NCAR Earth System Laboratory

Developing CESM land use data for actionable science at local scales

Peter Lawrence

Terrestrial Science Section
Climate and Global Dynamics Division

(With thanks to the TSS and Innovators groups for their many contributions)

The National Center for Atmospheric Research
NCAR
managed by UCAR to serve the community
sponsored by NSF

Peter: Project premise

Centering climate adaptation science and policy in Indigenous ecocultural practice to restore floodplains and ecohydrological processes in the Klamath River Basin, CA

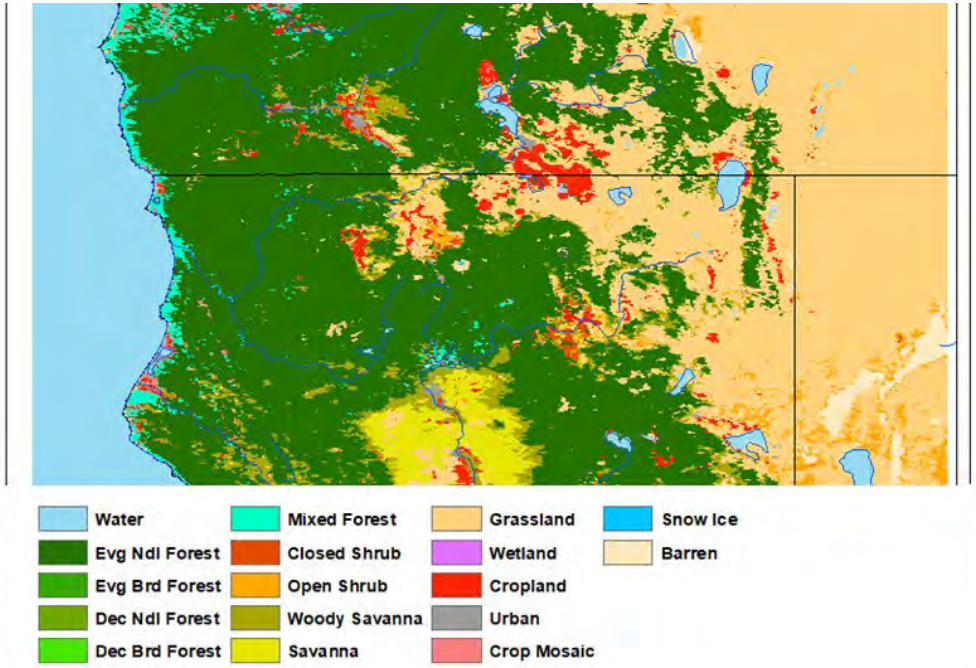
PI: Cleo Wölfle Hazard, University of Washington

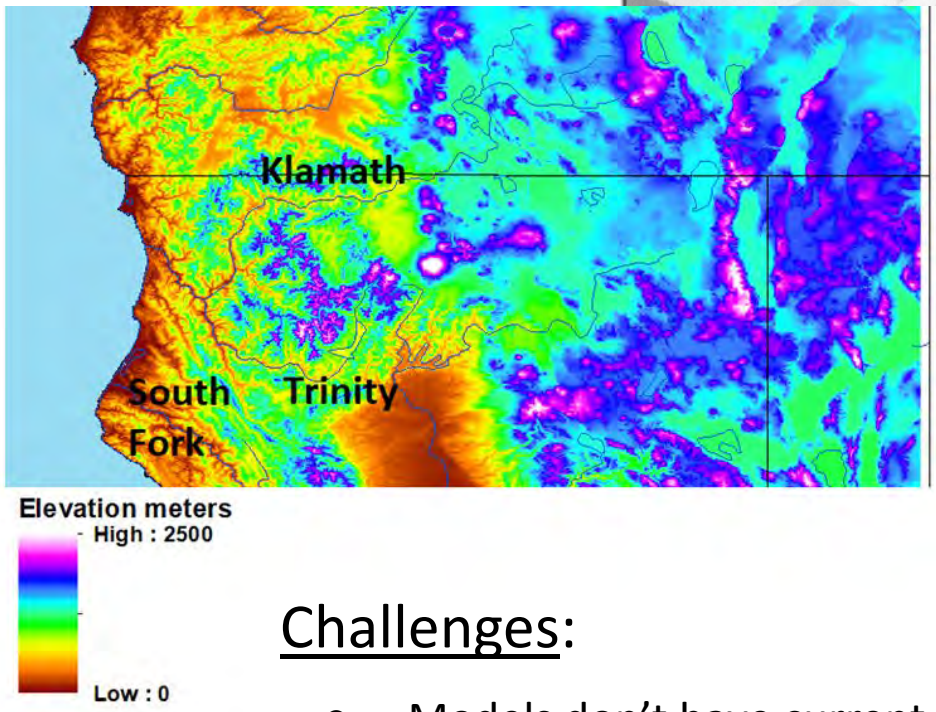
NCAR Collaborators: Peter Lawrence (CGD), Andy New
Andy Wood, Naoki Mizukami and Ethan Gutmann (RAL

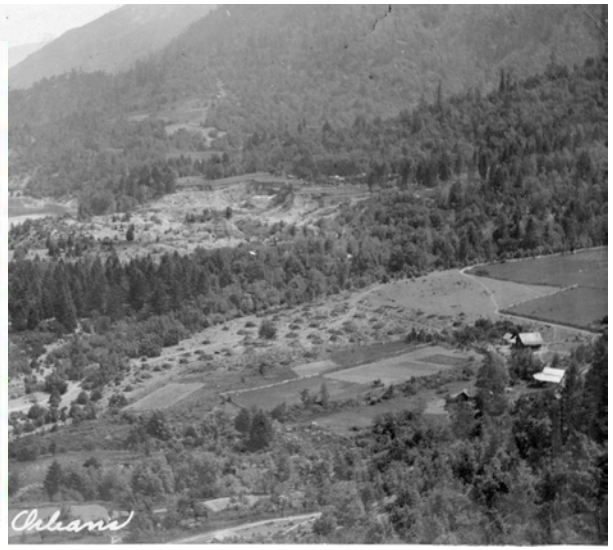
University of Washington Collaborators: Sofi Courtney
Robin Ruhm, Daniel Sarna, and Casey Duncan

- Collaboration with University of Washington, NCAR, Karuk Tribe and their NGO and agency partners.
- Project centers Indigenous knowledge and protocols on cultural ecosystems and species to develop strategies to restore ecocultural function to degraded land and river scapes.
- NCAR Collaborators providing support through 1 km high resolution modeling with the Community Terrestrial Systems Model (CTSM) and the stream flow model MizuRoute.
- Past, current and future landscapes will be developed from historical photos, fire regimes, place names and Karuk Indigenous knowledge through University of Washington and Karuk Tribe.
- Hydrological modeling with different land surface representations will be fed into the stream flow model. Further stream flow and temperature analysis will follow for fish and ecosystem assessment.

Peter: Bringing new perspectives to CGD science







Benefits:

- Working closely with diverse range of Stakeholders
- Testing NCAR models for use in societally relevant studies and with case specific resolution and features
- Providing information of use relevant to the Karuk Tribe for climate and ecosystem resilience
- Developing expertise in the University Community

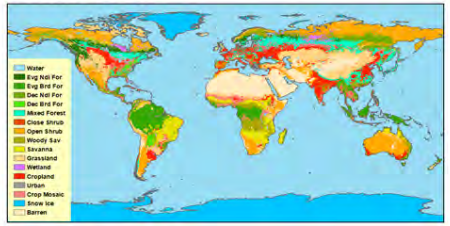
Challenges:

- Models don't have current, past or future representations of study area that are consistent with the complexity of stakeholder knowledge (i.e. only 15 PFTs)
- Incomplete data on the historical record of the Klamath river and Ingenious practices
- Missing processes in the CTSM setup in terms of fire and ecosystem processes
- Models lack stream temperature and fish ecosystem processes

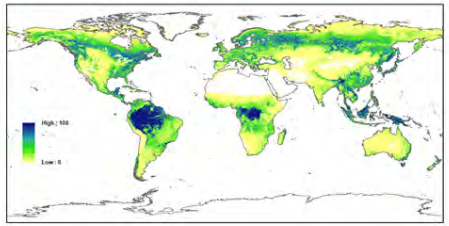
Integrating Land Data To Represent Land Use in CLM5

