Lewis A. Moran Reforestation Center

Adapting to and Planning for a Changing Climate

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NURSERY OPERATIONS

GREENHOUSE USE
RESTORATION
CAMP FIRE

REFORESTATION AREA
NURSERY OPERATIONS
The California Seed Zone Map and Post-fire Reforestation in a Warmer Future

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June 10, 2020

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Reforestation projects currently utilize Seed Zones:

- Pine seeds are moved safely within a 500 foot elevation band within each seed zone.
- Determine cone collecting needs for the region.
- Only one map for all tree species
- **Goal**: to develop provisional seed transfer guidelines based on the CA seed zone map to maximize the success and productivity of reforestation projects
CALFIRE funded collaborative approach

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Jim Thorne

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Michelle Stern (USGS/ UCD)
Questions

• What are the best seed sources for reforestation projects?
  – Provenance Test Data

• Is the California Seed Zone map the best approach?
  – Climate data sets
Testing on the ground: Provenance tests

- “Gold standard” for testing how trees grow in a novel climate
- Historical tests available
- New “operational” tests are being evaluated
H1: Local adaptation

H2: Adaptational lag

Growth rate

$T_{max}$ difference ($^\circ$C)

Planted in colder climate than origin

Planted in warmer climate than origin

Browne et al 2019
Data
Evidence for adaptational lag in 5 conifer species

Important to consider in seed transfer- trees are already not adapted to the place where they are found but to a place with a colder climate.
How much loss of tree volume can we expect if we don’t move seeds?

\[ P. \text{ contorta} \]

\[ P. \text{ ponderosa} \]
Questions

• What are the best seed sources for reforestation projects?
  – Provenance Test Data

• Is the California Seed Zone map the best approach?
  – Climate data sets
CA Seed Zone Climate and Hydrology Datasets

Michelle Stern, UCD/USGS
Ryan Boynton, UCD
Lorraine Flint, USGS
Alan Flint, USGS
Station-based gridded climate data sets:
- PRISM
- VIC
- TopoWx
- ClimateNA
- DayMet
- CRU
- Livneh

Data Set Properties:
- Native Resolution
  - 800m-40km
- Available Time Period
  - 1895-2020
- Downscaling/interpolation method
  - Range of regression and other modeling approaches
- Lapse Rate
  - Change in temp due to elevation
  - Fixed or variable
- Time step
  - Daily/monthly
- Future Scenarios
  - RCP 4.5, 8.5 etc
- Bias Correction methods
  - Livneh quartiles, none etc
- Variables included
  - Temperature, precipitation
Seed zone 526, 4000-4500ft

Seed zone and elevation bands with matching climate in 1981-2010
Seed zone and elevation bands with matching climate in 2039-2069 (hot/dry model)

Seed zone 526, 4000-4500ft
Take home messages

- The California Seed Zone map has been used since the 1970s as a guide for seed transfer in reforestation projects
  - Only one map for all species
  - No way to account for a changing climate

**CALFIRE/USFS/UC Davis/USGS**
- Exploring how seed transfer using the map will be impacted by a changing climate
- Expanding what data is available for deciding where to get seed sources
- Results will help inform seed transfer and maximize the use of seed in the CALFIRE and USFS Seed Banks.