NPLCC Charter Steering Committee Meeting and Decision Analysis Framing Workshop

October 4-6, 2011

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Introduction

The NPLCC Charter Steering Committee held a two and half day workshop in Portland, Oregon from October 4th through October 6th to begin to define the framework used to make decisions for the NPLCC, and begin identifying the information and applied science most needed to support decisions important to natural, cultural, and water resource managers and to other stakeholders. This framework will provide a basis for logically evaluating and prioritizing the information needs for the NPLCC partnership, and for developing a broader strategy for implementation of the LCC's support, funding and coordination roles.

Throughout the workshop, we distinguished between two types of decisions:

- Decisions *supported* by the NPLCC. These are the on-the-ground natural, cultural, and water resource management decisions that are made by, and are of interest to, a wide range of agencies, entities, and individuals throughout the region. Examples might include a decision of an NGO to purchase and restore the habitat on a particular piece of property, or the design and implementation of a species recovery plan by the US FWS. These are not decisions that the NPLCC makes, but understanding these decisions will help the NPLCC provide useful support to its many partners.

- Decisions *made* by the NPLCC. These are decisions made in order to fulfill the NPLCC's decision support mission - the promotion, development, coordination and dissemination of science and information useful for landscape level conservation and sustainable resource management in the face of changing climate and related stressors. These decisions must be solidly based on the understanding of the end-user decisions that the LCC supports. Examples include decisions about direct funding of science or other activities, decisions about information sharing and communication, and decisions about the organizational and operational practices of the LCC and its committees.

1 NPLCC Planning Process

Figure 1 shows a framework and process for the NPLCC to evaluate various strategic and organizational decisions about how it will fulfill its core mission, including development of a science plan. Effectively fulfilling its mission of providing decision-support for natural, cultural, and water resource managers begins with a clear understanding of the needs of those end-users (the top half of the diagram). With that foundation, the NPLCC can begin to consider how to prioritize information needs, how to build a portfolio of activities for addressing those needs, and how to effectively organize and operate the LCC (the bottom half of the diagram). This workshop focused primarily on developing an understanding of end users, but also included some discussion and illustration of the remaining steps. We will discuss possible actions needed to complete the remaining steps and develop a science plan in a later section of this document.

