Simulation of Terrestrial Ecosystem Dynamics, Past and Future: The Nested Scale Experiment (NeScE), A Mythical Beast

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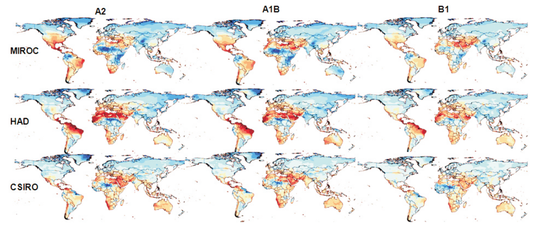
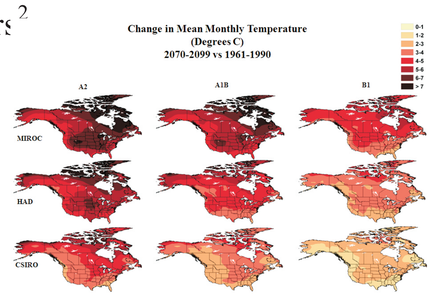
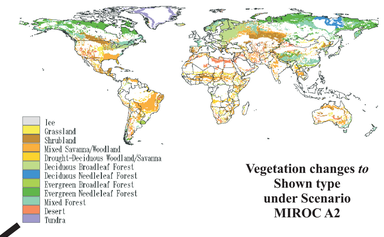
Bound the Uncertainties
3 GCMs X 3 SRES Emissions Scenarios





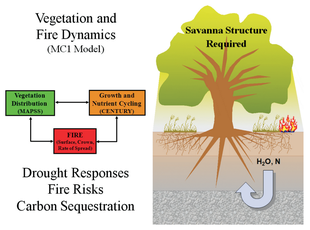
Habitat



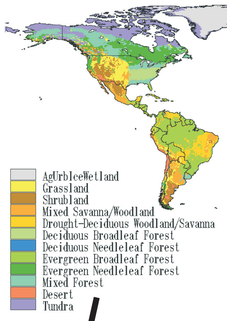
Vegetation changes *to* Shown type under Scenario MIROC A2

Leaf to Plot-scale Processes Applied from Global to Local Scales

Vegetation and Fire Dynamics
(MC1 Model)

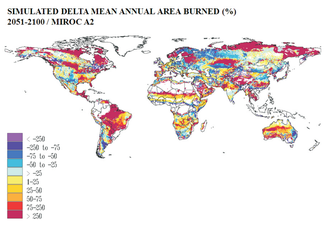


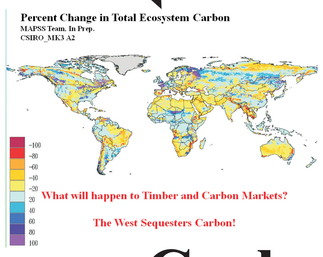
Drought Responses
Fire Risks
Carbon Sequestration

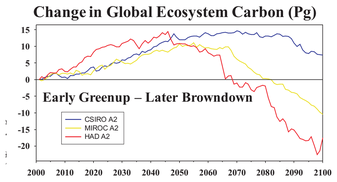


ca. 50 km Resolution

Fire





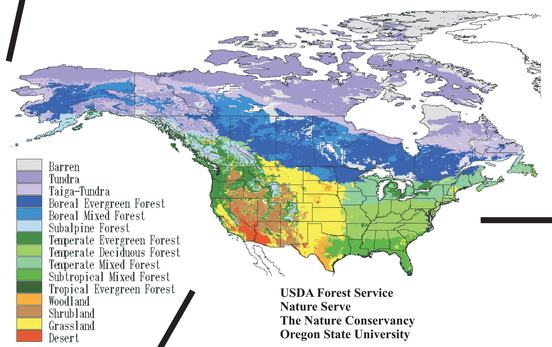


Lynx Conservation Project
MC1 Simulated Modal Vegetation Type
Historical 1961-1990

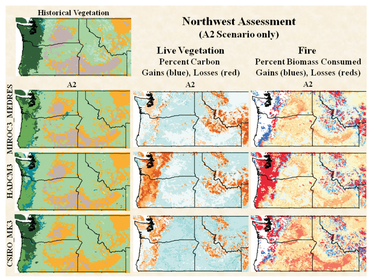
ca. 8 km Resolution

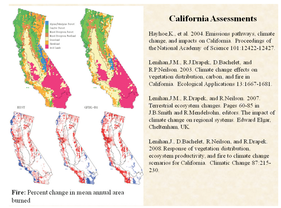
Carbon

ca.10 km Resolution



USDA Forest Service
Nature Serve
The Nature Conservancy
Oregon State University





Clients (Partial)

