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Drought Risk and Adaptation in the Interior (DRAI)
August 26, 2014

USDA-NCAR Workshop: Agriculture in a Changing Climate Across Scales

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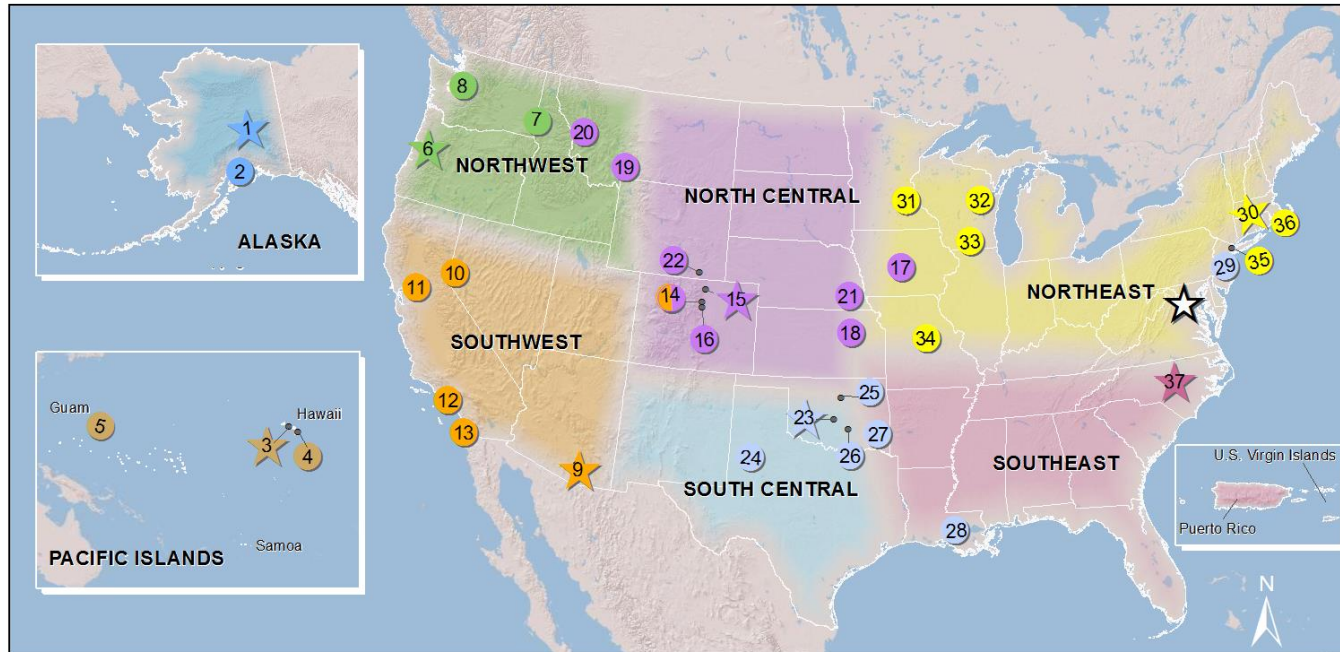
@NCCSC1

Today's talk...

- Introduce North Central Climate Science Center
- Background on Drought Risk and Adaptation in the Interior (DRAI) Project
- Framing drought in context of agriculture decision making in DOI and tribal lands
- Scalar Considerations within Climate and Agriculture Decision Space

❖ **What scale matters?**

NCCSC



Base from ESRI, 2009, Albers Equal Area Conic Projection, North American Datum of 1983

EXPLANATION

National Climate Change and Wildlife Science Center

CSC Lead Institutions

CSC Institutions

Alaska CSC

- 1. University of Alaska - Fairbanks
- 2. University of Alaska - Anchorage

Pacific Islands CSC

- 3. University of Hawaii at Manoa
- 4. University of Hawaii at Hilo
- 5. University of Guam

Northwest CSC

- 6. Oregon State University
- 7. University of Idaho
- 8. University of Washington

Southwest CSC

- 9. University of Arizona
- 10. Desert Research Institute (Nevada)
- 11. University of California - Davis
- 12. University of California - Los Angeles
- 13. Scripps Institute of Oceanography
- 14. University of Colorado

North Central CSC

- 14. University of Colorado
- 15. Colorado State University
- 16. Colorado School of Mines
- 17. Iowa State University
- 18. Kansas State University
- 19. Montana State University
- 20. University of Montana
- 21. University of Nebraska - Lincoln
- 22. University of Wyoming

South Central CSC

- 23. University of Oklahoma
- 24. Texas Tech University
- 25. Oklahoma State University
- 26. Chickasaw Nation
- 27. Choctaw Nation of Oklahoma
- 28. Louisiana State University
- 29. NOAA Geophysical Fluid Dynamics Laboratory

