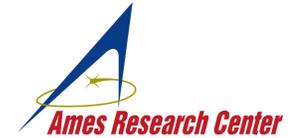


CASA-CQUEST Modeling for Carbon Cycle Assessments in Forested Ecosystems of the United States

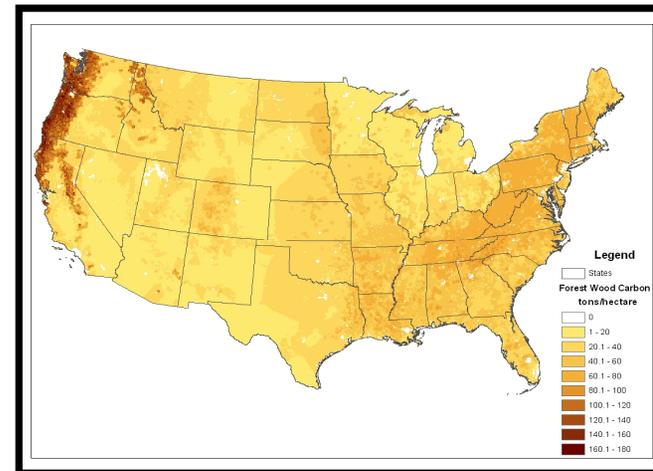
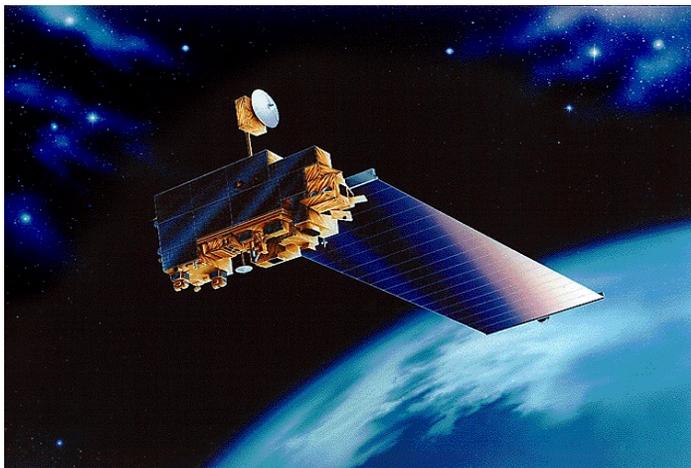
Christopher Potter
Principal Investigator (PI)
Senior Research Scientist, NASA Ames Research Center

Co-Investigators at California State University Monterey Bay:
Steven Klooster, Vanessa Genovese, Shuang Li, Cyrus Hiatt



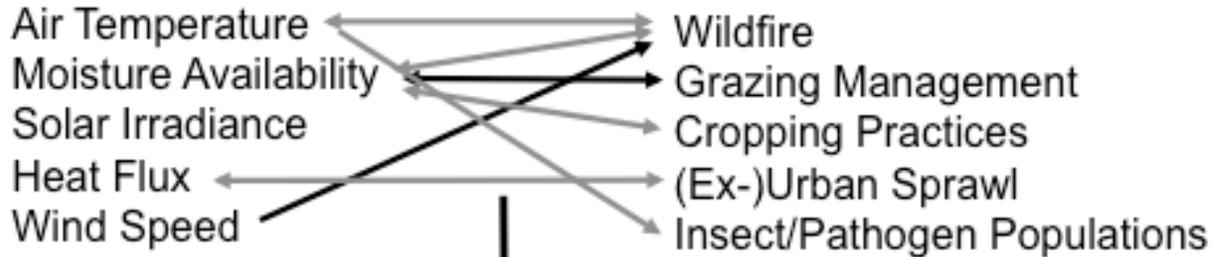
National Climate Assessment

NASA Products and Capabilities





INDICATORS
 Well-Being
 Diagnostics
 Monitoring



Snow Pack / Snow Water Equivalent
 Energy Balance / Surface Albedo
 River/Reservoir Water Quantity and Quality
 Soil Degradation and Erosion
 Woody Vegetation Mortality / Regeneration