Land Cover and Cropping Data

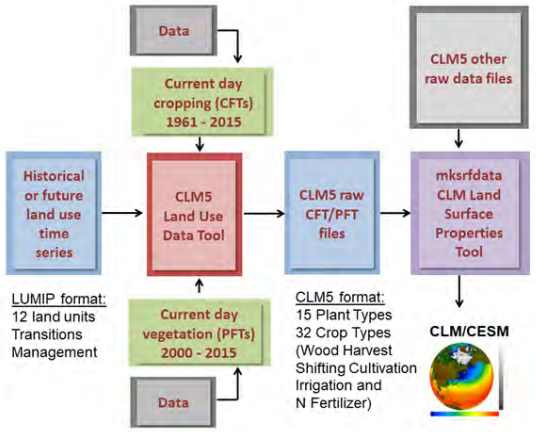
MODIS IGBP Land Cover



MODIS VCF Percent Tree

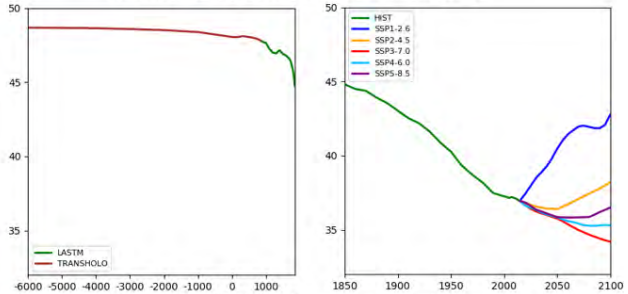


CLM5 Land Use Data Tool - Mksurfdata

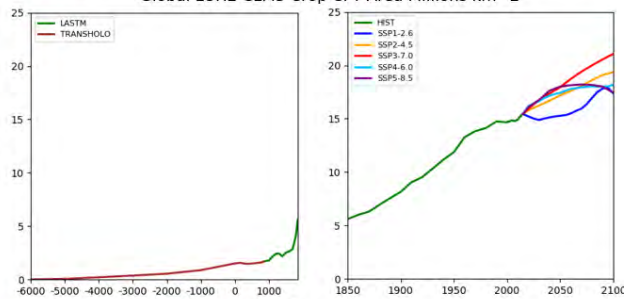


Time Series Data

Global LUH2 CLM5 Tree PFT Area Millions km^2

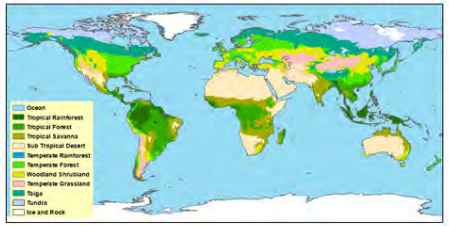


Global LUH2 CLM5 Crop CFT Area Millions km^2



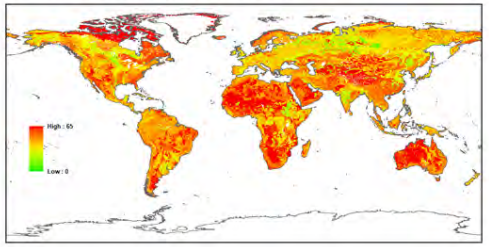
Climate Data

CRU Climate - Whittaker Biomes 2000 - 2015

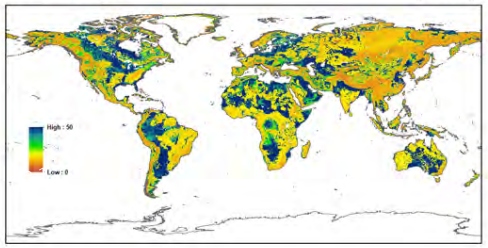


Soils Data

CLM5 Sand Content Top (avg 0 - 0.09m) (%)



CLM5 Soil Depth (meters)



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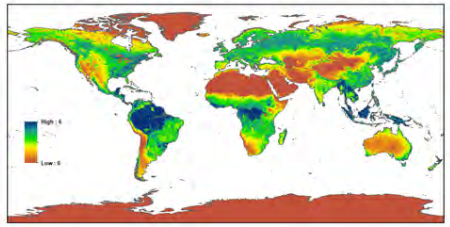

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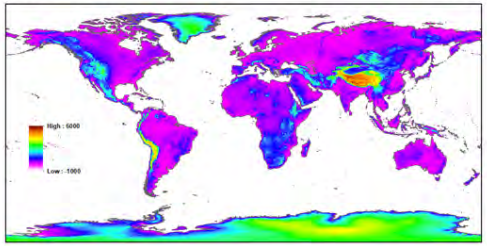
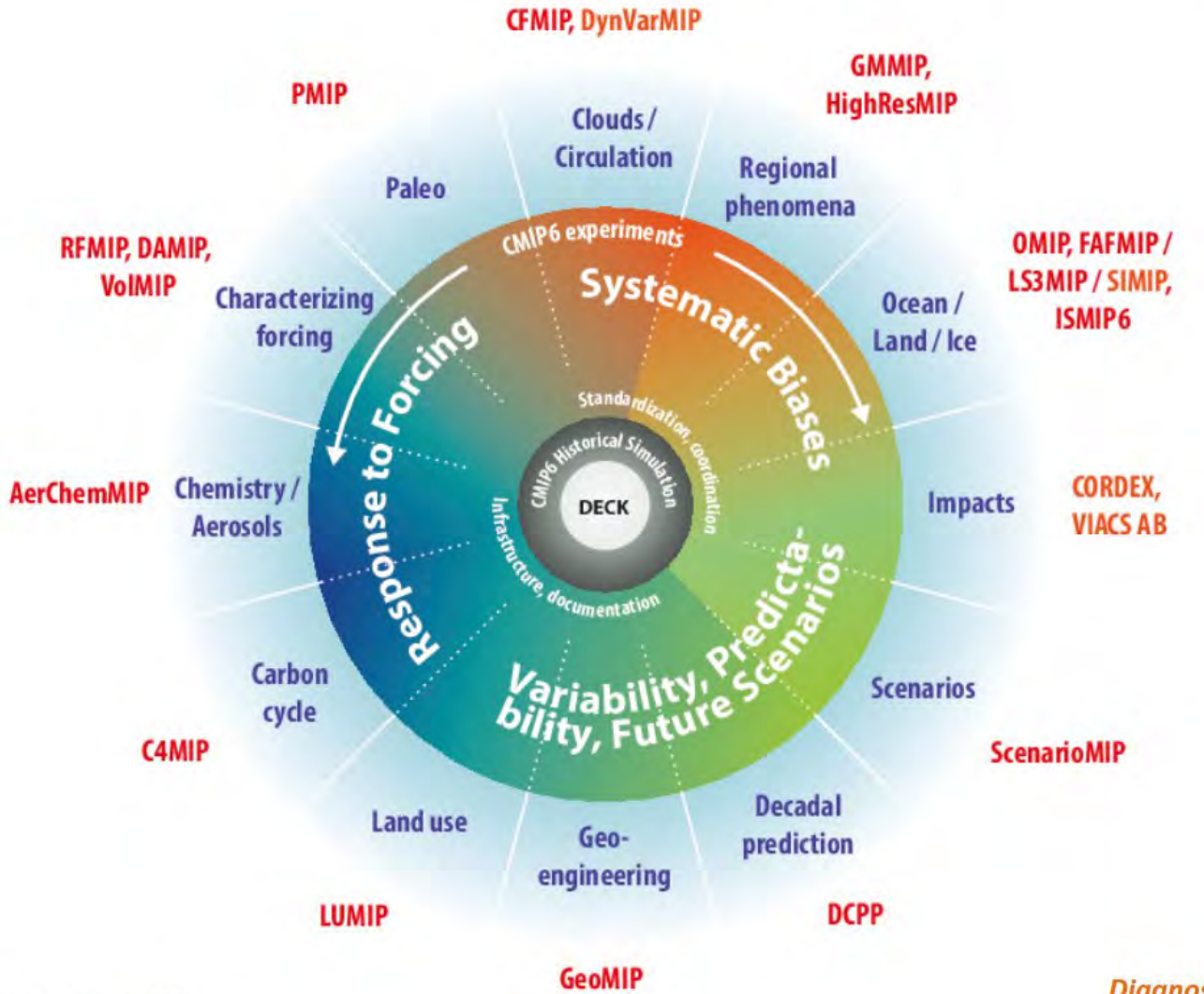