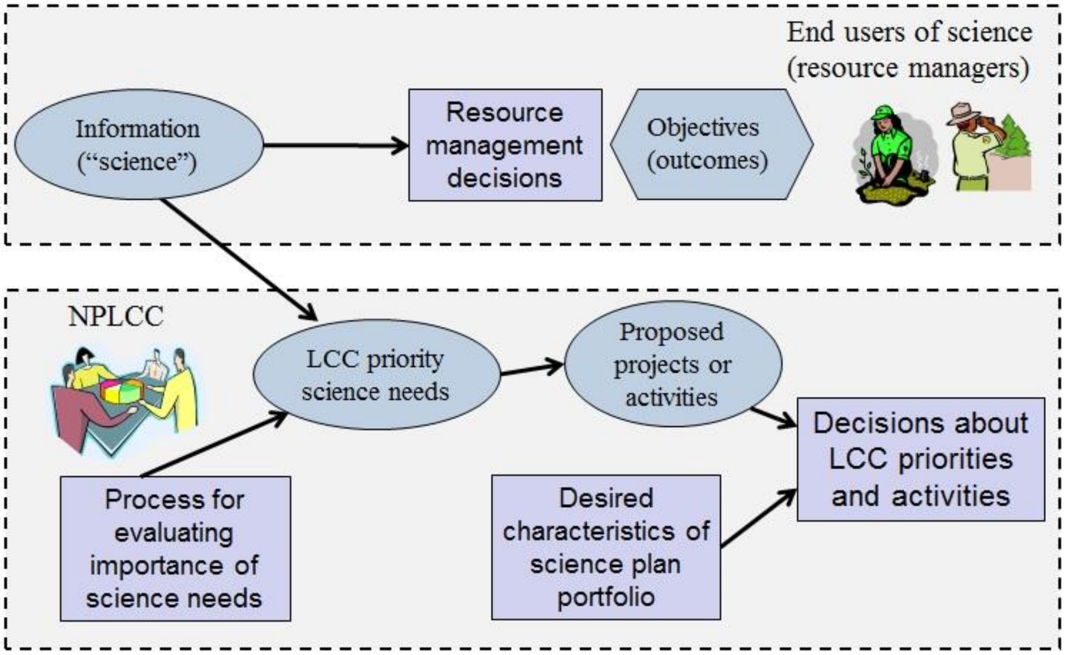

End users of science
(resource managers)
Information ("science")
Resource management decisions
Objectives (outcomes)
NPLCC
LCC priority science needs
Proposed projects or activities
Decisions about LCC priorities and activities
Process for evaluating importance of science needs
Desired characteristics of science plan portfolio

Figure 1: Overview of NPLCC planning process

1.1 Decision Analysis Framing

The structure of workshop framing discussions was designed around the principles of Decision Analysis (DA), which decomposes decision problems into three related but separable components:

- Decisions and alternatives are actions that the relevant decision makers can take. In the current context, these are conservation delivery-type decisions made by the NPLCC partners and other end-users of NPLCC-supported information.
- Objectives are the outcomes that are of interest for the decisions being considered, and are generally thing that the decision-makers would like to achieve (or avoid).
- Uncertainties are factors and processes that are outside the control of the decision-makers but which affect the objectives or outcomes of interest. Future climate conditions are an obvious example of an uncertainty that can affect conservation outcomes in the NPLCC (and elsewhere).

Using these three components to structure conservation-delivery decisions provides a useful platform for providing decision support – an important mission of the NPLCC. In the DA framing process we first focus on understanding who the relevant decision-makers are, what types of decisions they make, and what their objectives are in making those decisions. This focus on management decisions helps to narrow the vast list of uncertainties about climate and other stressors and their impacts on ecological functions in the NPLCC region to a more manageable list of uncertainties that are directly relevant to resource management decisions. Ultimately, these decision-relevant uncertainties point to a set of information needed by resource managers, and potential areas of focus for the NPLCC information development and delivery.

2 Framing of decisions the NPLCC aims to support

The first day and a half of the workshop focused on developing a clear understanding of the types of decisions that natural, cultural, and water resource managers are and will be making in the NPLCC region, and the outcomes that are of interest to those decision-makers and other stakeholders. We also illustrated several approaches for identifying information that could be useful to those decision-makers and stakeholders. This emphasis was consistent with the steps in a DA framing process, which include identifying and describing:

- Relevant decision-makers and stakeholders
- The range of decisions each group might make, and assumptions bounding those decisions
- Key objectives (outcomes of interest) for various decision-makers and stakeholders
- Potential metrics for measuring performance against those objectives
- Critical information (science) needed to evaluate how decisions will affect objectives

The fourth step, identifying potential metrics that can be used to measure or estimate performance of alternatives in terms of the objectives of the decision-makers was too detailed for this workshop.

2.1 Decision-makers, stakeholders, and types of decisions the NPLCC aims to support

Decision-makers are defined as those who make decisions that affect natural, cultural and water resource management in the North Pacific region, and stakeholders were defined as those who are affected by and can have an influence on those decisions. This division is not perfectly clean – the same entity can be a decision-maker for some decisions and a stakeholder for others. Workshop participants first brainstormed a list of decision makers and examples of the types of decisions they make, and this list is shown in Table 1. After the initial list, participants expanded the list of relevant decision-makers and stakeholders, as shown below. This list is intended to be illustrative rather than comprehensive, and was used to identify a set of agencies and entities who might be interested in NPLCC science and information, and whose interests and needs are relevant to NPLCC priorities.

Decision-makers and Stakeholders

The list below summarizes the types of entities who have natural, cultural, and water resource management responsibilities and interests in the NPLCC region, representing the entities whose information needs the NPLCC may support.

