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Written by Livia Bizikova

October 2011

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Funder: StewardEdge Inc.
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As a leading consulting and management company in Canada, StewardEdge Inc. is focused on managing consumer product company risks related to their post-consumer products and packaging and helping them to improve their environmental, economic and social performance, bringing decades of experience from across North America and internationally. For over 30 years, StewardEdge Inc. has gone where no one has gone before, accomplishing numerous industry firsts and continues to forge ahead, innovate and lead the way boldly into the future.

Table of Contents

Introduction

Poverty in Canada, as everywhere in the world, is a multi-dimensional issue. It is characterized by a serious lack of material well-being; food, housing, land and other assets lead to physical deprivation and a loss of psychological well-being. In addition, poverty, by its very nature, leads to a lack of power and access, making it difficult to have your views heard in various spheres of decision-making. Poverty also leads to a violation of social norms and an inability to maintain a cultural identity through participating in traditions, festivals and rituals (Fields, 1980). Many elements of poverty are closely tied to the status of the surrounding ecosystems and the quality of accessible ecosystem services.

In Canada, this is especially true in the context of remote First Nations communities and their traditional livelihoods. Here, community well-being often depends on ecosystem services such as:

- Food acquired by hunting
- Clean water
- Stable terrain for housing
- Accessibility
- Medicinal plants
- Cultural values that communities have placed on the ecosystems

Additionally, remote communities often rely in large measure on their immediate environment as a source of income in the form of timber, fish, fur and non-timber forest products. While such communities are dependent on the provisioning services provided by ecosystems, the regulating, supporting and cultural services provided by ecosystems also play a vital role in sustaining human well-being.

Unfortunately, recognition of the links between ecosystem and well-being has not yet penetrated public policy or regional planning to the degree that it can make a difference in the overall outcome. Typically, what results are less-than-optimal land-use and resource-use decisions. Often, responses rely on remedial measures, like repairing damage caused by flooding, or on regulation, which attempts to dictate certain patterns of land use. What is needed to improve this undesirable situation is a careful evaluation of the links between ecosystems and well-being of people to guide policy development and community and regional planning.

This paper provides a review of literature on the linkages between ecosystem services and human well-being, including their assessment and related policy development. The paper concludes with key insights for studies aiming to understand and assist in policy development for communities, whose well-being is strongly dependent on the status of the surrounding ecosystems and their services.

Understanding Linkages Between Ecosystem Services and Human Well-Being

Human well-being is vitally dependent upon improving the management of Earth's ecosystems to ensure their conservation and sustainable use (United Nations Environmental Programme [UNEP], 2009a; Organisation for Economic Co-operation and Development [OECD], 2006, p. 7). Intact, functioning ecosystems provide services—such as the provision of food, water, fuel and fibre, and climate regulation—on which nations and people rely to earn income from agriculture, fishing, forestry, tourism and other activities (for details see Box 1). Sustainable use of these ecosystem services and natural resource assets is increasingly recognized as a key factor in enduring economic development and improvement in human welfare, and as a necessary condition for achieving the Millennium Development Goals (UNEP, 2009b). Well-functioning ecosystems are even more crucial to those poor communities whose well-being (and thus often their poverty) is directly tied to the provision of ecosystem services.

BOX 1. TYPES OF ECOSYSTEM SERVICES

- **Provisioning services** are the products people obtain from ecosystems, such as food, fuel, fibre, fresh water and genetic resources.
- **Regulating services** are the benefits people obtain from the regulation of ecosystem processes, including air quality maintenance, climate regulation, erosion control, regulation of human diseases and water purification.
- **Cultural services** are the non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences.
- **Supporting services** are those that are necessary for the production of all other ecosystem services, such as primary production, production of oxygen and soil formation.

