**Handout A: Ecosystem-Based Adaptation to Climate Change**

Climate change is already having significant impacts on both human and ecological systems, and those impacts will only increase over time (IPCC, 2014). Through ecosystem-based adaptation, human communities can use biodiversity and ecosystems to adapt to ecological and climatic shifts and thus reduce the damages they face (Doswald et al., 2014; Wertz-Kanounnikoff et al., 2011)

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| **Adaptation:** Actions taken to help communities and ecosystems cope with changing climate conditions (UNFCCC, 2013; VCCCAR).**Ecosystem:** A community made up of living organisms and nonliving components that interact as a functional unit.**Ecosystem Services:** The benefits that people derive from ecosystems (Millennium Ecosystem Assessment, 2005). |

Climate change adaptation initiatives are classified as hard engineering (also known as grey) adaptation or soft adaptation, which comprises ecosystem-based solutions (green adaptation) and policies and social initiatives (Chambwera et al., 2014; Depietri and McPhearson, 2017). While hard adaptation modes like revetments and sea walls may be needed to protect some communities, ecosystem-based adaptation can also be successful, and in some cases may be better than pure engineering solutions (Rao et al., 2013). However, many ecosystem-based adaptation techniques are relatively new and there are uncertainties about their costs and benefits (Doswald et al., 2014).

Ecosystem-based adaptation measures reduce climatic risk by keeping climate hazards outside communities, increasing adaptive capacities, or helping communities be prepared for or recover from climate hazard impacts (Wamsler et al., 2016). Ecosystem-based adaptation relies on sustainable management, conservation, and restoration of ecosystems. The relationship between ecosystems and adaptation is, however, complex and multidirectional: ecosystem-based adaptation are actions that can help humans adapt to climate change, while non-ecosystem-based adaptation efforts can either protect or endanger biodiversity and ecosystem services (Secretariat of the Convention on Biological Diversity, 2009). Similarly, many initiatives to preserve ecosystems can yield both climate adaptation services and non-climate-related ecosystem services, like serving as habitat for important species. For example, mangrove forests provide an array of ecosystem services and protect coastal areas from flooding and storms (Faunce and Serafy, 2006).

The table below describes examples from the United Nations Development Programme’s Ecosystem-Based Adaptation Program (UNDP, 2015).

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| Nepal | Peru | Uganda |
| * maintaining and restoring ecosystems along roads to reduce landslides
* restoring wetlands, springs and ponds to ensure year-long drinking water supply
* soil nutrient management to increase soil moisture during dry periods
 | * restoring water channels and reservoirs to support micro-watersheds & wetlands to secure provision of water for the reserve communities and downstream users
* grassland management to enhance pastoral livelihoods and increase resilience to drought and frost
* vicuña management to produce animal fiber for livelihoods and communal livestock management in natural grasslands
 | * improved water retention through roadside drainage bunds and run-off retention drains
* a gravity flow engineered irrigation scheme, combined with reforestation, soil and water conservation
* riverbank restoration to create a hybrid grey-green solution to catchment-scale water management
* tree planting using agroforestry to stabilize soil to reduce landslides
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*Source: (UNDP, 2015)*

Adaptation is often most crucial in issues relating to water. Shifts in population and changes in human behavior in response to climate change will increase water stress, rendering adaptation even more necessary. For example, in Uganda, farmers are moving into wetlands because of increasing rainfall variability and land degradation on historically traditional agricultural lands (UNDP Green Climate Fund, 2017), while in other countries like Guinea, farmers are moving out of rich coastal areas due to salinity and sea level rise (UNDP Green Climate Fund, 2019). Thus, adaptation measures must respond to changes in both weather conditions and human populations.

While some ecosystem-based adaptation can occur at the community level, some adaptation must happen on land parcels owned by individuals (Scarano, 2017). Adopting these practices can be costly for landowners; for example, the community may be best served by an unfarmed buffer strip near a waterway, but that may be a farmer’s most productive land. Laws exist to require such practices in some cases (Uganda, 2000), but they can be hard to enforce. Alternatively, payment for ecosystem services programs may be effective in promoting ecosystem-based adaptation, but such programs are not a panacea and will only be effective in certain conditions (Wertz-Kanounnikoff et al., 2011).

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