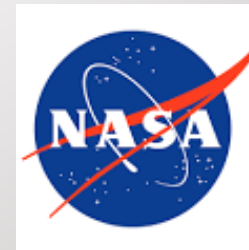


DECISION SUPPORT FOR POST-FIRE FOREST RESTORATION

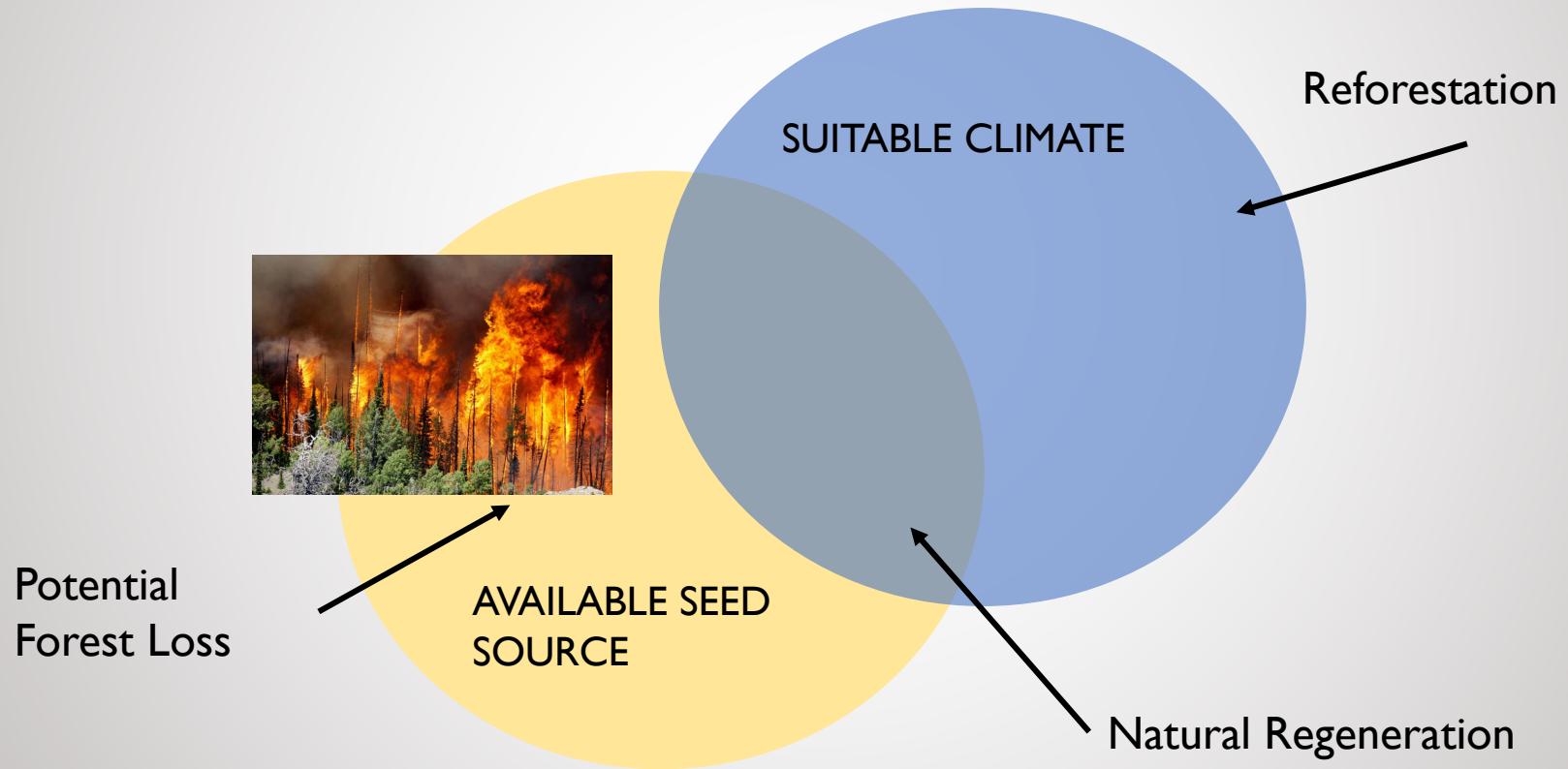
Solomon Dobrowski - University of Montana,
Zack Holden – USFS Region I
Marco Maneta – University of Montana



W.A. FRANKE
COLLEGE OF FORESTRY
AND CONSERVATION



FOREST REGENERATION



THE TASK

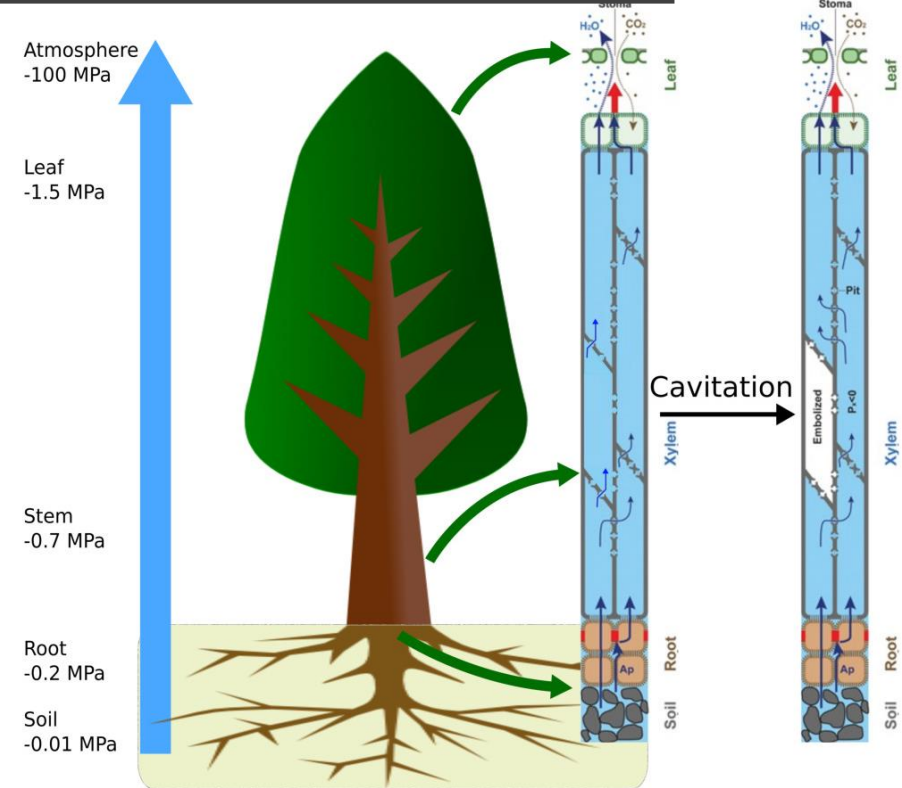
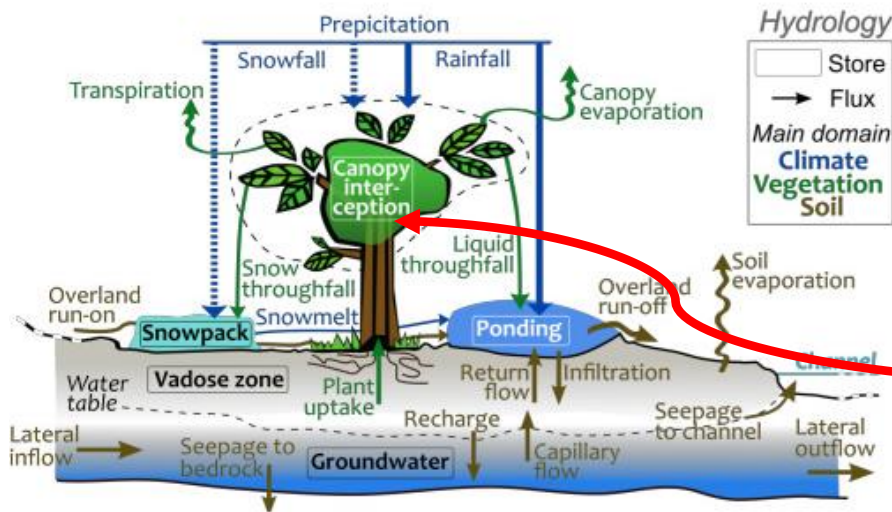
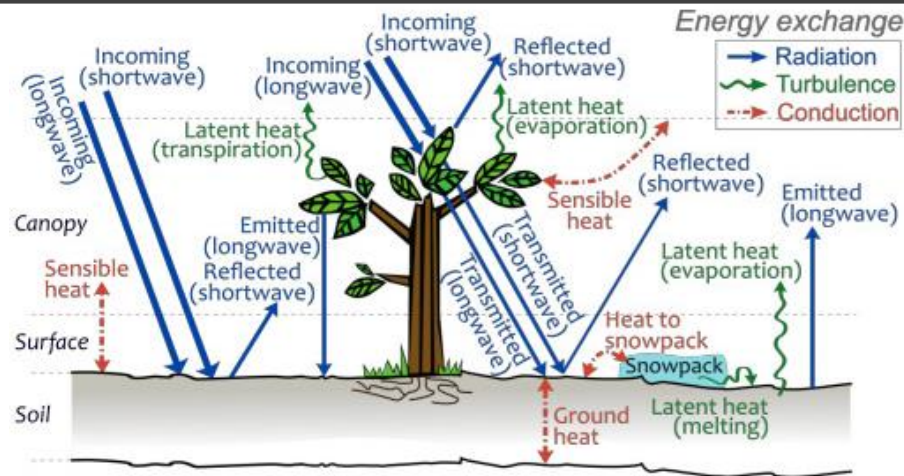
Develop a suite of geo-spatial products to inform reforestation efforts and a decision support tool for the USFS

