DECISION SUPPORT FOR POST-FIRE FOREST RESTORATION

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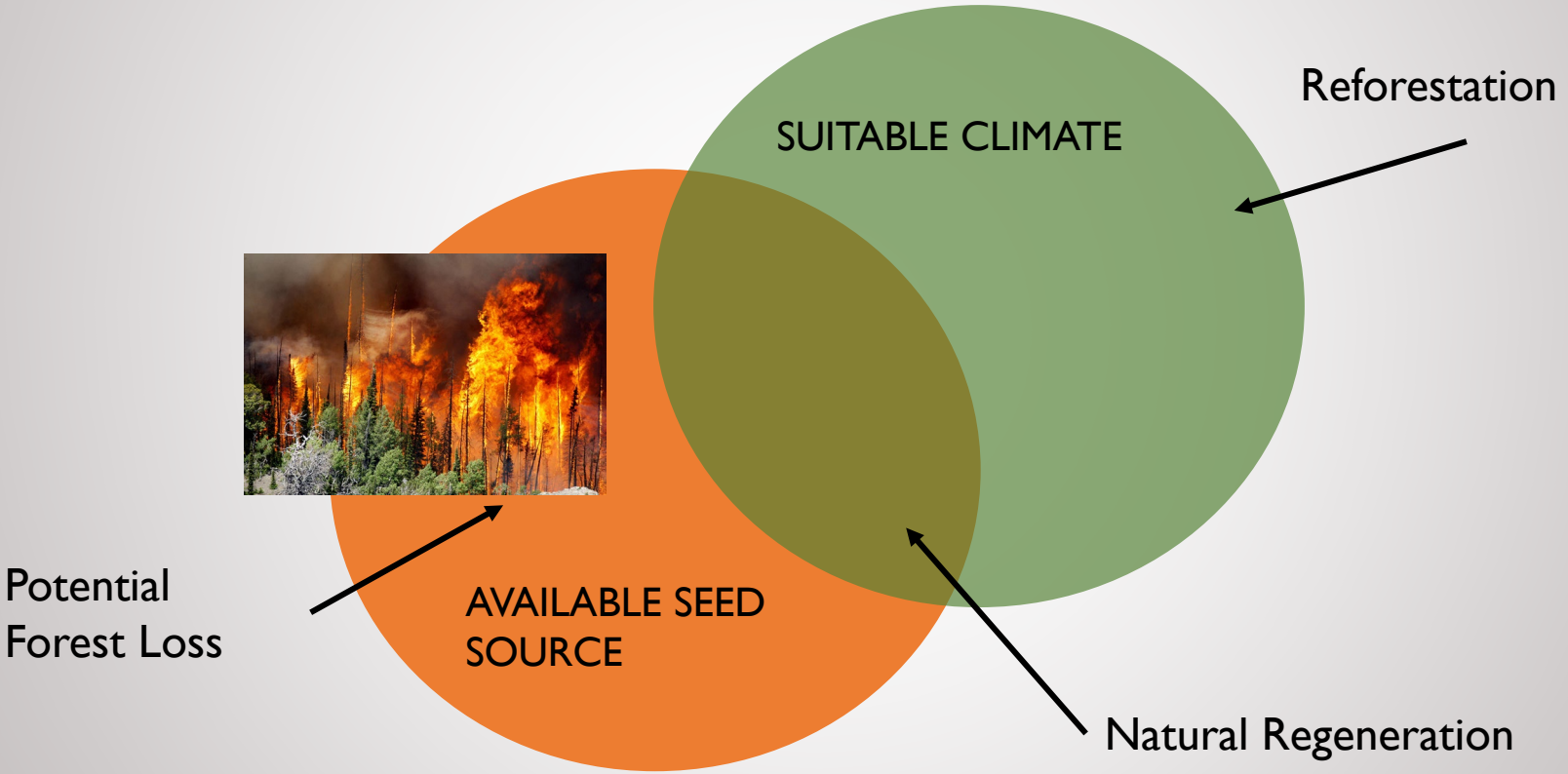
USDA National Institute of Food and Agriculture
U.S. DEPARTMENT OF AGRICULTURE

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

UNIVERSITY OF MONTANA | W.A. FRANKE COLLEGE OF FORESTRY AND CONSERVATION

REGENERATION

THE NEED

THE TASK

Develop a suite of geo-spatial products to inform reforestation efforts

Leverage these products to develop a decision support tool for reforestation decision making

WHAT LIMITS REGENERATION?

Available Seeds
Heat/Drought Stress

LETHAL SURFACE TEMPERATURES

o Very brief exposure to high surface temperature can kill conifer seedlings
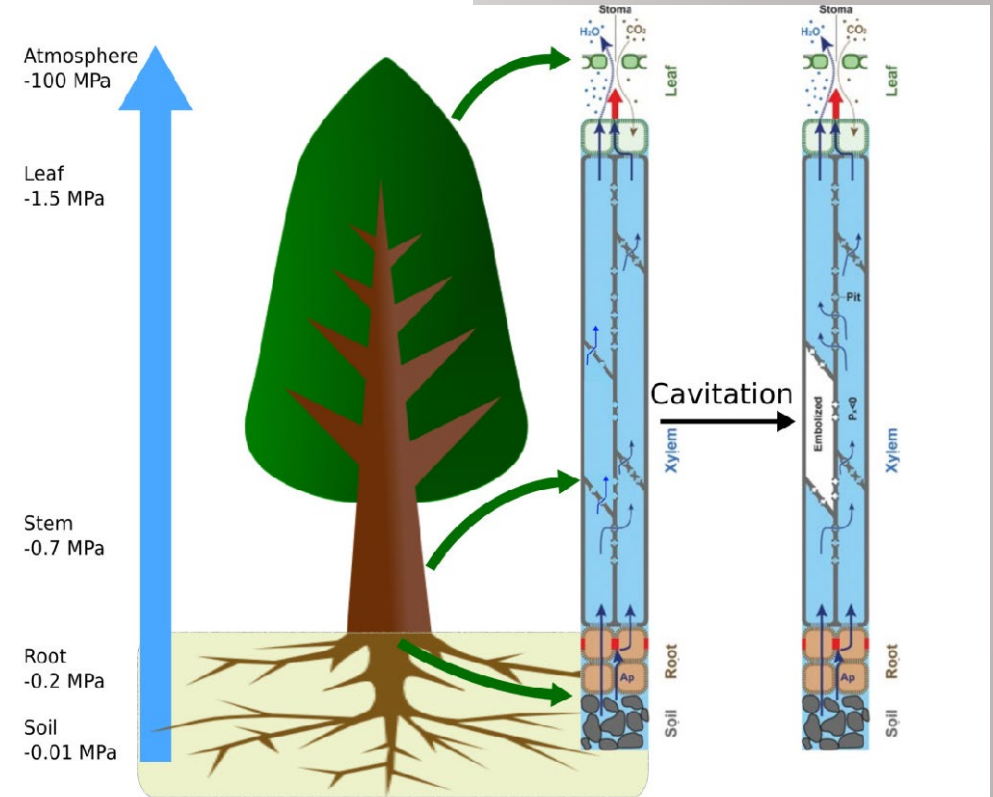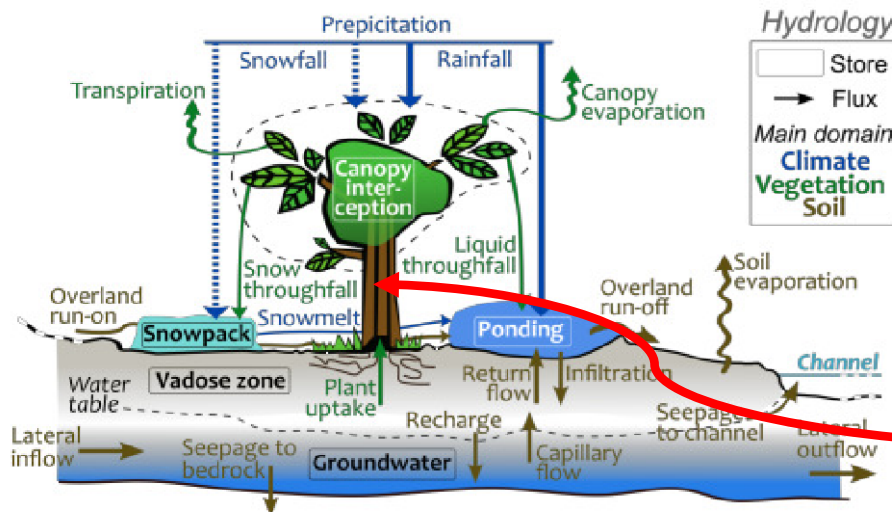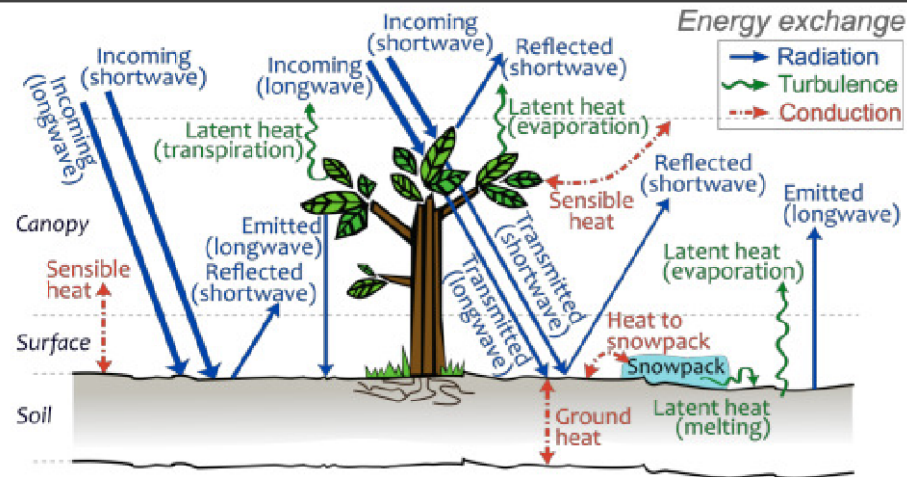
o Cambial damage and girdling;