Northeast CSC

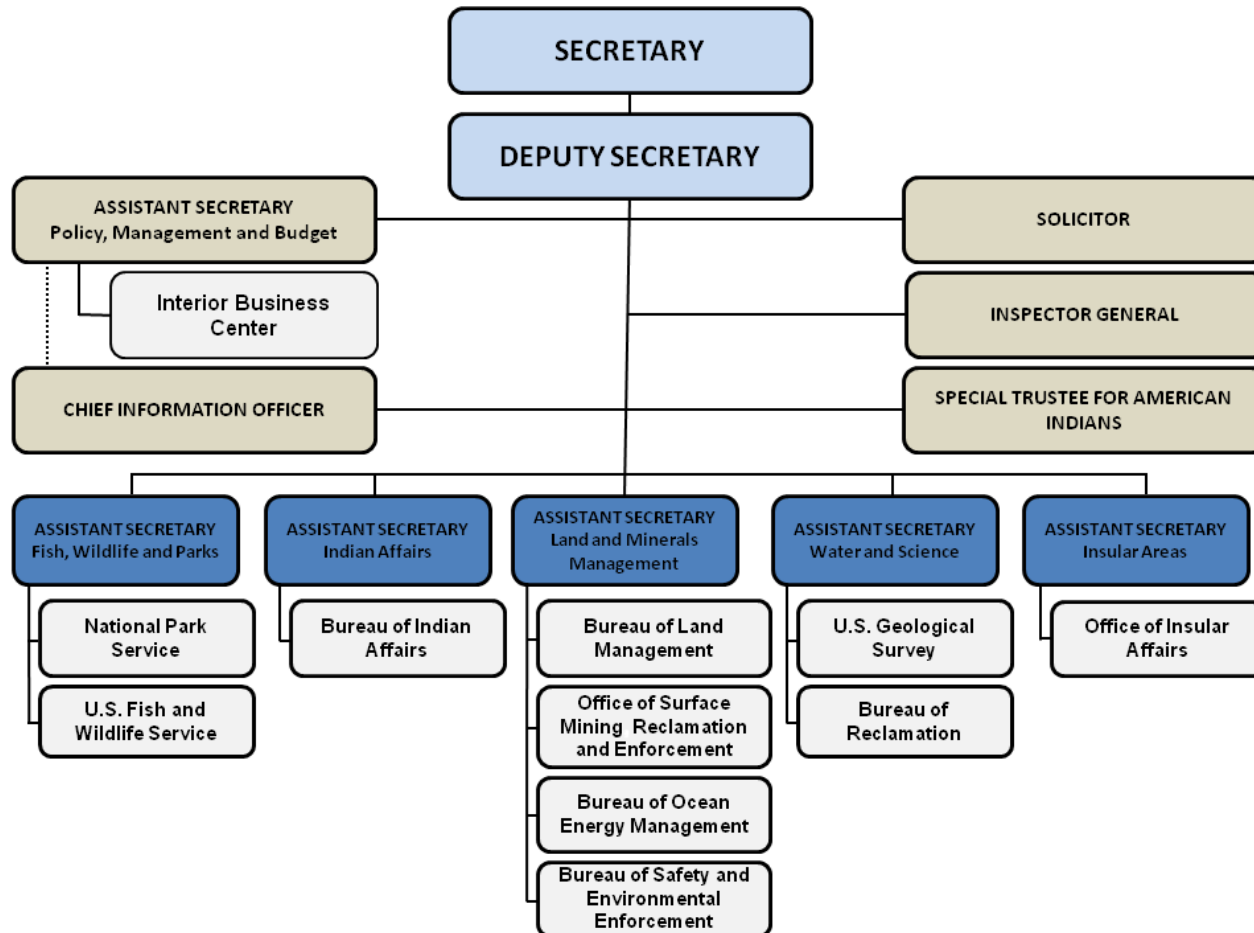
- 30. University of Massachusetts Amherst
- 31. University of Minnesota
- 32. College of Menominee Nation
- 33. University of Wisconsin - Madison
- 34. University of Missouri Columbia
- 35. Columbia University
- 36. Marine Biological Laboratory

Southeast CSC

- 37. North Carolina State University

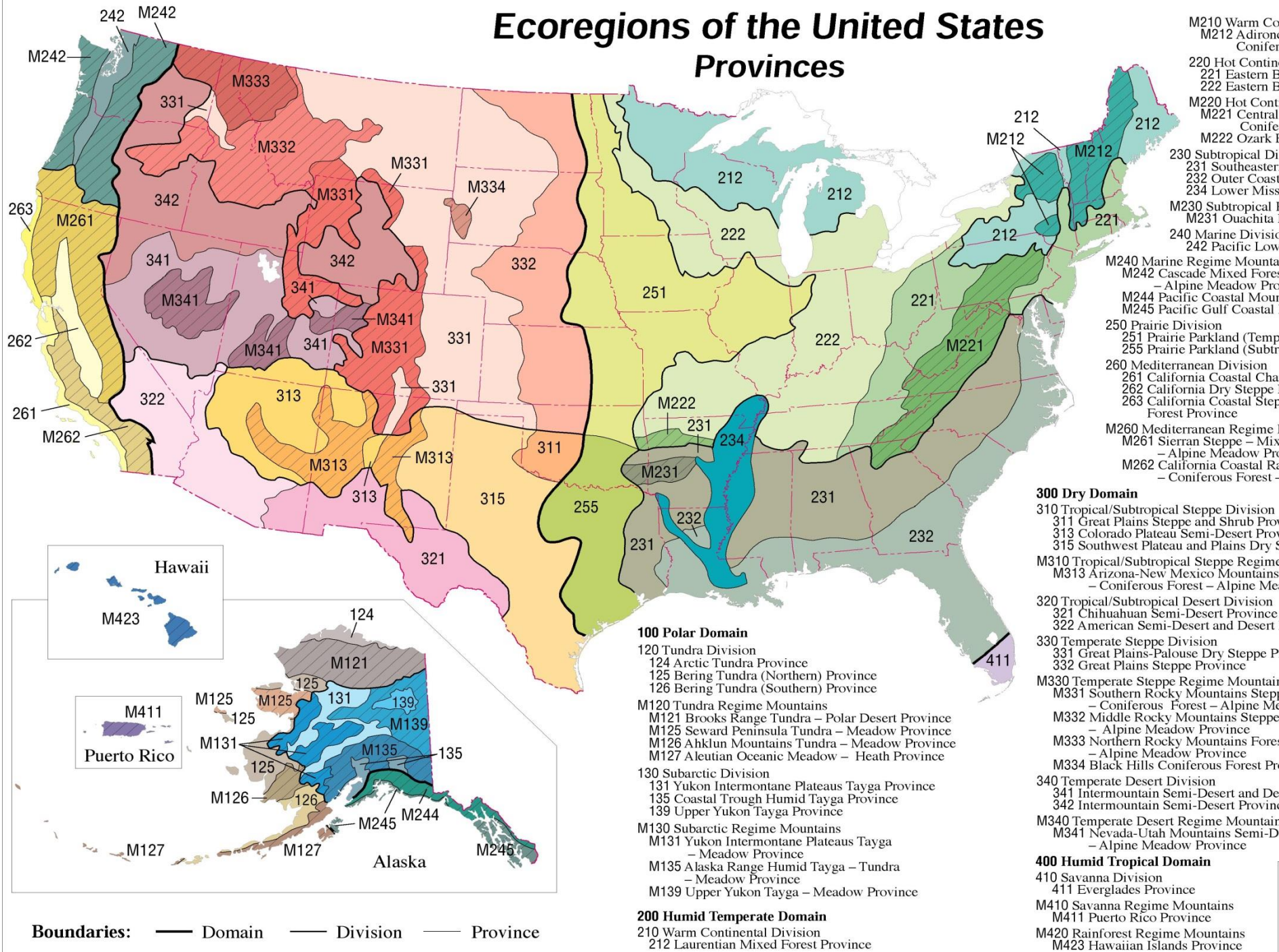
<http://www.doi.gov/csc/index.ctm>

U.S. Department of the Interior (DOI)