Leverage these products to support SDG 15.2.1 and 15.1.1 indicators

WHAT LIMITS REGENERATION?

Heat Stress
Drought Stress
Available Seeds

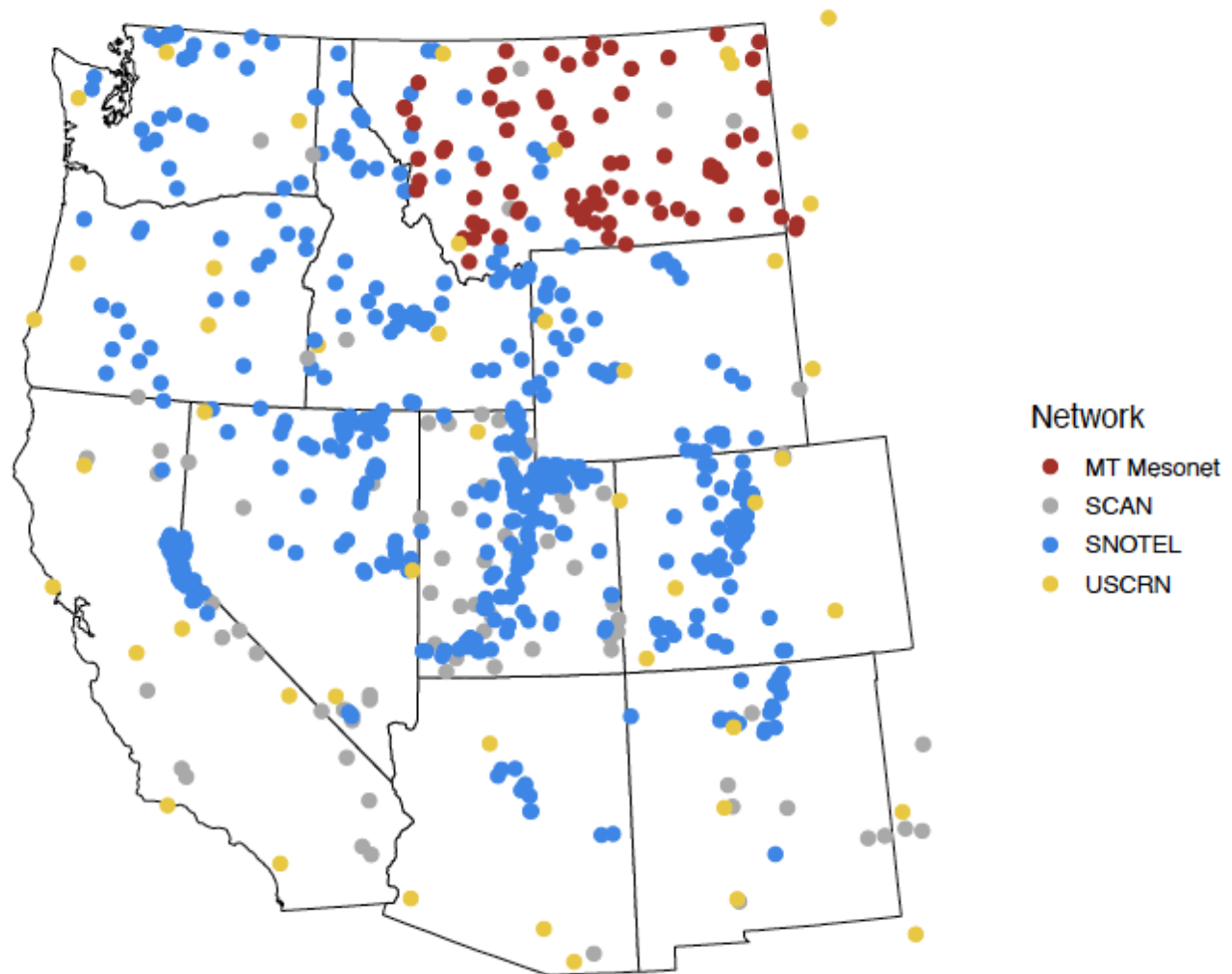
ECOHYDROLOGICAL MODEL (ECH₂O)



