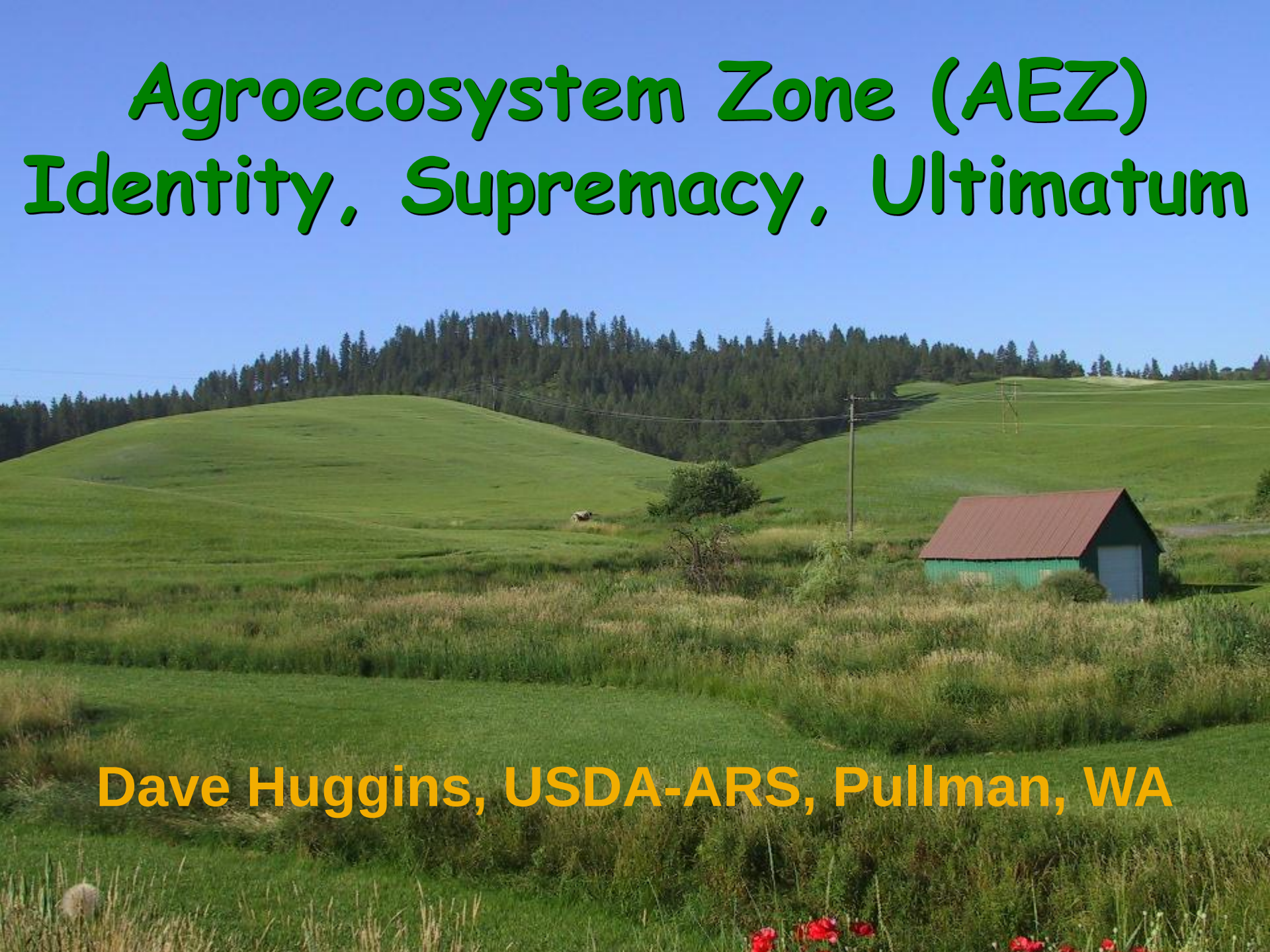
Agroecosystem Zone (AEZ) Identity, Supremacy, Ultimatum



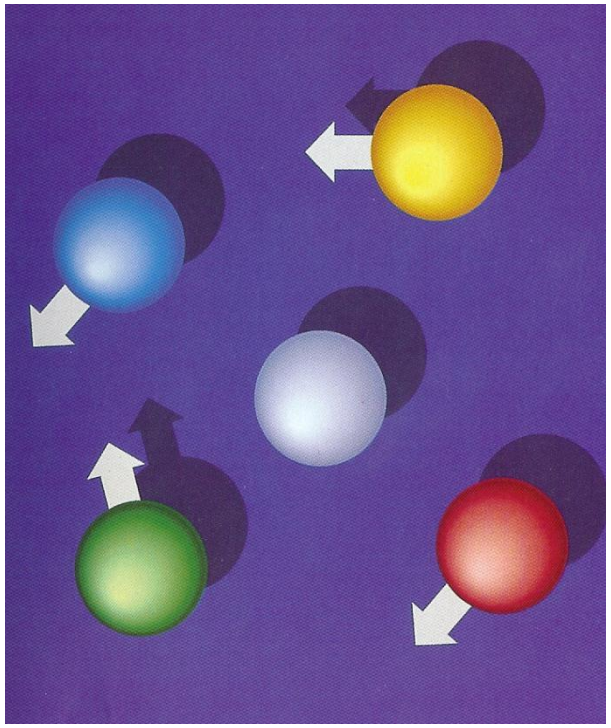
Dave Huggins, USDA-ARS, Pullman, WA

Research Integration

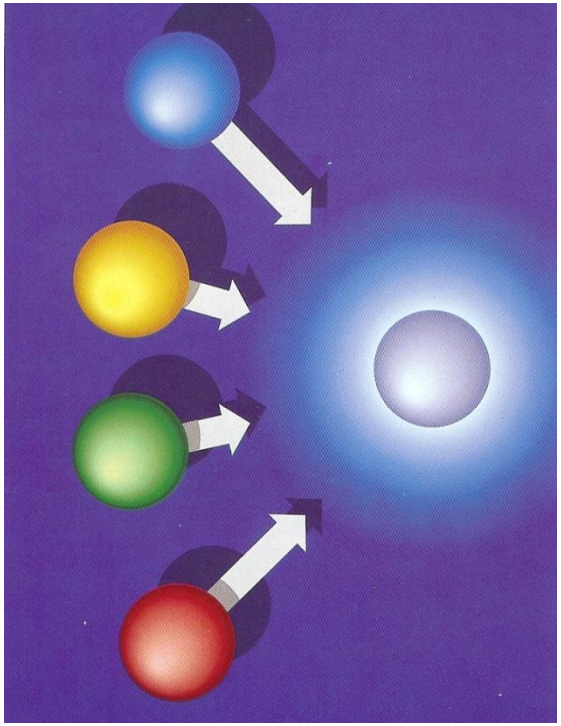
From: Julie Thompson Klein

- Integration from Latin: integrare --to make whole, associated with holism, unity, synthesis
- Transdisciplinary—complex problems of the real world need to frame research questions and practices, rather than disciplines
- Aimed at improved problem solving and decision making

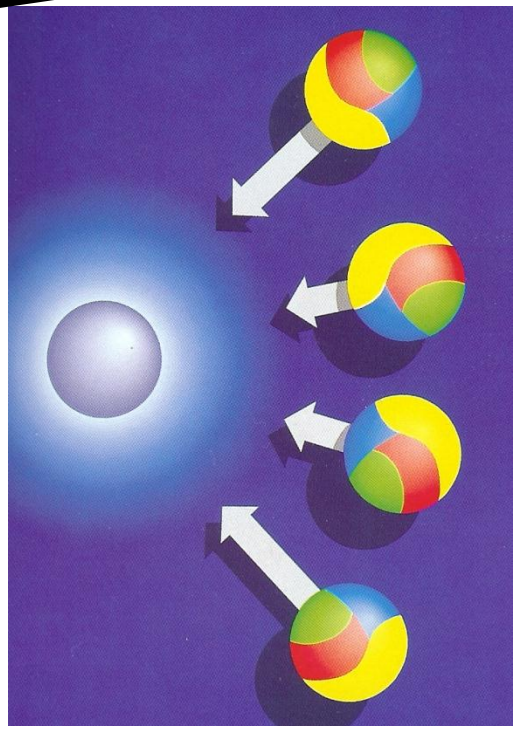
Relationship to Holism



Isolated disciplines, unable to manage gray of which they have little or no knowledge



Multidisciplinary team, focused on gray from their own perspective, but with little or no knowledge of gray

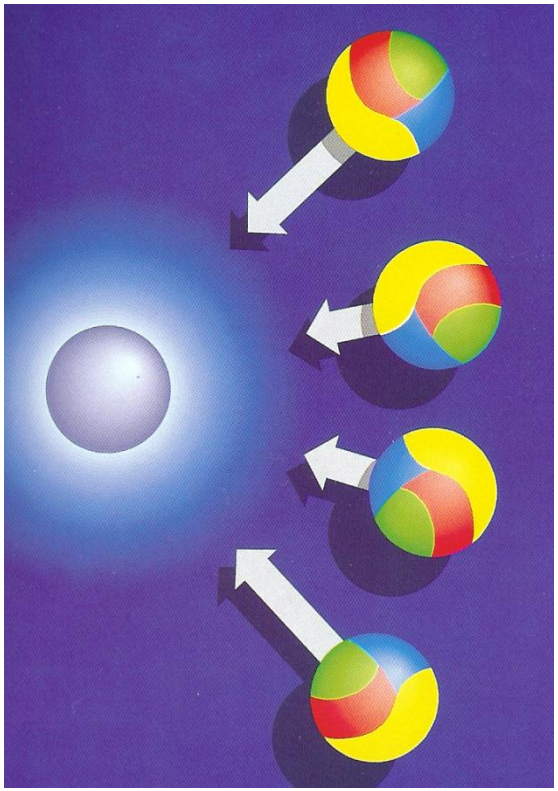


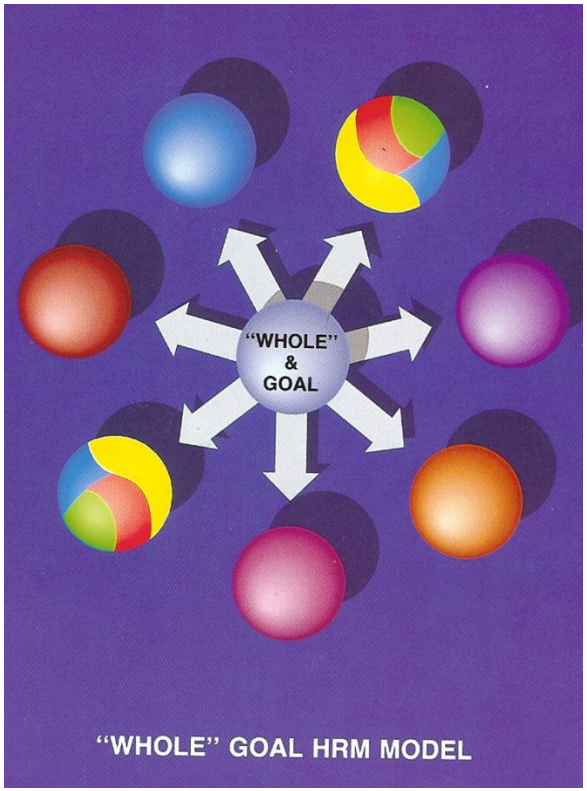
Interdisciplinary team with people trained in several disciplines, focused on gray, however, knowledge of gray is still lacking

Savory, 1988

Bridging Multiple Divides

Component focus ⟷ System focus

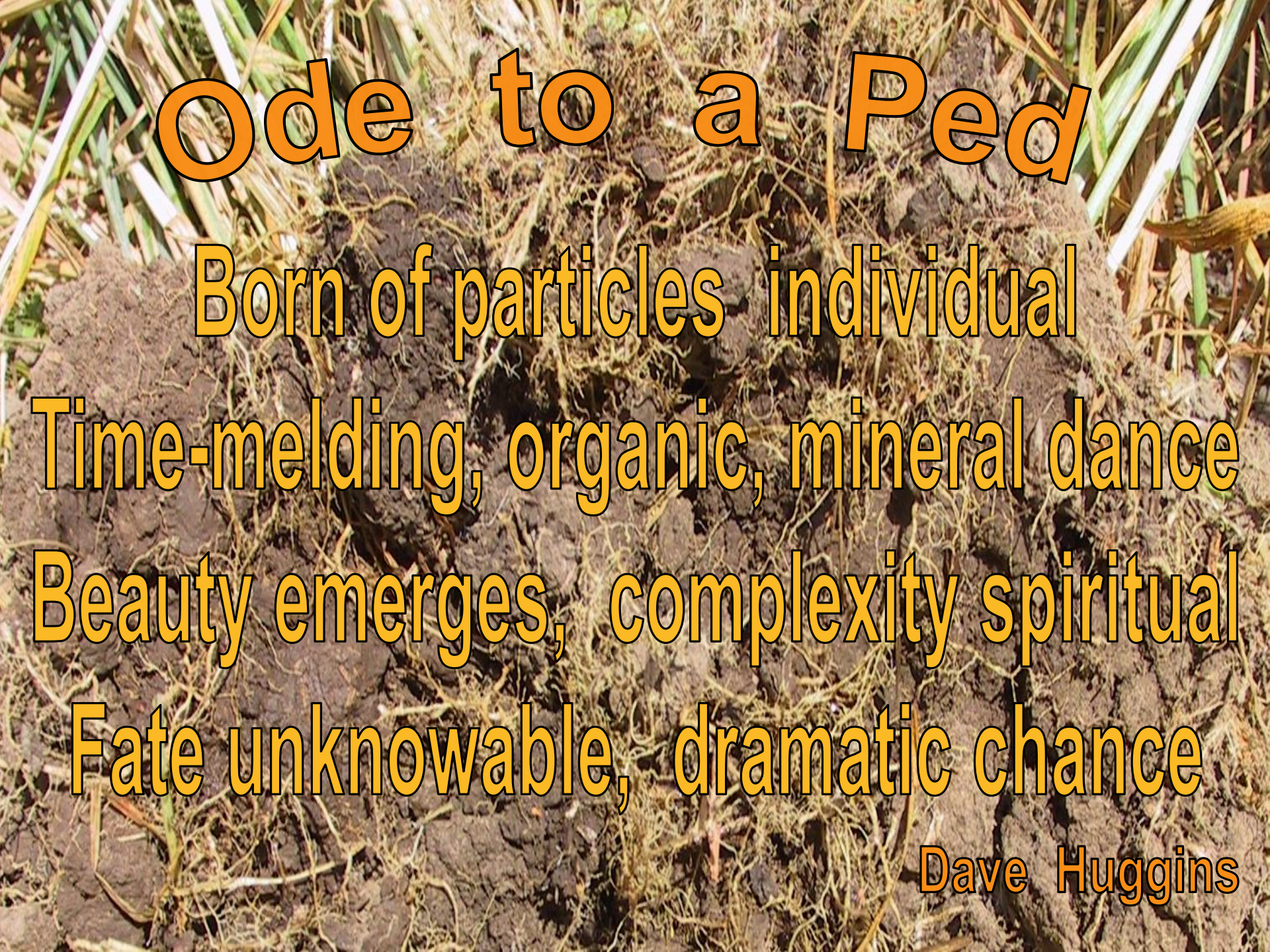




Interdisciplinary team with people trained in several disciplines, focused on gray, however, knowledge of gray is lacking

One must seek to understand the greater whole in order to understand its parts, not visa-versa

Savory, 1988


Ode to a Ped
Born of particles individual
Time-melding, organic, mineral dance
Beauty emerges, complexity spiritual
Fate unknowable, dramatic chance
Dave Huggins

