Southern Sierra Science Symposium
Round Table Discussion

REPORT

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Visalia, California

Hosted by USDA, Forest Service-Sequoia National Forest/Giant Sequoia National Monument and Pacific Southwest Research Station; USDI, Park Service-Sequoia and Kings Canyon National Parks; and USDI United States Geological Survey-Western Ecological Research Center

Prepared by Rebecca Reynolds Consulting

Table of Contents

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Participants: John Austin (NPS), Craig Axtell (NPS), Roger Bales (UC Merced), Klaus Barber (USFS), Colleen Bathe (NPS), John Battles (UC Berkeley), Danny Boiano (NPS), Matt Brooks (USGS), Tony Caprio (NPS), Ricardo Cisneros (USFS), Jeff Cordes (USFS), Marianne Emmendorfer (USFS), Annie Esperanza (NPS), John Exline (USFS), Carrie Fox (Fox Mediation), Linn Gassaway (USFS), Dave Graber (NPS), Steve Hanna ((USFS), Sylvia Haultain (NPS), Don Hunsaker (CSU-Fresno), Carolyn Hunsaker (PSW), Barbara Johnson (USFS), Terry Johnson (USFS) Rob Klinger (USGS), Rick Larson (USFS), Pat Lineback (NPS), Kathleen Matthews (PSW), Rachel Mazur (NPS), Connie Millar (PSW), Tom Munton (PSW), Linda Mutch (NPS), Malcolm North (PSW), Dave Parsons (USFS-Aldo Leopold Institute), George Powell (USFS), Trent Procter (USFS), Kathryn Purcell (PSW), Joe Reyes (USFS), Nancy Ruthenbeck (USFS), Brent Skaggs (USFS), Scott Stephens (UC Berkeley), Nate Stephenson (USGS), Peter Stine (PSW), Teresa Sue (USFS), Priscilla Summers (USFS), Charisse Sydoriak (NPS), Tina Terrell (USFS), Craig Thompson (PSW), Phil van Mantgem (USGS), Jan van Wagtendonk (USGS), Tom Warner (NPS), Harold Werner (NPS), Jim Whitfield (USFS), Rebecca Reynolds (RRC), facilitator

Background/Overview

The Sierra Nevada region is of vast importance to the well being of the nation, not only for its abundant recreational opportunities, but as the main source of California's thriving agriculture, energy production, and domestic water supplies. This relatively intact ecosystem provides an array of ecosystem services to the people of California, the country, and the world. Landscape change, including the effects of global climate change, shifting fire regimes, patterns of human land use, and other ecosystem stressors could have a significant influence on the natural resources associated with this area. The interaction of environmental and cultural stresses with global climate change is likely to be synergistic. Understanding these changes is vital to land managers in their efforts to make informed and sound land management decisions.

In recognition of this, four entities under three federal agencies entered into a cooperative agreement in January 2008 to jointly develop a program of research, resources management, and public education to help mitigate the impacts from and adapt to climate change effects on ecosystems of the Southern Sierra Nevada. These entities include: the USDA, Forest Service-Sequoia National Forest/Giant Sequoia National Monument (FS/GSNM) and Pacific Southwest Research Station (PSW); the USDI, Park Service-Sequoia and Kings Canyon National Parks (NPS); and the USDI United States Geological Survey-Western Ecological Research Center (USGS).

As a first step in this effort, the agencies agreed that a session would be needed to learn from science experts about the current state of science research and how it is being used in management decisions and practices. Following the scientists' presentations, a group of land managers joined them for a day of round table discussions to begin to develop a broad list of

information needs related to climate change and the future of the Southern Sierra Nevada ecosystem. From this work, a smaller group will develop a draft science agenda, which will be shared with the public to garner additional ideas about this important effort. The draft science agenda is anticipated to be ready for review in the spring of 2009.

Key Findings: Top Information Needs

Five groups made up of both land managers and scientists met to discuss what the top information needs are for each of five agents of change in the Southern Sierra Nevada: climate change, fire, forest management, pollutants and invasives. Groups were also welcome to consider critical information needs outside of their agent of change topic area. The following are the results from each group.

Climate Change

--What is a possible range of no regrets or low regrets of management actions to increase ecosystem resistance and resilience to a broad range of possible futures?
--Synthesis of information relevant to managing the Southern Sierra in the face of an uncertain future—relevant to rapidly changing climate. Prioritize this synthesis.
--How the system responds to changing precipitation patterns and how the system and the water budget changes. May affect other resources, infrastructure.
--What are the cumulative effects' thresholds triggering undesired conditions in southern sierra meadows, giant sequoias, etc.? Consider current uses. What are the beneficial values?
--Need foundational information on soils, chemistry of physical thresholds, etc.
--Communication, education, and social science needs—with the public and between ourselves (building bridges).

Fire

--WUII management – social science study, USA vs. Australia, engaging local level (fire safe councils)
--Sequoia Groves: what is an expectable risk? How safe do you have to be from fire coming into groves? What is susceptibility? How does that change based on Grove and past logging or slope etc.?
-- Desired effects?
-- Fire Effects: Intensity, seasonality, mosaic, effects to resources (i.e. sensitive species, cultural resources), scale, and fire season.
-- Achieving desired fire effects in small operational windows?
-- Smoke emissions budgets - Smoke pulse wildfire vs. long term prescribed fire – smoke climate interaction.
-- Resources of interest identification: what is the expectable amount of effects?
-- Where do you prioritize workload with the limited resources? Cost efficiency.
-- Fire History / regimes: need more diverse information, different vegetation, slope, aspect, etc.

Forest Management

--Forest change measured by long-term monitoring: create an extensive network from existing datasets.
--Disturbance interactions: what are the cumulative effects of fire, air pollution and drought?
-- Phenology of wildlife: reproduction, migration etc.

-- Need a better understanding of management actions (reforestation) on pools and fluxes of Carbon (particularly underground Carbon) at large scales.
-- Effects of forest dynamics and management actions on water yield and snow hydrology.
-- Better predictive models of ecosystem response.
-- Strong social science component for forest management.

Pollutants
-- More comprehensive assessment (i.e. One Atmosphere model, UC Davis)
-- Determine spatial distribution and pattern of ozone, nitrogen, particulate matter and contaminants.
-- Understand ecological effects and relating it to effects to human health from pollutants (short and long term).
-- Effects of smoke on human communities (social & health effects) (short term vs. long term).

Invasives
-- A synthesis of what we know about invasions in the Sierra (gray and published) is needed. Like SNEP Report. What makes a system resistant/resilient to invasion by species that would cause transformation (e.g., complexity)? What factors make a system more vulnerable to invasion?
-- How do the other stressors (e.g., contaminants, fire, and climate change) interact with species invasions?
-- Identify and define important management thresholds including when to start, stop, and expand projects.
-- Species-specific control investigations for high-priority exotics. How do we identify invasions on all scales and in all systems (e.g., disease pathogens, snails, range expansions)?
-- Evaluating the ecological response to species additions and deletions, as well as management actions against invasive species.

