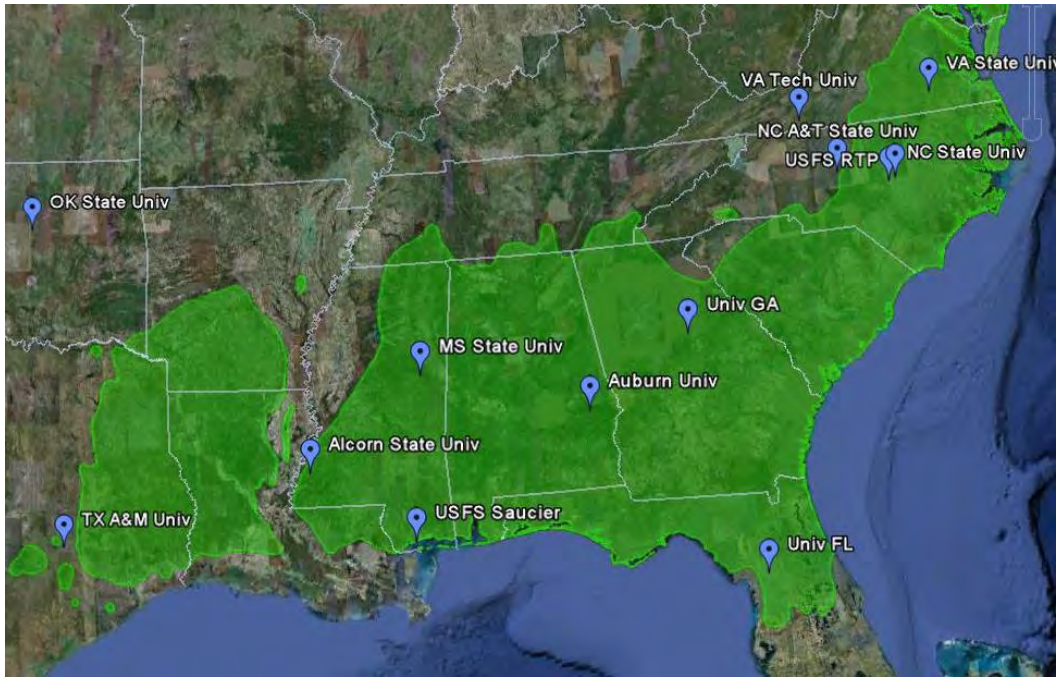
PINEMAP:
Mapping the Future of Southern Pine Management in a Changing World



Google Earth

A NIFA-Funded Climate Change CAP

Timothy Martin *et al.*

USDA United States Department of Agriculture
National Institute of Food and Agriculture

The Pine Integrated Network: Education, Mitigation, and Adaptation Project (PINEMAP) is a Coordinated Agricultural Project funded by the USDA National Institute of Food and Agriculture, Award #2011-68002-30185. For more information, visit http://www.pinemap.org.

Prescribed, Outcome-Based Program Dictates Project Goals

- RFP: Reduce the use of nitrogen fertilizer by 10% and increase carbon sequestration by 15% through resilient forest production systems under changing climate by 2030

PINEMAP Goals

To create, synthesize, and disseminate the necessary knowledge to enable southern forest landowners

- to harness pine forest productivity to mitigate atmospheric CO_2,
- to more efficiently utilize nitrogen and other fertilizer inputs,
- and to adapt their forest management approaches to increase resilience in the face of changing climate.

PINEMAP Approach: Integrating & Leveraging Existing Networks

Research Cooperative	Host University (year founded)
Cooperative Forest Genetics Research Program	University of Florida (1953)
Cooperative Tree Improvement Program	North Carolina State University (1955)
Forest Biology Research Cooperative	University of Florida (1996)
Forest Modeling Research Cooperative	Virginia Polytechnic Univ. (1979)
Forest Productivity Cooperative	Virginia Polytechnic Univ. / NC State Univ. (1969)
Plantation Management Research Cooperative	University of Georgia (1975)
Southern Forest Resource Assessment Consortium	North Carolina State University (1994)
Western Gulf Forest Tree Improvement Program	Texas A&M Univ. / Texas Forest Service (1969)

PINEMAP Project Team

57 Principal Investigators
23 Research and Technical Staff
38 Grad Students
7 Postdocs
At 11 land grants universities + USFS

Pinemap Outcome Themes

Engaged and literate public

Increased C Sequestration through productivity and resilience

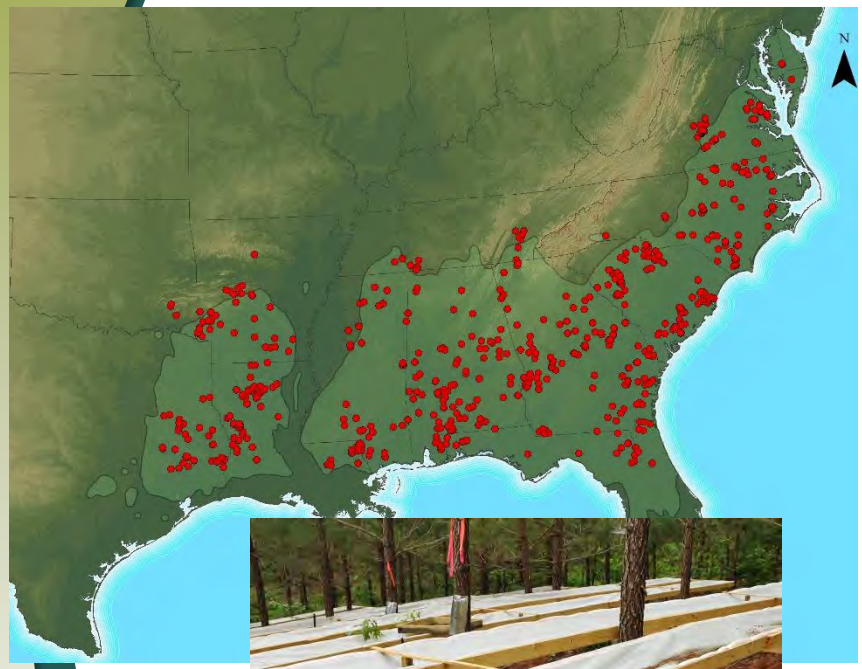
Public policy supporting sustainable forest management