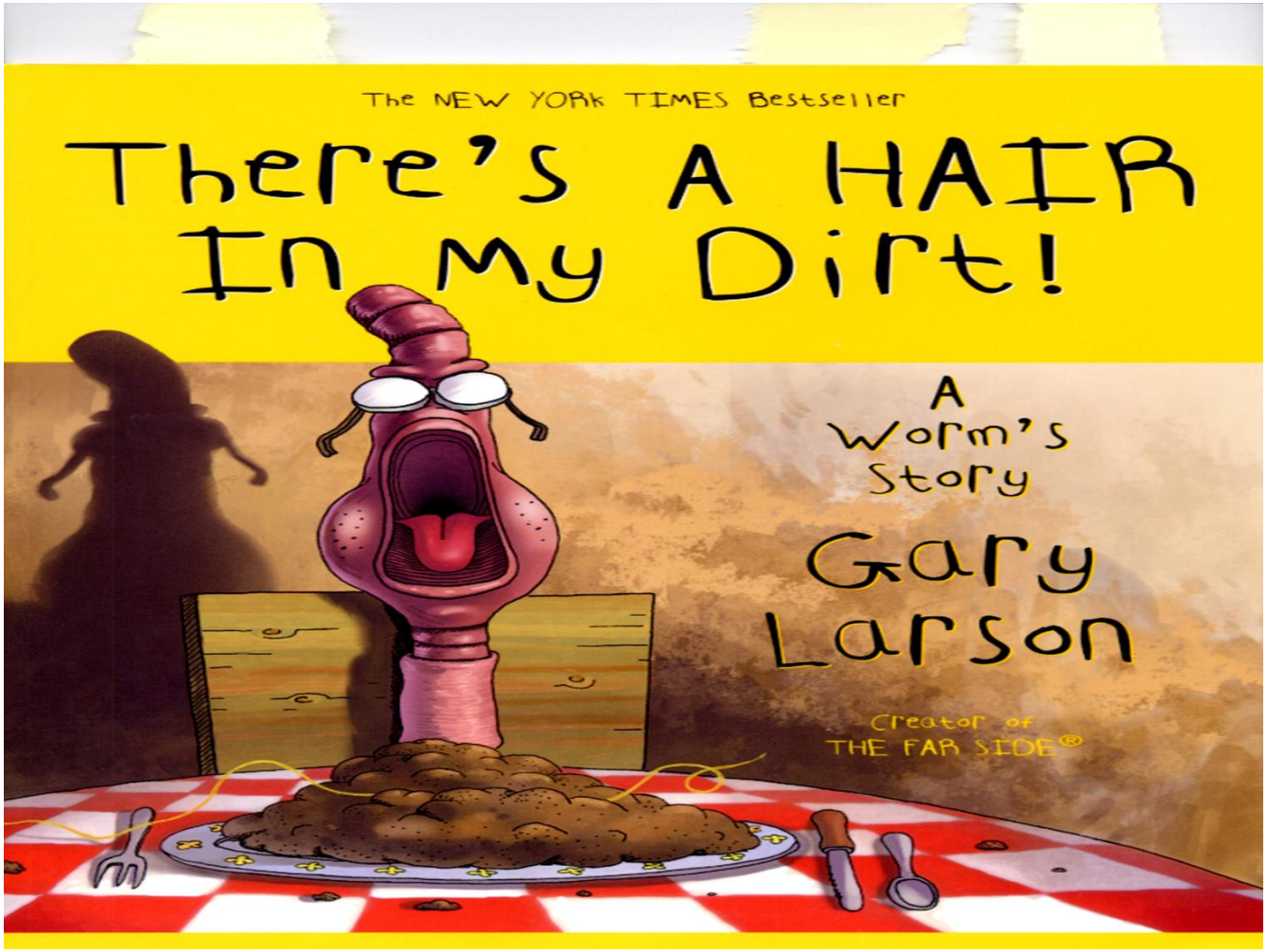
Research Integration

From: Julie Thompson Klein

- Participation of stakeholders from other sectors of society is essential, requiring cooperation and integration beyond academic boundaries
- Promotes integrative thinking
  - Raises new intellectual questions
  - Bridges multiple divides (theory and practice, disciplinary components and holism)
- Key factors
  - Commitment
  - Focus on collaboration and interactive activities
  - Development of partnerships with community

Agroecology

- **"It has never been more important to understand …. human and natural systems and the nature of their interactions" (Holling and Sanderson, 1996)**



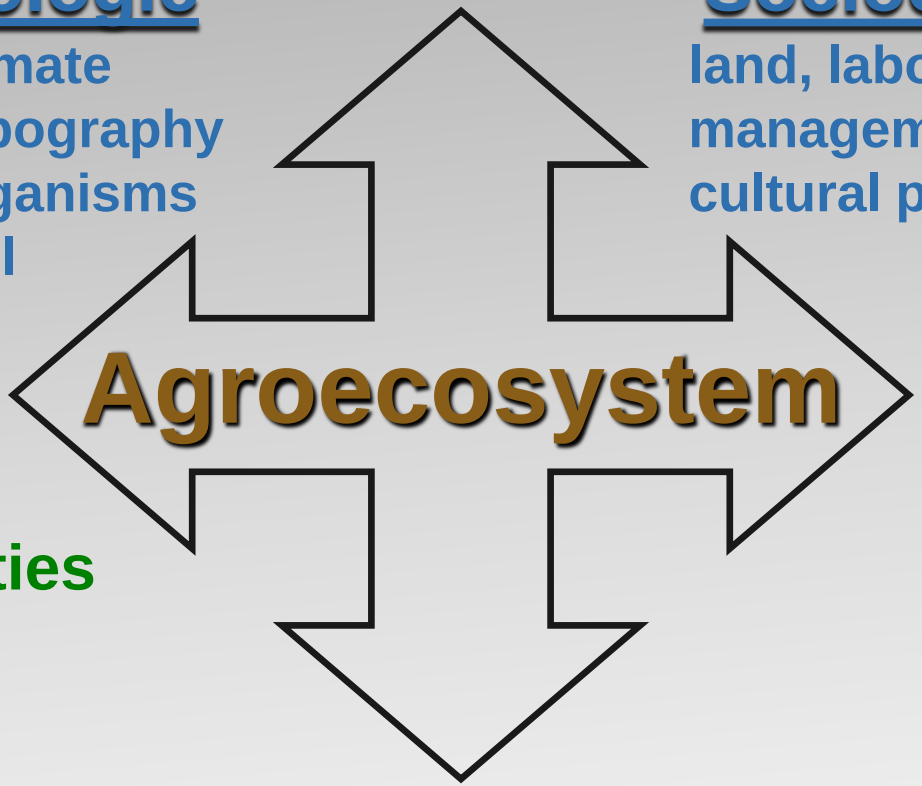
Agroecosystem Drivers

Ecologic

Climate
Topography
Organisms
Soil

Socioeconomic

land, labor, capital, tech., management skills, values, cultural practices, policies



Structure

Crops
Pests
Soil properties
Equipment
Buildings
Materials

Function

Production
Competition
Decomposition
Nutrient cycles
Transport
Energy flows

Agroecosystem Performance

Productivity, Stability, Sustainability, Equity, Autonomy

REACCH
Regional Approaches to Climate Change – PNA

Dynamic Agroecological Zones for the Inland Pacific Northwest, USA

Dave Huggins, Pullman, WA

USDA Agricultural Research Service
the in-house research arm of the U.S. Department of Agriculture

Richard Rupp, Dept. Crop and Soil Sci.
William Pan, Dept. Crop and Soil Sci.
David Brown, Dept. Crop and Soil Sci.

Washington State University
World Class. Face to Face.

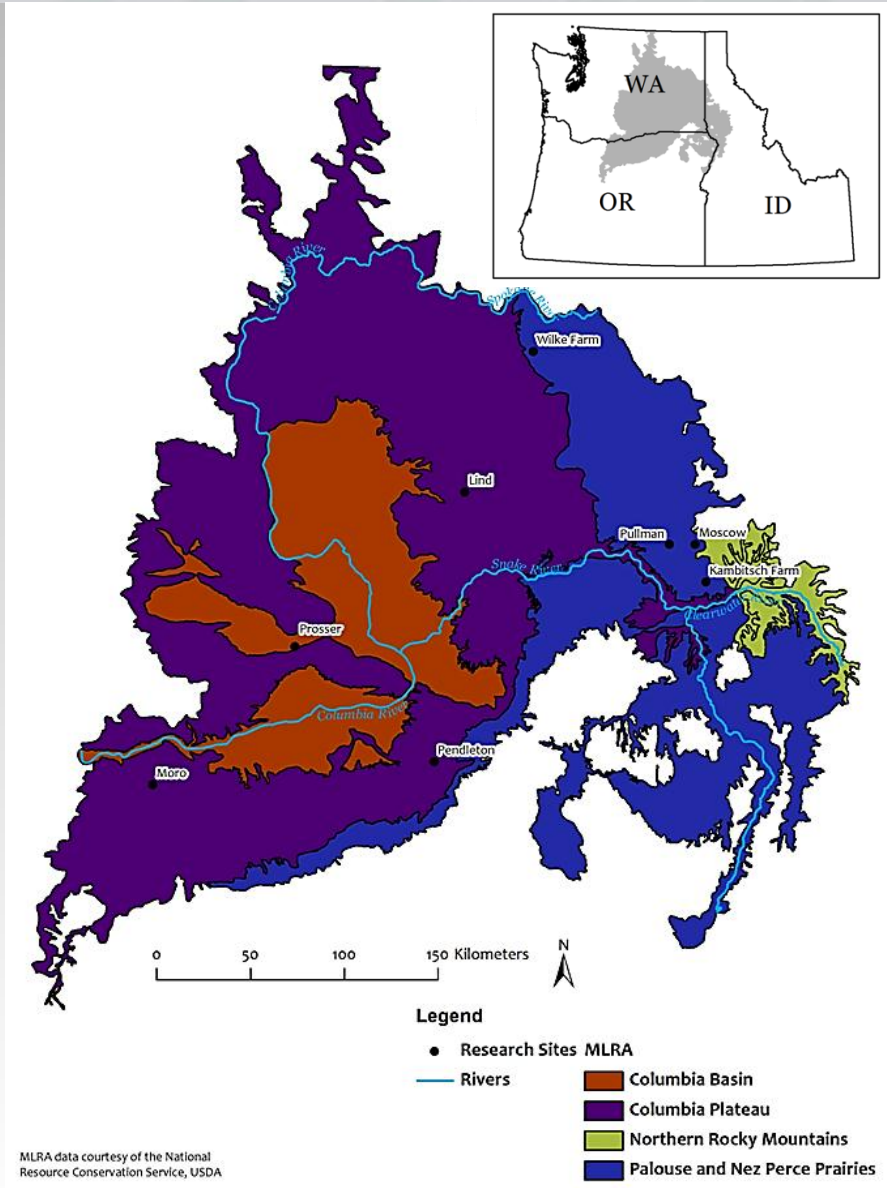
Paul Gessler, Dept. of For. Ecol. & Biogeo.
John Abatzoglou, Dept. of Geography
Von Walden, Dept. of Geography
Sanford Eigenbrode, Dept. of Plant, Soil, and Ent. Sci.

University of Idaho

Stephen Machado, CBARC

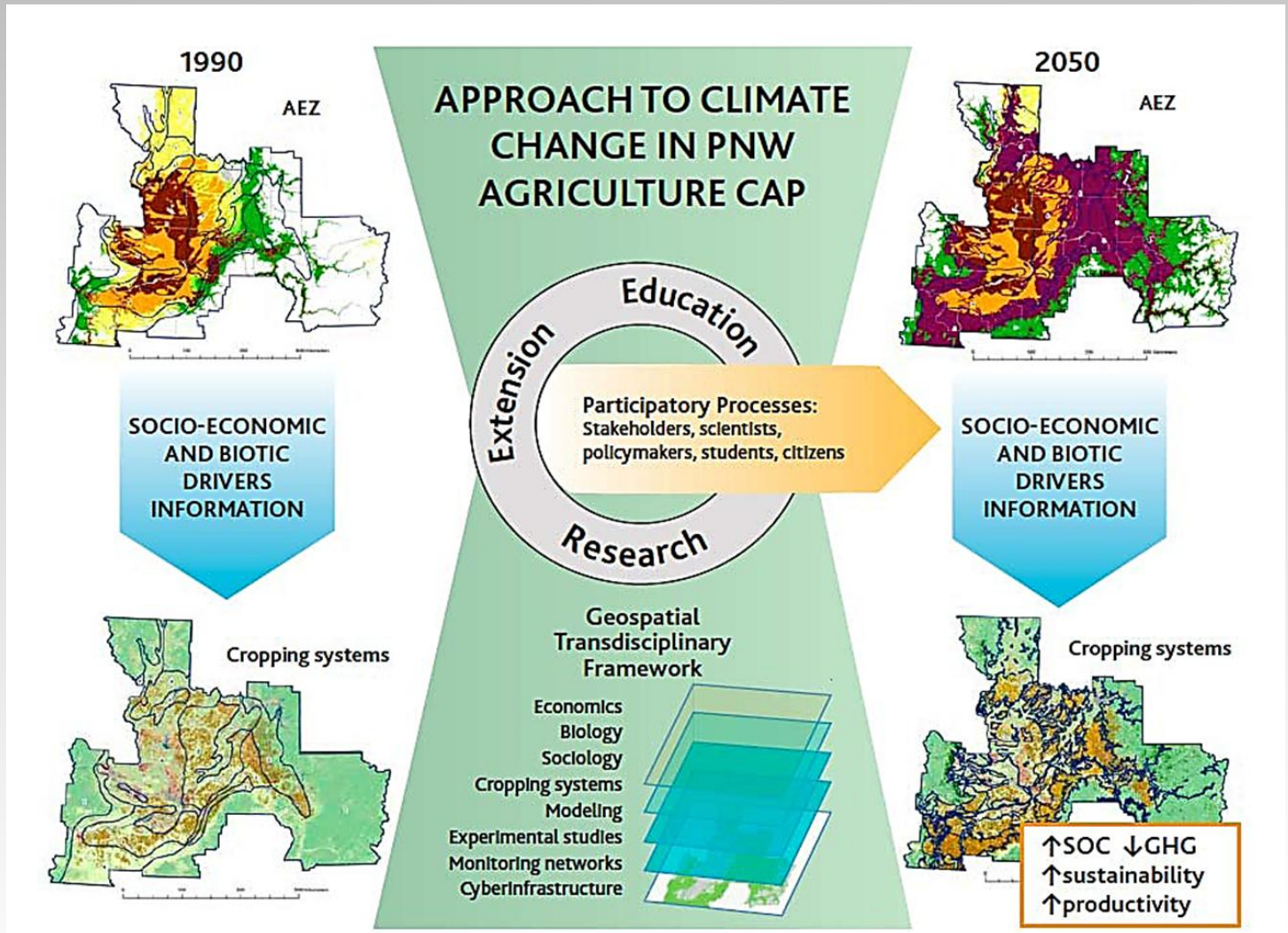
OSU Oregon State University

REACCH Regional Approaches to Climate Change – PNA



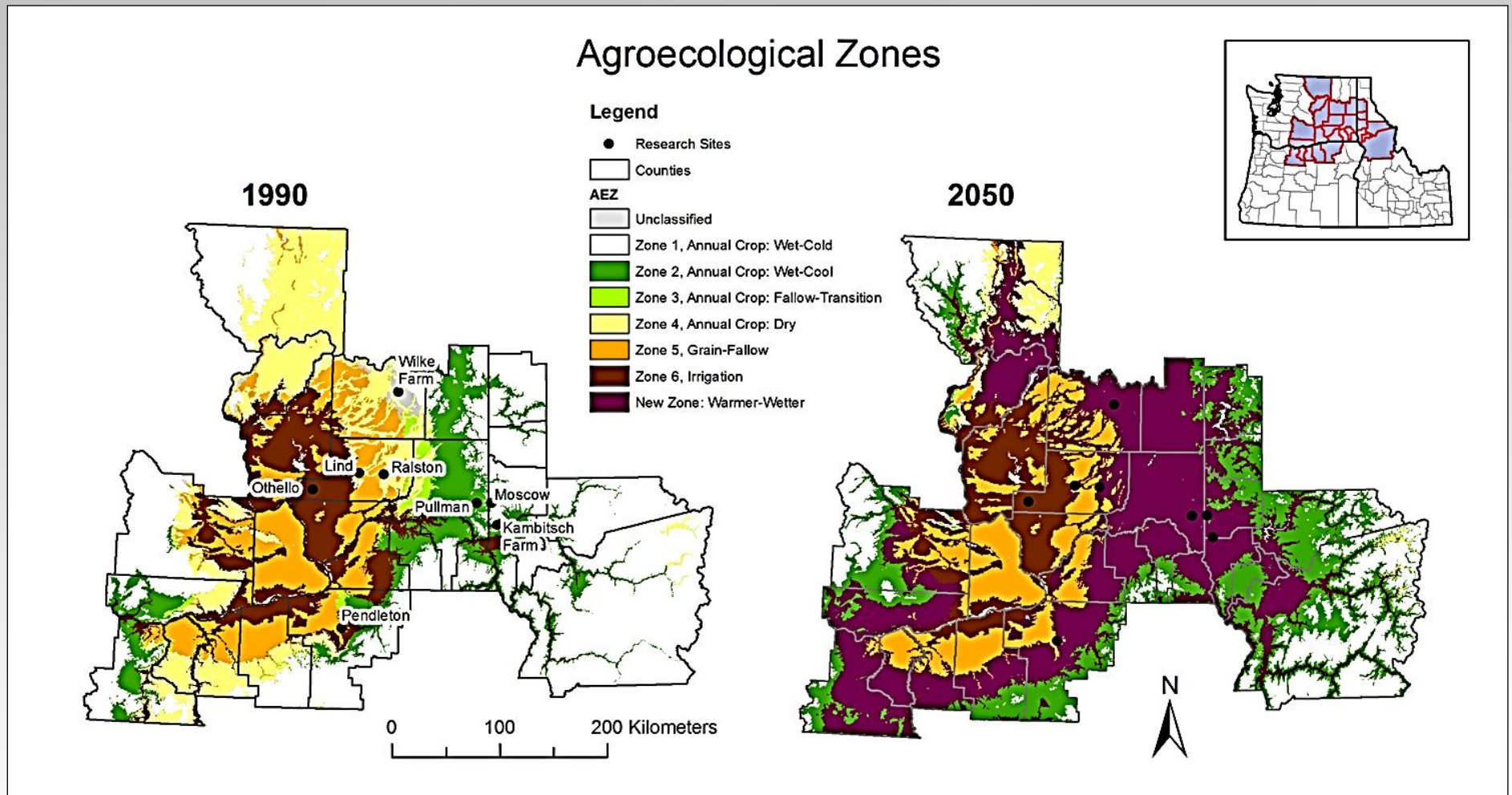
AEZ: REACCH overview

- AEZ central to project-wide integration for a USDA NIFA, AFRI, CAP entitled “Regional Approaches to Climate Change for Pacific Northwest Agriculture” (REACCH)



