Seed Movement and Climate Change from a Forest Service Perspective

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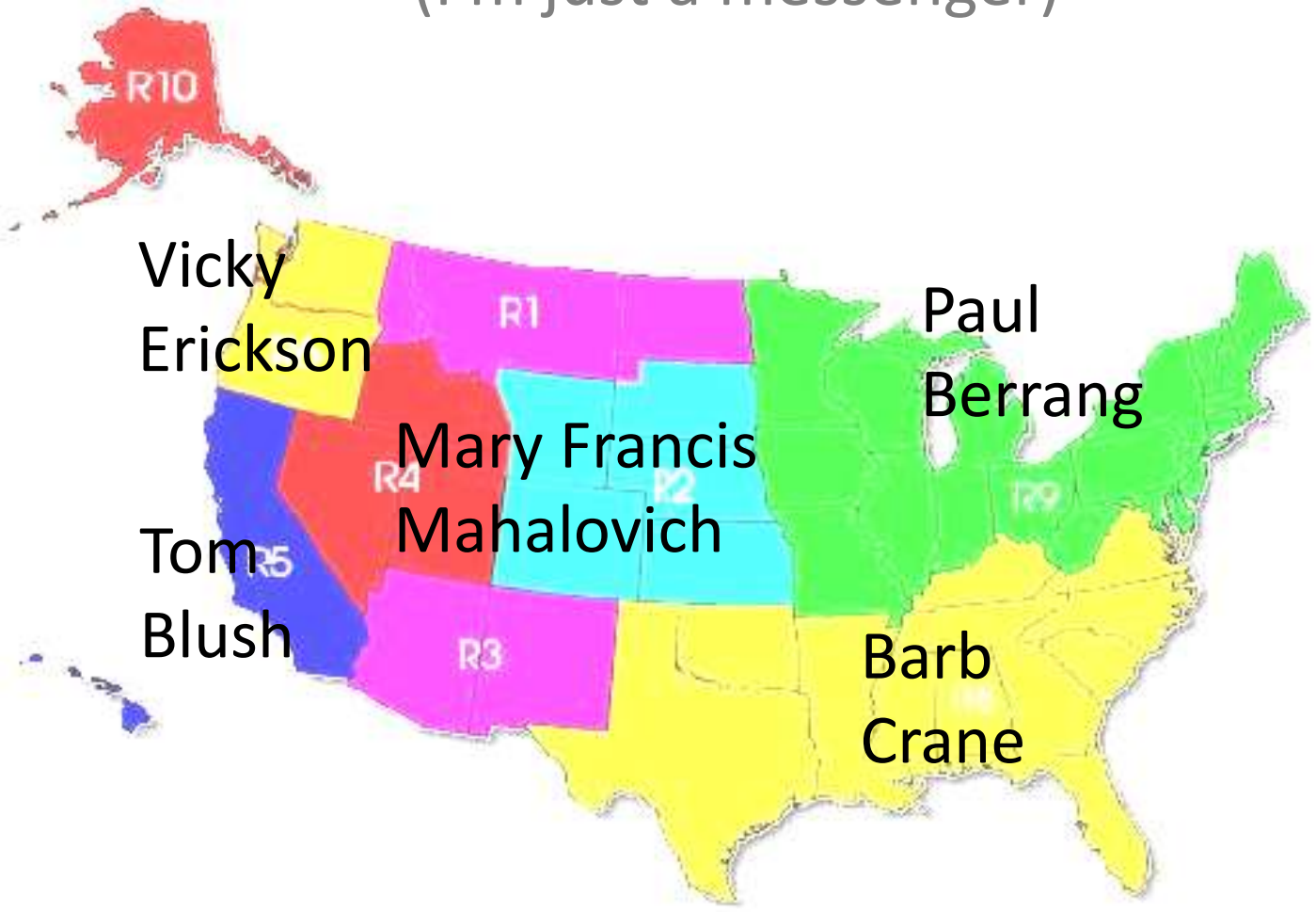
Washington DC

Really this is the effort of the National Forest System Geneticists

(I'm just a messenger)



Workshop in Corvallis Oregon March 2-4 2010

- National Forest System Geneticists
- Some Forest Service R&D geneticists
- Other Researchers, Oregon State University, University of British Columbia, BC Ministry of Forestry, Climate Change Research Institute & Oregon Climate Service

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- Goal - prepare a document that describes a consensus view of what the Forest Service should do with seed movement in light of climate change
- Not prescriptions, but concepts

Geneticists

Botanists

- Regeneration Interval
- Inbreeding
- Mating systems
- Range vs Forest Management

Agreement

- Climate is changing
- Changes probably most evident at ecotones
- Genetic diversity is a good thing
- Start with what has been working:

  locally-adapted regionally-appropriate seed sources
- Take large risks on small areas, and small risks on large areas
- Need for genetic conservation

Differing opinions

- Different levels of risk aversion
- Importance of species envelope models

Starting Points

Randy's musings on Strategic Plan, Disturbance, Trajectories, etc.