Source: UNEP, 2009a

Poverty is a widespread phenomenon throughout the world, and the poor in Canada have much in common with the poor elsewhere. Poverty is a multidimensional social phenomenon, which can be defined by a lack of material well-being, especially food, housing, land and other assets, leading to physical deprivation and a consequent reduction in psychological well-being. But poverty also typically leads to the lack of power to actively express views in various spheres of decision-making, a weakening of social norms and an inability to maintain a cultural identity through participating in traditions, festivals and rituals (Fields, 1980). Many elements of poverty can be closely linked to the status of the surrounding ecosystems and the quality and accessibility of these services. Linkages between poverty and the environment can be conceptualized in many ways, notably in terms of their relationship to livelihoods, and their resilience in the face of environmental risks, health and economic development. In this paper, we focus on these key linkages as defined by UNEP (2009a):

- ***Livelihoods:*** Ecosystems provide services on which poor communities rely disproportionately for their well-being and basic needs. These communities also depend on the environment to earn incomes in sectors such as agriculture, fishing, forestry and tourism, through both formal and informal markets. Livelihoods can be sustainable or not, depending on the way the environment is managed.

- ***Resilience in the face of environmental risks:*** Poor people are more vulnerable to natural disasters and environmental shocks that threaten their livelihoods and undermine food security. Improving the ways in which environmental resources such as forests are managed increases the resilience of poor people and their livelihoods when facing environmental risks.
- ***Health:*** Environmental conditions account for a significant portion of health risks to poor people. Environmental risk factors, such as occupational exposures to chemicals and indoor air pollution from household solid fuel use, play a role in more than 80 per cent of the diseases regularly reported by the World Health Organization.
- ***Economic development:*** Environmental quality contributes directly and indirectly to economic development and employment. These contributions are particularly important in developing countries in such sectors as agriculture, energy, forestry, fisheries and tourism.

Poverty-environment linkages are dynamic and context-specific, reflecting geographic location, scale and the economic, social and cultural characteristics of individuals, households and social groups.[1] We follow the characterization of poverty-environment linkages previously suggested, which focuses on their two main dimensions: accessibility and vulnerability. By including vulnerability in our definition set, we are able to capture a large proportion of people who can be easily pushed into poverty when the natural resource sector they depend on for basic needs is being degraded due to climate change and/or other drivers. We also include accessibility to reflect those people who depend on a sustainable flow of natural resources, and the mere fact that if access is taken away by natural, institutional or other drivers, these people would be forced into poverty (Duraiappah, 1996).

The recognition of ecosystem-poverty linkages has not yet effectively penetrated public policy and regional planning, typically resulting in socially sub-optimal land-use and resource-use decisions. Furthermore, in the context of a poor and degraded natural resource base and a situation with few livelihood development alternatives, the studies indicate that the implementation of policies, including environmental protection measures, can actually increase poverty (Liu, et al., 2008; Magis, 2007). Policies are seldom inappropriate for the sector problems they seek to address, but secondary, unforeseen impacts have repercussions across many livelihood dimensions that are interlinked (Ledogar & Fleming, 2008; Larocque & Nöel, 2009). The closure of lands for forestry regeneration, for example, can close off opportunities for livestock grazing for villagers. Frequent shifts in policy can both cause and exacerbate poverty too; communities might have no opportunity to adopt a long-term strategy for resource management, and policy often shifts between poverty reduction and environmental protection, without developing integrated solutions to facilitate both (United Nations Development Program [UNDP] 2009a; UNDP-UNEP Poverty-Environment Initiative Uganda, 2007).

The following frameworks focused on the assessment of the linkages between ecosystem services and human well-being and policy development are explored in this review:

- Millennium Ecosystem Assessment
- Mainstreaming poverty-environment linkages into development planning
- Ecosystem-based policy development in poor areas

[1] In particular, the sex and age of the head of household (male or female, adult or young person) are key factors influencing poverty-environment linkages.

Frameworks for Understanding Linkages Between the Environment and Human Well-Being

The Millennium Ecosystem Assessment

A comprehensive approach to the exploration of linkages between environment and poverty is presented by the Millennium Ecosystem Assessment (MEA) conceptual framework (MEA, 2003). The MEA describes the linkages as follows:

> *Ecosystem services are the benefits people obtain from ecosystems. These include provisioning, regulating, and cultural services, which directly affect people, and supporting services needed to maintain the other services. Changes in these services affect human well-being through impacts on security, the necessary material for a good life, health, and social and cultural relations. These constituents of well-being are in turn influenced by and have an influence on the freedoms and choices available to people. (MEA, 2003; see also Duraiappah, 2002)*