AEZ: Goal

- **Provide baseline information on current AEZs and the capacity to evaluate shifts in AEZ boundaries over time**



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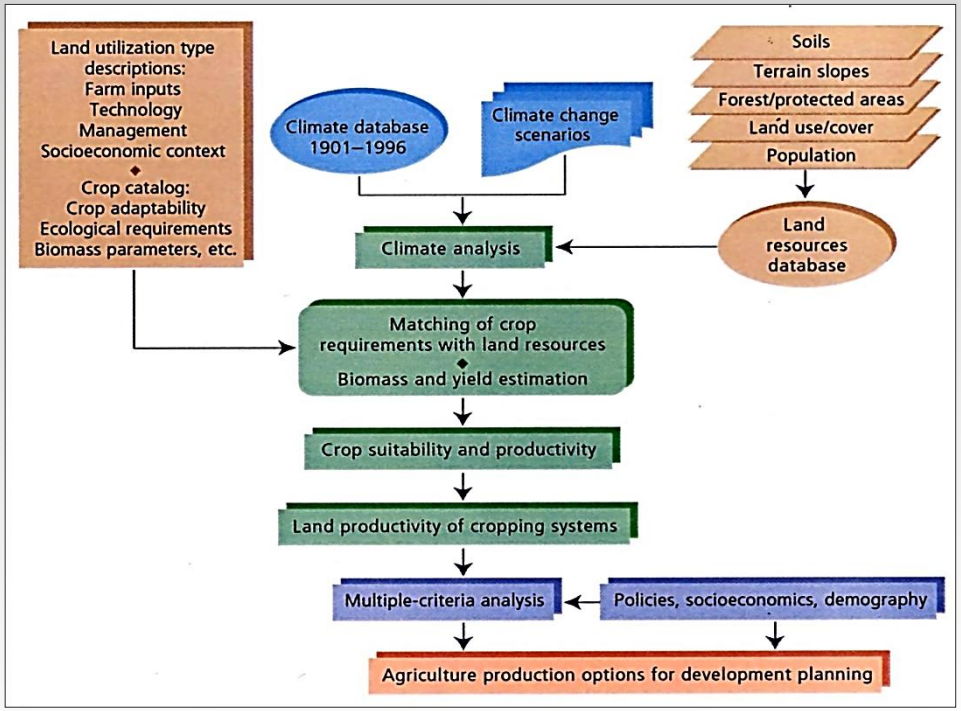
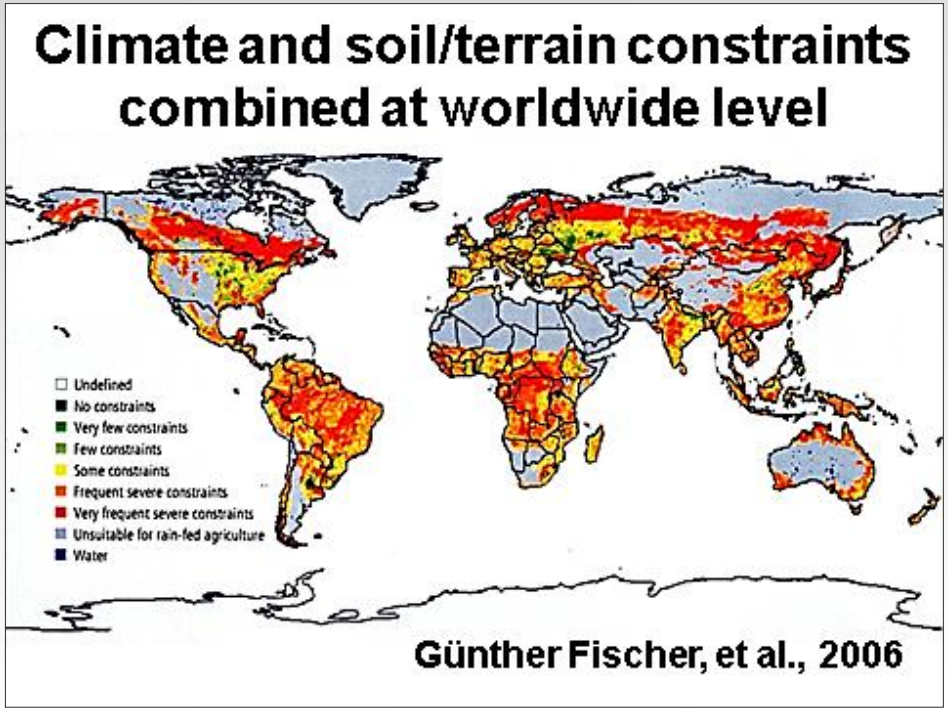
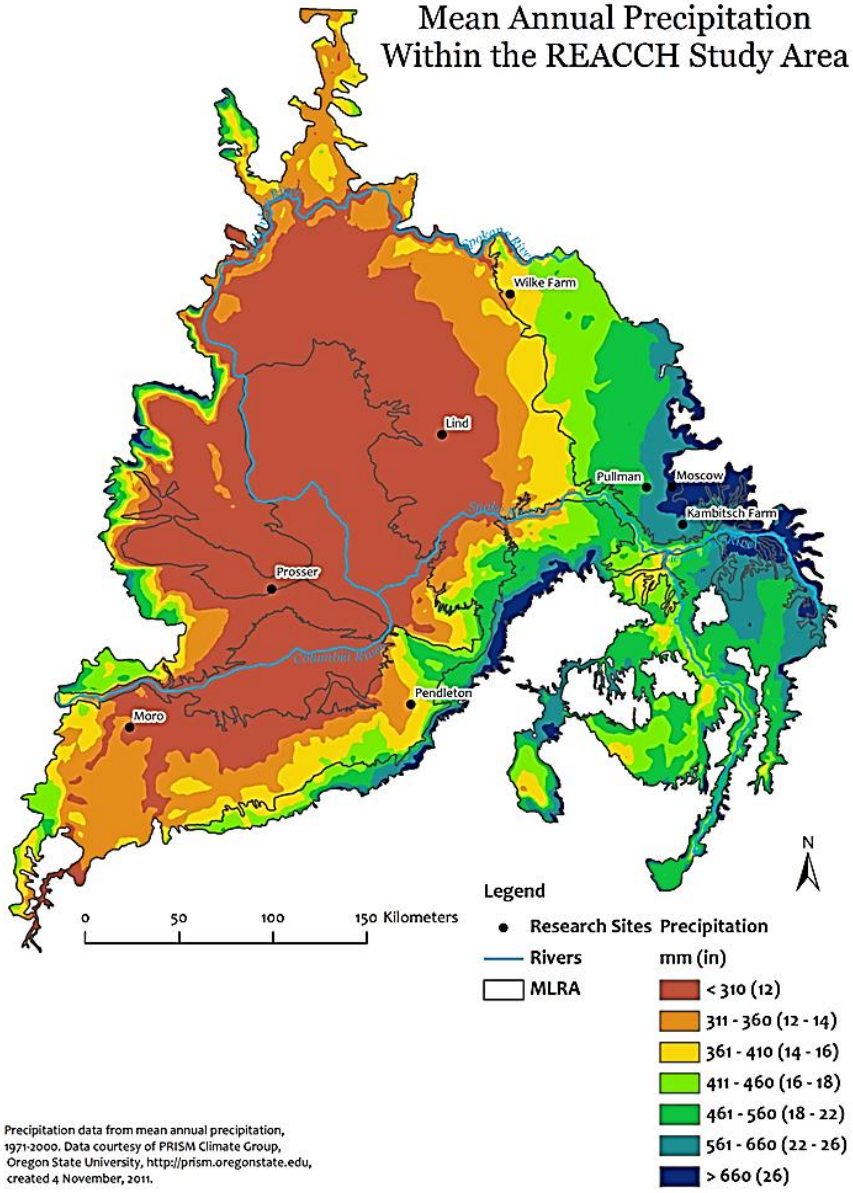
Agroecological Zones (AEZs)

- Unique zones with specific ranges of land use constraints and potentials
- Defined by integrating multiple layers of biophysical (e.g. climate, soil, terrain) and socio-economic data (FAO, 1996)

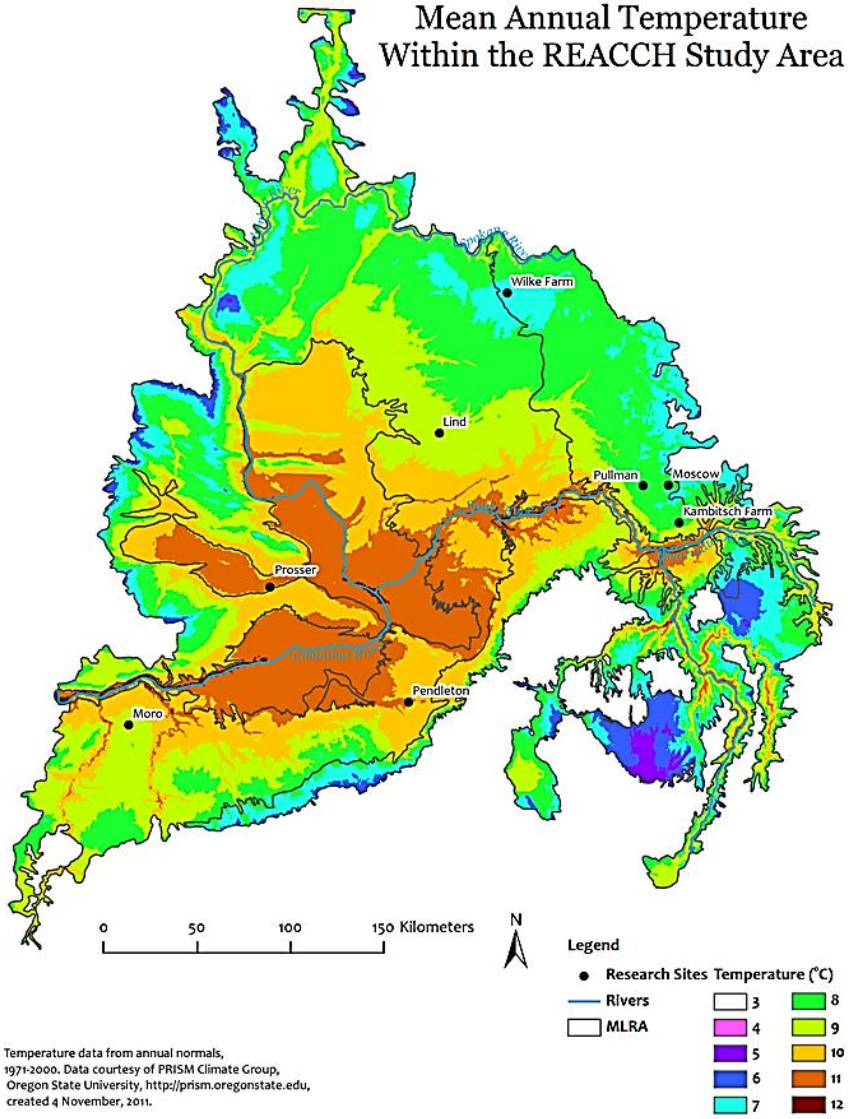




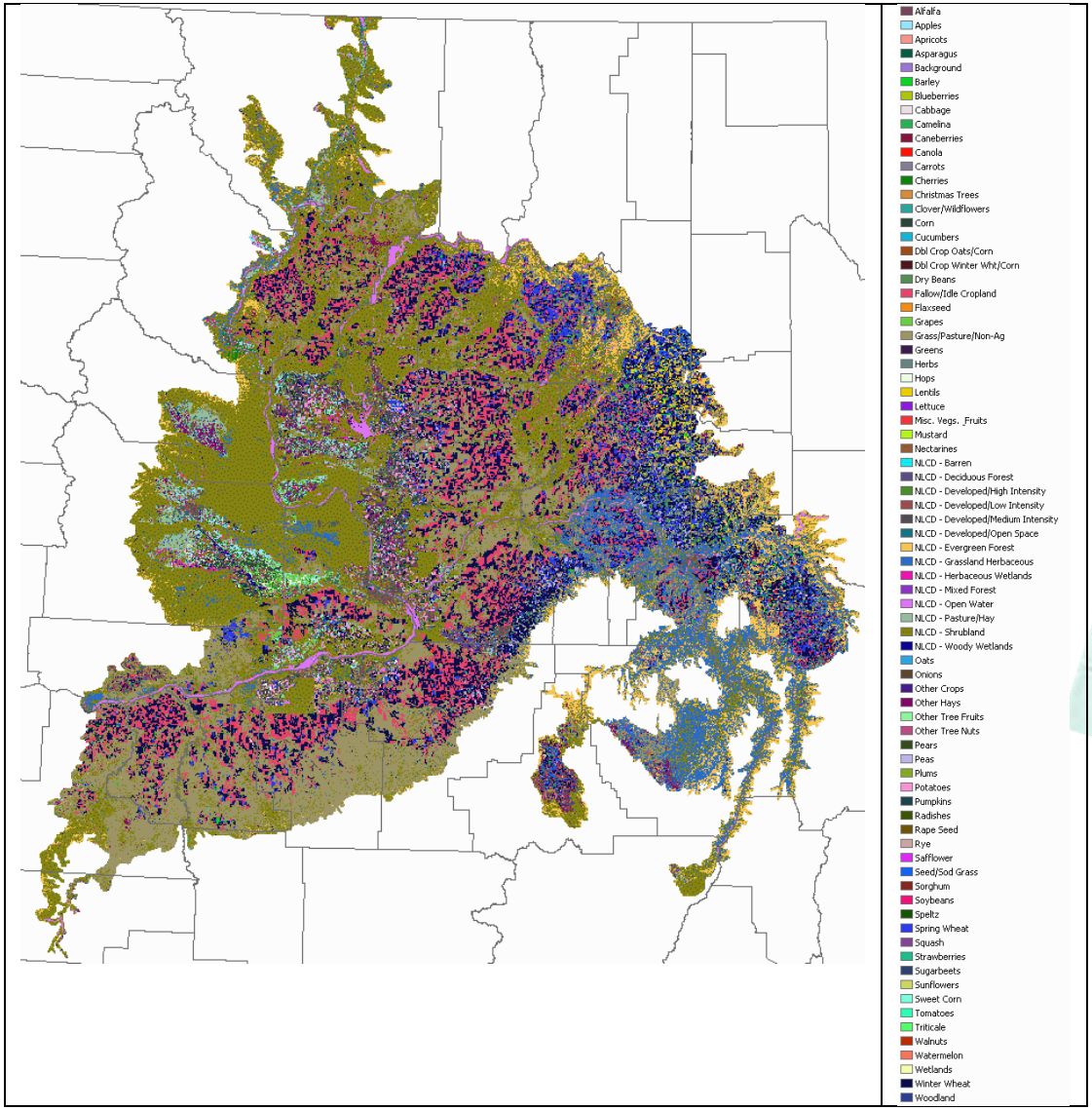
Defining AEZs



Precipitation data from mean annual precipitation, 1971-2000. Data courtesy of PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, created 4 November, 2011.



Temperature data from annual normals, 1971-2000. Data courtesy of PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, created 4 November, 2011.