Group Synthesis
The full group reviewed the above priorities and recognized the following similarities between them:

Synthesis work
Interactive effects from stressors
Social science influence
Better predictive models
Carbon, forest, fire
Factors that promote resilience
Direct connections between stressor groups, E.g.: Fire/Air; Nitrogen/ Invasives; Water Quality/Quantity; Pollution/Disease

Also noted was a concern that there may be areas that have not been considered due to the structure of the five stressors, e.g.: visitor use – recreation and others. This will need to be considered.

Breakout Sessions

The day was split into two round table discussions, each with five sub-groups made of a mix of the participants. The morning session focused on identifying the top information needs for each of the five agents of change. Groups were mixed based on the individual's specialty so that, for example, all scientists working on climate change were in that sub-group. The session began with a discussion of recent changes in scientific knowledge or societal values that are likely to alter managers' information needs. After the brainstorm and discussion, groups then brainstormed a list of information needs related to the agent of change topic area and also considered important needs that fell outside the topic area. After the brainstorm, the groups decided on what they considered of highest importance from that list.

The afternoon session focused on taking the results of the morning's session on top information needs and further refining the list. This time groups were re-mixed without consideration for specialty and were to address the entire list from all morning groups (the list above in Key Findings was used as the starting point). Groups were asked to consider how the identified information needs integrated (i.e., integrate for efficiency, for a more thorough understanding, etc.) and how they could be pursued collectively. After this discussion, groups were asked to estimate the number of years required to achieve meaningful results for each information need on the list, the particular location of the project if important, and any other relevant issues or details.

Before the sub-groups started their work, a question was raised about the physical boundaries of Southern Sierra Nevada—what this group is using. The answer was to use Mark Nechodom's map for now. A comment followed that the ecosystem should set the boundaries, not humans. Another questioner asked if there are resource frameworks of which the group should be aware. The answer was that these should be discussed and noted in the sub-groups so that we all can become aware of them.

The breakout session results follow, first the morning session (session 1) and then the afternoon (session 2). Results are by group A through E, followed by plenary discussion comments.

Breakout Session 1
Top Information Themes
9:00 – 10:30 AM

Group A: Climate Change

Recorder: Barbara Johnston

<u>Recent changes in scientific knowledge or societal values:</u>
It is now okay to talk about climate change

The past is no longer the target: The past is a guideline, snapshot

Assumption: Climate change affects only the resources. It also affects other disciplines such as maintenance, engineering.

Assumption: because past decisions were based on past history, we won't have time to develop new models. Move toward more physically based models. Need the ability to accept and use physically based models. New information needs, requires much more spatial detailed knowledge of the systems. (Water used as an example) Buy-in to climate change as a factor. A lot more information coming down if use physical based information and buy-in is needs. Technology, a lot of information we are not aware of or are using. Synthesis of the existing information is needed.

Science agenda instead of a research because there is a lot out there we have not found.

Science is now defined as less heroic.

Smaller SNEPs, for smaller regions.

We can only think conceptually and need to talk the conceptions to the ground.

Water and its importance has not been a focus in the past. Water is a stressor and a receptor.

We cannot pour millions of dollars into a single species if we are going to lose many species.

Manage holistic ecosystems or single species? Put it in a broader concept of the ecosystem; conscious decision about the particular species.

What are the things considering the trajectory of what we think and set the priorities for a future—we have to put the funding where it counts.

Assumptions that really change: 1. SNEP thought could predict the future, but now it is much more diffused – not sure.

Whole ecosystem, landscape planning, big picture look.

Need risk assessment, risks to go down that path, what is the expected outcome. Models that give an idea of the path.

In the future, define undesired conditions and manage to avoid them. For example, you don't want to lose all of the forest at once, cascading effects.

Need to build a bridge to science integration: change in relationships between scientists and managers—integrated approach between scientist and managers. Social context science is not as heroic as it used to be.

Challenges, scientists to be more effective.

Stakeholders and scientists influenced the science agenda—integrate the needs into the agenda.

Research was the continuing process that managers planned on. Annual meetings needed.

Framework for collaboration is critical. Managers are responsible for taking actions. Timeframes constraints. Constant dialogue. As a manager this is what is biting me, thinking about in the future.

Build relationships with managers, scientists, and the public. Need to move in that direction.

Joint project with a coordinator for the agencies, e.g. Kings River project.

Executive leadership is needed.

Scientists having the ability to respond immediately to the needed change.

Recognize that some people are really good at research.

Can have great research, great plans—stakeholders who say if you can't prove it, you can't do.

Missing the science of uncertainty. And that is okay. Decide to take the risk. Educate people that it is okay not to know.

Solid science base, experts, dueling science is an issue in the courts. These are our options, this is the decision, and here is the science.

800 lb gorilla! Has to be adaptive and we don't have to have all the answers. Economics has to play into it. It is how we get funded to do these things.

Important Information Needs Brainstormed List:

Synthesis of current scientific papers, studies. A mini SNEP. Use it to guide future needs.
Condition assessment – present day perspective.
Prioritize the synthesis as it relates to the management goals
Ability to maintain some of the past research, direction. Cultural history for example. Vignettes of the primitive America.
Giant Sequoias and what is climate change doing to them.
What are the things that are likely to go away, what can we do about it or can we do anything about it?
Science provides diagnostic tools to show probability of success.
If we do nothing, what things are at greatest risk, can we afford to do nothing?
What does climate change mean to the recreating public in the southern Sierras? More recreating on the forest, will recreation opportunities change?
What does climate change do to where people will live?
Values enable us to make decisions—how do we establish these values. Where are the thresholds—social science v policy issues.
How do we define the values we must preserve or manage? Values that enable to make informed decisions.
Values change over time, as you know more.
Ecological risk vs. societal values – risk assessment.
Subsets of values as a society == science can inform us in making that decision.
Need more social scientists.
Educating the public – bring the science to the public. Strategy to how we educate the public.
Developing curriculum on climate change.
Have to have 2-way communication between educators and scientists.
Need to reexamine how we spend our time – not enough time to do all of this.
Communication has to be ongoing.
Projections for loss of water.