Productivity
 Habitability
 Adaptability

Project Publications for the National Climate Assessment

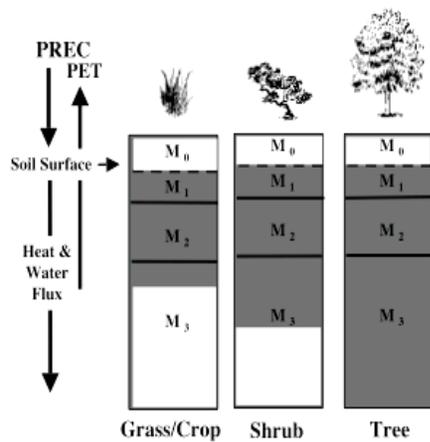
1. Potter, C., S. Klooster, and V. Genovese, 2013, Alaska ecosystem carbon fluxes estimated from MODIS satellite data inputs from 2000 to 2010, *Carbon Balance and Management*, 8:12.
2. Potter, C., 2013, Ten years of land cover change on the California coast detected using Landsat satellite image analysis: *Journal of Coastal Conservation*, 10.1007/s11852-013-0270-3.
3. Shupe, J., and C. Potter, 2013, Modeling Discharge Rates for the Merced River in Yosemite National Park, *Journal of the American Water Resources Association*, 1-10.DOI:10.1111/jawr.12124.
4. Potter, C., S. Li, and R. Crabtree, 2013, Changes in Alaskan tundra ecosystems estimated from MODIS greenness trends, 2000 to 2010, *Journal of Geophysics & Remote Sensing*, 2: 107, doi:10.4172/2169-0049.1000107.
5. Potter, C., S. Li, and C. Hiatt, 2012, Declining vegetation growth rates in the eastern United States from 2000 to 2010, *Natural Resources*, doi:10.4236/nr.2012.
6. Li, S. and C. S. Potter, 2012, Vegetation regrowth trends in post forest fire ecosystems across North America from 2000 to 2010, *Natural Sciences*, doi:10.4236/ns.2012.
7. Potter, C., S. Klooster, and V. Genovese, 2012, Net primary production of terrestrial ecosystems from 2000 to 2009, *Climatic Change*, doi:10.1007/s10584-012-0460-2.
8. Potter, C., S. Klooster, V. Genovese, C. Hiatt, S. Boriah, V. Kumar, V. Mithal, and A. Garg, 2012, Terrestrial ecosystem carbon fluxes predicted from MODIS satellite data and large-scale disturbance modeling, *International Journal of Geosciences*, doi:10.4236/ijg.2012.
9. Huntzinger, D.N., et al., 2012, North American Carbon Program (NACP) regional interim synthesis: Terrestrial biospheric model intercomparison, *Ecological Modelling*, 232, 144-157.
10. Li, S., and C. S. Potter, 2012, Patterns of aboveground biomass regeneration in post-fire coastal scrub communities, *GIScience & Remote Sensing*, 49, 182-201.

NASA Ames CASA Model Validation

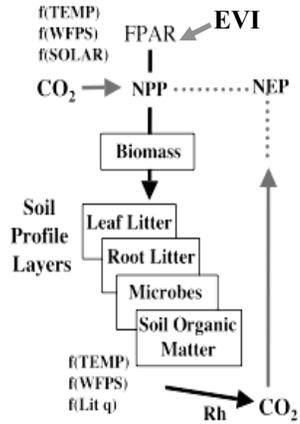
Potter et al. (2012) *International Journal of Geosciences*

C. Potter et al. / *Global and Planetary Change* 39 (2003) 201–213

(a) Soil Moisture Balance and Plant Functional Types



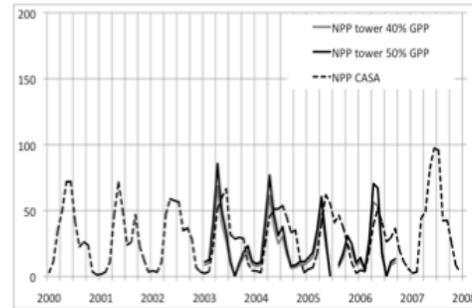
(b) Ecosystem Production Nutrient Mineralization



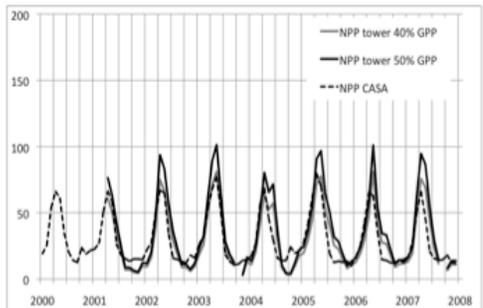
$$NPP = Sr * EVI * e_{max} * T * W$$

Comparison of CASA NPP to Ameriflux tower measurements for corresponding monthly fluxes. $R^2 = 0.77$ for all sites combined.

