

LS 2X03 - Lecture 8 – Climate Change and Ecosystems

1. Ecosystems and the Future Climate
2. Land Change under Climate Change
3. Velocity of Climate Change
4. Impacts on Marine Systems
5. Potential for Mitigation

Key Concepts

- Role of Ecosystem Services in Human Well-Being
- Relation between Ecosystem Health and Human Well-Being
- Major Ecosystem Services
- Land Change Scenarios & Availability of Crops
- Velocity of Climate Change
- Impacts on Infectious Diseases
- Factors affecting the Availability of Sea Food
- Relation between Biotic change and Environmental Change

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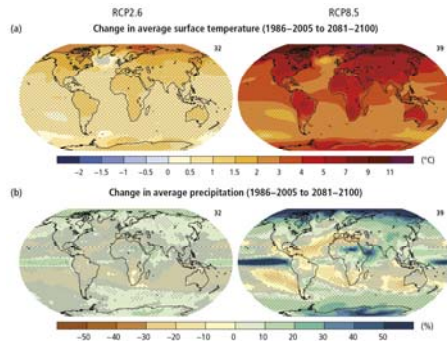
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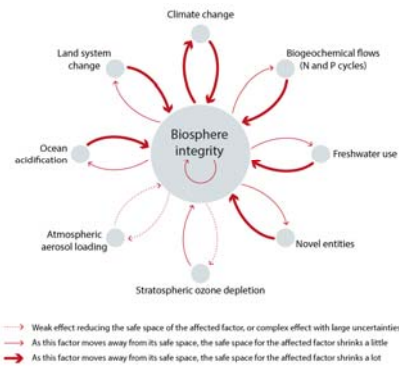
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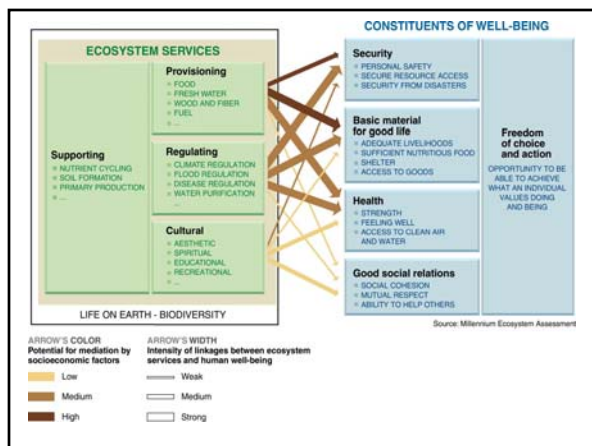
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1. Ecosystems and the Future Climate



The Planetary Boundaries Framework





Provisioning Services



Regulating Services



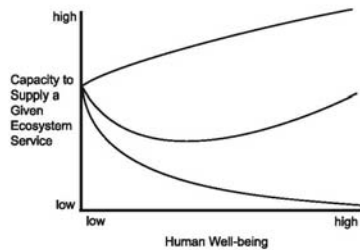
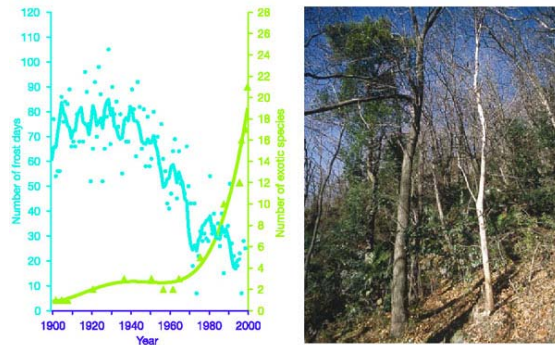
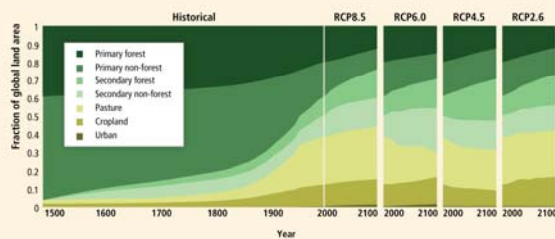


Figure 3.1. Examples of Some of the Possible Shapes of the Relationship between Human Well-being and Ecosystem Service Supply. The hypothesized relationships are for a single ecosystem service, from a particular location, followed over time as the human well-being in that location increases over time. In some cases, such as food provision, the capacity rises to an asymptote. In others, such as services related to biodiversity, it typically falls to an asymptote. Yet in others, such as water quality, it may initially fall, then recover somewhat.

