

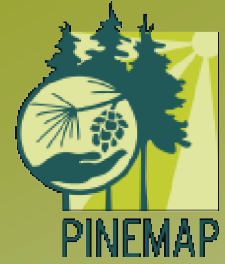


PINEMAP's Decision Support System (DSS)

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Ryan Boyles

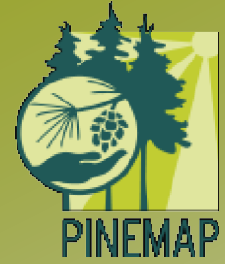
Science Presentation

PINEMAP 2014 Annual Meeting | May 14—16, 2014



What is a DSS?

- Collection of tool(s) to guide decision making
 - Often integrate science and data / models
 - Often web-based & targeted for specific audience
- Educational and related extension material



How does a DSS work?

- Input: Information
 - Climate data, forecasts are just one input
 - Other inputs required, often sensitive to climate e.g. decision triggers
 - Requires engagement
- Output: *Informed* Guidance
 - Sometimes YES/NO, often probabilistic
 - *Risk assessment* is often a focus

DSS Stand-Level Example Tool:

LobDSS: Loblolly Pine Decision Support for Silviculture

Input:

e.g. initial density, basal area, age, soil type, etc.

Forest Nutrition Cooperative: Silvicultural Decision Support System

File Tools Help About

Stand Initial State

Stand Number :

Initial Density [trees/acre] :

Basal Area [sq feet/acre] :

Dominant Height [feet] :

Initial Age :

Final Harvest :

Site Information

Site Index [feet] : Adjusted

Soil Type :

Drainage Class :

Surface :

P deficiency :

Competing Vegetation :

% BA in hardwoods :

Annual CO2 Increase (ppm) :

Stand Management | Costs | Products | Establishment and First Year Treatments | Output Windows

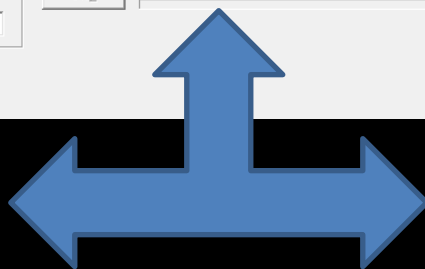
Fertilizations	Age	Elemental N (lbs/ac)	Elemental P (25 lbs/ac) (1=YES)
First			
Second			
Third			
Fourth			

Thinnings	Age	Row Removal Rate (2-5)	Residual Number of Trees	Residual Basal Area (sq.ft/ac)
First				
Second		N/A		

Simulate Optimize

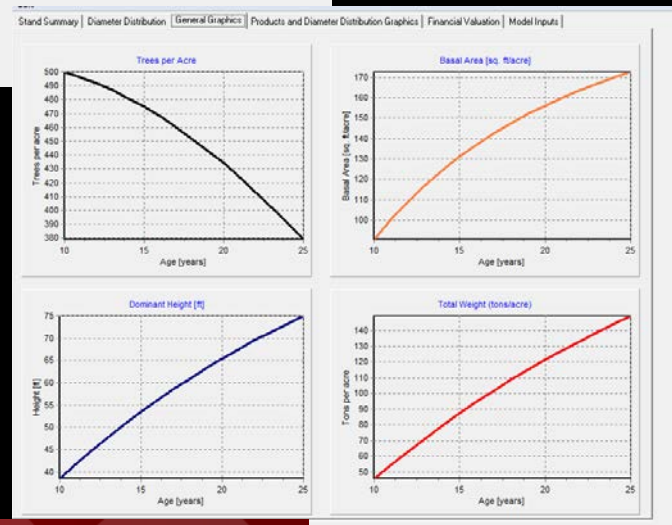
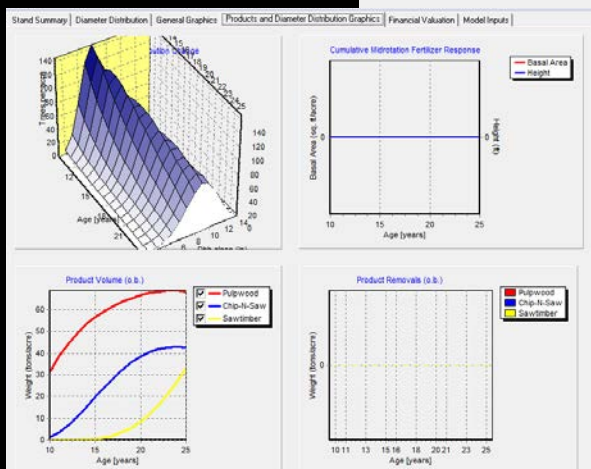
Current NPV Iterations or Time Limit (min)