The MEA recognized that human well-being elements are "complex and value-laden," but that some of elements are shared. The authors make specific reference to the results of the "voices of the poor" research (Narayan, et al., 2002). In this study, people in 23 countries were asked to "reflect, analyze, and express their ideas of the bad and the good life" (Narayan, et al., 2002). Among the results of this survey were the importance of *secure and adequate livelihoods, cultural and spiritual activities and the ability to provide for their children*. Among the five most comment elements, as cited in the MEA (2003), were the following:

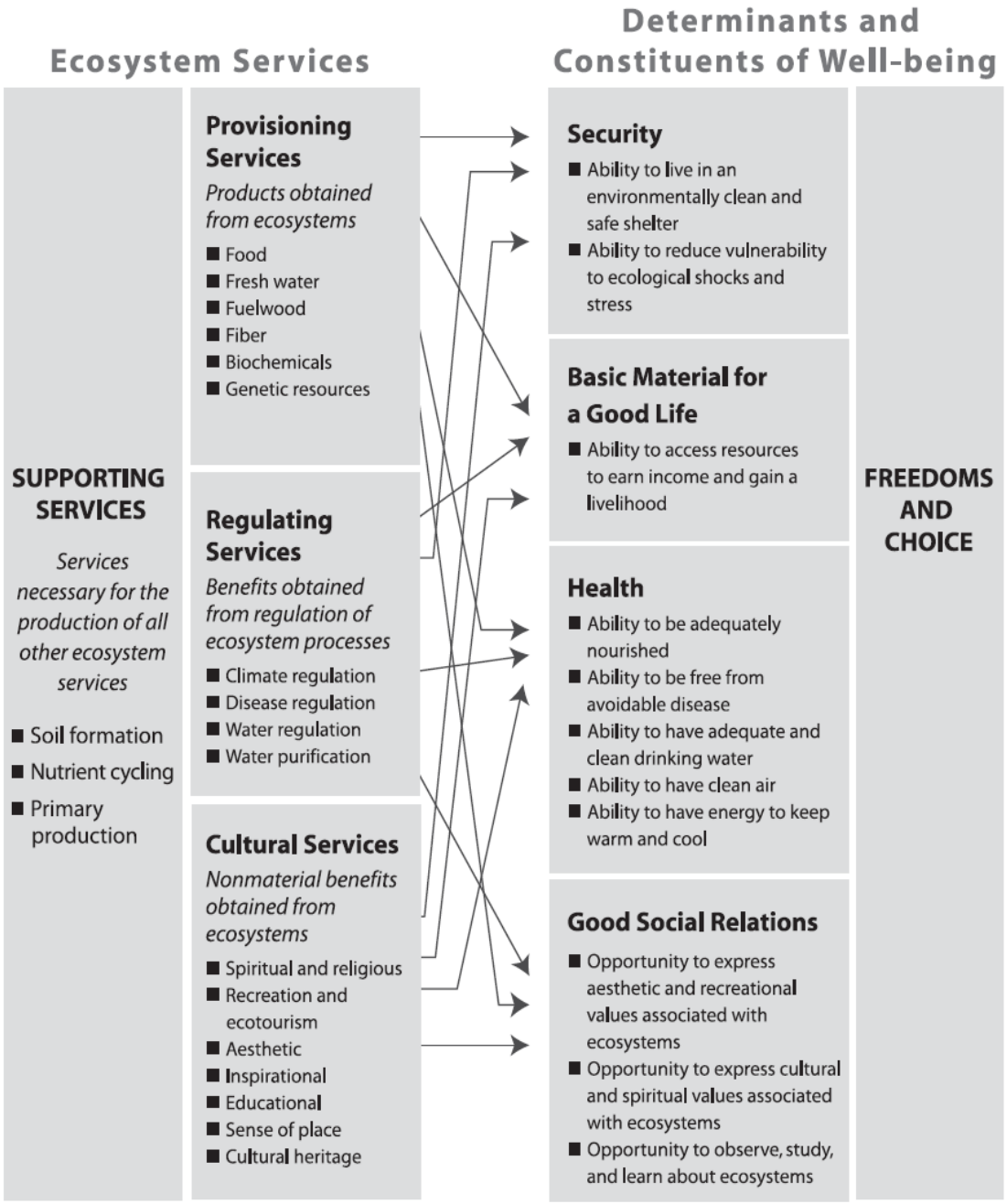
1. ***The necessary material for a good life—***including secure and adequate livelihoods, income and assets, enough food at all times, shelter, furniture, clothing and access to goods
2. ***Health—***including being strong, feeling well and having a healthy physical environment
3. ***Good social relations—***including social cohesion, mutual respect, good gender and family relations, and the ability to help others and provide for children
4. ***Security—***including secure access to natural and other resources, safety of person and possessions, and living in a predictable and controllable environment with security from natural and human-made disasters
5. ***Freedom and choice—***including having control over what happens and being able to achieve what a person values doing or being