Global
- Intergovernmental Panel on Climate Change (IPCC)
- International Geosphere-Biosphere Program

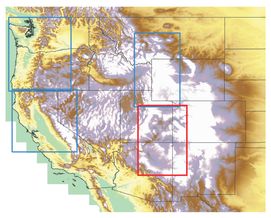
Continental - National
- North American Carbon Program (NACP)
- National Fire Plan
- Climate Change Science Program (CCSP)
- USDA - USFS Resource Planning Act (RPA)
- National Interagency Fire Center (NIFC, NICC)

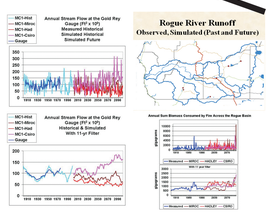
Regional
- Westwide Climate Change Initiative (PNW - PSW - RMRS)
  - National Forest Regions (National Forest Plans)
- Westwide Ecosystem Threat Assessment Center (WWETAC)
- Westwide Climate Initiative (WCI, Western States)
- Geographic Area Coordination Centers (GACC)
- Wildland Fire Leadership Council, Western Forestry Leadership Coalition

State
- California (California Energy Commission, CEC)
- Oregon (Advisory Panel, OFRI, FFRC), Washington

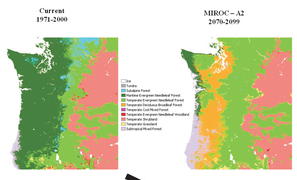
Watershed - Climate Leadership Initiative, Institute for a Sustainable Environment, University of Oregon

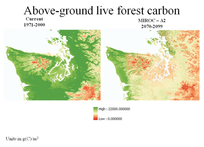
ca. 800 m Resolution

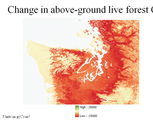


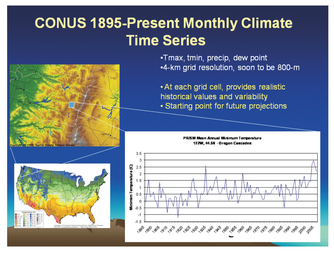


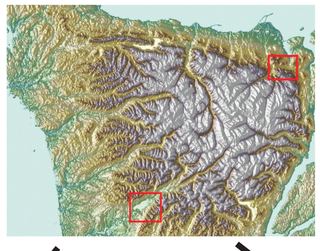
Simulated Current and Future Vegetation
MC1, 800m resolution