Search: Exhaustive Tabu Maximum NPV



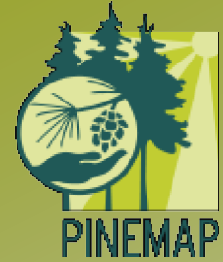
Outputs:

e.g. products & diameter distribution, trees/acre, total wt, etc.



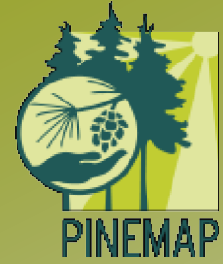
FOREST PRODUCTIVITY COOPERATIVE

North Carolina State University · Virginia Polytechnic Institute and State University · Universidad de Concepción



What is PINEMAP's DSS?

- Goal of DSS: Web-based toolbox to provide *regional guidance* on decisions associated with risk and opportunities (e.g. climate, genetics, management)
- Builds on coordinated research outputs
- Incorporates educational, extension materials



DSS development process

Step 1: identify target audience

- Professional foresters
- Specialized practitioner / land manager

Step 2: identify their decisions & questions

Step 3: how does PINEMAP research fit into those questions/decisions?



Decision-Based Menus and Topics

PINEMAP
Mapping the future of southern pine management in a changing world.

Environment Establishment Management Production

Temperature Precipitation Drought Other Weather Conditions Soils Water

To get started, choose a topic in the menu above.

Stakeholder Question

What is the risk of SPB outbreaks in the future?



