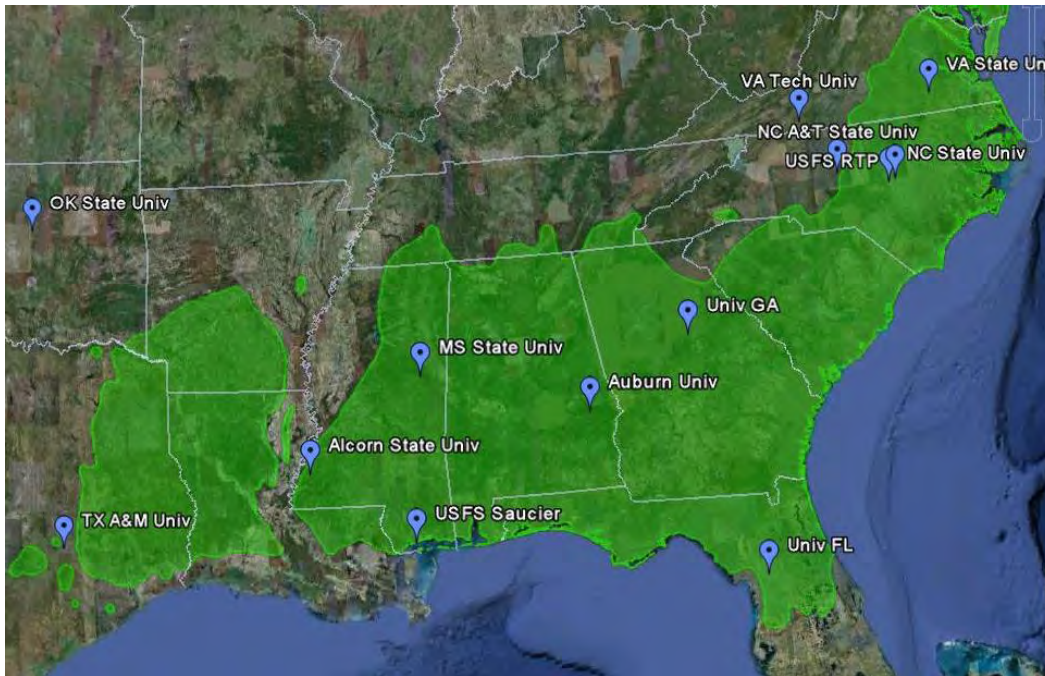




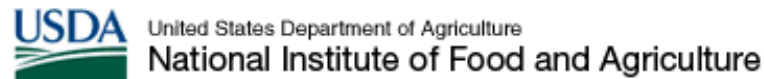
# PINEMAP: Mapping the Future of Southern Pine Management in a Changing World



Google Earth

A NIFA-Funded  
Climate Change CAP

Timothy Martin *et al.*



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

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- 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<sub>2</sub>,
- 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

**Project Learning Tree**

**State Climatologists**

**Extension Professionals:  
SREF, Land Grant & County Extension**

**University – Government - Corporate Forest Research Cooperatives**

<b>Research Cooperative</b>	<b>Host University (year founded)</b>
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