Enhanced capacity for collaboration

Enhanced connections

Robust/resilient regional forest-based economy

Monitoring networks

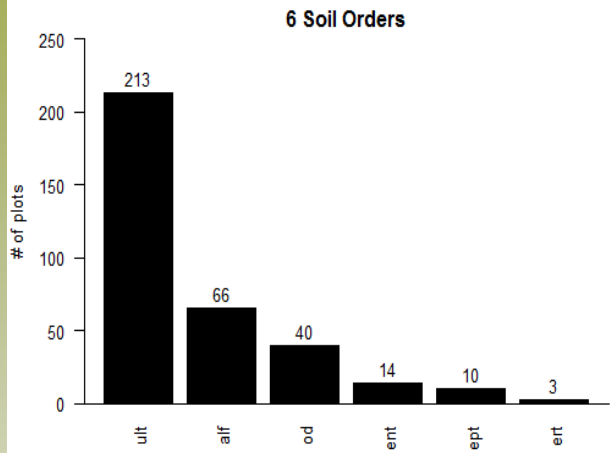


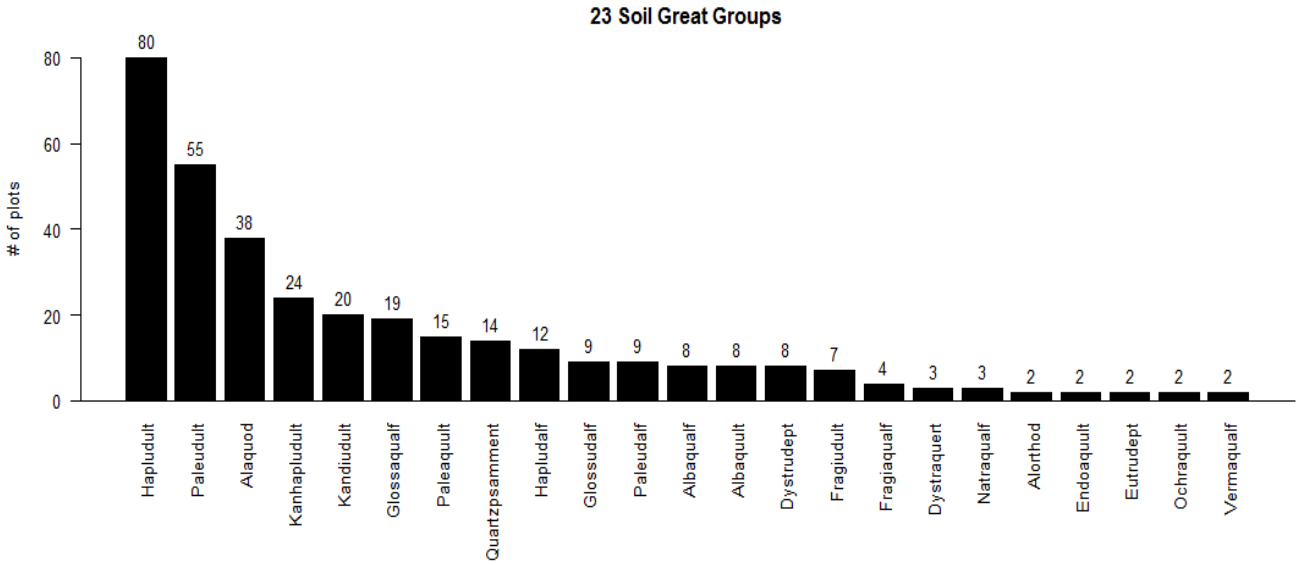
- Baselines + model parameterization and validation
- Tier I: ~ 700 sites with previously unshared data
- Tier II: 123 sites / 450 plots with newly-measured C and nutrient pool data
- Tier III: New experimental manipulation of H_2O and nutrients on four intensively monitored sites