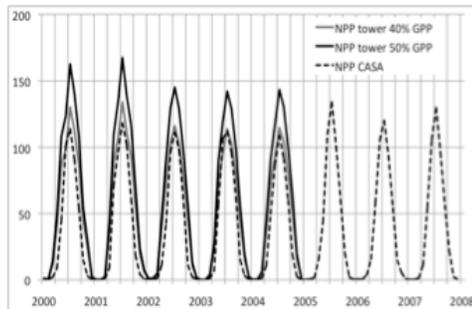
a. ARM SGP Mixed Cropland



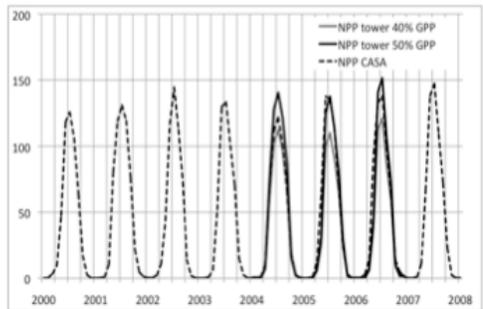
b. Tonzi Savanna Grassland



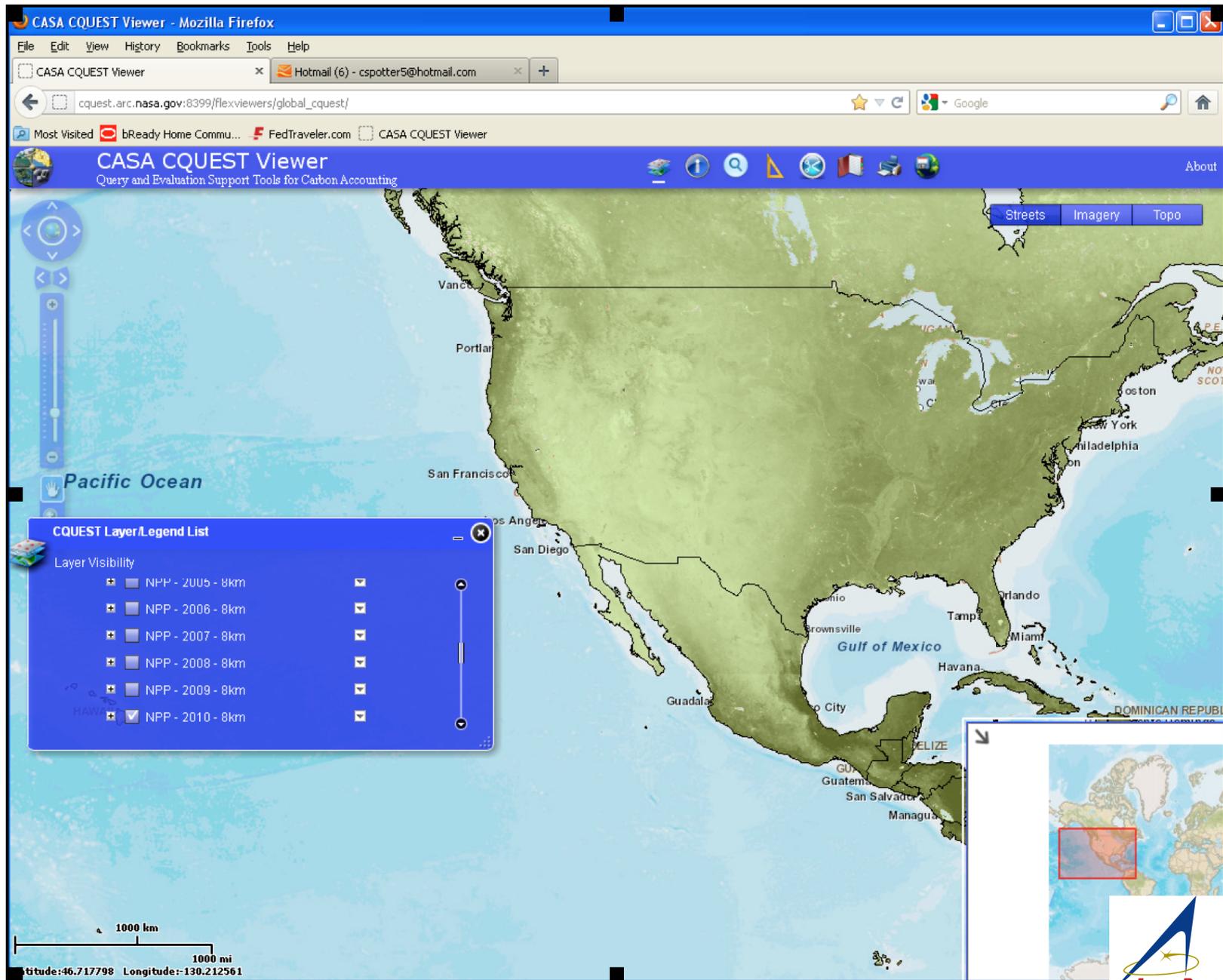
