Maximizing Ecosystem-Human Well-being Linkages for Sustainable Development

Fuchaka Waswa¹ and Arnold Mapinduzi²

1.1 Introduction

It is widely acknowledged that ecosystems in their various types and characteristics are life’s support systems because of the goods and services (tangible and intangible benefits) humans and other life forms derive from them. As such there is a strong relationship between ecosystems, their services and human well-being, as well articulated lately in the millennium ecosystem assessment (MA) framework (Alcamo et al, 2003). Further, all human activities (economic, socio-cultural and political) tend to be survival driven and occur in the context of certain types of relationships between people and the biophysical environment. These relationships are described by some basic paradigms (Figure 1), which over lap at some points and have been in discussion for a long time (Colby, 1990), thus:

i. Frontier Economics (FE)

The underlying principle in FE is that nature is an infinite supply of development resources (natural capital) to be used for human benefits, and also an infinite sink for the by-products (wastes generated) of the development and consumption of these benefits. Further, there is no explicit biophysical environment to manage as it is seen as irrelevant to the economy, while worries about exhaustion or depletion of resources are hard to rationalise. In addition, nature’s capacity and human’s ingenuity are boundless, so that there is little possibility of the combination of accumulated damage and depletion of resources to eventually limit production and human opportunity. As such man can always make possibilities out of nature’s limitations to meet his needs and wants through various means but notably technology. Hence nature is there for man’s benefits, to be explored, manipulated, exploited, and modified in any way possible that could improve the material quality of human life. Any damage to nature can easily be repaired where necessary, after development has been attained and not the other way round. As such humans are sovereign to nature, benefit at its expense and this relationship is anthropocentric. However, the main paradigm flaw is lack of awareness of the role of the environment (nature) as humans’ life-support system, permanent damage to the environment and failure to factor in the uncertainty of socio-political dynamics of any defined region.

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ii. Deep Ecology

Deep ecology is the extreme opposite of frontier economics. Focus is to integrate ethical, social and spiritual aspects in human-environment relationship. The underlying principle is that nature (environment) is sovereign and is above human beings and that well-being of nature comes first and not the economic well-being of people. As such humans must learn to relate with nature harmoniously. Some basic tenets include:

- intrinsic biospecies equality
- major reduction in human population to reduce pressure on ecosystems
- non-economic growth orientated economies
- non-dominant technology
- increased use of indigenous technological and management systems
- promotion of all round environmental diversity

As a fundamentally different ethical or value system, deep ecology evolved as a reaction to the “evils” of frontier economics and seeks to attain broader well being of the universe. The main flaw of this paradigm is to expect the whole world to return to pre-industrial, rural, simple life styles, amidst population pressure and globalisation forces. In addition, deep ecologism could undermine provision of basic needs for humans, if the Green Politics approach is literally and strictly adhered to.
iii. Environmental Protection

This emerged in response to environmental costs of development like pollution. The idea was to fix such problems as they emerged but continue the economic dominance pathway. As such the ecosystem was still in general external to the economy. This end of the pipe attempt to ameliorate the effects of human activities was a kind of trade-off between frontier economics and deep ecology but still falls short of sustainability since the root cause of the problem is ignored. Some common approaches have been setting up protected areas such as national parks and game reserves to protect wildlife, forest and nature reserves to protect forest biodiversity and water catchments, routine clean-ups of ecosystems as is often done on the Nairobi River in Kenya and Dar es Salaam city and coastal beaches in Tanzania. Resource depletion and ecosystem services are still not perceived in policy-making circles as serious limiting factors, due to an unbridled faith in “fixation” technologies and substitutes. Ultimately, human beings still tend to benefit at the expense of ecosystems.

iv. Resource Management

This could be seen as an improvement on environmental protectionism. Though the economic paradigm still prevails, it is enlarged to encompass some basic ecological principles in an attempt to enhance and maintain ecosystem resiliency for the support of sustainable development. For instance shifting from “clean up technologies to polluter pay principle (PPP); restoration ecology; resources conservation, ecosystem and social health monitoring among others. Nature is thus viewed as a resource for humans not to exploit and damage but to manage hence the notion of “economising the ecology”.