Related Research / Dataset

SPB risk models



DSS Product / Tool

Clickable map with risk of future outbreaks



Mapping the future of southern pine management

Environment

Establishment

Management

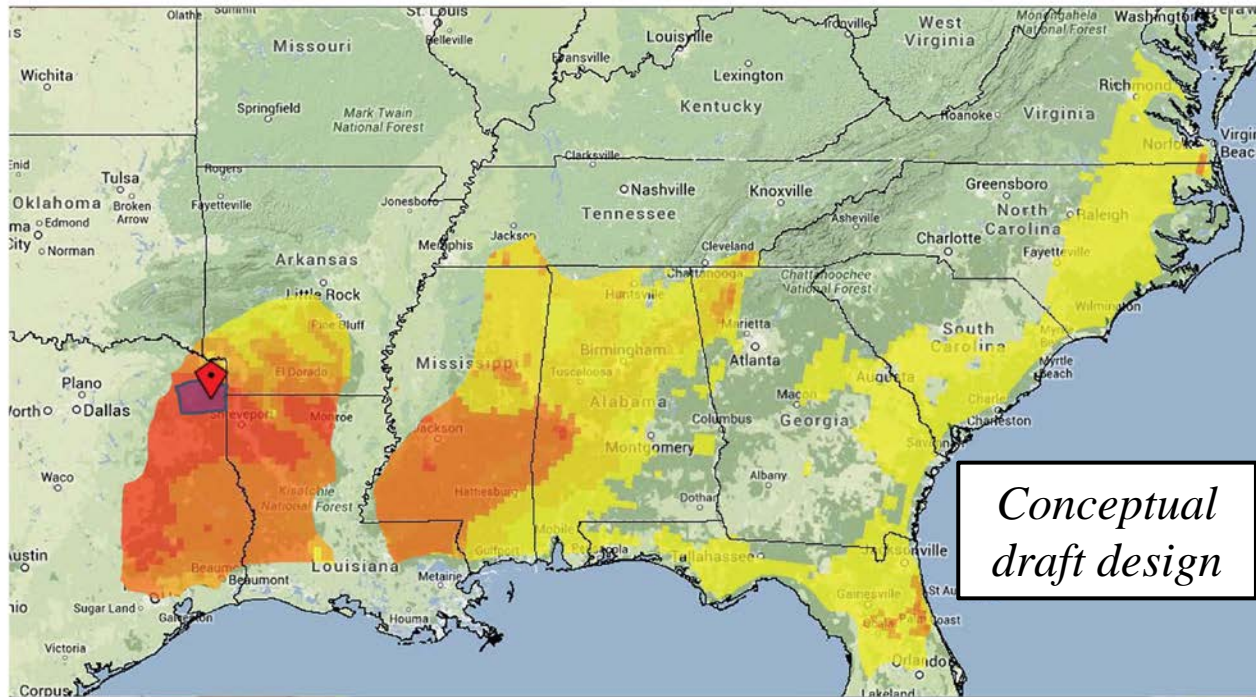
Thinning

Pests

Diseases & Vegetation

Nutrient Guidance

Select a tool:



At your location:

Region: Cass County, TX

Risk Level: Moderate

Other Resources:

[SPB Outbreak Fact Sheet](#)

[Pest and Disease Impacts on Loblolly Pine Stands](#)

What is the risk of SPB outbreaks in the future?

Conceptual draft design



Tools in Progress



[Decision Support System](#)

[Environment](#)

[Establishment](#)

[Management](#)

[Production](#)

Thinning

[Pests](#)

[Diseases and Vegetation](#)

[Nutrient Guidance](#)

Select a tool:



Mock-up Examples

- Environment
- Establishment
- ✓ Management
- Production

Select a tool: Extreme minimum temperature frequency

Historical dataset (from 1986 to 2005):

- Observations
- Model baseline data

Future projections:

Period: 2061 to 2080

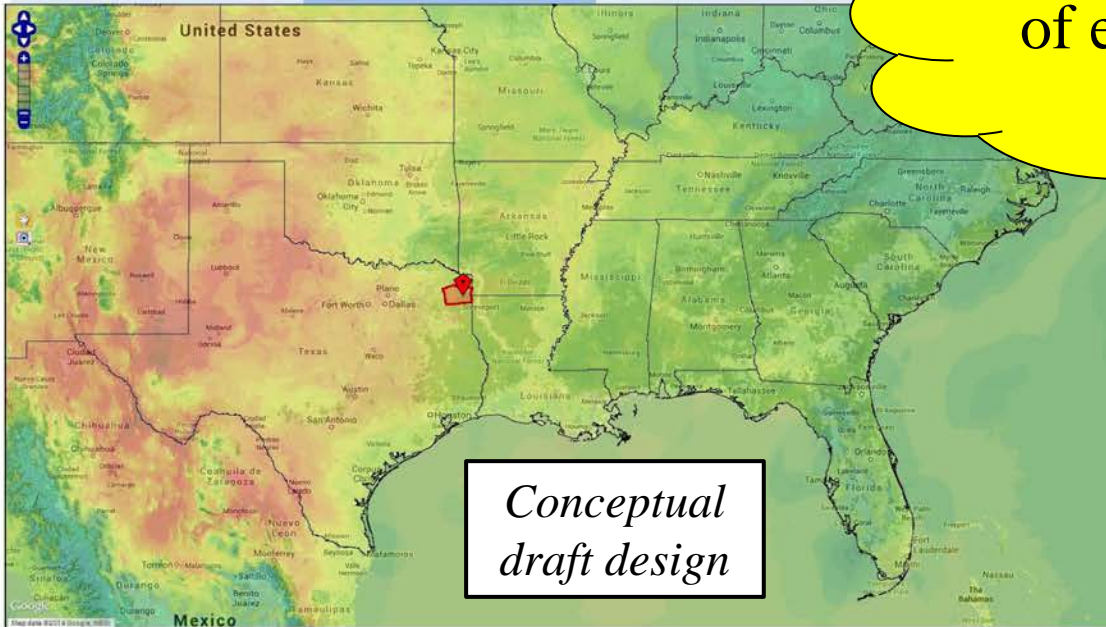
Temp. threshold: 20°F

Season: Winter (DJF)

RCP scenario: 4.5

Display

Minimum projected change Mean projected change Maximum projected change



Mean projected change in days per year with minimum temperatures < 20°F for the period from 2061 to 2080 (reference period: 1986 to 2005)