FOREST SERVICE MANUAL
NATIONAL HEADQUARTERS (WO)
WASHINGTON, DC

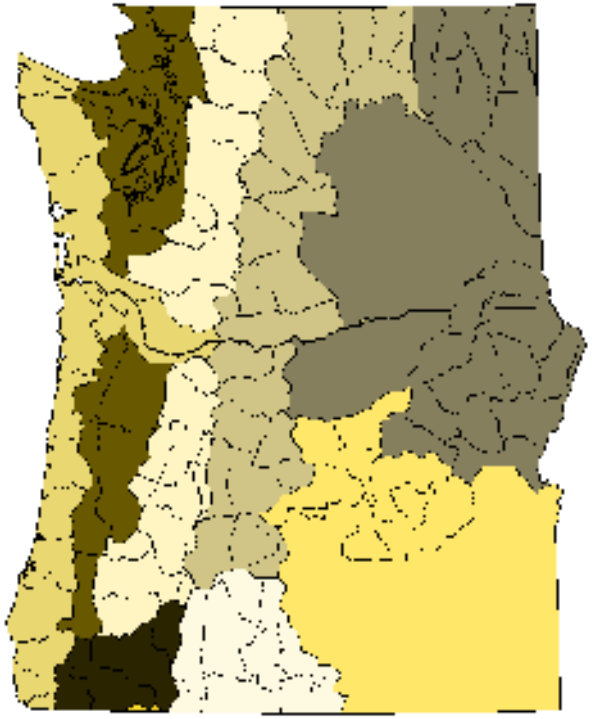
FSM 2000 – NATIONAL FOREST RESOURCE MANAGEMENT

CHAPTER 2070 – VEGETATION ECOLOGY

Amendment No.: 2000-2008-1

Effective Date: February 13, 2008

- Native species
- Locally-adapted
- Regionally-appropriate
- Genetically diverse



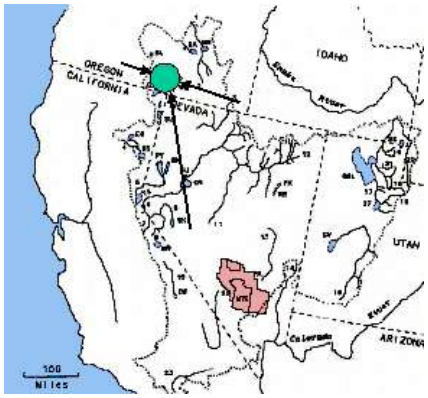
What are the best seed sources for ecosystem restoration on BLM and USFS lands?

Randy Johnson, Larry Stritch, Peggy Olwell, Scott Lambert, Matthew E Horning, and Richard Cronn

Native Plant Journal - In Press

What we want and the scientific basis

"Locally adapted" means different things to different people



And it also means different things to different species

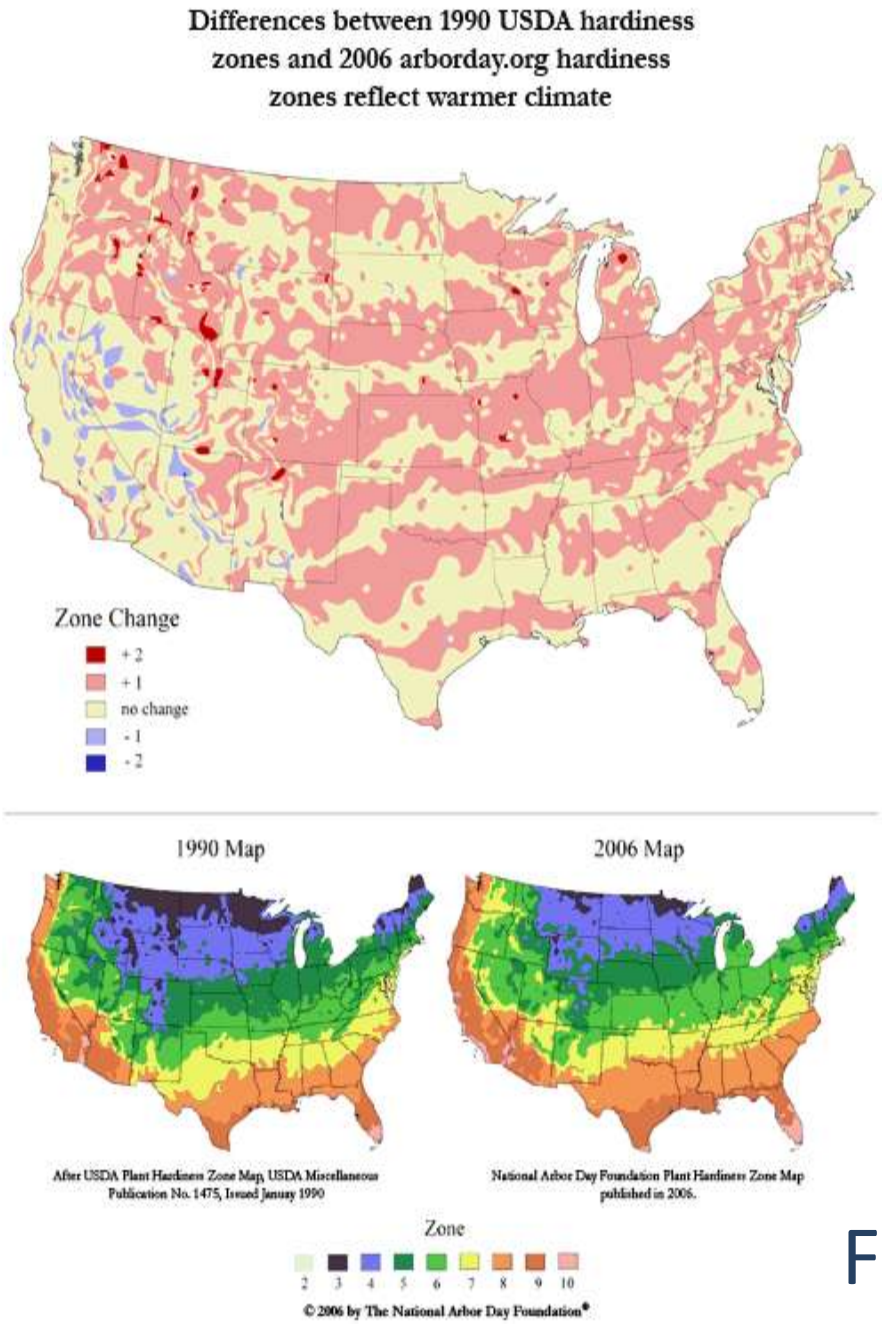
Climate today ≠
climate 20 years ago ≠
climate 20 years from now

So is local still local?