SOIL SURFACE TEMPERATURE (SST)

Time-dose response model of seedling survival

- Data derived from historical experiments
- Seedlings exposed to varying temperatures, durations
- Bayesian survival model fit using these data
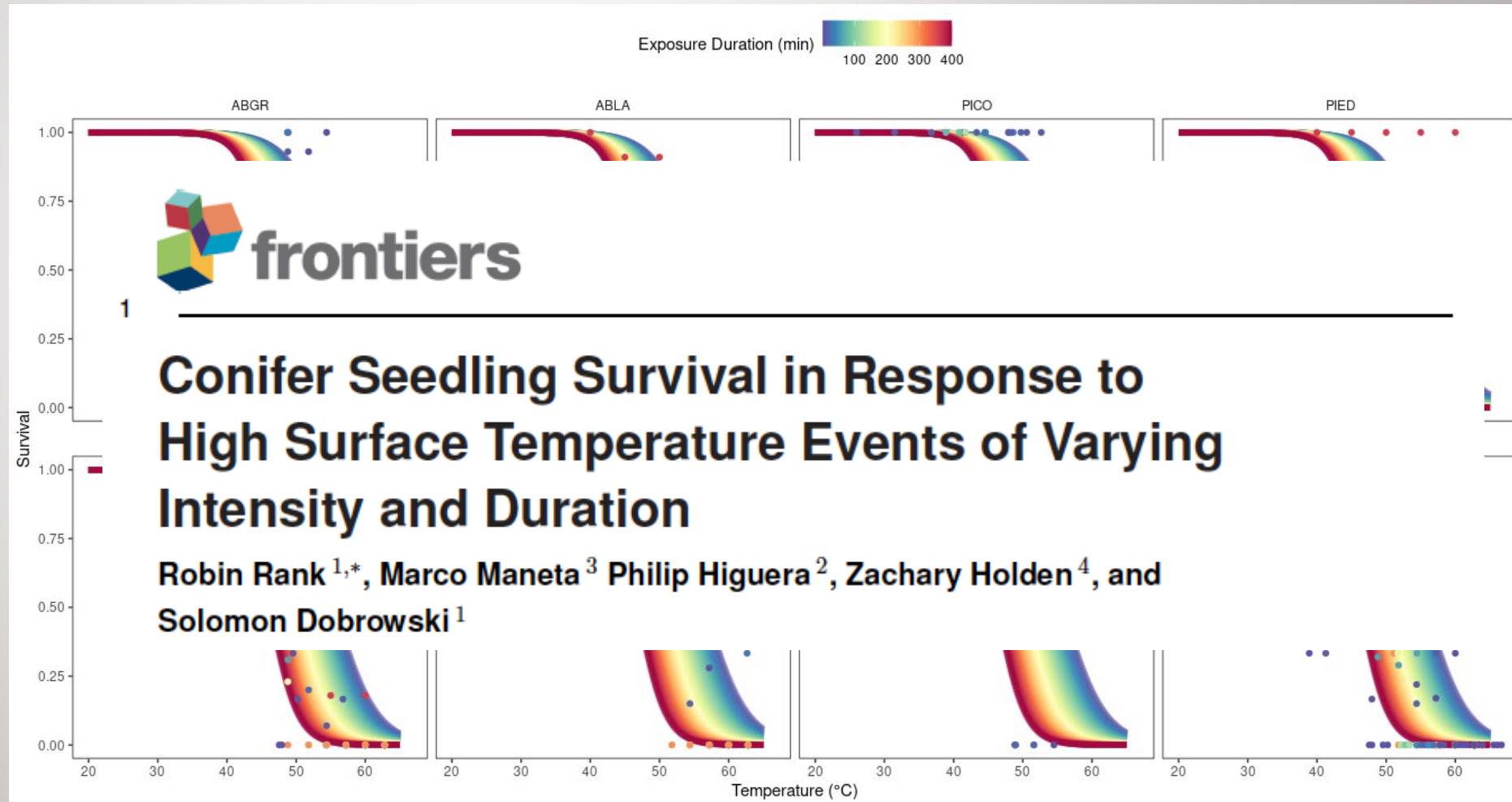
ECOHYDROLOGICAL MODELING (ECH$_2$O)

Modified from Taiz 2nd edition and Venturas et al. 2017

(Maneta and Silverman 2013, figure from Kuppel et al., 2018)

HIGH RESOLUTION WEATHER GRIDS ENABLE ASPECT-RESOLVING HYDROLOGIC MODELING

NASA A.35 WILDFIRE APPLICATIONS FUNDING (P.I. Z. HOLDEN

Historical daily (1979-present)