CLM5 MOSART River Network 0.5 Degrees

21 CMIP6-Endorsed MIPs



Eyring et al., GMD, 2016

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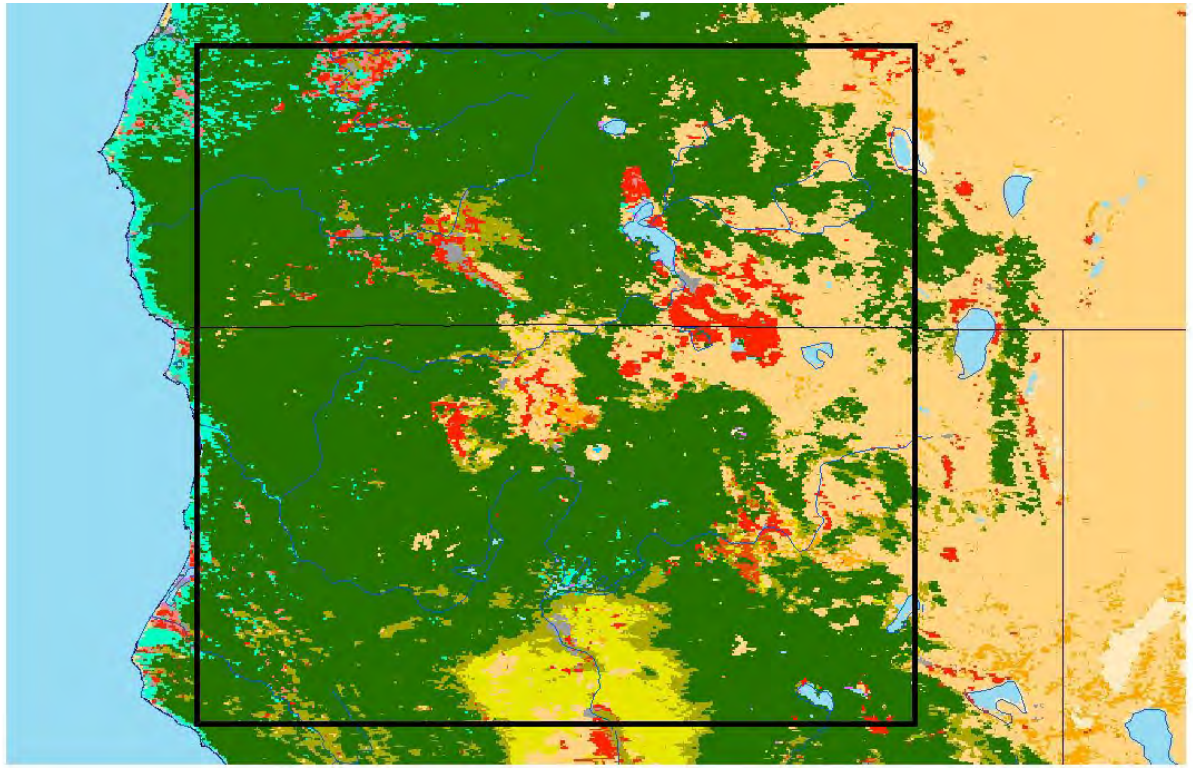
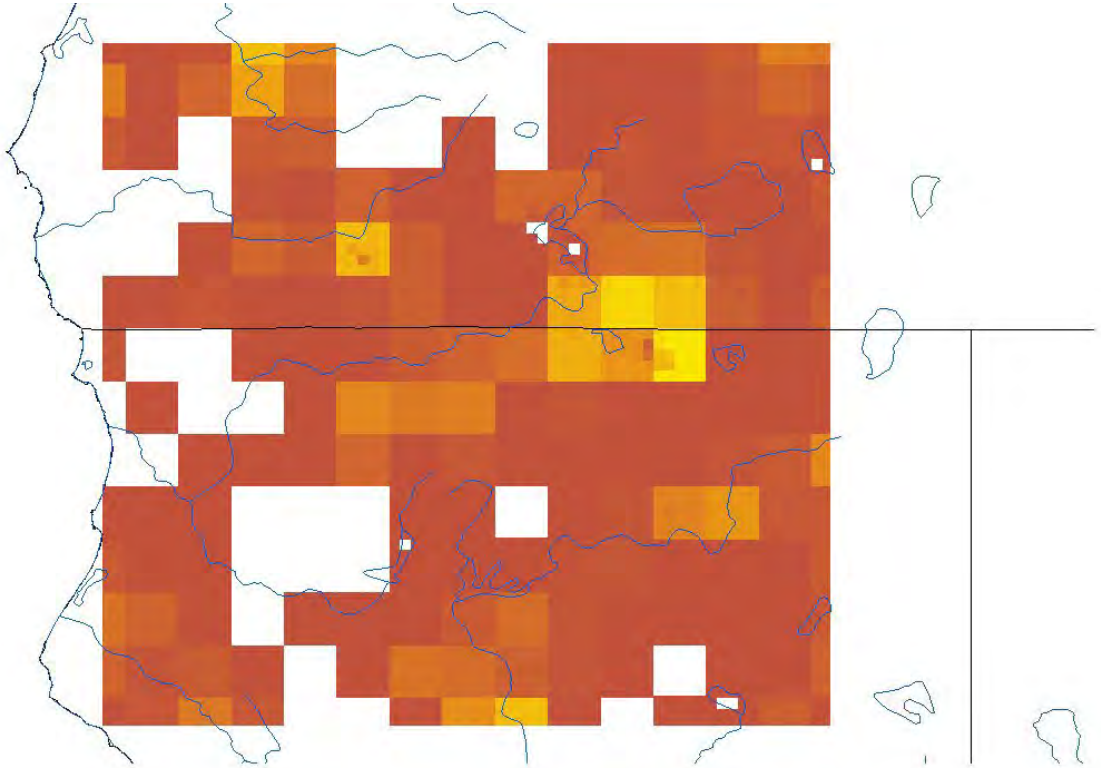


Current CLM5 Land Surface Data
Percentage Crop



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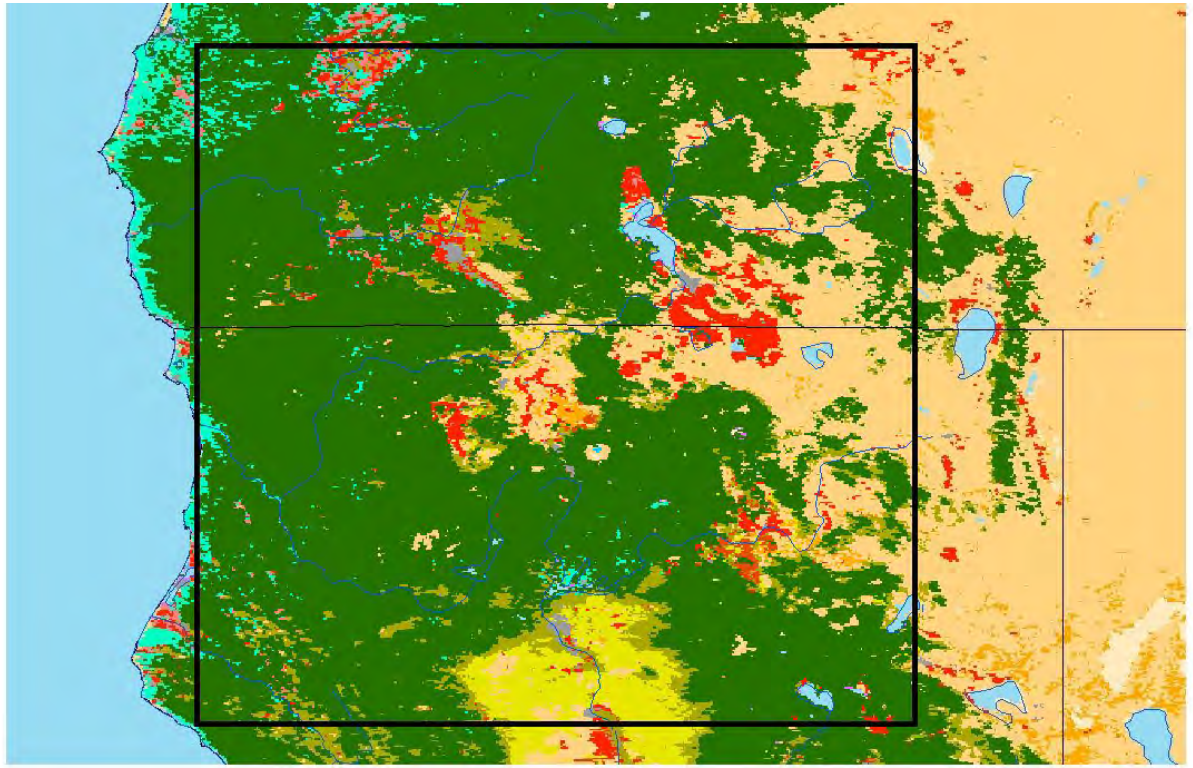