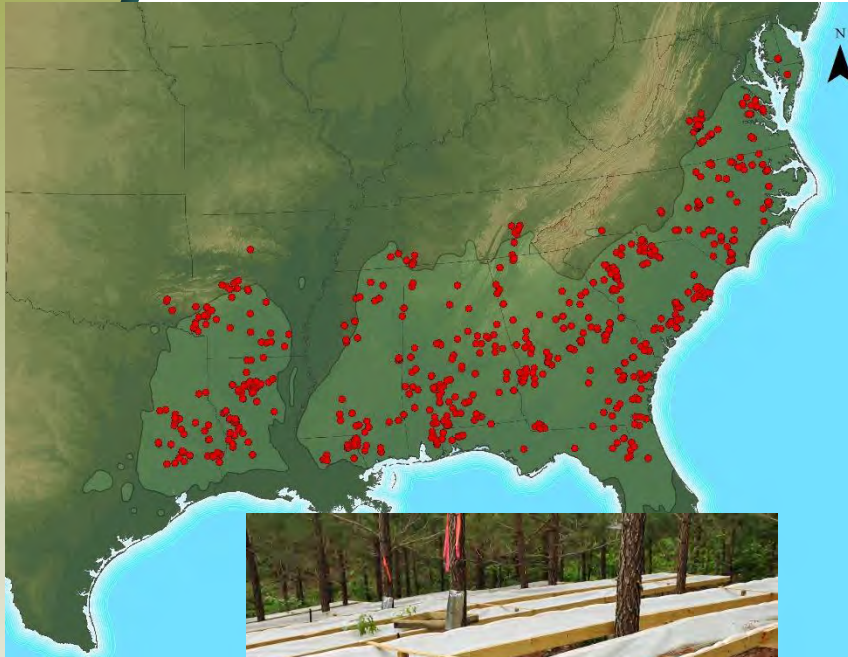
Enhanced connections



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<sub>2</sub>O and nutrients on four intensively monitored sites



# Overview of Tier II Network

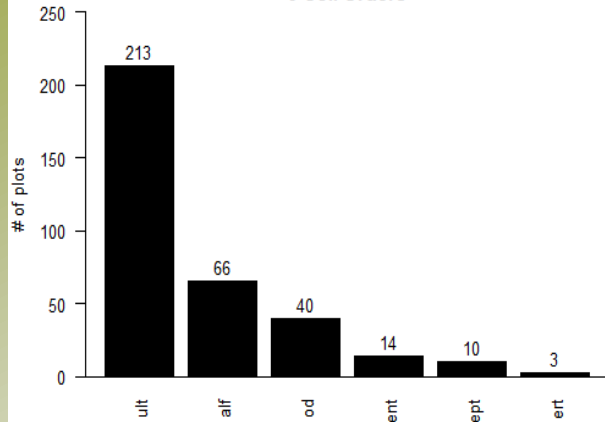
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- 123 distinct sites pulled from the experimental designs of coops
  - Forest Biology Research Cooperative
  - Forest Modeling Research Cooperative
  - Forest Productivity Cooperative
  - Plantation Management Research Cooperative
- 450 plots sampled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

