

## Breakout session 1

Table on p 14 –

Think in terms of water limited vs energy limited landscapes

Compared to Schimel map with course scale what is the realistic resolution? Gray agreed with Schimel maps (“big blobs”).

Downscale resolution we can feel comfortable with? 10-15 km resolution available. Can be done, questionable ds models are accurate. Hostetler – this shouldn't stop us. Fagre – GCMs get at direction of change (Temp). Morrison – doesn't want to accept that RCM aren't useful.

Cross – managers need finer scale models  
What are the climate related tools available and associated levels of uncertainty?

KM- Are there science questions that we have that aren't dependent on direction of climate change – where are the uncertainties of the present? Relationships between organisms and habitats (e.g. WbP and blister rust).

Mary – where do we know enough to take action in the short term?

Fagre – identify pathways...Thresholds. Need to test these – if patterns identified through monitoring lead to nonlinear change, in the absence of certainty in climate change projections.

Whitlock – questions: 1) Still need assessment of climate tools (models) available 2) analysis of historical trends and variability – need time perspective in drivers and responses.

Consolo-Murphy- need help in identifying what to monitor for meaningful data/info

CS - Den entry and exit, changes in food habitats over time. This type of info hasn't been looked at carefully in the past, but will be now.

Greg- can existing data be mined to look at cause and effect (correlative) – predictive value?

McDonald – need to identify question before we start collecting data for the sake of collecting data.

What are the questions?

-Do GCMs and RCMs show the same results, and where are the hotspots or the areas with

the most change? Do the GCMs generally agree? Evaluate agreement among approaches to identify hotspots – look for consistent patterns.

What are the thresholds or trigger points we need to think about?

2 sources of uncertainty: climate modeling and ecological responses (Gray: we won't be able to reduce uncertainty in a satisfactory way/timeframe. Look for new ways to adapt to the future that look at a wider range of climate change, range of ecological and management responses).

Other examples of species/habitat relationships needing investigation: WbP, brook trout, aquatic systems, responses of various vegetation types (regen rates, composition, productivity),

cascading effects – signal to landscape and feedback. We know more about snow veg responses than others. Need to run scenarios and look for thresholds and feedbacks.

Systemic thinking.

Will reductions in snow result in increases in ungulate populations.

Given the uncertainty in climate projections, what are the questions we can work on.

- Scenario planning
- Uncertainty in driver and response
- Ecological question: what are the cascading responses to climate change?
- Scenario planning showed need for monitoring (sagebrush monitoring) to determine which way the system is moving.
- What are the best predictions of veg community changes, monitor to determine which way the system is changing

Gray – predicted climate change in GYA: earlier snow melt, more drought, not entirely sure about ppt

## SESSION 2

Mary- given the uncertainty, are there irretrievable thresholds or irrational investments where action can be taken? Synthesis to help with short-term decisions.

Ken—frustration with climate change in all aspects of management...buzz words. How to help wildlife adapt to climate change

Chris- there have been ecological changes and always will be, we know change will continue. Focus on creating “healthy” ecosystems 50-100 years from now. For some alpine sp (pika) there may be nothing managers can do. For other species, there are options to improve conditions. Where are vulnerabilities that we can't do much about?

Kevin - Think about management actions with consideration of general ideas of climate change; specific or detailed climate projections may not be necessary. Need simple forward thinking. Do management you'd do anyway.

Lakes – importance may change

Mary – Whitebark pine restoration strategy – how much time to we have to decide how to spend money. Types of decisions: fuels treatments, fisheries, native/nonnative sp

Whitlock – paleoclimate record gives perspective and shows areas that are more subject to change. i.e. Lodgepole pine persists in warmer and cooler times in the paleo record. Douglas fir and subalpine forest vulnerable

Cross – many decisions are value driven. Change is going to happen and how we respond is often value-based.

Fagre – still science can guide decision making. Vulnerability assessments. What things do managers need to know for decisions now or in the future? Science template vs policy and legal templates.

Many people want to monitor demise of species and managers are constrained by this. Provide knowledge template (water balance example).

## Information needs (Session 2 only)

- Synthesis to help with short-term decisions.
- Enhanced science delivery
- Effective communication to public
- What are predicted impacts, and how do we start to adjust our management to address those impacts?
- Demand for energy development – how will that play out in the parks. What info

do we have to help make those decisions?

- Ability for managers to articulate their decision space – how do I or where do I invest for sp conservation?
- Decision support tools
- Where do I want to invest my resources and what info is necessary to determine where to best invest limited resources for best return? i.e. don't waste \$ where sky is falling. (need a particular target to determine what is a good or bad investment)
- Where/how to take advantage of opportunities – don't just focus on losses
- Where are vulnerabilities the most and least? What are species that we can't do much about? Don't monitor the demise of species with no hope of survival.
- Scenario planning – show managers what conditions will be 50-100 years from now so they can take management action. Futuring exercise.

- Ecological monitoring to confirm direction of ecological changes
- Where are places that species of concern can persist in the future? E.g. pikas. How do you determine this?
- Modeling to determine where species might persist into the future – refine over time as climate modeling improves. Need data to feed into model to allow refinement over time
- Need natural history data on species to develop climate envelopes
- Need info on generalist communities (not just pika, etc). What is the forest going to look like over time and changes in wildlife community in response to forest changes (what are the cascading effects of forest change?)
- How do different agencies approach assisted migration and similar actions?
- Are there sociological studies to aid decisions regarding assisted migration?
- Do species have the ability to migrate given the amount of human disturbance on the landscape?

- What are we managing for?  
Stationarity?
- How to define native species?
- What information is needed for managers to make decisions, now or in the future?
- Resistance – adaptation – ESA
- Bioclimate envelope validation (can use paleo record)