Daphnia

Cropland datalayer (NASS)

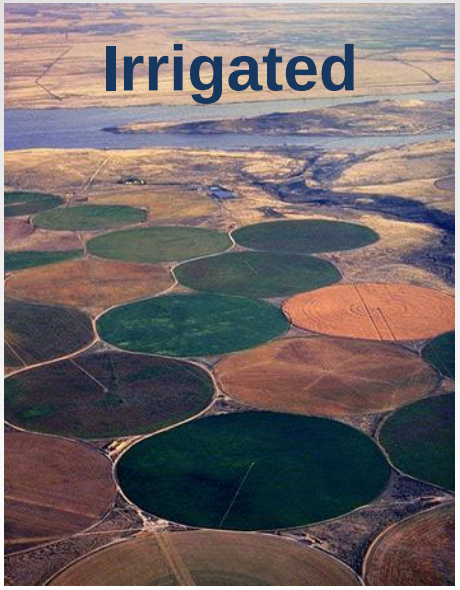
AEZ: Our current approach

- **Assumes that agricultural systems and land uses have emerged as a consequence of biophysical and socioeconomic drivers**
- **AEZs can be derived from the geographic distribution of major agricultural systems in the Inland Pacific Northwest**

Dryland wheat-fallow

Dryland annual cropping, wheat-based

Irrigated



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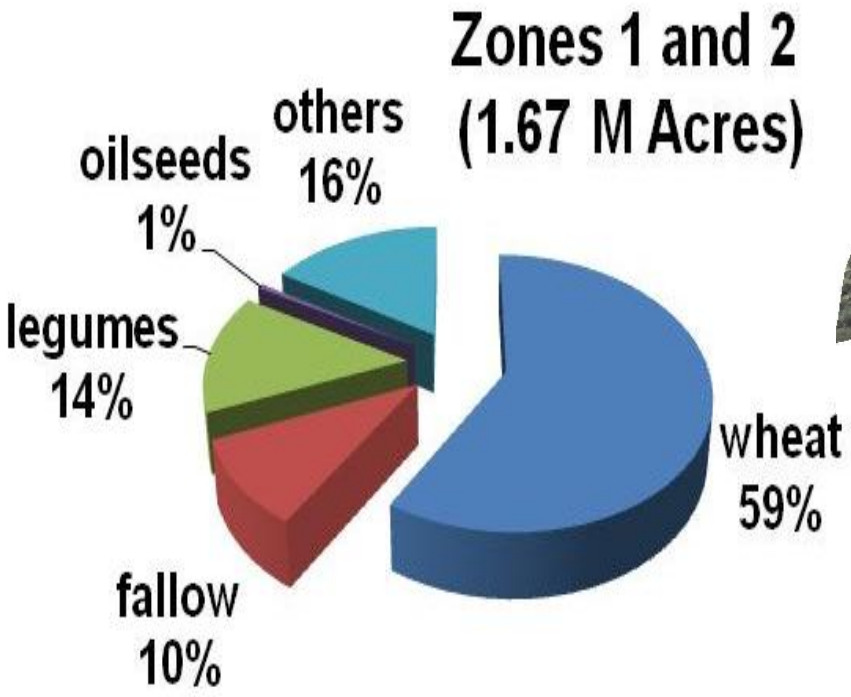
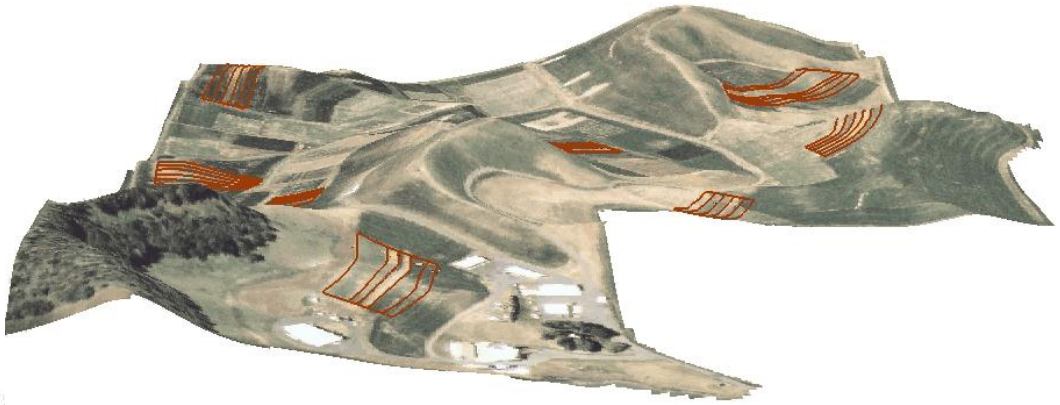
Cropping Systems: Mitigation and Adaptation Strategies

AEZ	Conventional System	Location of expt stations and farmer field sites	Alternative Management Strategies and Research Variables			
			Tillage	N Management	Crop Intensity	Recycled C and N
2	w. wheat-s. wheat-s. legume; chisel plow; field scale NH_3	Moscow/Pullman	direct seed^{O}	site-specific N^{O}	perennials^{O}, winter crops^{O}, oilseeds/legumes^{O}	biosolids^{N}





Palouse Conservation Field Station

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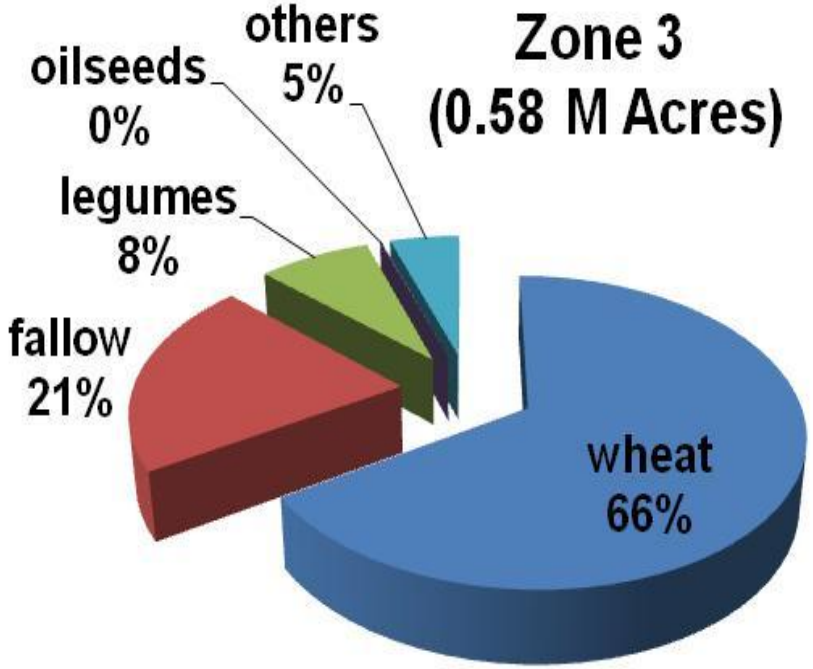
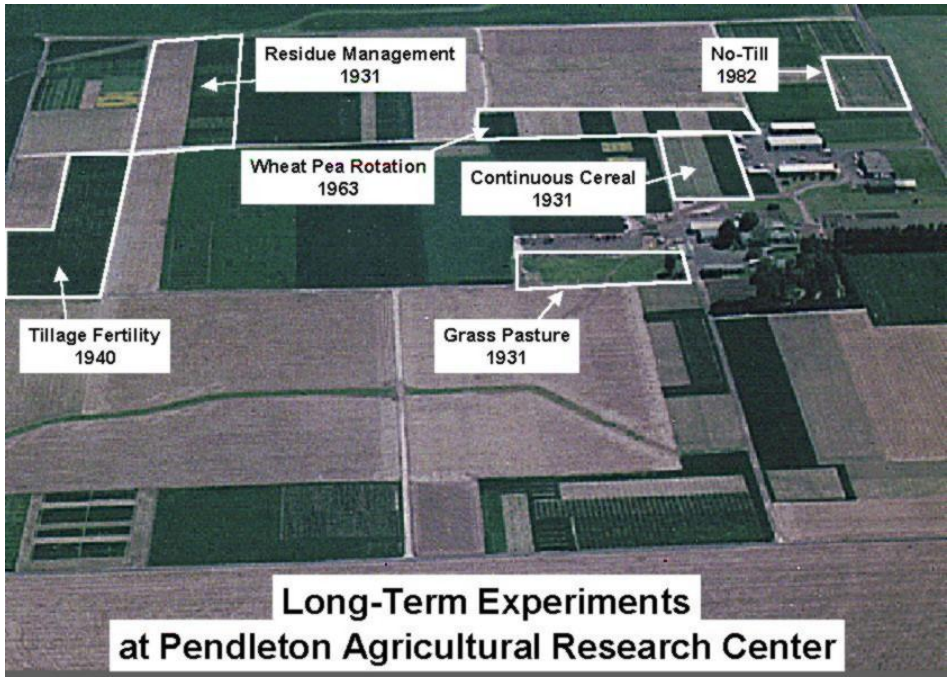
Cropping Systems: Mitigation and Adaptation Strategies

AEZ	Conventional System	Location of expt stations and farmer field sites	Alternative Management Strategies and Research Variables			
			Tillage	N Management	Crop Intensity	Recycled C and N
3	w. wheat-s. cereal-tilled fallow; field scale NH_3; deep soil	Pendleton	direct seed^0	NUE assessment^0	perennials^0, fallow replacement, oilseeds^0	animal manure^0





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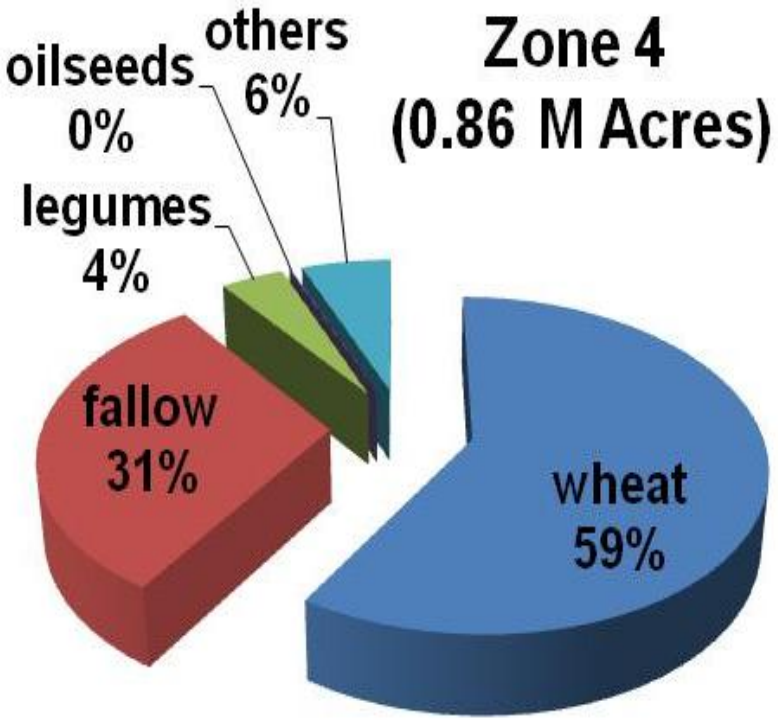
Cropping Systems: Mitigation and Adaptation Strategies

AEZ	Conventional System	Location of expt stations and farmer field sites	Alternative Management Strategies and Research Variables			
			Tillage	N Management	Crop Intensity	Recycled C and N
4	w. wheat-s. cereal-till fallow; field scale NH_3; shallow soil	Davenport, St. John, Okanogan	chemical fallow-direct seed^{O}	site-specific N^{N}	perennials; flex annual cropping^{O} / oilseed/legume^{O}	biosolids^{N}



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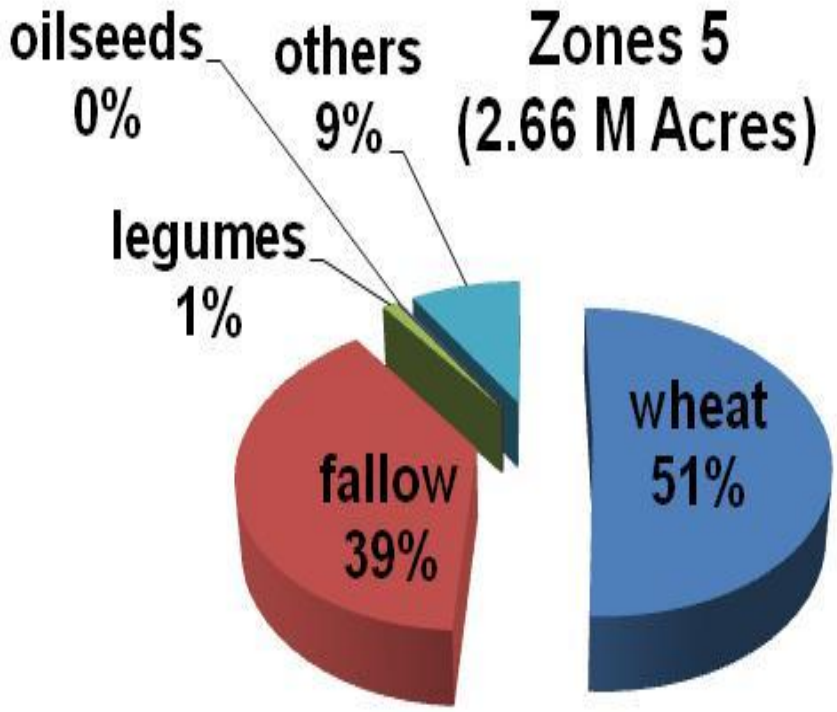
Cropping Systems: Mitigation and Adaptation Strategies

AEZ	Conventional System	Location of expt stations and farmer field sites	Alternative Management Strategies and Research Variables			
			Tillage	N Management	Crop Intensity	Recycled C and N
5	w. wheat-fallow; field scale NH_3	Lind/Moro Douglas	undercutter-fallow[O]	NUE assessment[O]	perennials; ww-s. oilseed-fallow	biosolids[O]



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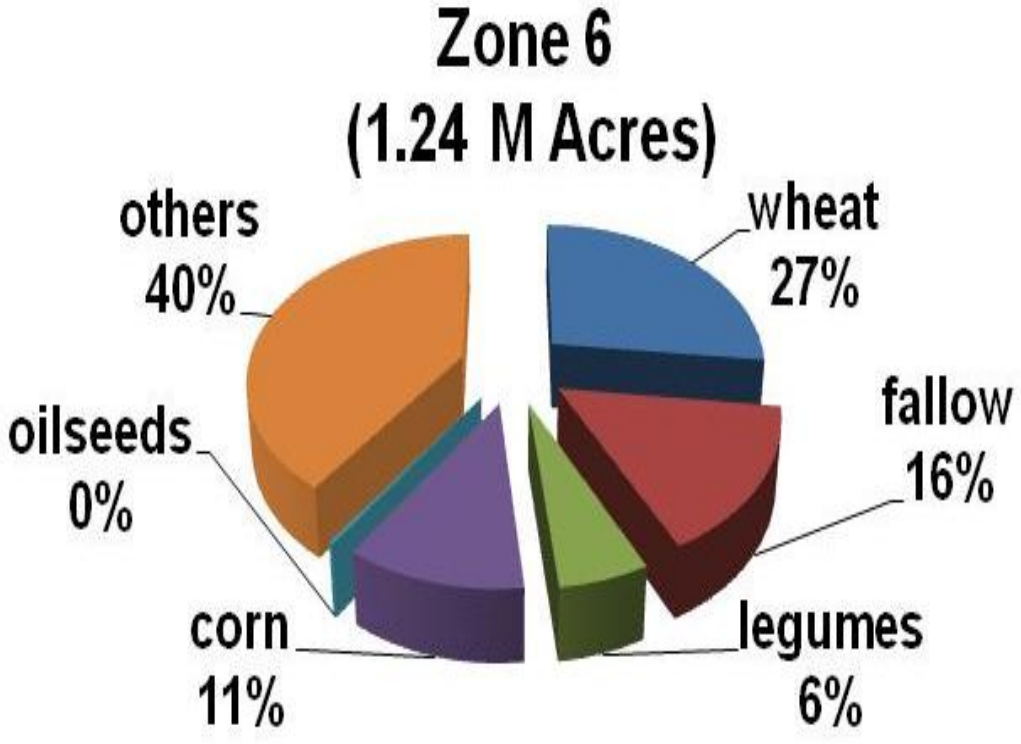
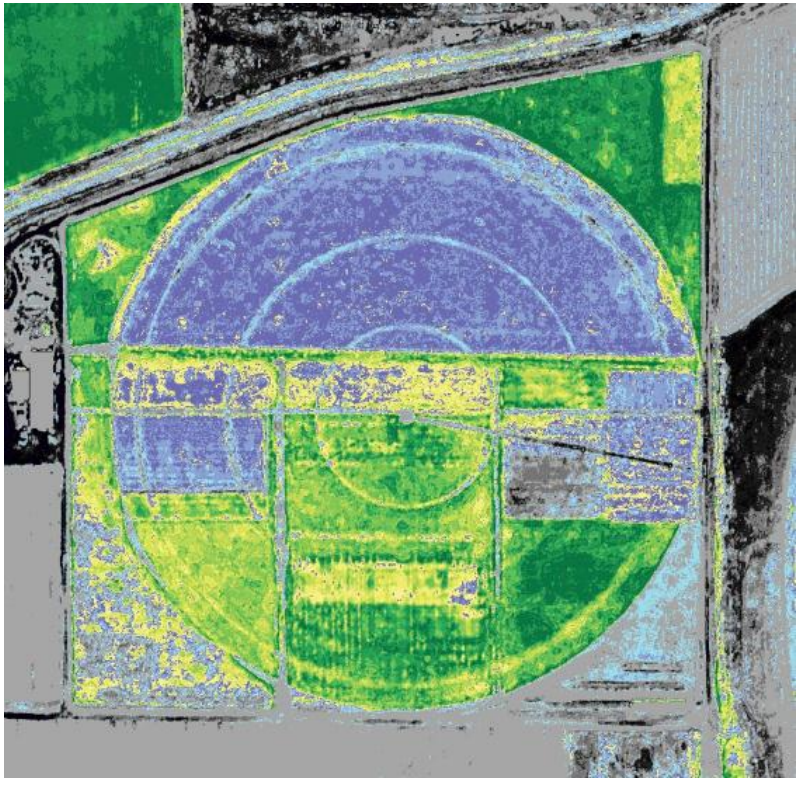
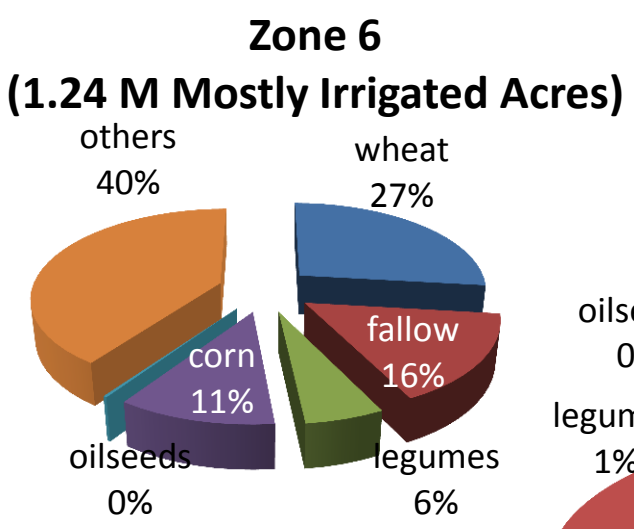
Cropping Systems: Mitigation and Adaptation Strategies