v. Eco-Development

This involves a larger shift in thinking and practice and sets out to restructure the human-environment relationship into a positive sum game by re-organising human activities so as to be synergistic with ecosystem processes and services. For instance the shift would be from polluter pay to pollution prevention, which thus addresses the root cause of environmental costs of development. Human beings and environment are seen as equal partners with none being above the other and hence the need to partner in various synergistic relationships. All workable tools towards sound environmental management such as legislation, awareness creation and education, would be useful in this case. Institutions playing key roles in this regard in the region include the National Environment Management Authority (NEMA) in Kenya and Uganda, and the National Environment Management Council (NEMC) in Tanzania.

A critical requirement is humans to manage self, first; then nature, hence the notion
“ecologising the economy” and whole social system. In essence eco-development is synonymous to sustainable development. From the United Nations Conference for Environment and Development in 1992 to the Johannesburg conference of 2002, global development policy agenda continues to be driven by the concept of sustainability. Maximizing ecosystem-human well-being linkages at all levels of decision-making presents perhaps the only logical and effective approach in pursuit for sustainable development, whether at community, regional, national or international levels.

1.2 Relationship between Ecosystems and Poverty

Synthesis of the ecosystems theory and proper understanding of ecology clearly indicates that the environment (ecosystem) is the single most important life support system. Poverty also is directly related to how environmental resources are used and shared. In agriculture dependent economies poverty and arable land are highly correlated. In this regard Liu (2006) defined sustainable land management (SLM) as integrated poverty eradication and large-scale ecosystem rehabilitation based on a success story of land rehabilitation and poverty alleviation in China. The persistent loss in land quality in Kenya through gully and rill erosion, as well as fertility loss tends always to translate into deeper poverty and more degradation in a kind of vicious cycle. Gully erosion and sedimentation in particular have both on-site and off-site effects, which makes them serious environmental and socio-economic threats. The cost of rehabilitation can be enormous, and hence the wisdom in the preventive and precautionary principles in environmental management.

The poverty situation in Kenya (SID 2004) is alarming and translates into serious threats to the environment especially because most people depend directly on natural capital, which is part and parcel of ecosystem services for their livelihood. There is no doubt that some positive correlations exist between poverty and various global environmental challenges such as land degradation and desertification, deforestation and loss of biodiversity, global warming and climate change, environmental pollution and waste accumulation among others. As long as poverty remains a big problem, ecosystems and their services will continue to decline in quantity and quality, resulting into deeper levels of human ill-being. This would mean that sustainable solutions for poverty alleviation would need tapping into and maximising the benefits of integrated ecosystem assessments and other integrated frameworks in resource use dynamics.

1.3 Integrated Environmental Assessment and Management Approaches

The word integration derives its importance from the systems concept. Integrated management thus entails holistic management as opposed to compartmentalised
approaches in management of resources for development. This is based on the ecological principle that all environmental components are connected in some way and thus are inter-dependent. Integrated approaches are thus hinged upon synergistic relationships from all ecosystem components or all stakeholders around a common issue. Synergism means mutually reinforcing effects from all system components for the good of the whole.

i. Integrated Environmental Assessment (IEA)

Integrated Environmental Assessment (IEA) is the inter-disciplinary process of identification, analysis, and appraisal of all the relevant natural and human processes, which affect the quality of the total environment and the services it provides. By integration is implied some more general and wide ranging assessment than the traditional approaches based on a broader view of the system than is usual in a study based on a single discipline, or an impact assessment of a single development. The basis for integration is that the environment is a large, complex, dynamic and multi-faceted entity, and the aim is to tackle the whole problem not just a part of it, by addressing all system components simultaneously. Two ways of integrating an assessment are generally distinguished, thus: vertical and horizontal.

a. Vertical or end-to-end Integration

This incorporates the whole of the casual chain of socio-economic driving forces, pressures on the environment, and the resulting state of the environment, the impacts, and the required managerial responses. The DPSIR framework (Figure 2) and the Millennium Ecosystem Assessment (MA) Frameworks (Figure 3) are good examples.