250 meter resolution grids

- Minimum temperature

- Maximum temperature

- Dewpoint temperature

- Minimum relative humidity

- Maximum relative humidity

- Shortwave radiation
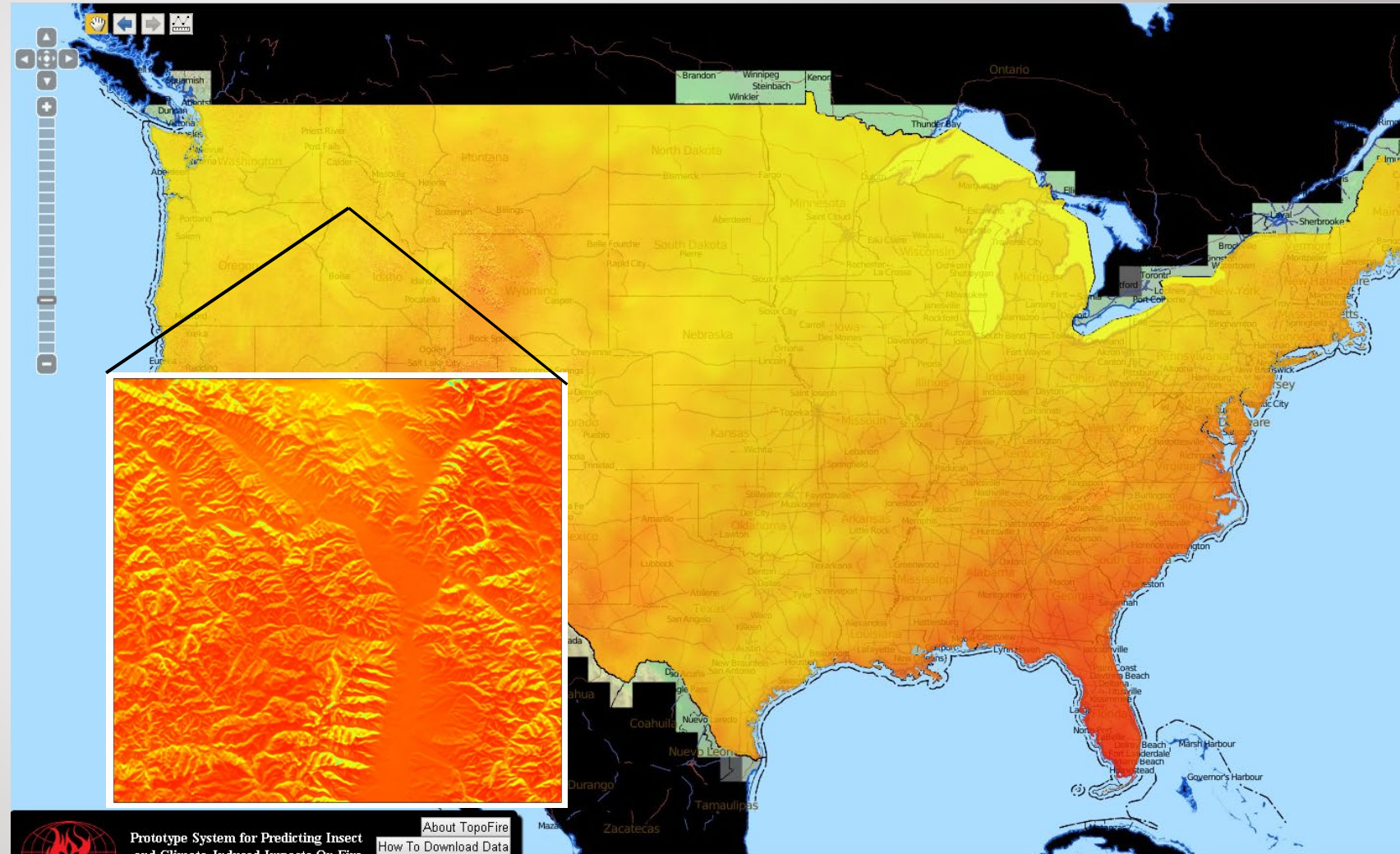
Prototype System for Predicting Insect and Climate-Induced Impacts On Fire Hazard in Complex Terrain
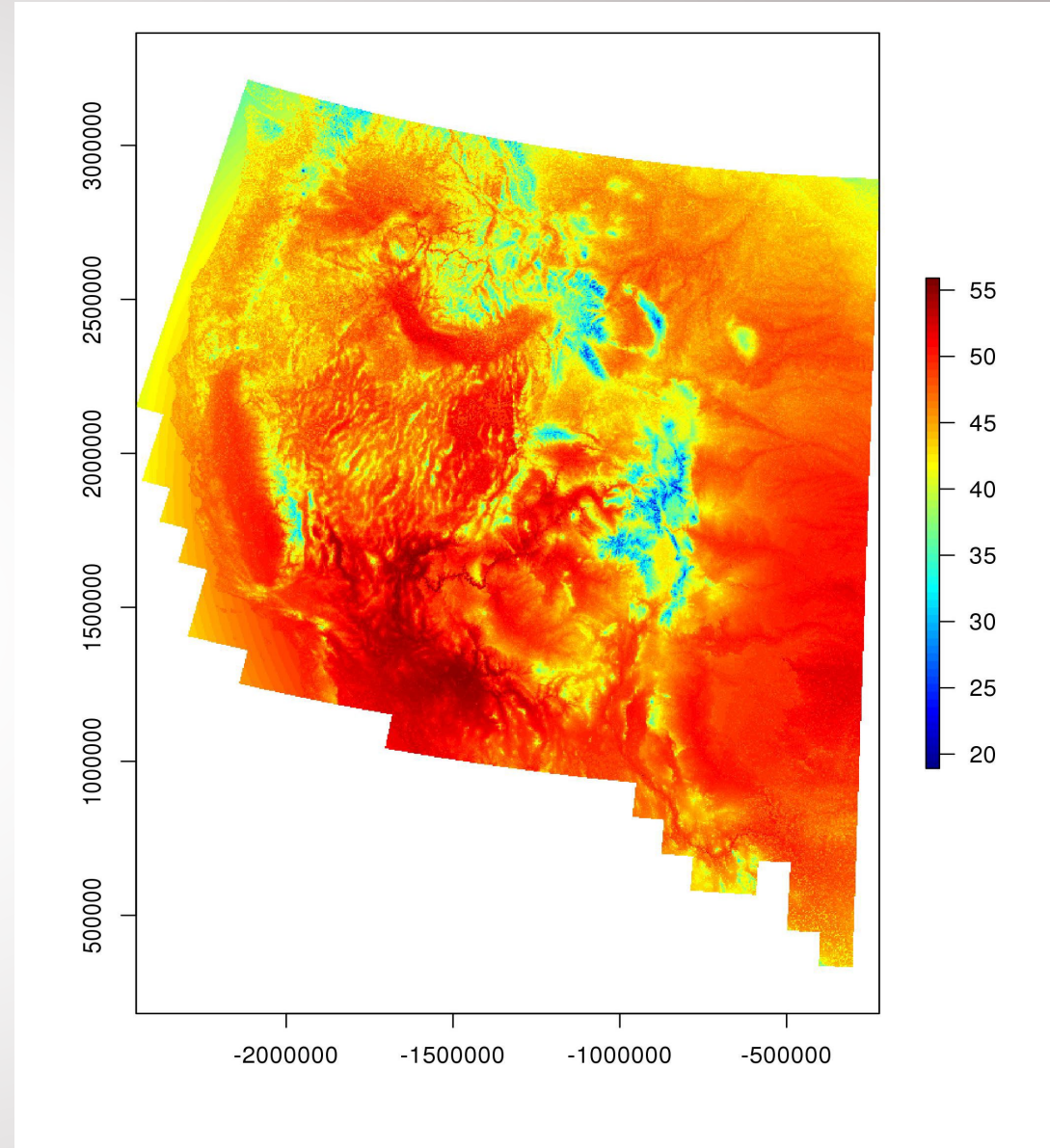
About TopoFire
How To Download Data
Publications
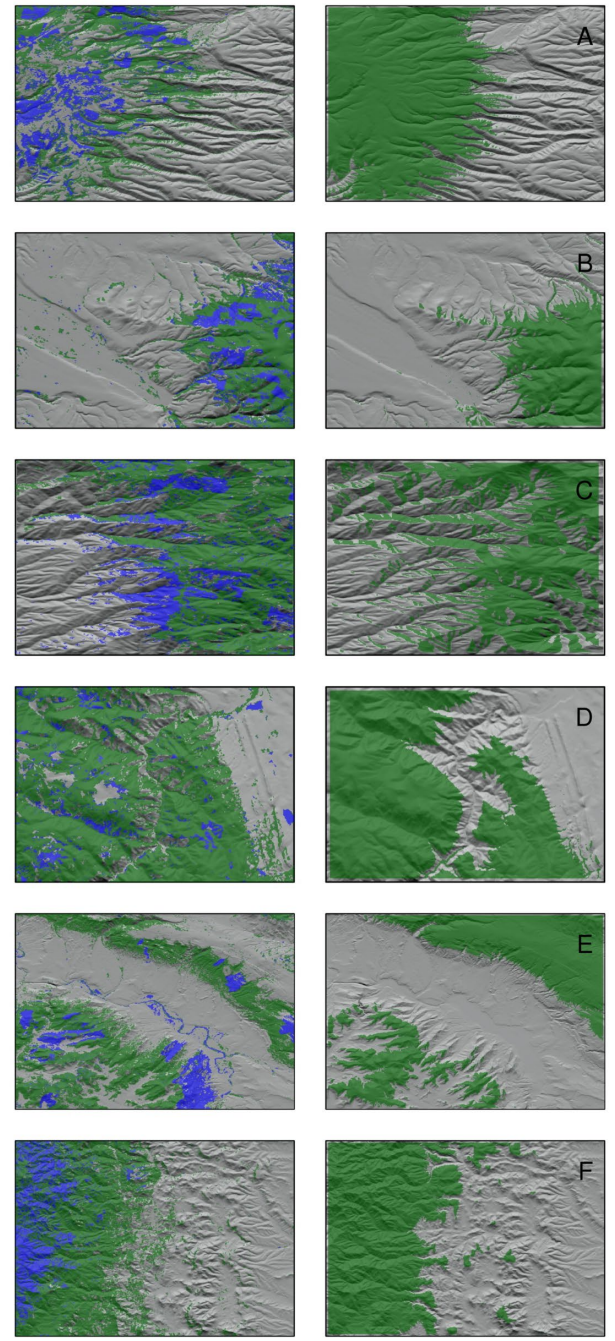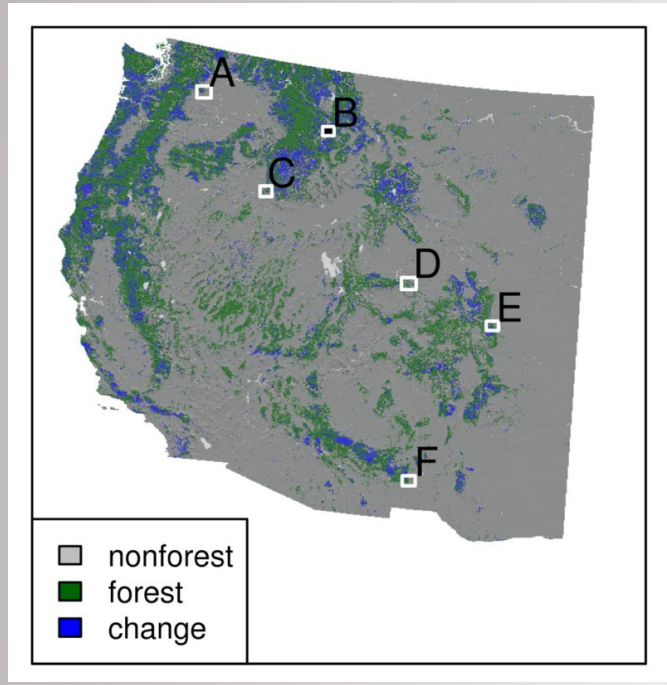
TOPOFIRE