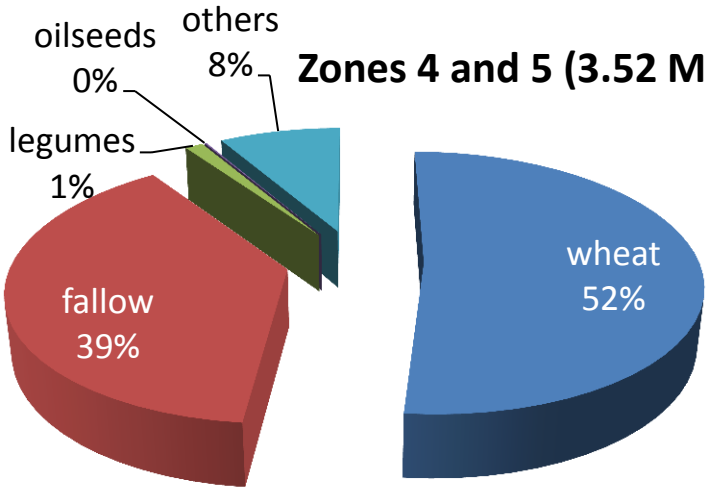
AEZ	Conventional System	Location of expt stations and farmer field sites	Alternative Management Strategies and Research Variables			
			Tillage	N Management	Crop Intensity	Recycled C and N
6	irrigated tilled corn-w. wheat-bean; field scale UAN	Othello	direct seed^{N}	N catch crops^{O}	perennials; winter cover crops^{O}	biosolids^{N}

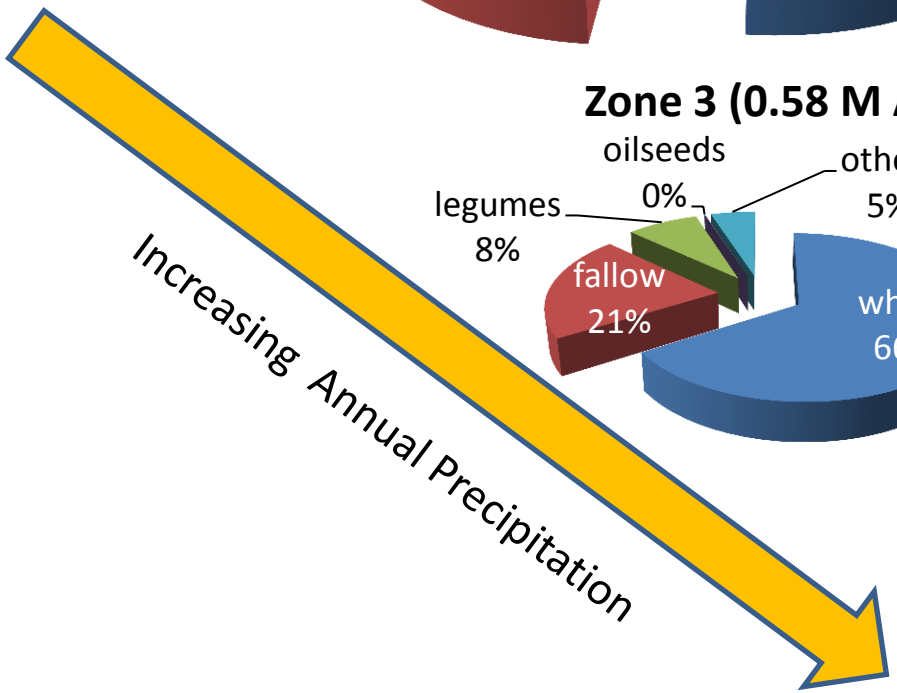


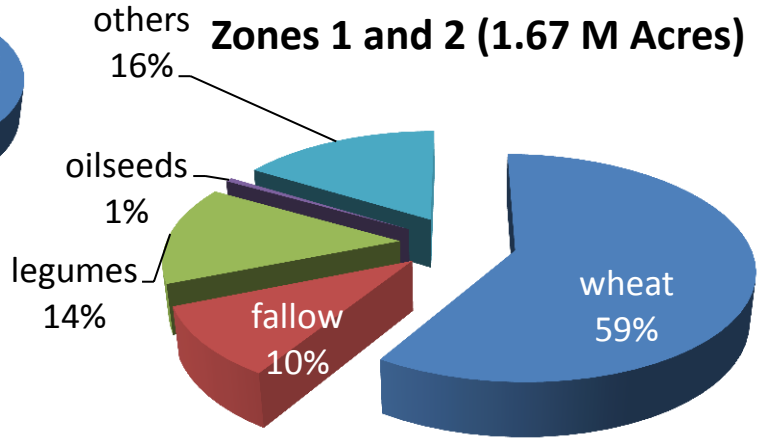


Inland PNW AEZ Crop Distributions



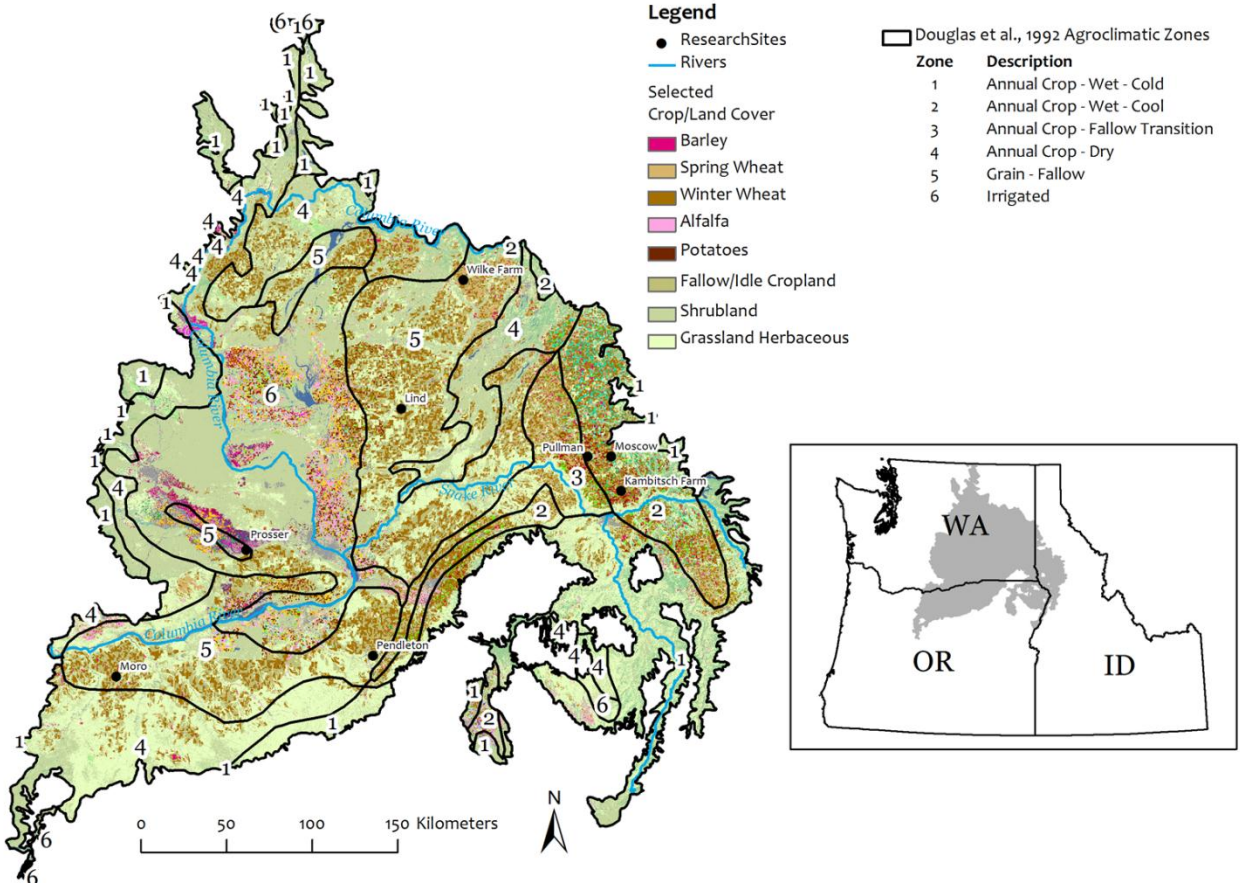






Defining Dynamic AEZs

- **Develop methodology to define major AEZs for the REACCH study area based on annual NASS cropland data layer**



Major AEZs to define:

1. Annual Crop
2. Annual Crop-Fallow Transition
3. Grain-Fallow
4. Irrigated

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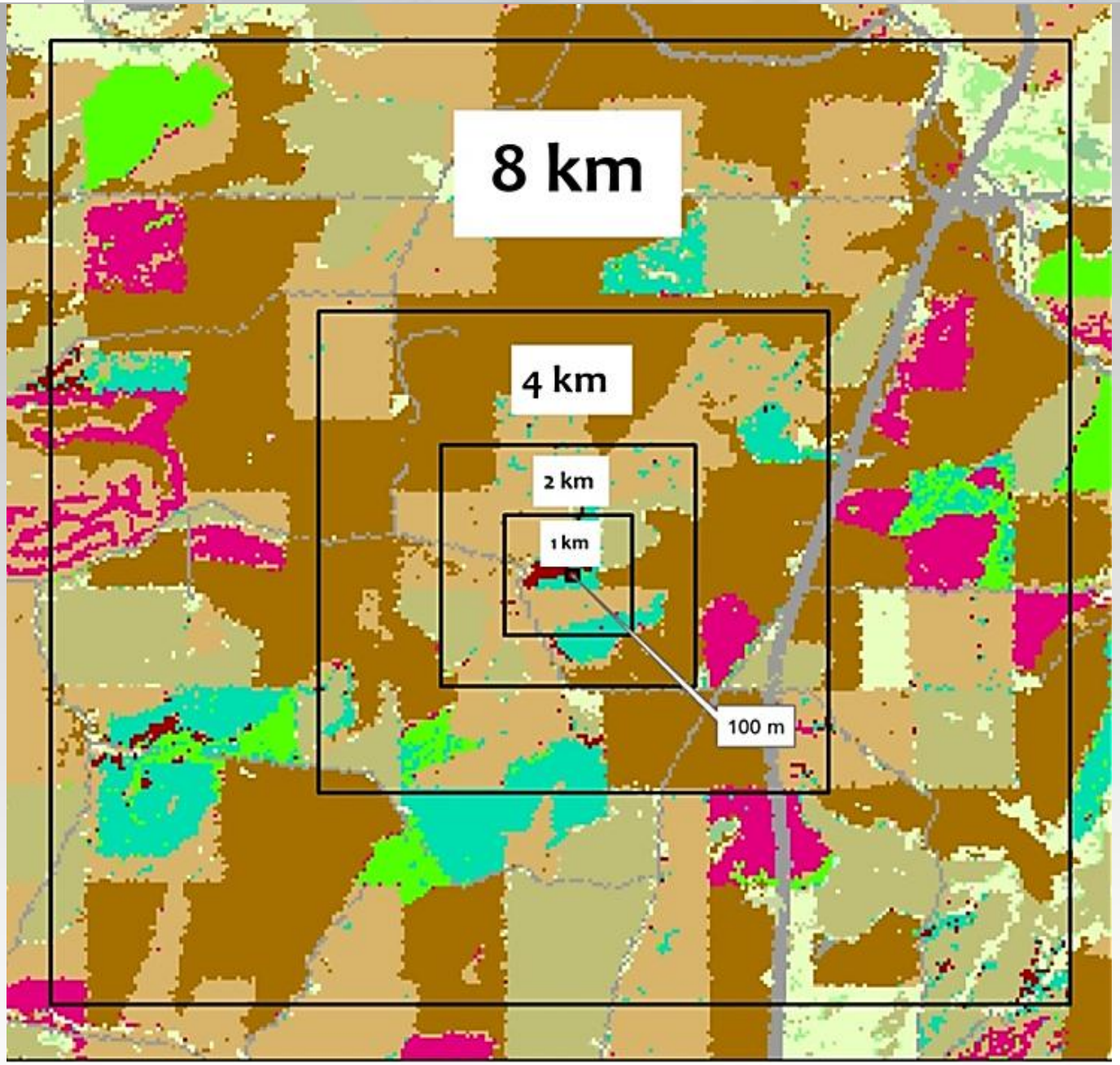
Regional Approaches to Climate Change – PNA

Defining Dynamic AEZs



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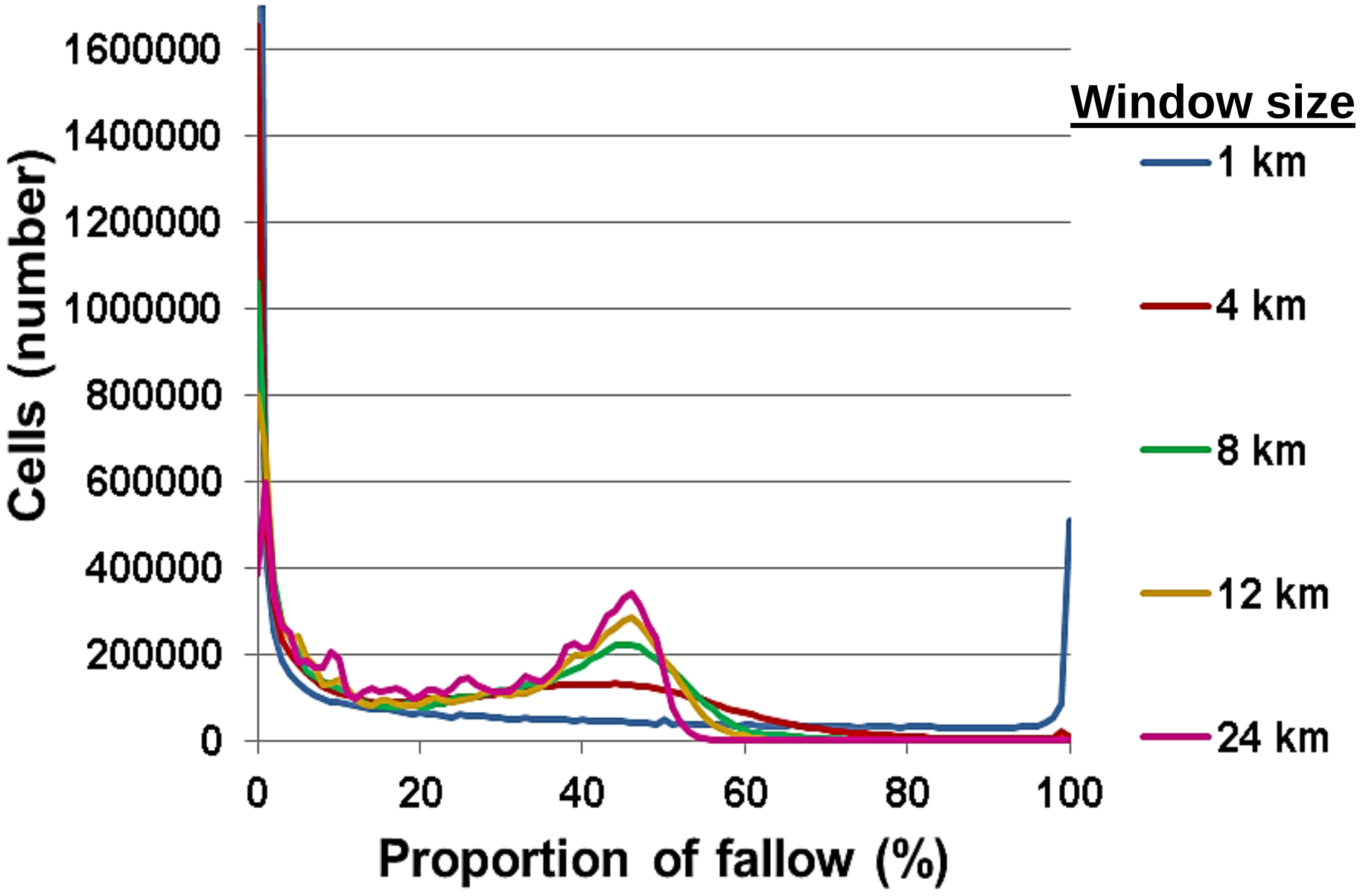
Defining Dynamic AEZs