Information on how the system responds to changes in precipitation. Resource mgrs need better information. Sierra Nevada forests need to be managed for water.
Population growth
Information on effectiveness of cloud seeding.
Air pollution and climate change folded together – deal with the 2 stressors together.
Assumption that air quality is better.
Can't understand effects of climate change without taken the other stressors into account.
Temperature and precipitation combined to be climate change.
Need the ability to do continuous monitoring.
Just synthesizing info does not make it useful, need to interpret into decision making context.
Evapo-transportation rates needed.
Data in the giant sequoias – could they endure a 10-year drought.
Consequences of changing climate on fire regimes, insect outbreaks, hydrologic changes,
Use the information to calibrate physically based models; Models much more reliable, parameters based on physical measurements.
Hydrologic systems for giant sequoia 6-7,00 feet; giant forest -- Potwisha (2-3,00 feet), oak woodland, forested wilderness areas (Panther meadow) missing information in these areas. Research needed in these areas. Distribution of water aspects needs more than 1 installation.
Water is going to be a key issue.
How do you make water use efficient – large mature forest, canopy cover, get rid of shrubs – how do you do it? Fire every few years, masticate? What treatments to do?
What is a possible range of no regrets or low regrets of management actions to increase ecosystem resistance and resilience to a broad range of possible futures.
Interactions of all the stressors

<u>Top Information Needs (Priorities):</u>

What is a possible range of no regrets or low regrets of management actions to increase ecosystem resistance and resilience to a broad range of possible futures?

Synthesis of information relevant to managing the Southern Sierra in the face of an uncertain future—relevant to rapidly changing climate.

How the system responds to changing precipitation patterns and how the system and the water budget changes.

What are the cumulative affects' thresholds triggering undesired conditions in southern sierra meadows, giant sequoias, etc. Make cumulative effects thresholds consider current uses – livestock, recreation (human use). How resilient will they be with the addition of livestock? What are the beneficial values?

Need foundational information on soils, chemistry of physical thresholds, etc.

Communication, education, and social science needs.

Group B: Fire

Recorder: Linn Gassaway

Recent changes in scientific knowledge or societal values:

Constraints –

- Goals can't be met – with resources
- Staffing
- Changing fire season
- Public influence WUII
- Smoke – short air quality windows
- Location of fire use
- Priority areas for prescribed areas
- Prescribed fire – not mimicking natural fire effects
- Saw logs and biomassing – mostly not an option
- Management Plans Thrown out

Slash size fuels are the drivers

Fuel load information and fire effects

Important Information Needs Brainstormed List:

Restriction of fire windows based on lack of data

Seasonality of burning – what are the difference of effects
Depth of mastication and fuel loads
Sensitive wildlife issues – seasonality of burn, mosaic burns – fisher
How to have mosaic prescribed burns in small operation windows for burning – spring burns??
Two light burns vs. one hot burn? Amount of large woody debris left?

Climate change and fire – Type conversions
Smoke pulse wildfire vs. long term prescribed fire emissions – smoke climate interaction

Expansion of groves – planting needed?

Triage – species.

Triage – target areas where fire needs are the greatest

Fire regime classes/ fire history

Loss of legacy trees and specific species – sugar pine, oak, as result of management activities and prescribed fire.

Top Information Needs (Priorities):

WUI management – social science study, USA vs. Australia, engaging local level (fire safe councils) – *Management options restraint and scale of WUI in sierra*.

Sequoia Groves – what is an expectable risk? How safe do you have to be from fire coming into groves? What is susceptibility? How does that change based on grove and past logging or slope etc.? Protection of groves and work priorities.

Desired effects?
Fire Effects – Intensity, seasonality, mosaic, effects to resources (i.e. sensitive species, cultural resources), scale, fire season shifting - *How can we meet our Management Goals and increase our effectiveness?*

Achieving desired fire effects in small operational windows? *How do we increase our effectiveness within our constraints?*

Smoke emissions budgets - Smoke plus wildfire vs. long term prescribed fire – smoke climate interaction. – *How can we get more opportunities to burn?*

Resources of interest identification - what is the expectable amount of effects? – *What limits our use of fire - Protection needs management constraints.*

Where do you prioritize workload with the limited resources? Cost efficiency – *Management constraints.*

Fire History / regimes – need more diverse information, different vegetation, slope, aspect, change through time and climate. How fire process across landscape – *Baseline information to determine management goals.*

Group C: Forest Management

Recorder: Phil van Mantgem

Recent changes in scientific knowledge or societal values:

Forest values might be changing – manage for increased water storage in the future. Much of this research has been done already (Colorado and New England). Small increases might be valuable, ignoring ecological issues of removing shrubs. How it interacts with ecosystems. Might be most valuable in hotter, southern Sierra Nevada.

Knowledge of climate change puts added pressure on the system.

Carbon is a new ecosystem service that newly valued.

Mitigation – lots of new research dollars for C sequestration. Not much for adaptation – what are the impacts of climate change in these systems.

Money for C sequestration kept for other management activities (Rx fire etc.).

Important Information Needs Brainstormed List:

Sci. need -- what do we need to know?

1) Increase growth of large trees,

2) Timing (what you do one decade affects the next).

3) Forest mortality (C release). Co-benefits (fire hardened forests).

4) Forest growth in the future

5) Variation across forest types. (Scientific values of high elevation forests)

6) Moving ecosystems? Species move, what is new environment?

7) Soils C, root ecosystems, invasive earthworms in east deciduous. Forest radically change. What is belowground C pools and fluxes are unknown and uncertain how management actions might changes these fluxes and pools.

8) Preserving individual species (SEGI, PILA). Facilitating reproduction (Prescribed burning is a precedence for this). Translocations. Unknown tolerances of these species. Lessons from Silviculture? Giving up 'naturalness' in exchange for biodiversity. Public acceptance?

9) Better predictive models of ecosystem response. Climate models are getting better, vegetation response models are poor, wildlife, parasites (bark beetles). Lots of unknowns. Use of experimental forests – high risk research.

10) Long-term research needs to be expanded. Monitoring. Research needs to help with monitoring design. FIA – opportunities and challenges. Fewer plots – remote sensing extrapolation. In the face of uncertainty forest monitoring becomes more important.

11) Cumulative effects at big scales. (i.e., preemptively remove species, PILA). "Over" thinning forests to increase resilience.

12) Climate fire interactions.

Top Information Needs (Priorities):

1) Forest change as measured by long-term monitoring: We need to create an extensive and well-designed network, building from existing datasets. We need to insure that these data will complement remotely sensed data. Can we manage for resistance and resilience? Rationale: We need to know how our resources are changing.

2) Disturbance interactions: what are the cumulative effects of fire, air pollution and drought? Rationale: These are the big, rapid agents of change for our forests.

3) Phenology of wildlife – reproduction, migration etc. Rationale: Wildlife might be an early indicator of pervasive forest changes.

4) Need a better understanding of management actions (reforestation) on pools and fluxes of Carbon (particularly underground C) at large scales. Rationale: Forest have a potentially large role to play in this climate mitigation strategy.

5) Effects of forest dynamics and management actions on water yield and snow hydrology. Rationale: Water is important ecologically and water storage is an increasingly important ecosystem service.

6) Better predictive models of ecosystem response. Rationale: need to anticipate potential changes and catastrophes.

