

# Biogeophysical Climate Impacts of Land Cover Change in Single Forcing IPCC AR5 climate experiments

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 The National Center for Atmospheric Research  
**NCAR**  
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# Land Cover Change Impacts

## Land Cover Change Impacts on Climate System cover:

### Direct Biogeophysical Processes:

- Albedo – Radiation Budget
- Surface Hydrology – Transpiration, Canopy Evap, Soil Evap
- Surface Roughness
- Atmospheric Responses in Temperature, Precipitation and Circulation with feedbacks in cloud cover

### Biogeochemical and Indirect Processes:

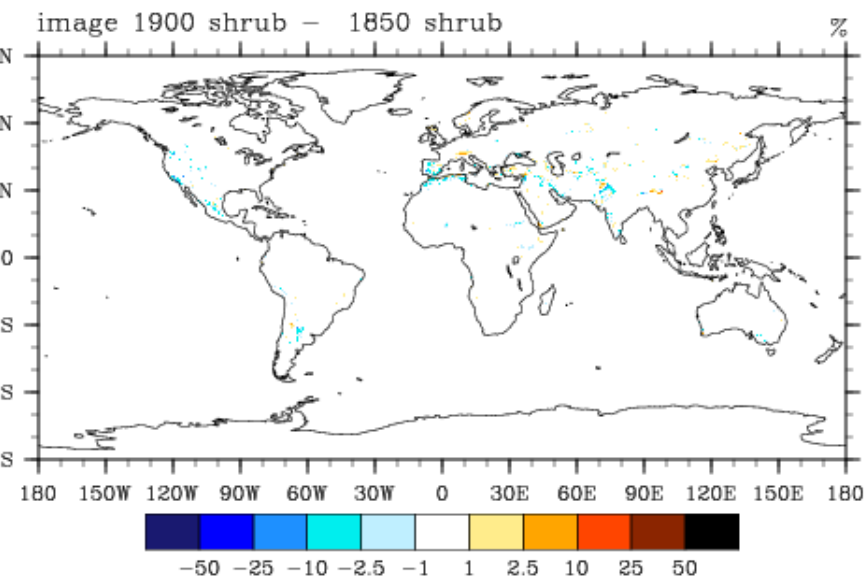
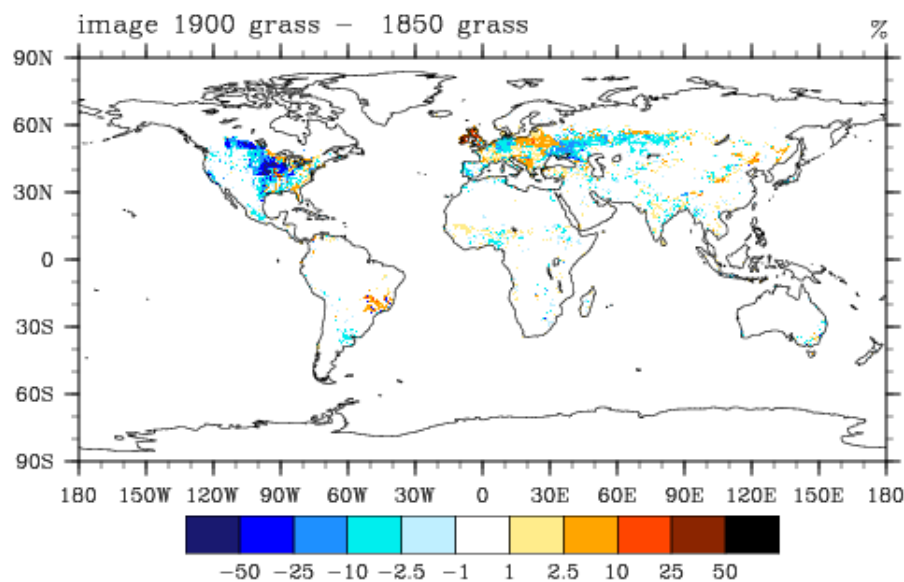
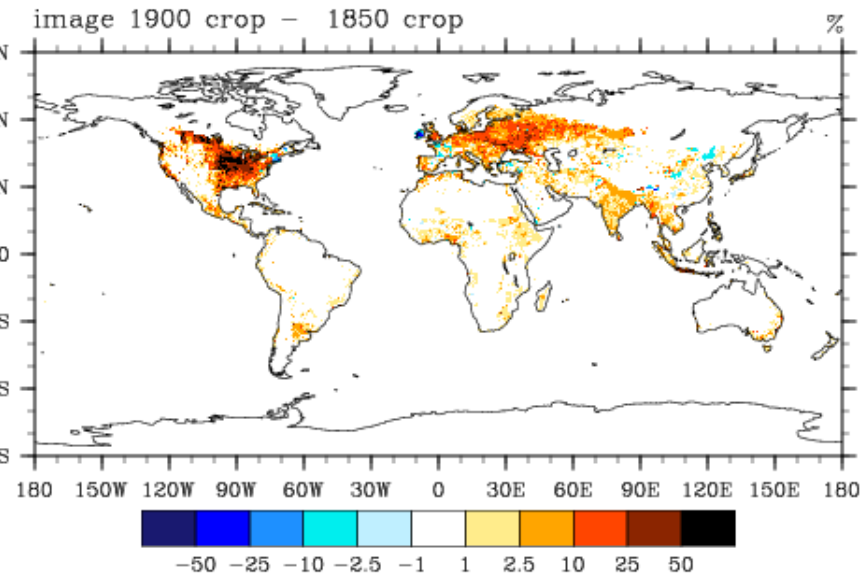
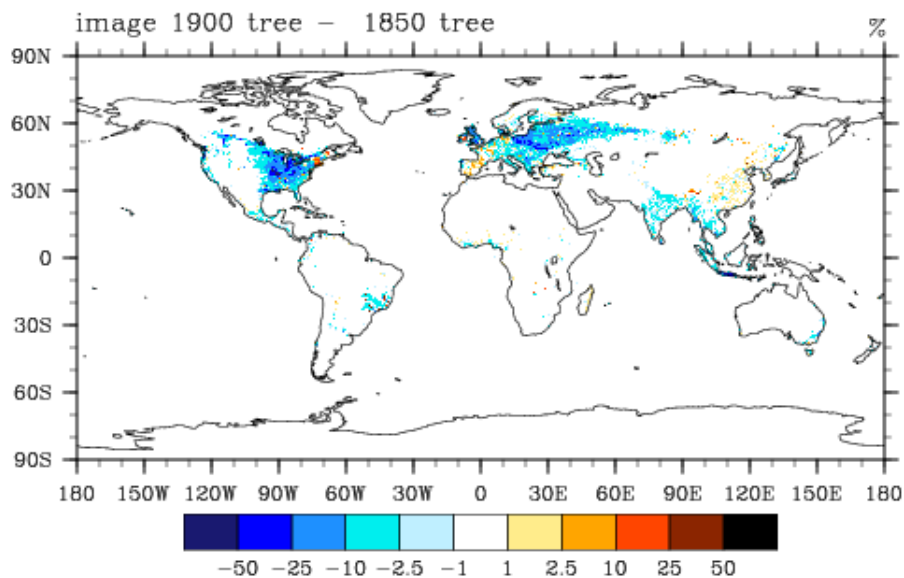
- Ecosystem – Atmosphere Carbon Exchanges
- Methane
- Volatile Organics (Isoprene) -> Photochemistry with NOX resulting in Tropospheric Ozone
- Dust, Black Carbon etc.