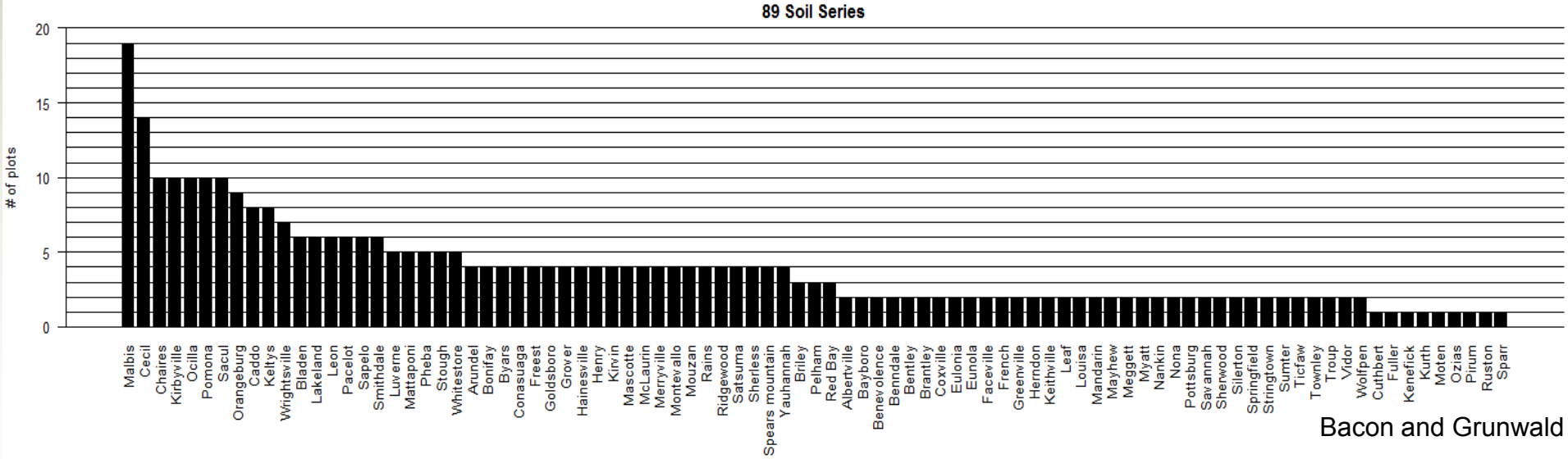
Overview of Tier II Network

- 123 distinct sites pulled from the experimental designs of coops
  - Forest Biology Research Cooperative
  - Forest Modeling Research Cooperative
  - Forest Productivity Cooperative
  - Plantation Management Research Cooperative
- 450 plots sampled
- Full carbon and nutrient pool quantification
  - Including soil to 1 m depth