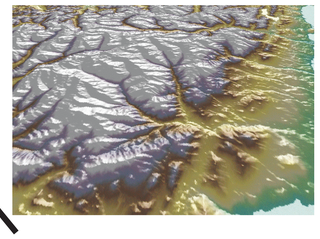


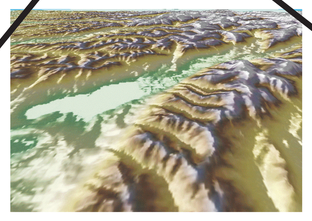












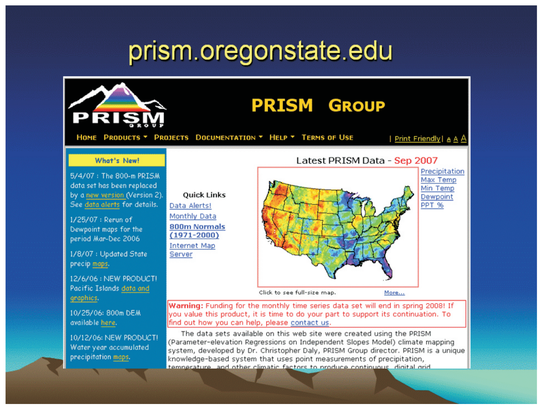
ca. 80 m Resolution

Accurate forecasting of the potential impacts of climate change on terrestrial ecosystems using Dynamic General Vegetation Models (DGVMs) is of critical importance for numerous reasons, depending in part, on the scale of interest. Global to continental-scale carbon balance and vegetation change could enhance or diminish climate change over the next century via trace gas and other biophysical feedbacks. These feedbacks are of critical concern for international negotiations on the controls of greenhouse gas emissions. However, at landscape to regional scales land managers are deeply concerned about potential forest dieback, changes in species composition, possible catastrophic disturbances and decline or changes in ecosystem services. Data to validate DGVMs are taken at various scales from site measurements to global (trace gases, remote sensing). As with climate models, DGVMs are based on fundamental concepts and, in theory, should operate at all spatial and temporal scales. However, limitations in basic knowledge and computational resources force the use of ever more coarse grid resolutions at larger spatial scales, forcing some processes to be 'parameterized', rather than explicitly simulated. Yet, smaller domains with higher resolution may require explicit simulation of processes, such as dispersal, fire spread and hydrologic routing. We present a Nested Scale Experiment (NeScE) from global to landscape and from 1900 to the present of observed monthly climate data and on to 2100 under 9 future climate scenarios (3 GCMs X 3 SRES Emissions Scenarios). Using the MC1 DGVM, we explore potential feedbacks, impacts and uncertainties associated with these multi-scale simulations. Consistency of impacts and feedbacks (both past and future), as well as sources of uncertainty, will be explored across four spatial resolutions in this preliminary investigation and presented for use by both scientists and natural resource managers. We present NeScE as an open-investigator framework for model testing, validation and impacts and feedback assessments.

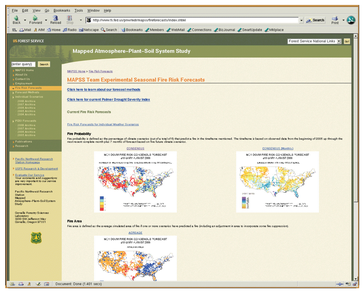
Climate Gridding from Observations

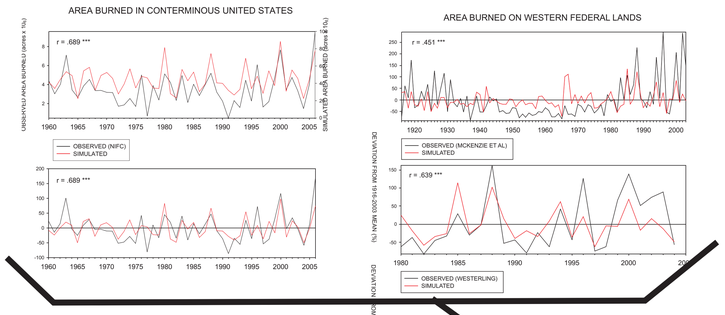
Technology Invented by the MAPSS Team

Daly, C.; Neilson, R.; Phillips, D. 1994. A statistical-topographic model for mapping climatological precipitation over mountainous terrain. Journal of Applied Meteorology. 33(2): 140-158.

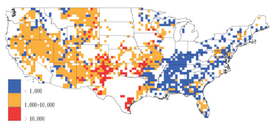


Seasonal Fire Forecasting

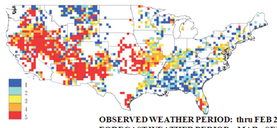




MC1 DGVM FIRE RISK CONSENSUS FORECAST
JANUARY-SEPTEMBER 2008

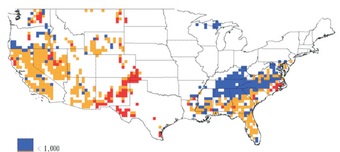
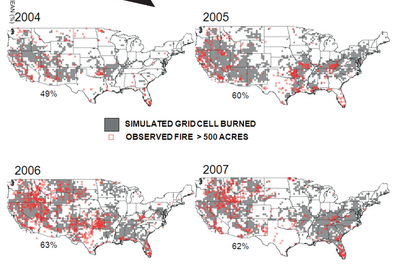


NUMBER OF WEATHER FORECASTS RESULTING IN FIRE OCCURRENCE



OBSERVED WEATHER PERIOD: thru FEB 2008
FORECAST WEATHER PERIOD: MAR - SEP 2008

MC1 DGVM FIRE RISK CONSENSUS FORECAST
JANUARY-DECEMBER 2008
ACRES BURNED



OBSERVED WEATHER PERIOD: thru AUG 2008
FORECAST WEATHER PERIOD: SEP - DEC 2008
TOTAL ACRES: 4,013,867