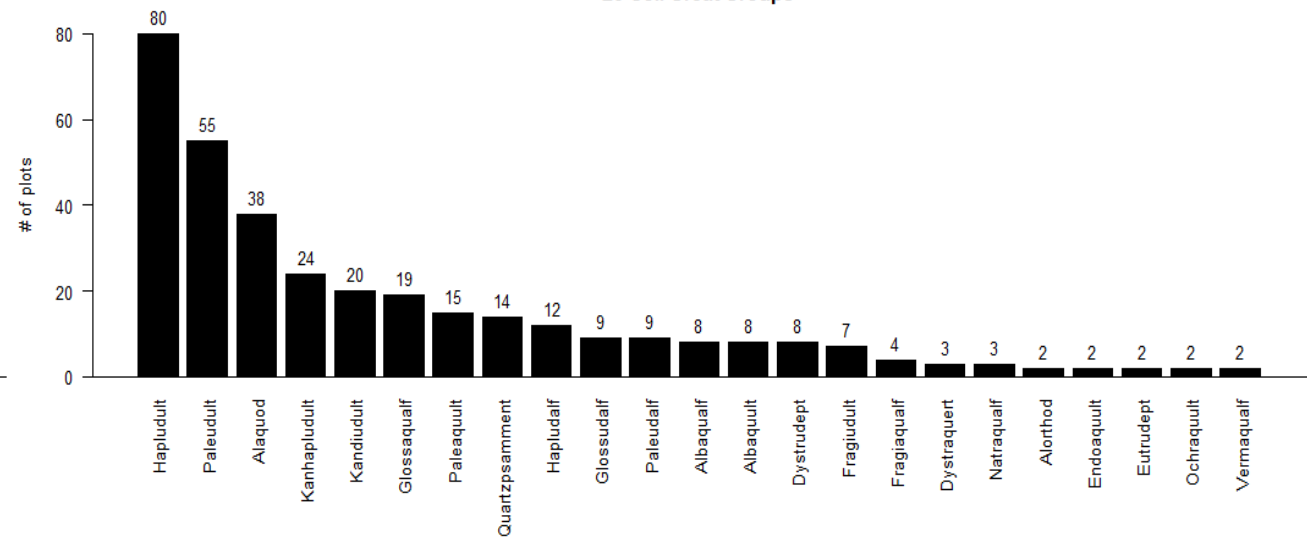


# Soil Classification from SSURGO

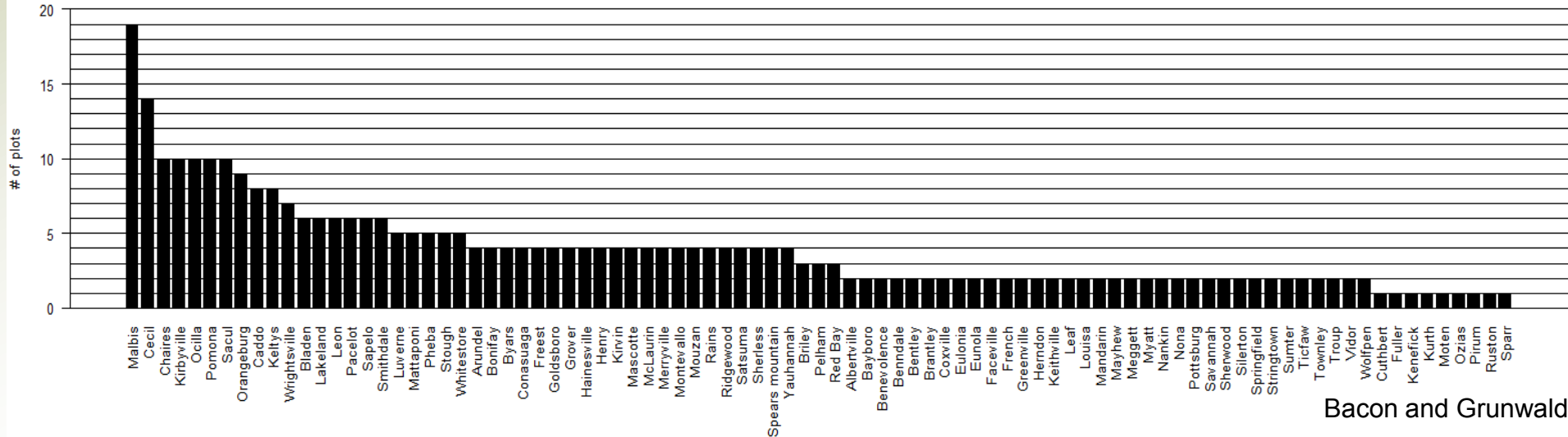
6 Soil Orders



23 Soil Great Groups



89 Soil Series







# TerraC Data Management System

**TerraC**  
Terrestrial Carbon Information System

**Sign Up for a Free Account**

**Log In**

Email Address: tamartin@ufl.edu  
Password: \*\*\*\*\*  
lost password? **Log In**

- Home
- About TerraC
- Documentation
- Resources
- Acknowledgements
- Contacts

**What is TerraC?**  
The **Terrestrial Carbon (TerraC) Information System** is dedicated to: (i) advance terrestrial carbon science through sharing of carbon and environmental data; (ii) facilitate environmental synthesis; and (iii) enhance collaboration among researchers, scientists, and extension specialists through shared resources. TerraC offers tools to upload, store, manage, query, analyze, and download data characterizing terrestrial carbon dynamics from various sources, including soils, plants/biomass, atmosphere, water, and whole ecosystems. ...more>

In a nutshell

**Setting Up a New Account**  
Access to the beta-version of the TerraC data engine is available only upon request at the current time.

**Search TerraC** **How To Use TerraC**

UF UNIVERSITY of FLORIDA

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# PINEMAP Regional Modeling

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*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



Monitoring Network Data

Remote Sensing

Downscaled Climate Scenarios

Models at Increasing Spatial Scales



Policy and Management Options

Regional Impacts on: C, H<sub>2</sub>O, N, timber supply, adaptation to change



# 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>

The screenshot shows the PINEMAP Decision Support System website. The header includes the PINEMAP logo, the text "DECISION SUPPORT SYSTEM", and navigation links for "About", "Environment", "Establishment", "Management", and "Production". There is also a search bar labeled "search all tools" and a "Search" button. The main content area is titled "DSS Introduction" and contains the text: "The guide below describes the features of the PINEMAP Decision Support System. Once you're ready to begin using the DSS, select a tool using the menu above." Below this text is a horizontal menu with five items: "1. Background", "2. DSS Tools", "3. Climate Data", "4. Three-Map Layout", and "5. Time Series". The "1. Background" item is selected and highlighted. To the left of a large image of a pine branch with a cone, there is a list of bullet points:

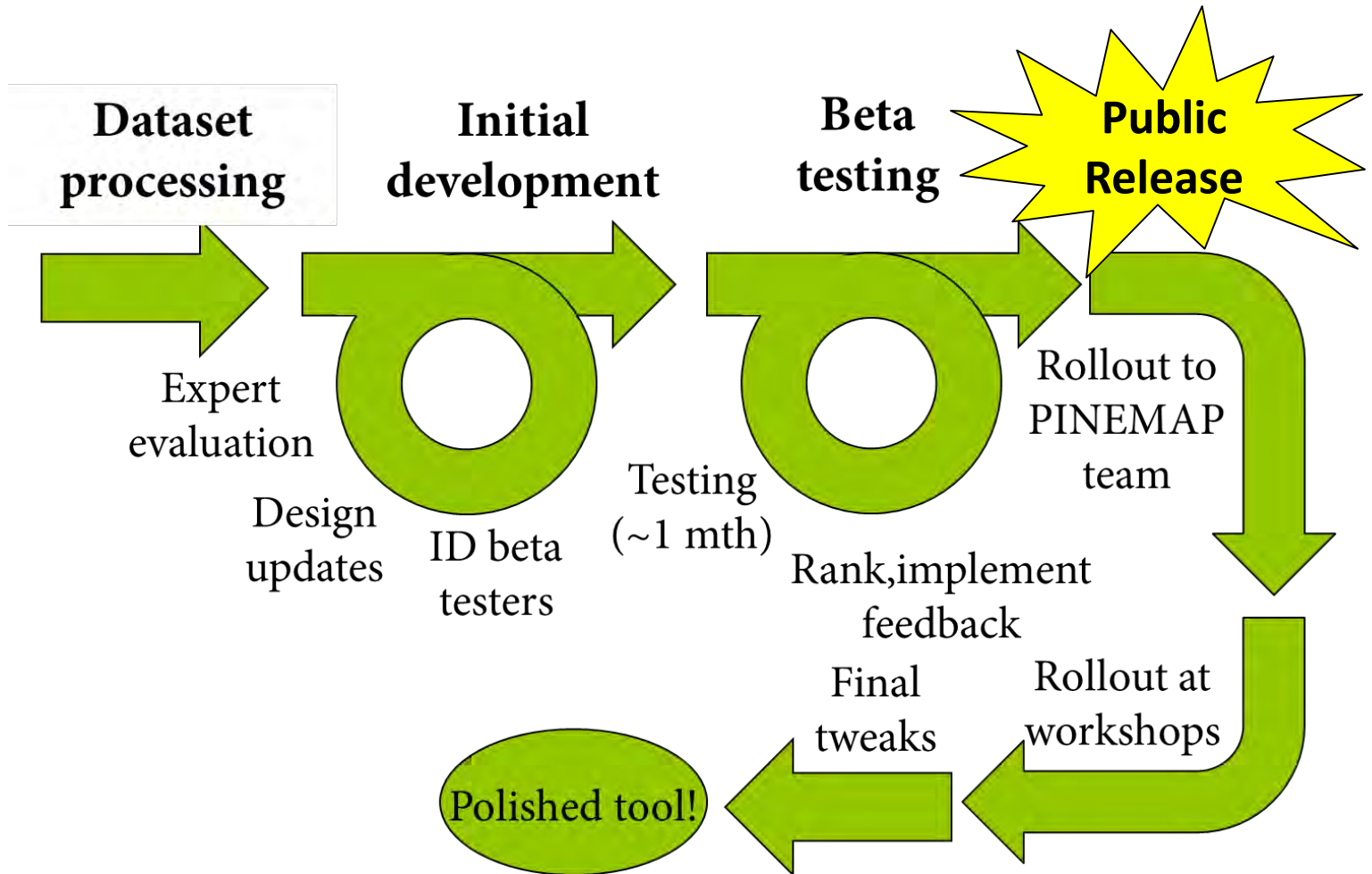
- The Pine Integrated Network: Education, Mitigation, and Adaptation Project (PINEMAP) studies planted loblolly pine forests in the Southeast US
- Pine trees influence their local climate yet are also themselves sensitive to climate factors including temperature and precipitation
- The tools in the PINEMAP DSS use climate data and regional productivity models to explore the relationships between pine trees and climate

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.