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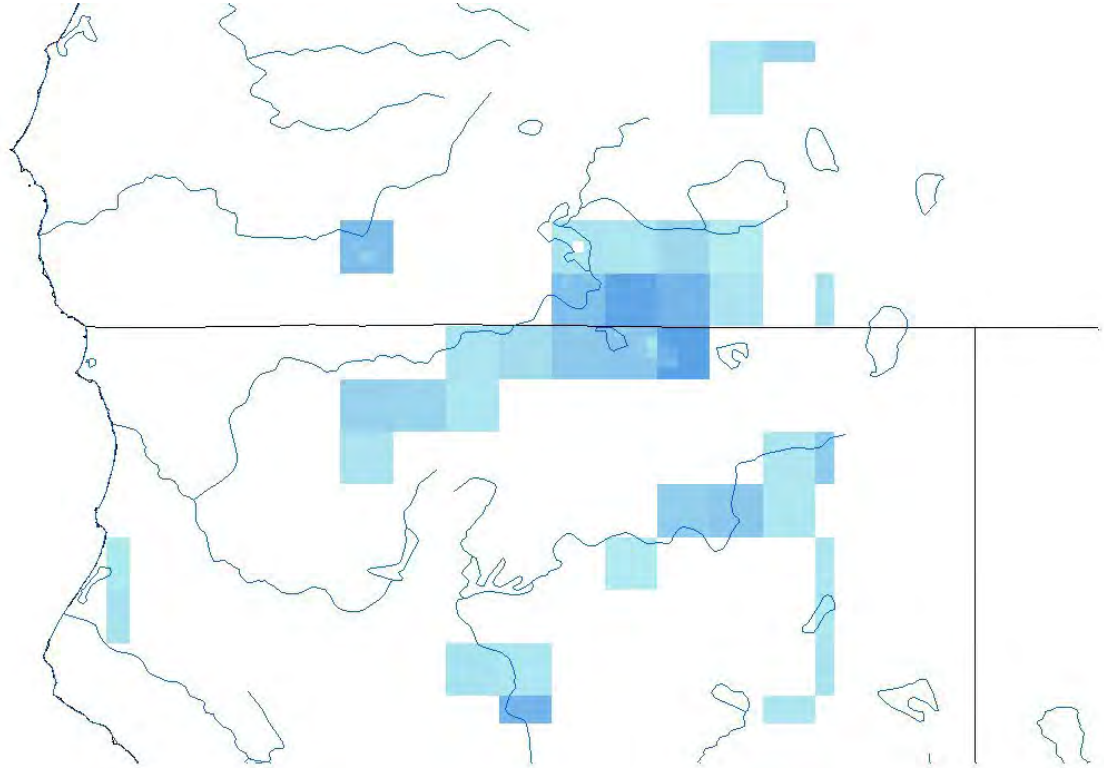

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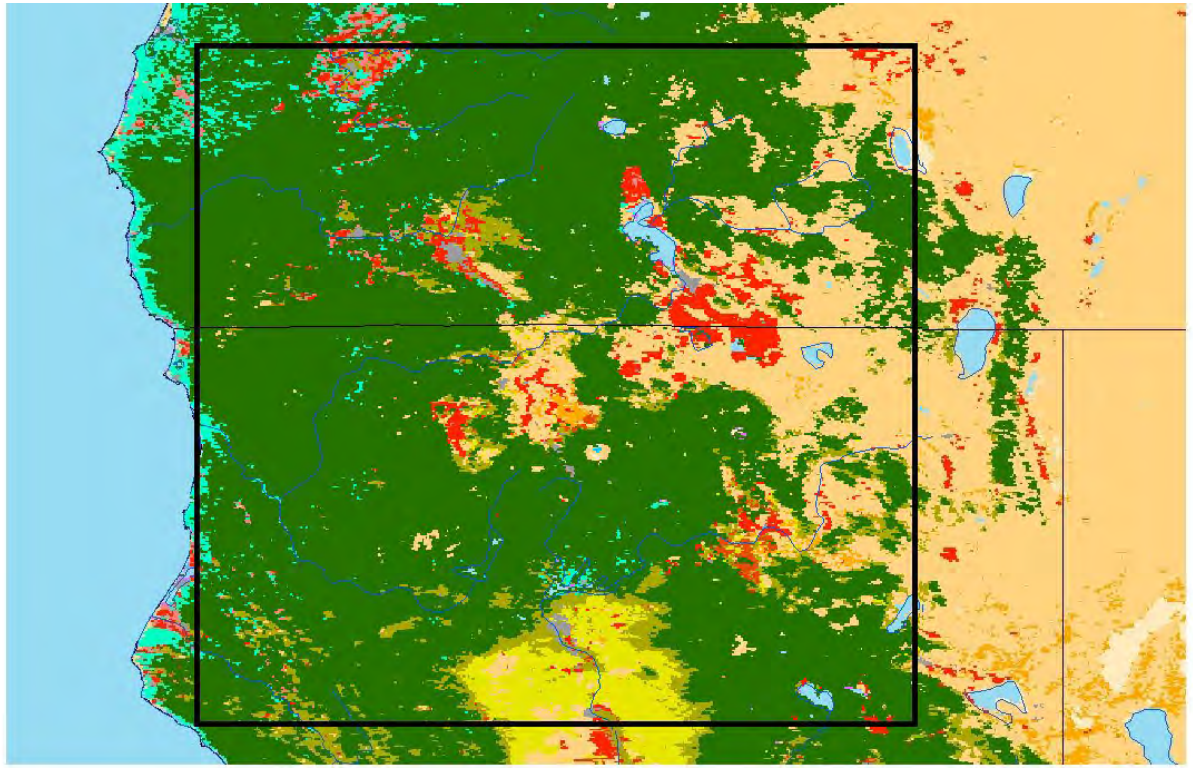

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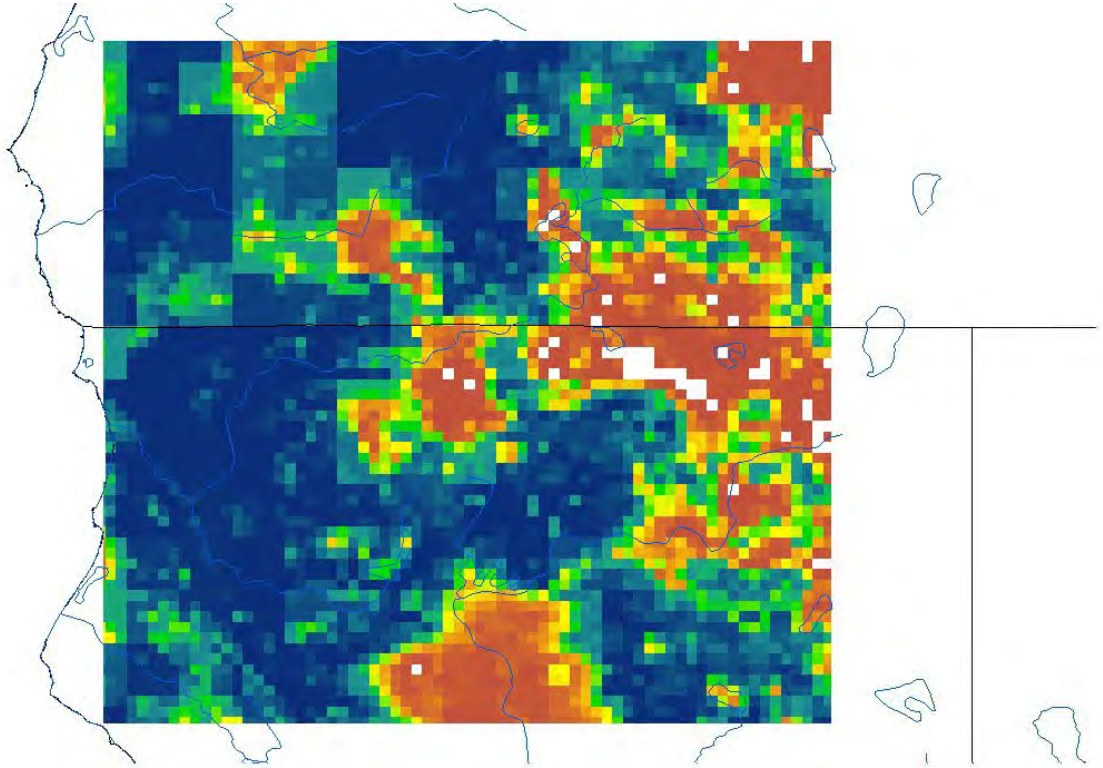

