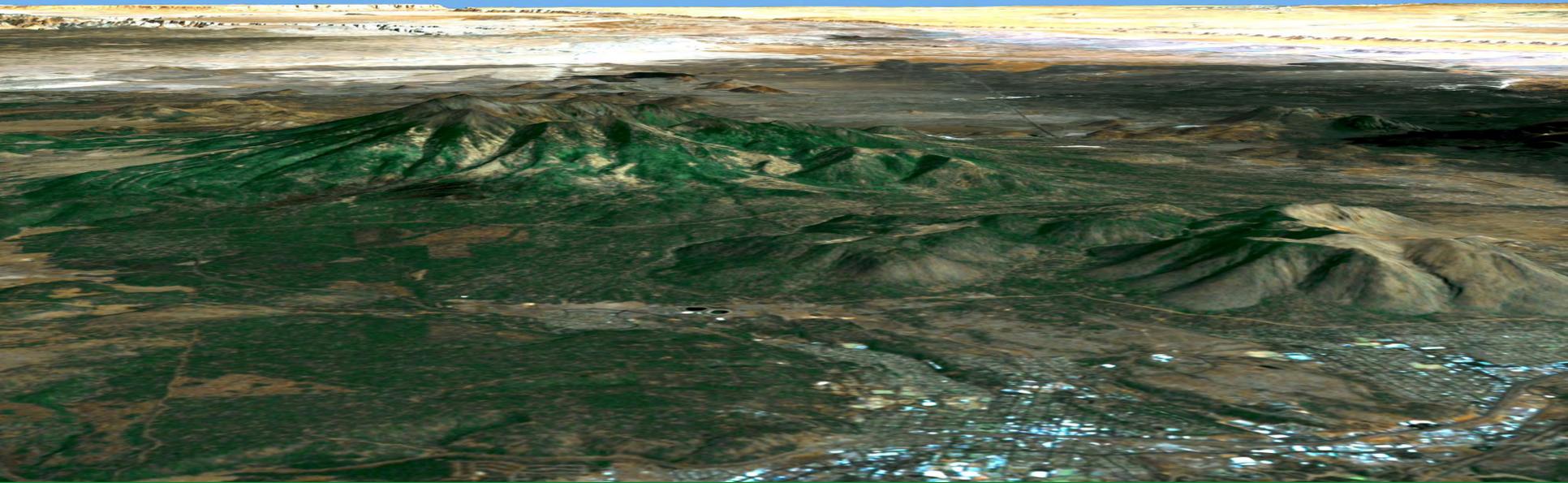


Southwest Experimental Garden Array (SEGA):

Planting Ideas for Tomorrow's Gardens



**Kris Haskins, The Arboretum at Flagstaff
Tom Whitham, NAU, George Koch, NAU, Amy Whipple, NAU,
Paul Flikkema, NAU, Sam Cushman, USFS**

In the beginning...



And then there
was science

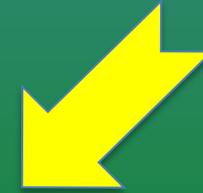


Mendel





Mendel



Why Build Such a Thing?

Importance of Common Gardens

The study of Genes x Environment

O'Neill, G.A., A. Hamann, and T. Wang. 2008. *Journal of Applied Ecology* 45:1040-1049.

And many others...