c. Howland Mixed Forest



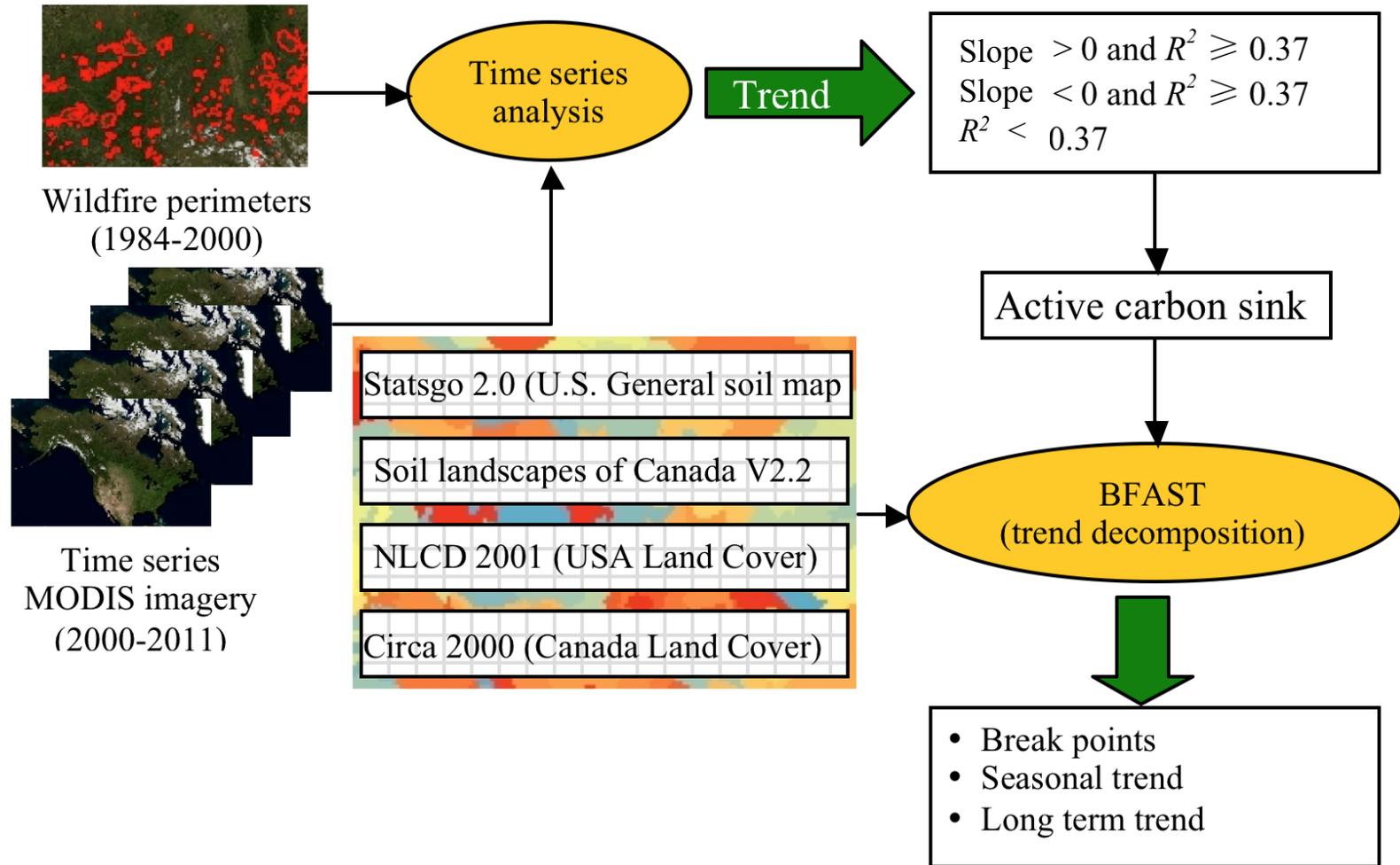
d. Bartlett Deciduous Broad-leaf Forest



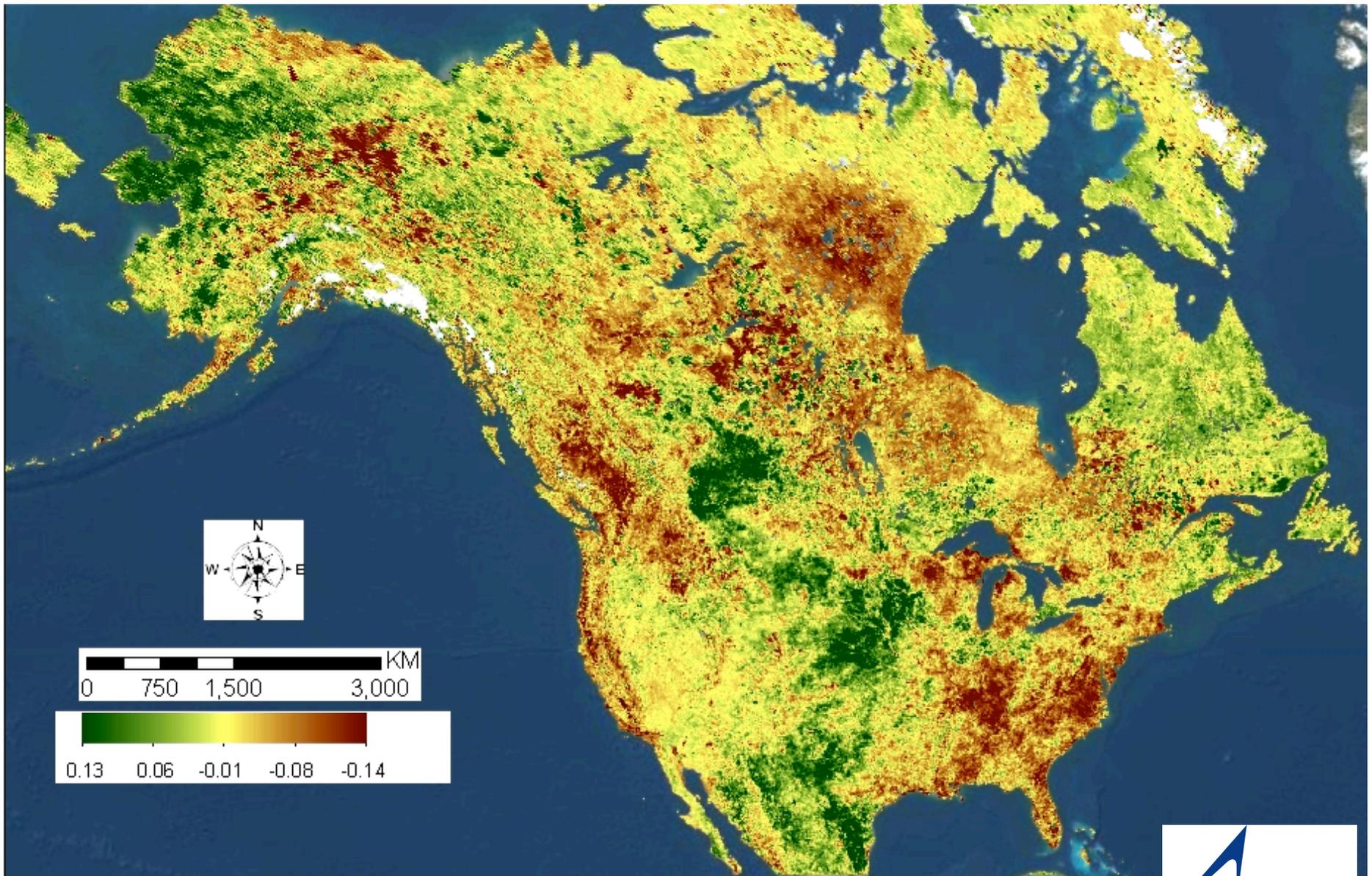
<http://geo.arc.nasa.gov/sgc/casa/cquestwebsite/>