7) Bonus information need: Strong social science component for forest management – how does this affect our other research needs and priorities?

Group D: Pollutants

Recorder: Marianne Emmendorfer

Recent changes in scientific knowledge or societal values:

Combination of ozone and nitrogen compounds on forests could be more important than or exacerbating climate change-stomata staying open, more litter on ground. Need to take stress off forest, and prescribed burn

Redistribution of carbohydrates to bole-increasing insect infestations-more food

Demographic changes-more retirees in foothills-expectation of clear air. May be false with potential for summer fires, and reality of fossil fuel based transport (ozone+), bay area smoke due to wind patterns, etc.

Air quality is perceived to be good in foothills and mountains-even though it is often worse than at valley floor. The invisible stuff in the air is worse than visible stuff.

Nitrogen can act as fertilizer to invasives (nitrogen loving)-giving them boost. Include eutrophication of aquatic systems: algae blooms, fish kills, green lakes. Public may not see this aspect of pollution.

Contaminants-pesticides, mercury, etc. the unknowns are large, small amounts have biomagnified effects, persistent and very toxic (often organic).

Public attention to air quality higher, results in stricter regulations on burning, etc. Balance of short-term "negative" impacts with long-term "positive" impacts: help public understand the trade offs.

Amount of fuels: need for multiple tools to treat; need for biofuels (biomass energy production) and mechanical.

Capture "One Atmosphere" that models all the components on a daily basis. UC Davis is using this.

ARB is using a regional haze plan: what is baseline? Uses "best bad day." Is this still a realistic baseline? Goal is to reach baseline by 2064. Potential for social science study.

WUIs: societal choice to live in rural areas with expectations of clear air, vs. need to reduce fuels with prescribed burns. High costs to stop wildfires in WUIs.

Relate all back to public health: ozone and PM10 relates directly.

Important Information Needs Brainstormed List:

More comprehensive modeling (i.e. One Atmosphere)

Which are more sensitive areas in terms of spatial distribution to identify higher risk areas so they can be prioritized for land managers to understand ecological effects?

Effects of pollution on ecology (water, animals, plants, etc.) and interconnections.

Effects to water from nitrogen and other pollutants; water expected to be a limiting factor.

What are synergistic effects to humans and other resources from a variety of pollutants, i.e. ozone and particulate matter?

Short term vs. long term impacts to human health from forest management activities and inactivity.

Human behavior modification: training, education. Are existing air quality warnings affecting people's activities?

Topography alters how air quality changes (i.e. 9000+ less ozone, except for San Joaquin River drainage). Some air systems within the larger air sheds.

What are people willing to "pay" in health or resources (sequoias, fires, etc.) for what they want?

Disconnect between regulatory standards and timeframes, and the resource goals. Secondary standards could address part of this (i.e. plants and humans have different response rates to pollution).

Education of people about benefits and costs of pollution (nitrogen improving plant growth).

Air quality and climate change may have a stronger link or overriding effect or stronger synergy than other stressors. More pervasive layer: the "super stressor."

Is there a science base for adage, "If you can smell smoke, then you need to get inside?"Yes/No; more public education is needed to clarify when, how much smoke is dangerous to health.

Fleet of solar-powered aircraft?

Desired condition is resilience to deal with "new climate"…need to experiment with management activities on the fly.

Is NEPA an outdated mode of decision making? May not be law, but actual implementation and follow up. Some is education of public, building trust through showing monitoring of successful work.

Need, in Forest Service and others, for change of policies, legislation, funding structures to improve responsiveness to resource needs (adaptive, and nimble to response and implement quickly).

Pursue and gain grants to make the research, etc. happen. Need for non-federal partner who can lead funding search and has the funds to help (Universities, etc.).

Reestablish ARB as grant funding source and research.

Top Information Needs (Priorities):

More comprehensive assessment (i.e. One Atmosphere) Rationale: Synergistic effects; most currently modeled individually.

Determine spatial distribution and pattern of ozone, nitrogen, particulate matter and contaminants. Rationale: Determine areas of higher risk to optimize management.

Understanding ecological effects and relating them to effects to human health from pollutants (short & long term). Rationale: Because we care! And develop management strategies and mitigations.

Effects of smoke on human communities (social & health effects) (short term vs. long term). Rationale: Develop better smoke management and public education strategies.

Group E: Invasives

Recorder: Rachel Mazur

Recent changes in scientific knowledge or societal values:

We can have a broad sense of who is likely to be an invader and what areas are likely to be invaded, but it does not translate down to smaller scales.
There is a need to recognize stopping them at the front end and containing them and predicting where they are going to go and what you can do at the back end. E.g. fish were found to be the "smoking gun" in the trout decline, but then we find out there are actually several stressors -- perhaps pollution and climate change are other forms of invasives? We can take fish out, so we do that. In the meantime, we are studying the other things, but we might not be able to do anything about them.
Advances in genetic analysis are changing our priorities.
Mix up the genomes to strengthen resistance?
Novel assemblages are new.

Important Information Needs Brainstormed List:

At what level do we see the problem and what do we want to see done about it? Researchers tend to develop large ecosystem models that may have a disconnect with how things work on the ground – and managers sometimes do the opposite and miss the big picture.
There are different ways to consider this - tactical based (lawsuit) and strategic (big picture).
What is the regional picture of plant invasions – where do we stand? We need this on a big picture – this should include an analysis by species. (We know most of this is at lower altitudes and where people are in terrestrial systems. In aquatic systems, it is system-wide. A twist – you may only have one invader – but it is a transformer species – you have huge problems. In the mid-elevations – cheat grass could be this transformer, in the lower elevations – there are several.)
How do we know that we are being effective? Are we succeeding anywhere? What are the cascading effects of our efforts? When do you give up? When do you press on?
Triage question – you only have limited dollars – where do you get the most bang for the buck.
If invasion isn't a system-wide catastrophic situation right now, it will likely get worse – we can't predict what is coming if they haven't gotten here yet.
Consider focusing on management context.
There are economic and ecological issues.
We know species basic life history, but we don't know the threats it might present to the system.
We need to remember that our observations are only snapshots – and invasions ebb and flow based on climatic and other factors. This relates to our management strategies – and the issue of one non-native replacing each other.
Species that tend to be transformers in one ecosystem will be a transformer in another. This is not always the case – Monterrey Pine is an example.
There is not always a way to predict the effects of new invasive species – or their role.
Prioritization is a fundamental question.
How do we know when to give up?