Ecoregions of the United States

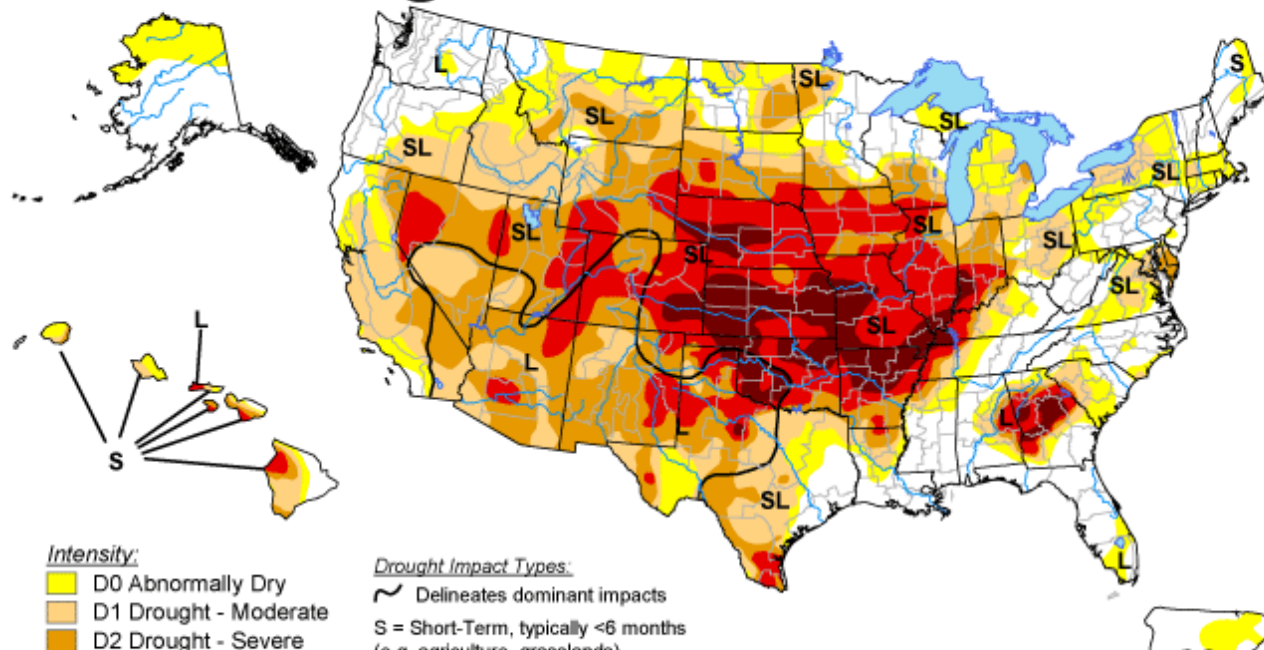
Provinces



U.S. Drought Monitor

August 21, 2012

Valid 7 a.m. EDT



Intensity:

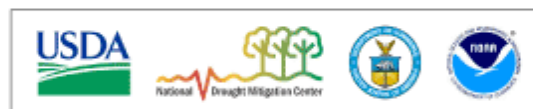
- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:

- Delineates dominant impacts
- S = Short-Term, typically <6 months
(e.g. agriculture, grasslands)
- L = Long-Term, typically >6 months
(e.g. hydrology, ecology)

The Drought Monitor focuses on broad-scale conditions.
Local conditions may vary. See accompanying text summary
for forecast statements.