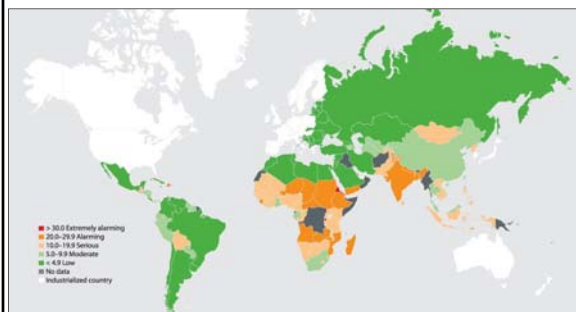
Vegetation Shifts



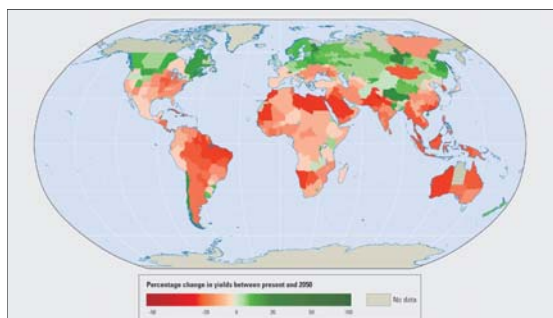
2. Land Change under Different Climate Change Scenarios



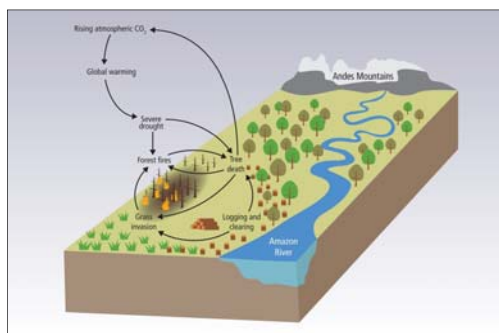
Global distribution of hunger as quantified by the 2012 Global Hunger Index.



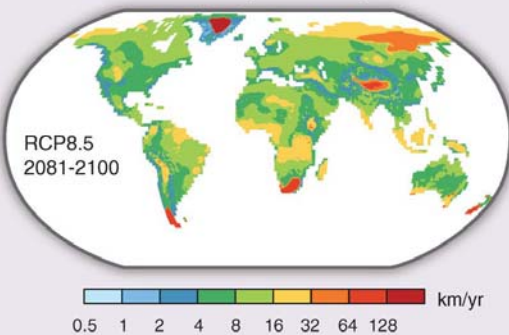
Global Impacts of Climate Change on Crop Productivity

