



Climate Change and Ecosystem Impacts

Ecosystem	Ecosystem services	Key climatic variables	Implications for biodiversity	Projected implications for humans	International agreements, organizations and actions	Links for further reading
Oceans and Coral Reefs	<ul style="list-style-type: none"> • Food • Medicines • Climate regulation • Nutrient cycling • Recreation 	<ul style="list-style-type: none"> • Sea surface temperature • Indirect chemical effects of higher CO₂ concentrations in the ocean • Reduced sea-ice cover 	<ul style="list-style-type: none"> • Coral bleaching, which may result in coral death, due to rises in temperature (even <1°C) • Increasing CO₂ concentrations could reduce calcification rates (skeletal development, growth rate) • Declining fish 	<ul style="list-style-type: none"> • Loss of goods and lives due to floods • Loss of livelihoods due to declining fish stocks etc. • Increased malnutrition and hunger • Conflicts over fishing grounds 	<ul style="list-style-type: none"> • International Coral Reef Action Network (ICRAN) • Coral Reef Alliance (CORAL) • International Coral Reef Initiative (ICRI) • UNEP Coral Reef Unit • Reef Relief • International Ocean Institute 	<ul style="list-style-type: none"> • Law of the Sea Treaty: http://www.un.org/Dpts/los/convention_agreements/convention_overview_convention.htm • Coral Reefs & Mangroves of the World: http://www.unep-wcmc.org/marine/data/coral_mangrove/ind

			stocks			ex.html
Mangroves	<ul style="list-style-type: none"> • Food • Fiber • Timber • Fuel • Climate regulation • Storm and wave protection • Waste processing • Nutrient cycling • Recreation • Ecotourism • Aesthetic values 	<ul style="list-style-type: none"> • Relative rate of sea-level rise • Hydrological balance changes of estuaries (where ocean tides and river currents meet) • Storm frequency and severity 	<ul style="list-style-type: none"> • Decrease – coastal zone becomes compressed between sea and inland agriculture • Declining fish stocks 	<ul style="list-style-type: none"> • Loss of goods and lives due to floods • Loss of livelihoods due to declining fish stocks etc. 	<ul style="list-style-type: none"> • International Society for Mangrove Ecosystems 	<ul style="list-style-type: none"> • Coral Reefs & Mangroves of the World: http://www.unep-wcmc.org/marine/data/coral-mangrove/index.html • Status and Trends in Mangrove Area Extent Worldwide (FAO): http://www.fao.org/docrep/007/j1533e/j1533e00.HTM
Low-lying islands	<ul style="list-style-type: none"> • Fresh water • Food • Recreation • Ecotourism 	<ul style="list-style-type: none"> • Relative sea-level rise • Storm frequency and severity • Mean annual temperature 	<ul style="list-style-type: none"> • Loss of land area • Loss of seabird nesting colonies • Increased human demands on remaining 	<ul style="list-style-type: none"> • Loss of goods and lives due to floods • Forced migration: environmental refugees 	<ul style="list-style-type: none"> • Alliance of Small Islands States (AOSIS) • Small Islands Developing States Network 	<ul style="list-style-type: none"> • UNEP Islands: http://islands.unep.ch/ • Small Island Developing States at the Forefront of Global Climate Change: http://

			terrestrial habitats <ul style="list-style-type: none"> • Increased threat of extinction for insular species 			/www.worldwatch.org/files/pdf/SOW09_CC_small%20islands.pdf
Wetlands and Coastal Marshes	<ul style="list-style-type: none"> • Fresh water • Food • Disease regulation • Flood regulation • Pollution control • Nutrient cycling • Sediment retention and transport • Recreation • Ecotourism • Aesthetic values 	<ul style="list-style-type: none"> • Mean summer temperature • Mean annual precipitation • Flooding • Relative rate of sea-level rise • Changes in hydrological balance • Storm frequency and severity 	<ul style="list-style-type: none"> • Lower species diversity if inland wetlands dry out due to increased variability in the hydrological cycle • 85% of all remaining wetlands could be eliminated by a warming of 3-4°C • Habitat loss of estuaries and deltas, especially where natural retreat is prevented due 	<ul style="list-style-type: none"> • Loss of goods and lives due to floods • Loss of livelihoods due to decline of freshwater species etc. • Heat-related deaths • Decline of freshwater sources 	<ul style="list-style-type: none"> • Wetlands International • Society of Wetland Scientists • International Wetlands Conservation Agreement 	<ul style="list-style-type: none"> • The Convention on Wetlands of International Importance (Ramsar Convention): http://www.ramsar.org/cda/ramsar/display/main/main.jsp?zn=ramsar&cp=1-31-38^20671_4000_0