<http://droughtmonitor.unl.edu/>



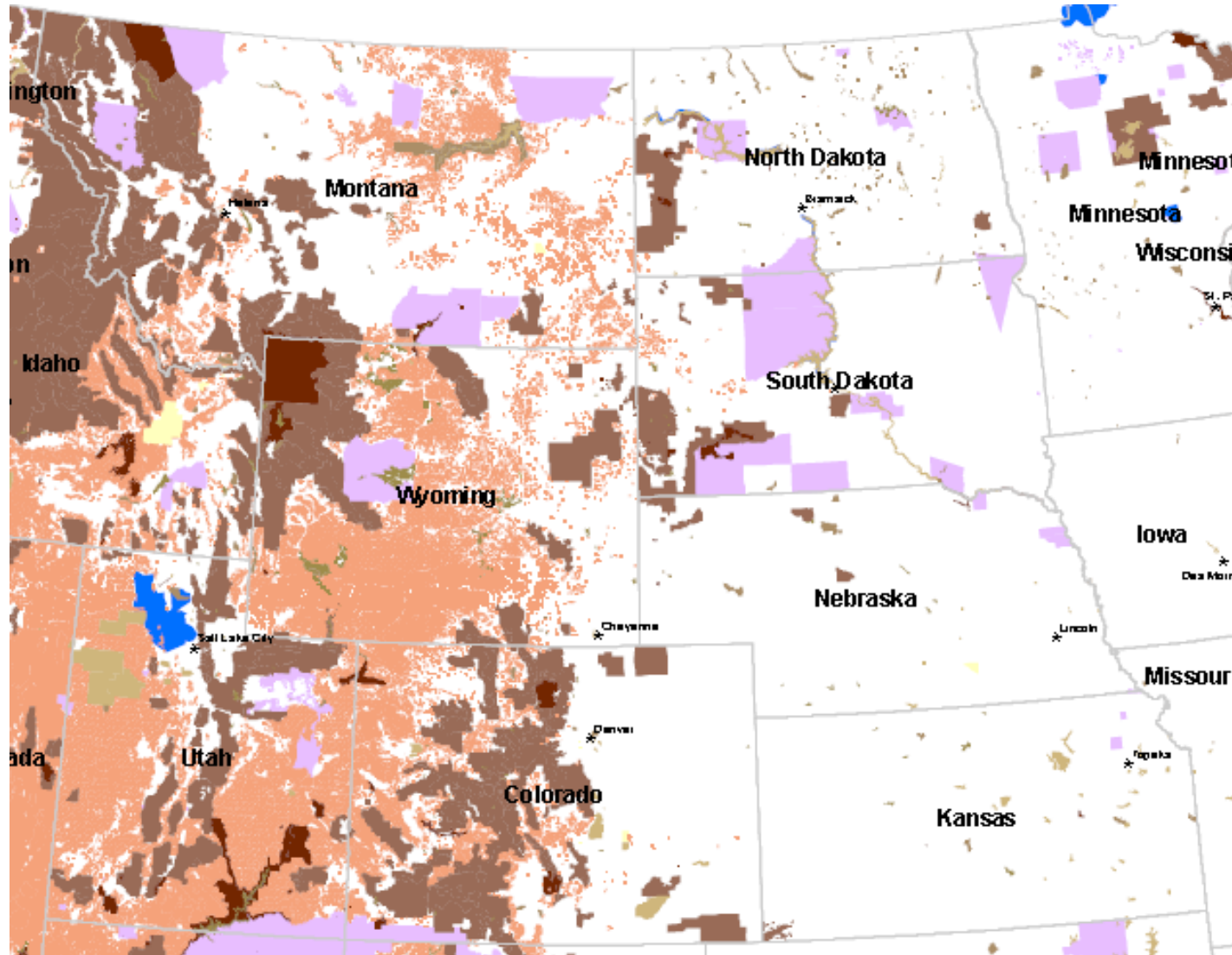
Released Thursday, August 23, 2012

Author: Michael Brewer/Liz Love-Brotak, NOAA/NESDIS/NCDC

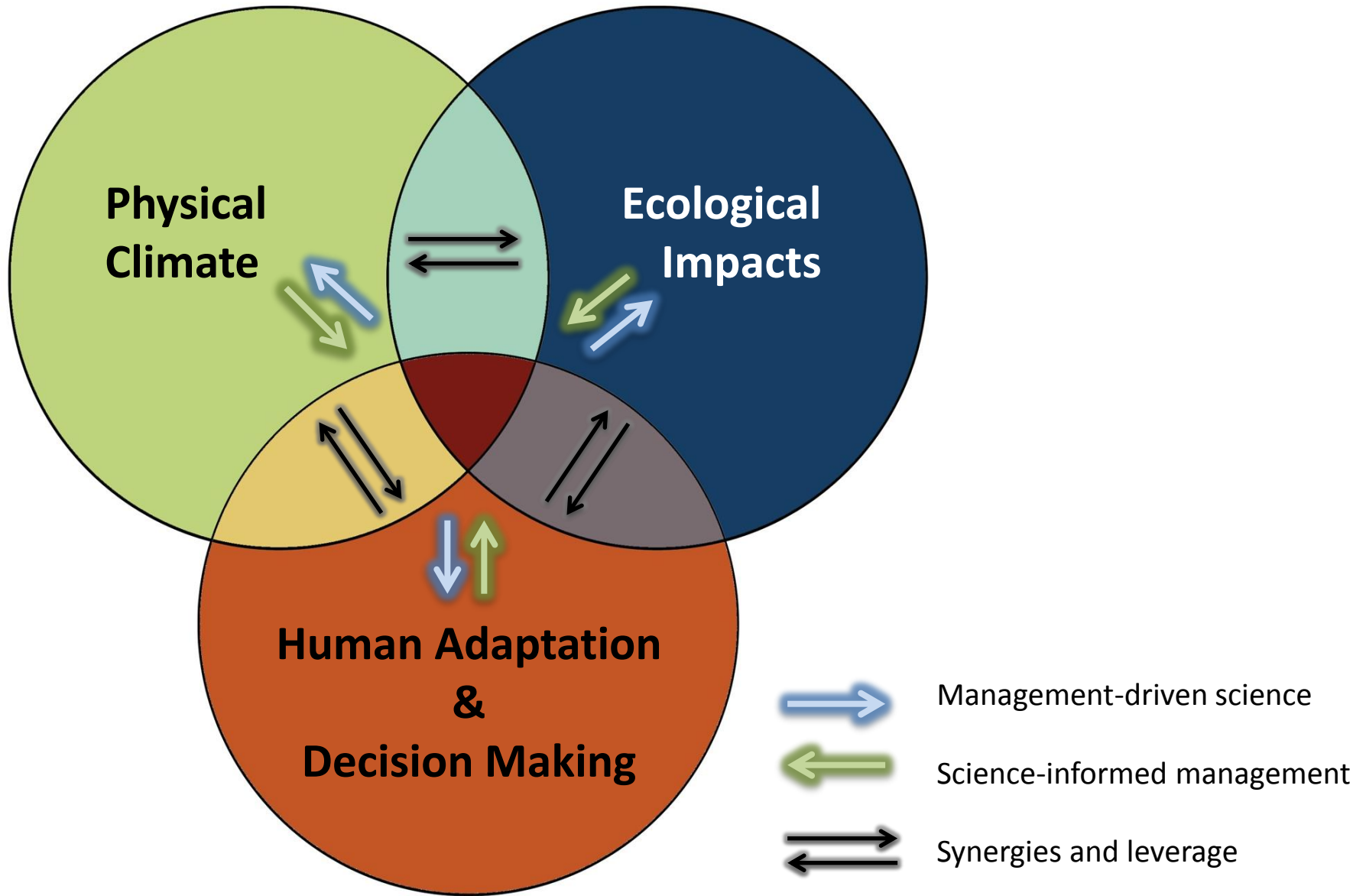


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Federal and Tribal Lands



NCCSC Integration Philosophy



Social-ecological Systems (SES)

Perspective of Drought

- Consideration of **ecosystem-livelihood** connections in semi-arid regions of the West (Rocky Mountains to the Great Plains)
- Drought context in the region historically related to grassland and mountain **ecosystem services**
- Connections to management / interconnections:
 - Water for livestock and wildlife forage
 - Water for recreation and tourism
 - Water for cities and rural areas
 - Water for energy (power generation and extraction/production)
- **Social changes** along the mountain-plains interface that affect public lands and vice versa



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Why the SES study on drought risk and responses in the DOI context?

- Public land management is a complex interplay between DOI managers and their stakeholders/neighbors
- Agricultural-conservation-energy-natural resource management objectives intersect over north central domain
- Multi-scaled local to federal management and jurisdictional concerns and activities complicate impact and responses to drought



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DRAI (Drought Risk and Adaptation in the Interior)

Broad Research Questions:

1. How are the DOI and tribal resource managers experiencing and dealing with drought?
2. How do DOI managers frame drought risk for the land and resources they manage?
3. How do the federal agencies work with each other and with state, local, tribal entities on preparing for and responding to drought?
4. What are adaptive capacities federal agencies have utilized to cope with drought in their systems? Barriers?