![Figure 2. DPSIR framework in integrated ecosystem assessment](image)

Conceptually, the DPSIR framework entails:

D: Drivers are underlying causes, which lead to environmental pressures e.g. human demand of agriculture, energy, industry, housing etc.

P: Pressures on the environment are caused by drivers. e.g. emission of pollution, exploitation of natural resources etc.
S: State of the environment (quantitative and qualitative), which affects their carrying capacities
I: Impacts such as on human health, ecosystems, biodiversity etc due to changing state of the environment.
R: Responses taken by decision-makers to address emerging environmental problems such as introducing laws to limit emissions and increasing taxes against pollution.

Decisions for intervention can be made at any point on the casual chain. This calls for availability of necessary capacity and competence to inform policy makers and implementers. In this chapter emphasis is put on the MA by virtue of its strength in linking ecosystems and human well-being as a basis for decision-making towards sustainable development.

ii. Horizontal integration

This entails broadening the assessment (study) across disciplines within a single link of the causal chain, such as covering many or all the pressures, many or all the impacts, and many or all the geographical media (air, groundwater, and surface water bodies among others).

Other aspects of integration whether vertical or horizontal include:

- Integrating quantitative and qualitative dimensions of the environment
- Integrating policy and scientific objectives in an assessment
- Involvement and participation of the various stakeholders in the process
- Consideration of feedbacks and dynamics
- Recognising that systems under study will depend on other systems, which may change for independent reasons.

On an even higher level of integration such as “grand integrated assessment”, the task would be to look at the whole field of activity e.g. the whole question of food security. Resources however often limit this scope, hence the popularity of traditional assessments, which often focus on a single item. The ultimate in integration would be to answer the question: “How can we optimise the total impact of our lives on the environment? Practically, an Integrated Ecosystem Assessment will normally employ both end-to-end and horizontal integration. The MA by virtue of its scale requirements and ultimate objective is perhaps the best example in this regard.

1.4 The Millennium Ecosystem Assessment (MA)

The millennium ecosystem assessment framework (MA) was development to assist in decision-making towards sustainable development by focusing on ecosystems and human well-being because of their inherent inter-dependence. This initiative
Environment and Sustainable Development

is one of the focuses of the international community through such United Nations agencies like UNEP. The MA had a multi-stakeholder board of directors and was prepared by 1360 experts from 95 countries. The goal of the MA is to establish the scientific basis for actions required to enhance understanding of the contribution of ecosystems to human well-being (HWB), without undermining their long term productivity. Conceptually MA places HWB as the central focus for ecosystem management (Figure 3).

**HWB and Poverty Reduction:**
- Basic material for a good life
- Health
- Good social relations
- Security
- Freedom of choice and actions

**Indirect drivers of Change:**
- Demographic
- Economic
- Socio-political
- Science and technology
- Cultural and Religious

**Ecosystem Services:**
- Provisioning e.g. food, water, fuelwood etc.
- Regulating e.g. water purification and climate regulation etc.
- Cultural e.g. spiritual, recreation etc.
- Supporting e.g. nutrient recycling etc.

**Direct drivers of Change:**
- Changes in land use and cover
- Species introduction or removal
- Technology adaptation and use
- External inputs
- Harvest and resource consumption

Figure 3. Illustrated Millennium Ecosystem Assessment Conceptual Framework

The heads across the arrows indicate areas of intervention; the MA can be conducted at local, regional and global scales. Most action research projects at postgraduate level would focus on local scales like a catchment, basin or even focal development area.

The key questions addressed in such an integrated assessment framework include among others:

- What are the current conditions and trends of ecosystems, their services and effect on human well-being?
- What are the plausible future changes in ecosystems and their services and consequent effects on human well-being?
What are the key uncertainties that hinder effective decision-making concerning ecosystem?

What can be done to enhance human well-being and conserve ecosystems on a sustainable basis?

In the context of the MA, an assessment means a social process aimed at bringing the findings of science to bear on the needs of decision-makers (Lee, 2007). It is an interactive and learning process involving multiple stakeholders such as researchers, governments, private sector, civil society and local communities (Figure 4), and is necessitated by the complexity of issues involved in human-environment relationships, the need for objective view of the state of knowledge, and the need for accurate input for decision-making. Further, an assessment is not necessarily time bound. It can continue and keep feeding into the dynamic decision-making processes.