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

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

ECOHYDROLOGICAL MODELING



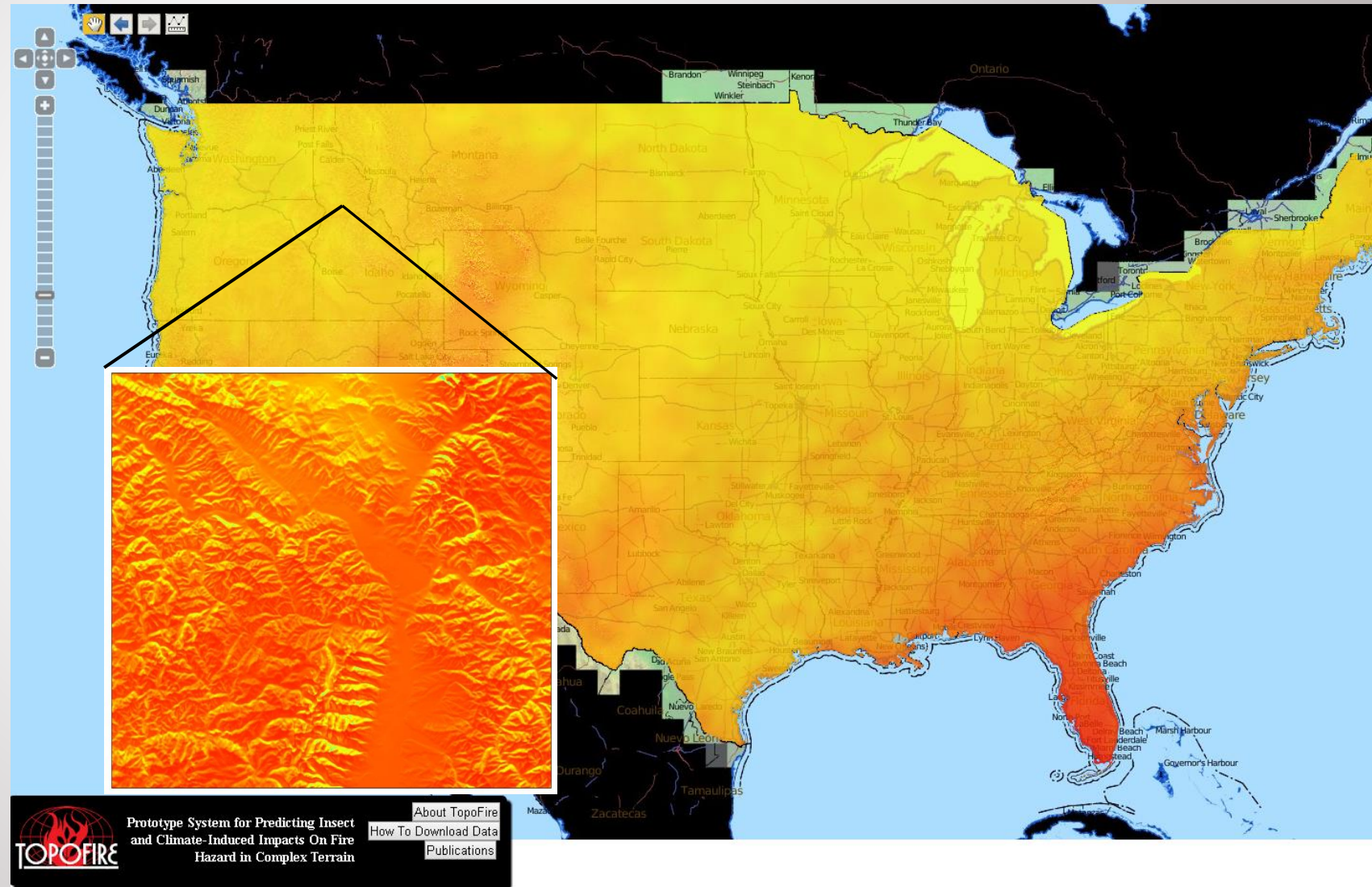
HIGH RESOLUTION WEATHER GRIDS ENABLE ASPECT-RESOLVING HYDROLOGIC MODELING

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



LETHAL SURFACE TEMPERATURES

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



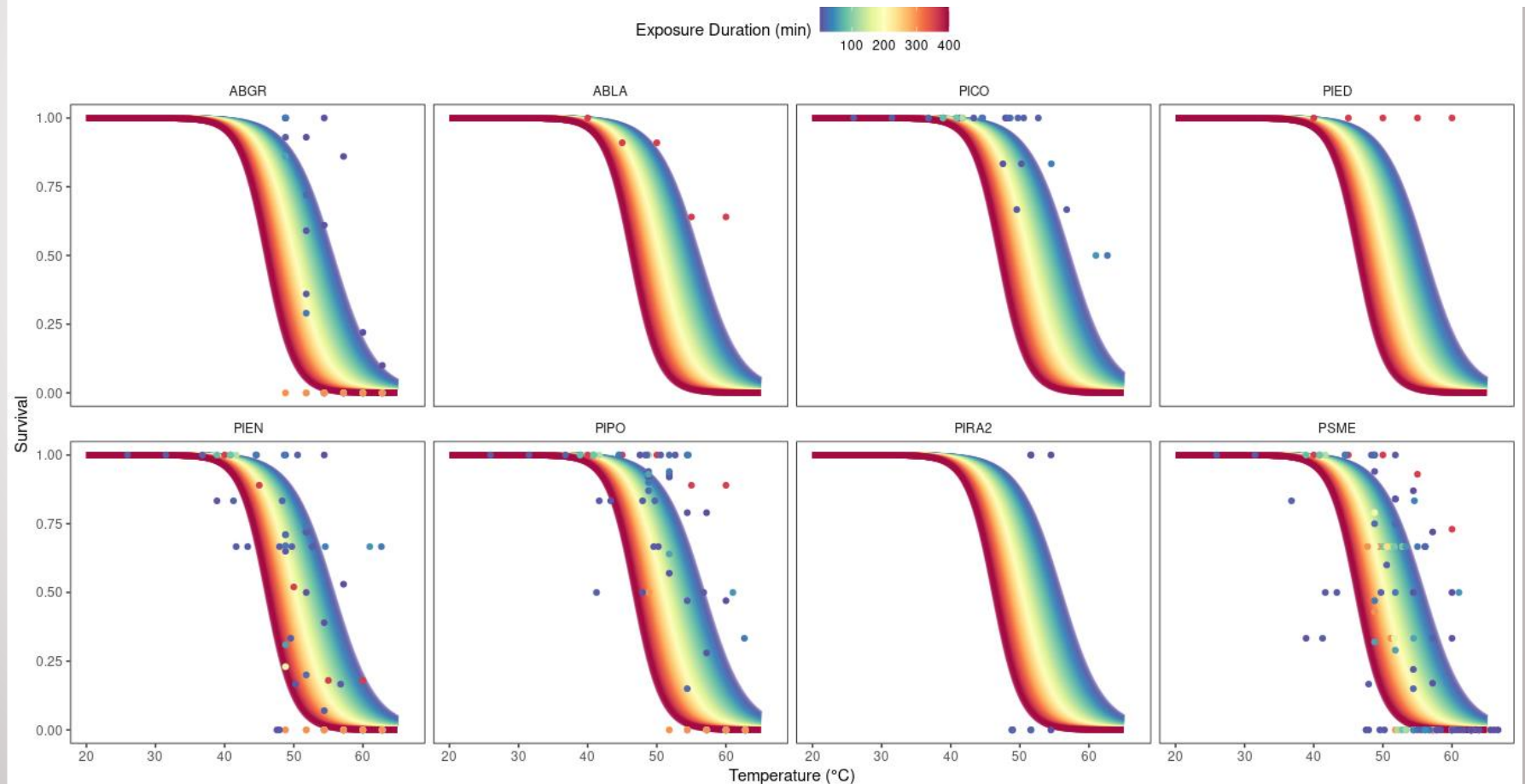
SOIL SURFACE TEMPERATURE (SST)

Conifer Seedling Survival in Response to High Surface Temperature Events of Varying Intensity and Duration

Robin Rank^{1,*}, Marco Maneta³, Philip Higuera², Zachary Holden⁴, and Solomon Dobrowski¹

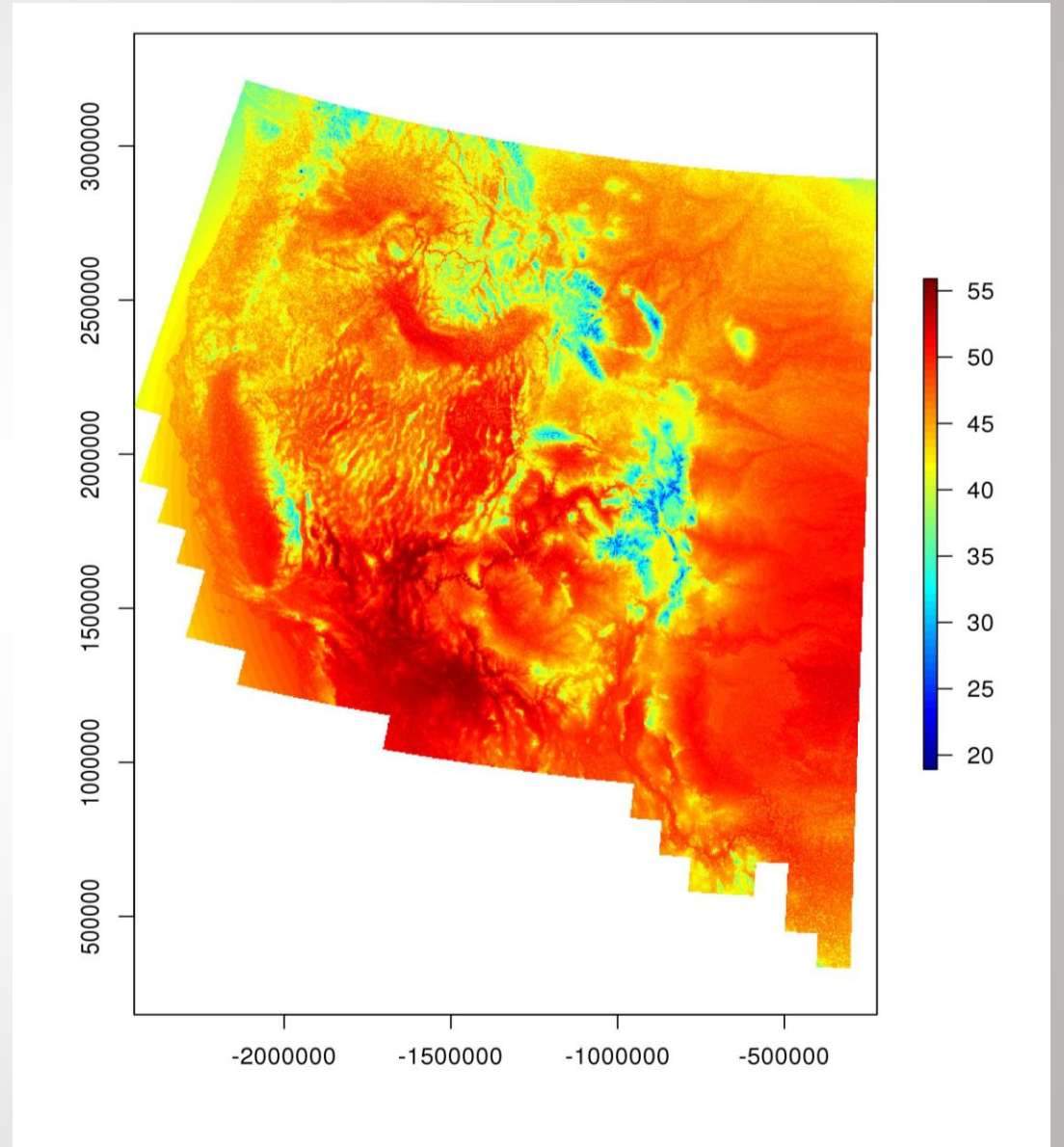
Time-dose response model of seedling survival