ECOHYDROLOGICAL MODELING
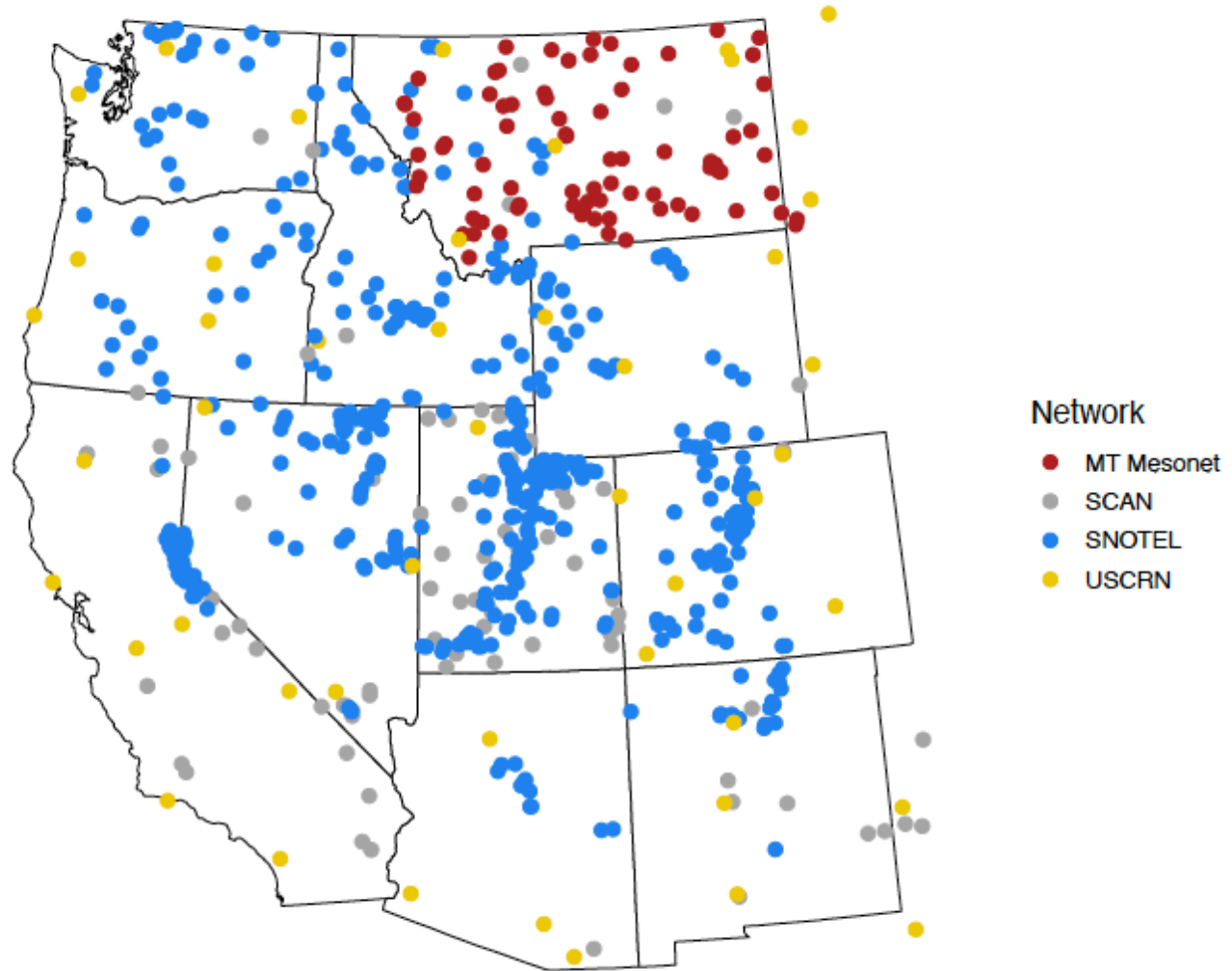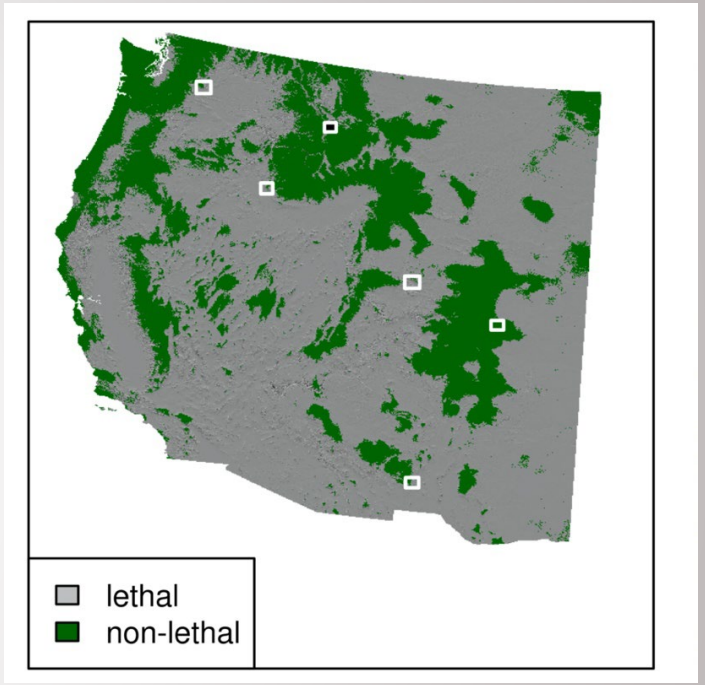
POTENTIAL SOIL SURFACE TEMPERATURE (P-SST)

o Maximum SST in absence of overstory
o Simulated 3 hourly timestep between 1980-2017 for a bed of 2 inch ponderosa pine seedlings
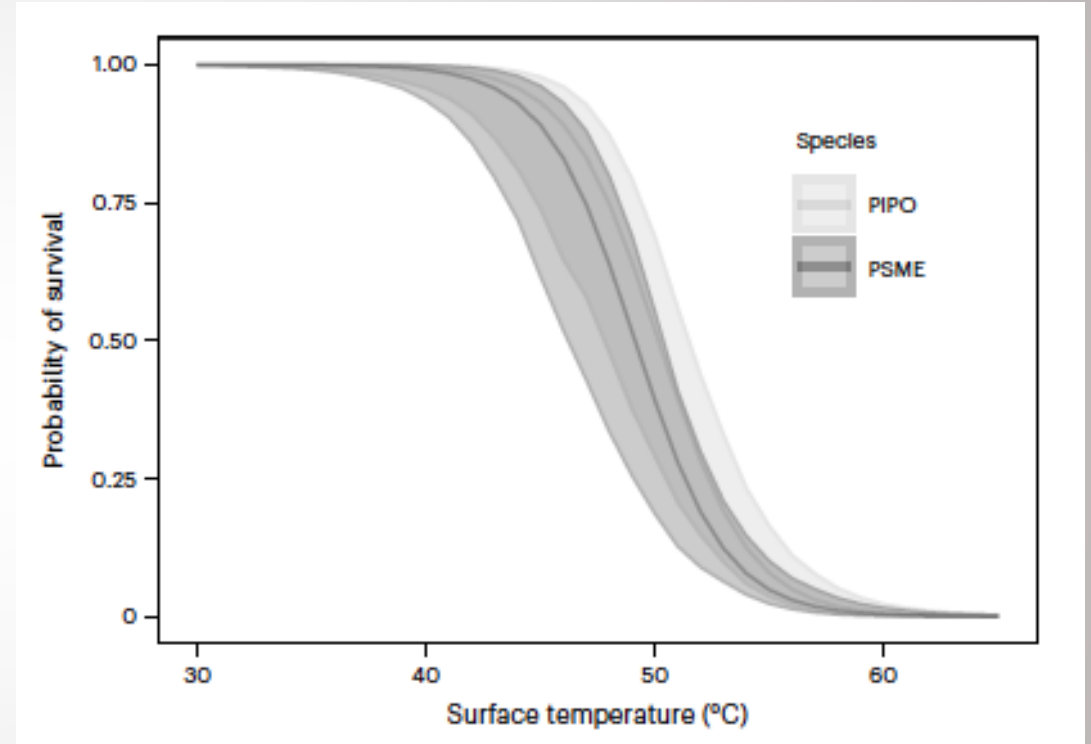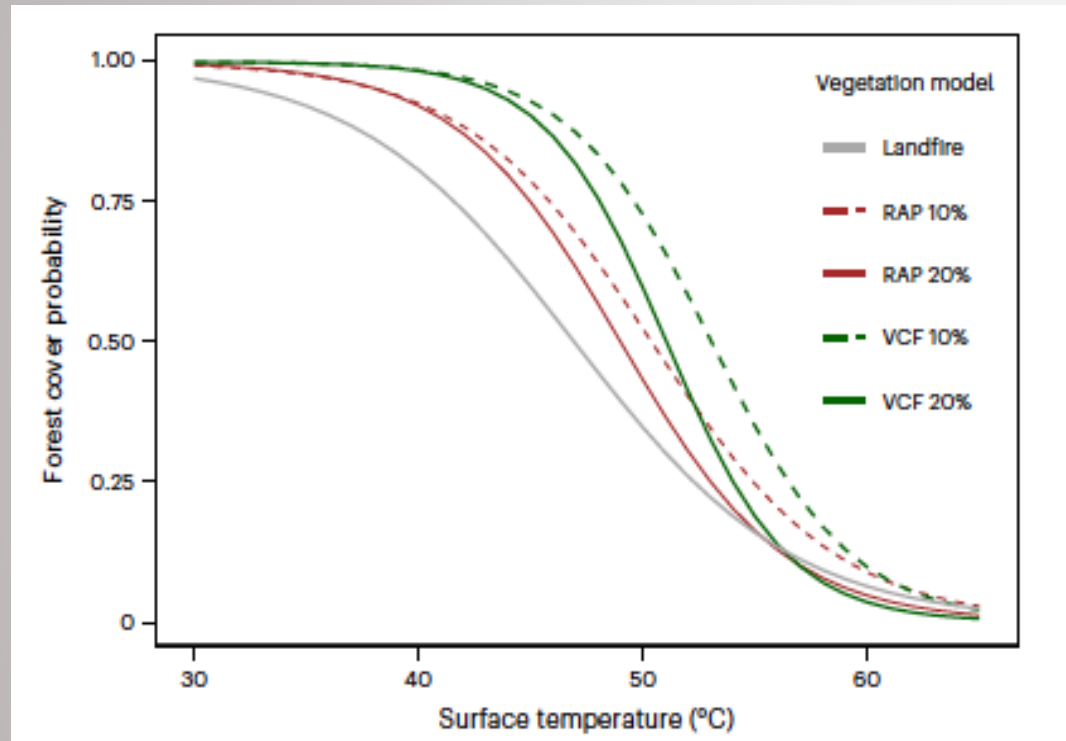o Future (2050) simulations for 5 GCMs

