Land Use and Climate Change

According to Roger Pielke Sr., a leading authority on land-use change, "change and variability in land use by humans and the resulting alterations in surface features are major but poorly recognized drivers of long-term global climate patterns ... these spatially heterogeneous land use effects may be at least as important in altering the weather as changes in climate patterns associated with greenhouse gases."1

NASA reports that between one-third and one-half of our planet's land surfaces have been transformed by human development.

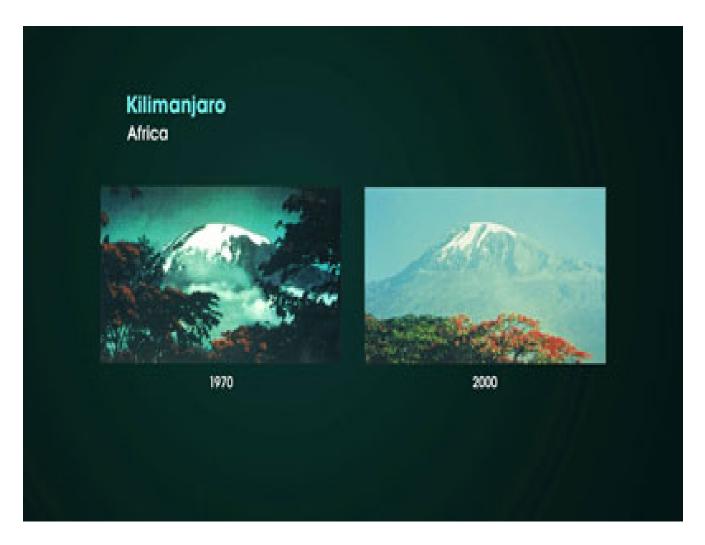
Experiments by Feddema et al. using the USDOE Parallel Climate Model (DOEPCM) showed how land use changes altered the climate change simulations, and should be considered a first order climate forcing factor.

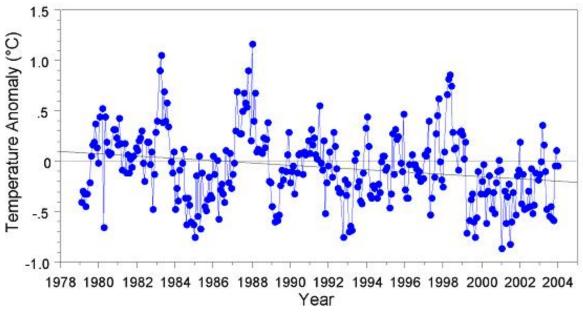
Man alters the planet surfaces in diverse ways trough urbanization, suburbanization, deforestation, foresting former grasslands, irrigating desert land for crops, damming rivers to create man-made lakes and reservoirs, land-filling swamps and marshlands, etc.

These factors affect the climate on scales ranging from the macroscale to the microscale.

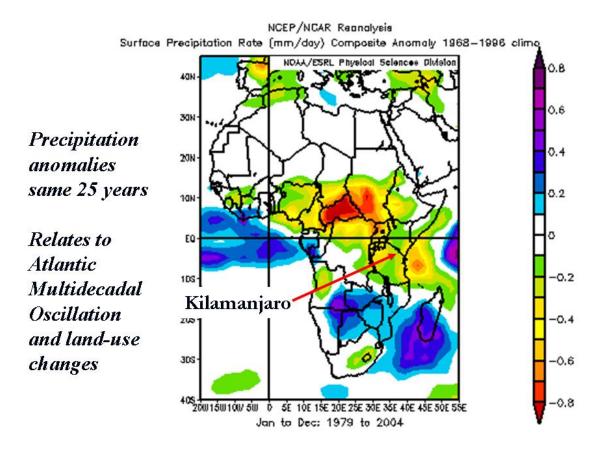
One example of how land use and land cover affects global climate is the changing spatial and temporal pattern of thunderstorms. Deforestation or urbanization may influence the nature of the heat fluxes and availability of water vapor. Deforestation in central Africa and South America may have played a role in the shifting of the thunderstorms associated with the ITCZ.

The accelerated shrinking of the glacier atop Mt Kilamanjaro is thought to be associated with a combination of Atlantic Multidecadal Cycle changes and land use (deforestation) in Africa. Temperatures in that region have been declining for the past 25 years, so the melting of the Kliamanjaro glacier is not related to global warming but these other factors.





Temperatures have been declining at Kilamanjaro since the late 1970s during the satellite era. Precipitation during this same period has been below normal.



Since most of the world's thunderstorms occur over land (about 10 to 1), the changes we make to the land surface will have a proportionally greater influence on climate than is represented by the fraction of the area that land covers. When spatial differences in thunderstorms occur, it can affect the atmospheric circulation systems and affect weather and climate.

Jim Hansen of NASA estimated that 25% of the 20th century warming could be coming from soot on snow (which is a land-use change).

On a smaller scale, land use changes influence local temperatures In a BAMS 2005 paper, Pielke and Davey noted issues with siting with the majority of 57 coop stations (10 which were part of the USHCN network for climate assessment. In many cases, the temperature sensors did not meet the WMO 1996 requirements for proper siting. Though Peterson responded (2006) that he can adjust poorly sited stations of this type, Pielke (2006) showed that no value is added from such sites. In addition, for locations where these poorly sited locations are the only data used to construct a grid area average in the global temperature trend data base, their use will introduce spatially unrepresentative data into the analyses. Kalnay and Kai (2003) estimated 40% of the global temperature rises is coming from land use changes, Marland estimated 50%.

Additional studies conducted for NOAA in Georgia and New England uncovered similar anomalies in siting that make some of the climate sites unsuitable for climate change studies without proper adjustment. The Oklahoma mesonet, the gold standard for observing networks, conducted a survey of their own network, which were meticulously set up to meet WMO standards and found even there with time factors changed. One site had small cedar bushes to the west grow into large cedar trees affecting both the wind and temperature profiles.

This factor overlaps with Urban Heat Island effect

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Expert Contact:

Roger Pielke Sr';s Climate Science web log http://climatesci.atmos.colostate.edu/category/climate-change-forcings-and-feedbacks/ Roger A. Pielke Sr. Senior Research Scientist Email: pielkesr@cires.colorado.edu

970-491-8293 (phone) 970-491-3314 (fax)

Other recommended links:

Hoyt, Doug, Urban heat Islands and Land Use Changes http://www.warwickhughes.com/hopyt/uhi.htm