The MEA further elaborates on the aspects of human well-being by describing six categories of "freedom." These include participative freedom, economic facilities, social opportunities, transparency guarantees, protective security and ecological security. The sixth freedom, ecological security, is the contribution from the MEA analysis and is defined as "the minimum level of ecological stock (an ecological safety net), defined by respective communities through an open and participatory process, that is required to provide the supporting services needed to ensure a sustainable flow of provisioning, regulating, and cultural ecosystem services" (MEA, 2003).

Figure 1 illustrates these aspects of human well-being, along with the various ecosystem services upon which the aspects depend. Among the different categories of ecosystem services are:

1. ***Provisioning services,*** such as food, water, timber, and fibre
2. ***Regulating services*** that affect climate, floods, disease, wastes and water quality
3. ***Cultural services*** that provide recreational, aesthetic and spiritual benefits
4. ***Supporting services*** for the above three services, including soil formation, photosynthesis and nutrient cycling

FIGURE 1. OVERVIEW OF THE MILLENNIUM ECOSYSTEM ASSESSMENT CONCEPTUAL FRAMEWORK



(Source: MEA, 2003)

A more detailed description of the different types of ecosystem services is provided in Table 1.

TABLE 1: OVERVIEW OF THE ECOSYSTEM SERVICES AND THEIR DESCRIPTIONS

SERVICE	DESCRIPTION
Provisioning Services	
Food and Fibre	This includes the vast range of food products derived from plants, animals and microbes
Fibre	Materials such as wood, jute, hemp, silk, and many other products derived from ecosystems
Fuel	Wood, dung and other biological materials that serve as sources of energy
Genetic Resources	The genes and genetic information used for animal and plant breeding and biotechnology
Biochemicals, Natural Chemicals and Pharmaceuticals	Many medicines, biocides, food additives such as alginates, and biological materials that are derived from ecosystems
Ornamental Resources	Animal products, such as skins and shells, and flowers are used as ornaments, although the value of these resources is often culturally determined
Freshwater	Freshwater is another example of linkages between categories—in this case, between provisioning and regulating services.
Regulating Services	
Air Quality Maintenance	Ecosystems both contribute chemicals to and extract chemicals from the atmosphere, influencing many aspects of air quality.
Climate Regulation	Ecosystems influence climate both locally and globally. For example, on a local scale, changes in land cover can affect both temperature and precipitation. On the global scale, ecosystems play an important role in climate by either sequestering or emitting greenhouse gases.
Water Regulation	The timing and magnitude of runoff, flooding and aquifer recharge can be strongly influenced by changes in land cover, including, in particular, alterations that change the water storage potential of the system, such as the conversion of wetlands or the replacement of forests with croplands or croplands with urban areas.
Erosion Control	Vegetative cover plays an important role in soil retention and the prevention of landslides.
Water Purification and Waste Treatment	Ecosystems can be a source of impurities in freshwater but also can help to filter out and decompose organic wastes introduced into inland waters and coastal and marine ecosystems.
Regulation of Human Diseases	Changes in ecosystems can directly change the abundance of human pathogens, such as cholera, and can alter the abundance of disease vectors, such as mosquitoes.
Biological Control	Ecosystem changes affect the prevalence of crop and livestock pests and diseases.
Pollination	Ecosystem changes affect the distribution, abundance and effectiveness of pollinators.
Storm Protection	The presence of coastal ecosystems such as mangroves and coral reefs can dramatically reduce the damage caused by hurricanes or large waves.