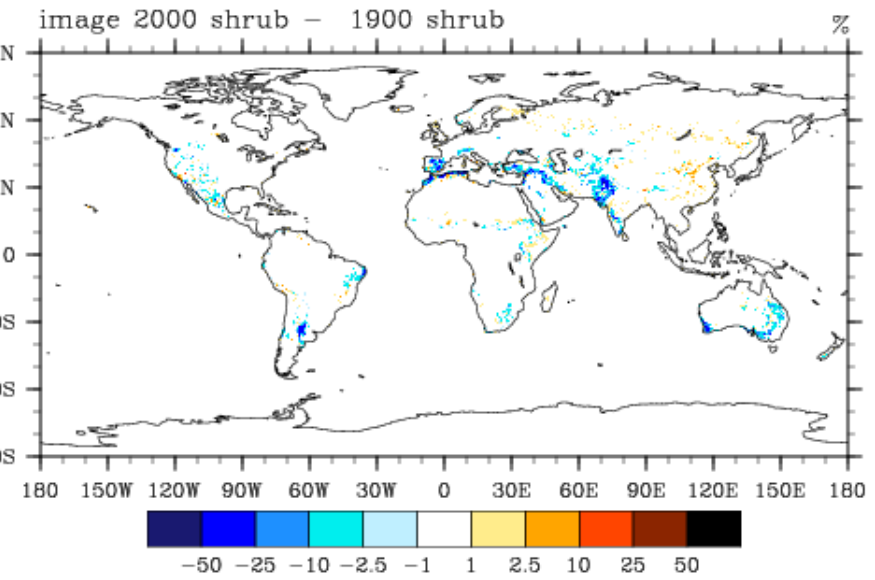
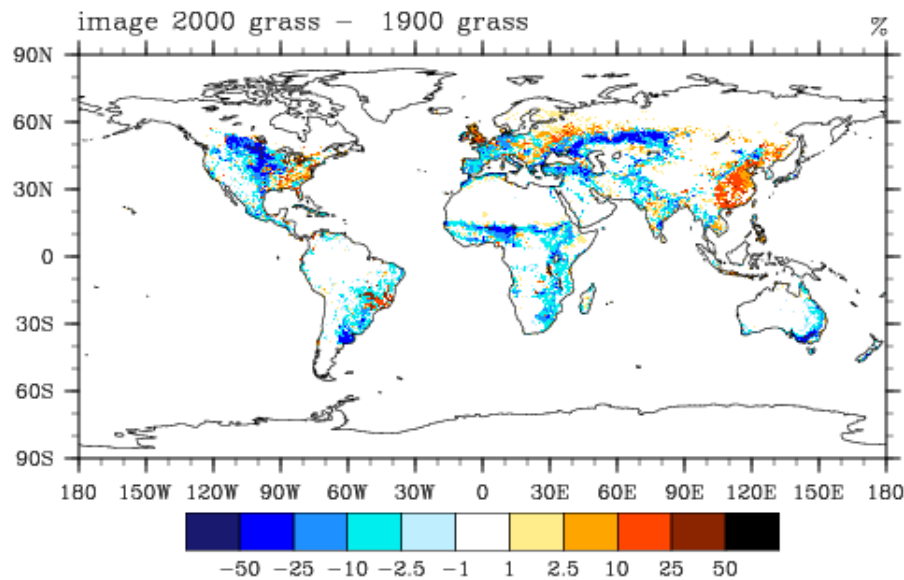
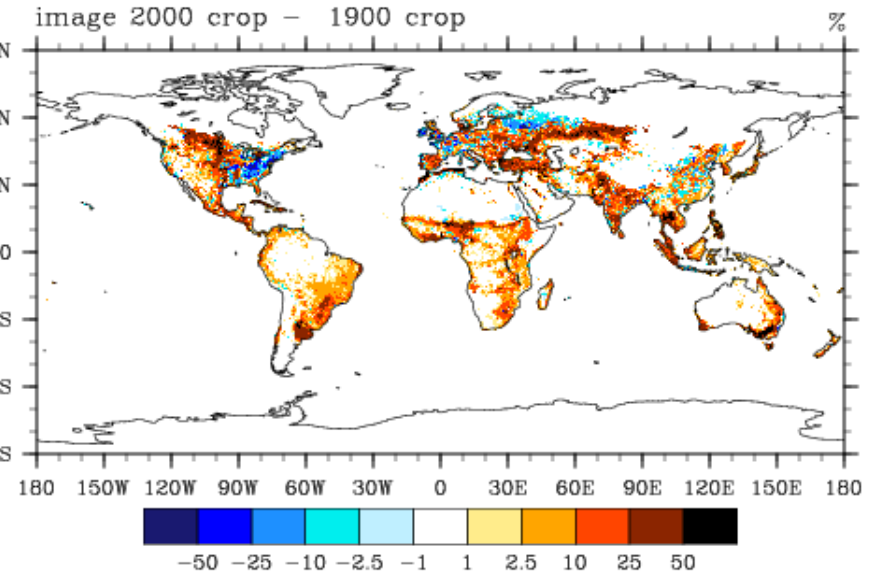
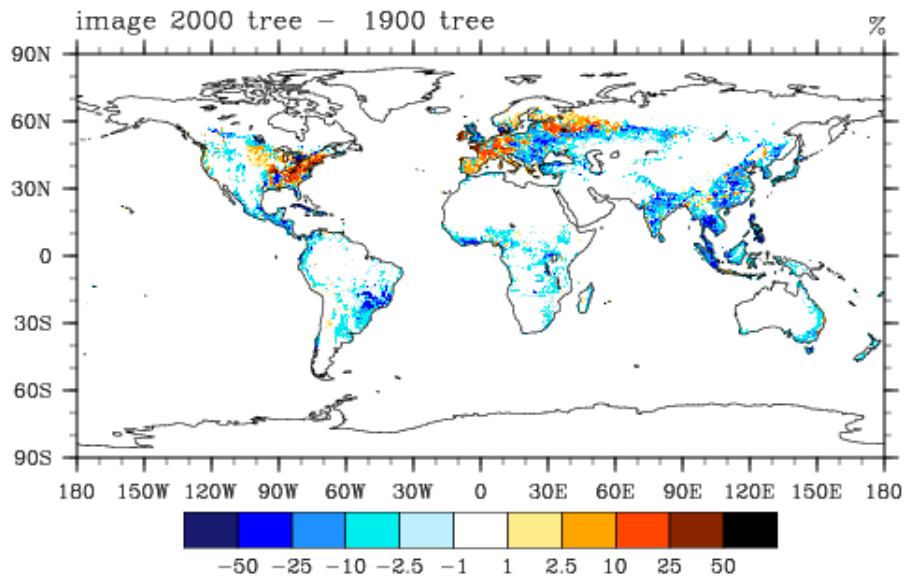
# IPCC Assessment Report 5 – RCP Development