- Data derived from historical experiments
- Seedlings exposed to varying temperatures, durations



POTENTIAL SOIL SURFACE TEMPERATURE (P-SST)

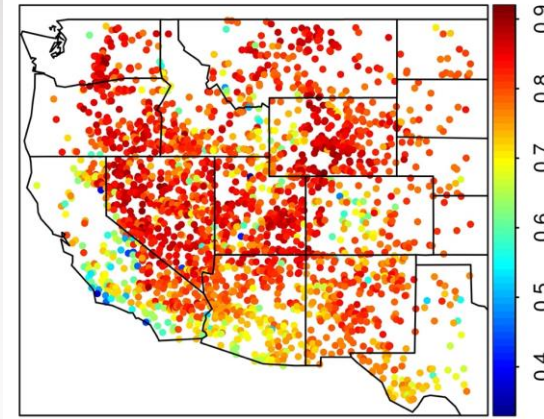
- Maximum SST in absence of overstory
- Simulated 3 hourly timestep between 1980-2017 for a bed of 2 inch ponderosa pine seedlings
- Future (2050) simulations for 3 GCMs in progress (currently running on the NASA Pleiades cluster)



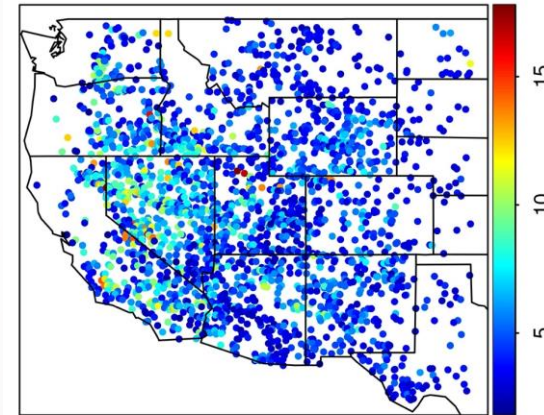
POTENTIAL SOIL SURFACE TEMPERATURE (P-SST)