Cultural Services	
Cultural Diversity	The diversity of ecosystems is one factor influencing the diversity of cultures.
Spiritual and Religious Values	Many religions attach spiritual and religious values to ecosystems or their components.
Knowledge Systems	Ecosystems influence the types of knowledge systems developed by different cultures.
Educational Values	Ecosystems and their components and processes provide the basis for both formal and informal education in many societies.
Inspiration	Ecosystems provide a rich source of inspiration for art, folklore, national symbols, architecture and advertising.
Aesthetic Values	Many people find beauty or aesthetic value in various aspects of ecosystems, as reflected in the support for parks, "scenic drives" and the selection of housing locations.
Social Relations	Ecosystems influence the types of social relations that are established in particular cultures. Fishing societies, for example, differ in many respects in their social relations from nomadic herding or agricultural societies.
Sense of Place	Many people value the "sense of place" that is associated with recognized features of their environment, including aspects of the ecosystem.
Cultural Heritage Values	Many societies place high value on the maintenance of either historically important landscapes ("cultural landscapes") or culturally significant species.
Recreation and Ecotourism	People often choose where to spend their leisure time based in part on the characteristics of the natural or cultivated landscapes in a particular area.

(Source: MEA, 2003)

Mainstreaming Poverty-Environment Linkages into Development Planning

Since 2008 an initiative led by UNEP focused on environment and poverty linkages in more than 15 developing countries (UNEP, 2009b). Similarly, the World Bank is increasingly engaged in projects on ecosystem-based policies in poor areas (World Bank, 2010). Both of these initiatives recognize that specific policies and measures need to be designed and implemented to improve the situation of poor people.

This UNEP initiative focused on environment and poverty linkages aimed directly at assisting in policy development. It recognizes that addressing poverty and improving degrading ecosystems and related services are, however, not identical problems that are automatically addressed together. Poverty could contribute to further deterioration of the ecosystems and overexploitation of services, and changing ecosystems could lead to outcomes that perpetuate poverty (UNEP, 2009a; 2009b). Some activities aiming to maintain well-being and reduce poverty could make certain ecosystem services more vulnerable, such as overfishing and increased soil erosion, limiting agricultural production that could lead to poverty because of diminished income and food insecurity (for examples, see Box 2). This could further perpetuate poverty, as the vulnerability of the population to food shortages could lead to a low-quality diet or malnutrition. Impacts of these negative trends on poor people could be further worsened if, for example, policy and management options limit their access to additional ecosystem services and/or create conflicts if the limited ecosystem services are used by other communities (for example, water retention and water availability for downstream communities during floods and

droughts). While there is growing literature on specific management options for diverse sectors such as agriculture, forest and water, it has been emphasized that a broader set of measures is required, including those focusing on underlying drivers of ecosystem degradation and those that account for broader developmental priorities that regions and poor communities are facing (Eriksen & O'Brien, 2007; Schipper & Pelling 2006).

In this context, the poverty-alleviating policies and measures that effectively target the interface between ecosystems and related services and poverty are described as follows (Eriksen & O'Brien, 2007):

1. ***Those measures that target the degradation of key ecosystem services to the poor,*** such as the destruction or deterioration of water quality and accessibility and the viability of utilized cropping systems and other sources of livelihoods
2. ***Those measures that aim to strengthen the capacity to cope with and adapt to stresses,*** such as engaging in alternative sources of income during drought, accessing forest products or seasonal movements of livestock for grazing
3. ***Those measures that address the causes of poverty,*** such as poor market relations in trading in niche drought products, conflict, or poor social and physical infrastructure.

Many of the actual measures in these three categories could include actions that involve building infrastructure, training and capacity building for poor people to acquire new skills in resource management and production to diversify their incomes and overall improvement in access to basic services such as water, quality housing, and information about emergency procedures and resilient construction. However, in current policy design we tend to focus mostly on measures that limit access to stop further degradation of natural resources, and developing infrastructure without explicitly considering the relationship between poverty and ecosystem status and services.

BOX 2. EXAMPLES OF VULNERABILITY OF POOR PEOPLE IN THE CONTEXT OF CHANGING ACCESS AND AVAILABILITY OF ECOSYSTEM SERVICES

The ability of poor populations to draw on a range of assets to cope with stressors is limited: the resources at their disposal are often less resilient and their ability to recover from both slow- and rapid-onset events is consequently weak.