Methods and Computational Tools for MODIS VI Trend Analysis (Source: Potter et al., 2012, *Natural Resources*)

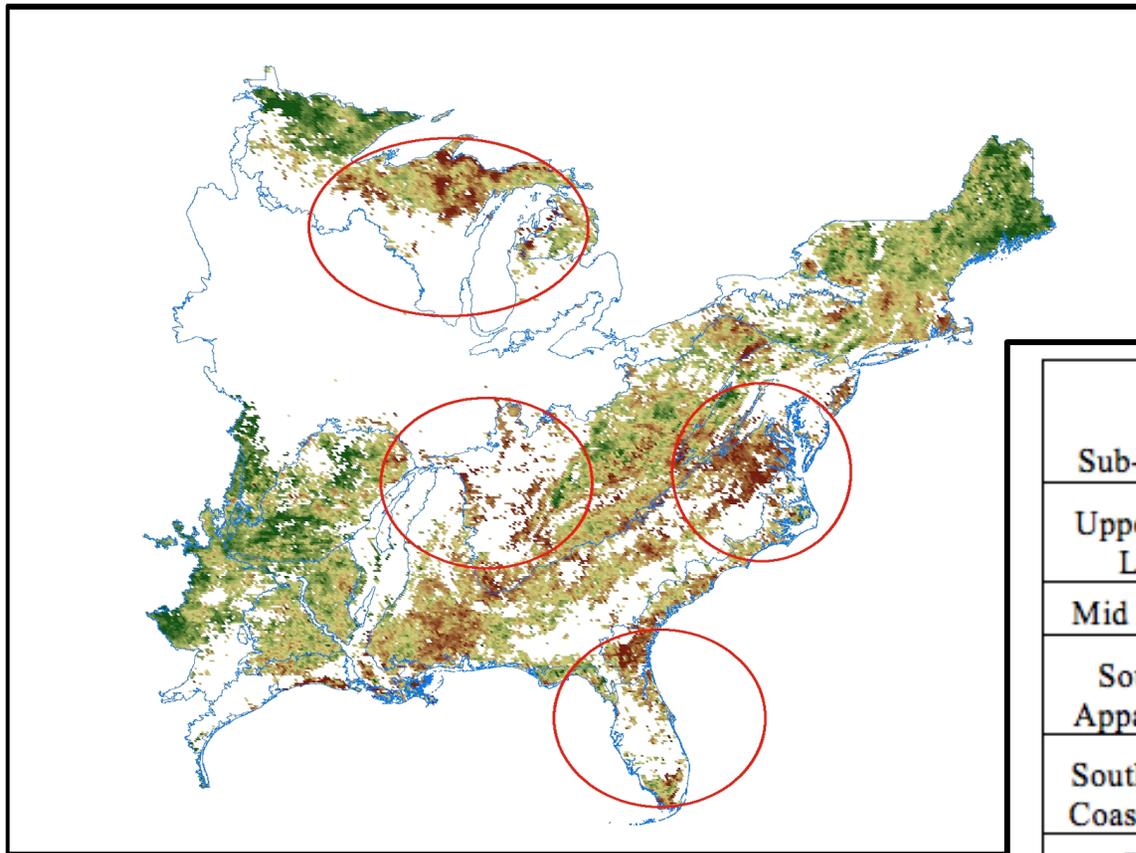


MODIS EVI Trend Results 2000-2011
(Source: Li and Potter, 2012, *Natural Sciences*)



Declining Vegetation Growth Rates in the Eastern United States from 2000 to 2010

(Source: Potter et al., 2012, *Natural Resources*)



Sub-Region	Sig. Negative EVI Forest Area (km ²)	% Forest Area with Sig. Negative EVI
Upper Great Lakes	17,472	14
Mid Atlantic	3,456	38
Southern Appalachian	9,408	6
Southeastern Coastal Plain	2,240	12
Total	32,576	10

Accomplishments Under NASA NCA

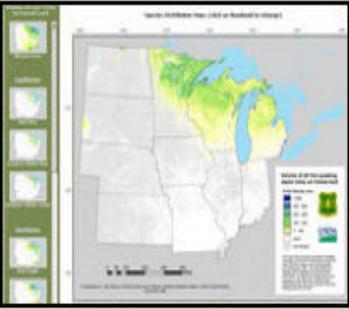
A. US Forest Service Research Partnerships



Main hypotheses to be tested
(from the NCADAC 2013 Climate Assessment Report):

- Forests have responded to climate change with faster growth in humid areas and slower growth in drier areas of the country.
- Longer growing seasons and warmer winters are enhancing moisture stress and pest outbreaks, leading to tree mortality and to more severe and extensive fires.