Further, the MA recognises that biodiversity especially at species and ecosystem levels also has intrinsic value and that people take decisions on ecosystems based on both HWB and this intrinsic value. There exists a dynamic interaction between people and ecosystems and that changing human conditions serves to both directly and indirectly drive changes in ecosystems, which then affects HWB. As such a full assessment of the interaction between people and ecosystems requires an inter-disciplinary and multi-scale approach as this reflects better practical realities. Ultimately, MA is aimed at informing decision-making for positive change, thus contributing to sustainable development, both at community and national levels.

HWB is a context and situation dependent state, comprising of basic materials for a good life, good health, good social relations, security, and freedom of choices. Together, these provide the conditions for physical, social, psychological and spiritual fulfilment. The opposite of HWB is human ill-being. Past milestones in the analysis of integrated poverty have been done by among others Chambers (1983). Both conditions depend on the ability of ecosystems to supply their services in a sustainable manner and the ability of people to share and use them equitably. As such the gist of poverty alleviation is to shift from the state of ill-being to well-being through sustainable environmental management (Figure 5).
Ill-being components

- Powerlessness
- Vulnerability
- Physical weakness
- Bad social relations
- Material lack for a decent life

Well-being components

- Freedom of choice and action
- Security
- Good health
- Good social relations
- Materia'lly enough for a good life

Figure 5. From ill-being to well-being. Source: Adapted from Rhodes/UNU (2005): Note that these components are inter-linked in multiple ways, and have been discussed within the concept of integrated rural poverty by Chambers (1983) and in the millennium ecosystem assessment framework (MA).

Ecosystem Services (ES) are on the other hand the benefits (in all their variety/diversity) that people obtain from ecosystems. These benefits include both goods and services, whether tangible or intangible; and short term or long term. Within the MA framework (Alcamo et al., 2003), there are four categories of ES as illustrated in figure 3 above. Some examples of the services are outlined in box 1 below.

Some key findings of the MA (UNEP/Rhodes University, 2005) indicate that over the past 50 years humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber and fuel. The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people particularly the low income households. The degradation of ecosystem services could grow significantly worse during the first half of this century and is a barrier to achieving the Millennium Development Goals. The challenge of reversing the degradation of ecosystems while meeting increasing demands for their services can be partially met under some scenarios that the MA has considered but these involve significant changes in policies, institutions and practices that are not currently under way in most countries including Kenya.
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![Assessment Stakeholders]

**Assessment Stakeholders:**
- Government
- Private sector
- Civil Society
- Local Communities, etc

Further, the MA recognises that biodiversity especially at species and ecosystem levels also has intrinsic value and that people take decisions on ecosystems based on both HWB and this intrinsic value. There exists a dynamic interaction between people and ecosystems and that changing human conditions serves to both directly and indirectly drive changes in ecosystems, which then affects HWB. As such a full assessment of the interaction between people and ecosystems requires an inter-disciplinary and multi-scale approach as this reflects better practical realities. Ultimately, MA is aimed at informing decision-making for positive change, thus contributing to sustainable development, both at community and national levels.

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To be able to address societal developmental concerns, the MA entails the following salient features among others:

- The assessment is demand-driven (providing information requested by government, business and civil society etc.)
- The assessment cuts across spatial dimensions from local to global (its multi-scale)
- Assessment cuts across temporal dimensions from recent past to projections into the future.
- It examines how the capacities of ecosystems are being compromised, or enhanced through various drivers of change
- It is integrated, multi-sector, multi-disciplinary and assesses all resources simultaneously.
- It assesses mechanisms available to improve access and delivery of ES
- Evaluates past and future trade-offs and their consequences
- It is a multi-stakeholder process, interactive and participatory in nature
- Generates information useful for decision-making in poverty alleviation and enhancement of human well-being on a sustainable basis.