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DRAI (Drought Risk and Adaptation in the Interior) Research to Date

2 field sites to date:

Northwest CO Yampa River Basin

Southwest South Dakota

Interviews to date:

20 DOI, Tribal ,and other land and
resource managers

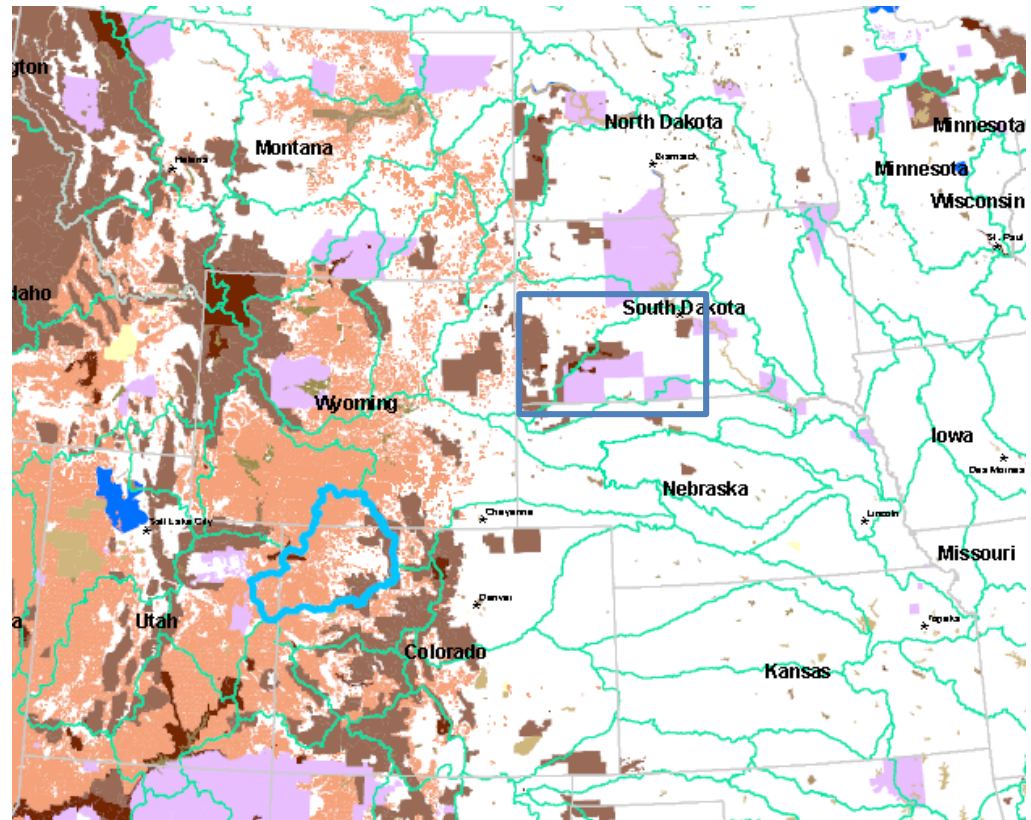
Summer and Fall of 2013

Analysis:

Coding in Atlas. Ti

Identify “hotspots”


Key issues, decisions, issues of scale,
indicators, etc.



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Top Responses Across All Agencies


How do you define or think about drought on your landscape? (N = 56)



Top Ten Co-Occurring Variables	Drought Definition (56)	Drought or Climate Risks (133)
1	Precipitation (11)	Vegetation (20)
2	Vegetation (10)	Ranching and grazing (14)
3	Climate variability (7)	Wildlife (12)
4	Ranching and grazing (6)	Wildlife-Mammals (11)
5	Wildlife (5)	Adaptive capacity (10)
6	Bison (3)	Fire (10)
7	Extreme events (3)	Precipitation (9)
8	Private lands and landowners (3)	Wildlife-Ungulates (9)
9	Temperature (3)	Private lands and landowners (8)
10	Veg-Grass (3)	Veg-ES-Habitat (8)

Variable (Code)

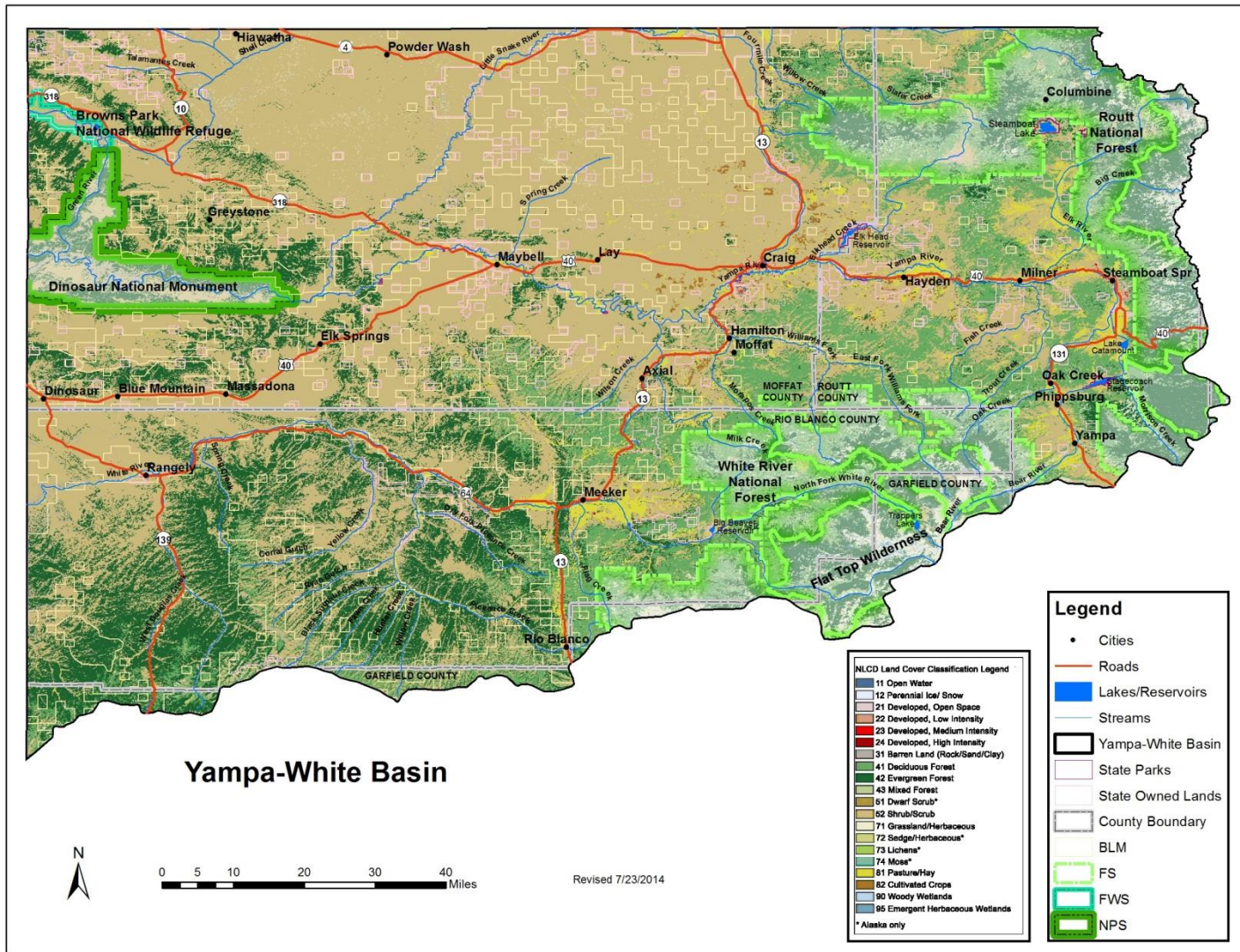
What, if any, indicators do you use to know if/when/how drought is going to cause negative impacts on your landscape? (N = 99)