Soil Classification from SSURGO

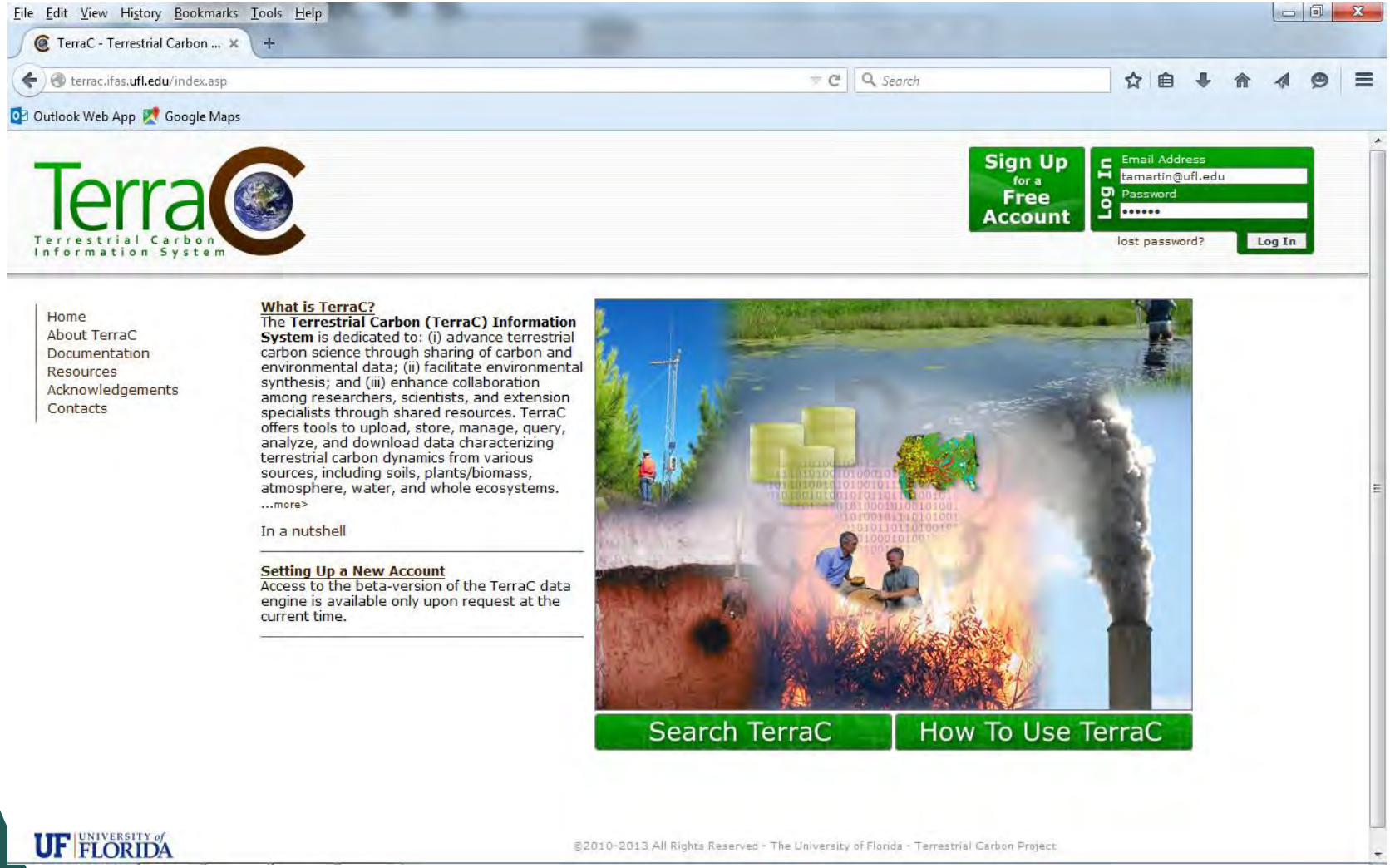






Bacon and Grunwald

TerraC Data Management System

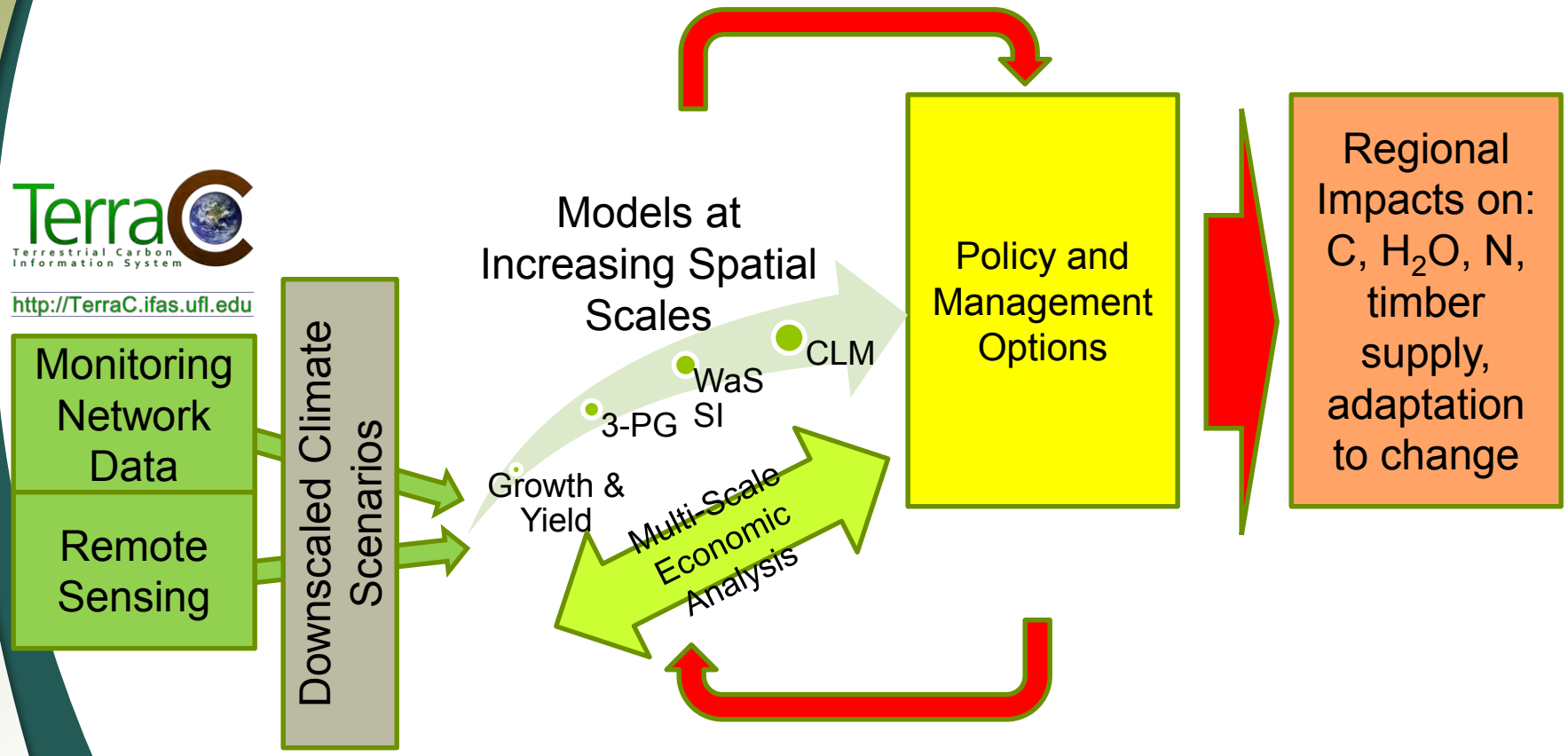


PINEMAP Regional Modeling

Suite of complementary models focused on understanding opportunities and risks, and comparing management alternatives under future predicted climate

- Growth and yield (climate-responsive)
- Water Supply Stress Index (WaSSI)
- Physiological Principles Predicting Growth (3-PG)
- Community Land Model (CLM-BGC)
- Sub-regional Timber Supply Model (SRTS)

PINEMAP Models to Assess Scenarios and Estimate Regional Impacts



Education audiences & activities

Forest landowners Forest managers Forest agencies	Cooperative Research Programs
	State Extension Programs
	Decision Support System
Undergraduate students Graduate students	UG Fellowship Program
	Graduate Course & Activities
High school science teachers Secondary students	Southeastern Forests and Climate Change – Project Learning Tree Module
	Teacher Workshops & Website