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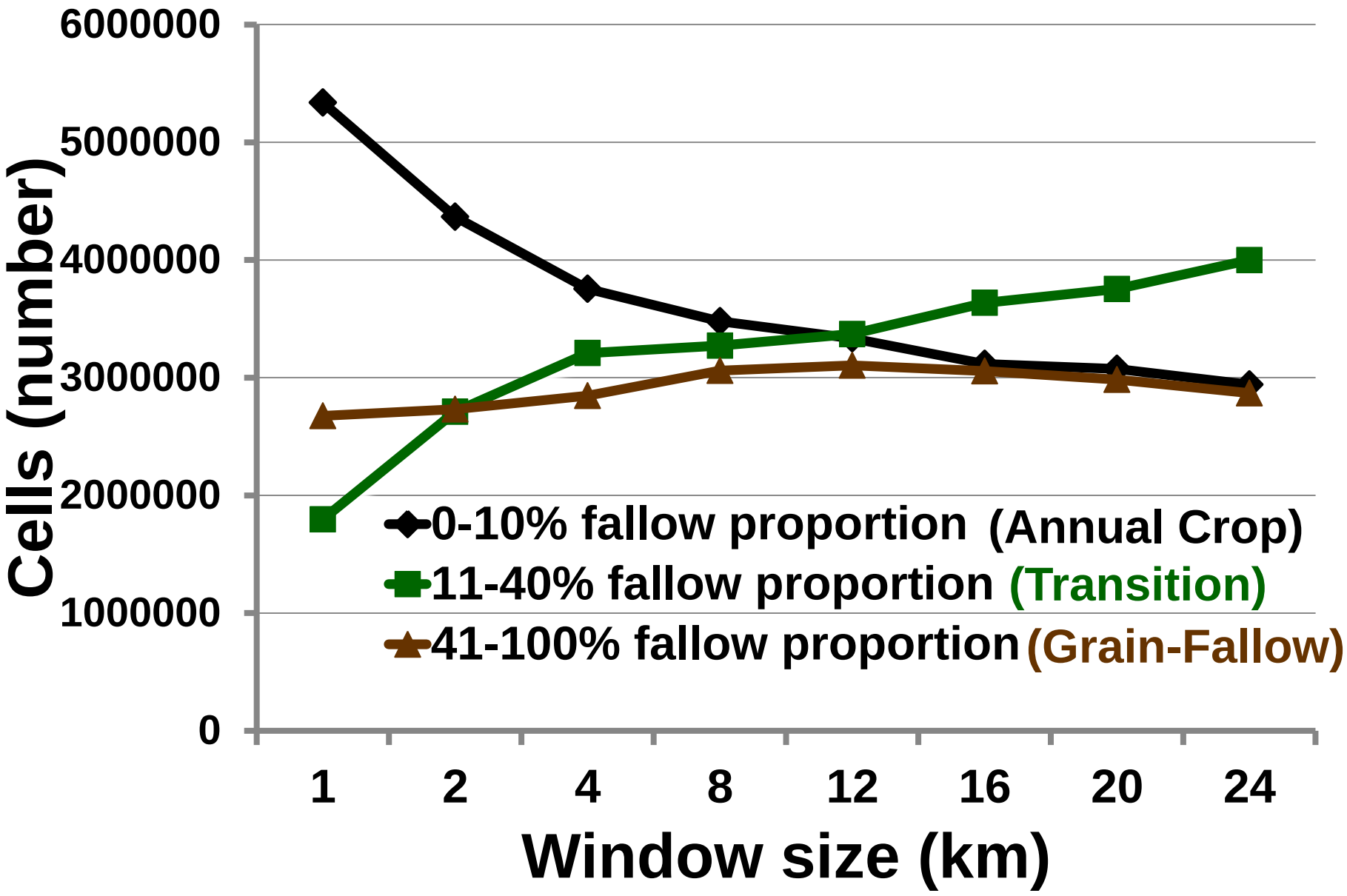
Defining Dynamic AEZs



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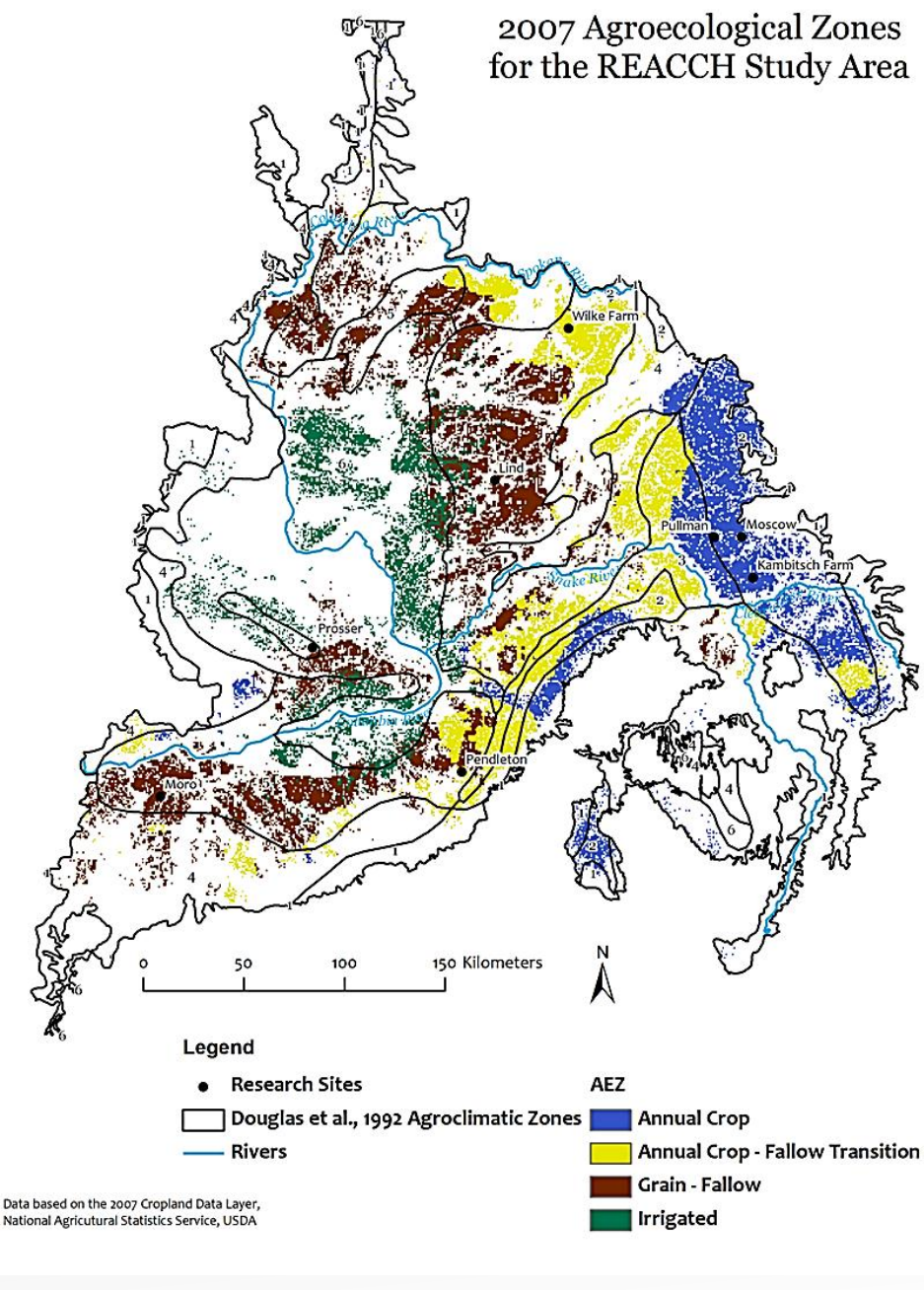
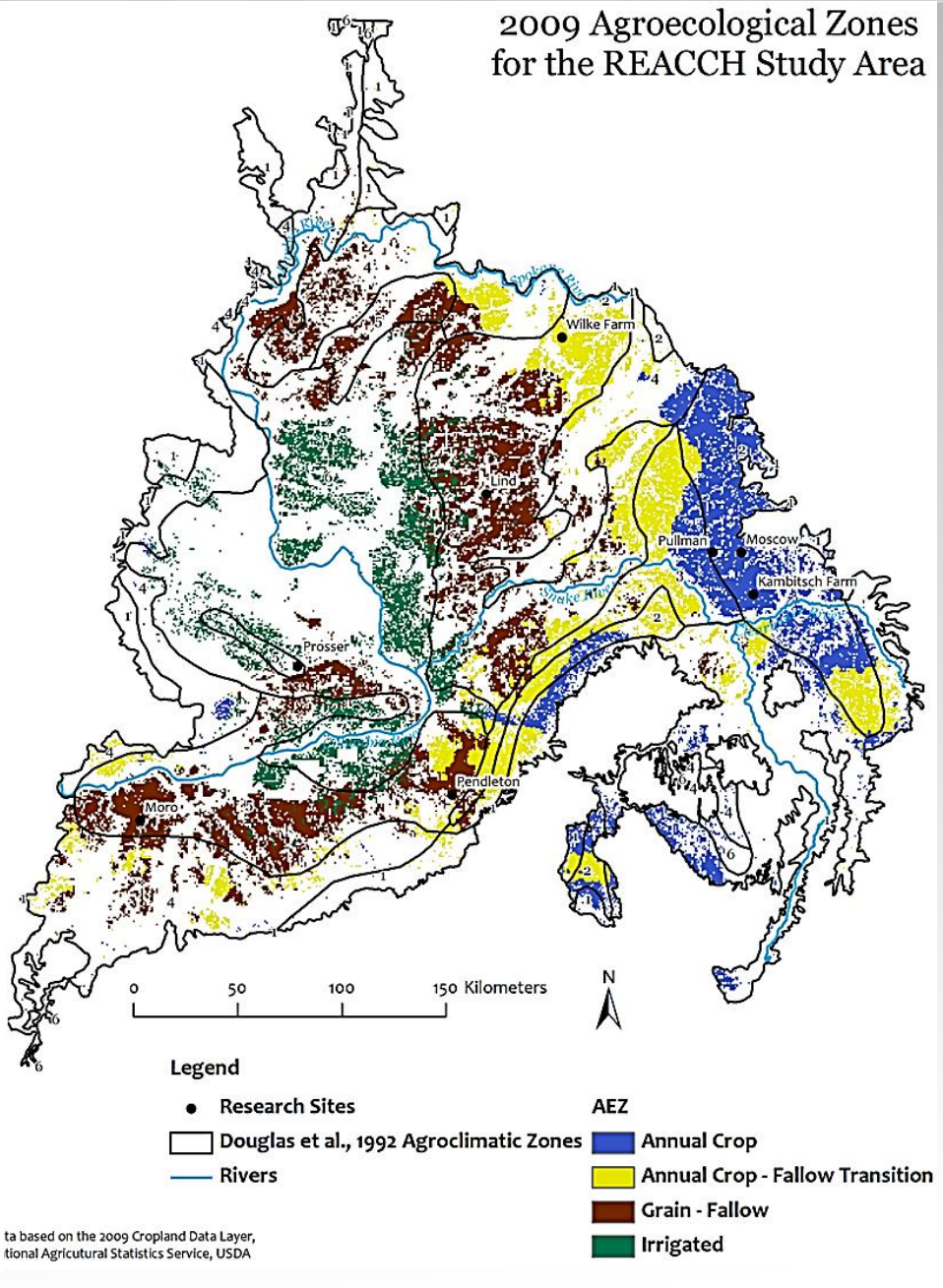
Dynamic AEZs





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Defining Dynamic AEZs

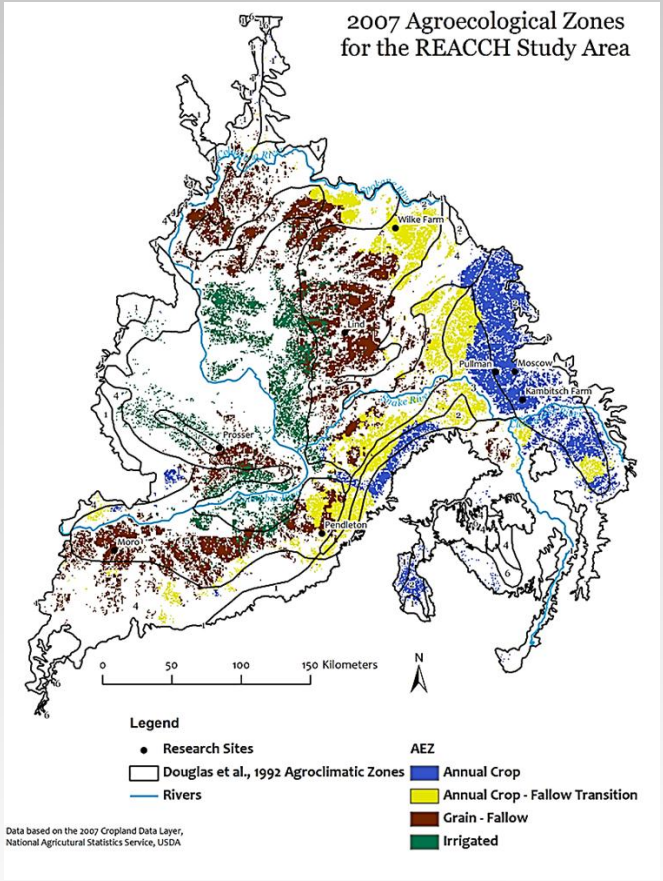
AEZ	Fallow	Winter wheat	Spring cereal	Grain legume	Alfalfa	Potato	Other
	%						
Annual Crop	3	39	20	21	5	0	12
Crop-Fallow Transition	27	39	20	3	4	0	5
Grain-Fallow	48	45	3	0	1	0	3
Irrigated	9	16	5	4	16	8	42

Comparing AEZs

Douglas et al. (1992) AEZ	Dynamic AEZ: Annual Crop	Dynamic AEZ: Crop - Fallow Transition	Dynamic AEZ: Grain - Fallow	Dynamic AEZ: Irrigated
	%	%	%	%
Annual Crop	67	29	4	1
Annual Crop-Fallow Transition	26	65	9	0
Grain-Fallow	2	20	59	18
Irrigated	0	1	20	78

Dynamic AEZs

- **Defining AEZs from annual cropland data layer enables:**
  - **Establishment of AEZ baseline**