Box 1: Description of Ecosystem Services

- **Provisional services:** These are tangible products obtained from ecosystems such as food, fibre, fuel, building material and genetic resources. Demand for these services present the biggest threat to ecosystems in agriculture-dependent countries like Kenya.
- **Regulating services:** These are benefits obtained from the regulation of ecosystem processes such as air quality maintenance, climate regulation, flood control, pollination and water purification.
- **Cultural services:** These are non-material benefits obtained from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences. The importance of the Kaya shrines in Kenya attest to community’s appreciation of this service in the coastal region, while urban botanic gardens do the same in cities.
- **Supporting services.** These are services necessary for the production of all other ecosystem services. They differ from the other services in the sense that their impacts on people are either indirect or occur over a long time; e.g. nutrient re-cycling, primary production and soil formation. The level of communities’ appreciation of these services is generally low, which often translates into environmental degradation through survival activities.

An example of MA at sub-regional level is the SAfMA (Bohensky et al., 2004)
The analytical approach in the MA assumes a logical sequence focussing on:

- Identify the ecosystem for assessment. Some criteria in this regard are presented in Box 2 below.
- Analysing factors that indirectly affect the state of ecosystems (Indirect drivers of change) such as life styles, population pressure, policies and laws.
- Indirect drivers of change will in turn lead to changes in factors that directly affect ecosystems (direct drivers of change) such as use of agro-chemicals, use of space saving technologies, deforestation or drainage of marsh land to reclaim more land for farming.
- The resulting changes in the state of ecosystems automatically result into changes in services obtained from those ecosystems, which in turn affects human well-being.
- These interactions can occur at more than one scale (local to global).
- Actions should then be taken to respond to negative changes (mitigation measures) or to enhance positive changes at almost all points in the MA framework.

As an example insecurity of land tenure is an indirect driver, which causes people to mine the soil (using without replenishing the fertility). Soil mining is thus a direct driver that results into loss in soil fertility and productivity. This in turn will lead to reduced availability of ecosystem services (benefits) like food (provisioning service), which ultimately affects human well-being through such things like malnutrition, famine and increased income poverty.

Box 2: Some factors for prioritizing an Ecosystem for Assessment

- Level of environmental risk exhibited
- Fragility and resilience of the ecosystem
- Significance of services provided
- Economic importance within national development agenda
- Level of community dependence
- Degree of biodiversity value
- Linkages to other ecosystems
- Current management status
- Current state of knowledge on the ecosystem
- Location, size and age of ecosystem

(Source: Mapinduzi, 2007).

The basic assessment design should however ensure among others the following requirements:

- Accessibility: Assessment output should be readily accessible and should be easy to understand even by lay stakeholders.
Credibility: Assessment should be able to stand peer review from the scientific community (Experts)

Legitimacy: Process should be transparent, fair and open.

Saliency: Assessment must be of relevance and value to decision-makers

Scalability: Assessment should be able to capture change in space and time.

Utility: Assessment focus should be strongly shaped by stakeholders and thus be able to apply to the multiple user needs.

The MA output would then inform decision-making for integrated environmental management (IEM) and hence sustainable development. Some critical principles underpinning Integrated Environmental Management (IEM) are:

- Informed decision-making
- Accountability at all levels of decision-making
- An attempt to ensure that society benefits as a result of actions of developers
- Broad meaning of the term environment (i.e. one that includes physical, biological, social, economic, cultural, historical, and political components)
- Democratic regard to individual rights and obligations
- Due consideration of alternative options
- Open participatory decision-making at all levels in the planning of proposals.
- Opportunity for the public and specialist input in decision-making process

As such IEM must depend on Integrated Environmental Assessment (IEA), which is a function of various tools such as:

- Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA)
- Strategic Environmental Assessment (SEA)
- Environmental Risk Assessment (EnRA)
- Science and technology
- Quantitative and qualitative measurements
- Awareness, education, and legislation

1.5 Developing and Communicating Scenarios

Scenarios Analysis (SA)

Scenarios are an inevitable consequence of survival-driven actions by humans. They often stem from the role of ecosystems as productive engines of the planet earth that interact with each other as life-support systems for humans because of the goods and services (ES) they provide. As such future ecological change is critical in ecosystem management decision-making.
The future of ecosystems, their services and HWB can be analysed by several methods:

- Prediction (cf. EIA study)
- Forecasting (cf. weather forecasting and implication on ES and HWB)
- Projections (Based on data)
- Scenarios.