# 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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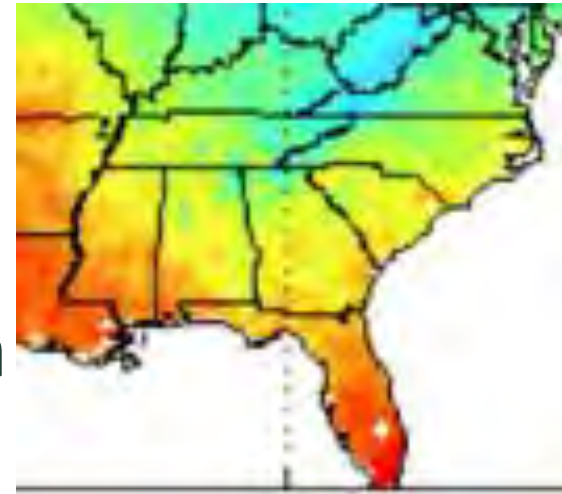
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- *forest productivity model outputs*
  - *gross and net primary productivity*
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  - *merchantable volume*
  - *carbon above ground*
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# State-of-the-Art Climate Data

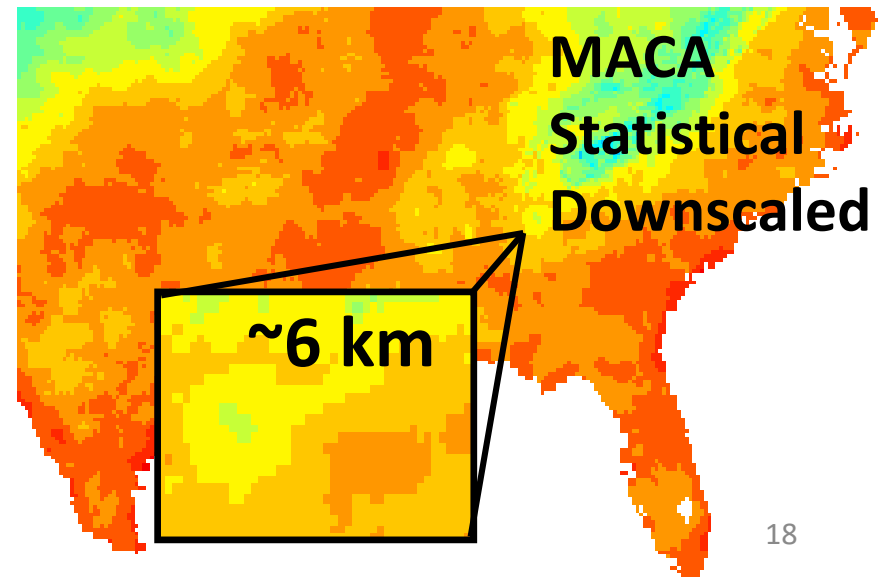
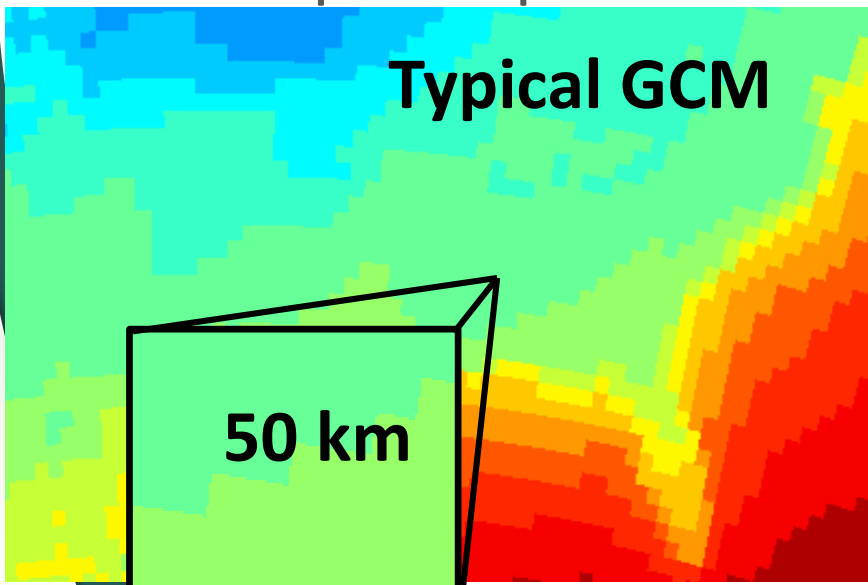
- Historical weather station data
- Projected future climate from Coupled Model Intercomparison Project (CMIP5)
  - 20 different large-scale General Circulation Models (GCMs) used by IPCC 5<sup>th</sup> Assessment