Comparisons against MODIS LST

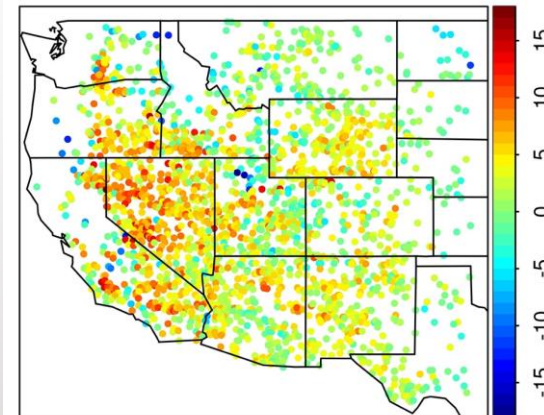
Pearson r



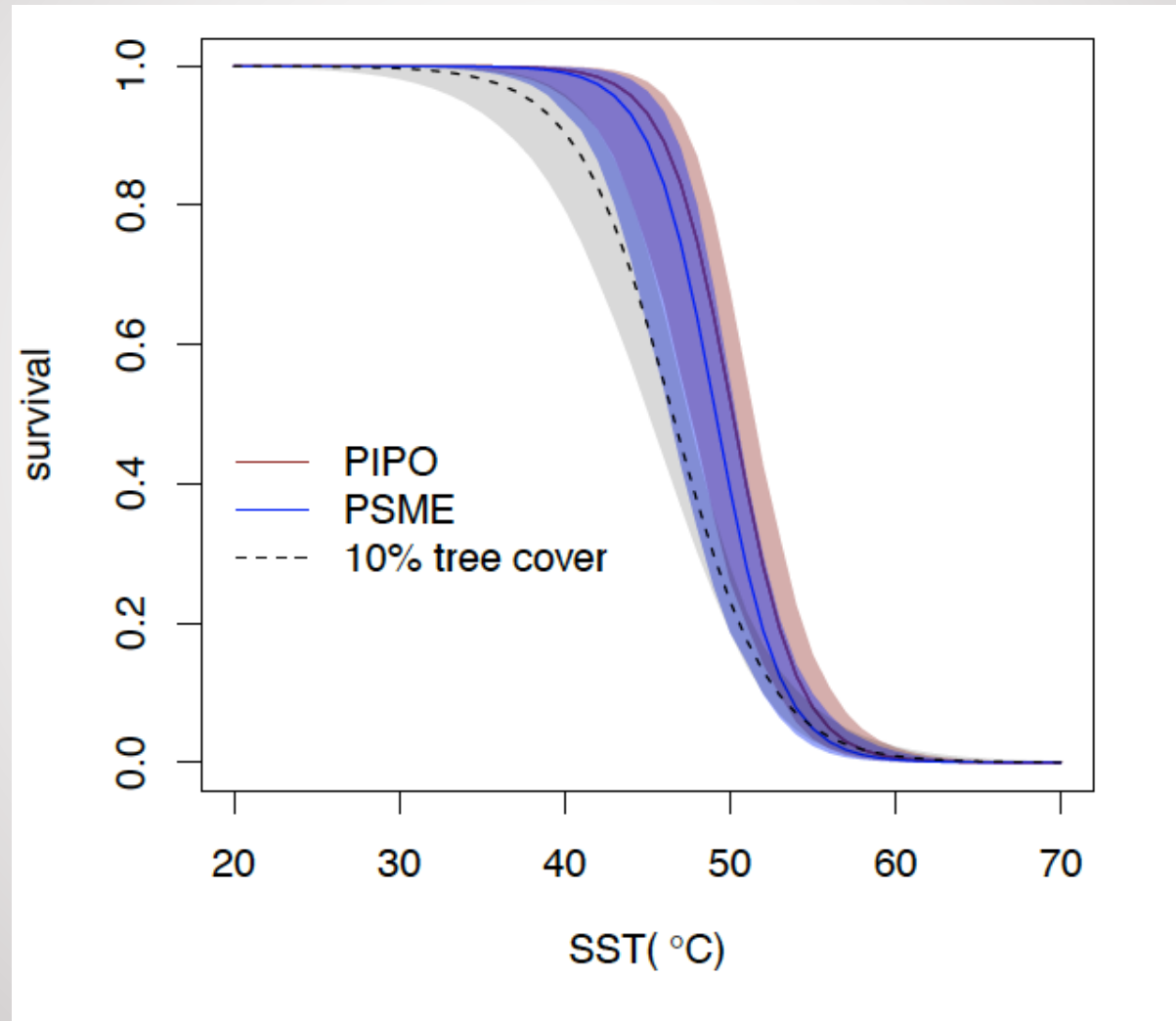
MAE

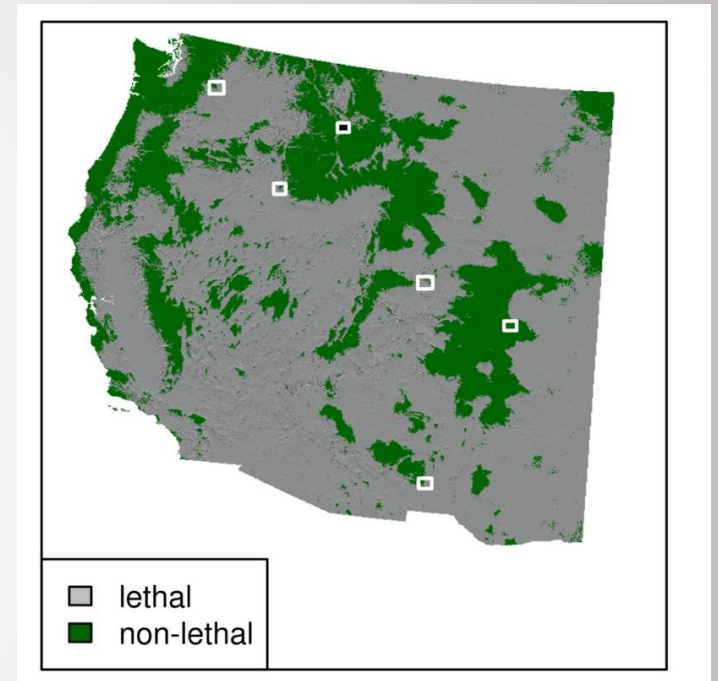
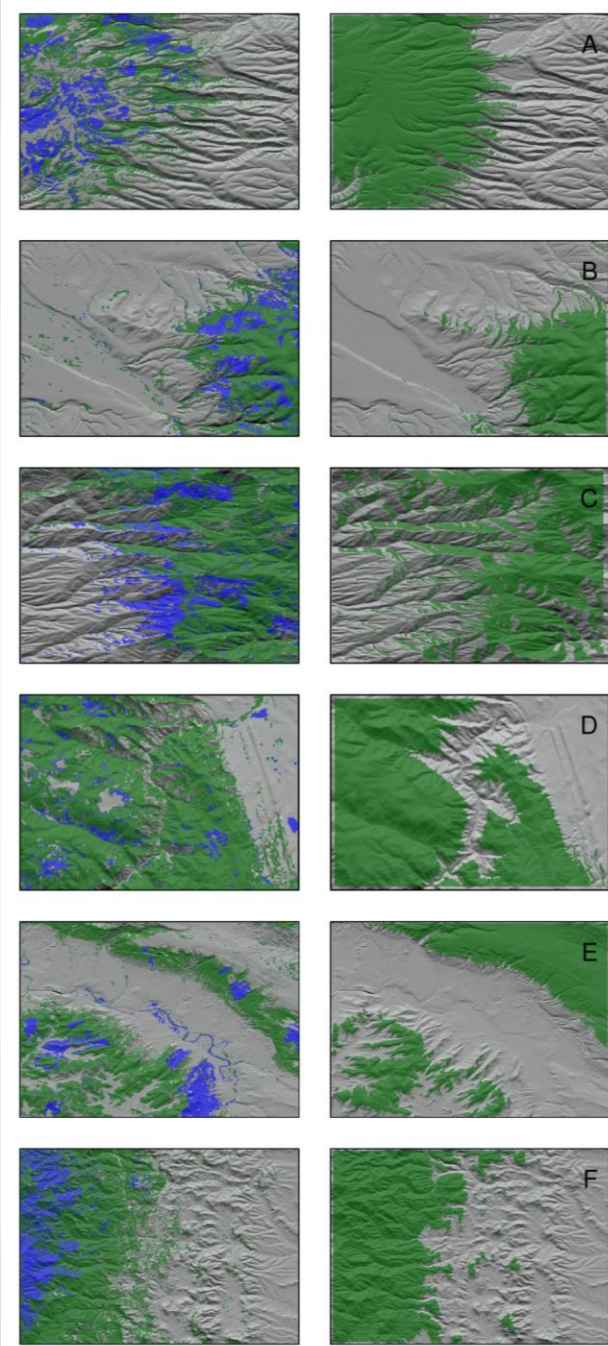
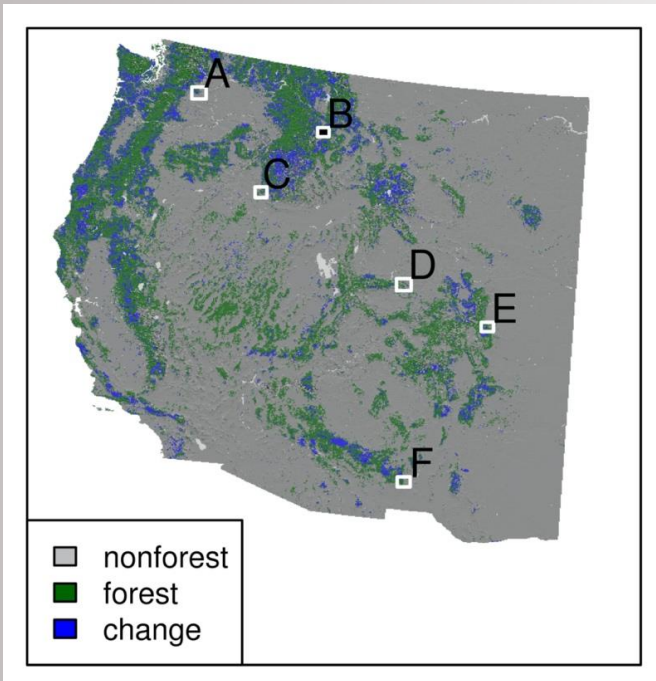


Bias



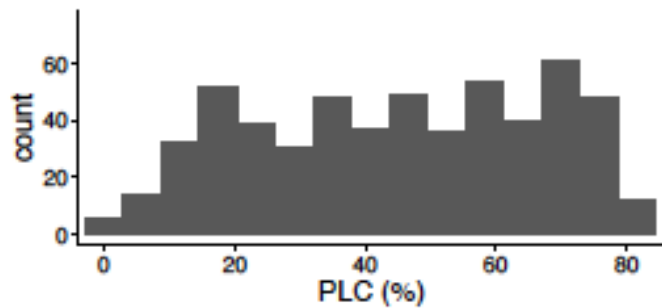
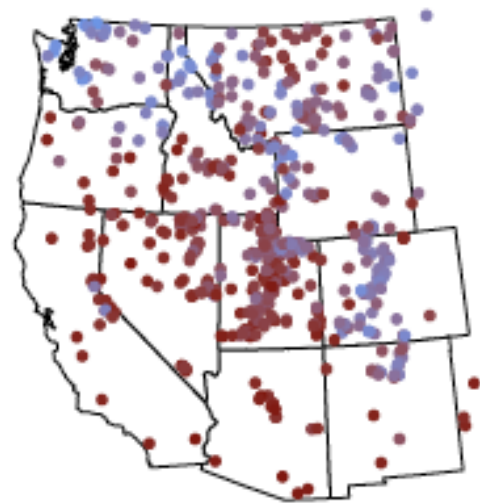
SOIL SURFACE TEMPERATURE (SST)