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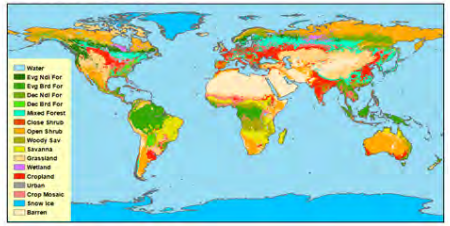

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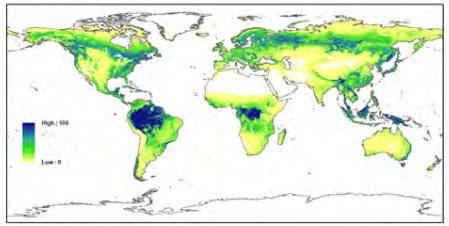

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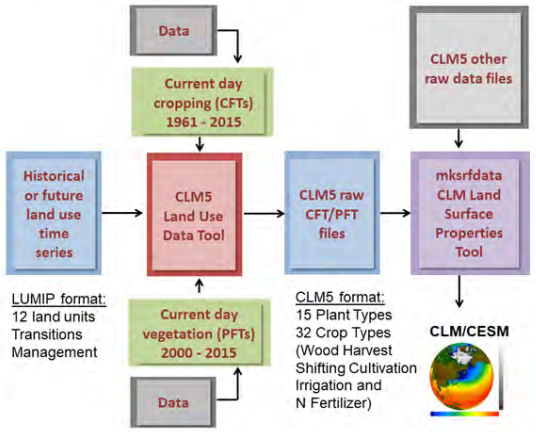

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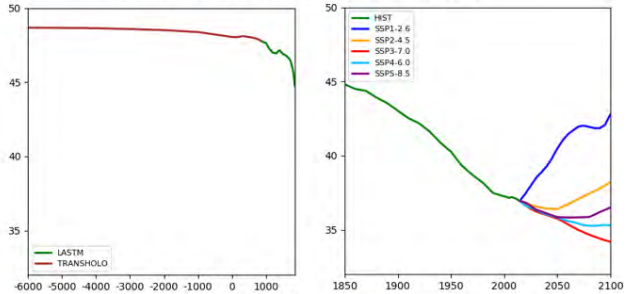

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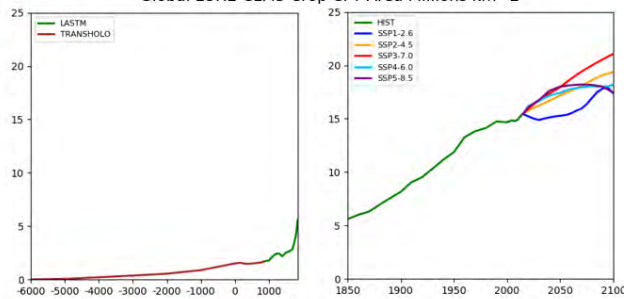

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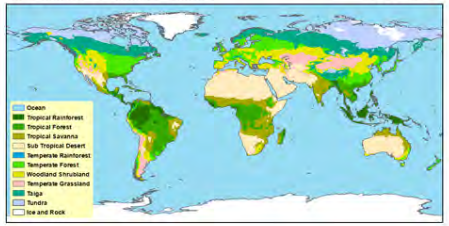

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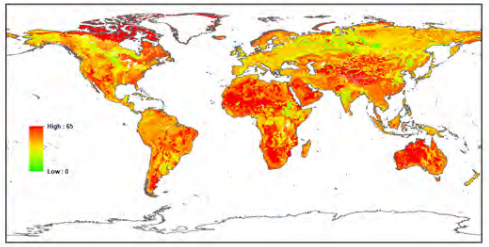

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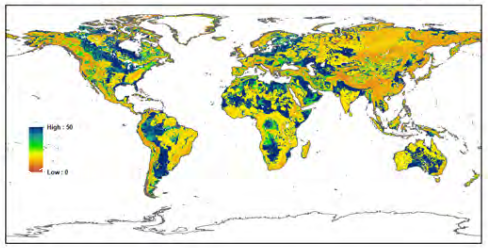

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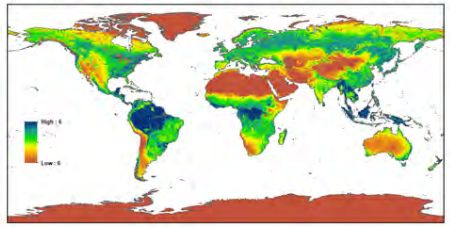

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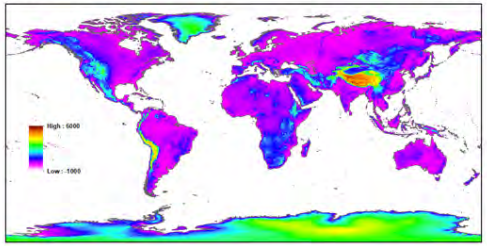

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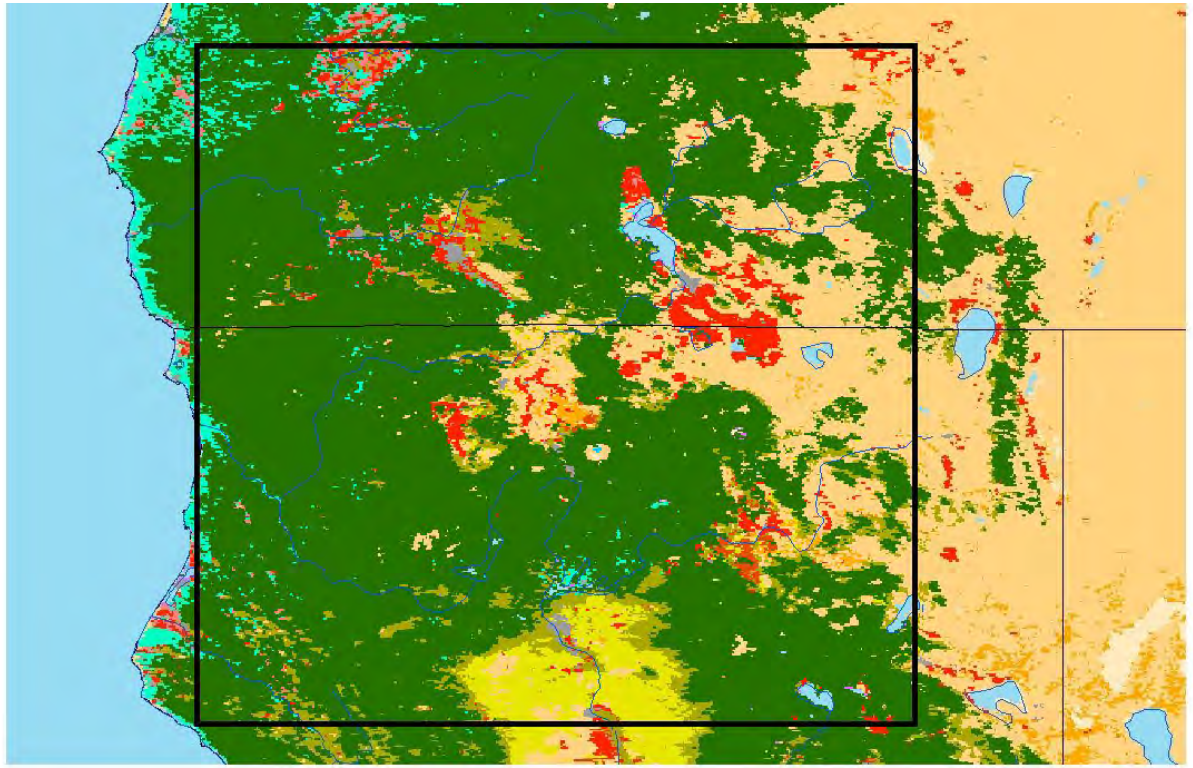
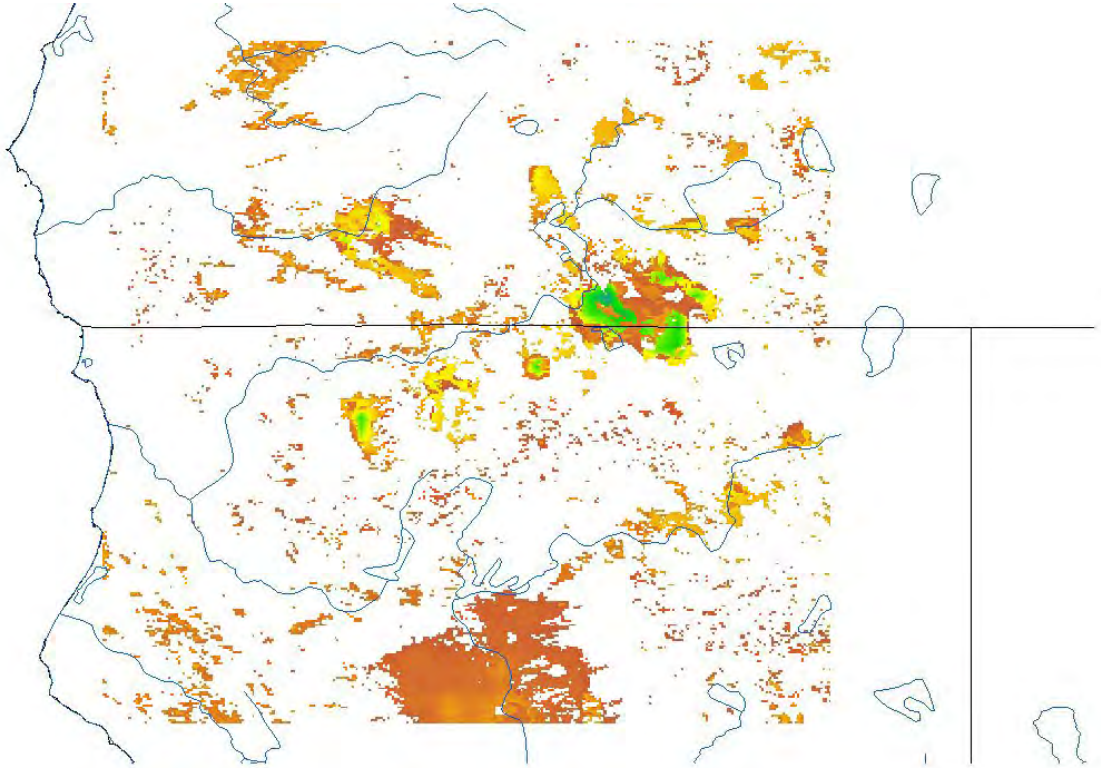