Do we need to start "heavy"?
What are the consequences if we give up? What if we give up in one location?
We need a research agenda that will capture a time element.
You need a really effective early detection program.
If you are containing a species – it can still be very valuable.
There is research that could inform what we need to do – policy-wise.
Direct research to predict and prioritize sites – and to think about vectors. Ecological and policy-driven research.
Invasives are even more important because of pollution and all of the other stressors – we need to start understanding how these invasive species react in a variety of situations.
We need more complex research to understand the effects.
With these different stressors, is there experimental work that would be productive to see how different guilds would respond?
What kind of NEPA is it going to take? We need to consider the time element. – Policy roadblocks will stop our research.
Managers want to know how to allocate resources.
What to do about exotics that the public loves? Social science issues.
We might not need research as much as we need management.
Pathogens are largely unknown and unstudied? E.g.: West Nile.
How do you detect pathogens and other small organisms? How do you set up detection systems for these things?
We don't have any idea how to manage or monitor things like West Nile.
Research to identify the communities (micro and macro scale) that are most resistant, resilient, etc. – and why – and under what situations.
We could try to do a type-conversion of a community from one that is less to more resilient.
How did we get to the assumptions that some communities are more important than others?
You need a basic threats assessment for ecosystem transformers.
What are our high-value assemblages and what are they based on (define high value and who decides). What metrics should we use to assign value?
What are the most resistant and resilient ecosystems? Should we focus on them?
What are the interactive effects of the invasive species with other stressors?
[Note from scribe: This group is really focused on exotic plants.]
What is the management threshold? At what point do you accept a novel assemblage?
We need a big literature search of the gray and published literature.
What are the specific research needs of targeted invasives? E.g.: targeted control of Reed Canary Grass. [Species-specific control investigations?]

What makes a system vulnerable? [fire, hikers, and other vectors]
What makes a system resistant? [pesticides]

<u>Top Information Needs (Priorities):</u>

- A synthesis of what we now about invasions in the Sierra (gray and published) is needed. This would be a comprehensive look at the history of invasions, what we know about vulnerabilities, prevention, management, etc. [Like a second SNEP report] *Rationale: We*

need a big-picture perspective to give us an understanding that will take us to the next step in a thoughtful way. It will provide context for management decisions.

- What makes a system resistant/resilient to invasion by species that would cause transformation (e.g., complexity)? What factors make a system more vulnerable to invasion? *Rationale: To prioritize species, sites, and management actions.*
- How do the other stressors (e.g., contaminants, fire, and climate change) interact with species invasions? *Rationale: To understand the relative importance of each stressor and ensure we are covering all bases. It helps prediction and modeling.*
- Identify and define important management thresholds including when to start, stop, expand projects. *Rationale: Resources are limited.*
- Species-specific control investigations for high-priority exotics. *Rationale: Increase management effectiveness.*
- How do we identify invasions on all scales and in all systems (e.g., disease pathogens, snails, range expansions). *Rationale: Reduce the likelihood of being blindsided.*
- Evaluating the ecological response to species additions and deletions, as well as management actions against invasive species. *Rationale: We need to know we are doing good and not harm to the system.*

Breakout Session 2
Priorities Integration and Time Frame
1:10 – 2:40 PM

Group A
Recorder: Barbara Johnston

Integration of the morning session list:	**Rationale for change:**
Creating a bridge – Sierra-wide assessments. Synthesis of information. How relevant is the information to the decision.	
Recreation – effect on the resources—meadows, forests, water quality	
Water need to understand the system better, affects recreation, soil moisture—trees, fire implications. What mgmt actions feed back to the control of water. Integrate water and fire, forest management.	Look at the stressors to see how you can make your water system more resilient.
Studies on questions that relate to land use, things happening on the ground that need to be modified.	How far can we do down the road – how the system works, how does it address management decisions.
How to adjust for climate change – can adjust for recreation	
Fire, forest management, invasive plants, manager can do something about these.	
Air pollution, climate change, mgrs can't control.	
Understand how system works, so you can forecast how the system will respond.	
Short term to address management needs	
Long term sustained resource for how the system functions. Study tree plots, study water systems at the same time.	Using satellite data to set up the study areas.

<u>Information Needs:</u>

Synthesis of information: Creating a bridge – Sierra-wide assessments. How relevant is the information to the decision.
Location: Southern Sierra

Climate change information synthesis is needed.
Smoke management synthesis.
Invasive species
Forest Management
Timeframe: 2 years with annual updates.

Giant sequoia groves hot issue on the Sequoia. Water budget needs to be addressed and understood. What is an acceptable risk? What treatment is needed in the groves? What has fire done in the groves?

Location: All sequoia groves in the Sierra
Timeframe: 1 year
Rationale: already know so much, and the information is need now.

Water budget for the Sequoias

Location: Grant Grove
Location: Redwood Mountain
Timeframe: 2-10 years; Put in infrastructure to gather precipitation data.
Rationale: Redwood Mountain grove water gradient, rain/snow transitions.
Rationale: Grant Grove, competition for water with the visitors.

Science infrastructure of data systems and information made available and continually updated.

Location: Southern Sierra
Timeframe: 2 to 5 years.

Short term management needs vs. long-term management needs. Short term studies locally controlled meet management needs. Long term has to have separate money that doesn't depend on crisis funding.

Location: Southern Sierras
Timeframe: 2 years short term; 5-10 years long term

Allow for the study of common ecosystems between agencies.

Modeling or risk assessments on the stressors.

Location: Southern Sierras
Timeframe: 2-5 years.

What is the affect on the Sierran meadow systems by the stressors?

Group B

Recorder: Linn Gassaway

Resilience (Long Term) species dependents

- What is a possible range of no regrets or low regrets of management actions to increase ecosystem resistance and resilience to a broad range of possible futures.
- Desired effects? Fire Effects – Intensity, seasonality, mosaic, effects to resources (i.e. sensitive species, cultural resources), scale, fire season
- Achieving desired fire effects in small operational windows?
- Disturbance interactions: what are the cumulative effects of fire, air pollution and drought.
- What makes a system resistant/resilience to invasion by species that would cause transformation (e.g., complexity)? What factors make a system more vulnerable to invasion?
- Sequoia Groves – what is an expectable risk? How safe do you have to be from fire coming into groves. What is susceptibility? How does that change based on Grove and past logging or slope etc.?

Comprehensive assessment (short to moderate) 3-5 yrs – 10-20yrs

- Synthesis of information relevant to managing the Southern Sierra in the face of an uncertain future—relevant to rapidly changing climate. Prioritize this synthesis.
- More comprehensive assessment (i.e. One Atmosphere model- UC Davis)
- How do the other stressors (e.g., contaminants, fire, and climate change) interact with species invasions?
- Fire History / regimes – need more diverse information, different vegetation, slope, aspect, etc.

Pollutants/Smoke – (short term to long term)

- Effects of smoke on human communities (social & health effects) (short term vs. long term).
- Smoke emissions budgets - Smoke pulse wildfire vs. long term prescribed fire – smoke climate interaction.
- Determine spatial distribution and pattern of ozone, nitrogen, pm and contaminants.
- Understand ecological effects and relating it to effects to human health from pollutants (short & long term).
- How do the other stressors (e.g., contaminants, fire, and climate change) interact with species invasions?