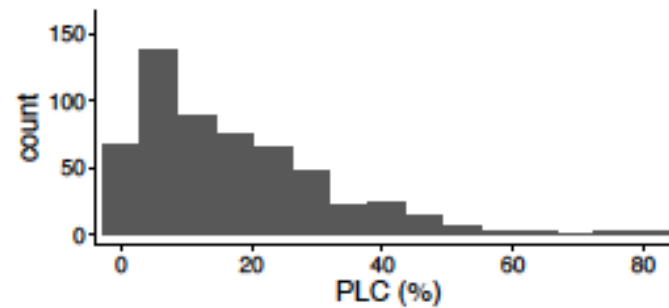
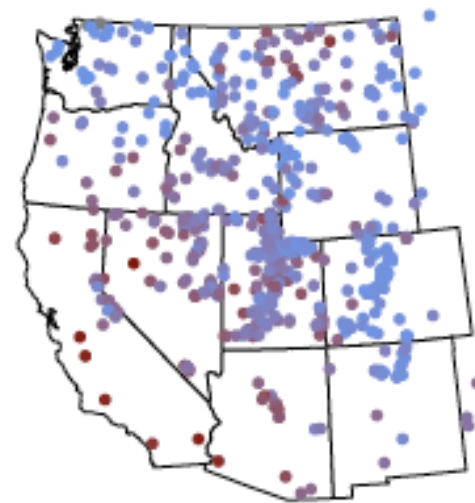
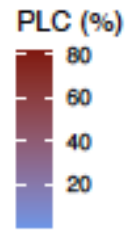


DROUGHT STRESS

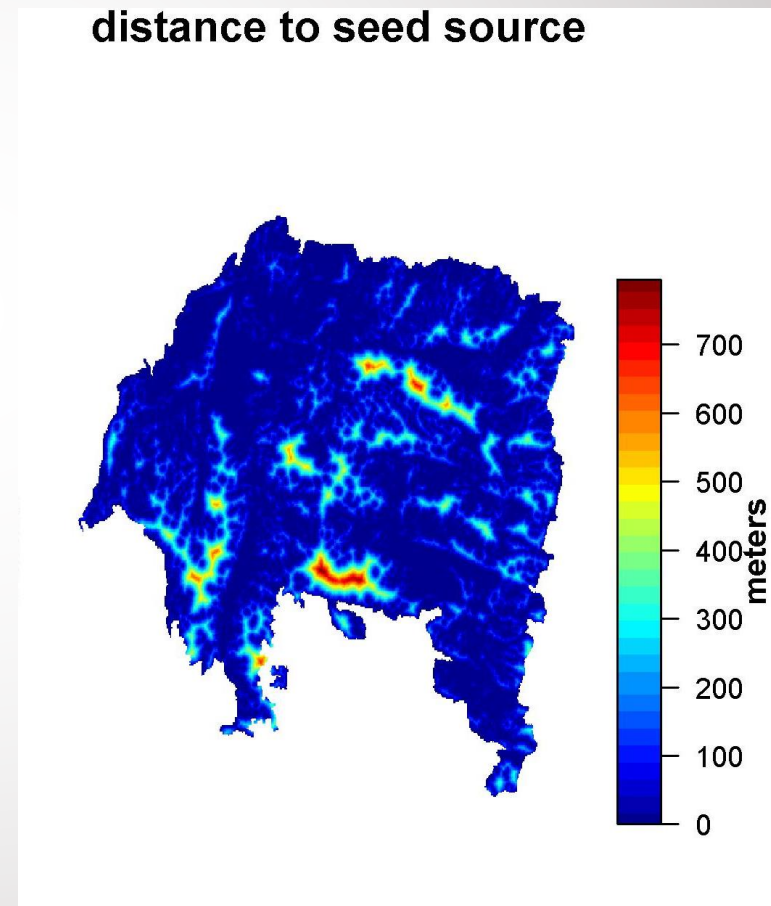
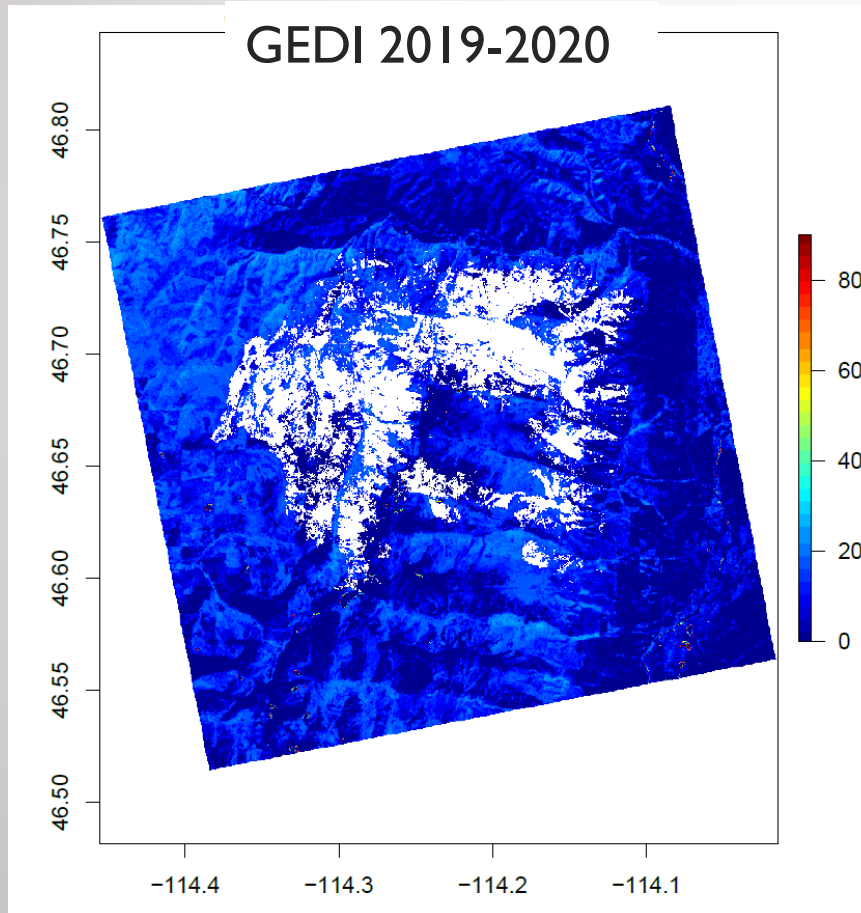
a) Average summer max PLC





b) Average summer PLC



SEED SOURCES



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


Job Queue Logout  Computational Ecology Lab
Regeneration Mapper  About

Choose State/Province

Show 50 entries Search:

