participation
    - Development environmental scientific and technological knowledge
    - Technology transfer