PINEMAP

Decision Support System

- http://pinemapdss.org

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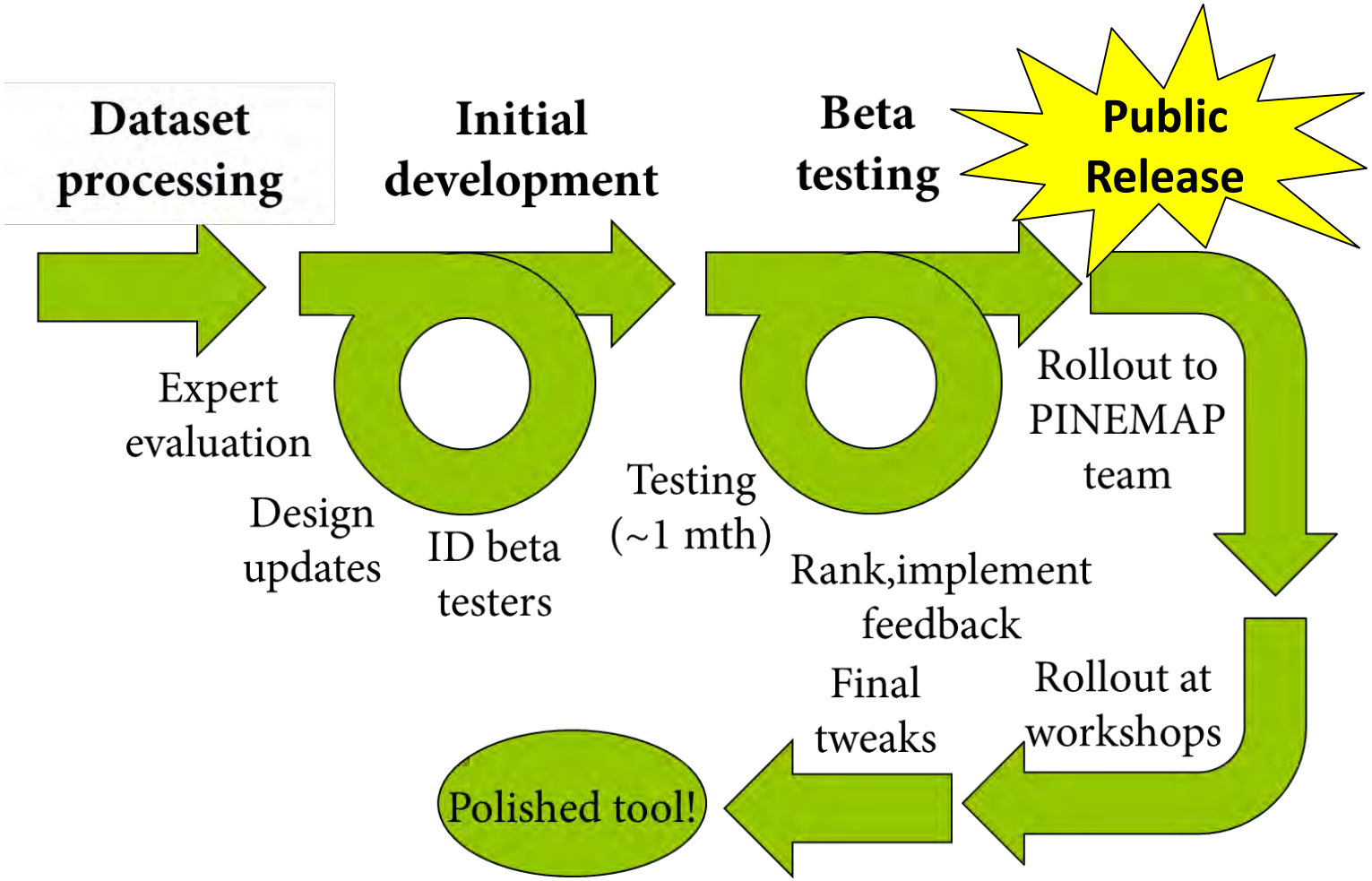
DSS Tool Development- iterative process

- Seedling deployment & environment tools: beta testing and refinements (~2 month process each)



Tools structured into Four Groups

1. Environment

Temperature
- Extreme Minimum Temperature
- Summer Temperature

Precipitation
- Summer Precipitation

2. Establishment

Seedling Deployment
- Seedling Markets
- Seedling Sources

3. Management

Tools coming soon!

4. Production

Tools coming soon!

Tools coming soon:
- *growing season length*
- *drought and flood risk*
- *forest productivity model outputs*
  - *gross and net primary productivity*
  - *net ecosystem productivity*
  - *merchantable volume*
  - *carbon above ground*
  - *water stress*

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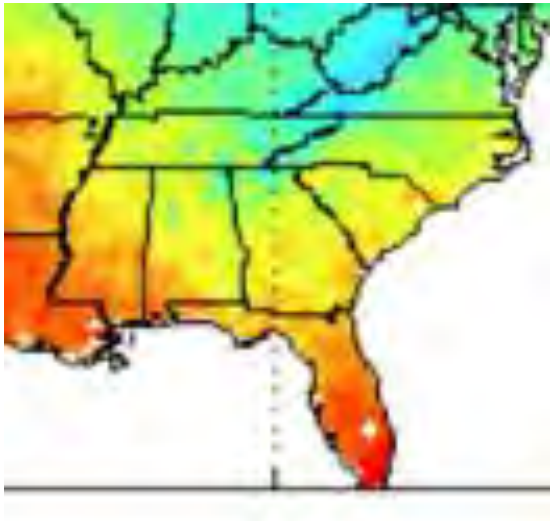
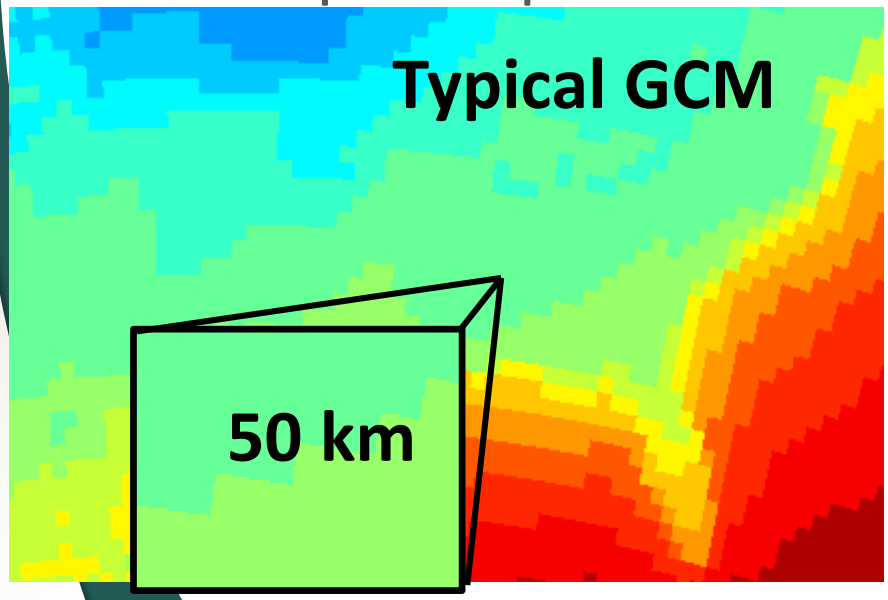
State-of-the-Art Climate Data