1. In CESM 1.0 CMIP5 Transient Land Cover Change is prescribed from annual changes in four basic land units:
  - Primary Vegetation (V)
  - Secondary Vegetation (S)
  - Cropping (C)
  - Pasture (P)
2. These changes are represented as changes in CLM 4.0 as changes in Plant Functional Types (PFTs) and in
3. Harvesting of biomass for both primary and secondary vegetation land units in Tree PFTs
4. To separate out the biogeophysical climate impacts of these changes from other CMIP5 climate forcing Land Cover Change experiments are being performed with all other forcing kept constant at 1850 values

# Historical Time series CLM 4. PFTs 1900 - 1850

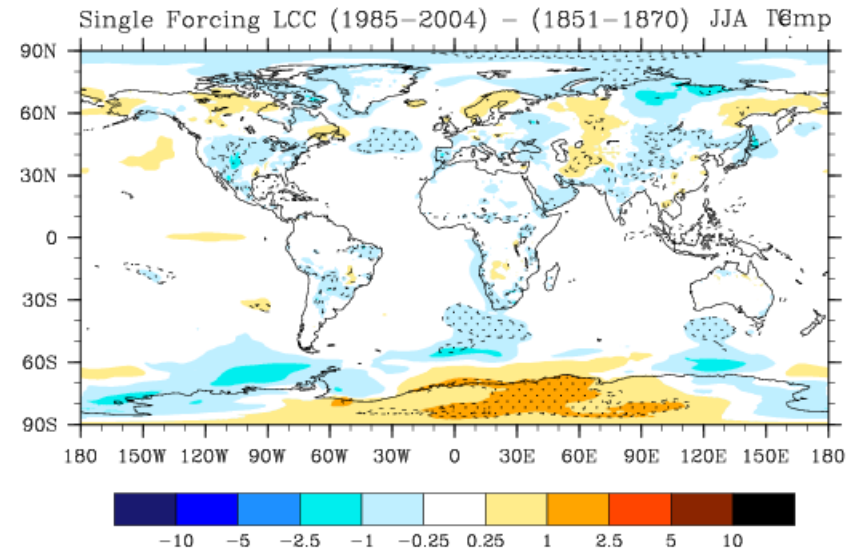
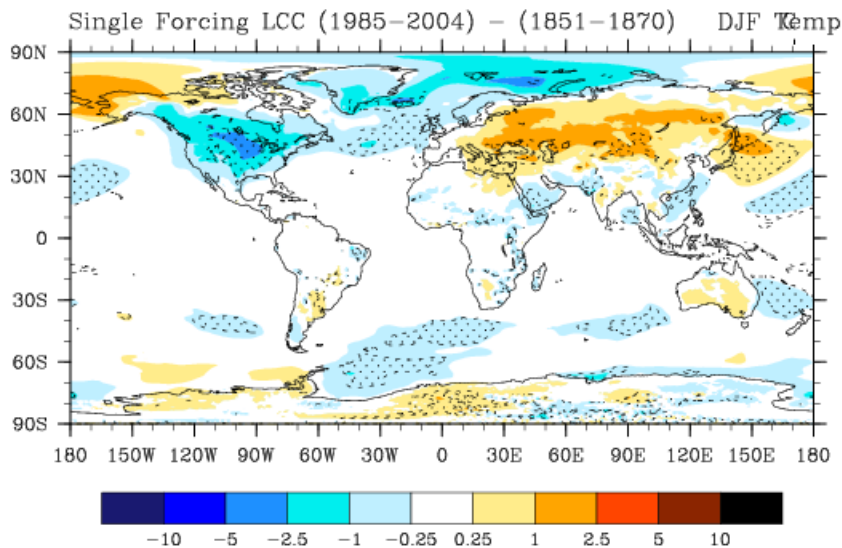
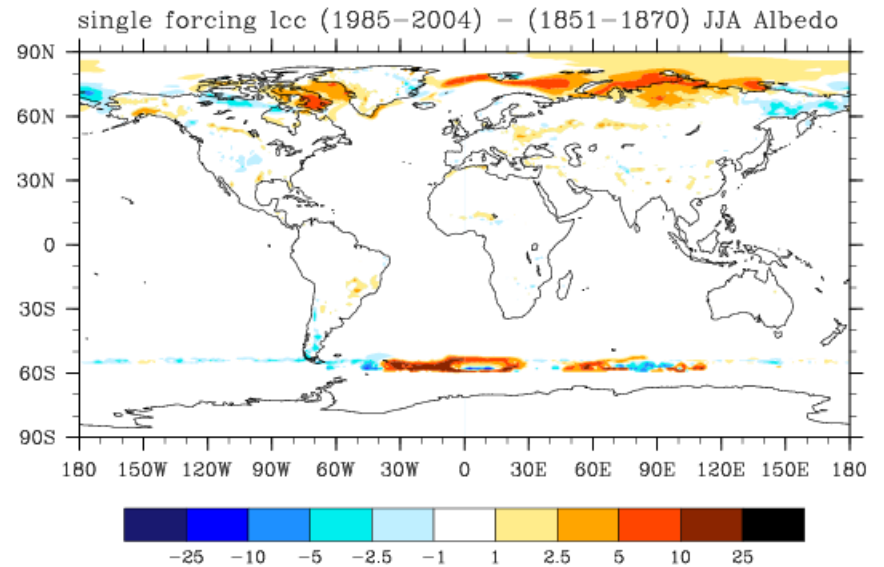
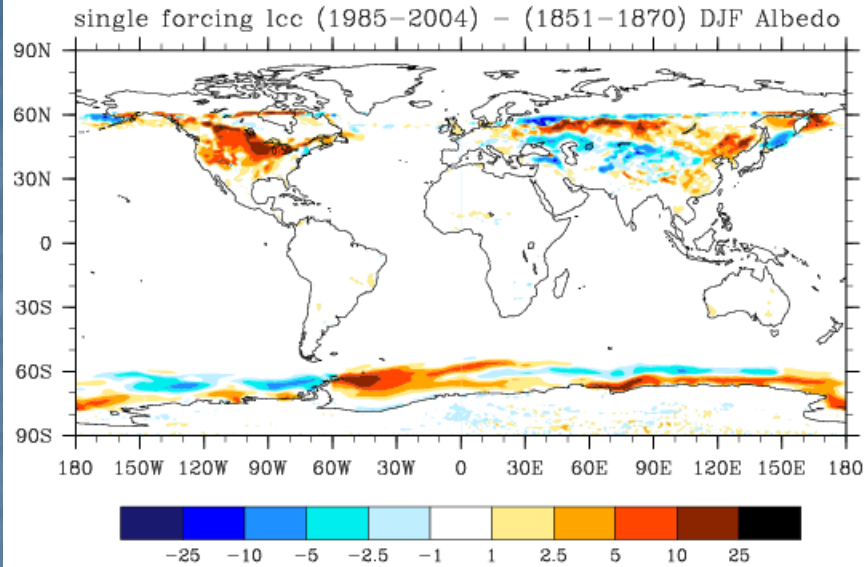