Observed

Predicted

nonforest
forest
change

lethal
non-lethal

SOIL SURFACE TEMPERATURE (SST)

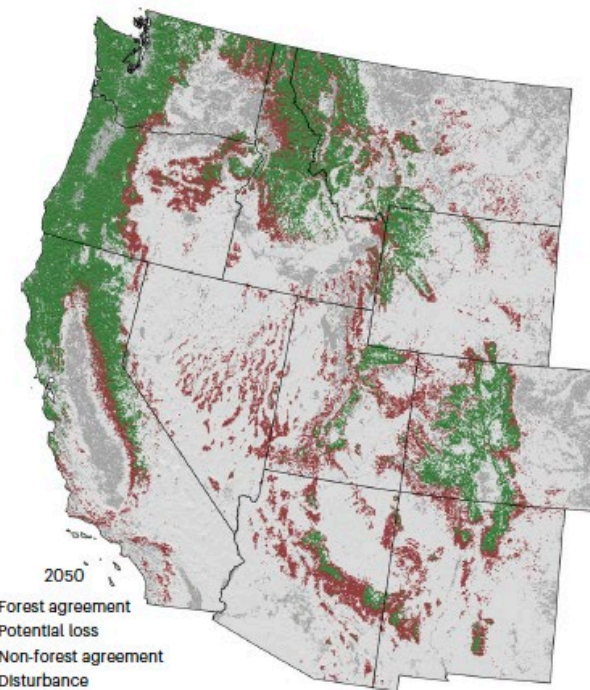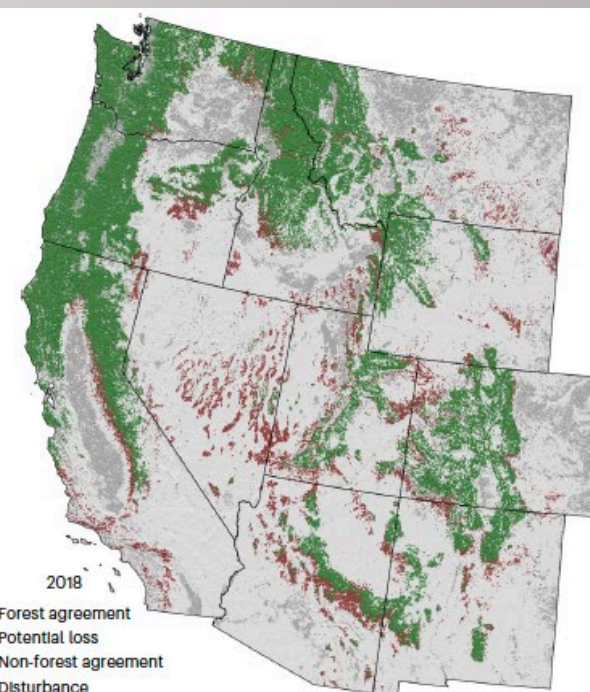# Low-elevation forest extent in the western United States constrained by soil surface temperatures

Zachary A. Holden [1] ✉, Solomon Z. Dobrowski [2], Alan Swanson [3], Zachary Hoylman [2,4], Drew Lyons [5], Allen Warren [3] & Marco Maneta [6]

Climate change and disturbance threaten forested ecosystems across the globe. Our ability to predict the future distribution of forests requires understanding the limiting factors for regeneration. Forest canopies buffer against near-surface air temperature and vapour pressure deficit extremes,