New CTSM52 Land Surface Data
Percentage Crop



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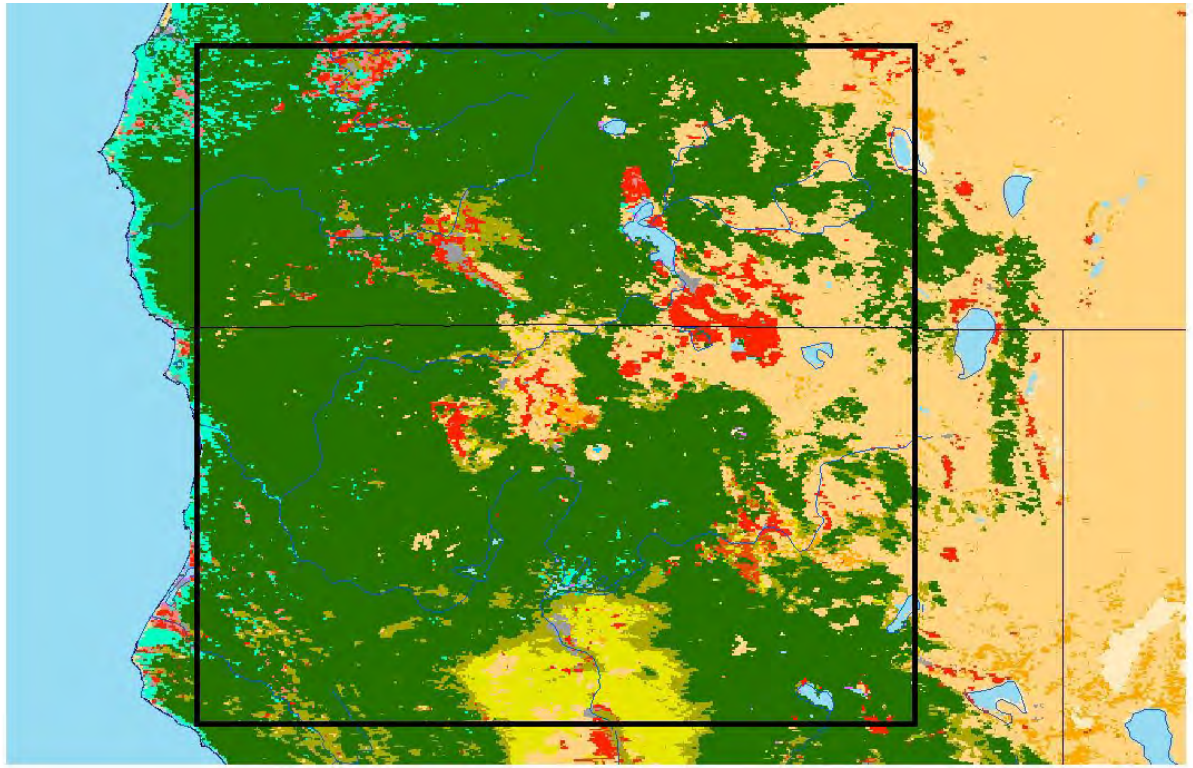

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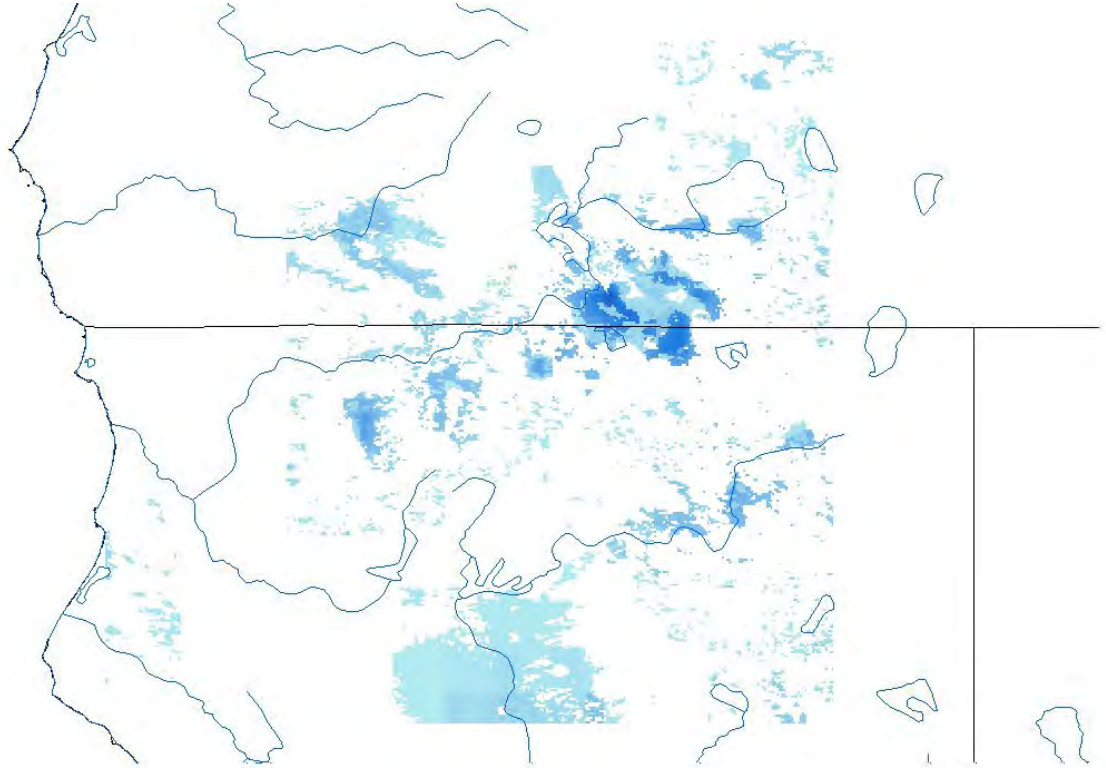