Climate today ≠
climate 20 years ago ≠
climate 20 years from now

So is local still local?

"If it ain't broke don't fix it"

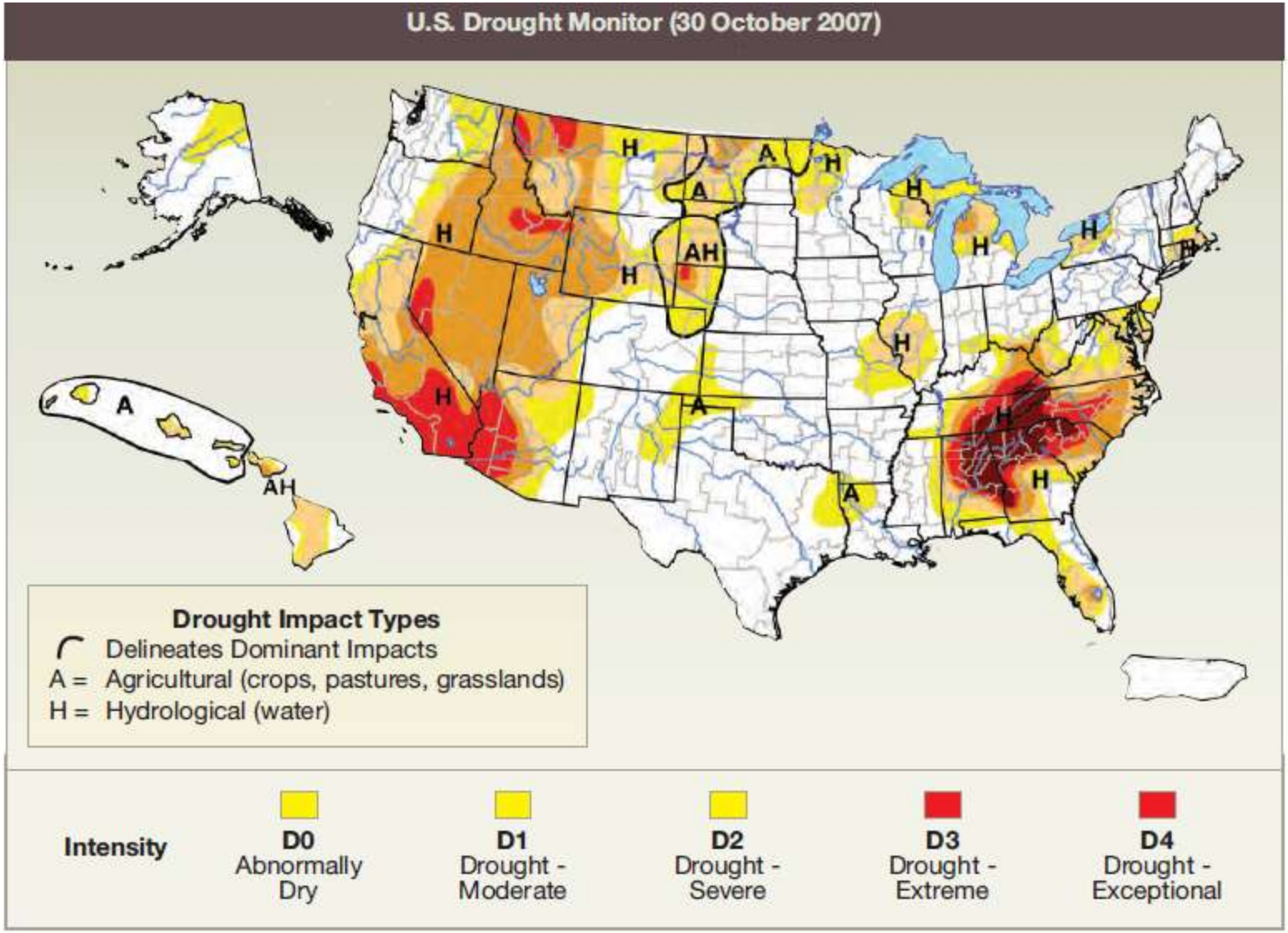


Climate change is already here

- About half of the US has warmed one hardiness zone based on the last 15 years of weather data