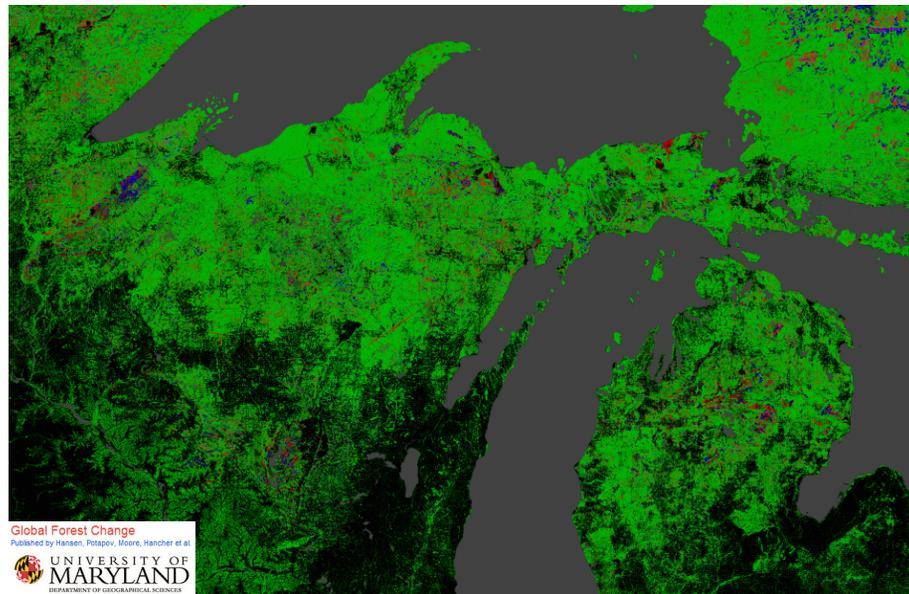
FIDO (Forest Inventory Data Online)



FIDO is the next generation web tool that will eventually replace MapMaker. Please try it out and let us know if you have suggestions for improvement.

Strategic Foresight and Rapid Response Group
U.S. Forest Service Northern Research Station
Newtown Square, PA