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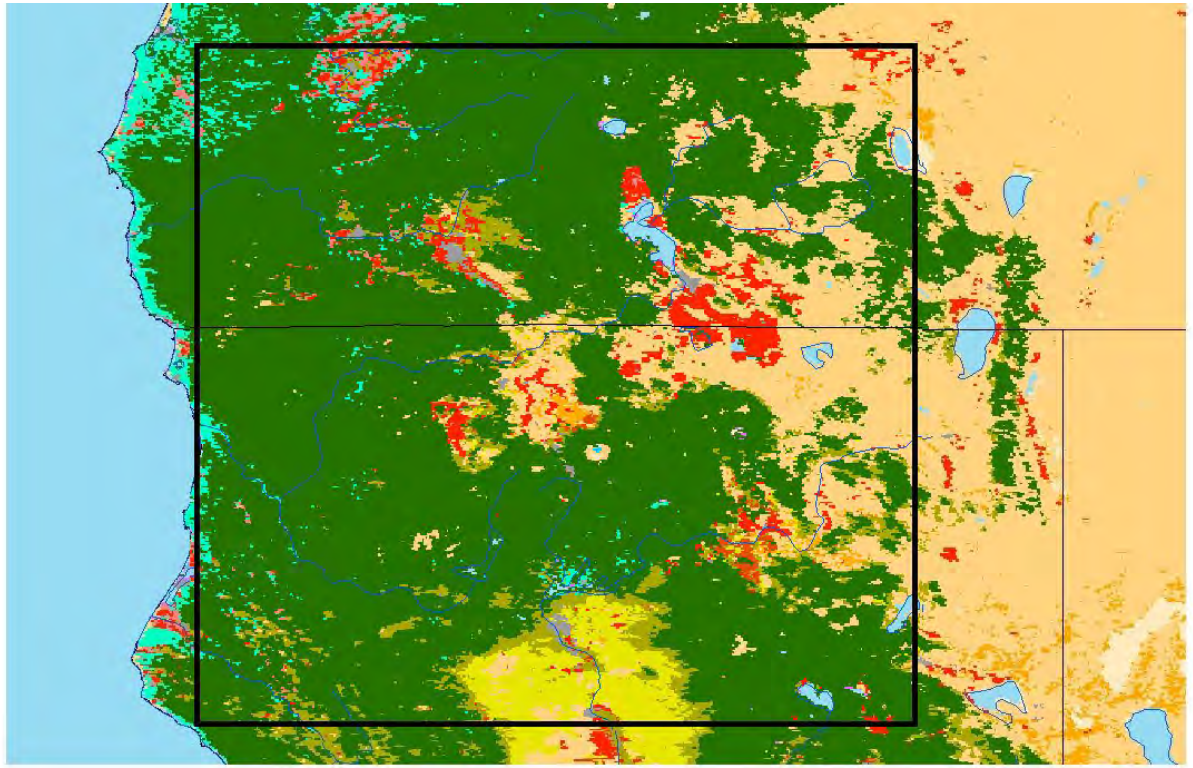

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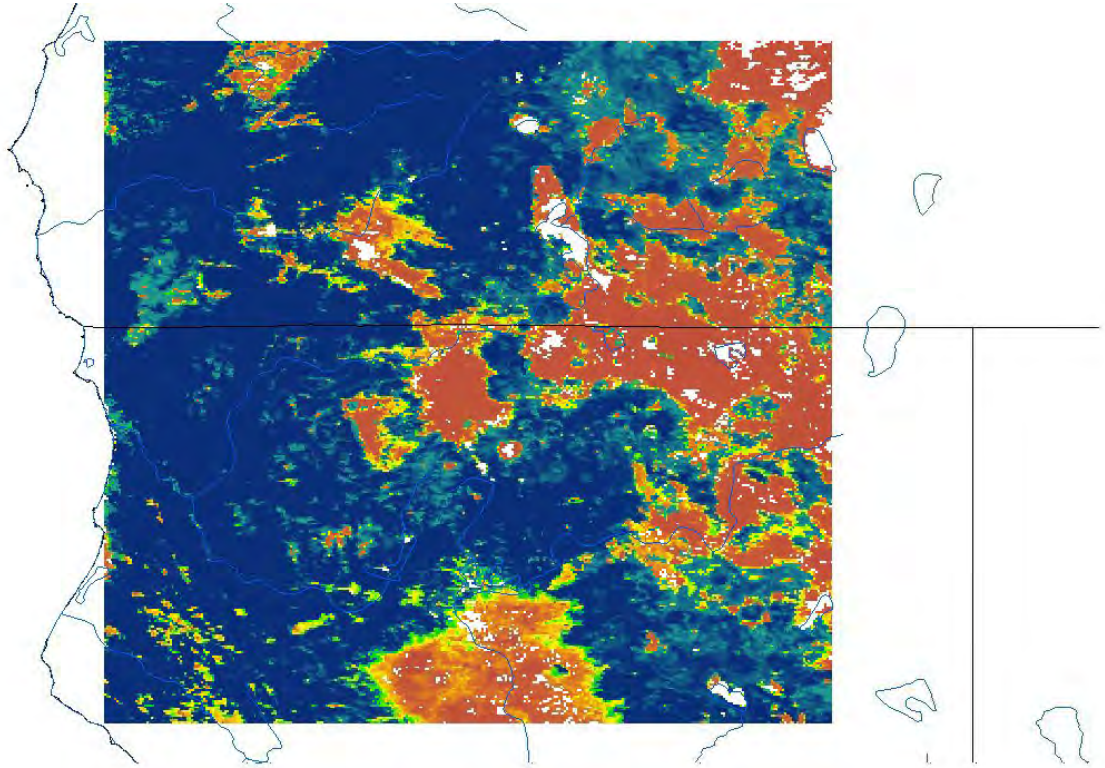