- US Congress
- Federal agencies (e.g., FWS, USFS, NPS, EPA, BLM, USACE, etc.)
- State Departments or agencies (e.g., Fish & Game, Fish & Wildlife, etc.)
- State land managers
- Provincial agencies
- Municipalities
- Tribes and First Nations
- Assorted Boards and Commissions (e.g., Pacific Salmon Council)
- Partnerships and Consortia (e.g., Pacific Coast Joint Venture)
- NGOs, especially conservation organizations (e.g., The Nature Conservancy, Ducks Unlimited, etc.)
- Utilities (quasi-governmental organizations)
- Private companies / industry (e.g. mills, energy companies)
- Private landowners (e.g., farmers)
- Resource end-users (e.g., hunters, basket weavers, etc.)
- Public / individuals / heads of households
- Court system
- Watershed councils
- Land trusts

- Public health agencies
- Inter-governmental organizations
- Insurance sector
- Investment sector
- Universities and research organizations
- Tourism / recreation groups
- Security sector (e.g., food security, national security, emergency management)

Request for review and input: Please review the list for completeness, and provide additional detail to NPLCC staff (Coordinator, Science Coordinator) as appropriate. It would be particularly useful to identify specific organizations actively working in the region, including not only entities involved directly in conservation delivery, but also those engaged in information development, coordination and support of natural, cultural, and water resource management.

Decision Types

Workshop participants also expanded on the list of example decisions; the list was large and many of the decisions were of similar type and many were shared among multiple decision-makers. The group discussed how best to organize the list into common high-level decision types. There are multiple ways to define these broad decision types; the grouping in Table 1 shows one such organization.

Table 1 also contains some of the types decisions that fall within each group and examples of relevant decision makers responsible for those decisions. The table is not meant to be complete either in terms of capturing all of the detailed decisions or the relevant decision-makers for each; rather it illustrates the variety of decisions and the commonality of types across multiple agencies and organizations. Decisions shared by many organizations become relevant when discussing common information needs.

Table 1. Types and examples of decisions related to natural, cultural, and water resource management in the NPLCC region, examples of (some of) the relevant decision-makers and stakeholders for each

Decision types, example decisions	Examples of relevant decision-makers
Decisions about conservation models employed	Many
Mitigation and restoration decisions (where, how, when) - Restoration of ecological function of shorelines - Prioritizing areas for conservation and mitigation - Restoration contract specifications	Federal, state, and provincial agencies (e.g., Restoration coordinators, Environmental assessment decision-makers, permitting entities), Aboriginal decision-makers, Tribal Councils

Decision types, example decisions	**Examples of relevant decision-makers**
Identification and prioritization of areas/species for conservation - Identifying high priority areas for conservation - Prioritizing species and habitats for conservation and management - Decisions to defend, mitigate, move, abandon a place;	Federal, state, and provincial agencies (e.g., BLM managers, Provincial Cabinet Subcommittee, State Fish and Game planners), Joint Ventures, NGOs
Decisions about mitigating and compensating for land/habitat/species loss in specific geographic areas	Federal, state, and provincial agencies (e.g., policy level decision-makers)
Land use decisions / decisions about allowable activities - Land use designation (areas of critical environmental concern) - Location & establishment of parks, conservancies, other areas for protection - Constraints on planned uses or activities - Zoning, etc. – affecting where and how growth happens - Permitting of various activities on the landscape - Wetland easement terms (and terms of any easement?)	Numerous, including: Federal, state, and provincial agencies (e.g., Environmental assessment decision-makers, Provincial Cabinet Subcommittee, State Fish and Game planners), Aboriginal decision-makers, Tribal Councils, Joint Ventures, NGOs
Land management decisions / decisions about managing allowable activities - Forest land management plans - Development, transportation, land planning - Infrastructure development and maintenance (roads, pipelines, transmission lines, etc.) - Invasive species prevention, management, and designation - Fire management strategies - Drought management strategies - Agricultural practices - Aquaculture practices - Energy (renewable energy) development	Land owners and land managers at all levels, including private land owners
Water allocation, use and management - Hydropower & reservoir management - Irrigation methods	Water managers (at all levels)
Species management decisions - Harvest levels - Management of an isolated species - Maintenance and restoration of fish passages - Translocations - Disease control (plants, wildlife, livestock)	Wildlife and Fisheries managers, Park superintendents, Refuge managers, regulatory agencies (at all levels)
Decisions about cultural and historic resources - Preservation of cultural and historic resources (where, how, when) - Relocation of tribes and tribal (trust) lands and cultural and heritage sites (including migration of trust species) - Decisions about mitigating and compensating for losses	Federal, state, and provincial agencies, Tribes (e.g., Historic preservation officers)