# Historical Time series CLM 4. PFTs 2000 - 1900



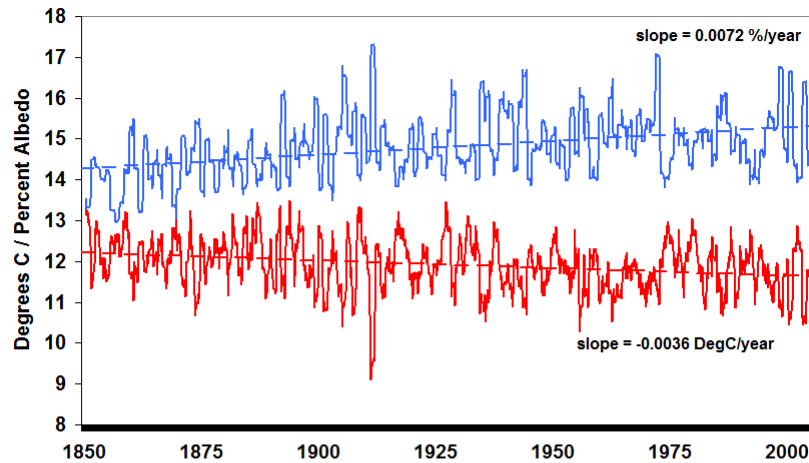


# Albedo and Temperature Diff (1985-2004) – (1851-1870)

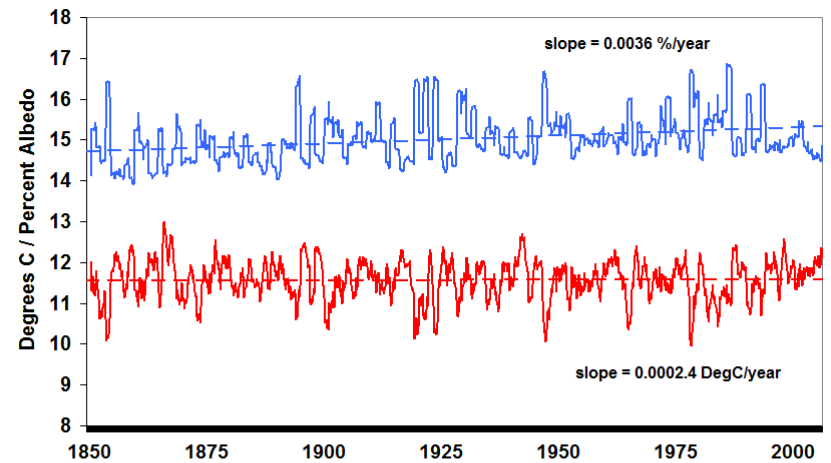


# East US & Europe Albedo Temp Diffs vs PFTs 1850-2004

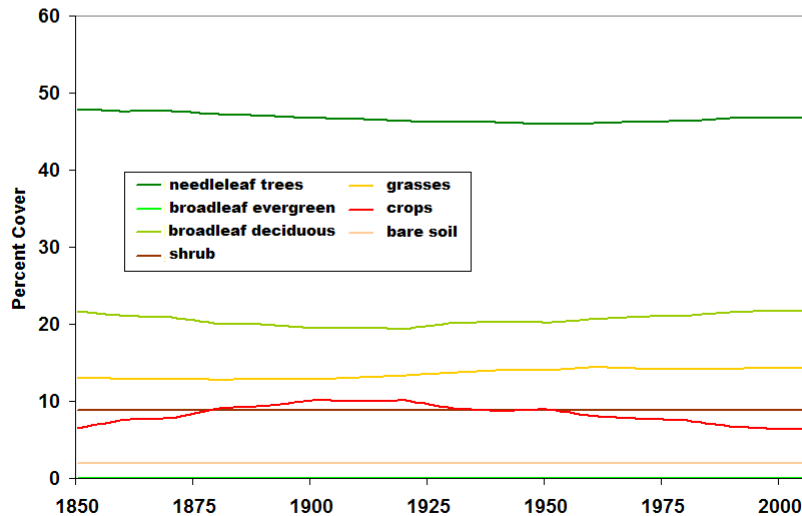
Eastern US 20th Century Single Forcing Land Latent Heat Fluxes



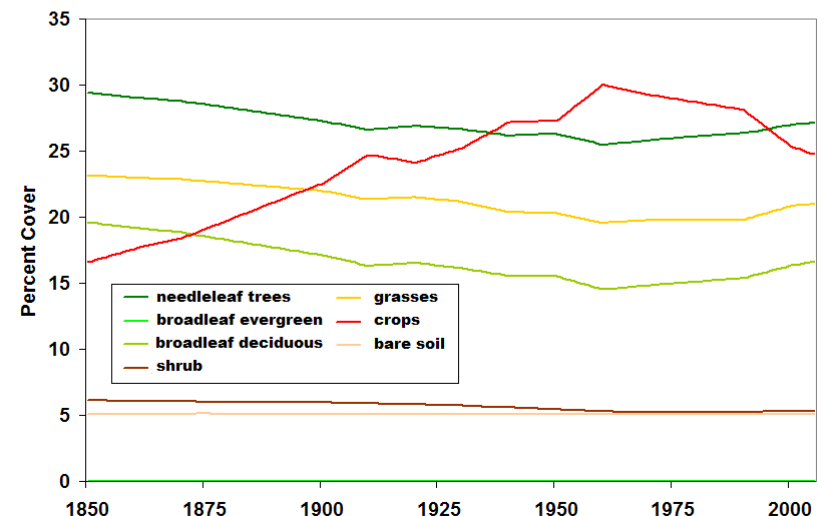
Europe 20th Century Single Forcing Land Latent Heat Fluxes