While all methods are important, the MA approach borrows heavily from Scenarios Analysis and focuses on implications on HWB. A scenario is a plausible⁴ and often simplified) description of how the future may develop and look like based on a set of assumptions about key driving forces (environmental change agents) e.g. population dynamics, technology, governance and politics, economic dynamics (liberalisation), climatic disasters like floods or droughts, emergence of diseases and pests (Avian disease, locusts). Scenarios can be either:

- Exploratory: Are descriptive and begin in the present and explore trends into the future (MA for long term planning)
- Anticipatory: Commence with a vision of the future that could be positive or negative, and work backwards in time to imagine how society might reach that future (e.g. MDGs, Poverty Alleviation Strategy plans etc.)

A scenario analysis (SA) is used to address uncertainties that could be expected in the future given the dynamic nature of human decision-making process. It offers a structured account of possible long-term eventualities and or attempts to predict future happenings based on present circumstances. In essence SA seeks to:

- Address uncertainties that could follow changes in ecosystems as a result of defined drivers, and the ultimate effects thereof on HWB and the ecosystem itself.
- Offers a structured account of possible long-term eventualities.
- Predict future happenings based on present circumstances.
- Is a tool for long-term development planning based on current circumstances

Development of scenarios requires information (synthesised data relevant for decision-making). This could be either qualitative or quantitative or both, primary or secondary or both etc. Some common data sources in SA are:

⁴See chapter 19
⁵See chapter 20
⁶Reasonable, believable, with high probability of being true
⁷A driver is any natural or anthropogenic (human induced) factor that directly or indirectly causes a change in an ecosystem. Changes in ecosystems will naturally cause changes in ES (-ve or +ve), often times -ve, and changes in HWB
Like any standard research process some commonly used tools for data collection include:

- Interviews and Questionnaires
- Participatory Rural Appraisals (PRA)
- Spatial Analysis (Remote sensing, GIS, Transect Surveys etc)
- Content analysis of secondary data.

Ultimately, scenarios can thus be presented as narratives (Qualitative data) and also using approaches consistent with quantitative data. A typical scenario would thus contain a description of step-wise changes, driving forces, base year, time horizon, and a story line, and be used to seek answers to the following questions among others:

- How do current conditions and happenings affect the capacity of ecosystems to provide their services?
- What will be the implications on poverty?
- How will Human Well-Being be affected?
- What are the lessons for decision-making for sustainable development?

When it comes to decision-making, the basic message from scenarios analysis is that if future predictions on ecosystems, their services and Human well-being are negative, then the current happenings (policies, legislation, technology, institutions, behaviour etc) are inadequate, inappropriate or both and thus corrective measures are needed today to halt the negative progression and enhance the positive progression.

Similarly, if the future looks positive, current happenings should be consolidated and the gains maximised. Scenarios analysis is not restricted to environmental themes, but can be applied to any activity done by human beings (Table 1). As far as the future is concerned, Raskin et al., 1998, have discussed three possible future sustainability scenarios, thus:
i. Conventional World

According to this scenario the current pathway of economic globalisation, with evolutionary changes in institutions, environmental systems and human values will continue. That developing regions of the world will move toward industrial country patterns and values. However the future condition/status of developed countries is not described.

ii. Barbarisation

It depicts a world in which deepening social and environmental tensions are not resolved, civilized norms erode, and great human misery ensures. Before the enactment of EMCA, 1999, Kenya was perhaps drifting into this scenario, a possibility that was occasioned by the existing type of political governance.

iii. Great Transitions

This scenario envisions fundamental social and institutional transformation towards more sustainable development, bringing a new and arguably higher stage of human civilization. This would however require among others:

(i) Resurgence of quality values as a component of human welfare
(ii) High valorisation of nature
(iii) Equitable wealth distribution
(iv) Strong social solidarity.
(v) Deliberate efforts to institutionalise ethical and professional political and corporate governance

There is no doubt that lack of good governance remains the single most important hindrance to sustainable development in most sub-Sahara countries.