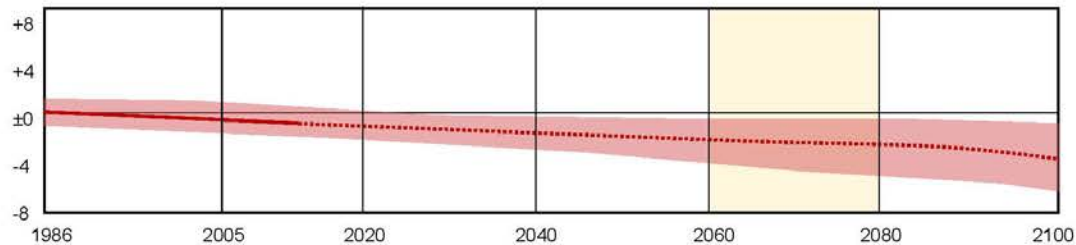


At your location:

Region: Cass County, TX

Baseline: 12 ± 3.2 days

Projected Change: -2.8 ± 2.1 days



What are projections of extreme minimum temperature?

Conceptual draft design



PINEMAP

Mapping the future of southern pine management

[Environment](#)

[Establishment](#)

[Management](#)

Seedling Selection

[Planting](#)

[Site Preparation](#)

Select a tool: [Seed Deployment Tool](#)

Historical dataset (from 1986 to 2005):

Observations

Model baseline data

Future projections:

Period: [2021 to 2040](#)

RCP scenario:

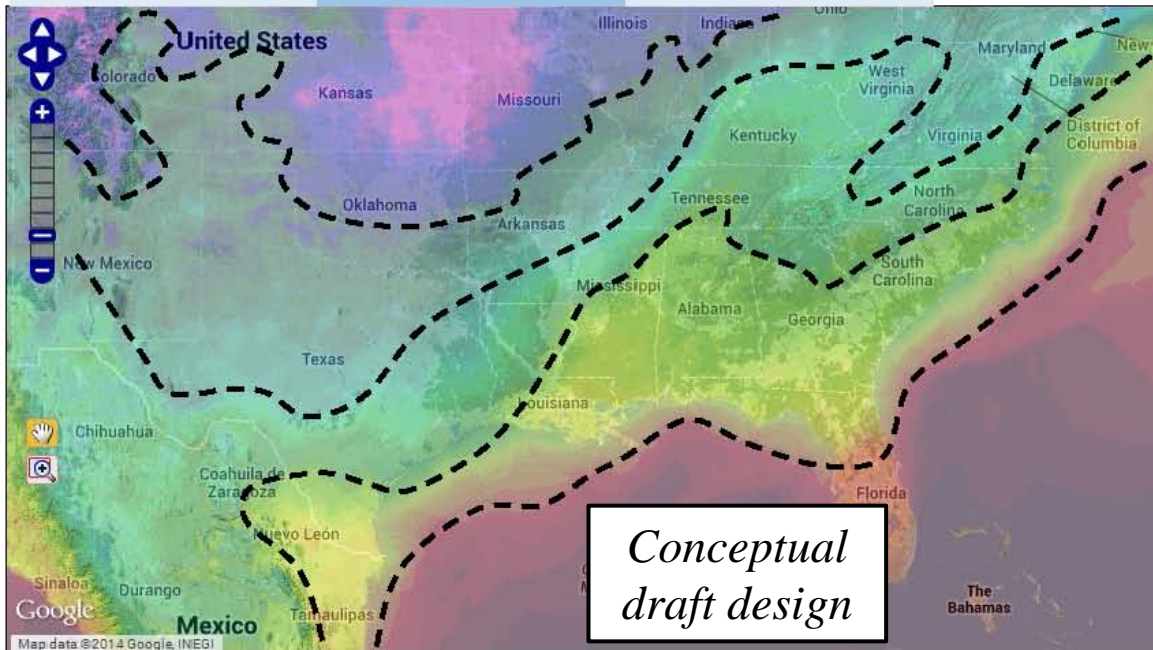
[Low \(4.5\)](#)

[Display](#)

[Minimum projected values](#)

[Mean projected values](#)

[Maximum projected values](#)



*Conceptual
draft design*

Projected mean annual extreme temperature for the period from 2021 to 2040



[Click to select your location](#)

Where can I plant my seed in the future?

