
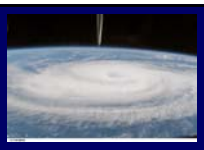


Global Climate Change – Effects on Forests of the Asian-Pacific

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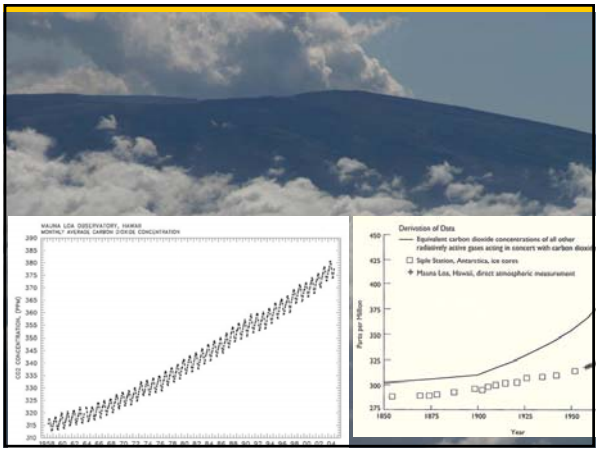
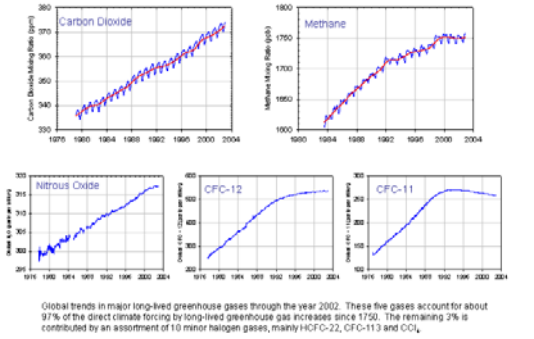
Tropical forests

- Cover about 10% of the earth's land surface
- Store about 40% of the C residing in terrestrial vegetation
- Are large global C sinks and sources - (deforestation 1-3 Pg C atm flux; remaining forests a terrestrial sink of ~ 1 Pg C; Lewis 2006)
- Harbor between one-half to two-thirds of the world's species
- Provide many vital ecosystem services to humanity
- Small changes in tropical forest biome can potentially lead to major impacts to both biodiversity and global change

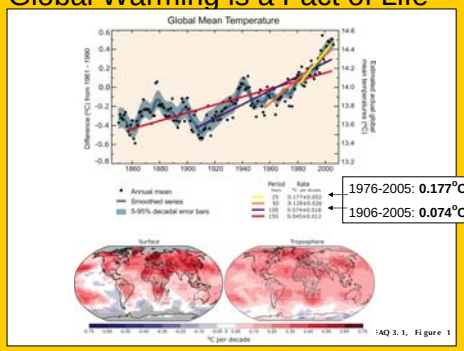


Global Trends in Major Greenhouse Gases to 1/2003



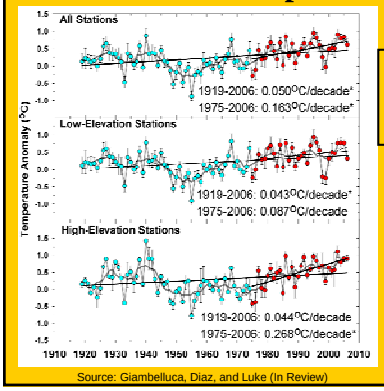
Global trends in major long-lived greenhouse gases through the year 2002. These five gases account for about 97% of the direct climate forcing by long-lived greenhouse gas increases since 1750. The remaining 3% is contributed by an assortment of 10 minor halogen gases, mainly HCFC-22, CFC-113 and CCl_4.