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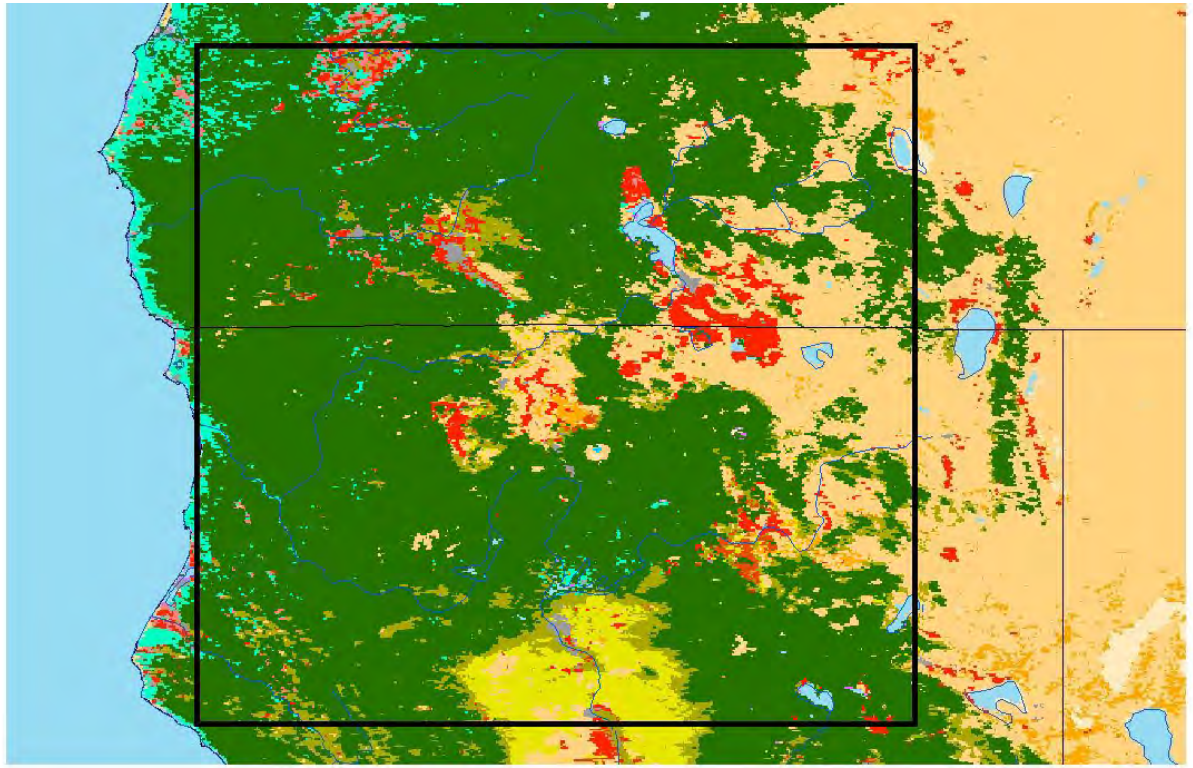
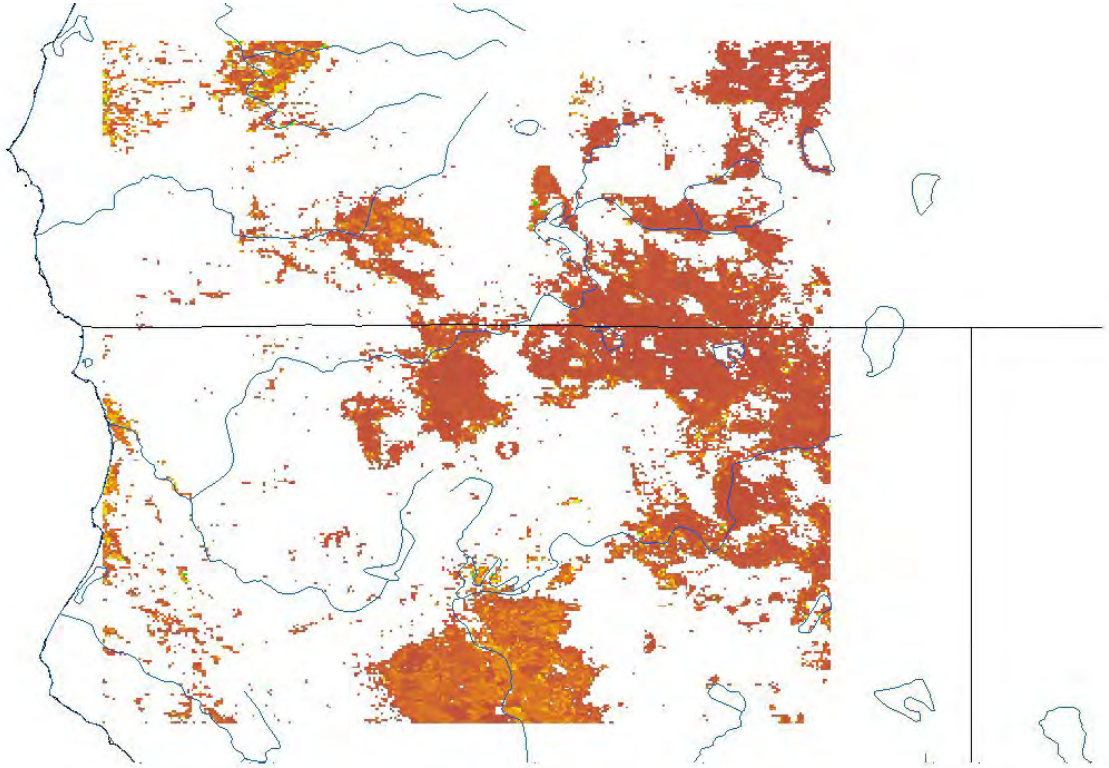
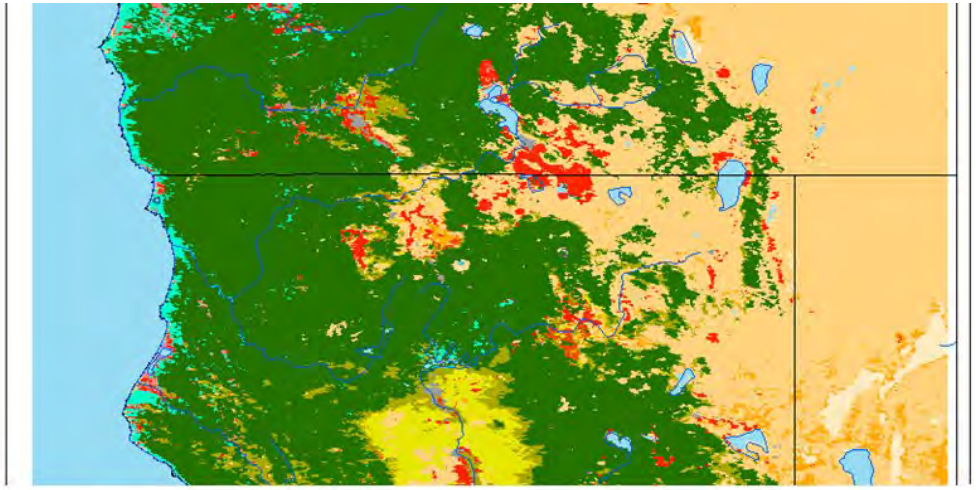
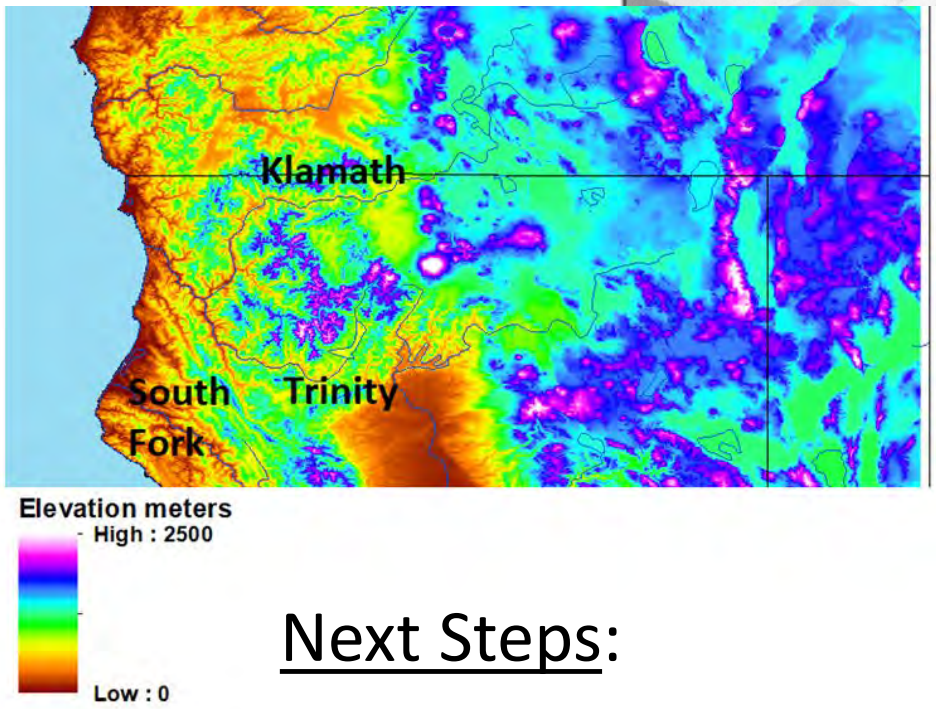


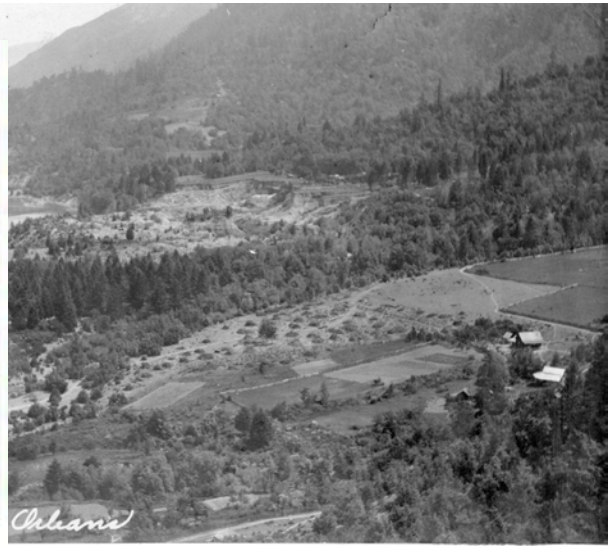
New CTSM52 Land Surface Data
Percentage Broadleaf Deciduous Trees



Peter: Bringing new perspectives to CGD science







Project Status:

- Stakeholder Meeting in the Orleans next week to discuss usability of the modeling framework
- Land only runs at 0.01 degrees with Satellite Phenology coupled to the River Transport Model with the original data compared to the new high resolution data

Next Steps:

- Developing Land Use histories from the Karuk and University of Washington collaborators
- Develop the next round of simulations with active carbon cycle
- Start planning for different land management strategies to investigate the key scientific and societal questions in terms of climate, fire and ecosystem management