
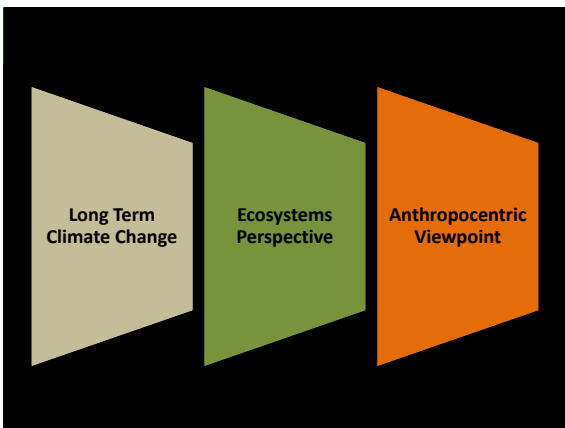


Climate Change, Ecosystem Services
and
Human Well-being

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- What are the impacts of climate change on Ecosystem Services?
- How does this affect Human Well-being?

What are Ecosystem Services?

“The benefits that humans derive from ecosystems are known as ecosystem services and include breathable air, fertile soils, and productive forests and fisheries, as well as many cultural benefits such as recreational hunting or inspirational values.” (MA, 2005)

Such ecosystem services are possible only if ecosystems include the biodiversity that guarantees the functional processes necessary to deliver them. (MA, 2005)

Ecosystem Services



Source: Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC.

How do they Influence Human Well-being?



Source: Millennium Ecosystem Assessment, 2005. *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC.




Greater than 60% of services provided to society by biotic systems have been diminished due to human activities, particularly in the last 50 years
(MA, 2005)

C3 – Indicators of Climate Change

- Birds
- Butterflies
- Frogs
- Pine trees
- Redwoods
- Coral reefs
- Biodiversity
- Plant phenology
- Sea level
- Hurricanes

What does this mean for human well-being?

C3 Ecosystem Categories

		
Terrestrial	Marine and Coastal	Urban

Terrestrial Ecosystems

Provisioning, Regulating and Cultural services

Economic	Non-economic
<ul style="list-style-type: none"> - agriculture - forestry - livestock - timber - fuel - medicine - biochemicals - fresh water - tourism and recreation, etc. 	<p>Regulatory</p> <ul style="list-style-type: none"> - air/water/soil quality; - climate; - water availability; - pests and diseases; - hazards; etc. <p>Cultural</p> <ul style="list-style-type: none"> - spiritual/religious, - aesthetic and recreational

Anthropogenic Stressors on Terrestrial Ecosystems

- **Habitat change, fragmentation, loss, degradation**
- **Invasive alien species**
- **Disease (human wildlife interface)**
- **Pollution**
- **Overexploitation**
- **Climate change**

Conversion Of Terrestrial Biomes

A biome is the largest unit of ecological classification that is convenient to recognize below the whole globe, such as temperate broadleaf forests or montane grasslands. A biome is a widely used ecological categorization, and because considerable ecological data have been reported and modeling undertaken using this categorization, some information in the assessment can only be reported based on biomes. Whenever possible, however, the MA reports information using 10 socioecological systems, such as forest, urbanized, coastal, and marine, because these correspond to the regions of responsibility of different government ministries and because they are the categories used within the Convention on Biological Diversity.

According to the four MA scenarios, for 2050 projections, the average value of the projection under the four scenarios is plotted and the error bars (black lines) represent the range of values from the different scenarios.


Source: Millennium Ecosystem Assessment

Source: Millennium Ecosystem Assessment, 2005, *Ecosystems and Human Well-being: Synthesis*. Island Press, Washington, DC.

Marine and Coastal Ecosystems


Marine

- Fisheries: industrial and subsistence
- Oil, gas, minerals
- Waste disposal
- Transport
- Climate regulation
- Nutrient cycling
- Recreation and aesthetic values



Coastal

- 40% of people in the world live within 100 kms of the coast; support some of the wealthiest populations
- Resource rich coastal habitats: mangroves, coral reefs, open water
- Services: Food security and livelihoods, wave breaking and land-building, aesthetic and recreational
- Economic sectors: Fisheries and aquaculture, ports and shipping, trade, industry, recreation and tourism, military and security, etc.



Anthropogenic Stressors

- Development related loss of habitat and services
 - Urbanization
 - Port development
 - Fisheries and aquaculture
 - Industry
 - Toxin and nutrient run-offs
 - Reduction of sediment flows due to reservoirs and water diversions
- Climate change

"Many coastal systems at thresholds of healthy functioning"
(MA, 2005)

Urban Areas

- Support a majority of the human population
- Range of land-use types: paved and constructed, gardens, grasslands, wooded land and agricultural land
- Not major producers of ecosystem services but can alter them at every scale
- Heavy dependence on adjoining areas for food, clean water, waste disposal, etc. ; Significant land transformation in peri-urban areas – Large ecological footprint





Ecosystem Impacts of Urban Growth


- Impacts on air quality, quality and availability of water, soil quality, waste processing and recycling, etc.
- Conflicts with wildlife and habitat conservation; introduction of exotic and invasive species
- Modification of biogeochemical cycles and local micro-climates




Climate Change Impacts on Urban Eco-services

 Reduced availability of a range of basic natural resource based goods and services e.g. food, fuel, fiber, water, etc. Increased costs of living

 Densely populated areas highly vulnerable to the increasing geographic range of infectious and vector borne diseases

 Amplification of the urban heat island effect; direct implications for quality of life and human health

 In coastal cities, sea-level rise and increased intensity of hurricanes threaten human safety, security and livelihoods

Resources

- Millennium Ecosystem Assessment:
<http://www.millenniumassessment.org/en/index.aspx>
- Global Climate Change Impacts in the United States, USGCRP:
<http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts>
- Convenient Solutions to an Inconvenient truth: Ecosystem Based approaches to Climate Change, World Bank, 2009: [siteresources.worldbank.org/.../ESW_EcosystemBasedApp.pdf](http://siteresources.worldbank.org/ESW/EcosystemBasedApp.pdf)
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<http://www.cbd.int/information/library.shtml>
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