1.6 Strategic Interventions, Response Options and Decision-making

The rationale for response options and strategic interventions within the MA include:

- The need to protect and restore ecosystems and the services they provide.
- To ensure the equitable distribution of the benefits (services)
- To enhance human well-being and sustainable development.
Table 1. Overview of some global scenario projects

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Scenario Group (GSG)</td>
<td>Examines global scenarios based on 3 classes: conventional world, barbarisation, great transitions</td>
</tr>
<tr>
<td>Global Environmental Outlook 3 (GEO-3)</td>
<td>Similar to GSG, with emphasis on regional texture</td>
</tr>
<tr>
<td>World Business Council on Sustainable Development (WBCSD)</td>
<td>Focus is on corporate members to reflect on the business risks &amp; opportunities of the SD challenge</td>
</tr>
<tr>
<td>World water Vision (WWV)</td>
<td>Focus is water supply and demand dynamics</td>
</tr>
<tr>
<td>IPCC Special Report on Emission Scenarios (SRES)</td>
<td>Focus is GHG emissions to the year 2100</td>
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Source: (UNEP 2002)

As would be expected these options tend to revolve around (i) interventions that stimulate or suppress certain human activities and or behaviour, (ii) interventions that create knowledge, and (iii) interventions that create investments. These response options and strategic interventions are and can be implemented through various mechanisms nationally and globally.

- International Conventions
- Multi-lateral and bilateral treaties
- National and local laws
- Institutional changes
- Governmental and industrial policies
- Contractual agreements, partnerships and collaborations
- Private and public action.

This calls for negotiations and trade offs within the parameters of win-win for both people and the environment. Making trade off is influenced by among others the following factors:

- Ethics and value systems
- Local versus national interests
- Extend of local rights
- Relative importance of priorities (private, public, for the rich or poor etc)
- Long term planning
- Fair compensation
- Sensitivity to ecosystems
When it comes to decision-making, the goal of the MA is to make decisions that will enhance sustainable flow of ES and hence HWB for all people. Some desirable characteristics in this regard are:

- Use of the best information
- Being transparent to increase the legitimacy of the process
- Increased participation of stakeholders
- Learning from the past and the protection of options on the premise that all policies are experiments and hence the importance of adaptive management for risk management.
- Accountability on the part of decision-makers i.e. ability and willingness to take responsibility for their decisions.
- Being biased towards options that are efficient due to scarcity of resources
- Consideration of cumulative and cross-scale effects because of the spiral nature of effects from local to wider spatial settings.
- Consideration of equity and vulnerability factors particularly because changes in ecosystems tend to have severe impacts on the poor.

Ultimately, research and assessment outputs can only yield desirable benefits if they are communicated to the relevant decision-makers in a way that they understand and then buy into the idea. Identifying various categories of decision-making stakeholders and the methodology of communication is critical. Much would be achieved in Kenya if the MA output is effectively communicated to the three wings of government: executive, judiciary and legislature. Further, research outputs in Kenya hardly reach the intended target populations. Ways and means must be found to ensure that appropriate links to operationalise multiple direction information flow among research institutions, civil society, government and local communities are established. Further, mainstreaming environmental sustainability thinking at all levels of decision-making for national development is important. In East Africa, national efforts in this regard are being realised in poverty eradication strategies in collaboration with such bodies like UNDP and UNEP. Assey et al (2007) have discussed some progress made in Tanzania in this regard.

A major challenge for East Africa governments is to deliberately factor IEA concerns into annual budgets for each district and also invest more in capacity building in MA whether as degree programmes or short courses for re-tooling purposes.

1.7 Review Questions

a. Identify key ecosystems and their services in your locality and assess their status, indicating the key drivers of change.

b. Discuss the linkages between poverty and the environment in your locality citing specific examples.

c. On the basis of prevailing political dynamics, develop possible scenario and response options for your country, focussing on environmental quality and
d. Citing specific stakeholders, explain how the output from the MA can be communicated to them to guarantee maximum benefits for decision-making.

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