Historical dataset (from 1986 to 2005):

Future projections:

RCP scenario: **Low (4.5)**

Display

Observations

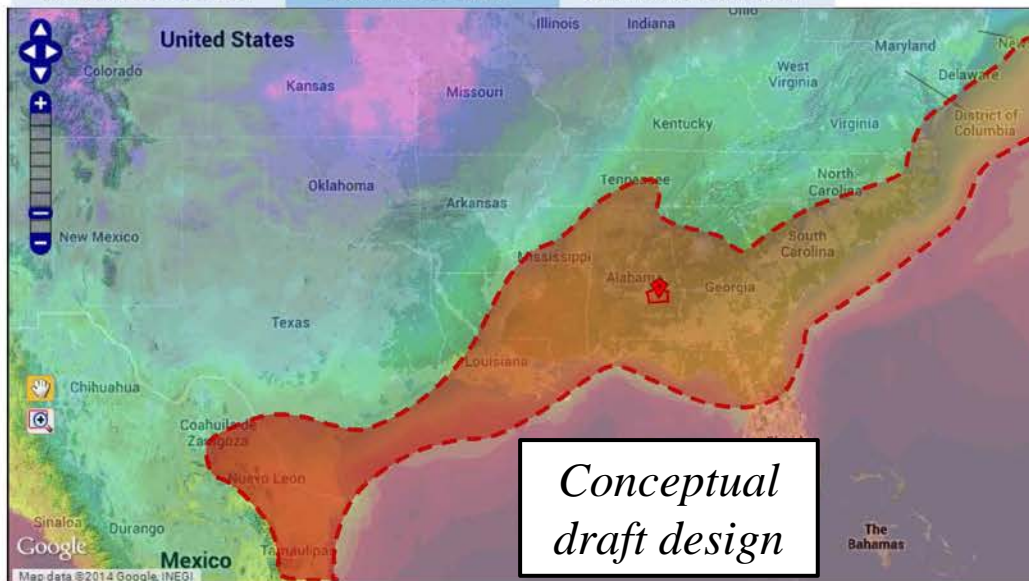
Period: 2021 to 2040

Model baseline data

Minimum projected values

Mean projected values

Maximum projected values



Projected mean annual extreme temperature for the period from 2021 to 2040



Potential seed selection range (locations with mean annual extreme temperatures within $\pm 2.5^\circ\text{F}$)



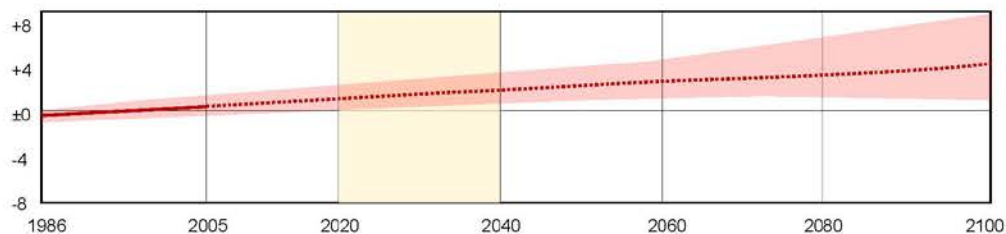
◆ At your location:

Region: Macon County, AL

Historical mean annual extreme temp. for the period from 1986 to 2005: 7°F

Projected mean annual extreme temp. for the period from 2021 to 2040: 8°F (+1°F)

Projected future changes in mean annual extreme temperatures:



Select a tool: Growth & Yield Model: Green Weight

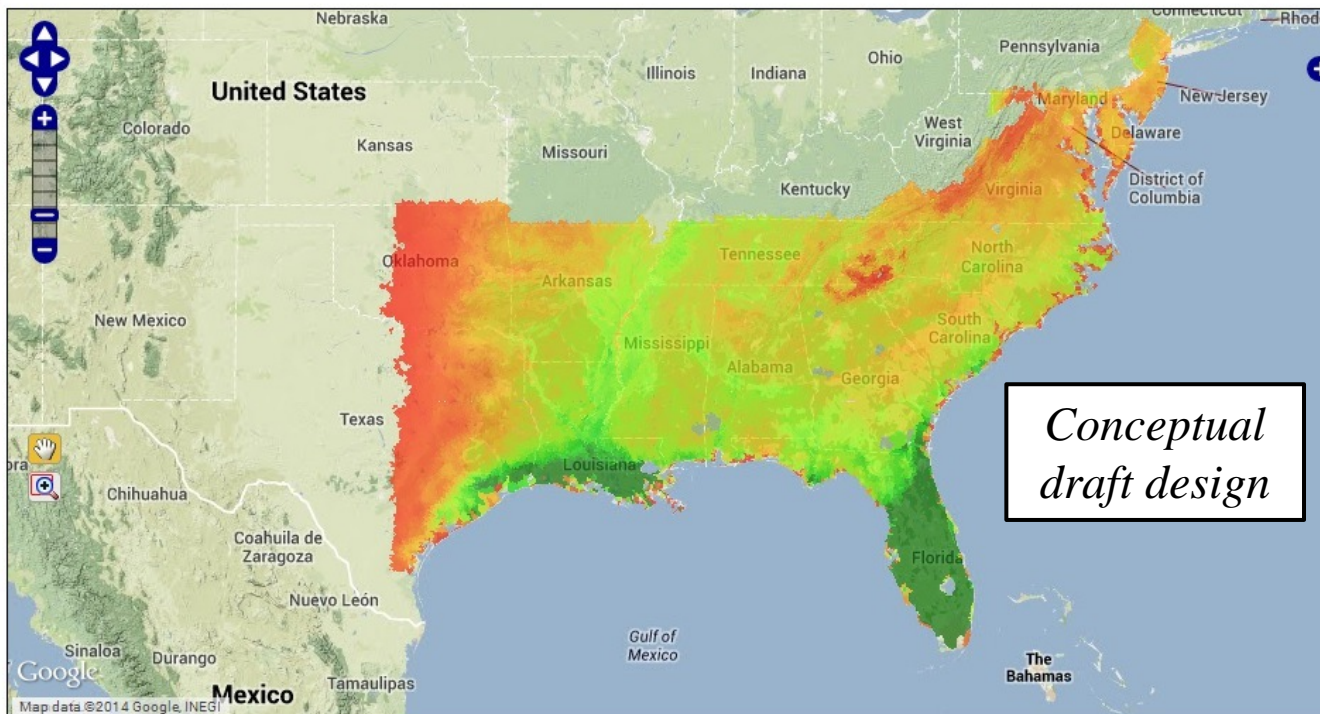
Year: 2014

Display

RCP scenario: Intense (8.5)

Management scenario: Baseline (control)

How does future climate influence pine productivity?

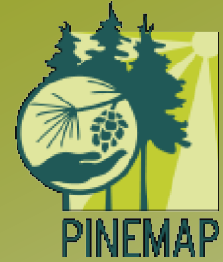


Green weight (tons per acre)



Other Resources

[Virginia Tech's Forest Modeling Research Cooperative](#)
For more information on this data, contact [Dr. Harold Burkhardt](#) at Virginia Tech University.



Coming soon...

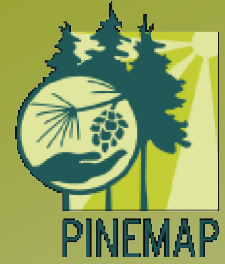
- Future decision support tools:
 1. How does future climate influence pine productivity using 3PG models?
 2. What is the risk of hurricane impacts on pine stands when considering future climate?
 3. What is the risk of SPB outbreaks on pine stands when considering future climate?



DSS Tools...