2018
- Forest agreement
- Potential loss
- Non-forest agreement
- Disturbance

2050
- Forest agreement
- Potential loss
- Non-forest agreement
- Disturbance

SEED SOURCES

- Combine 30m GEDI lidar height data with 30m RAP forest cover

GEDI lidar canopy height (meters)
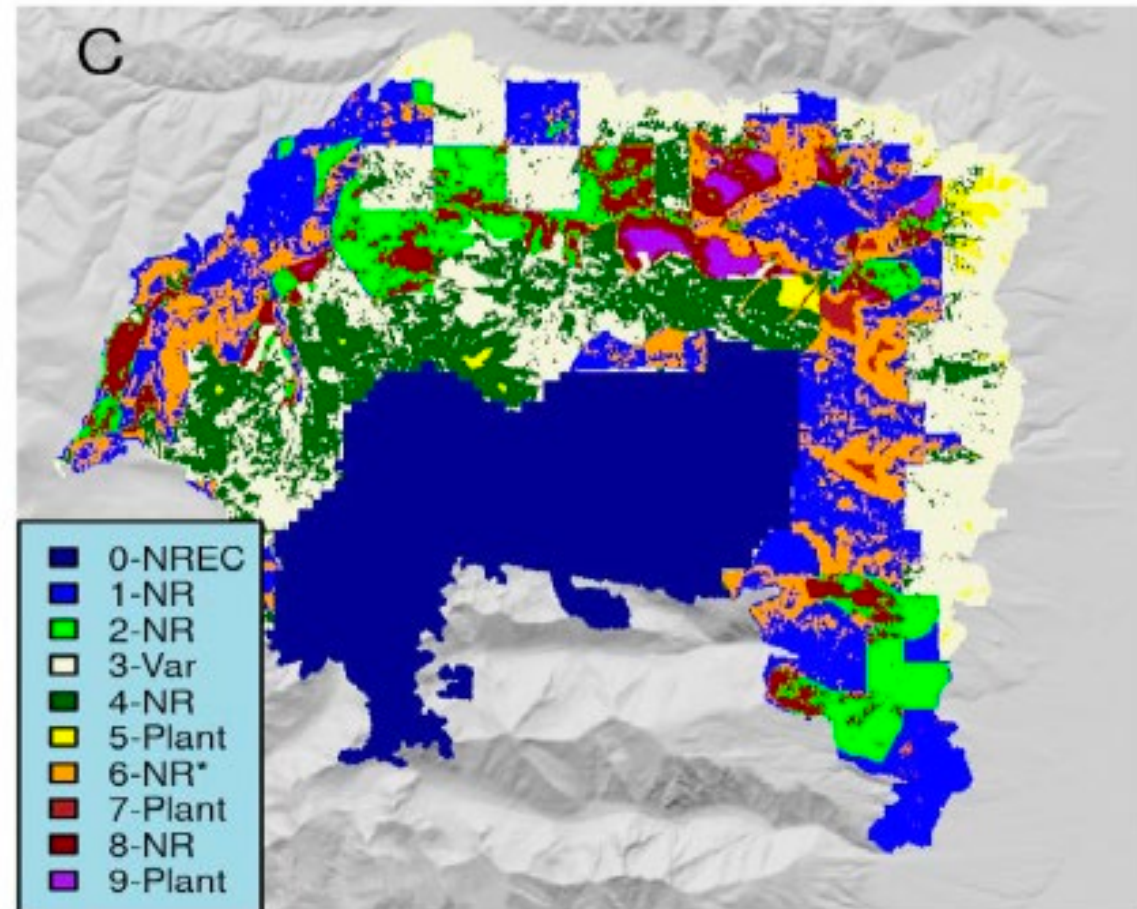
distance to seed source
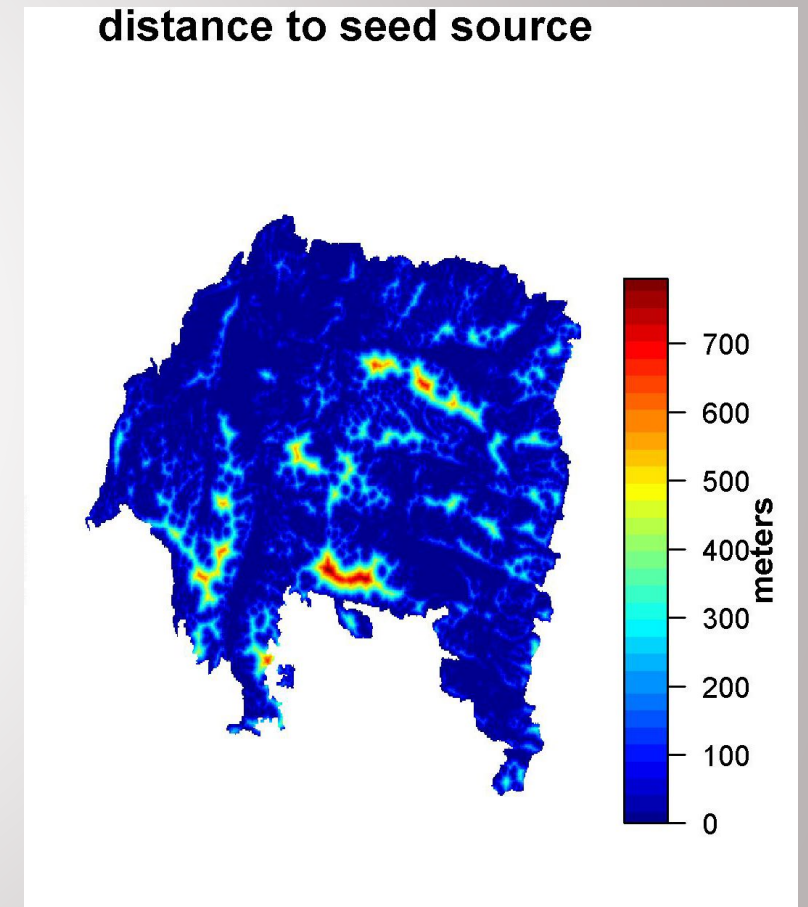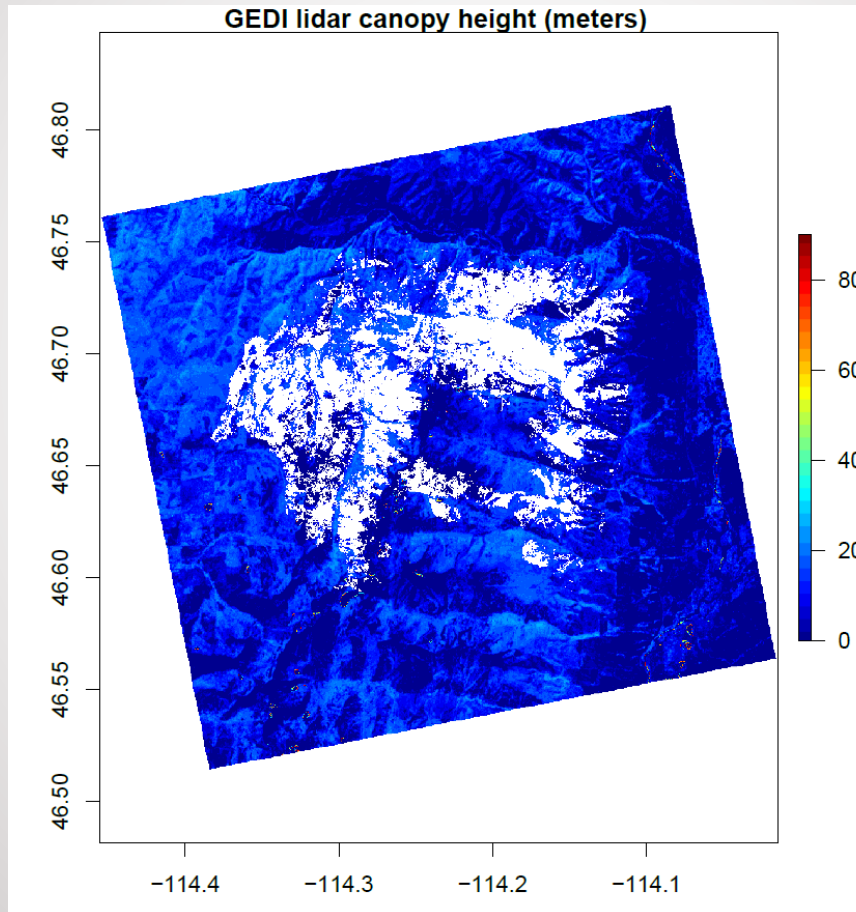
WHAT LIMITS REFORESTATION?

Administrative constraints
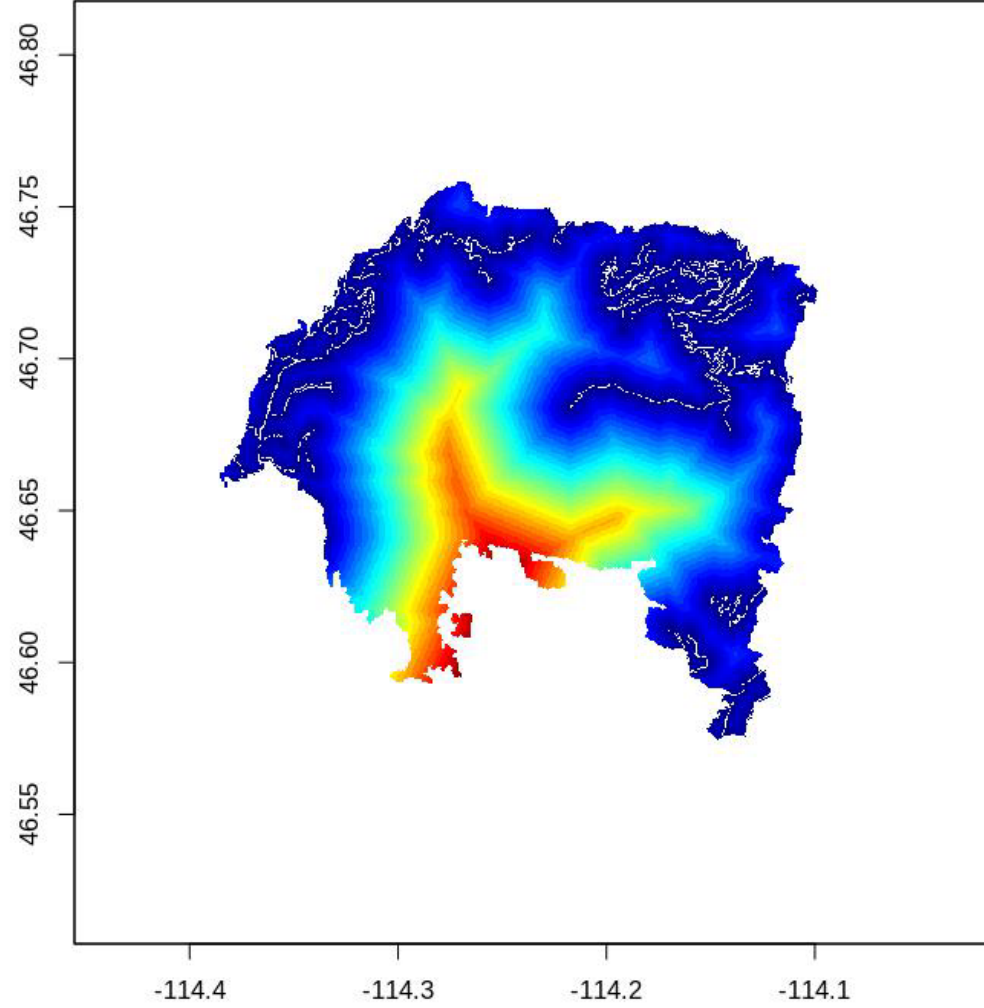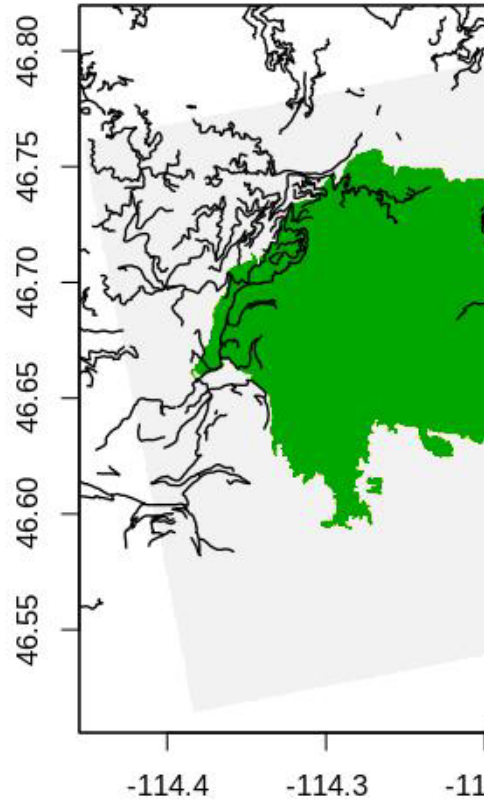Resources (cost vs benefit)