Drought Indicators/Triggers (99)	Management Decisions (147)	Top 10 of All Variables [223]
Vegetation (23)	Ranching and grazing (28)	Vegetation [139]
Precipitation (18)	Vegetation (27)	Ranching and Grazing [131]
Ranching and grazing (16)	Wildlife (25)	Wildlife [107]
Local knowledge and observation (13)	Wildlife-Mammals (20)	Precipitation [67]
Climate science and information (12)	Precipitation (16)	Streams and Streamflows [58]
Veg-ES-Productivity (11)	Private lands and landowners (16)	Adaptive Capacity [55]
Streams and streamflows (9)	Management responses (15)	2012 Drought [51]
Wildlife (9)	Wildlife-Ungulates (15)	Bison [51]
Management decision (8)	Fire (12)	Private Land and Landowners [50]
Veg-ES-Forage (8)	Veg-ES-Forage (12)	Management Decision [49]

Variable (Code)

Northwest Colorado



McNeeley, S. M., 2014: A “Toad’s Eye” View of Drought: Regional Socio-natural Vulnerability and Responses in 2002 in Northwest Colorado. *Reg. Environ. Chang.*, **14**, 1451–1461, doi:10.1007/s10113-014-0585-0.

NW Colorado Exemplar Quotes

Do you **view drought as a significant risk** to your management activities?

What, if any, indicators do you use to know if, when, how drought is going to cause negative impacts on your landscape?

“Yes, I have my attitudes about drought, but we’re talking about public lands here, and we have, somewhere on the order of 175 permittees, which means there’s 175 different outlooks and 175 different ways of planning. And I would say the majority of them have been through considerable droughts here in this country, and I understand and plan for it, but quite a few aren’t quite used to it, and are much slower to recognize it as a risk. And from my standpoint as a public land manager that it’s really just looking at an individual allotments, and deciding whether or not, you know, it’s appropriate to turn out [livestock], or whether somebody needs to start thinking about, getting off and going home, and things like that.” (BLM)

NW Colorado Exemplar Quotes

Are there management decisions related to drought?

“The State [of Colorado] owns land, up from us. They lease it to a family, who then has hayfields. And so then the order of water rights is they have first rights on the Beaver [Creek] and then we have all the rest, and after we go through ours, that’s where the challenge comes in, is then **their one water right isn’t enough for the family to water all of their fields**. In a regular year or heavy year everyone has enough water and there are no issues.

Now we’re just trying to work cooperatively; [voluntarily alternating days of use], because we’re trying to get fields going for ungulate use. And he’s growing for hay, his first cutting and then **after that it’s all for wildlife**. That’s the deal he has with the State. That’s the challenge. If you do the letter of the law, he can only do a third of his fields.” **(FWS)**

A photograph of three men in cowboy hats standing in a field. The man on the left is wearing a light blue shirt and jeans. The man in the middle is wearing a plaid shirt and jeans. The man on the right is wearing a light blue shirt and khaki pants. They are all smiling and looking towards the camera. The background is a grassy field with some trees in the distance.

SW South Dakota Exemplar Quotes

How do you define or think about drought in your landscape?

“Drought is definitely an ongoing year-to-year thing. I always tell ranchers that we’re either in a drought, coming out of a drought, or preparing for a drought. It’s something that we’re constantly thinking about. ...we’re constantly working with NRCS closely and the ranchers. Everything here is a scattered land pattern, so we have to really work closely with the landowners.” (BLM)



SW South Dakota Exemplar Quotes

Do you view drought as a significant risk to your management activities?