Northern Wisconsin and Michigan



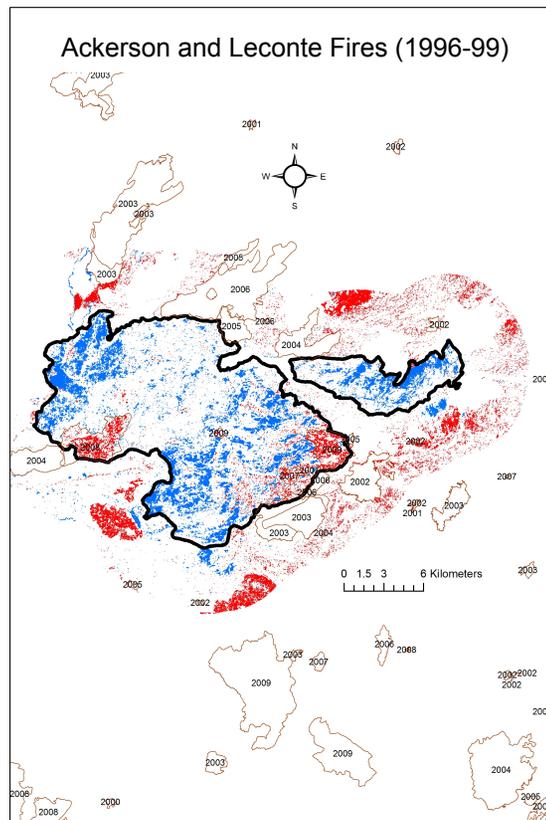
Accomplishments Under NASA NCA

A. US Park Service Research Partnerships

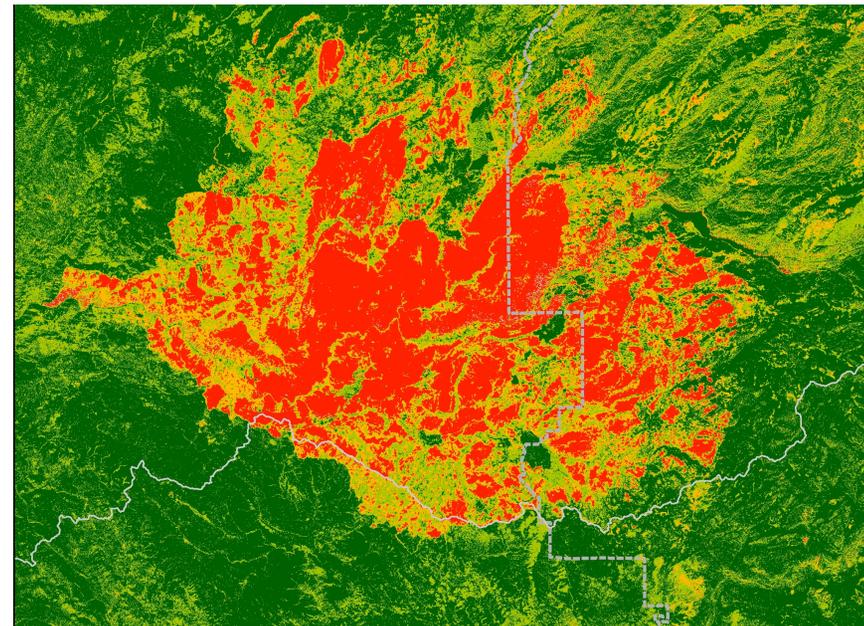


Main hypotheses to be tested
(from the NCADAC 2013 Climate Assessment Report):

- Longer growing seasons and warmer winters are enhancing moisture stress and pest outbreaks, leading to tree mortality and to more severe and extensive fires.



2013 Rim Fire dNBR and Yosemite NP



Accomplishments Under NASA NCA

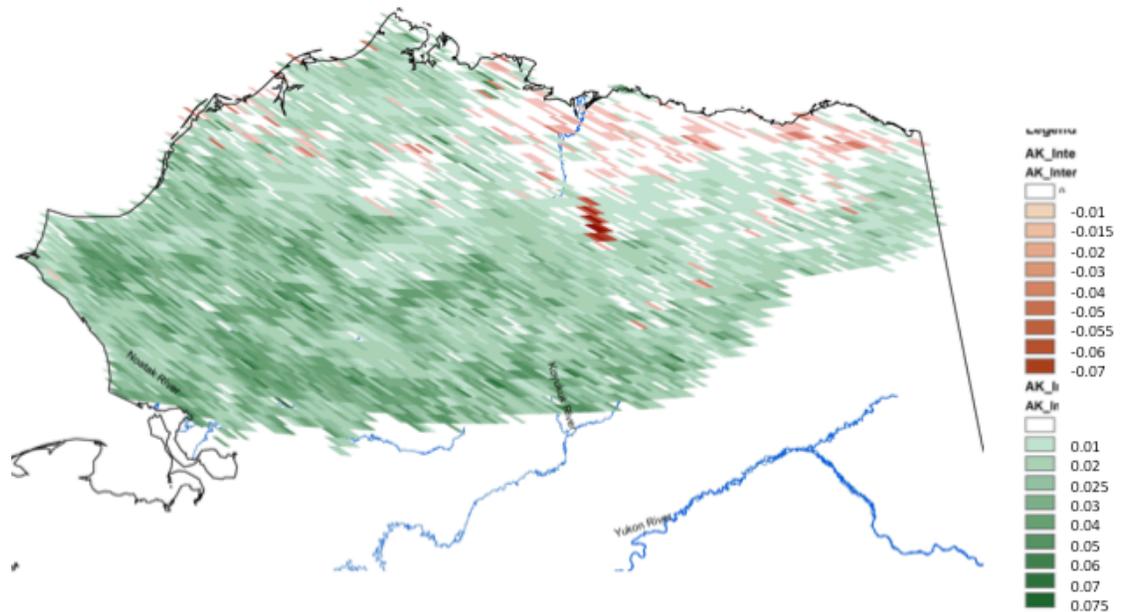
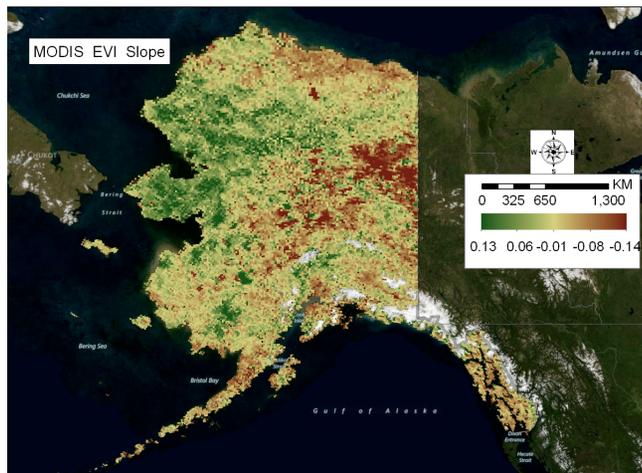
A. US Fish & Wildlife Service Research Partnerships



Main hypotheses to be tested
(from the NCADAC 2013 Climate Assessment Report):

- Longer growing seasons and warmer winters are enhancing moisture stress and pest outbreaks, leading to tree mortality and to more severe and extensive fires.

