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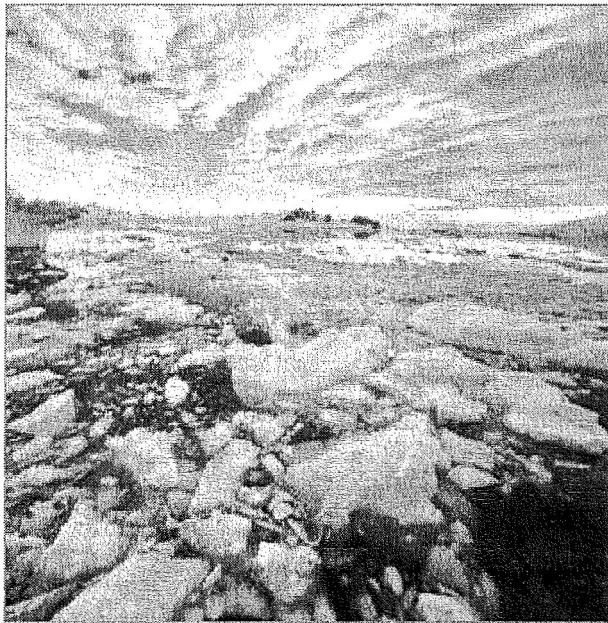
Climate change and the biosphere

Posted by F. Stuart Chapin

[Entry posted at 1st January 2008 12: 59 PM GMT]

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Climate change and the biosphere



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From corals to human disease, scientists watching the effects of global warming are convinced: It's time to act.

By F. Stuart Chapin

Scientific assessments now clearly demonstrate the ecologic and societal consequences of human-induced climate change, as detailed by the most recent Intergovernmental Panel on Climate Change (IPCC) report. ¹Global warming spells danger for Earth's biomes, which in turn play an important role in climate change. On the following pages, you will read about some of the specific changes, from fruit flies to microbes, that scientists have observed.

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The effects have been most dramatic at high latitudes, where multiple processes contribute to decreased surface reflectivity, thus increasing the solar radiation absorbed and the heat transferred to the atmosphere. Retreating sea ice, earlier spring snowmelt, shrinking glaciers, and expansion of shrubs and trees within tundra all amplify high-latitude warming.² Together, these ecosystem feedbacks have caused air temperature to increase and sea ice to retreat more rapidly than previous climate models had projected.³ These observations suggest that the magnitude of ecosystem feedbacks on Arctic warming will continue to intensify.

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In contrast to the Arctic, boreal warming has been associated with a decline in greenness indices since 1990 as a result of increased drought, insect outbreaks, and more widespread wildfire.⁴ Although the carbon release from these boreal disturbances contributes to climate warming, the associated declines in forest cover increase surface reflectivity, causing climate cooling and raising questions about the net ecosystem-climate feedbacks of recent changes in the boreal forest." In addition, the large carbon stock in permafrost - similar in magnitude to carbon in the atmosphere - represent a potential for additional positive feedbacks to climate warming through release as carbon dioxide or methane." Because the boreal forest is one of Earth's most extensive biomes, the direction and magnitude of climate feedbacks as a result of recent boreal changes represent key uncertainties in predicting future climate changes.

Past human actions have already committed the planet to a warmer future.

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entirely on carbon sequestration associated with expanded forest cover and have ignored the large (and often contrasting) climate feedbacks that changes in energy budget have caused.⁷ The cooling effect of carbon sequestration might prove to be strongest in the tropics, where warm moist conditions speed the carbon cycle, and changing cloudiness buffers reflective warming. In contrast, the reflective warming effect of increased forest cover is most likely strongest at high latitudes, where there is a large reflectivity contrast between forests and snow-covered, treeless lands. These observations suggest that reducing deforestation might have most favorable climate consequences in the tropics, where it also conserves biodiversity.

One thing that would help policymakers is a more comprehensive assessment of ecosystem feedbacks to the climate system. Policies that seek to use ecosystem feedbacks to mitigate climate change have focused almost

A second valuable item would be to develop spatially explicit projections of

local climatic impacts that have large societal consequences. In regions of rapid climate change, such as high latitudes, projected climatic and ecological changes provide an informed basis for community and regional planning.

The central focus of the climate debate has shifted from whether climate is changing to how rapidly the trends will continue and to what magnitude the long-term changes will reach. Considering that past human actions have already committed the planet to a warmer future, now is a critical time to plan adaptively to minimize the societal consequences of these changes. For instance, governments might consider giving coastal arctic communities that lose access to sea mammals legal access to salmon fisheries that will likely migrate northward into an increasingly ice-free Arctic Ocean. That is just one example of how the science of climate change is now entering a phase with expanded opportunities that could contribute to policy innovation.

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References

1. IPCC, "Climate change 2007: The physical science basis," in S. Solomon, et al., Eds., *Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press: Cambridge, 2007,
2. F.S. Chapin et al., "Role of land-surface changes in arctic summer warming," *Science*, 310:657-60, 2005.
3. ACIA, Arctic Climate Impact Assessment, Cambridge University Press: Cambridge, 2005,
4. S.G. Goetz et al., "Satellite-observed photosynthetic trends across boreal North America associated with climate and fire disturbance," *Proc Natl Acad Sci*, 102: 13521-5, 2005.
5. J.T. Randerson et al., "The impact of boreal forest fire on climate warming," *Science*, 314: 1130-2, 2006.
6. S.A. Zimov et al., "Permafrost and the global carbon budget," *Science*, 312: 1612-3, 2006.
7. C.S. Field et al, "Feedbacks of terrestrial ecosystems to climate change," *Ann Rev Environ Res*, 32:1-29,2007,

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