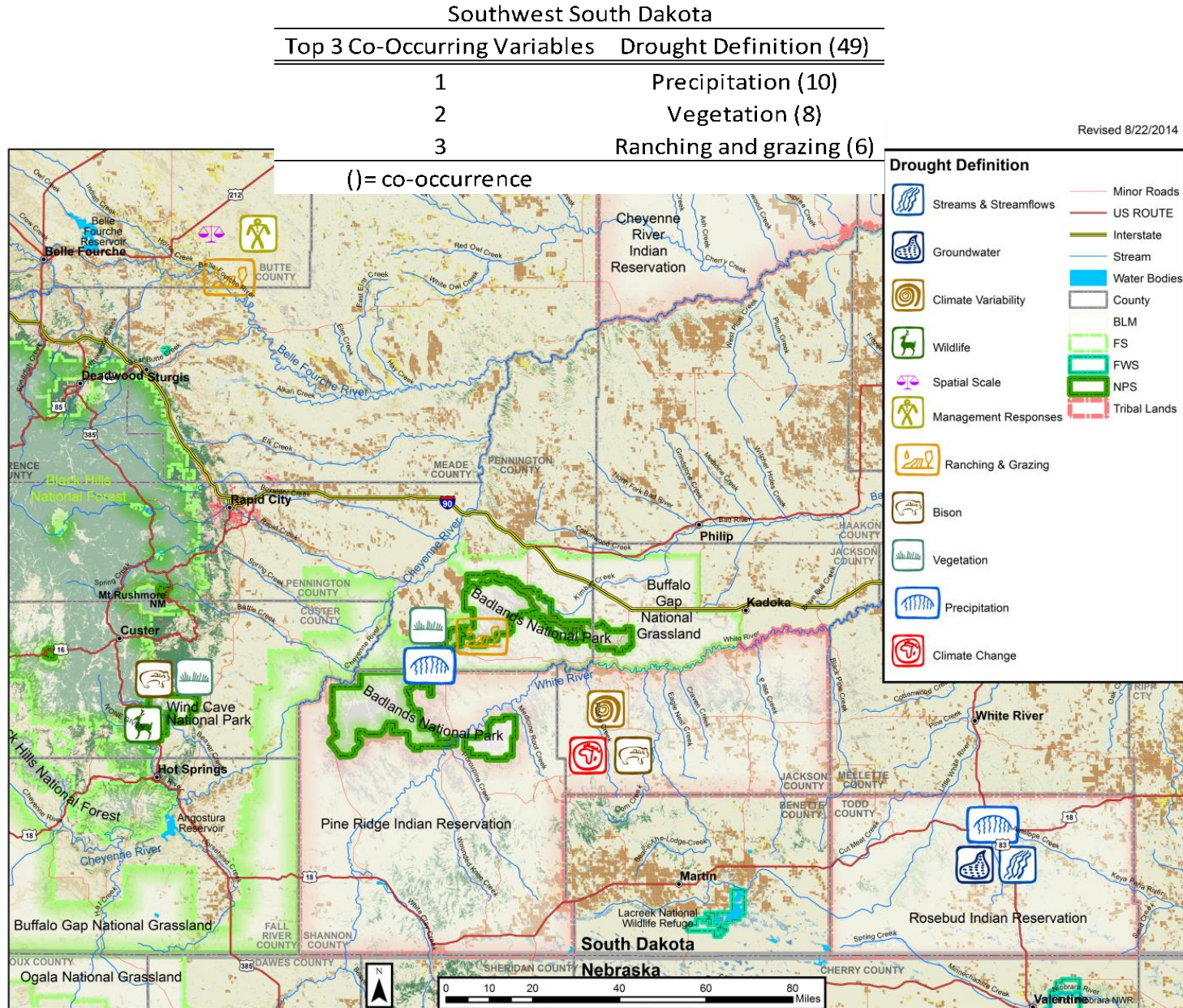
“I do, both from where I live and had worked in Pine Ridge [Indian Reservation], and I think for quite a few of the tribes that we’re working with in the Northern Great Plains...yes, I really think it’s going to be a big impact that we need to address, particularly **stocking rates and nutrition and feeding of the bison**. We consider them wildlife, but, unfortunately, we have to have a fence, so we have to try to figure out ways to keep them wild but still be able to manage them.” **(Tribal)**

SW South Dakota Exemplar Quotes

What, if any, indicators do you use to know if, when, how drought is going to impact the landscape here?

“That’s why I started the **stream-monitoring** project in 2009. I think what we’re doing now is collecting a full dataset every three years, and I’m collecting in a smaller subset annually, so that we’ll be able to see if we’re improving our ecological condition, or at least keep a pulse on it. I’m also doing **forage monitoring in the park** ...If our grazing does get really bad, our forage is going to show it, and so trying to keep a pulse on that. Those are the two main things that I do.” (NPS)

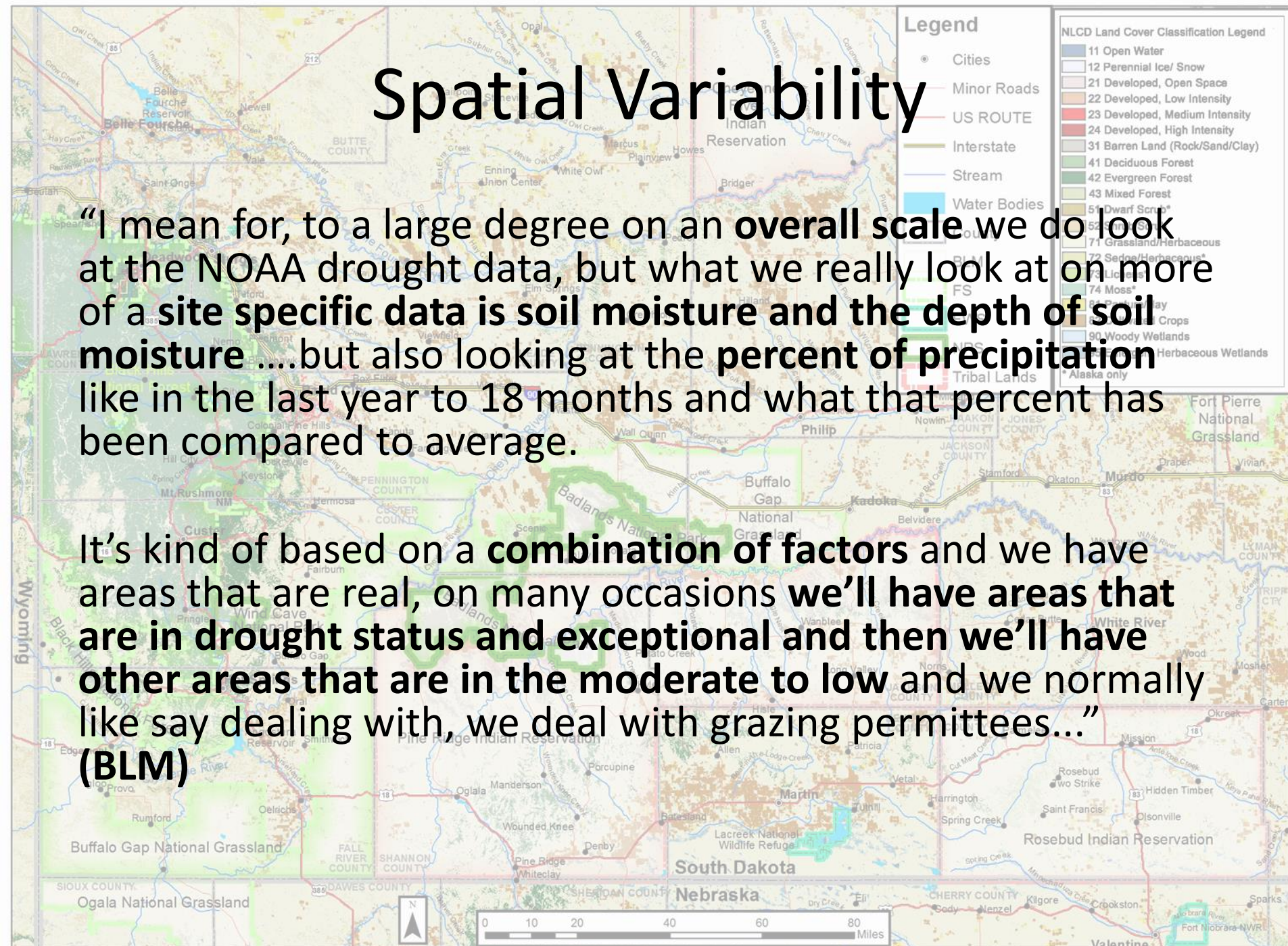
Climate Science and Decision Making: A mismatch in scales



Spatial Variability

"I mean for, to a large degree on an **overall scale** we do look at the NOAA drought data, but what we really look at on more of a **site specific data** is **soil moisture** and the **depth of soil moisture**but also looking at the **percent of precipitation** like in the last year to 18 months and what that percent has been compared to average.