From Kay Haven's Talk Earlier

We have seen precipitation changes too



The Nature Conservancy
Protecting nature. Preserving life.™

ClimateWizard

Climate Wizard Text

UNIVERSITY OF WASHINGTON

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Future Climate Model

IPCC Fourth Assessment

Emission Scenario

High A2

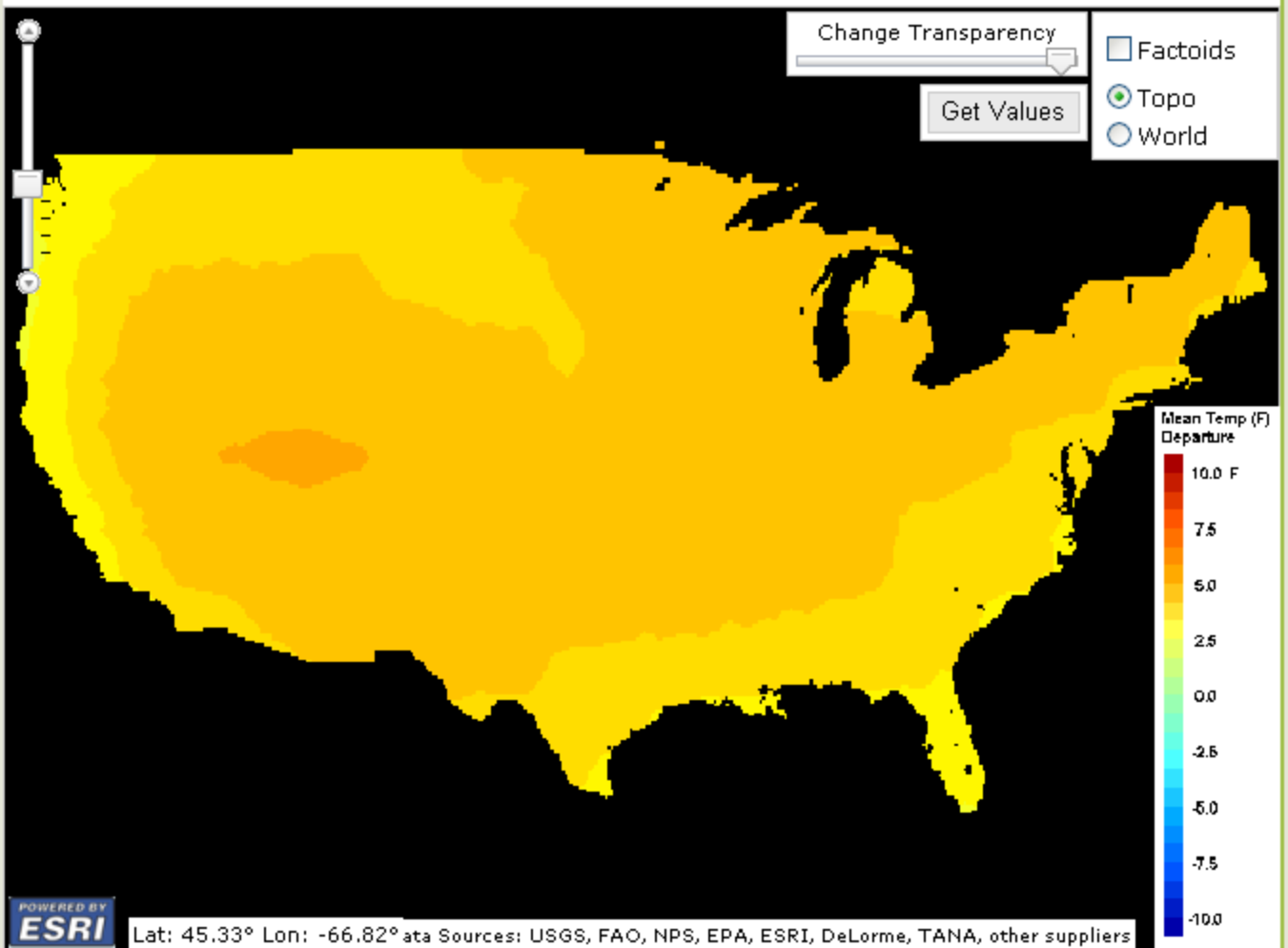
General Circulation Model

Ensemble Average

50%: This map shows the temperature change projected by the middle model. That is, **half of the models project a greater amount of change, and half of the models project less change** as compared to the 1961-1990 baseline average.

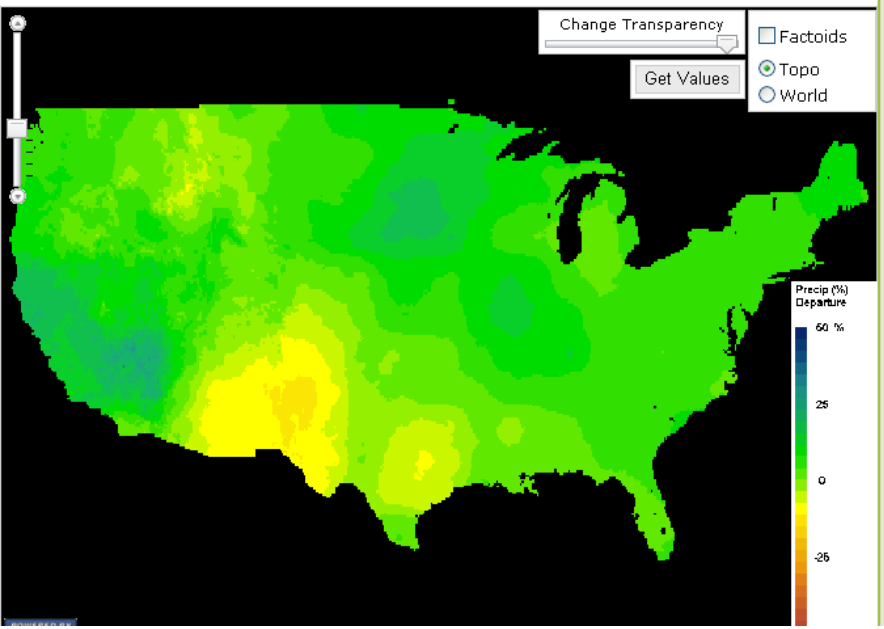
Change in Annual Temperature by the 2050s