Greening of Arctic Alaska from MODIS



Accomplishments Under NASA NCA

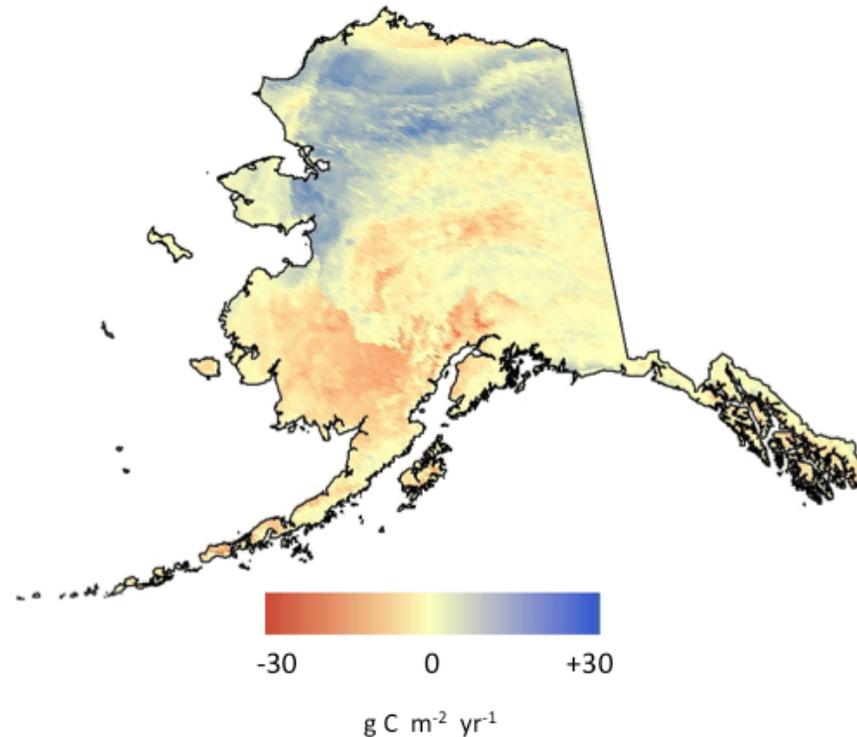
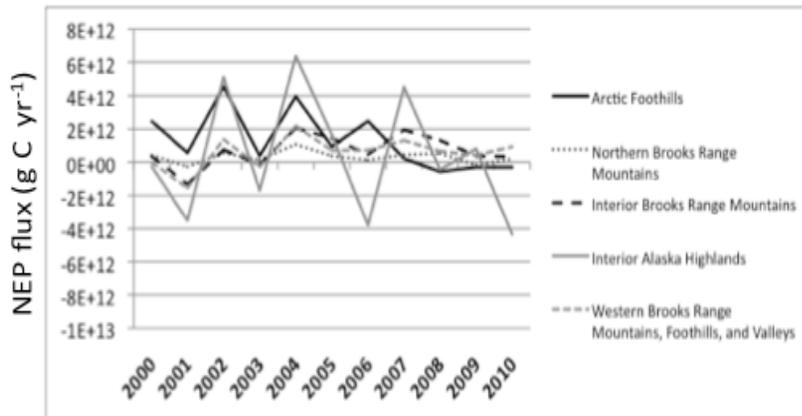
A. US Fish & Wildlife Service Research Partnerships



Main hypotheses to be tested
(from the NCADAC 2013 Climate Assessment Report):

- Longer growing seasons and warmer winters are enhancing moisture stress and pest outbreaks, leading to tree mortality and to more severe and extensive fires.

CASA Model NEP Flux Average (2000-2010)



Accomplishments Under NASA NCA

B. Expanded NCAnet Participation



Main objective:

- Extend the NCA process and products to a broad audience through the development of assessment-related capacities and products, such as collection and synthesis of data relevant to current and future NCA reports.

This screenshot shows the website for the Institute of the Environment at the University of Arizona. At the top left is the University of Arizona logo. The main header features the 'Institute of the Environment' logo, which includes a globe with a sun, a hand, and waves. Below the header is a map of Arizona with a legend for 'April 2010 Long Term Drought Status' and 'Data Through March 31st, 2010'. The legend includes categories like 'Normal Drought', 'Drought-Modest', 'Drought-Severe', and 'Drought-Extreme'. At the bottom of the page is the 'CLIMAS' logo with the tagline 'Climate Assessment for the Southwest'.

This screenshot shows the 'USGS Science in Alaska' website. The top navigation bar includes 'USGS science for a changing world', 'USGS Science in Alaska', and links for 'science portal', 'alaska science center', 'USGS Home', 'Contact USGS', and 'Search USGS'. The main content area features a map of Alaska with numerous red location markers. A sidebar on the left lists 'Investigators' and 'Principal Investigators'. The sidebar on the right offers 'Basemaps' such as Imagery, Imagery with Labels, Streets, Topographic, Terrain with Labels, and Light Gray Canvas. The map interface includes view controls (Map View, List View, Statewide) and a scale bar.

Peer Review Comments on NASA Climate Science (HELP WANTED)

"A very important distinction that many managers would be interested in is whether the recovering vegetation is primarily shrubs or trees. Even with a strong field validation component, this distinction between trees vs. shrubs may not be possible with Landsat data."

"First order effects cannot be inferred from (Landsat) change detection in fires (before 1980)."

"I am not sure the (satellite radar) dataset provides adequate delineation of wetland areas in the interior region of Alaska. Specifically, this dataset overestimates the area of forested wetlands along major rivers."

"The MODIS (1-km) land cover data set used is totally inadequate for mapping of vegetation cover types in the interior region of Alaska."

"Ecosystem types in Alaska are complex, and using only 3 (tower flux) sites is inadequate to provide confidence in the (CASA model) results."

"The time period of the study (11+ years) is far too short to assess vulnerability and resistance (to ecosystem carbon losses)."