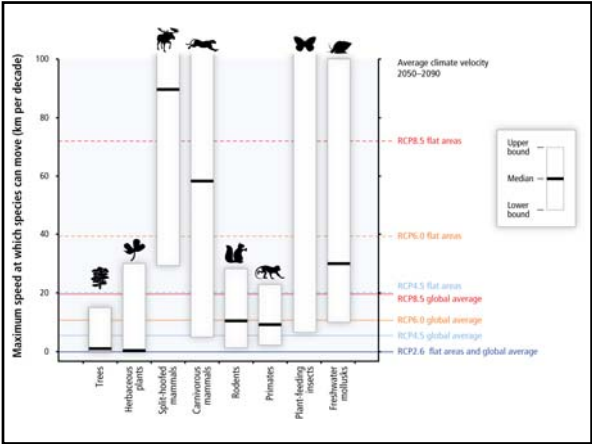


Factors Driving Future Ecosystem Changes in the Amazon River Basin



Velocity of climate change
based on nearest equivalent temperature







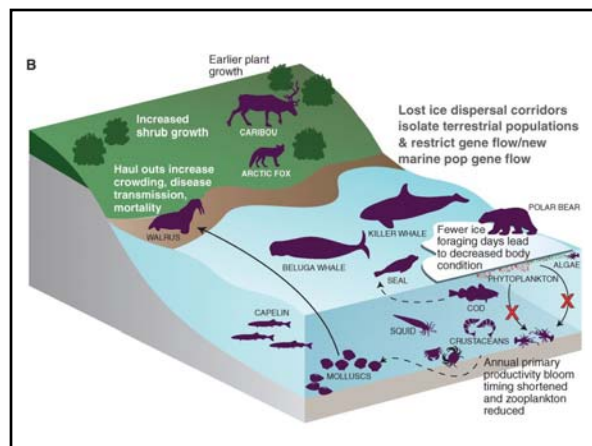
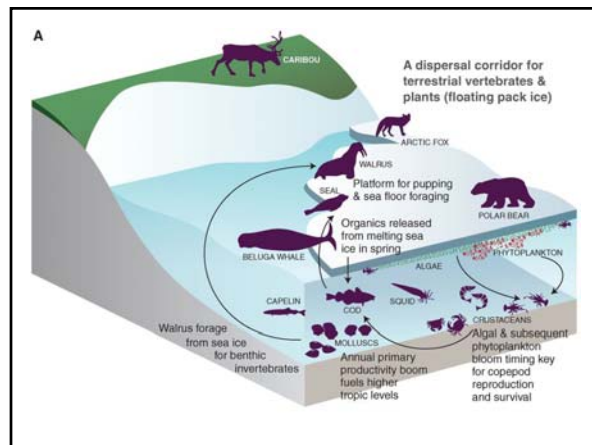
Appendix Table A.3. Incidence of Infectious Diseases as Related to Ecosystem Changes (C14 Table 14.0)

Disease	Cases Per Year	Disability-adjusted Life Years* (thousands)	(Proximate) Emergence Mechanism	(Ultimate) Emergence Driver	Geographical Distribution	Expected Variation from Ecological Change	Confidence Level
Malaria	350 m	46,456	insect invasion; vector expansion	deforestation; water projects	tropical (America, Asia, and Africa)	****	***
Dengue fever	80 m	616	vector expansion	urbanization; poor housing conditions	tropical	***	**
HIV	42 m	84,458	host transfer	forest encroachment; bushmeat hunting; human behavior	global	*	**
Leishmaniasis	12 m	2090	host transfer; habitat alteration	deforestation; agricultural development	tropical (America, Europe and Middle East)	****	***
Lyne disease	23,763 (5/1 2003)		depletion of predators; biodiversity loss; reservoir expansion	habitat fragmentation	North America and Europe	**	**
Chagas disease	16-18 m	667	habitat alteration	deforestation; urban sprawl and encroachment	Americas	**	***
Japanese encephalitis	30-50,000	709	vector expansion	irrigated rice fields	Southeast Asia	***	***
West Nile virus and other encephalitis	-	-	-	-	Americas and Eurasia	**	*
Guarano; Junin; Machupo	-	-	biodiversity loss; reservoir expansion	monoculture in agriculture after deforestation	South America	**	***
Oropouche/ Mayaro virus in Brazil	-	-	vector expansion	forest encroachment; urbanization	South America	***	***

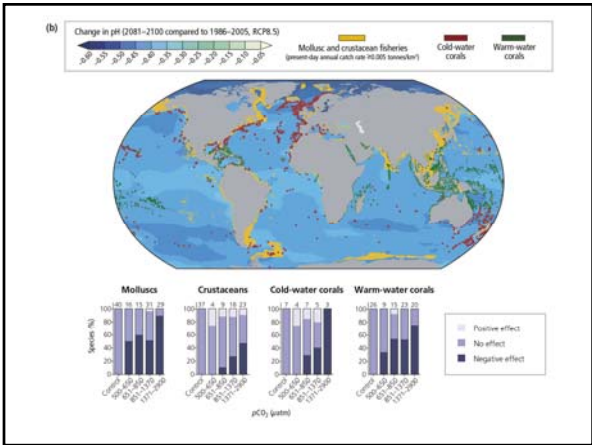
Appendix Table A.3. IMPACTS OF INFECTIOUS DISEASES AS RELATED TO ECOSYSTEM CHANGES (C-14 Table 14.6) (continued)