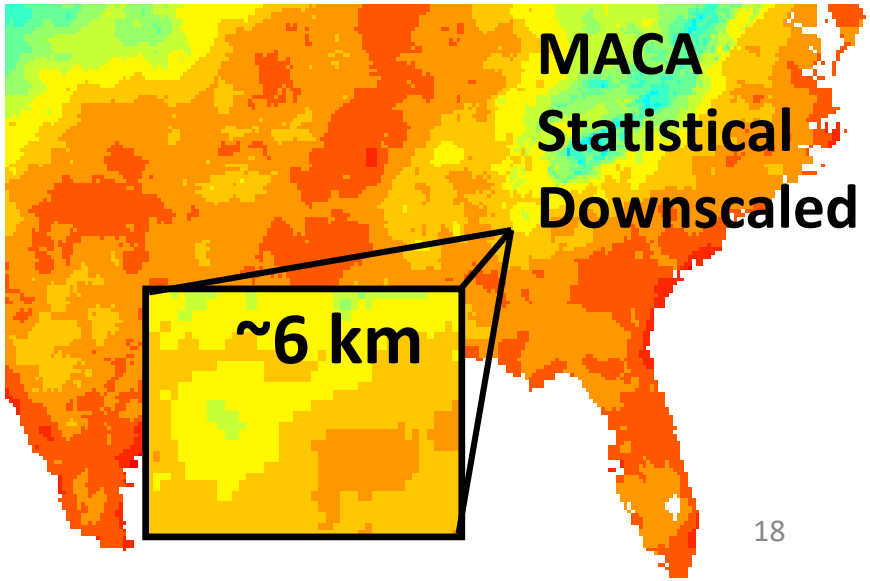
- Historical weather station data
- Projected future climate from Coupled Model Intercomparison Project (CMIP5)
  - 20 different large-scale General Circulation Models (GCMs) used by IPCC 5th Assessment



Statistical downscaling provides finer resolution

- Variables:
  - ***mean wind speed***
  - ***mean specific humidity***
  - ***surface downwelling shortwave radiation (heat reaching the soil surface)***
  - accumulated precipitation
  - min/max air temp
- Example -- spatial resolution differences:





Carbon Emissions Scenarios

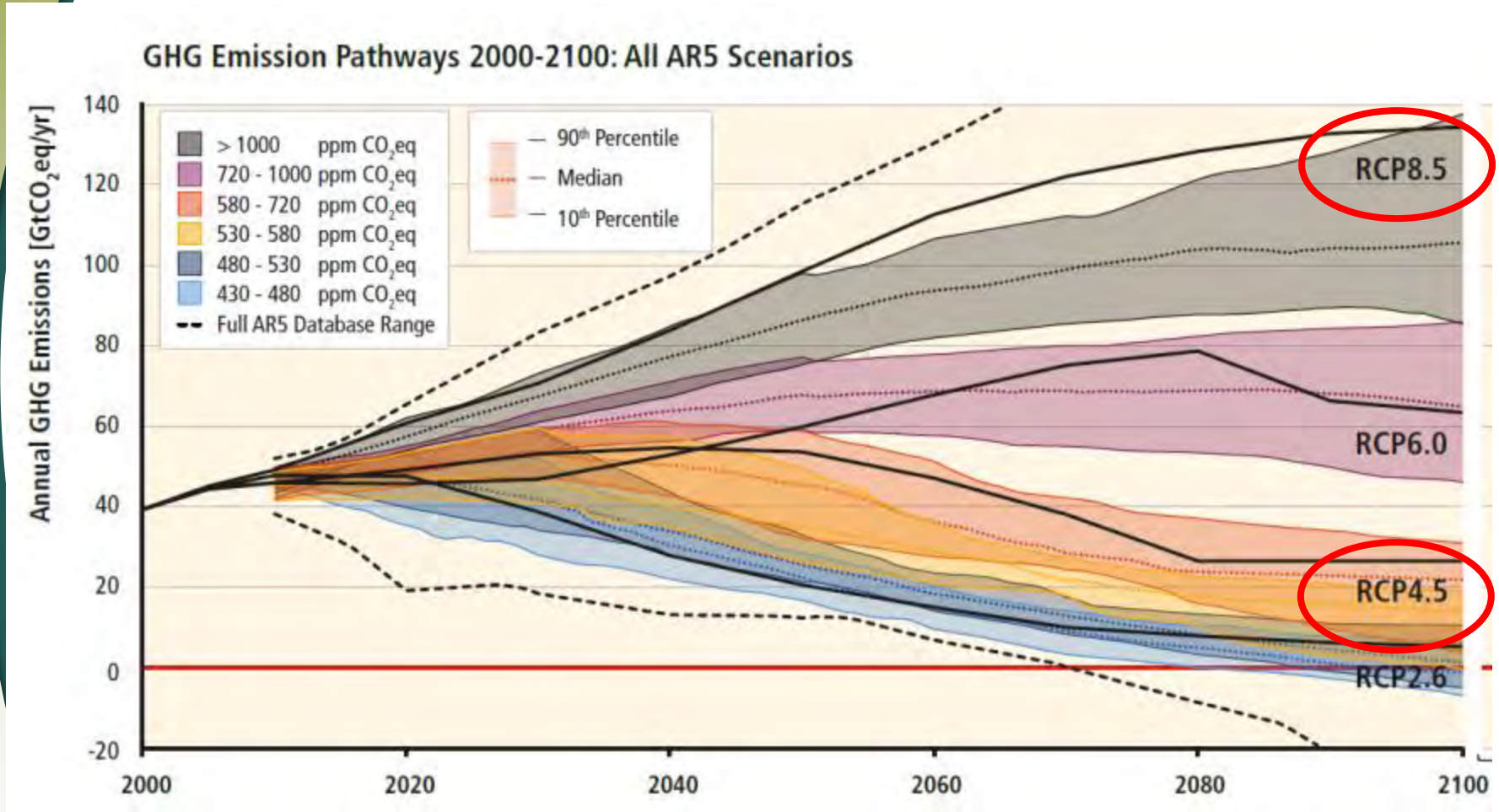
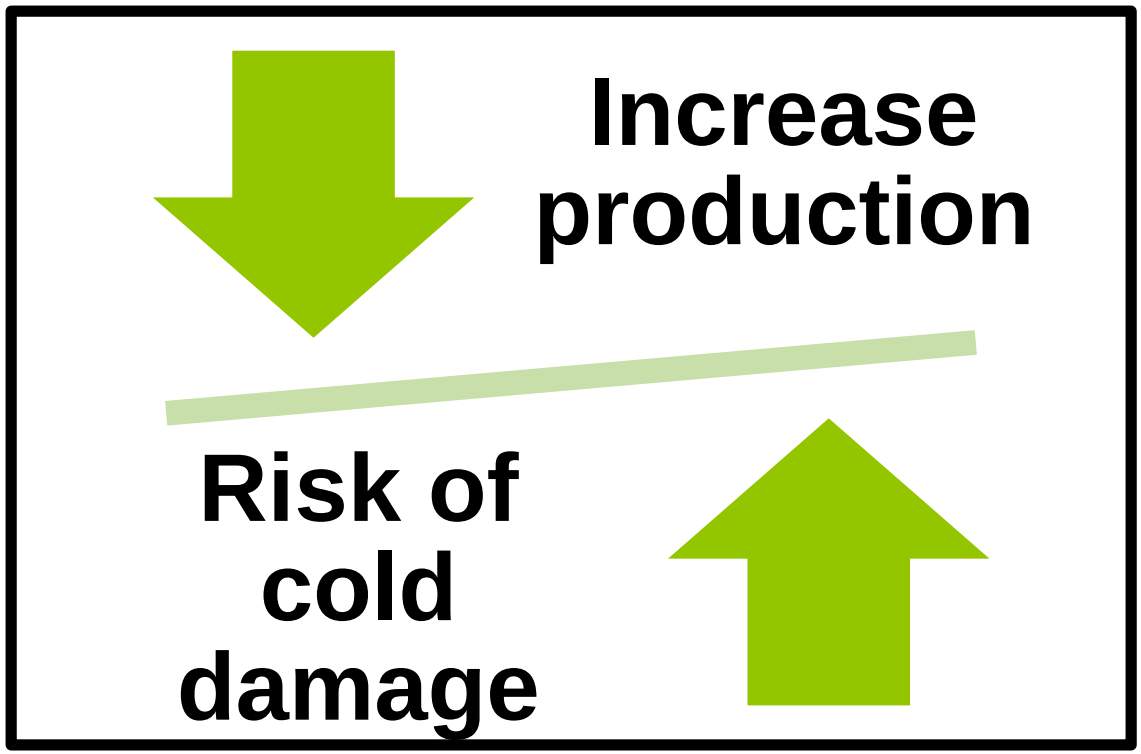


Figure 3. Pathways of global GHG emissions (GtCO2eq/yr) in baseline and mitigation scenarios of all IPCC AR5 scenarios (including the RCPs) for different long-term concentration levels. Source: IPCC 2014 WGIII Report (Figure SPM.4)

Climate Data Interface Demonstration

Seedling Deployment Tools: Background

- Goal: enable foresters to better match seed sources with future climates to increase and optimize productivity