Eastern US Transient Plant Functional Types

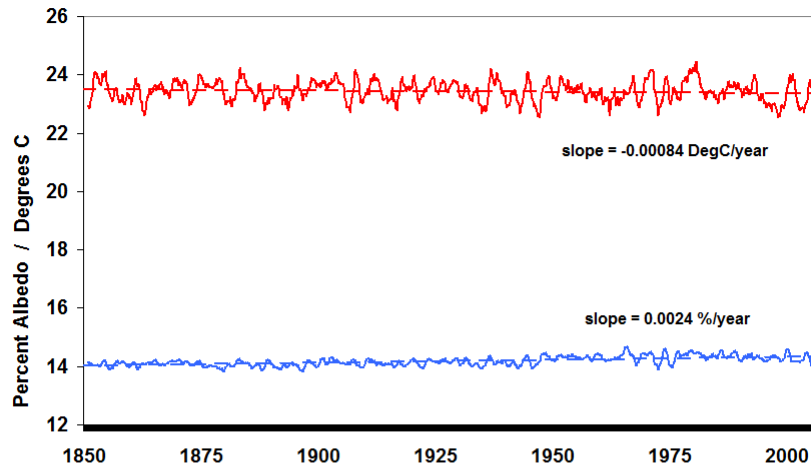


Europe Transient PFTs

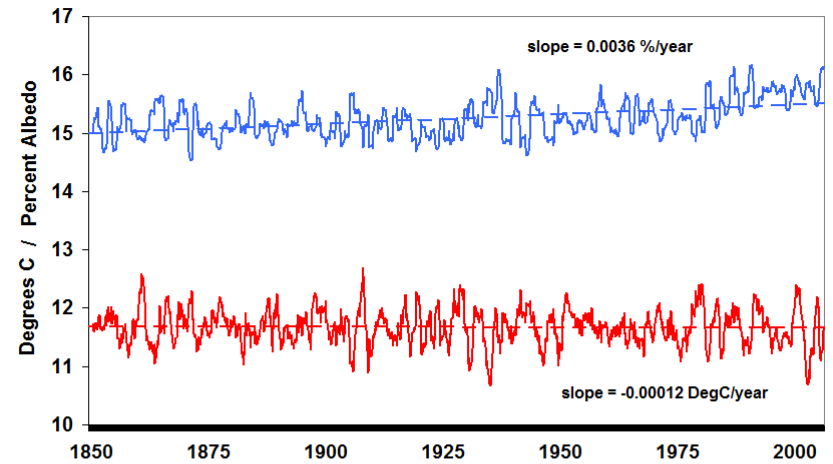


# India & China Albedo Temp Diffs vs PFTs 1850-2004

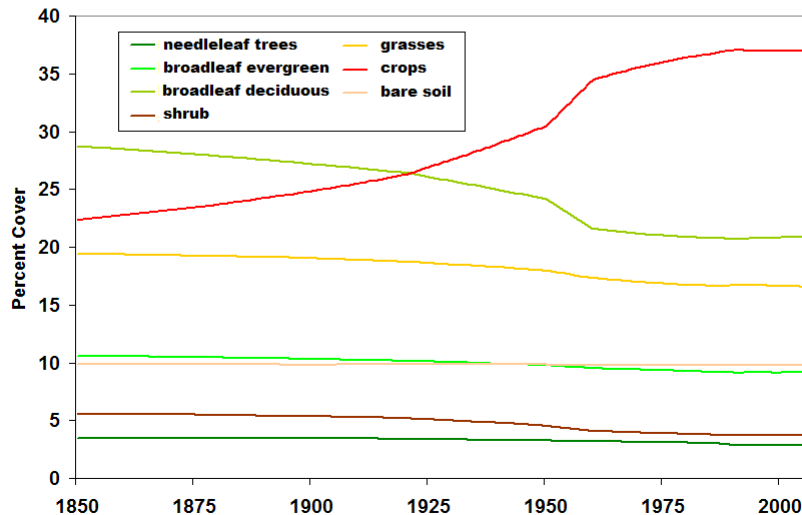
India 20th Century Single Forcing Land Latent Heat Fluxes



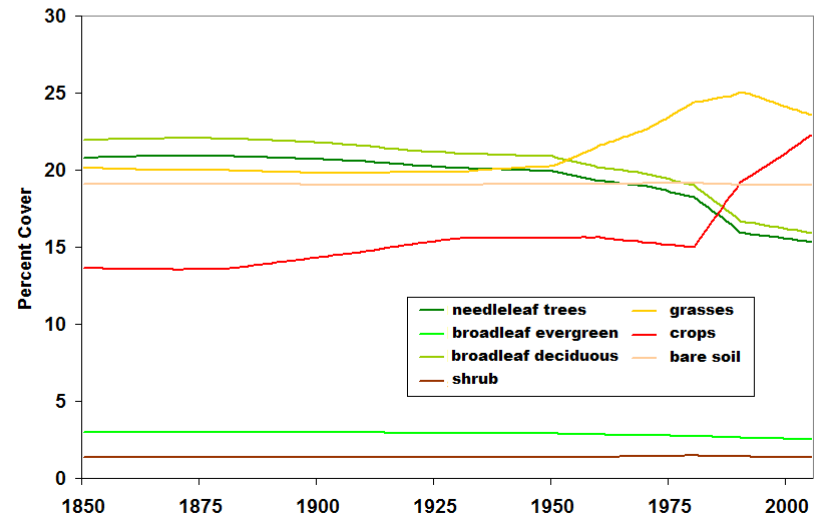
China 20th Century Single Forcing Land Latent Heat Fluxes