Globally:

- Cluster analysis of 294 households in **Ethiopia** revealed that poor farmers—in particular young agro-pastoralists—were most vulnerable when compared to households with larger landholdings.
- In **Bolivia**, generally the poorest in the community faced difficulties coping with the impacts of climate change, including elderly people, single women and subsistence farmers with scarce resources who often either were unable to work due to lack of opportunities or due to physical inability. In addition, these families were generally unable to migrate to seek new economic opportunities due to lack of resources. These families were more likely to endure hardship and rely on neighbours and other family members for assistance.
- In **Mozambique**, about 25 per cent of surveyed households did not identify any ex ante coping strategy for managing drought and 45 per cent of households did nothing in preparation for floods or cyclones. A lack of resources to cope with these events seems to be a main factor contributing to this sense of resignation and disempowerment.
- In **Bangladesh**, poverty status and lack of assets forced vulnerable households to pursue short-term measures at odds with long-term sustainability, such as withdrawing children from school. In the end, a climate event pushed these households even deeper into poverty. This example shows how poverty and lack of resources can lead to maladaptation and perpetuate a cycle of vulnerability.

First Nations communities in Canada:

- Shifts in seasonal characteristics were felt to be more worrisome, and indicative of the more serious nature of climate change, than isolated climate events. For example, summer and autumn seasonal conditions were observed to extend further into the traditional winter months, causing changes in traditional seasonal activities.
- Shifts in animal distribution and local ecology, and changes in accessibility to traditional food species could result in food insecurity.
- Recently, summers were observed to be abnormally dry, with rainfall having no appreciable effect on moisture levels; the quantity and quality of water is deteriorating in their territories, in part due to human activity.
- Unpredictability of weather is influencing their preparedness for outdoor activities.
- Plants, including trees and berry-producing shrubs, are showing the effects of heat and associated drought, such that useful products from these sources are no longer as abundant.
- Decreases in the quality and thickness of the winter coats of fur-bearing animals are affecting the livelihood of Northern people engaged in trapping.
- However, increasing temperatures and lengthening growing seasons present opportunities for small-scale agriculture.

Sources: World Bank (2010); Sauchyn & Kulshreshtha (2008); Furgal & Prowse (2008)

Ecosystem-Based Policy Development in the Context of Well-Being

Besides the call for measures addressing the specific needs of the poor, the importance of specific ecosystem-based policies is being emphasized as they are measures that harness ecosystem services in reducing vulnerability of the poor to global and regional processes such as climate change, flooding, droughts and economic shocks.[2] **Ecosystem-based policies** are those that help to preserve and restore natural ecosystems that can provide protection against some of these threats (Perez, et al., 2010) and thus help build the resilience of local communities (Convention on Biological Diversity, 2009). For example, coastal ecosystems like wetlands, mangroves, coral reefs, oyster reefs and barrier beaches all provide natural shoreline protection from storms and flooding, in addition to their many other services important for well-being (Munang, et al., 2009). Ecosystem-based approaches consider the fact that both natural and managed ecosystems can reduce vulnerability to hazards and gradual changes in the natural and socioeconomic environment (Perez, et al., 2010; for examples see table 2). By making ecosystems more resilient, ecosystem services (e.g., fish stocks, fuel, clean water) on which vulnerable communities depend for their subsistence and livelihoods are maintained (Hale, et al., 2009).

Measures that improve the quality of the ecosystems and their services are particularly crucial in poor communities that derive most of their well-being from these services. If ecosystems are not targeted in policy development, it could lead to maladaptation. For example, the promotion of economic development through shrimp farming may enhance incomes, but it may also contribute to the loss of wetlands and mangroves and increase vulnerability to cyclones, which can have disastrous effects on livelihoods and hence exacerbate poverty (Adger, Arnell & Tompkins, 2005). However, there are also constraints to implementing ecosystem-based adaptation that have to do with a lack of information, the uncertainty of how ecological processes will react to both climate change and management and a lack of adequate institutions to manage the ecosystem services in the new adaptation context (Colls, Ash & Ikkala, 2009).