Decision types, example decisions	**Examples of relevant decision-makers**
Where and how to monitor for environmental changes	Many
Decisions about education/outreach (where, when, and how) - How to communicate information about stressors and changes (how to tell the story)	Everyone
Private investment and development decisions - Capital investments - Locations of facilities - Provision of insurance	Various private industries (e.g., wood products mill owner, cannery, utilities, renewable energy developers)
Decisions about how to use natural resources - Participation in sporting & recreational activities - Collection of materials necessary for individual use (e.g. where to collect basket making materials)	Individuals
Decisions about standing, tribal sovereignty	Tribes, federal agencies
Regulations & legislation - Industry regulations and oversight - Decisions about quality standards - Establishing enforceable targets for water pollution reductions - Design of incentives, market based trading schemes, protocols and procedures for ecosystem services / emerging markets - Decisions about government structure, how you govern, staffing, etc.	Congress , federal agencies (e.g., EPA –Office of Water), regulators at all levels
Decisions about control of and response to infectious (human) diseases	Federal, state, and provincial agencies (e.g., CDC), municipalities (e.g., local health entities)
Decisions about climate change prevention	Many
Allocation of agency or entity resources (funding, personnel) among various research efforts and conservation efforts.	Federal, state, and provincial agencies, municipalities and local communities, Tribes, NGOs, etc.
Decisions about information and knowledge governance - Monitoring and data collection decisions - Consistent data sets	Many agencies Note: the NPLCC itself may choose to take on a role and be a decision-maker for some of these decisions

Request for review and input: Please review the table and provide feedback, if necessary, on the major decision types. We are more interested in ensuring that all of the major decision types are captured, than in developing an exhaustive list of every individual decision made by NPLCC partners and stakeholders. Provide additional detail to NPLCC staff, as appropriate.

2.2 Outcomes of interest to end-users

Objectives represent outcomes that are of interest to decision-makers, typically things they are trying to achieve or avoid when they make any of the specific decisions listed above. Objectives can be defined at many different levels, and it is helpful (and can be challenging) to organize objectives into a hierarchy, where fundamental or top-level objectives represent the ultimate goals of the decision maker: outcomes that they care about because they are of value in and of themselves. Sub-objectives or lower level objectives are typically outcomes that are of interest because they are believed to be a means for achieving the fundamental objective, because they provide further definition of an abstract objective, because they are reasonable proxies for the larger objective and/or because they are easier to measure, quantify, and estimate than the top level objectives.

The list below shows the preliminary set of outcomes of interest or objectives of conservation-management decisions identified by the workshop participants. This list is organized by higher-level objectives, with some potential sub-objectives listed under each major category of outcome. This list also does not consider (yet) the inevitable trade-offs that must be made between these objectives, and no priority is implied by the list order. It is important to note again that these are not the objectives of the LCC itself, but rather the objectives of the end-users that the LCC aims to support.

Maximize habitat quality and species population health

- Quantity and quality of habitat for species of management interest, including but not limited to:
    - Habitat permanently conserved for birds during all life cycles
    - Oceans
    - Old growth forests
    - Designated wetlands
    - Habitat for rare and endemic species
- Quality of near-shore function/habitat/resilience to sea level rise
- Risk of harm to species, species extinctions
- Health of federal species at risk and allow to thrive without intervention
- Number of depleted fish populations, Productivity of fisheries
- Species biodiversity (in situ)

Maximize ecosystem function and services

- Health of ecosystems
- Ecological function and sustainability of working lands (farms, forests, etc.)
- Accounting systems' ability to capture value of ecosystem function
- Forest ecosystem ability to adapt to climate change
    - Ecosystem function
    - Water availability
    - Susceptibility to fire

    - Quantity of renewable resources
- Carbon sequestration capacity of ecosystems

Maximize cultural resources

- Abundance, access and quality of cultural resources
- Continue and restore tribal life ways including cultural and subsistence resources
- Use of traditional cultural practices