Global Warming is a Fact of Life



Global mean surface temperatures have increased by 0.6°C over the past century and and are expected to rise by an additional 2-5°C over the next century Source: AR4, IPCC (2007)

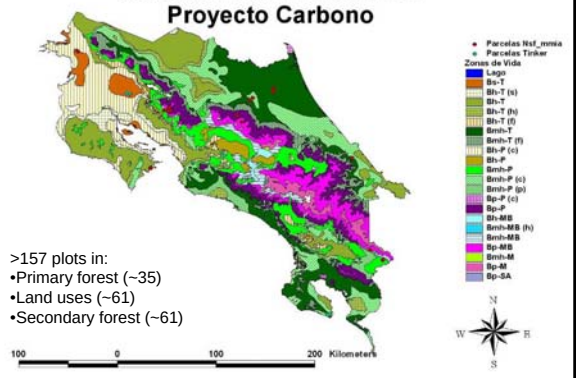
Hawai'i Temperature Index



GLOBAL TRENDS:
1906-2005: **0.074°C** per decade
1976-2005: **0.177°C** per decade
Source: AR4, IPCC (2007)

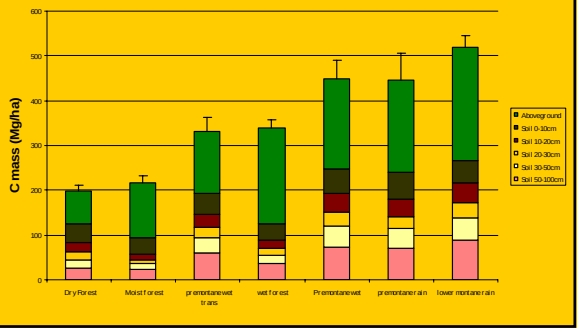
Source: Giambelluca, Diaz, and Luke (In Review)

Ubicacion sitios muestreo Proyecto Carbono

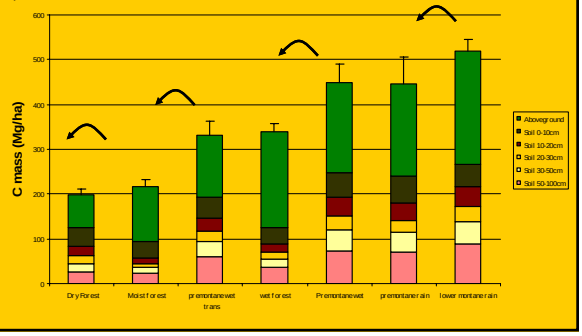


>157 plots in:
•Primary forest (~35)
•Land uses (~61)
•Secondary forest (~61)

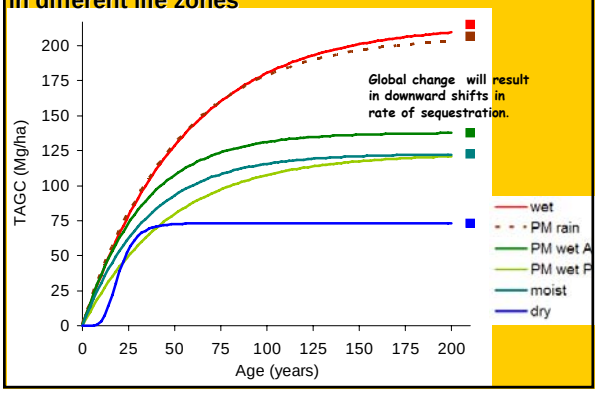
Ecosystem C pools (Tagb and soils to 1 m) of Costa Rican Primary Forests. C pools range from 208 Mg/ha in tropical dry forest to 527 Mg/ha in Lower montane rain forest



Ecosystem C pools (Tagb and soils to 1 m) of Costa Rican Primary Forests. C pools currently range from 208 Mg/ha in tropical dry forest to 527 Mg/ha in Lower montane rain forest--- but **shifts to warmer/drier life zones can be expected**.