gid	fire_id	fire_name	year	start_month
14534	WA4671511999020170720	400	2017	7
14535	ID4235211343720170730	COE	2017	7
14537	CA4078912330120030914	LOMA	2003	9
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14541	CA3435111888220090922	GUIBERSON	2009	9
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14543	OK3440809767720060301	NORTH LOCO	2006	3
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14550	WA4650111992720020929	HWY 24	2002	9
14552	OR4413711826919940828	LITTLE MALHEUR COMPLEX (POWDER)	1994	8
14554	OR4360412179420030628	DAVIS	2003	6
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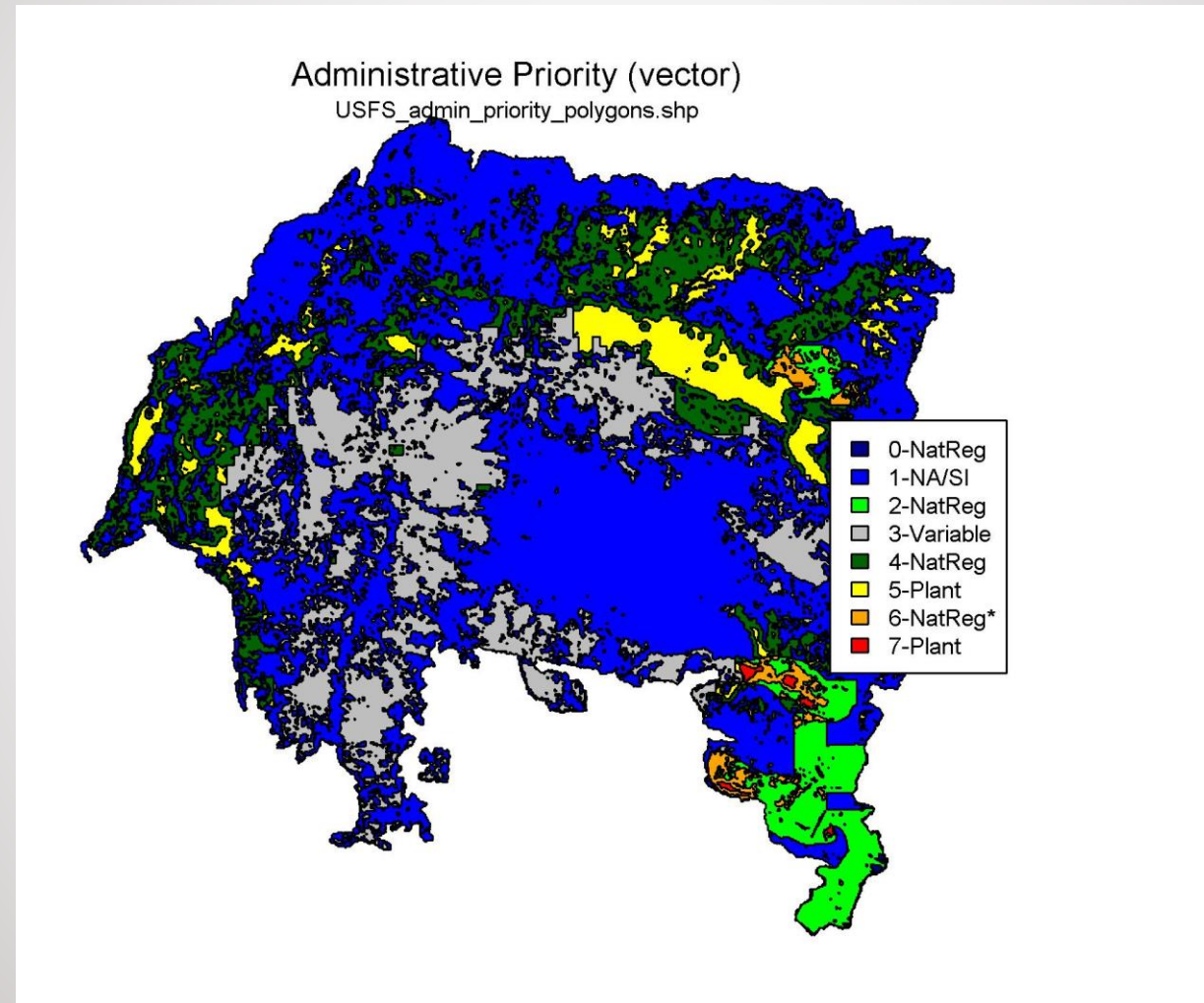
Showing 1 to 50 of 11,446 entries Previous 1 2 3 4 5 ... 229 Next



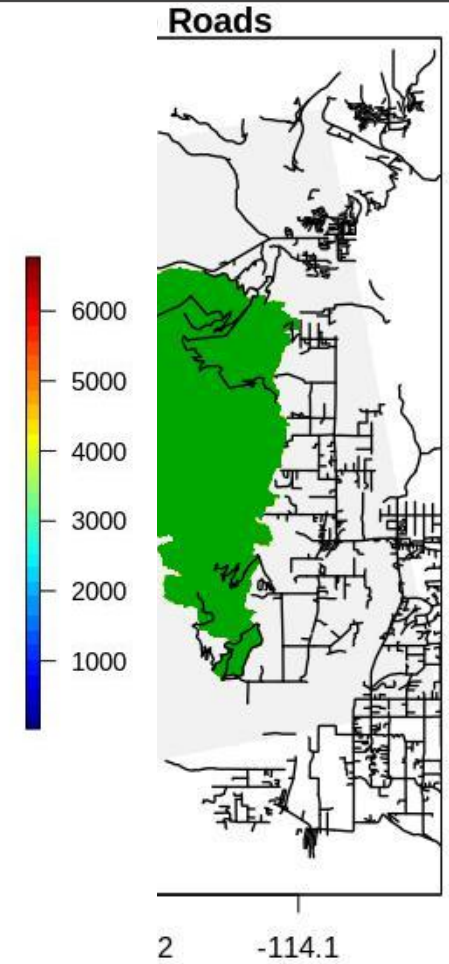
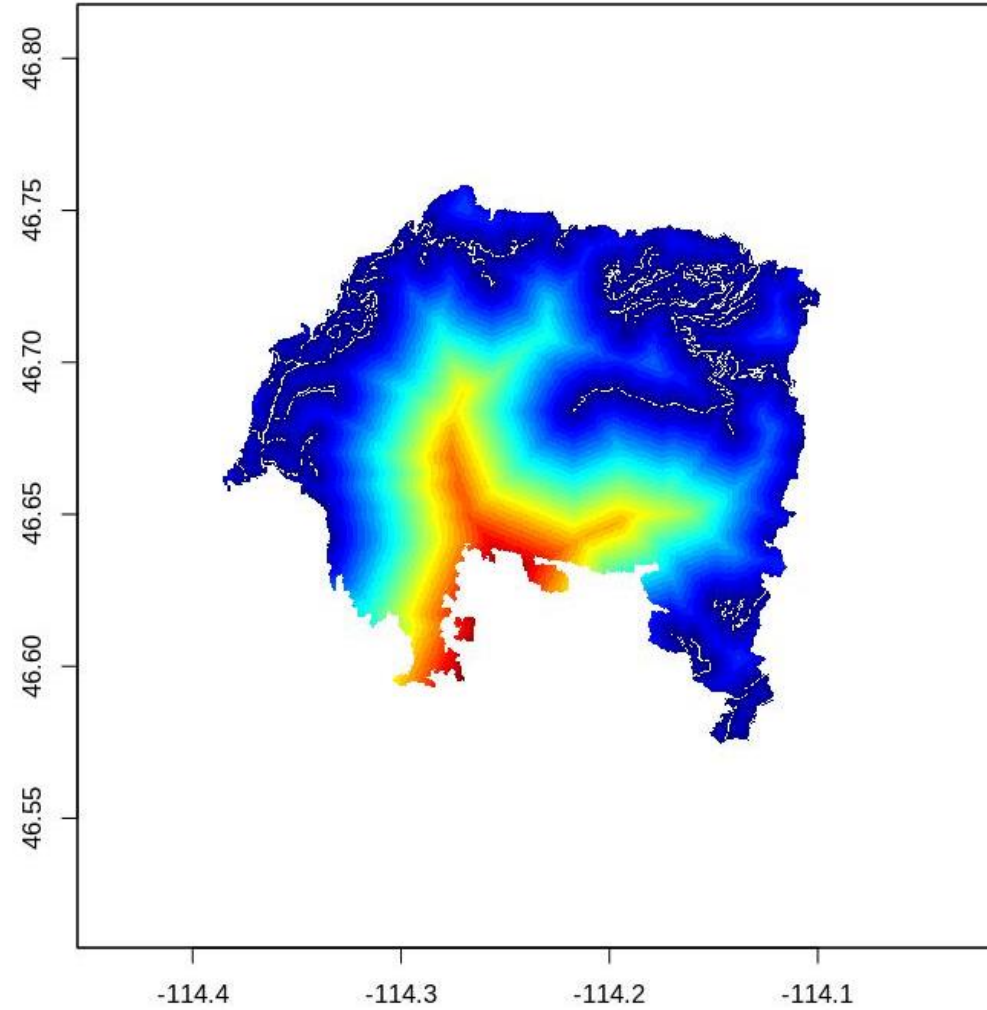
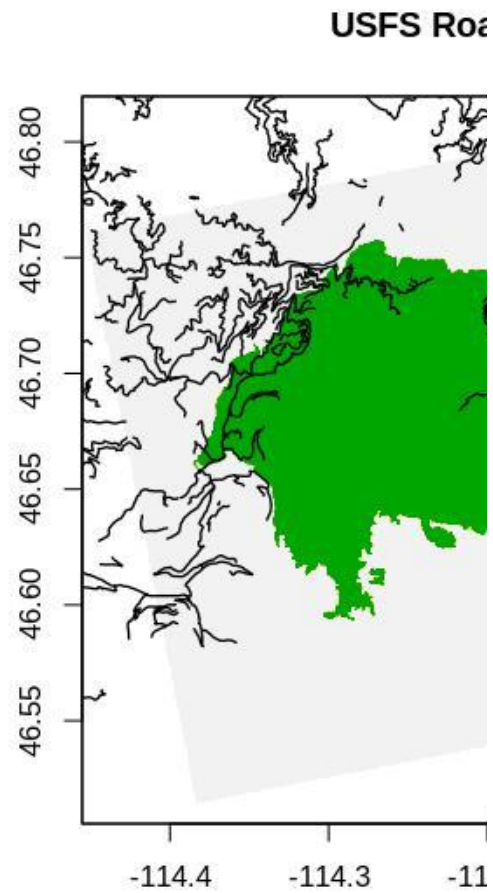
WHAT LIMITS REFORESTATION?