Seedling Deployment Tools: Schmidtling's Guidelines

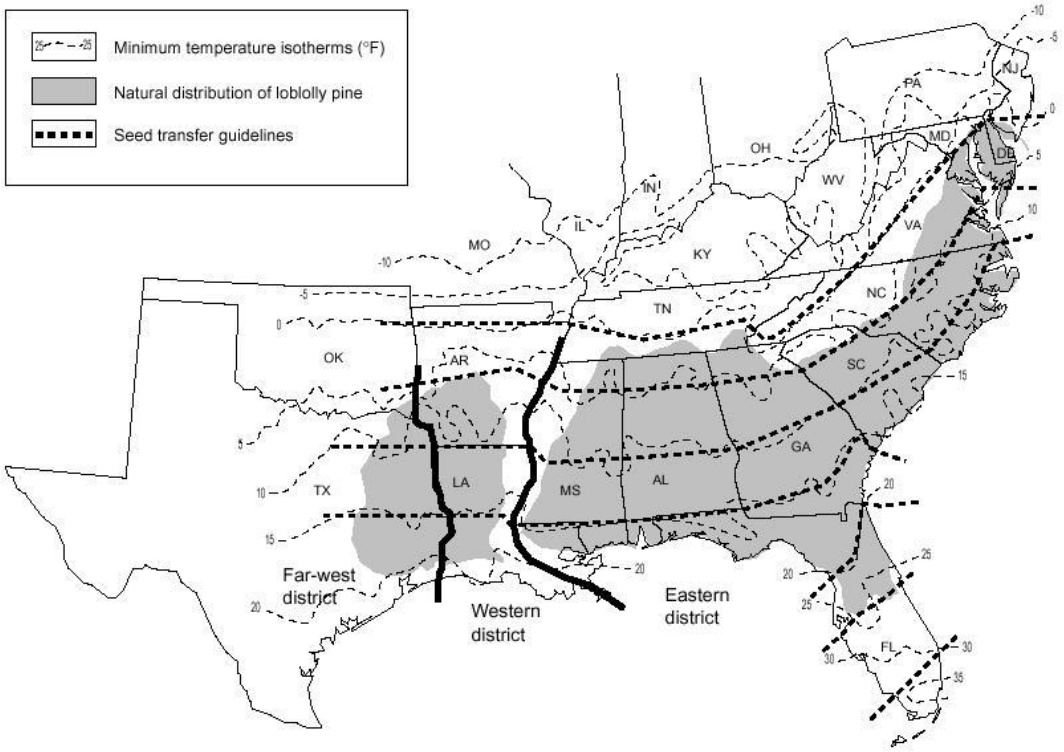


Figure 2—Loblolly pine distribution with seed transfer guidelines. Natural distributions of species adapted from Critchfield and Little (1966); minimum temperature isotherms from USDA (1990).

Schmidtling's Guideline:

- Based on Average Minimum Temperature
- *Seedlings will survive and grow well if they come from any area having a yearly annual minimum temperature within five degrees of the planting site's minimum temperature*

Seedling deployment tool demonstration

PINEMAP DSS Tools

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Precipitation
- Summer Precipitation

Coming Soon!
- Growing Season Length
- Drought and Flood Risk
- Water Stress

2. Establishment

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3. Management

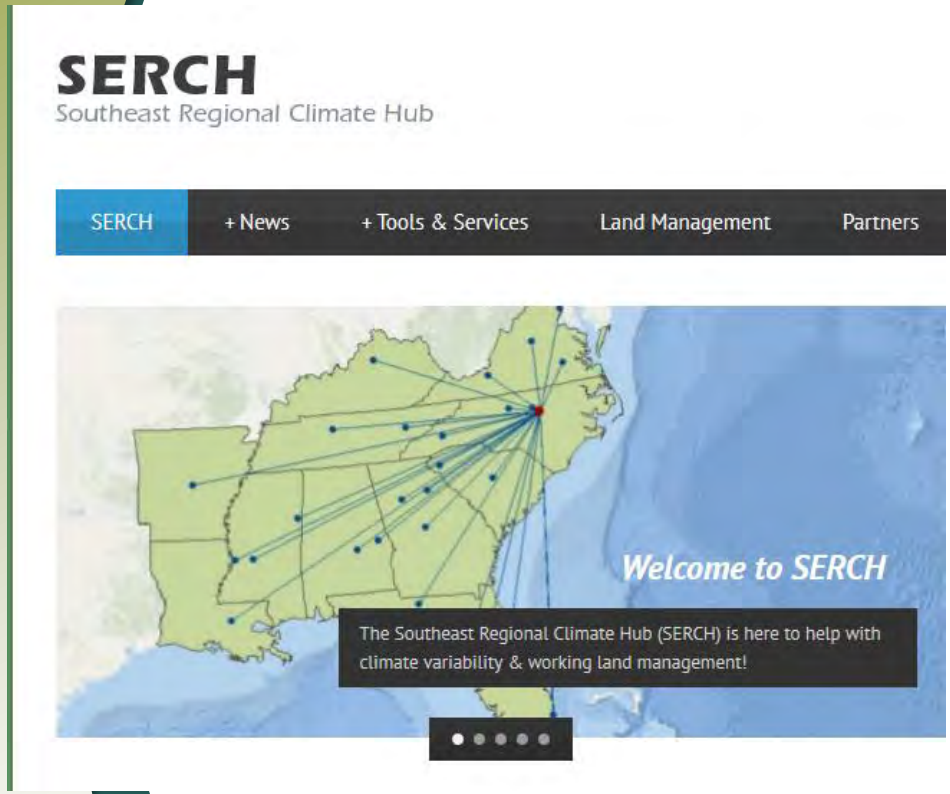
Coming Soon!
- Thinning Key

4. Production

Coming Soon!
- Gross and Net Primary Productivity
- Net Ecosystem Productivity
- Merchantable Volume
- Carbon Above Ground
- Water Stress

New Tools Spring 2016

After PINEMAP



- 30-year outcome goals, 5-year project
- Data and tools
- Outreach and educational resources
- Network coordination
- Southeast Regional Climate Hub will be central to our efforts
- Cooperative advisory board consisting of coop directors will advise SERCH on outreach needs of corporate community

PINEMAP

Decision Support System

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