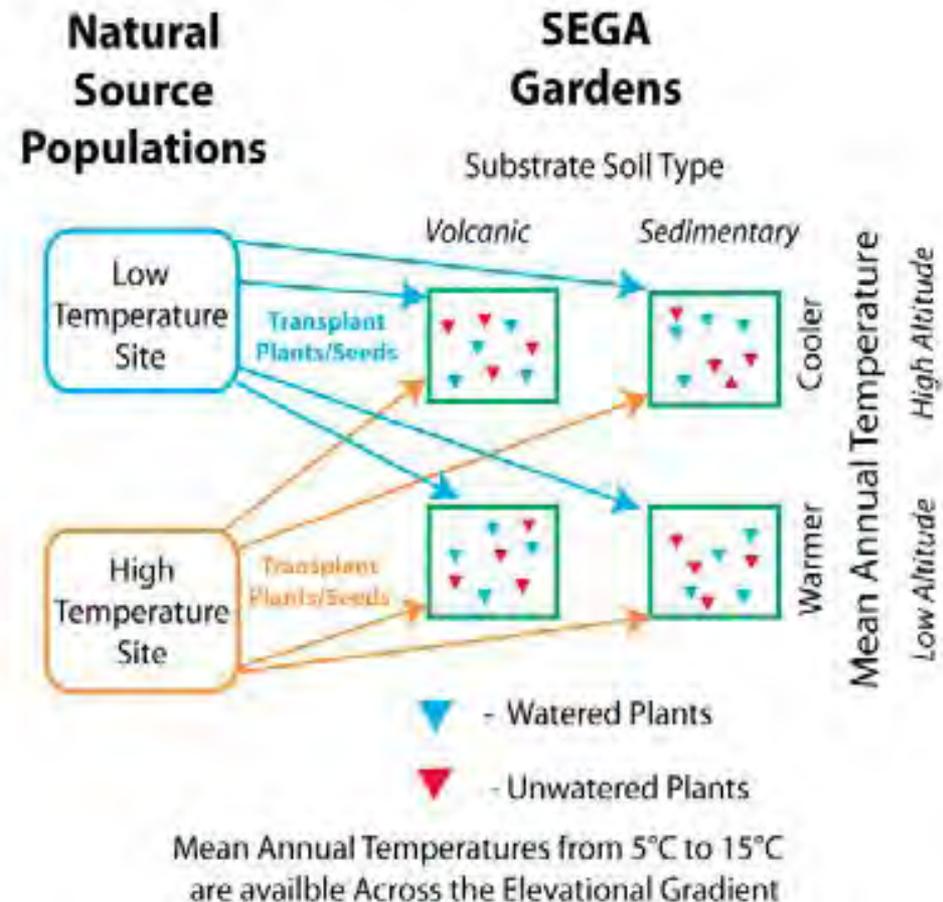


Figure 2: Reciprocal Transplant Design - SEGA experiments will use a reciprocal transplant design in order to separate genetic and environmental effects.

Importance of Common Gardens

- Seed transfer zone reassignment
(Miller et al. 2008, Final Report to BLM)

A common garden study plot of big sagebrush (*Artemisia tridentata*).

Data will be instrumental in the development of seed zones for this species.



Common Gardens are Becoming More Common

Knapp, E.E. and K.J. Rice. 1998. *Conservation Biology* 12:1031-1041. (*Nassella pulchra*)

Erickson, V.J., et al. 2004. *Canadian Journal of Botany* 82:1776-1789. (*Elymus glaucus*)

Johnson, M.T.J. and A.A. Agrawal. 2005. *Ecology* 86:874-885. (*Oenothera biennis*)

And many, many, more...

The BIG Idea

- Make available common garden field sites
- Insure that the gardens have fencing and water
- Be able to examine community, genetic, and climate effects
- Offer a range of elevations and soil types





What is the Southwest Experimental Garden Array?

- Major Research Instrumentation Award
- 4 year, ~\$2.5 million grant, + 1 million match
- Ten 5+ ac garden sites with infrastructure, instrumentation, and data management
- Data storage and data management planning

Who Developed the BIG Idea?

PIs: Tom Whitham, Amy Whipple, George Koch, Paul Flikkema, Sam Cushman (and others)



Project Management

Project Manager: Amy Whipple

Assistant Project Manager: Kris Haskins

Garden Manager: Karla Kennedy

Data Manager: Paul Heinrich



Microclimate sensing will be set up at all 10 sites.

What would you like to see measured?