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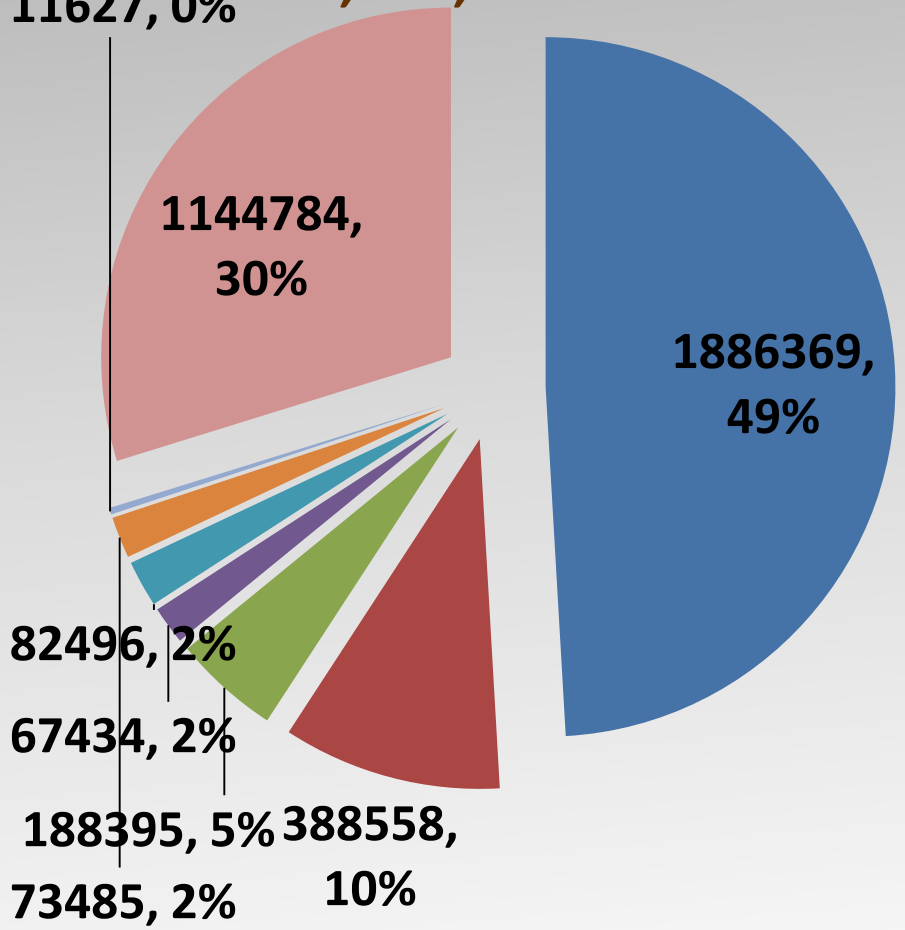
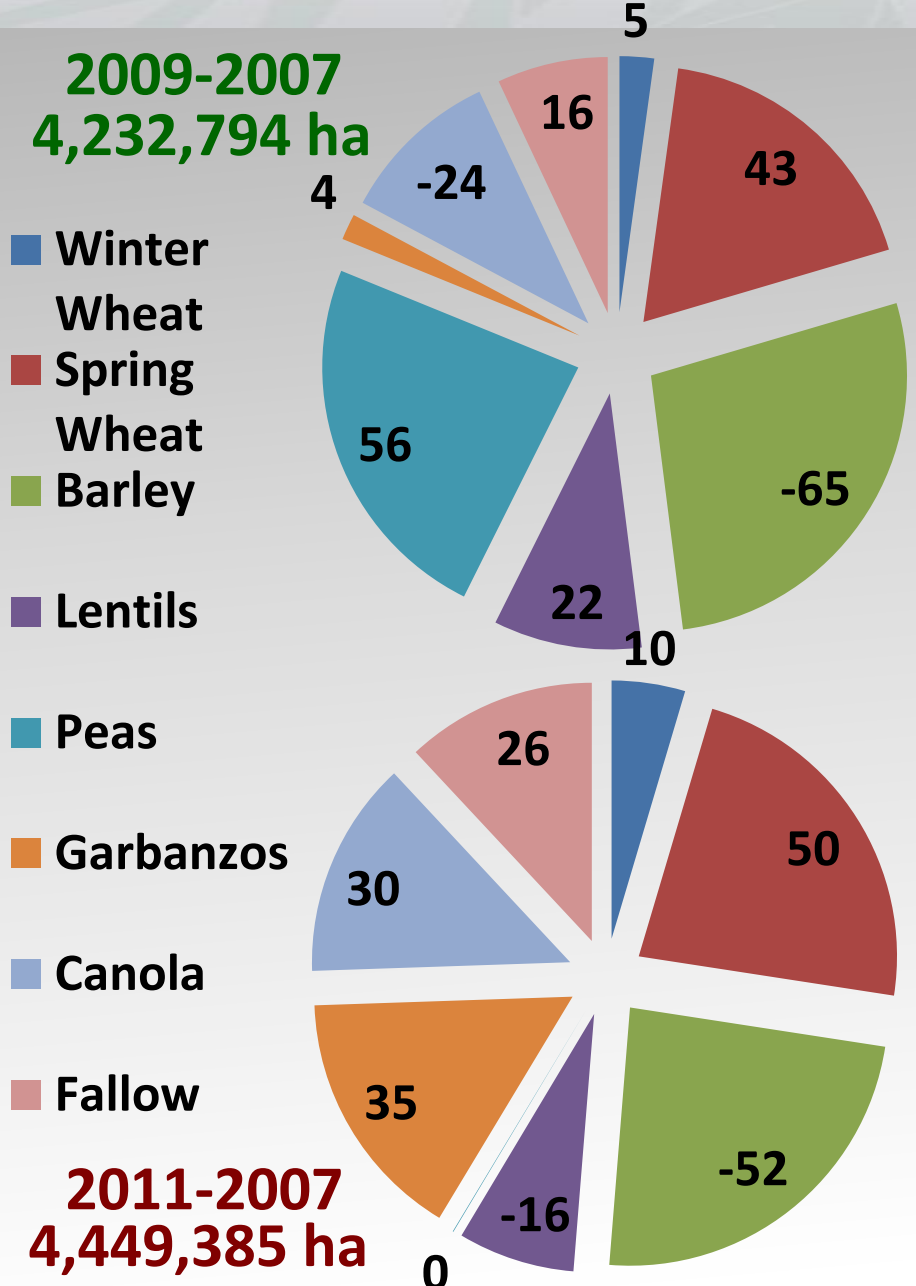
Establishment of AEZ baseline



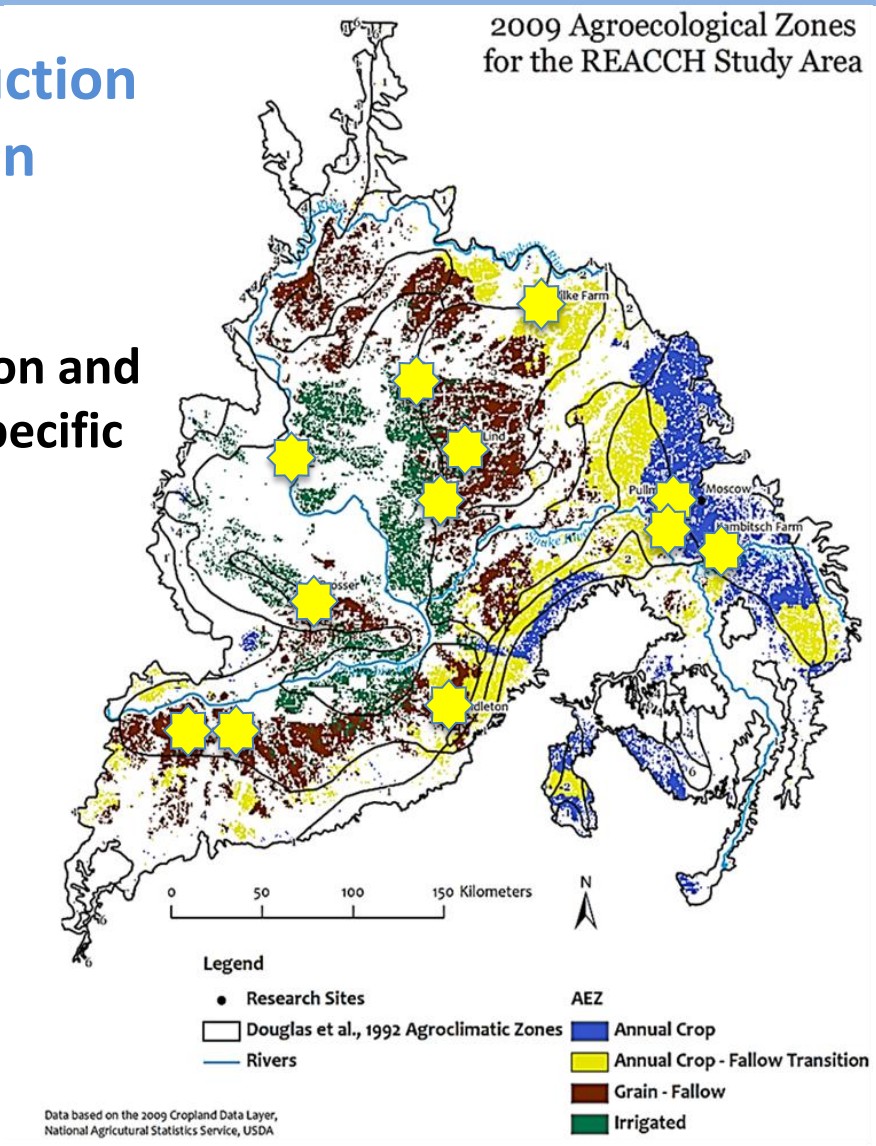


Linking of climate mitigation and adaptation strategies to AEZs

Establishing Alternative Production System Trials Across the Region (Pan et al.)

Trials designed to examine adaptation and mitigation potential suitable for a specific production zone

Wilke Farm
Cook Agronomy Farm
Palouse Conservation Field Station
Hennings Farm (Ritzville)
Jariva Farm (Ritzville)
Kambitsch Farm
Prosser Station
Pendleton Station
Troutman Farm
Boyd Family Farms
Moro Station



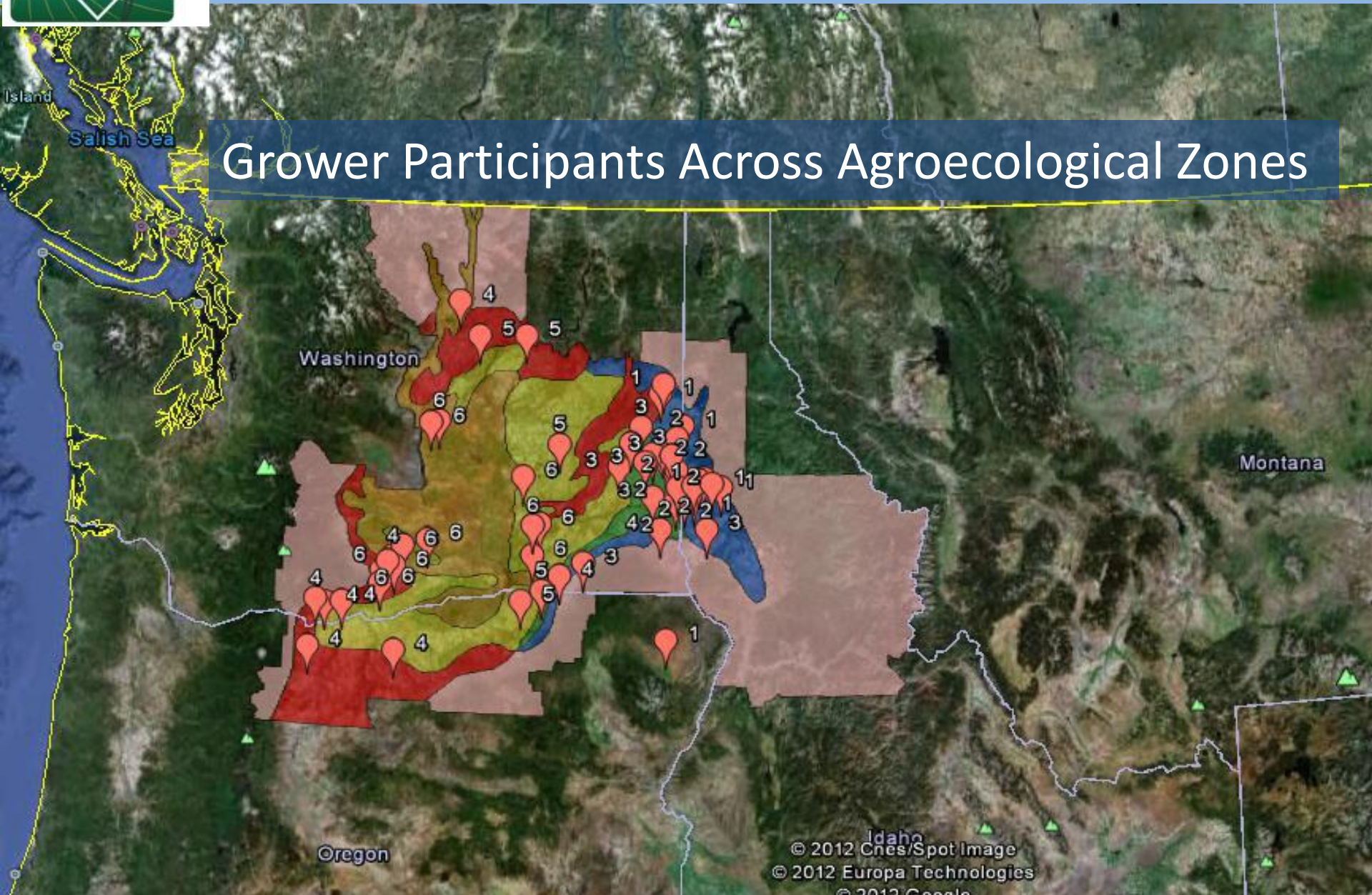
Linking of climate mitigation and adaptation strategies to AEZs

Establishing Alternative Production System Trials Across the Region (Pan et al.) – Different variables examined

	Wilke Farm	Cook Agronomy Farm	Palouse Conservation	Hennings Farm	Troutman Farm	Jariva Farm (Ritzville)	Kambitsch Farm	Prosser Station	Pendleton Station	Boyd Family Farms	Moro Station
Site specific N management	■	■									
Crop intensification/diversification	■	■		■	■	■		■	■	■	■
Residue management		■		■		■	■	■		■	■
Crop rotation			■								
Rotational N cycling and management			■								
Tillage							■		■		■
N fertility, recycled C, N byproducts									■		

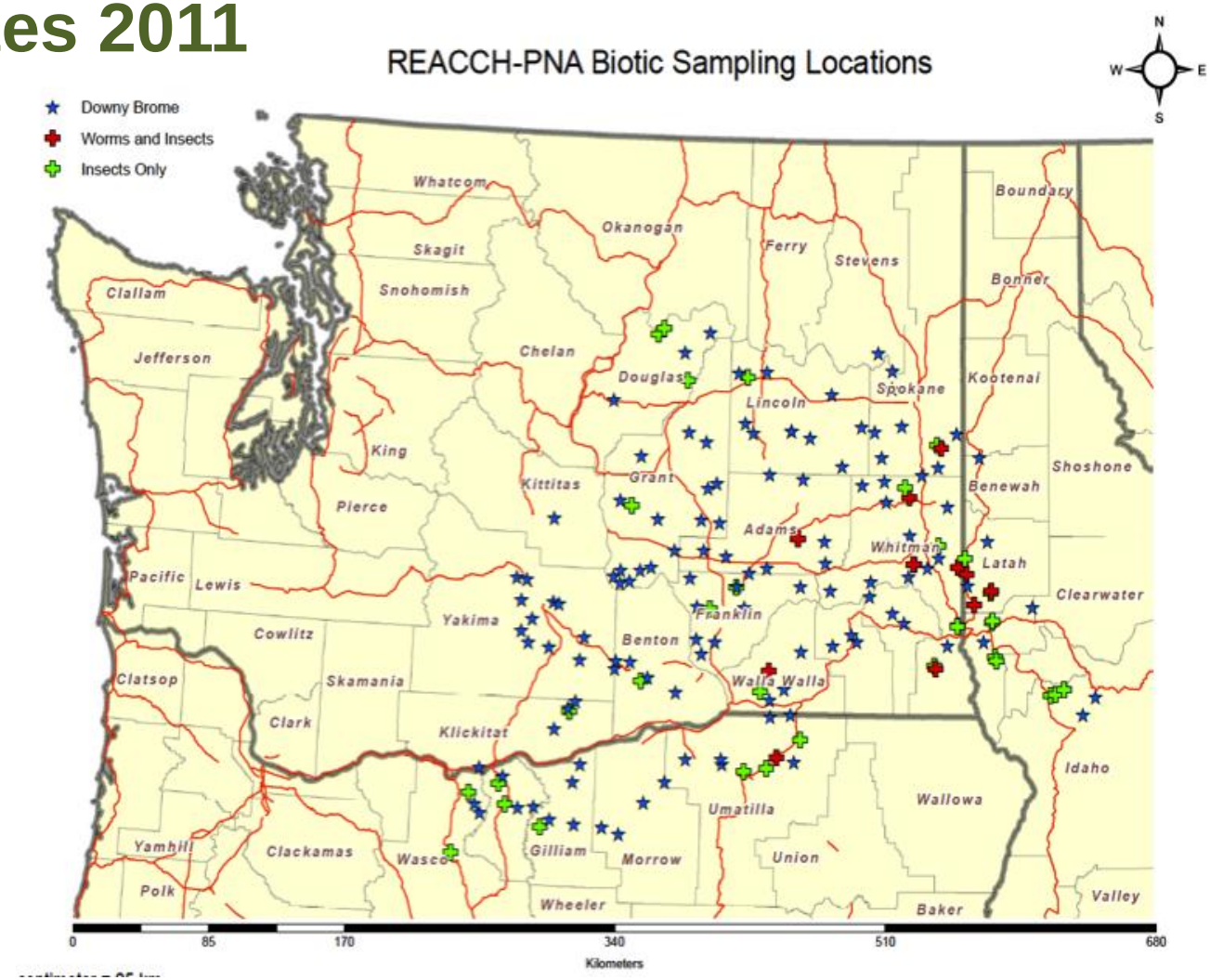
REACCH Longitudinal Survey

Grower Participants Across Agroecological Zones



REACCH Biotic Monitoring Sites

Monitoring sites 2011

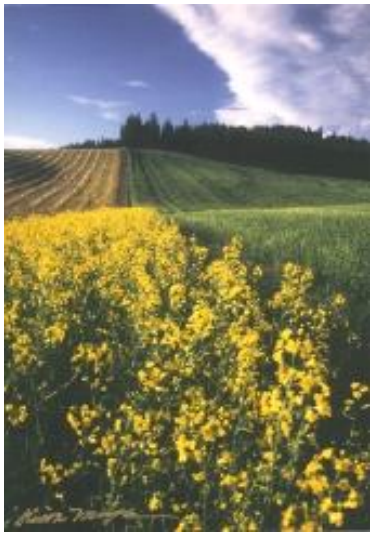


Dynamic AEZs

- **Defining AEZs from annual cropland data layer enables:**
  - **Linking of climate mitigation and adaptation strategies to relevant AEZs**
  - **Key in development of education and outreach materials**