Ecosystem shifts and Species interaction (Organism Data) – short baseline data – ongoing rest of human history, models may shorten but models need testing.

- Phenology of wildlife – reproduction, migration etc. – shifts overtime
- Need foundational information on soils, chemistry of physical thresholds, etc.
- How the system responds to changing precipitation patterns and how the system and the water budget changes. May affect other resources, infrastructure.
- What are the cumulative affects thresholds triggering undesired conditions in southern sierra meadows, giant sequoias, etc. Consider current uses. What are the beneficial values?

- Forest change measured by long-term monitoring: Create an extensive network from existing datasets.
- Species-specific control investigations for high-priority exotics. How do we identify invasions on all scales and in all systems (e.g., disease pathogens, snails, range expansions).
- Effects of forest dynamics and management actions on water yield and snow hydrology.
- How the system responds to changing precipitation patterns and how the system and the water budget changes. May affect other resources, infrastructure.
- Evaluating the ecological response to species additions and deletions, as well as management actions against invasive species.
- Better predictive models of ecosystem response.

Social science needs – short term and long term
- Strong social science component for forest management.
- Communication, education, and social science needs. With public and between ourselves – building bridges.

Management – on going
- Evaluating the ecological response to species additions and deletions, as well as management actions against invasive species.
- Effects of forest dynamics and management actions on water yield and snow hydrology.
- Need a better understanding of management actions (reforestation) on pools and fluxes of Carbon (particularly underground C) at large scales.
- Resources of interest identification - what is the expectable amount of effects?
- What is a possible range of no regrets or low regrets of management actions to increase ecosystem resistance and resilience to a broad range of possible futures.
- Identify and define important management thresholds including when to start, stop, expand projects.

Water – moderate - long term (short term base line)
- How the system responds to changing precipitation patterns and how the system and the water budget changes. May affect other resources, infrastructure.
- Effects of forest dynamics and management actions on water yield and snow hydrology.

Categories:
Stability and the lack thereof (Resilience, disturbance) (Long Term) species dependents (N=6)
Comprehensive assessment (short to moderate) 3-5 yrs – 10-20yrs (N=4)

Pollutants/Smoke – (short term to long term) (N=5)

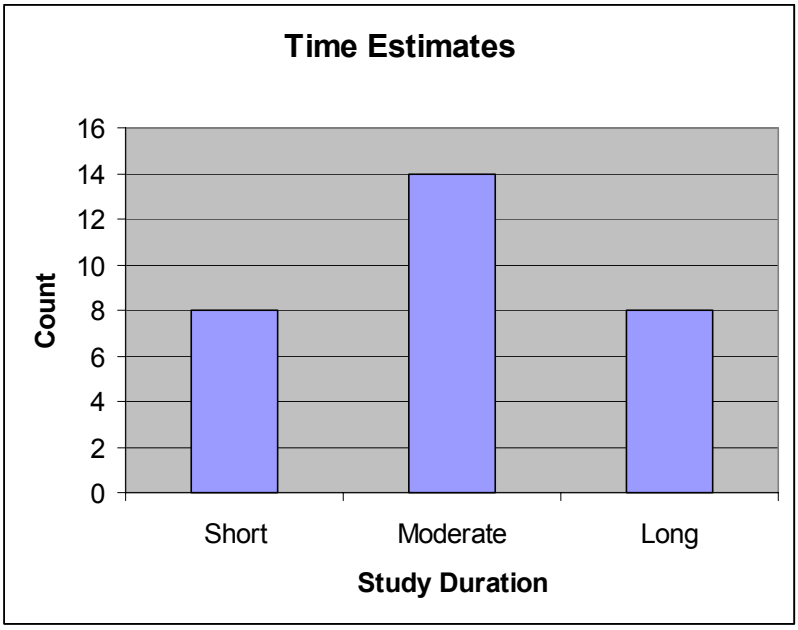
Ecosystem shifts and Species interaction (Organism Data) – short baseline data – ongoing rest of human history, models may shorten but models need testing. (N=10)

Social science needs – short term and long term (N=2)

Management – on going (N=6)
Water – moderate - long term (short term base line) (N=2)

Eliminate (N=2)

TIME:
It's really hard to estimate timeline on a high dynamic system when we don't have a specific question.



Group C

Recorder: Phil van Mantgem

Integration of the morning session list:

Social science – how might values change with expected changes in stressors and expected ecological response?
Smoke – inability to have prescribed fire due to smoke. Carbon emissions.
Resistance and resilience – how to create? Forest thinning experiments? Larger, more genetically diverse wildlife populations. Communities with high richness, high diversity.
Are there hotspots of vulnerability? Prioritization of needs.
Synthesize existing knowledge and information (data sets).
Need to fund and expand on long-term monitoring.
Interacting stressors.

Information Needs:

1) How do we manage for resistant and resilient ecosystems (especially evaluating the ecological response to management actions)? Time frame: >10 yr.
2) Synthesize existing knowledge and information (data sets). Including predictive models. Time frame: 3 yr.
3) How do we design the research/management relationship to allow for continual feedback? Sierra Nevada Adaptive Management Program. Time frame: 5-10 yr.
4) Communication, education, and social science needs.

Group D

Recorder: Marianne Emmendorfer

Integration of the morning session list:
Synthesis of information relevant to managing the Southern Sierra in the face of an uncertain future—relevant to rapidly changing climate. Prioritize this synthesis.

Smoke emissions budgets - Smoke pulse wildfire vs. long term prescribed fire – smoke climate interaction.

Effects of smoke on human communities (social & health effects) (short term vs. long term).

Presence of smoke can be a limiting factor influencing what actions occur which air quality regulations trigger stoppages.

Need for better understanding and communication between public land users and stakeholders, and public land managers. Lead to reduced negative impacts and more positive impacts.

Better understanding of resilience/resistance to changes and ID gaps

Do not reinvent the wheel.

Broad Goal:
Identify beneficial and negative, acceptable/unacceptable, cost effective/not-cost effective risks of management actions to increase ecosystem resistance and resilience to a broad range of possible futures.

- Identify societal/management (mandated) values: Which basic mandated agency directions are not feasible/viable currently? Which basic social values are not feasible/viable currently- Weigh risk of societal backlash/impact from mgt decisions. 1 year

- Synthesis of information relevant to managing the Southern Sierra in the face of an uncertain future-relevant to rapidly changing climate. Prioritize this synthesis. 1 year

- Use various scenario planning to clarify uncertainties (e.g. ID Gaps, tweak physical & process models) and potential outcomes within a scientific framework? *Continual/iterative*

All could be done simultaneously. Location is variable, starting at broad scale southern sierras and/or focusing on specific areas (i.e. societal values at a more local scales/locations).