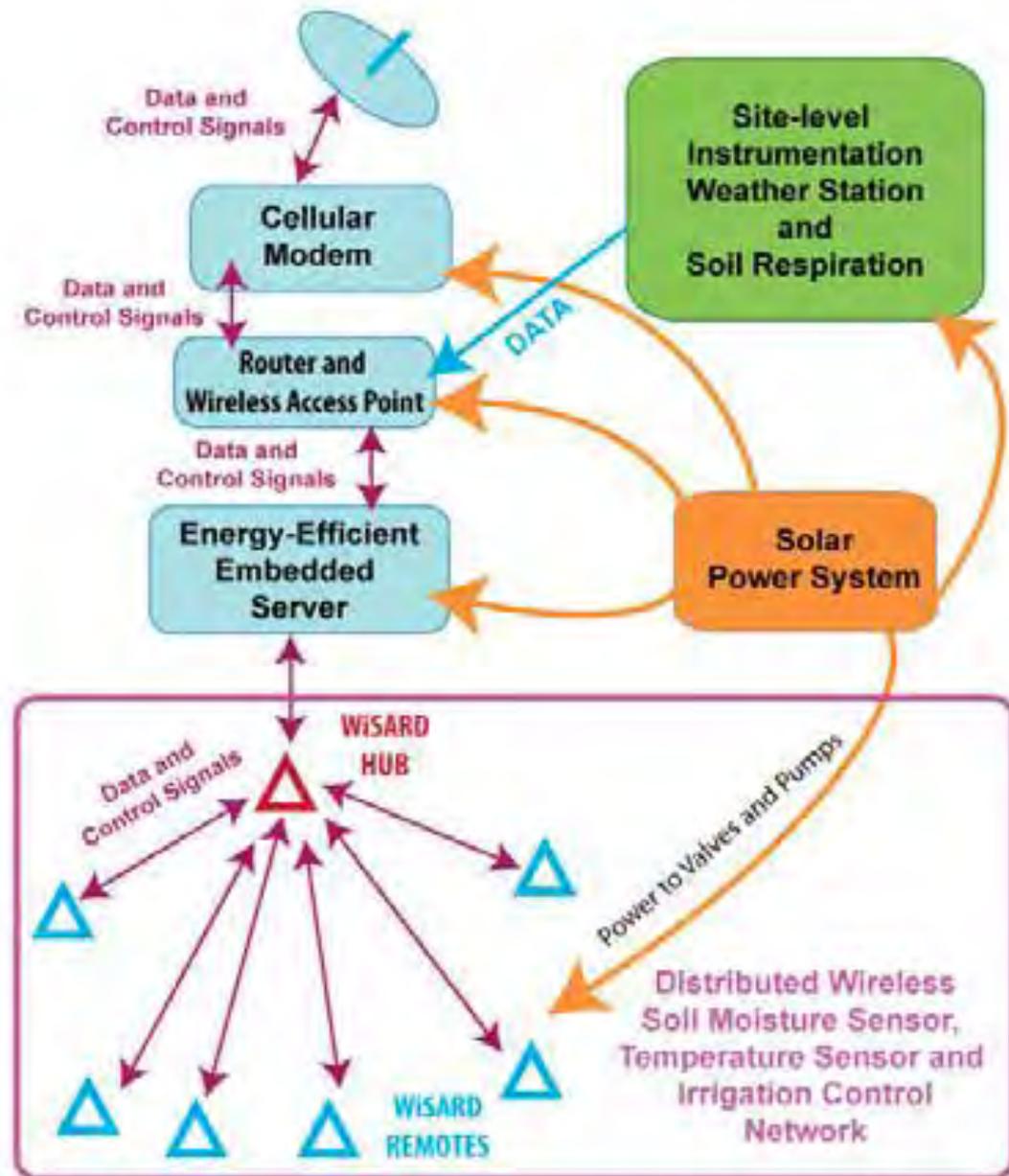


Figure 3: On-site sensing, computation, control, and energy infrastructure
- SEGA systems are designed to be extensible and sustainable

Data Management

...Is very important and an excellent plan has been developed.

What type of data do you envision contributing?

Where is SEGA?

Site Number	Habitat	Soil Parent material	Riparian Site	Name
1	Mixed Conifer/Aspen	Volcanic		Hart Prairie
2	Mixed Conifer/Aspen	Limestone	Yes	Buck Springs
3	Ponderosa	Volcanic	Yes	Arboretum
4	Ponderosa	Limestone		
5	Piñon-Juniper	Volcanic		Cedar
6	Piñon-Juniper	Limestone	Yes	Walnut Creek
7	Grassland	Volcanic		Antelope
8	Grassland	Limestone		
9	Desert scrub	Volcanic		
10	Desert scrub	Limestone	Yes	Chevelon Crk.

Hart Prairie

5+ acres of
mixed
conifer/aspen
habitat on
volcanic
parent
material soils.