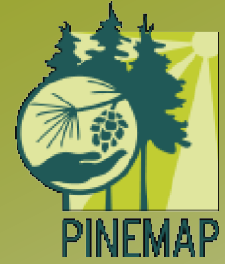
...will take these risks and opportunities into consideration:

- Climate
- Soils
- Pests/Disease
- Productivity
- Fire
- Genetics
- Markets
- Management



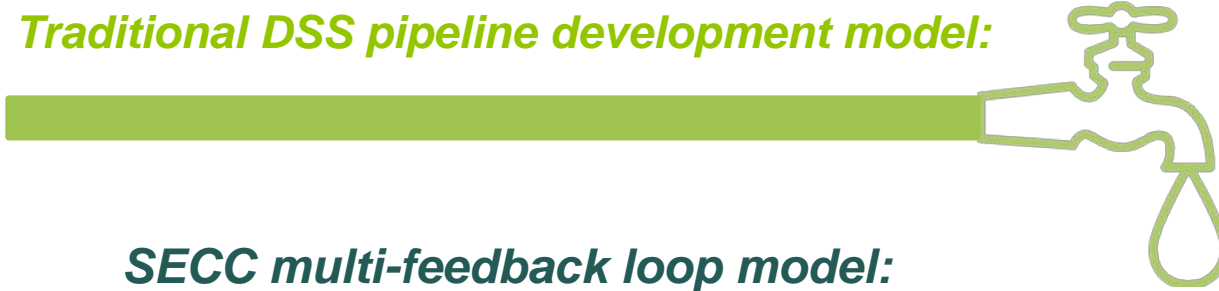
Challenges and Lessons Learned

- Communication, communication, communication
- Iterative process

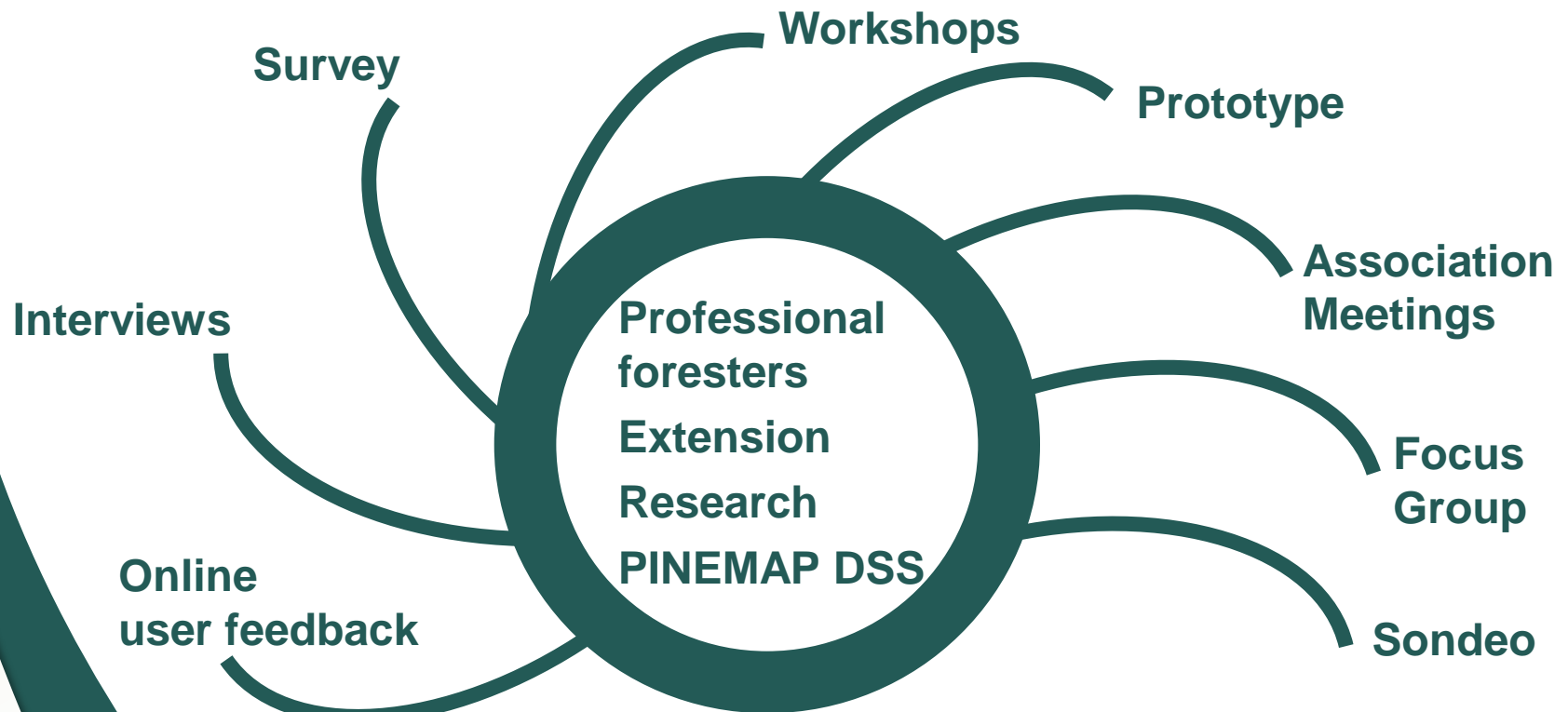


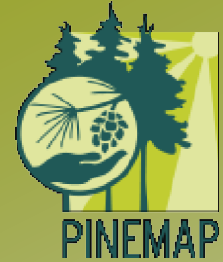
Challenges and Lessons Learned

Traditional DSS pipeline development model:



SECC multi-feedback loop model:





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919-513-0244

Environment

Establishment

Management

Products

Temperature

Precipitation

Drought

Other Weather Conditions

Soils

Water

Select a tool:

Historical dataset (1986 to 2005):

Observations

Model baseline data

Future projections:

Period:

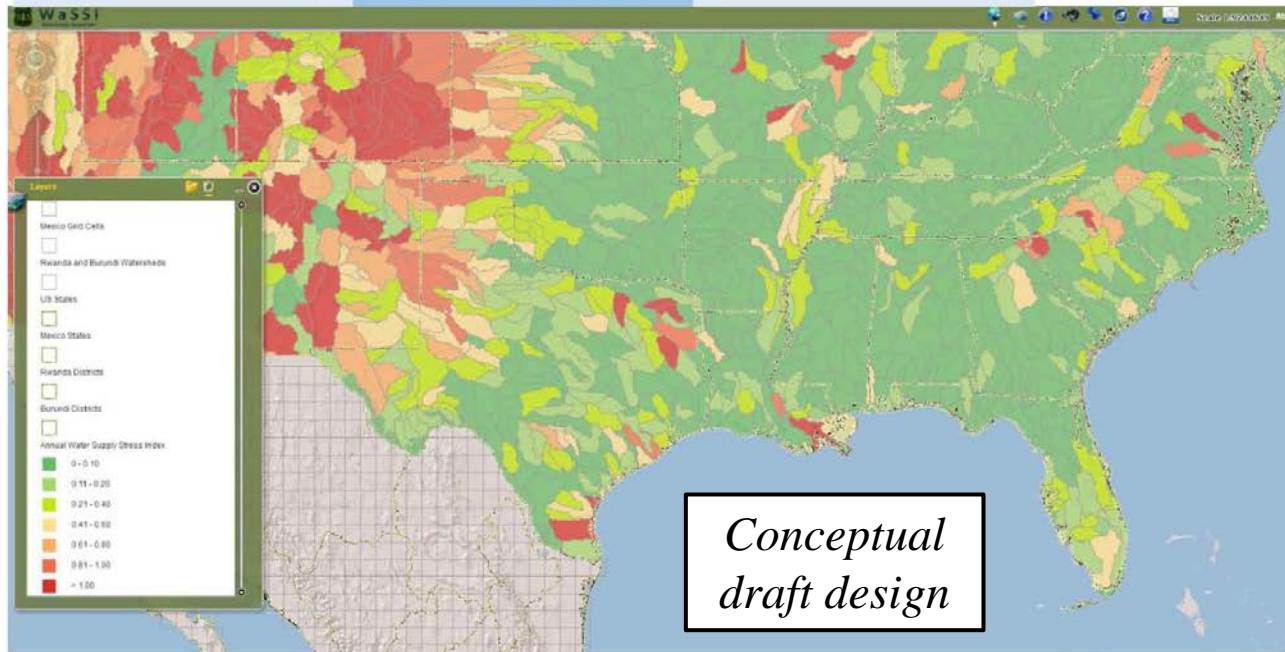
Output:

RCP scenario:

Minimum projected change

Mean projected change

Maximum projected change



What will future water supply and demand look like?

Other Resources:

 [Water Supply Stress Index Fact Sheet](#)

 [Background: WaSSI](#)