Administrative constraints
Resources (cost/benefit)

USFS ADMINISTRATIVE PRIORITIES



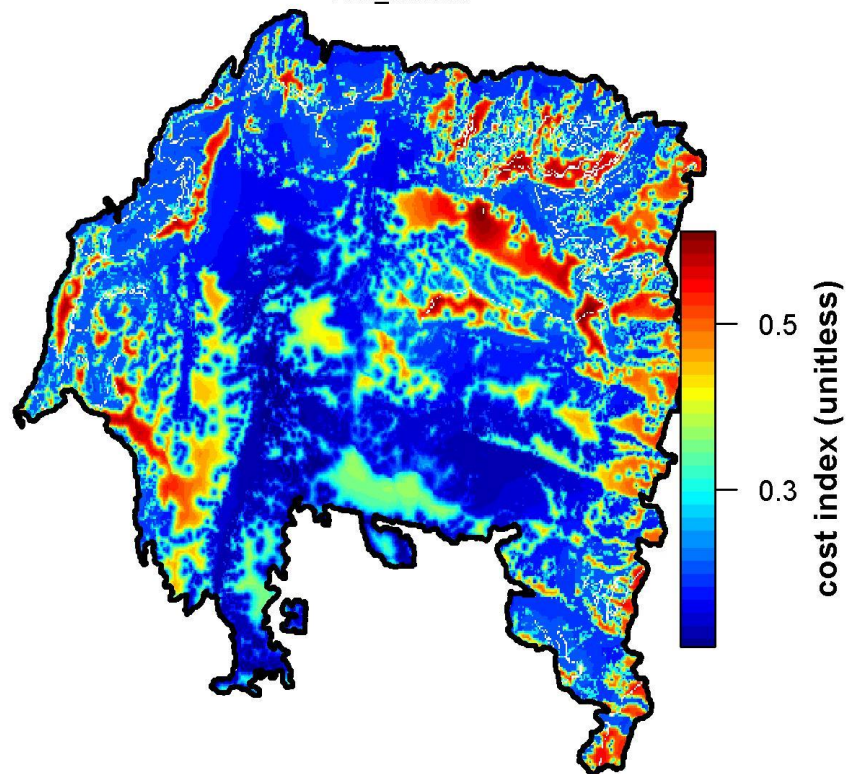
COST/BENEFIT



COST/BENEFIT

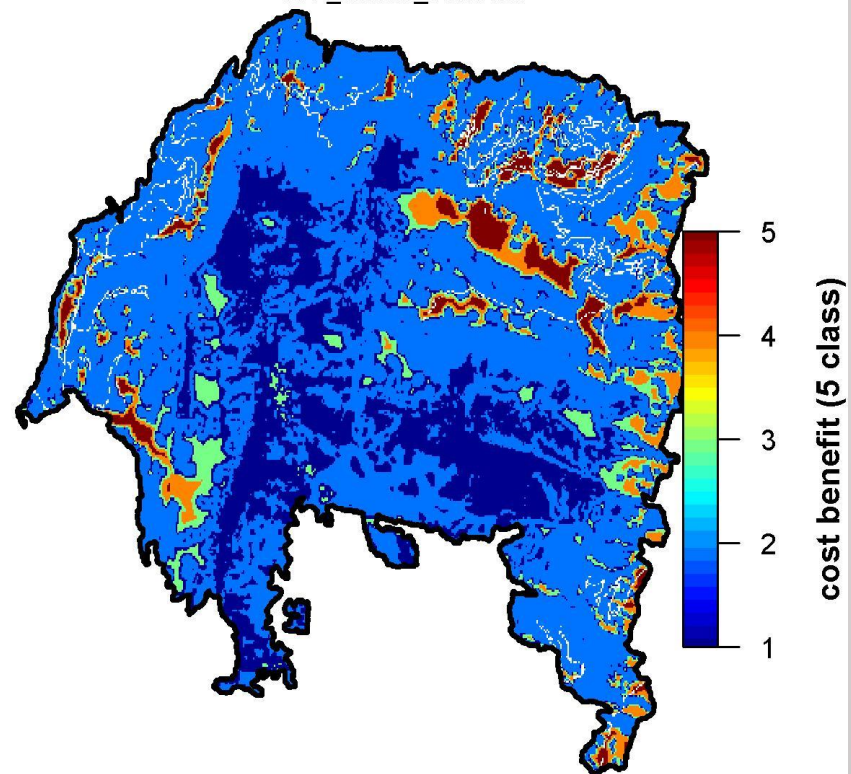
cost-benefit index

cost_index.tif



cost-benefit clusters

cost_cluster_5class.tif



OUTREACH AND ADOPTION

- 1) USFS Region I has officially adopted RegenMapper as their primary tool for conducting reforestation assessments.
- 2) The tool was used for 22 post-fire assessments in Region I in 2021
- 3) The DSS is also being evaluated in USFS Regions 2,4,5 and 6.
- 4) As of December 2021 there has been 57 unique users of the RegenMapper tool.
- 5) Awarded the USFS Region I Forester's Honor Award for work on RegenMapper
- 6) The national director of reforestation has provided co-PI Holden with funding to maintain the RegenMapper tool

ACKNOWLEDGEMENTS

- NASA (A BIG THANKS!)
- NSF
- Shelagh Fox (USFS)
- Vince Archer (USFS)
- Nicole Ballofet (USFS)

NASA A8 APPLIED SCIENCE (2018-2021)

Integrating Earth observations, ecohydrologic, and plant hydraulic models for forecasting recruitment failure in semi-arid forests: Decision support for adaptive forest management.

Team:

PI: Solomon Dobrowski, Associate Professor of Landscape Ecology, Department of Forest Management, The University of Montana

Co-I: Marco Maneta, Associate Professor of Ecohydrology, Department of Geosciences, The University of Montana

Co-I: Zachary Holden, Scientist, USDA Forest Service Region 1

Collaborator: Shelagh Fox, Regional Silviculturalist, USDA Forest Service Region 1

Collaborator: Vince Archer, Regional Soil Scientist, USDA Forest Service Region 1



A climatic dipole drives short- and long-term patterns of postfire forest recovery in the western United States

Caitlin E. Littlefield^{a,b,1} , Solomon Z. Dobrowski^a , John T. Abatzoglou^c , Sean A. Parks^d ,
and Kimberley T. Davis^e

^aDepartment of Forest Management, College of Forestry and Conservation, University of Montana, Missoula, MT 59812; ^bSilviculture and Applied Forest Ecology Lab, Rubenstein School of Environment and Natural Resources, University of Vermont, Burlington, VT 05405; ^cManagement of Complex Systems, College of Engineering, University of California Merced, CA 95343; ^dAldo Leopold Wilderness Research Institute, Rocky Mountain Research Station, US Department of Agriculture Forest Service, Missoula, MT 59801; and ^eDepartment of Ecosystem and Conservation Sciences, College of Forestry and Conservation, University of Montana, Missoula, MT 59812

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Soil moisture variation drives canopy water content dynamics across the western U.S.

Drew S. Lyons^{a,*}, Solomon Z. Dobrowski^a, Zachary A. Holden^{b,c}, Marco P. Maneta^d, Anna Sala^e

^a University of Montana W.A. Franke College of Forestry & Conservation, Department of Forest Management, 32 Campus Drive, Missoula, MT 59812, United States of America



1

Conifer Seedling Survival in Response to High Surface Temperature Events of Varying Intensity and Duration

Robin Rank^{1,*}, Marco Maneta³, Philip Higuera², Zachary Holden⁴, and Solomon Dobrowski¹

REGENMAPPER WORKFLOW OVERVIEW