*The Nature
Conservancy* 

SAVING THE LAST GREAT PLACES ON EARTH

Buck Springs

5+ acres on
Coconino N.F.,
consisting of
mixed conifer and
riparian habitat
on limestone
parent material



The Arboretum at Flagstaff

5+ acres of
privately owned
ponderosa pine
forest and alpine
meadow habitat
on volcanic
parent material
soils



THE ARBORETUM
AT FLAGSTAFF

Walnut Creek Center for Education and Research

- 5+ acres on Prescott N.F. consisting of piñon-juniper, old field and riparian habitats on limestone parent material soil.



Antelope

5+ acres of
grassland on
Babbitt Ranch
land



Spiderweb

5+ acres of
desert scrub
on Babbitt
Ranch land



Chevelon Creek

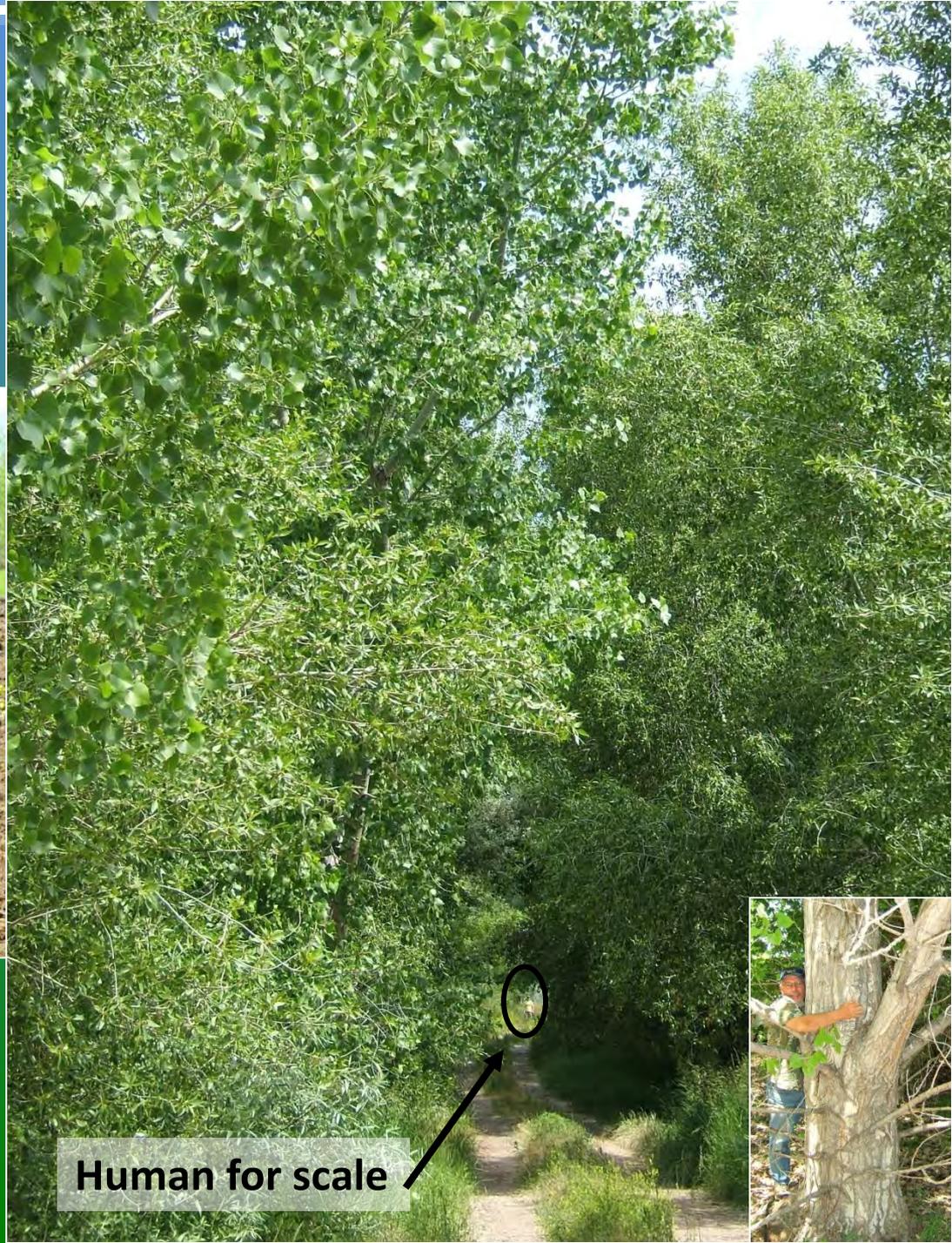
5+ acres of
desert scrub
and riparian
habitat on
limestone
parent
material soils



Plan Now for Tomorrow's Research



A common garden gallery
forest after 13 years.