USFS ADMINISTRATIVE PRIORITIES

- FACTS database: Forest Activity Tracking System

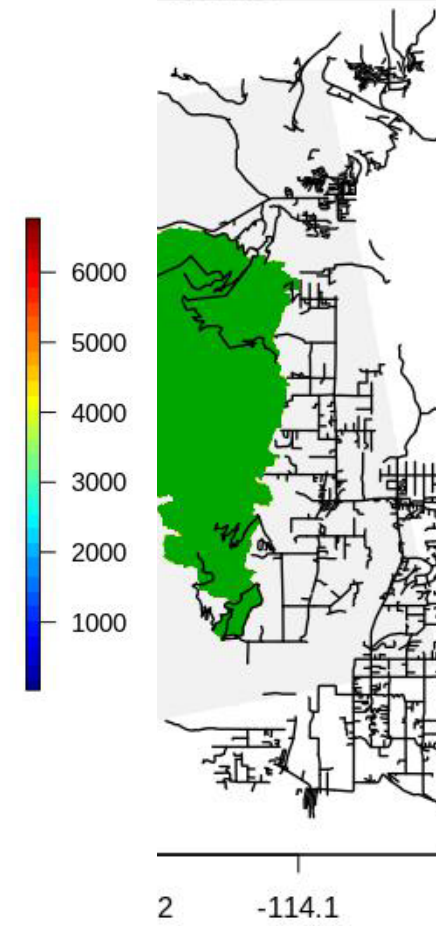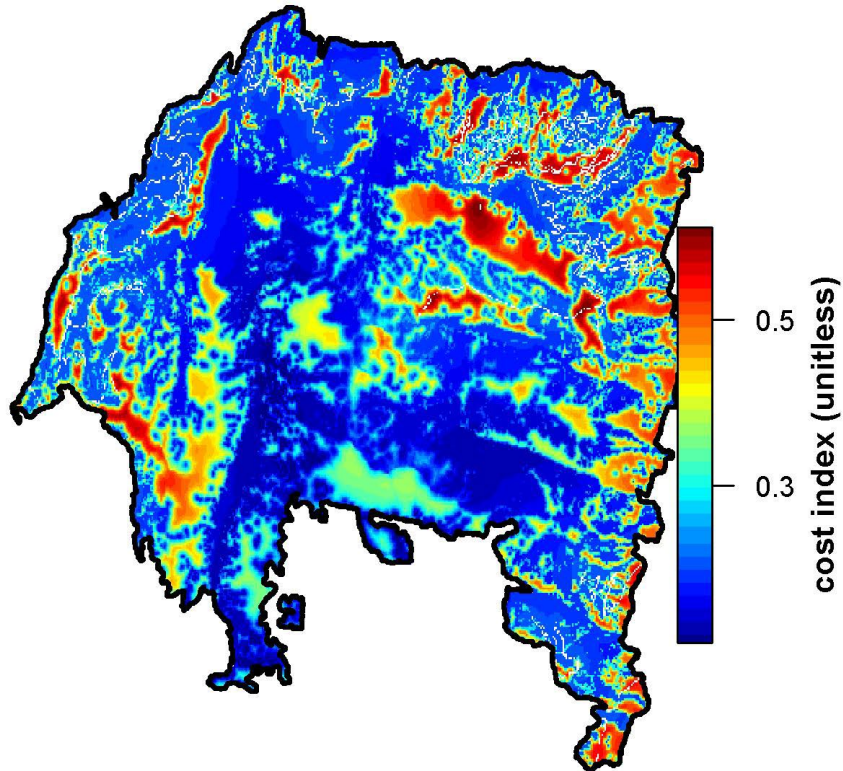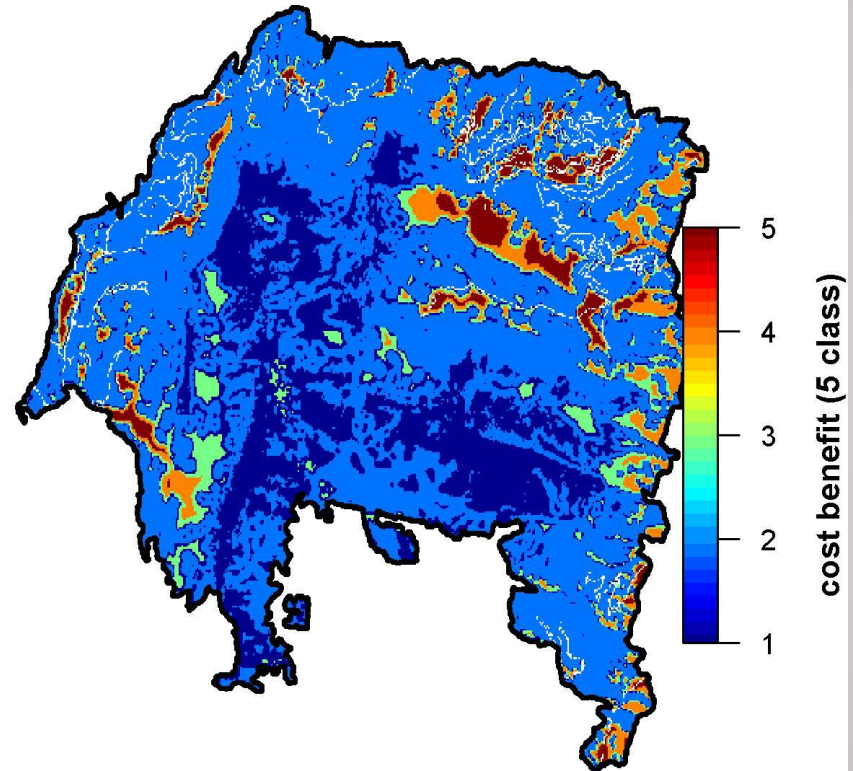- Tabular and spatial tracking of all activities on USFS lands