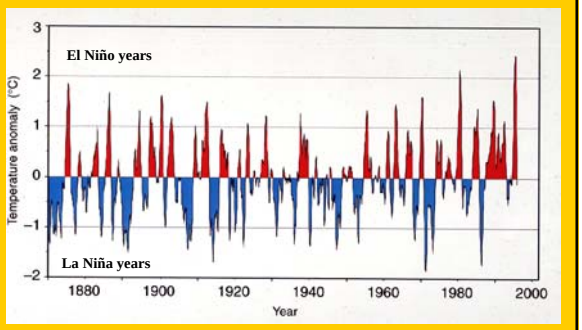
Aboveground C sequestration by secondary forests in different life zones



With warmer and possibly drier conditions what are the ecological predictions:

- Declines in C pool potentials for most tropical forests
- Rates of C sequestration will be lower than models developed for current secondary forests.
- Models of C mass, sequestration developed on the past will not work in the future

The frequency, persistence and magnitude of El-Nino events have increased in the last 20 years



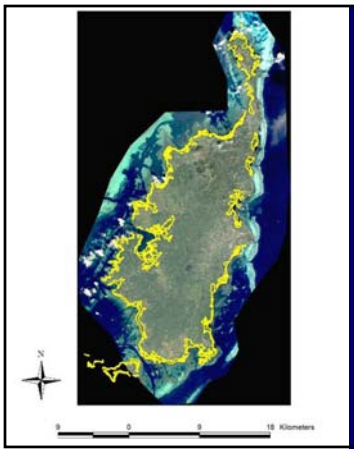
The El-Nino phenomena leads to floods and droughts throughout the tropics and subtropics

An interacting multitude of feedbacks, threshold, and non-linear responses make predictions of future forest structure and dynamics difficult. Possible responses:

- Collapse due to droughts
- Collapse due to fire
- Loss of biodiversity – pollinators, large animals, predators…
- Dominance of Invasive species – plants, insects, disease
- Disturbance regimes will be different -Increases in disturbances which affect C pools – fires, typhoon severity, invasives, diseases

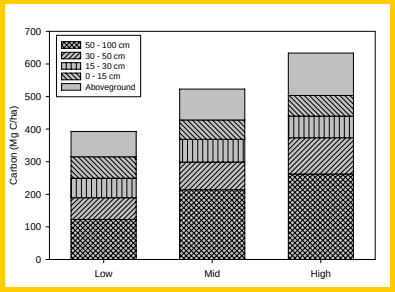
Mangrove forests posses a number of ecosystem services of great value

- biodiversity
- carbon
- water resources
- protection from tropical typhoons
- Fish/shellfish
- wood



Mangroves: about 9.4% Palau

Total ecosystem C pools are very high in mangroves exceeding that of upland forests largely because of very large belowground C pools.



Palau mangroves, Kauffman, in prep,

Sea-Level Rise

New research indicates:

1. **Doubled melting rate of Greenland ice sheet,**
2. **Net melting of the Antarctic ice sheet,**
3. **Global rise approaching 3.0 mm/yr, twice the rate last century,**
4. **Continued heating of atmosphere – heating of water column,**
5. **1 m rise is now expected during this century.**
6. **3ºC temperature rise suggests 3-6 m sea-level rise in a century.**

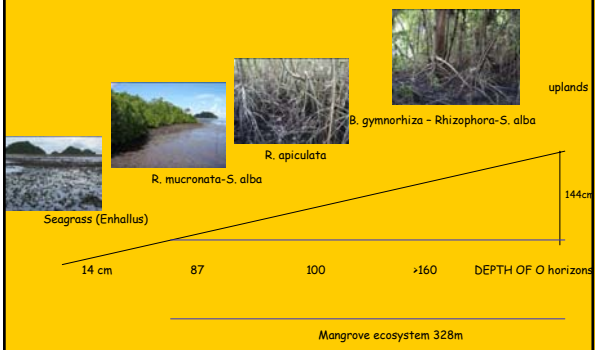
There are still major uncertainties in sea-level science, but these latest results are significant in that:

1. **They do not point in the direction of *smaller* rates of rise,**
2. **They are consistent with the worse case of longstanding predictions,**
3. **Counter arguments grow fewer and fewer**

Source: C. Fletcher, Univ Hawaii, Manoa

Beaches will erode and costal ecosystems will lost.