Model: Ensemble Average, SRES emission scenario: A2



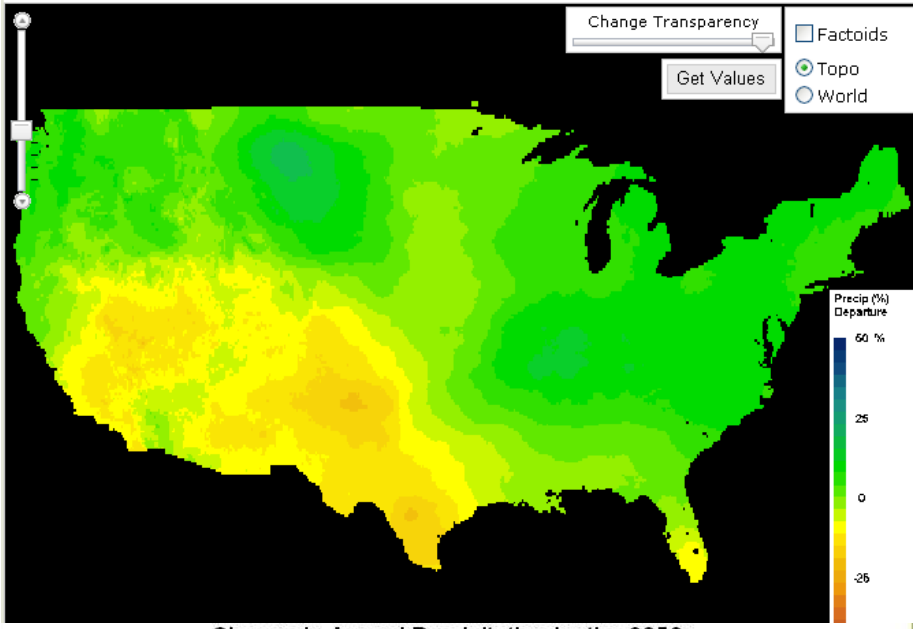
Change in Annual Precipitation by the 2050s

Model: MRI-CGCM2.3.2, SRES emission scenario: A2



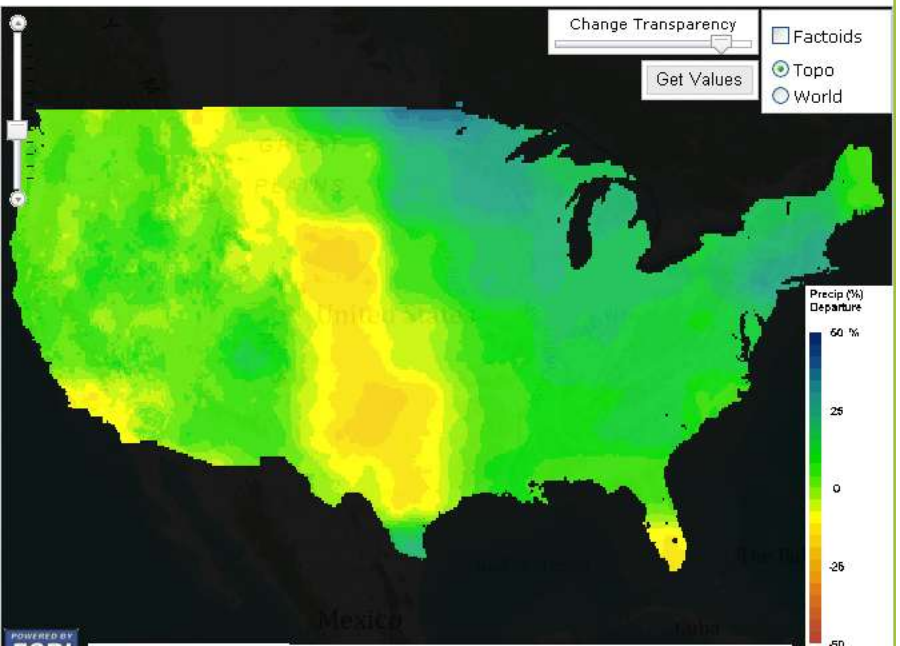
Change in Annual Precipitation by the 2050s

Model: BCCR-BCM2.0, SRES emission scenario: A2



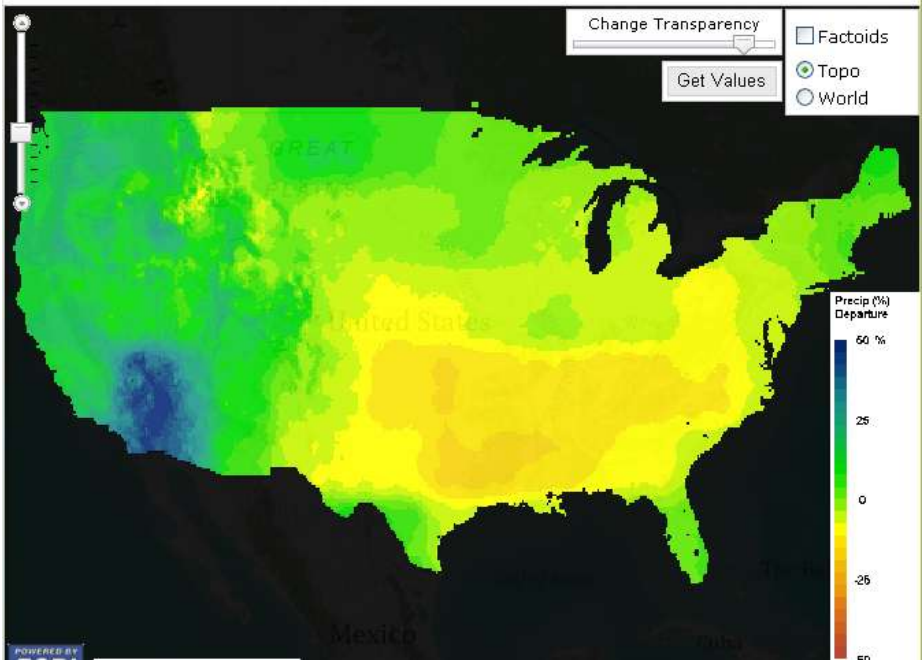
Change in Annual Precipitation by the 2050s