Group E

Recorder: Rachel Mazur

Begin with a Common Understanding:
Begin with comprehensive analysis of the status of the research and the stressors. This analysis will include a social science component. Include at least two levels of summary – executive, shorter, and full – and a layperson's version. Gaps in knowledge will be identified. As gaps are identified, they will be shared with researchers that may be interested in beginning work.

Give Managers Tools to Manage Change and Crises:
Then, we would develop a set of scenarios for the future. This way, we will be forced to look at ALTERNATE futures and we will be better prepared for future management – including crises – even seemingly implausible. We should then be sure to establish a feedback loop based on ongoing detection of change. Computer models will be useful here – a visual picture could be helpful to open dialog with the public and show the uncertainty to the public. This has to be streamlined and do-able. [Time frame: 5 years]

Research Considerations:

- Determine Appropriate Parties for Tasks:
    - Scientists that must publish could focus on research
    - Scientists that do management could focus on experimental management
- The scientist and the manager are two people. There is a missing person here – that is the synthesizers – a group with different backgrounds. [Synthesis, change detection, research, public policy, outreach, management]. We are in-effect creating a new field.
- Other parties include the public, non-profits, etc – we should cooperate with them to come up with novel approaches.
- Consider ways to coordinate research such as co-locating study sites.
- Include effects on humans to make issues relevant.

Involve the Public and Never Forget Education:

- Get Sierra Nevada Research Learning Center going to be the communication node that works with the public. This center would reach out to schools. Fresno State Institute of Climate Change, Oceans, and Atmosphere (ICCOA). [Time Frame: 5 years]
- Risk communication with the public.
- We need to understand what motivates people to take action and how to modify behavior. An example of successful campaign is smoking – in many places smoking is no longer socially acceptable.
- We need an ad campaign that reaches out to people – Florida has had an effective campaign that has led to a lot of public acceptance.
- The importance of education and social science cannot be understated.
- We need to make connections. For example, people could be shown the commonalities between pesticide effects on humans and the natural system.
- NIMBY is prevalent.
- Urban residents are uneducated about the natural world.

- People are getting more used to the idea that quick decisions might be needed – and they may be willing to accept some error – but they want alternatives.

Plenary Discussion

When the sub-groups re-assembled, each group presented their work and offered some comments and suggestions, as follow.

Group A (John Exline, presenter)
We struggled with how to integrate the list from the morning session. We did not come up with anything very conclusive. We thought that internal vs. external might be one way, i.e., where stresses are coming from.
Synthesizing data is the shorter-term issue—what is pressing today (1-2 years).
Long-term data sets: impacts of stressors in 10-25 years.
One issue to tackle first was Giant Sequoia and fire: what is an acceptable risk? This is an immediate question to pursue.
Another issue was water. There are a lot of opportunities to look at this, specifically how climate change will affect water supply.
We thought we might change "Forest Management" to "Land Use Management" to be a more inclusive term, to cover recreation, etc.

Group B (Rob Klinger, presenter)
We categorized the morning session's list. (See "Categories" section of the group notes)

The timeline may be premature to think about, but we think the intervals are something like this:
Short: 1-5 years
Med: 5-25 years
Long: 25+ years

Group C (Danny Boiano, presenter)
(Reviewed group notes.)
We wanted to emphasize the value of long-term data sets both for monitoring and also for research. We recommend more than the usual three to five years—more like 25 years.

Group D (Carolyn Hunsaker, presenter)
(Reviewed group notes.)
We stressed the importance of the social science approach to natural resource management, and the need for training.

Group E (Nate Stephenson, presenter)
1) A new kind of person needs to be hired to address the flood of information coming. There is a schism between science and management; we need synthesizers to bridge this. They should be high functioning people with a strong background. Each agency should hire one.
2) The first project should be a state of knowledge synthesis, like SNEP but more targeted, 100 pages only, with summaries and information gaps and social science, which usually tends to fall off the plate. It should be a living document.

3) We should create a set of scenarios (plausible, diverse, etc.) for the future. (Google Resilience Alliance) The synthesizers would work with managers and scientists on scenarios.
4) Detection and attribution of change (aka: monitoring). In parallel with this is the Research Learning Center working on "risk communication" to the public.

Closing

The time frame for next steps in this process was reviewed, as follows:

Science Symposium Report
Review Draft: Nov 1 – 15, 2008
Report Final: Dec 1, 2008

Science Agenda
Review Draft: Feb 1 – 21, 2009
First Iteration Science Agenda Final: Mar 15, 2009

Pete Stine explained that a small sub-set of people including scientists and managers is needed to develop the Science Agenda over the next few months. The intent is to have a document to work with soon so as to advantage funding opportunities.

Tina Terrell, Craig Axtell, Peter Stine and Nate Stephenson expressed their sincere appreciation to all of the Round Table participants and indicated that the work accomplished would provide a valuable foundation for the development of the science agenda.

Adjourn 3:30 p.m.

Appendix

AGENDA

Southern Sierra Science Symposium
Friday, September 5th, 2008
Visalia Convention Center

Meeting Objective: To garner the input and ideas of a diverse group of managers and researchers on the critical information needs for managing Southern Sierra ecosystems in a rapidly changing world. This input will be used in developing a Science Agenda for the Southern Sierra.

8:00 – 8:15 a.m.	**Welcome**	Tina Terrell, USFS & Craig Axtell, NPS
8:15 – 8:20 a.m.	**Opening Remarks**	Peter Stine PSW
8:20 – 8:40 a.m.	**Agenda Review & Introductions**	Rebecca Reynolds, Facilitator, RRC
8:40 – 8:55 a.m.	**Breakout Work Set-Up**	Rebecca Reynolds
8:55 – 9:00 a.m.	**Assemble in Groups**	All
9:00 – 10:30 a.m.	**Breakout Session 1: Top 3-5 Major Information Needs**	Small Groups (5)
10:30 – 10:45 a.m.	**Break**	
10:45 – 11:30 a.m.	**Group Synthesis: Breakout 1**	Facilitated
11:30 – 1:00 p.m.	**Lunch**	
1:00 – 1:10 p.m.	**Breakout Work Set-Up**	Rebecca Reynolds
1:10 – 2:40 p.m.	**Breakout 2: Priorities Integration and Time Frame**	Small Groups (5)
2:40 – 2:55 p.m.	**Break**	
2:55 – 3:40 p.m.	**Group Synthesis: Breakout 2**	Facilitated
3:40 – 4:00 p.m.	**Next Steps**	Facilitated
4:00 p.m.	**Adjourn**	Tina Terrell, USFS & Craig Axtell, NPS

SOUTHERN SIERRA SCIENCE SYMPOSIUM
FRIDAY, SEPTEMBER 5TH, 2008

BREAKOUT GROUP HANDOUT

INSTRUCTIONS APPLICABLE TO ALL BREAKOUT GROUP SESSIONS:

1. Breakout groups have been pre-assigned with the intention of providing a broad range of perspectives in each group. Groups are small (eight to ten people) to facilitate meaningful discussion among all participants. The lists for the breakout session groups as well as their meeting locations will be announced prior to each breakout session.