TABLE 2. EXAMPLES OF DIFFERENT TYPES OF POLICIES AND MEASURES TO HAZARDS SUCH AS FLOODING AND HEAVY RAINFALL, INCLUDING ECOSYSTEMS-BASED, INFRASTRUCTURE AND CAPACITY-DEVELOPMENT MEASURES

INFRASTRUCTURE AND CHANGES IN PRACTICES	ECOSYSTEM-BASED MEASURES	GOVERNANCE, TRAINING AND CAPACITY DEVELOPMENT
Increasing the capacity of water/ sewage pipelines to account for access water and limit overflowing Building small and medium dams Building resistant roads to withstand flooding, permafrost thawing	Prompting sustainable non-forest product extraction to allow natural regeneration agriculture, organic farming and appropriate technology to reduce degradation Erosion control by encouraging vegetation planting and water storing Restoring vegetation around river beds to limiting flooding	Sustainable water management Farmer education—water harvesting and contour farming Training centres and microfinance to develop skills for off-farming-season activities Vocational training—especially for youth, in places with low levels of education Developing extension services to provide information about seasonal weather changes sea-ice changes, status of permafrost Health awareness programs and mobile clinics

Source: Bizikova, et al., 2010 (modified)

[2] The ability of poor populations to draw on a range of assets to cope with stressors is limited; the resources at their disposal are often less resilient; and their ability to recover from both slow and rapid-onset events is consequently weak (World Bank, 2010).

Synthesis of Ecosystem and Human Well-Being Linkages

The magnitude of observed impacts and anticipated future consequences of environment impact, including biodiversity loss, deforestation, soil degradation and climate change, points to the increasing vulnerability of human and natural systems and to their limited capacity to cope. This has implications for the protection and management of wildlife, fisheries, forests and livelihoods (Furgal & Prowse, 2008). These changes will impact everyone; however, the poor will be hit first and hit hardest.

Poverty and well-being status are crucial determinants of access to entitlements and resources and directly shape vulnerability to risks (World Bank, 2010). Because poor communities derive their well-being from ecosystem services, combining ecosystem-based measures with responses to improve the situation of poor people and communities is an important approach that decision-makers need to consider. How well-being and poverty are experienced and expressed depends on context and situation, reflecting local physical, social and personal factors such as geography, environment, age, gender and culture.

In all contexts, however, ecosystems are essential for human well-being through their provisioning, regulating, cultural and supporting services. However, combining ecosystem-based and poverty-alleviating policies and measures is a challenging task, as it requires connecting domains that are rarely addressed in tandem.

Based on the analyzed approaches to conceptualizing the linkages between ecosystem services and well-being and to policy development, we observe the following key points:

- **It is important to understand the key ecosystem services that are crucial for maintaining well-being.** While ecosystems provide a number of services relevant to the well-being of people, it is important to identify those ones that provide the highest relevance. This could include any of the provided services, including cultural services that are important for many indigenous communities (Rowcroft, 2006).
- **It is important to understand the key drivers behind changes in ecosystem services.** Quality and availability of ecosystem services could be the outcome of my many drivers, including global processes, such as climate change; regional processes, such as industrial development in proximity of the community; and also local processes, such as unsustainable land use and harvesting. It is important to understand these drivers so we can target possible causes of the problems instead of only dealing with the impacts.
- **A spectrum of policies are needed to improve the well-being of the people.** To address the complex relationships between ecosystem services and well-being, often different types of policies are needed, including those that: improve regulating and provisioning; cover gaps in ecosystems services if the availability of food, other products, land and pastures are limited for communities; and assist in governance issues and conflict-resolution to ensure functioning polices targeting ecosystem services that often span across communities and regions.
- **Ecosystem-based policies should be a key component of the policy spectrum.** Many of the policies needed to improve the well-being of communities could directly involve ecosystems and ecosystem services, for example: restoring wetlands could provide water quality and adopting sustainable harvesting practices for fish; other animals and plants could provide sustained provisioning and regulating services such as food, products to sell; water levels preventing flash flooding; and creating habitats for species. Policy development processes need to explore the opportunities for ecosystem-based measures.
- **Deliberation with the community members is necessary to uncover relationships between ecosystem services, well-being and possible policy choices.** Linkages between community well-being and ecosystem services are often specific to the communities—including the drivers of changes in available services. Therefore, community participation and involvement are needed to assess the linkages and identify feasible and acceptable policy choices.

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Published by the International Institute for Sustainable Development.

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