			to agricultural or urban land			
Arid and semi-arid areas	<ul style="list-style-type: none"> • Food • Fuel • Firewood • Local climate regulation • Cultural heritage • Recreation • Ecotourism • Spiritual values 	<ul style="list-style-type: none"> • Precipitation patterns • Minimum winter temperatures 	<ul style="list-style-type: none"> • Deserts are expected to become hotter and drier (a few exceptions) • Desertification into Central Asian Steppes • Salinisation • Loss of grassland • Loss of arable land 	<ul style="list-style-type: none"> • Increased malnutrition and hunger • Increased migration: environmental refugees • Heat-related deaths • Conflicts over water and fertile land 	<ul style="list-style-type: none"> • United Nations Convention to Combat Desertification (UNCCD) • International Agreement to Fight Desertification 	<ul style="list-style-type: none"> • Sustainable development of drylands and combating desertification (FAO): http://www.fao.org/docrep/v0265e/V0265E01.htm • Desertification (FAO): http://www.fao.org/desertification/default.asp?lang=en • UNCCD text: http://www.unccd.int/convention/text/convention.php
Forests	<ul style="list-style-type: none"> • Fresh water • Food • Timber 	<ul style="list-style-type: none"> • Changes in rainfall • Changes in temperature 	<ul style="list-style-type: none"> • Major changes in vegetation types • Forests may 	<ul style="list-style-type: none"> • Loss of habitats • Loss of livelihoods due to 	<ul style="list-style-type: none"> • United Nations Forum on Forests • Reducing 	<ul style="list-style-type: none"> • State of the World's Forests 2009 (FAO): http://

	<ul style="list-style-type: none"> • Fuelwood • Medicines • Local climate regulation • Disease regulation • Flood regulation • Carbon sequestration • Recreation • Aesthetic values • Spiritual values 	<ul style="list-style-type: none"> • Potential evapotranspiration (loss of water from the soil by evaporation and transpiration from the plants growing on this soil) • Increased frequency of forest fires • Increased frequency of storms 	<p>disappear in certain areas – at a faster rate than the potential rate of migration to, or re-growth in, new areas</p>	<p>deforestation etc.</p> <ul style="list-style-type: none"> • Increased migration: environmental refugees 	<p>Emissions from Deforestation and Forest Destruction in developing countries (REDD)</p> <ul style="list-style-type: none"> • Global Canopy Programme • Center for International Forestry Research (CIFOR) • FAO Forest Products and Industry Division • International Tropical Timber Organization • Rainforest Alliance 	<p>www.fao.org/docrep/011/i0350e/i0350e00.HTM</p> <ul style="list-style-type: none"> • Earth Negotiations Bulletin reports: http://www.iisd.ca/vol24/index.htm • International Tropical Timber Agreement 1994: http://www.ecolex.org/server2.php/libcat/docs/multilateral/en/TR E001195.txt • REDD Toolkit
Mountains	<ul style="list-style-type: none"> • Fresh water • Food • Fiber • Climate regulation • Erosion 	<ul style="list-style-type: none"> • Mean annual temperature • Snow fall and melt • Growing season length 	<ul style="list-style-type: none"> • Altitudinal migration of habitats • Highest altitude habitats may be unable to 	<ul style="list-style-type: none"> • Loss of habitats • Loss of livelihoods due to decline of freshwater 	<ul style="list-style-type: none"> • International Partnership for Sustainable Development in Mountain Regions (Mountain 	<ul style="list-style-type: none"> • Third Pole Project: http://www.chinadiologue.net/debate/show/9-the-third-pole • Moving

	<ul style="list-style-type: none"> • control • Recreation • Ecotourism • Aesthetic values • Spiritual values 		<ul style="list-style-type: none"> • migrate • Shrinking mountain glaciers can affect downstream ecosystems as well 	sources etc.	<ul style="list-style-type: none"> • Partnership) • [absence of a worldwide convention focused on mountains] 	<ul style="list-style-type: none"> • mountains (FAO): http://www.fao.org/docrep/W9300E/w9300e03.htm
Cities (including urban parks and gardens)	<ul style="list-style-type: none"> • Local climate regulation • Water regulation • Air quality regulation • Education • Cultural heritage • Recreation 	<ul style="list-style-type: none"> • Dependent on healthy ecosystems and biodiversity 	<ul style="list-style-type: none"> • Local and global biodiversity loss due to unsustainable production and consumption habits, harmful subsidies etc. • Cities occupy 2% of the Earth's surface, but use 75% of it's resources 	<ul style="list-style-type: none"> • Lower quality of life in cities due to degradation of ecosystems anywhere 	<ul style="list-style-type: none"> • International Centre for Sustainable Cities (ICSC) • Local Governments for Sustainability (ICLEI) 	<ul style="list-style-type: none"> • Sustainable Cities Initiative: http://webapps01.un.org/dsd/partnerships/public/partnerships/1019.html

Sources:

Convention of Biological Diversity, International Day for Biological Diversity, Biodiversity and Climate Change: <http://www.cbd.int/doc/bioday/2007/ibd-2007-booklet-01-en.pdf>

Millennium Ecosystem Assessment, Ecosystems and Human Well-being, Opportunities and Challenges for Business and Industry, Figure 1: Ecosystems and some services they provide: <http://www.millenniumassessment.org/documents/document.353.aspx.pdf>

United Nations Environment Programme, Ecosystems and Biodiversity, The Role of Cities: http://www.unep.org/urban_environment/PDFs/Ecosystems_and_Biodiversity_Role_of_Cities.pdf

United Nations Environment Programme – World Conservation Monitoring Centre, Climate Change and Biodiversity: Ecosystems, Sensitive Ecosystems Analysis: <http://www.unep-wcmc.org/climate/impacts.aspx>