2. Each group has one individual pre-assigned to record the session's findings and aid the group in staying on course with the session timeline and objectives. This person is not the group facilitator, but rather the group scribe and time steward. The group will self-facilitate as the group chooses.

3. To allow more time for full group synthesis of the breakout group products, the results of each session will be compiled and presented as the basis of the synthesis discussion following each breakout session. At the end of each session, the group recorders will bring the group's product on a flash drive to Rebecca Reynolds for inclusion in the full group synthesis process.

4. Please review the instructions specific to the session you are in (below). Specific questions have been outlined to assist in focusing the group's efforts. In addition, time allotments for each have been suggested to aid the groups in accomplishing their objectives.

5. Each breakout session is followed by a 15 minute break. Break time will be used to synthesize group results to inform the plenary session following the breakouts. *Recorders please return results on flash drive prior to taking your break.*

6. Rebecca Reynolds will be circulating to address any questions during the breakout session. She will also provide time interval notice, particularly for the last 15 minutes of each session.

BREAKOUT SESSION 1
TOP 3-5 MAJOR INFORMATION NEEDS
9:00 – 10:30 AM

Breakout Group Instructions:

During this session, groups will begin with a discussion of recent changes in scientific knowledge or societal values that are likely to alter managers' information needs. For example, the climate change breakout group might note that in the past, most efforts to meet managers' information needs were based on the assumption that future climate would resemble past climate – an assumption that must now be dropped. This is meant to be a quick brainstorm to help open the group's thinking and allow for new ideas and views. (Recorders please capture all of the changes in knowledge, societal values, or assumptions identified by the group.)

After the above brainstorm and discussion, please then start a brainstorm on information needs related to your stressor area. Group members do not have to agree on which information needs are most important here, rather, identify what ones are on people's minds. Note: in developing this list, you may discover information needs that you consider very important that fall outside your stressor area. Please note these as well. (Recorders please capture the information needs, and note if one or more is not specific to the stressor area.)

After you have developed the above list to the group's satisfaction, please review the list and together decide on the top 3-5 strategic information needs. Please give a brief rationale for why your group considered each one a priority. (Recorders please note the top 3-5 and the rationale.)

<u>The set of discussion points to engage during this session are:</u>

1) What are the recent changes in scientific knowledge or societal values that are likely to alter managers' information needs?
2) What are the top 3-5 strategic information needs in this stressor area or beyond?

Recorder will bring your results back to Rebecca on flash drive for inclusion in the full group synthesis.

Suggested Time Allotment

9:00 – 9:10 a.m.	Get oriented; make introductions as needed (10 min)
9:10 – 9:30 a.m.	Number 1 (20 min)
9:30 – 10:15 a.m.	Number 2 (45 min)
10:15 – 10:30 a.m.	Review and finalize recorder's results (15 min)

BREAKOUT SESSION 2
PRIORITIES INTEGRATION AND TIME FRAME
1:10 – 2:40 PM

Breakout Group Instructions:

From the results of the morning session (see handout), please consider how the identified information needs integrate (i.e., integrate for efficiency, for a more thorough understanding), and how they could be pursued collectively. In this discussion, refine, add to and re-structure the list as appropriate. Note any changes and rationale for the changes.

After this discussion, estimate the number of years required to achieve meaningful results for each information need on the list, giving a brief explanation for why the time frame noted is needed. If a particular location stands out in your discussion as appropriate, record it and a brief explanation. Feel free to note any other important issues or details that arise in your discussions.

The set of discussion points to engage during this session are:

1) From the morning's information needs priorities, decide how to revise them toward a more integrated science strategy.
2) For each of the information needs selected, consider its time frame and location. Note briefly the group's rationale for the time frame and location, and any other issues that are important.

Recorder will bring your results back to Rebecca on flash drive for inclusion in the full group synthesis.

Suggested Time Allotment

1:10 – 1:15 p.m.	Get oriented; make introductions as needed (5 min)
1:15 – 1:40 p.m.	Number 1 (25 min)
1:40 – 2:25 p.m.	Number 2 (45 min)
2:25 – 2:40 p.m.	Review and finalize recorder's results (15 min)

Breakout Composition

Session 1: Top Information Needs

Group A: Climate Change

Roger Bales
Colleen Bathe
John Exline
Jim Whitfield
Connie Millar
Nate Stephenson
George Powell
Charisse Sydoriak
Carol Hunsaker
Barbara Johnston, recorder

Group B: Fire

Jan van Wagtendonk
John Austin
Rick Larson
Tony Caprio
Scott Stephens
Peter Stine
Craig Thompson
Scott Williams
Robert Sanders
Linn Gassaway, recorder

Group C: Forest Management

Dave Graber
Kathryn Purcell
Steve Hanna
John Battles
Linda Mutch
Malcolm North
Tom Warner
Klaus Barber
Dave Parsons
Tom Munton
Phil van Mantgem, recorder

Group D: Pollutants

Nancy Ruthenbeck
Ricardo Cisneros
Annie Esperanza
Teresa Sue
Pat Lineback
Don Hunsaker
Trent Procter
Brent Skaggs
Joe Reyes
Marianne Emmendorfer, recorder

Group E: Invasives

Matt Brooks
Kathleen Matthews
Jeff Cordes
Rob Klinger
Harold Werner
Danny Boiano
Priscilla Summers
Sylvia Haultain
Rachel Mazur, recorder

Breakout Composition

Session 2: Priorities Integration and Time Frame

Group A

Matt Brooks
Kathleen Matthews
Roger Bales
Colleen Bathe
John Exline
John Austin
Harold Werner
Jeff Cordes
Barbara Johnston, recorder

Group B
Rob Klinger
Rick Larson
Linda Mutch
Nancy Ruthenbeck
Tony Caprio
Brent Skaggs
Steve Hanna
Linn Gassaway, recorder

Group C

Peter Stine
Dave Graber
Kathryn Purcell
George Powell
Danny Boiano
Tom Warner
Terry Johnson
Phil vanMantgem, recorder

Group D

Craig Thompson
Carol Hunsaker
Dave Parsons
Charisse Sydoriak
Annie Esperanza
Teresa Sue
Priscilla Summers
Pat Lineback
Marianne Emmendorfer, recorder

Group E

Ricardo Cisneros
Don Hunsaker
Nate Stephenson
Scott Williams
Klaus Barber
Sylvia Haultain
Trent Procter
Joe Reyes
Rachel Mazur, recorder