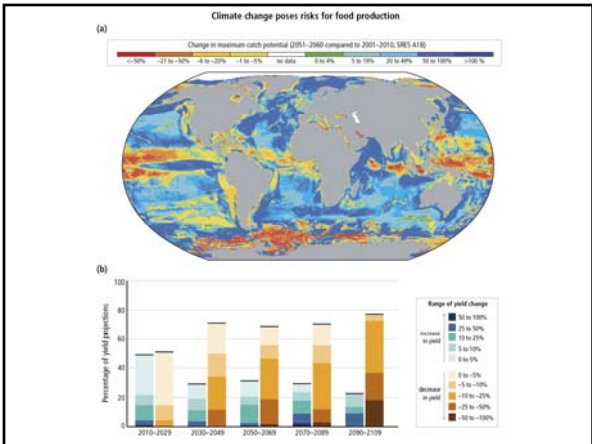
Disease	Cases Per Year	Disability-adjusted Life Years (thousands)	(Proximate) Emergence Mechanism	(Ultimate) Emergence Driver	Geographical Distribution	Expected Variation from Ecological Change	Confidence Level
Meningitis		6,192	dust storms	desertification	Saharan Africa	++	++
Coccidioidomycosis	—	—	disturbing soils	climate variability	global	++	+++
Lymphatic Filariasis	120 m	5,777			Tropical America and Africa	+	+++
Trypanosomiasis	30–500,000	1,525			Africa		
Onchocerciasis	18 m	484			Africa and tropical America	++	+++
Rift Valley Fever			heavy rains	climate variability and change	Africa		
North-Hendra viruses			richie invasion	industrial food production; deforestation; climate abnormalities	Australia and Southeast Asia	+++	+
Saltwaterfish			richie invasion	antibiotic resistance from using antibiotics in animal feed			
Ebola			forest encroachment; bushmeat hunting				

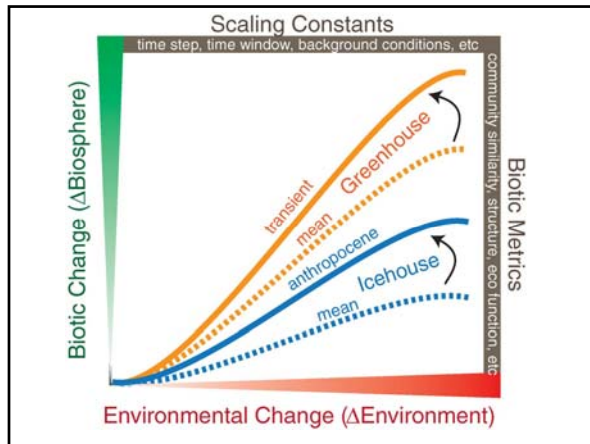
+ = low; ++ = moderate; +++ = high; ++++ = very high
 m = million
 * Disability-adjusted life years: years of healthy life lost – a measure of disease burden for the gap between actual health of a population compared with an ideal situation where everyone lives as full health into old age.
 † and ‡ Data of diseases (legionnaires' disease and SARS) respectively 1,700 to 1,000 cases and 61,000 to 1,000,000 cases.

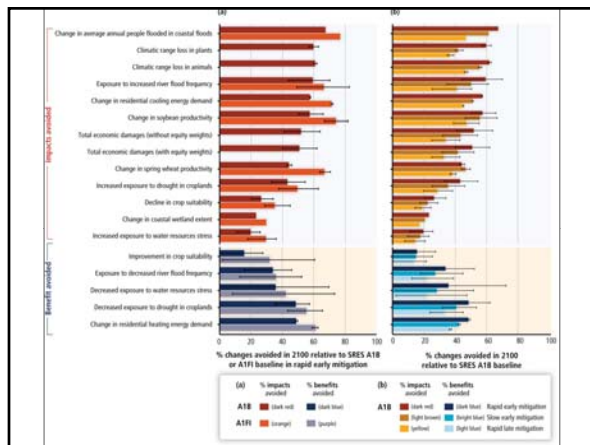












Conclusion

- Climate change is expected to compromise the ability of ecosystems to provide services essential to human well-being
- Terrestrial ecosystem productivity is expected to be affected, possibly leading for shortages in the food supply
- The impacts on the Arctic food web are expected to be profound, with effects on the traditional food supply of Aboriginal populations

End of Lecture Question

1. Which specific actions can be taken under a Climate Change scenario, to protect ecosystem services?



TO DO!

1. For next Lecture: read Article 8
2. Tutorials this week: Group Discussion on News Articles
 - What is a news article?
 - What differentiates a good one from a bad one?
 - Bring Worksheet for Group Discussion (posted on A2L)