# 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

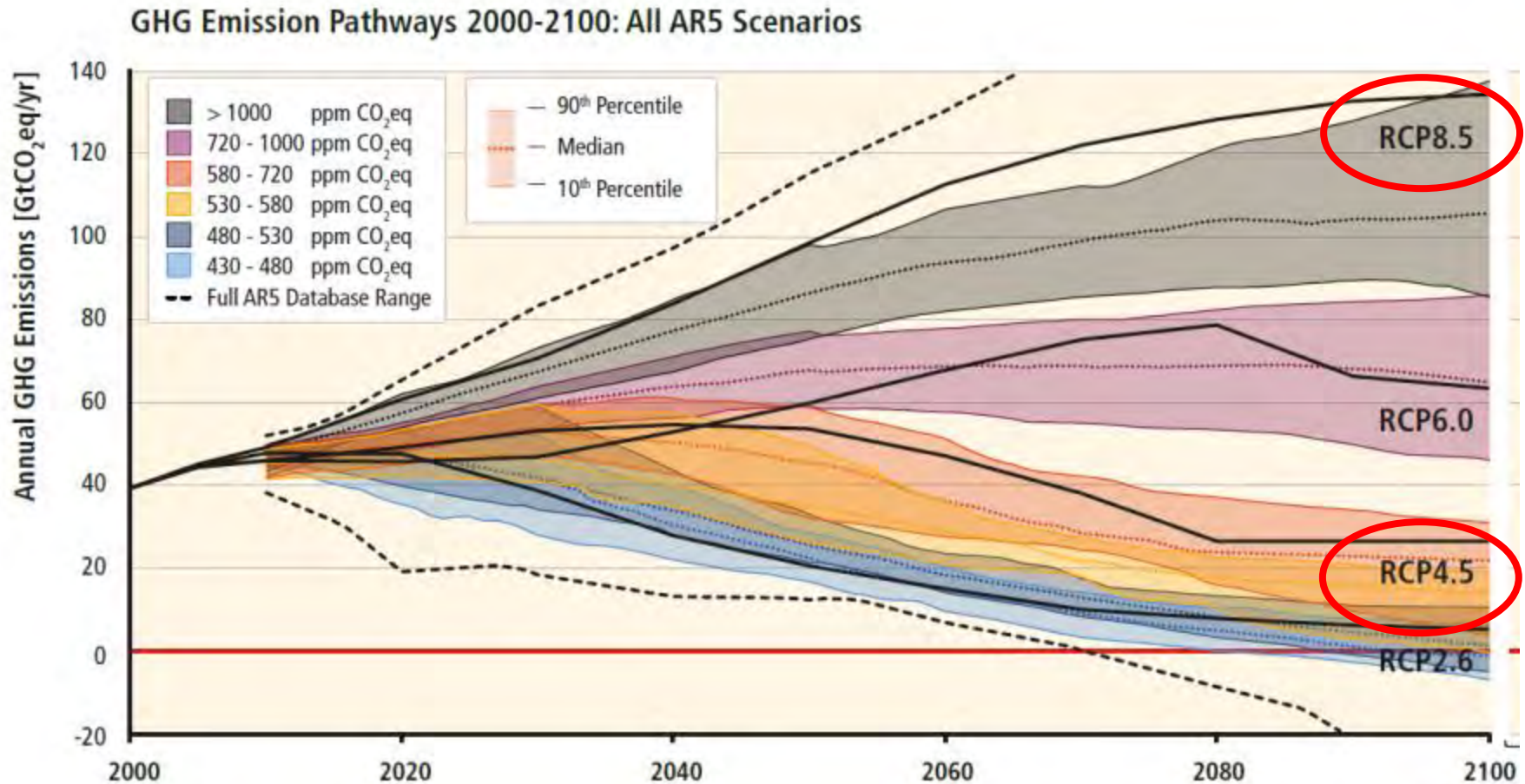


Figure 3. Pathways of global GHG emissions (GtCO<sub>2</sub>eq/yr) in baseline and mitigation scenarios of all IPCC AR5 scenarios (including the RCPs) for different