It's kind of based on a **combination of factors** and we have areas that are real, on many occasions **we'll have areas that are in drought status and exceptional** and then **we'll have other areas that are in the moderate to low** and we normally like say dealing with, we deal with grazing permittees..."
(BLM)



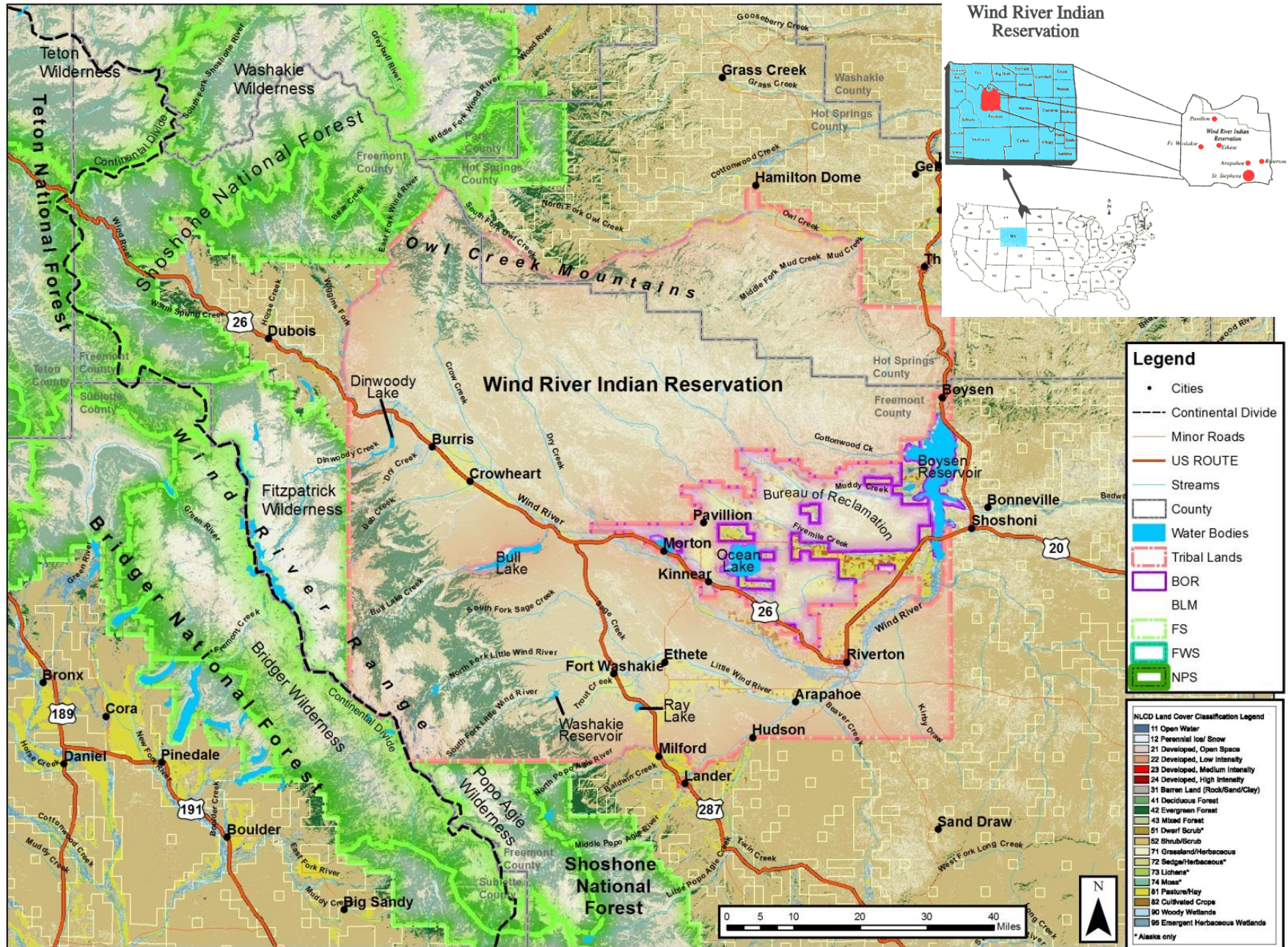
Triggers

“...with programmatic **NEPA** [National Environmental Protection Act] documents, it analyzes a broad range of actions. In this case, on any given allotment, the field office action would be to compel through legal means for someone to come off specifically because of drought conditions, and what’s analyzed as part of that would be a process where certain triggers are built in....

...typically would be a combination of triggers being **vegetative conditions**, as well as **precip data**, reliance on **indices like the drought monitor**, and some of those associated products, and basically using those as... and incorporating them as a series of triggers to take certain actions as we move more into a drought.” (**BLM**)

Wind River Reservation

Revised 7/31/2014



In Conclusion - Early Insights

- Ranching and grazing is one of the most important topics for DOI and tribal resource managers and drought for grazing permitting, bison, and managing in multi-jurisdictional landscapes
- A lot of diversity in drought definitions and risk perceptions, largely mission, management-specific
- Time and space scale-specificity is key, but an area for more focused research (e.g. at what scale of analysis is most useful/usable?)

In Conclusion - Early Insights

- Local knowledge/observations are used as much or more than technical knowledge and information
- Adaptive capacities and barriers often have little to do with climate or climate science (challenging the “information deficit” paradigm)
- However, opportunities do exist to provide **targeted** climate science and tools if/when at **appropriate scales, tailored to specific management issues**

In Conclusion - Utility for Climate Change Adaptation

- Helping inform and shape “actionable science” by linking science to management decisions
- Identifying climate sensitive decisions and decision calendars (at appropriate temporal and spatial scales)
- Identify climate science needs and indicators
- Inform climate history and model storylines
- Work toward climate-savvy decisions, climate change adaptation planning, and implementation