COSTS

COST/BENEFIT

HTTPS://ORTHANC.DBS.UMT.EDU/REGENMAPPER

SPATIAL OPTIMIZATION (IN THE WORKS)
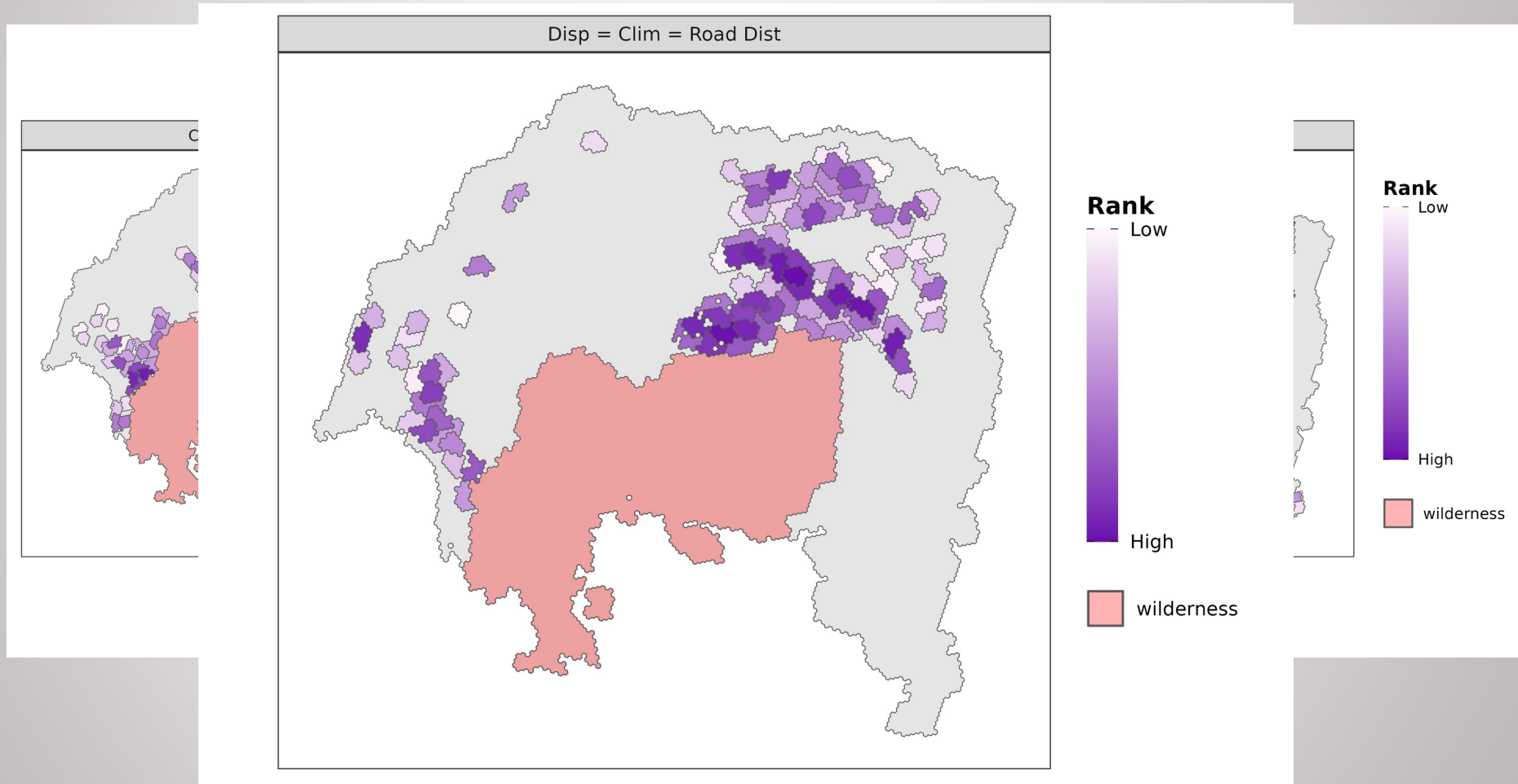
OPTIMAL PLANTING?
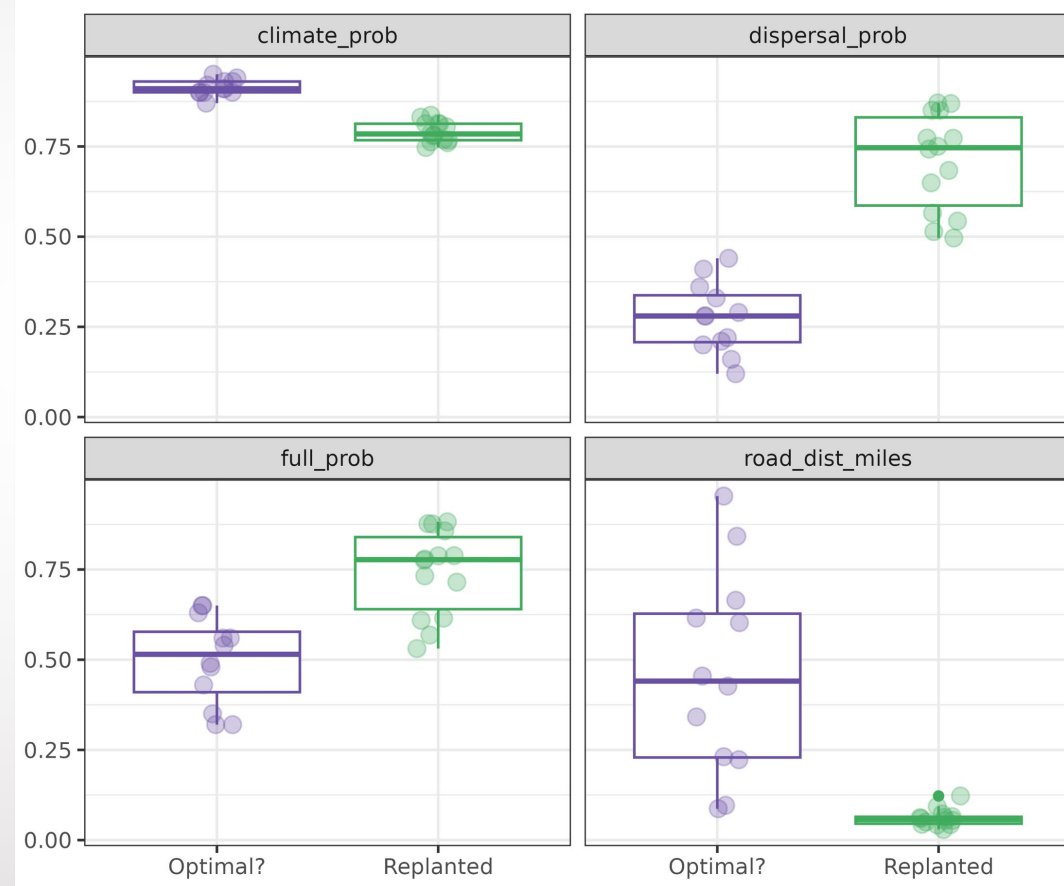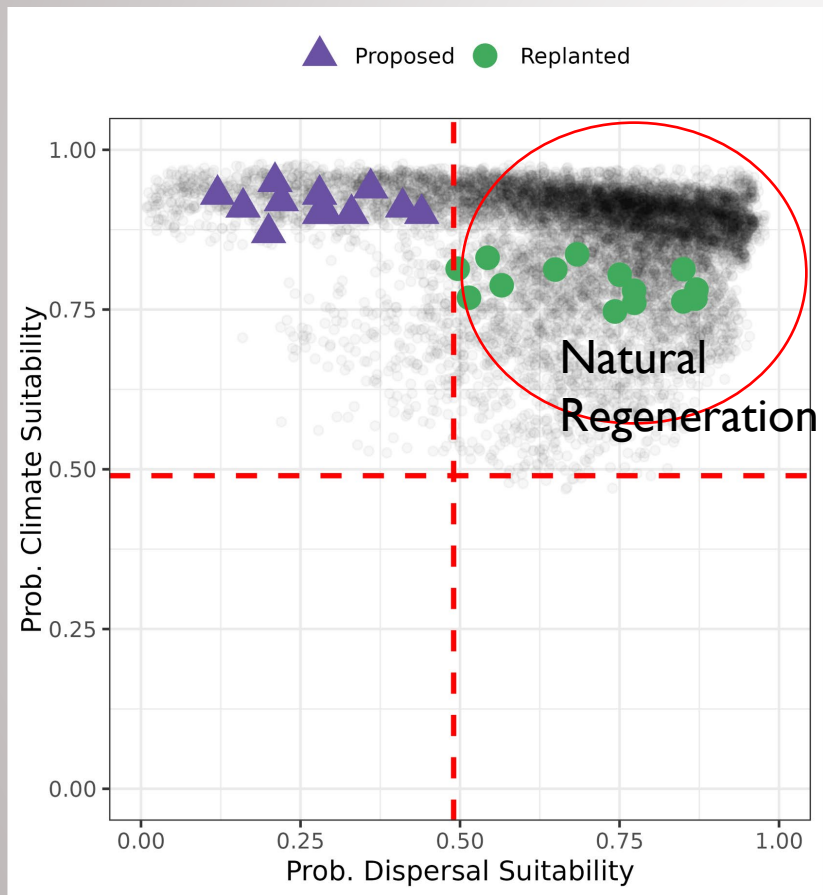
THANK YOU
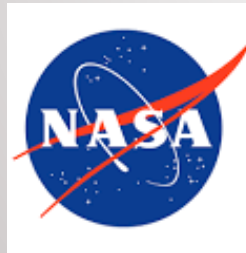
POTENTIAL SOIL SURFACE TEMPERATURE (P-SST)

Comparisons against MODIS LST and MODIS VCF data
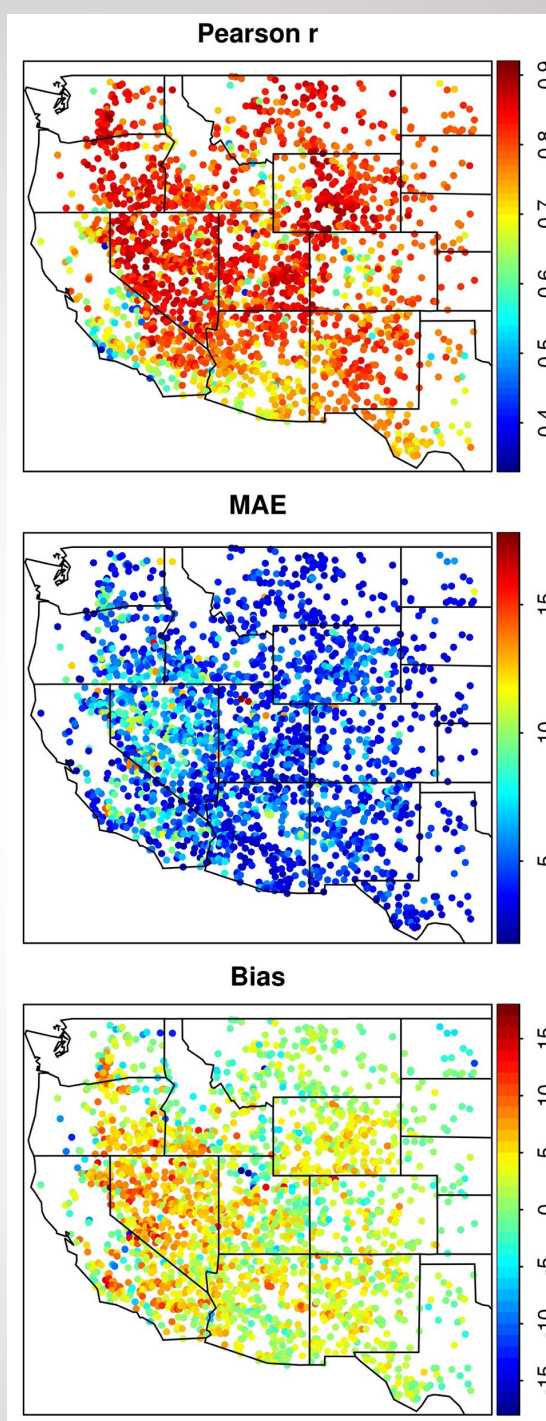
REGENMAPPER WORKFLOW OVERVIEW