long-term concentration levels. Source: IPCC 2014 WGIII Report (Figure SPM.4)



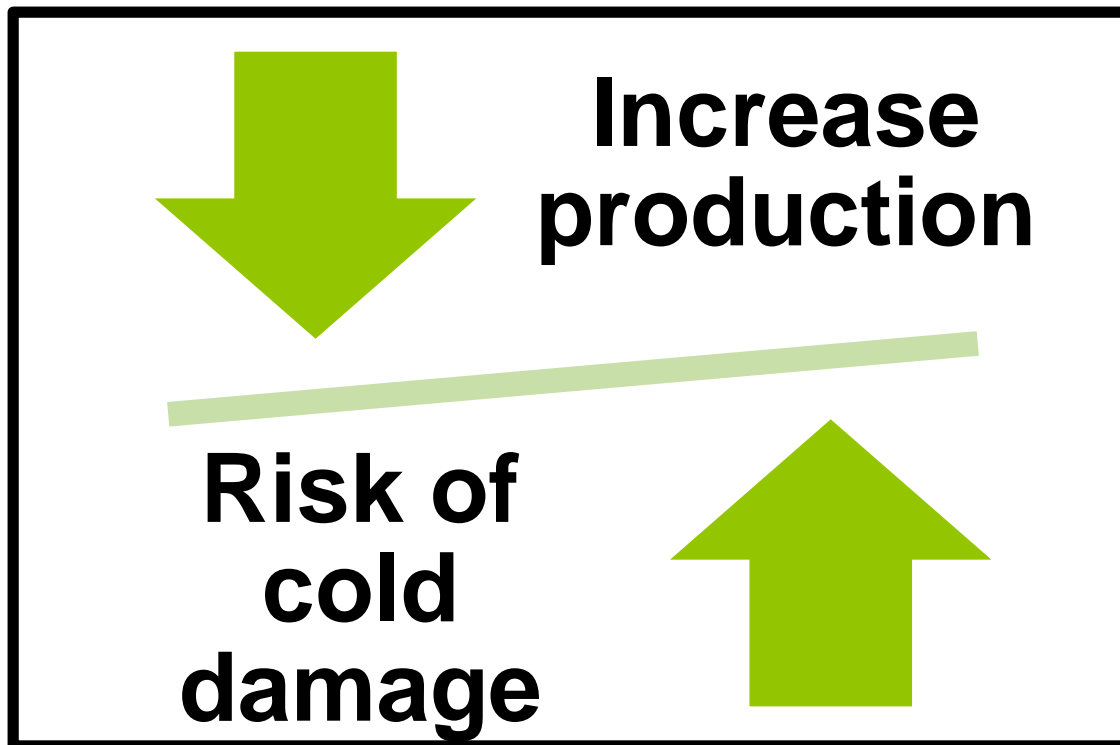
# Climate Data Interface Demonstration

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# 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