While mangroves are adapted to life at the land/ocean interface and disturbances such as typhoons, tsunamis, etc they are greatly threatened by land use/land cover change as well as the results of global climate change



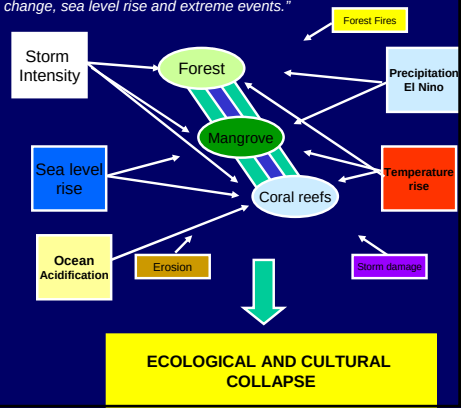
Increased risk of floods, potentially displacing tens of millions of people, due to sea level rise and heavy rainfall events, especially in Small Island States and low-lying deltaic areas.

Bangladesh is projected to lose about 17% of its land area with a sea level rise of one meter - very difficult to adapt due to lack of adaptive capacity

Global Changes- How will it affect Pacific Islands?

- Increases in sea level
- Increased severity of typhoons
- Increased El Nino events-droughts
- Changes in temperature
- Decreased Stream flows
- Coral Bleaching
- Ocean Acidification

"Small islands, have characteristics which make them especially vulnerable to the effects of climate change, sea level rise and extreme events."

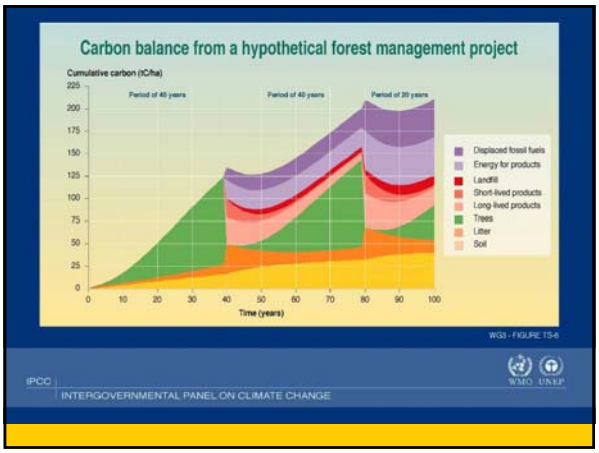


Developing countries are the most vulnerable to climate change

- **Impacts are worse** - already more flood and drought prone and a large share of the economy is in climate sensitive sectors
- **Lower capacity to adapt** because of a lack of financial, institutional and technological capacity and access to knowledge
- **Climate change is likely to impact disproportionately upon the poorest countries and the poorest persons within countries**, exacerbating inequities in health status and access to adequate food, clean water and other resources.
- **Net market sector effects are expected to be negative in most developing countries**

What Should We Do?

- Climate and biological monitoring is essential
- Efforts to predict global change effects on the Asia Pacific's future climate and ecosystems should be on-going
- Efforts are needed to understand impacts of these changes on hydrology and ecology (other ecosystem services)
- Prepare for warmer climate
- Prepare for a possible drier climate
- Intact (healthy) forests will be most buffered to change - Increased efforts on restoring and maintaining forests and wetlands
- Be part of global mitigation efforts - Reforestation to sequester C



Global Change in the Pacific

- The biological as well cultural/social impacts are unprecedented.
- There is no quick technological fix.
- Will preservation of native species become a Quixotic endeavor?

We cannot continue to consider ecosystem services "subsidies of nature" ...ignoring the vital role of forests places people as well as ecosystems in peril.