India Transient PFTs



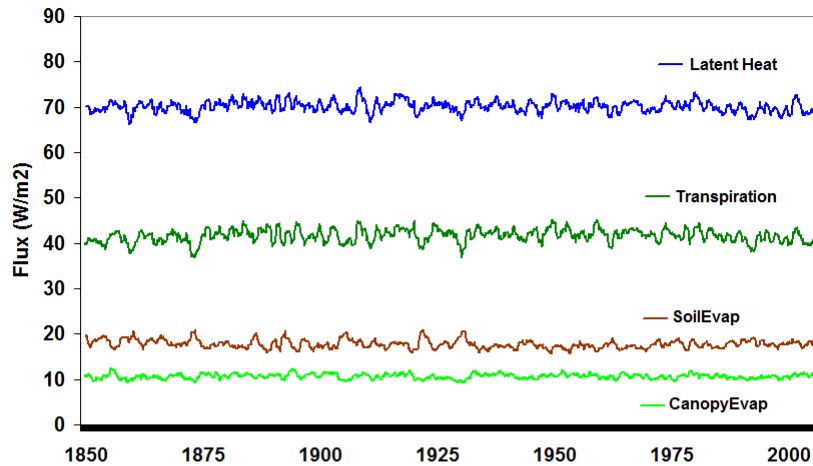
China Transient PFTs



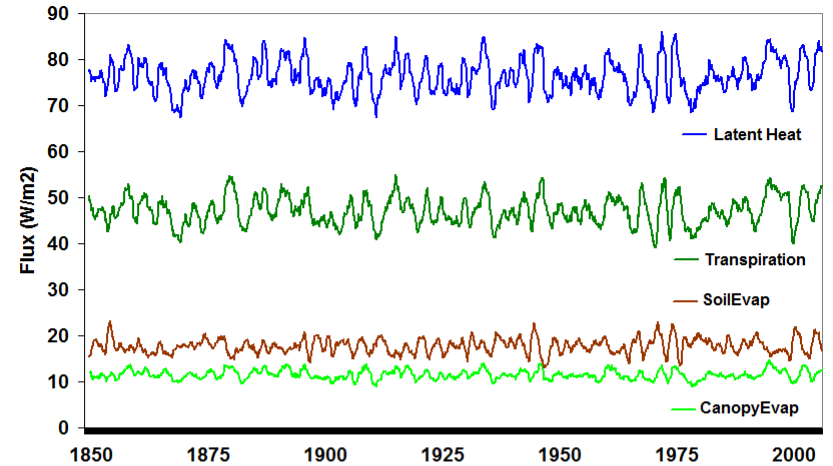


# East US & India Hydrology Diffs vs PFTs 1850-2004

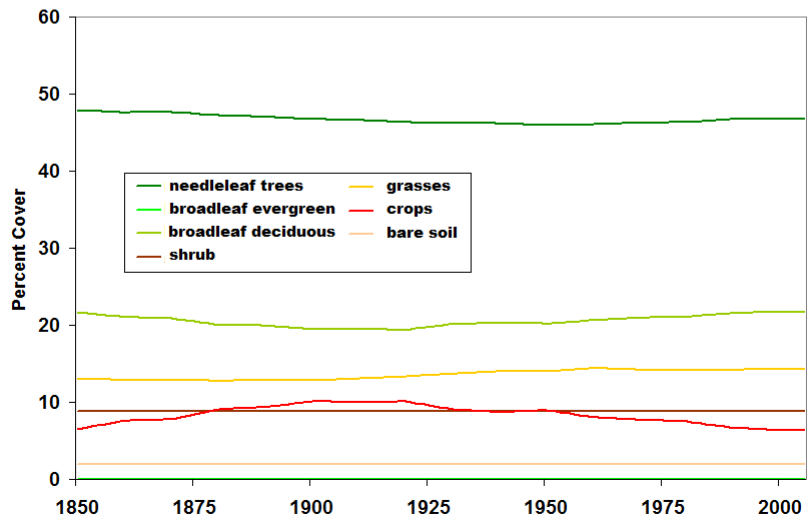
Eastern US 20th Century Single Forcing Land Latent Heat Fluxes



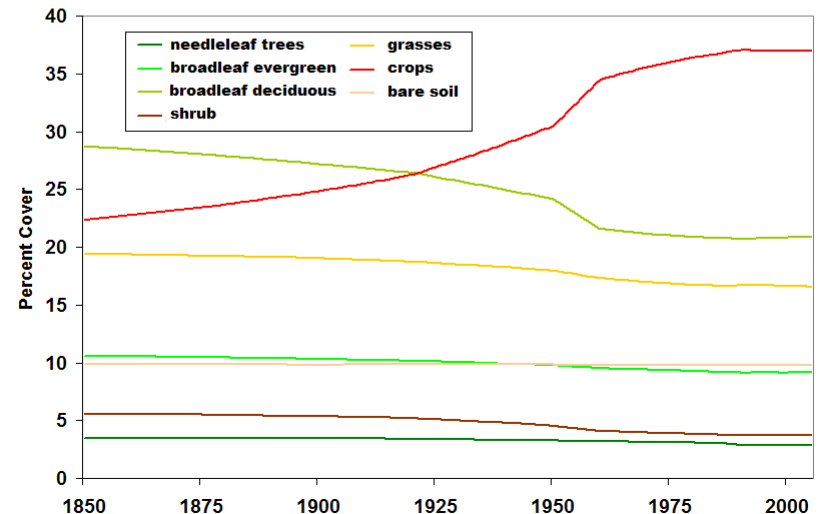
India 20th Century Single Forcing Land Latent Heat Fluxes



Eastern US Transient Plant Functional Types



India Transient PFTs



# Conclusion

1. Initial analysis of 1850 – 2005 Single Forcing Land Cover Change experiments show regional impacts in Albedo and Temperature that are consistent with the Land Cover Change forcing
2. Further analysis is underway to look at the hydrological impacts of the land cover change