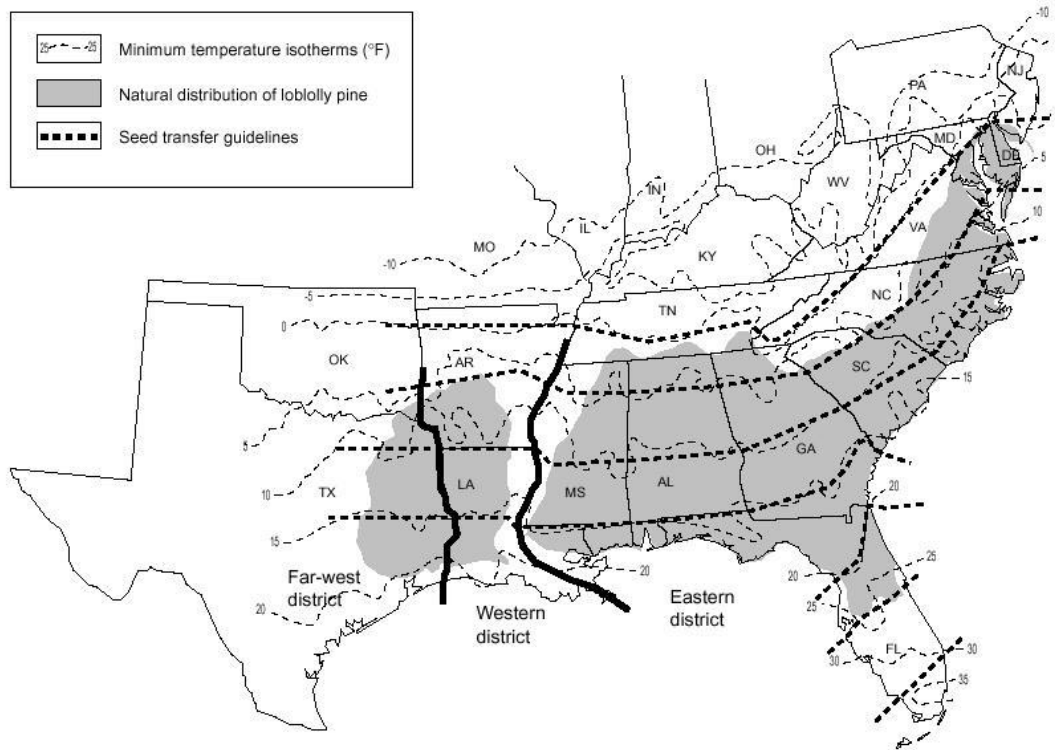


Figure 2—Loblolly pine distribution with seed transfer guidelines. Natural distributions of species adapted from Critchfield and Little (1966); minimum temperature isotherms from USDA (1990).

## 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

## 1. Environment

### Temperature

- Extreme Minimum Temperature
- Summer Temperature

### Precipitation

- Summer Precipitation

### Coming Soon!

- Growing Season Length
- Drought and Flood Risk
- Water Stress

## 2. Establishment

### Seedling Deployment

- Seedling Markets
- Seedling Sources

## 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

## SERCH

Southeast Regional Climate Hub

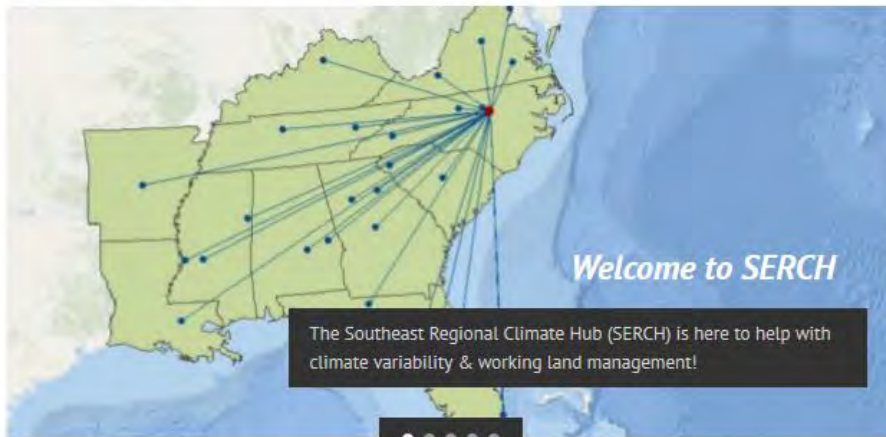
SERCH

+ News

+ Tools & Services

Land Management

Partners



- 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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