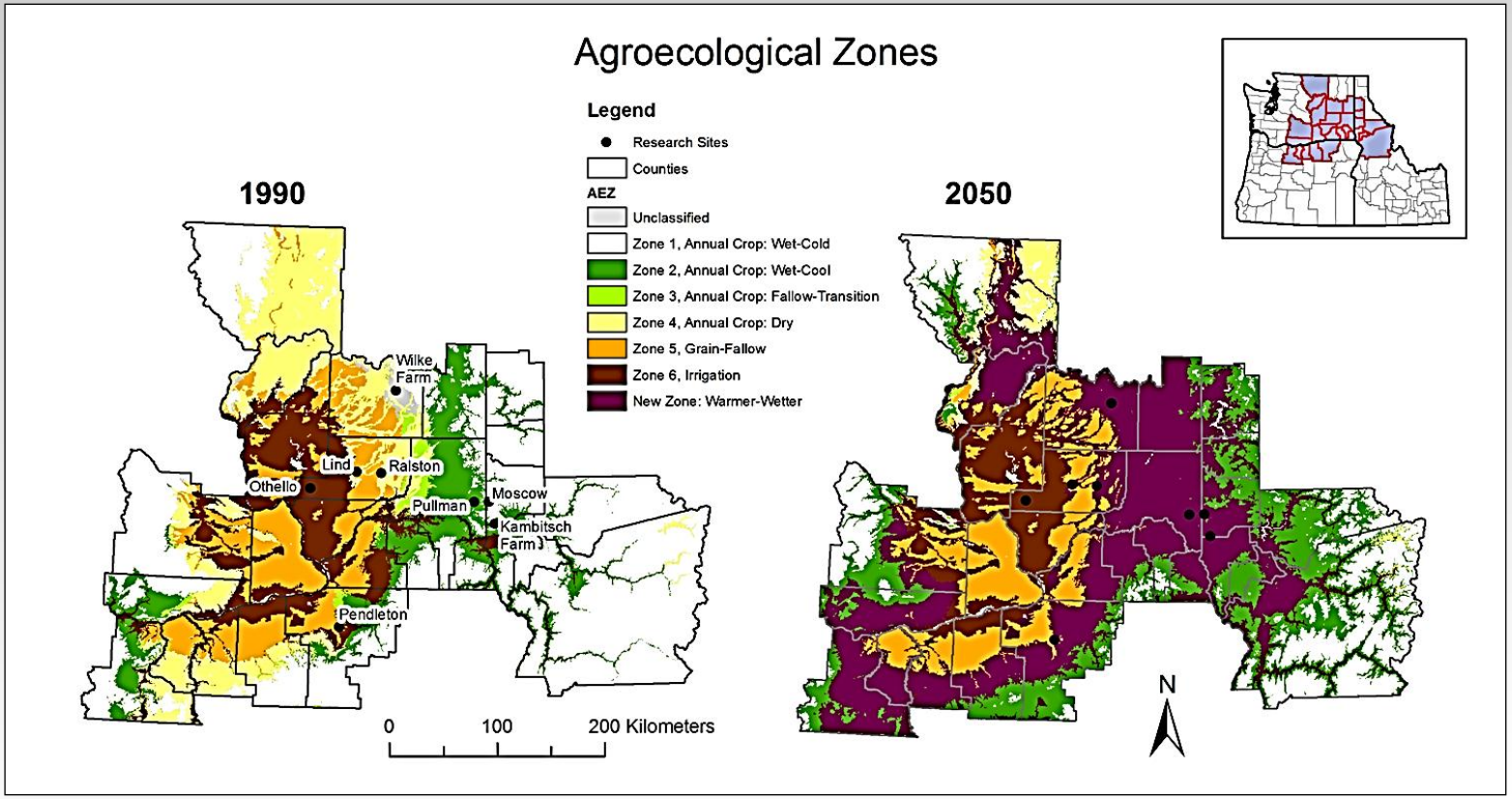
Future Directions

Low Disturbance, Site and Time Specific, Diverse, Renewing, Efficient, Learners



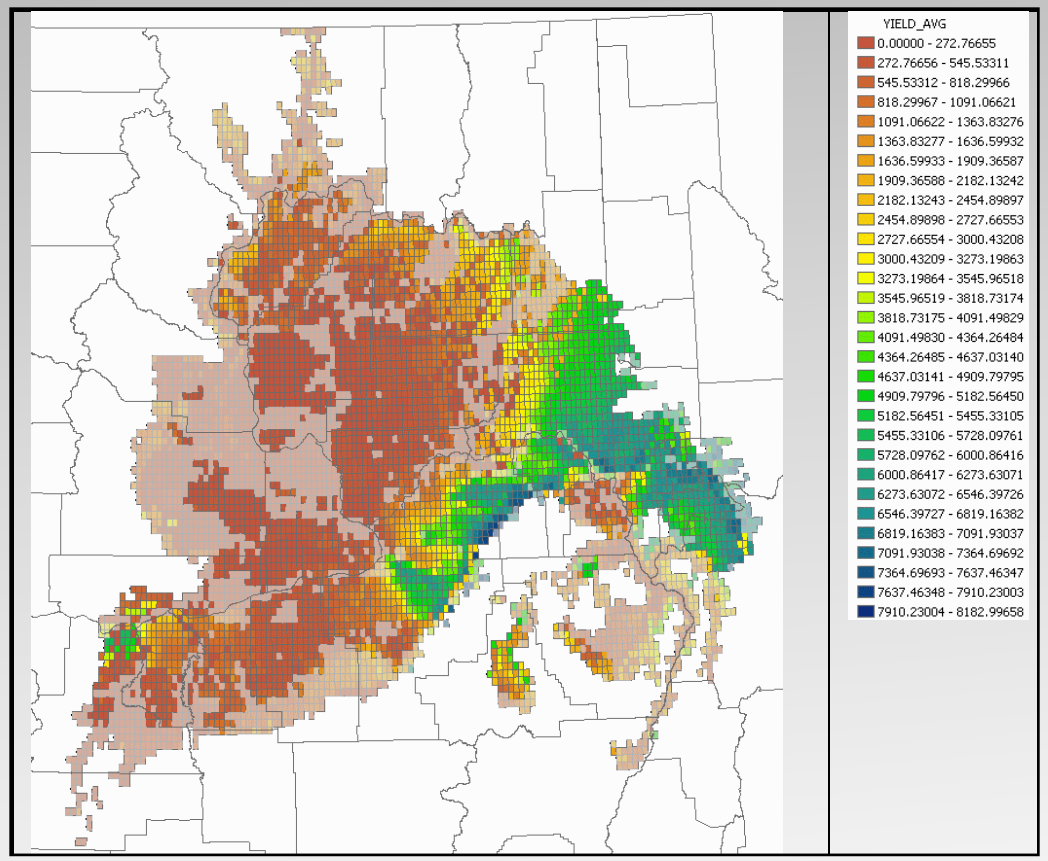
Dynamic AEZs

- **Defining AEZs from annual cropland data layer enables:**
  - **Capacity to evaluate shifts in AEZ boundaries over time**



Dynamic AEZs

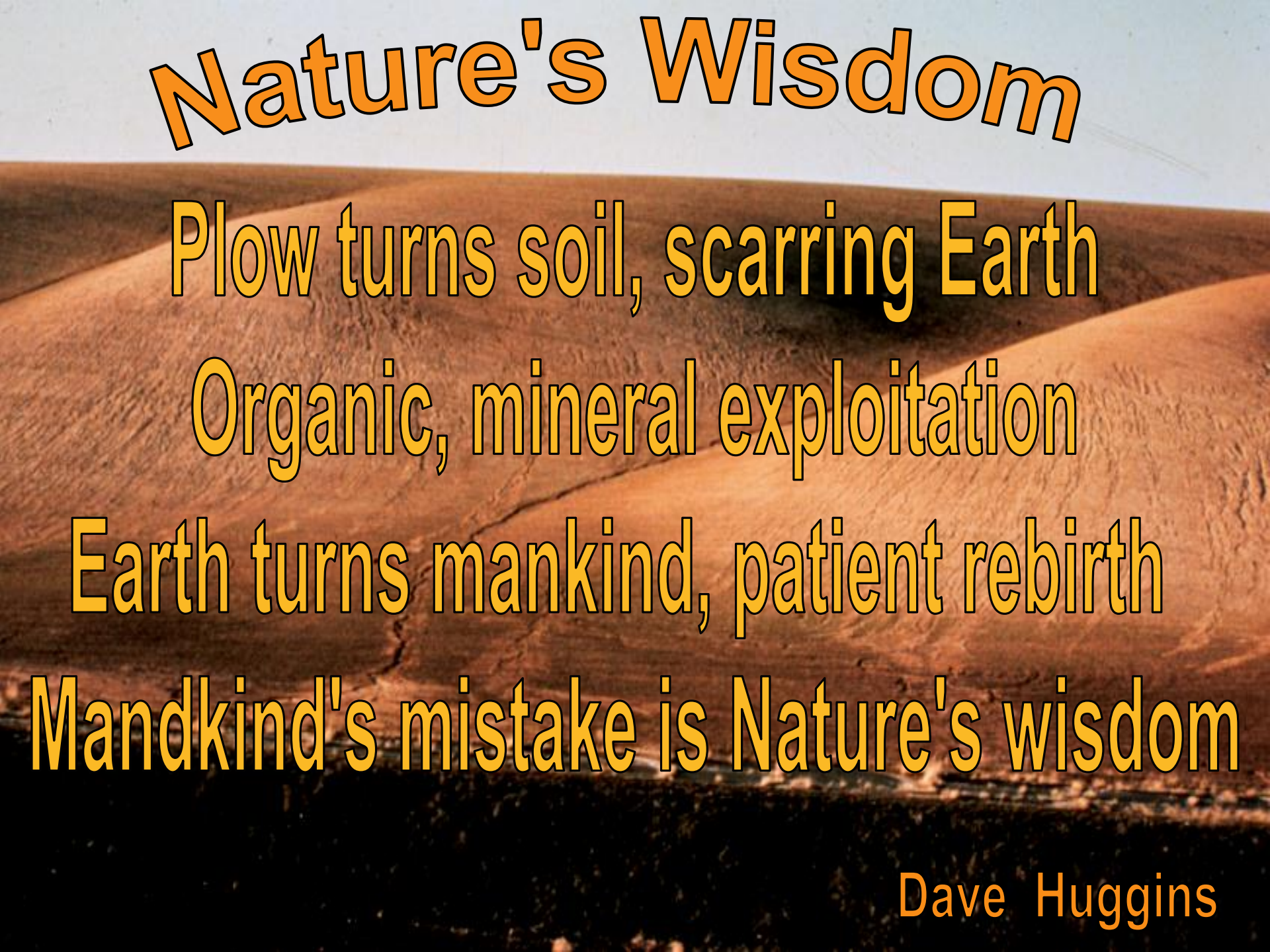
- Capacity to evaluate shifts in AEZ boundaries over time



- CropSyst simulation of grain yield in wheat-fallow systems

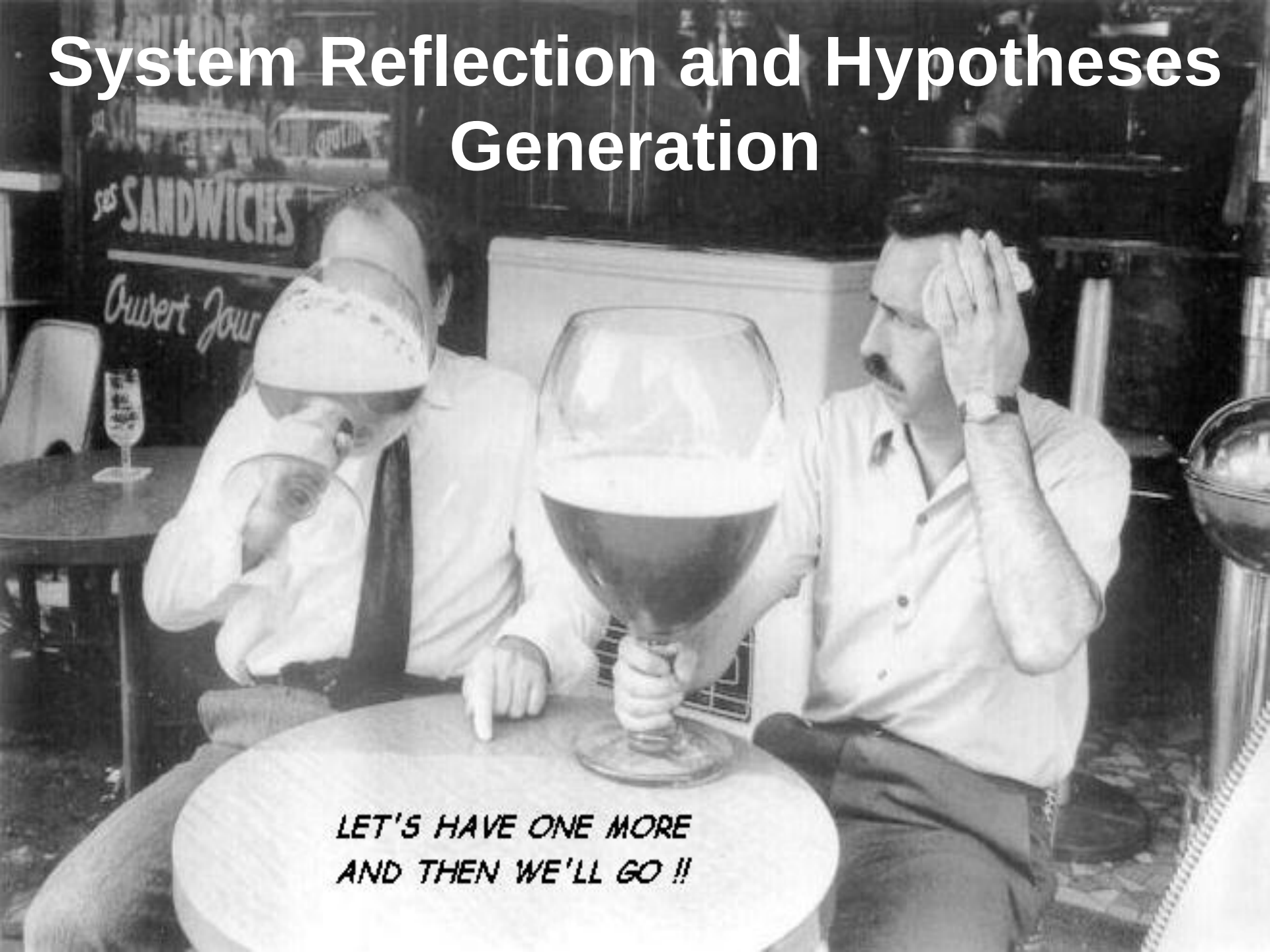
Dynamic AEZs

- **Defining AEZs from annual cropland data layer enables:**
  - **Assessment and integration of biophysical and socioeconomic data to pursue a transdisciplinary examination of climate-driven AEZ futures**


Nature's Wisdom
Plow turns soil, scarring Earth
Organic, mineral exploitation
Earth turns mankind, patient rebirth
Mandkind's mistake is Nature's wisdom
Dave Huggins

My View

System Reflection and Hypotheses Generation



Foodweb Ethics

Taste of wind, water, sun and soil
Sensual celebration of profound intimacy
Deep communion with earthly toil
Entwined with justice, peace, love and ecstasy

Dave Huggins