Model: GISS-ER, SRES emission scenario: A2



Change in Annual Precipitation by the 2050s

Model: INM-CM3.0, SRES emission scenario: A2



Uncertainty with regard to future climates

Both Direct and Indirect Effects

Regardless of uncertainty, Federal land managers will need to address climate change

National Environmental Policy Act

(NEPA)

Species and population movement

Forest Ecology and Management 259 (2010) 778–785

Contents lists available at ScienceDirect

Forest Ecology and Management

journal homepage: www.elsevier.com/locate/foreco

Selecting tree species for testing climate change migration hypotheses using forest inventory data

C.W. Woodall [a,*], C.M. Oswalt [b], J.A. Westfall [c], C.H. Perry [a], M.D. Nelson [a], A.O. Finley [d]

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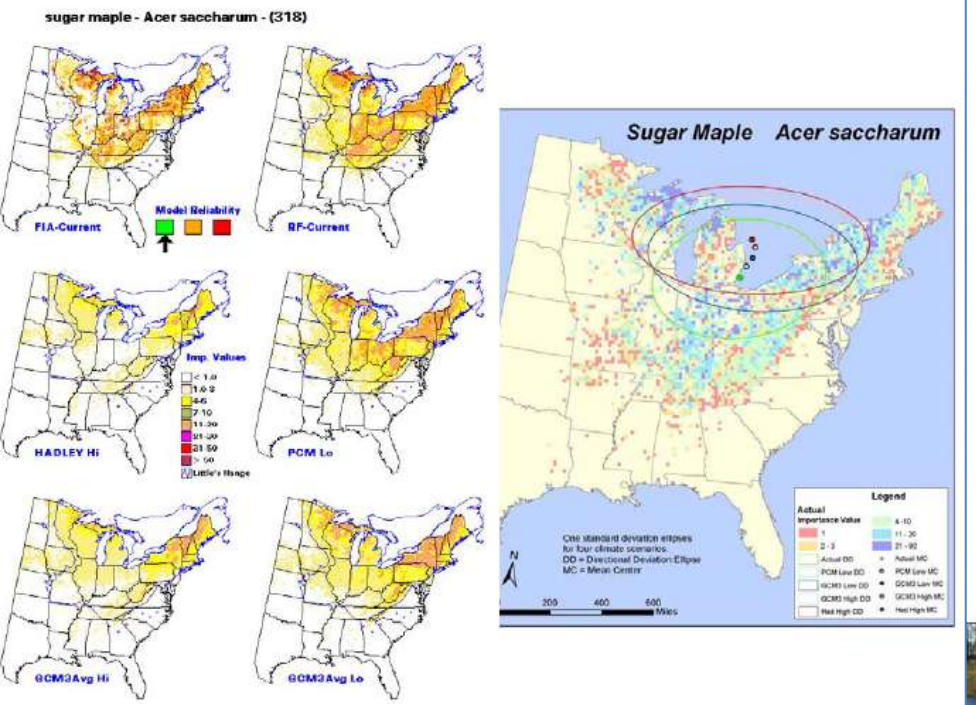
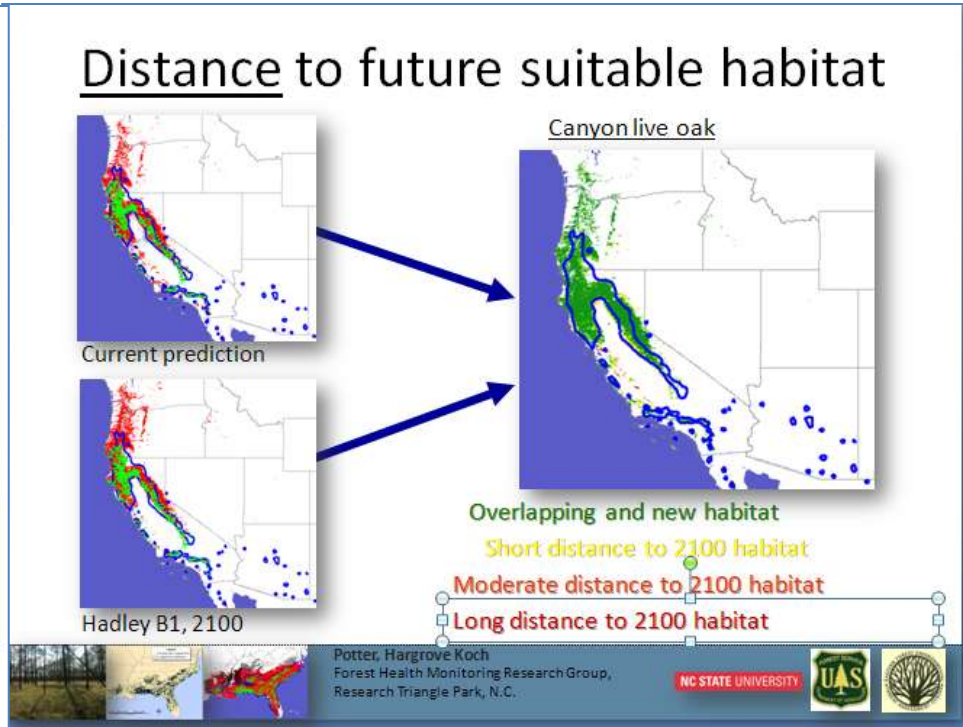




Predicting Appropriate Species / Seed Source

Complicating factors Influencing Species Presence:

- Uncertainty of future climate
- Temperature
  - Extremes (more so than means)
- Precipitation
- Soils
- Competition
- Disease and insects
- Fragmentation

Future environmental conditions many not exist right now?