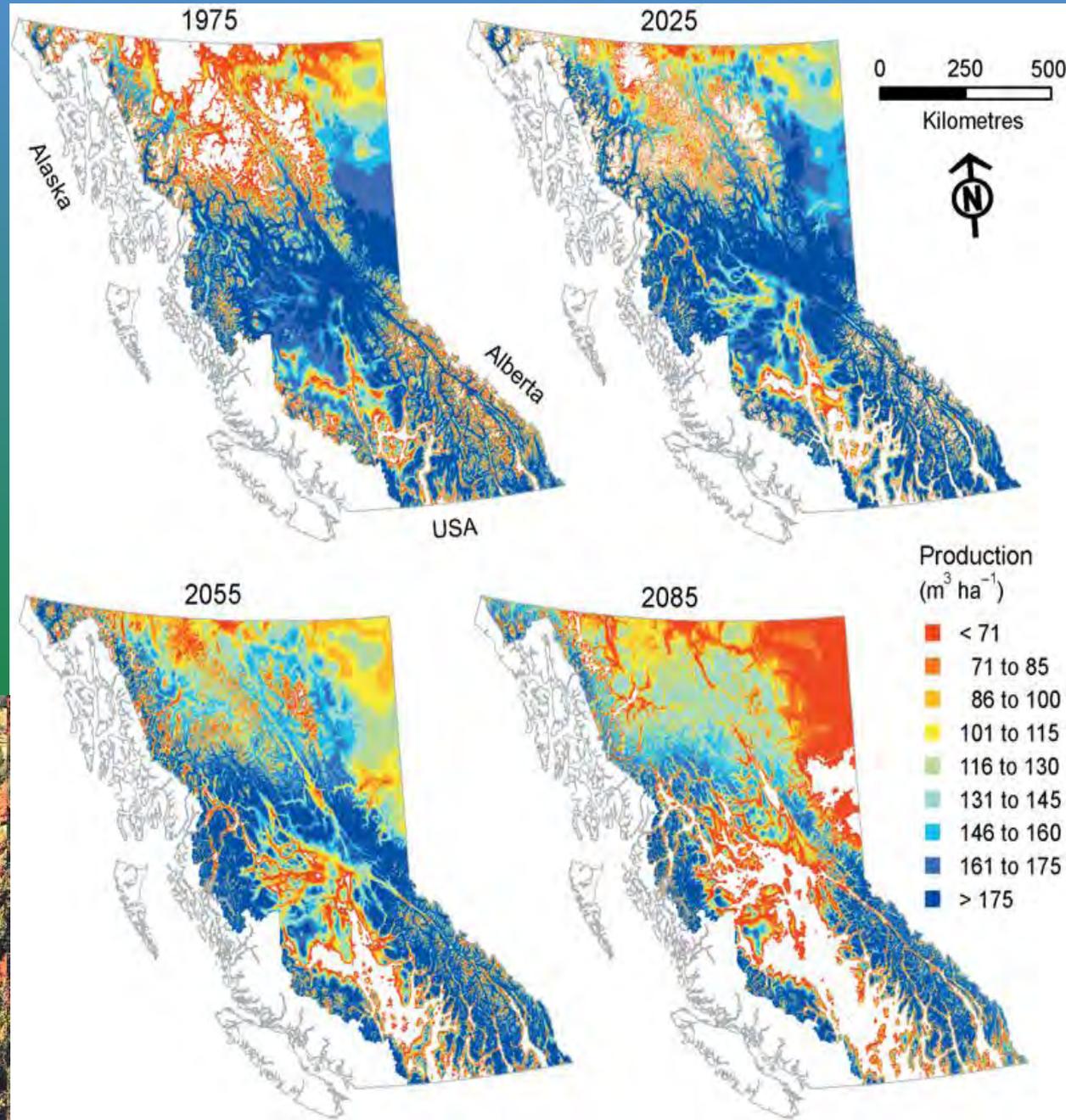


Human for scale



Genetic based analysis of the effects of climate change on production by *Pinus contorta*.

Areas of highest production become areas of lowest production.



Questions? Comments? Feedback