- Photoperiod vs heat sums
- Warmer winters but still late frosts
- Different disease triangle relationships
- etc

Action Principles we agreed on:

Principle 1

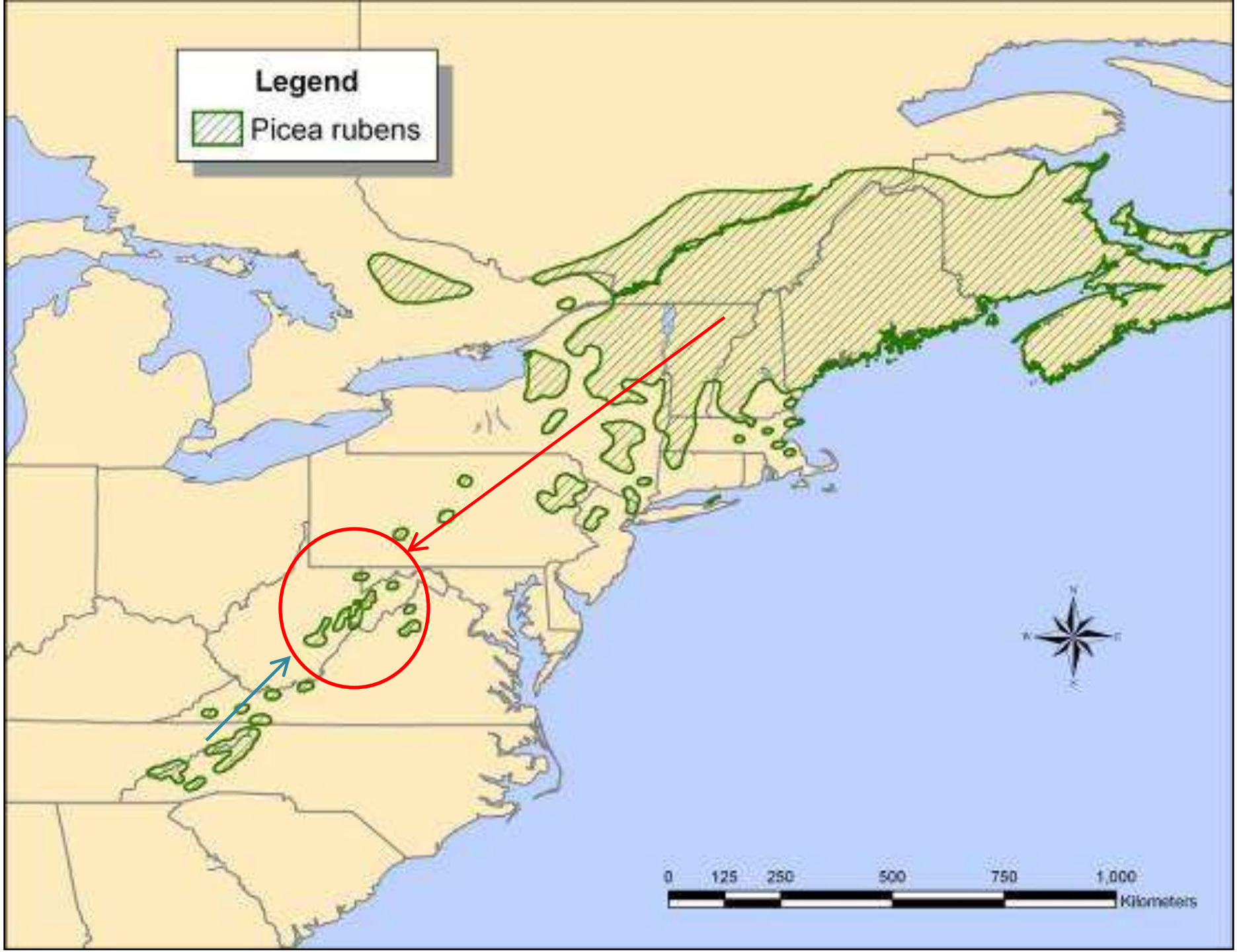
Diversity (Genetic Variation) provides insurance

If we need something new the pieces need to be there

Principle 1

Diversity provides insurance

But we need the right diversity… maladapted diversity will decrease fitness


Legend
Picea rubens
0
125
250
500
750
1,000
Kilometers

Principle 2

Large Risks over Small Areas

Small Risks over Large Areas

Small Risks over large areas

- Some seed zones have already shifted > 1,000 ft
- Not replacement of seed sources, but mixing
- Some regions already moving seed from the adjacent warmer seed zone

Brewer Spruce

Large moves on experimental basis

Principle 3

Need for Gene Conservation Programs

(*in situ* and *ex situ*)

Genetic Conservation

- Climate Change
- Exotics
  - Diseases
  - Insects
  - Animals
  - Plants
- Native bugs and crud

Examples of current Forest Service funded species

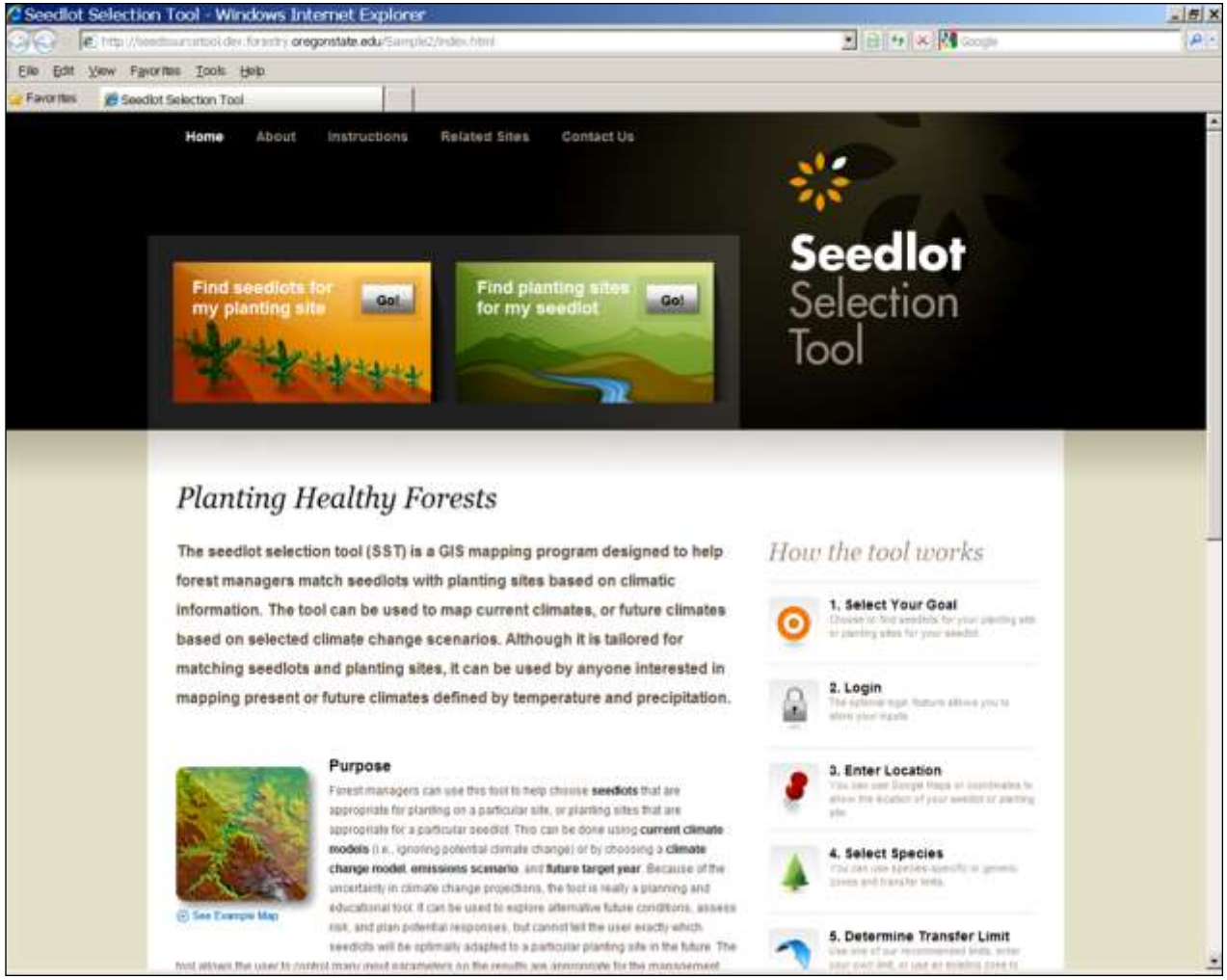
- Whitebark pine
- Elms
- Eastern hemlocks
- Boyton Oak
- Butternut
- Beech

Principle 4

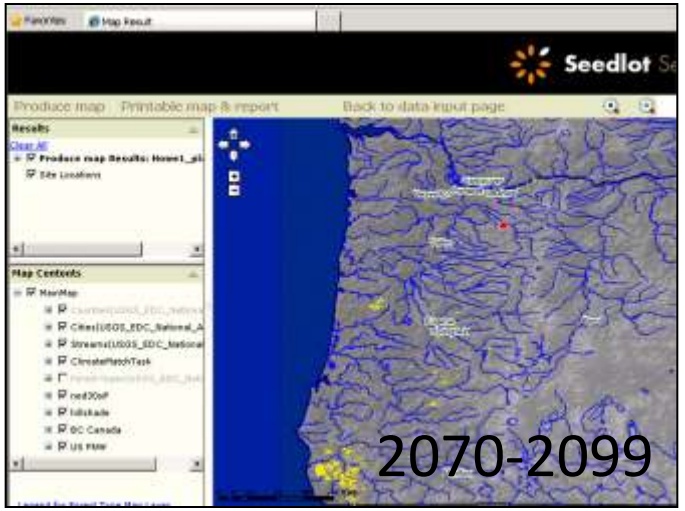
Having the seed ready for the future

- Knowing our seed needs (nationally)
- Having seed information available
  - Where it is (coordination)
  - Where it came from
- Breeding programs
  - Disease, drought
- Having decision tools in hand

Seedlot Selection Tool (SST)



Find seedlots for my planting site



Questions?