Maximize ability of tribes to exercise treaty rights

- No diminishment of treaty hunting or fishing rights

Maximize economic benefits

- Economic opportunities, now and in future
- Jobs, career opportunities, technology development
- Economic security of native villages and rural communities associated with National Forest land
- Economic stability
- Loss of infrastructure investments due to sea level rise

Maximize education

- Education of landowners, public
    - Public engagement in park-based education related to climate change
- Number of elementary and secondary courses promoting wise use of resources
- Awareness by public and elected officials of scope and magnitude of current and probable future climate change impacts
    - Create public expectation of accurate up-to-date information on climate change and that large scale landscape conservation is in the public interest (including individual and collective financial interests)

Maximize water quality and availability

- Resource (water) efficiency of agriculture
- Sustainability of groundwater use
- Flow of ecological water and in the right places
- Use of pesticides
- Flow of contaminants into surface water and groundwater

Minimize GHG emissions and CO2 concentration in atmosphere

Maximize security and human health

- Frequency and severity of diseases
- Food production

- Ability to respond to natural disasters
- Coordination with international security agencies

Note: The following three categories of objectives represent outcomes that may be relevant not only for the natural, cultural, and water resource managers but also for the NPLCC itself.

Maximize quality of decision making

- Efficiency of decision making
- Identification of policy and legislative impediments to good decision making
- Scientific and management efficacy of an all-lands approach
- Quality of cross-jurisdictional decision making, including land-sea
- Cross-stakeholder data sharing
- Buy-in to long-term monitoring
- Use of best climate change information in decision making

Maximize diversity of groups involved with coordinated climate change decision making

Maximize global recognition of excellence in sustainable resource management and economic development

Request for review and input: Please review the list of outcomes of interest for completeness, in particular that all of the major categories are captured. Provide additional detail to NPLCC staff, as appropriate.

2.3 Identifying information needed to support decisions

In the DA framing, “information needs” are defined as information that could reduce key uncertainties. Key uncertainties are those issues where limited knowledge prevents decision-makers from making a sufficiently accurate prediction of conservation outcomes to enable them to make an informed decision or choice. Specifically, “information needs” should identify uncertainties where the current level of knowledge leaves considerable doubt as to preferred conservation and sustainable management actions.

An important goal of the NPLCC is to support activities that produce or enable access to information that is directly relevant to decision-maker / end-user needs. This requires consideration of how information is used to influence or inform a very wide range of decisions made by a variety of different end-users. Ideally, one could build conceptual decision models of all of the major types of decisions outlined previously to ensure that all of those links are made and understood (and this may be a worthwhile exercise for the LCC over the longer-term).

Given the limited time during the workshop, the participants saw and tested several different approaches for identifying potential decision-relevant information needs. There was no intent to be comprehensive, but simply to illustrate several processes that could be used to identify information needs. Three approaches were demonstrated and are described below:

- using conceptual models of biogeophysical changes to identify common issues,
- developing decision-focused conceptual models to identify information needed to predict outcomes of conservation and management decisions, and
- simple brainstorming and listing of perceived information needs.

Each of these approaches comes at the task from a different perspective and thus each has its own strengths. Using the multiple methods in combination is best, helping to ensure that the information needs list is comprehensive, and that each of the information needs is linked to relevant management decisions and outcomes that are of interest to decision-makers.

1) Conceptual models of biogeophysical changes

The USGS developed conceptual models for five areas of similar ecological setting for use in discussing landscape scale stressors and information needs across the LCC. The five areas are shown in Figure 2:

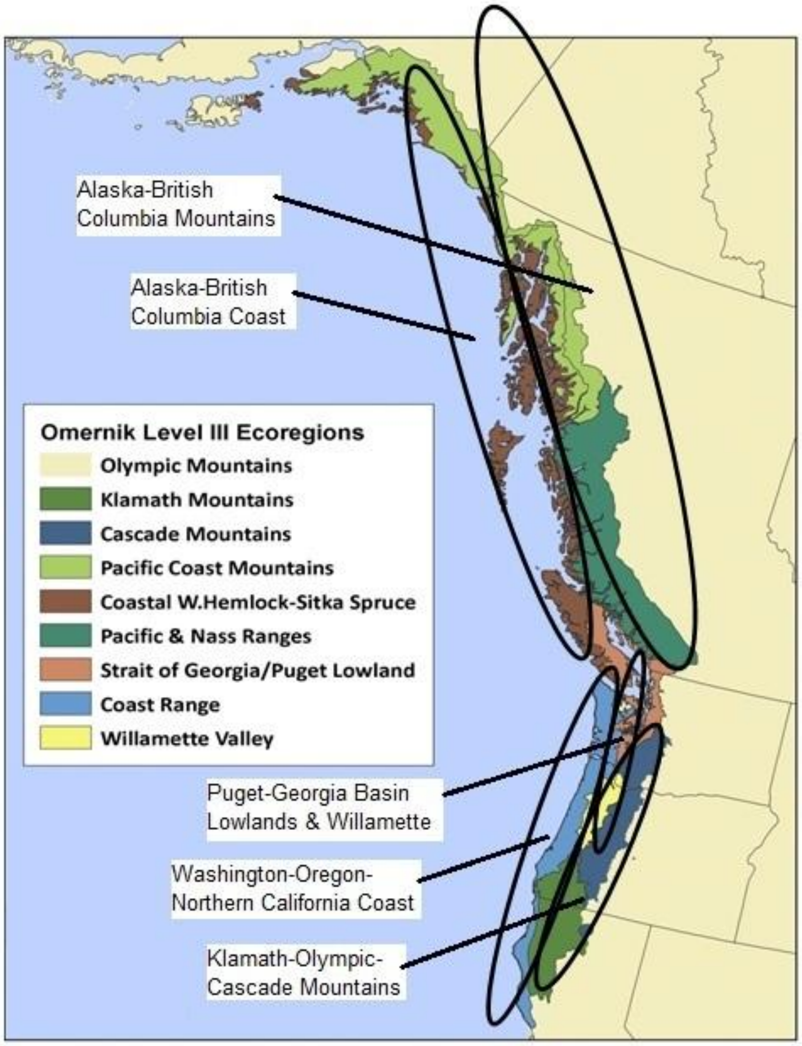

Alaska-British Columbia Mountains
Alaska-British Columbia Coast
Omernik Level III Ecoregions
Olympic Mountains
Klamath Mountains
Cascade Mountains
Pacific Coast Mountains
Coastal W.Hemlock-Sitka Spruce
Pacific & Nass Ranges
Strait of Georgia/Puget Lowland
Coast Range
Willamette Valley
Puget-Georgia Basin Lowlands & Willamette
Washington-Oregon-Northern California Coast
Klamath-Olympic-Cascade Mountains

Figure 2: Conceptual model areas

In each of these areas, expertise within the USGS and published literature were used to develop lists of 1) valued human, ecological and cultural resources, 2) existing stressors, and 3) current and potential climate change impacts. These models were reviewed and expanded upon by members of the ad hoc Science Advisory Team. These conceptual models were presented and discussed at the workshop, with an emphasis on the draft list of common themes, issues that are common across all of the NPLCC. The list of common themes is shown in Appendix 2.

The use of biogeophysical conceptual models is especially good for visualizing physical processes and stressors to the landscape, though the links to management decisions and outcomes of interest are often not as well articulated.

2) Decision-focused conceptual models / influence diagrams

Building influence diagrams is a useful way to identify and highlight the information needed to make forecasts about outcomes of interest for specific decisions. The influence diagram / conceptual model illustrated below was created quickly during the workshop. To illustrate the approach, the group began by focusing on a timber harvest decision with the primary outcome of interest being economic benefits. The participants identified what information would be needed to predict how timber harvest decisions could affect local and regional economic benefits, and discussed how those factors relate to each other.

The brainstorming results in rapid identification of information needs, and often a complex web of relationships between the decision components. Uncertainties shown in the following diagram (the light blue ovals and dark blue rectangles) represent potential information needs for people making timber harvest decisions. For example, the diagram indicates that information about how climate affects the type and prevalence of (forest-affecting) diseases will help inform judgments or estimates of forest productivity, both directly and as it relates to fire risks, and that timber productivity directly affects the profits of the timber harvest, which is a direct and indirect economic benefit.

This exercise did not result in a complete model, but was meant to show some of the links between decisions, outcomes of interest, and the information that would be necessary to predict the outcomes of decision options.

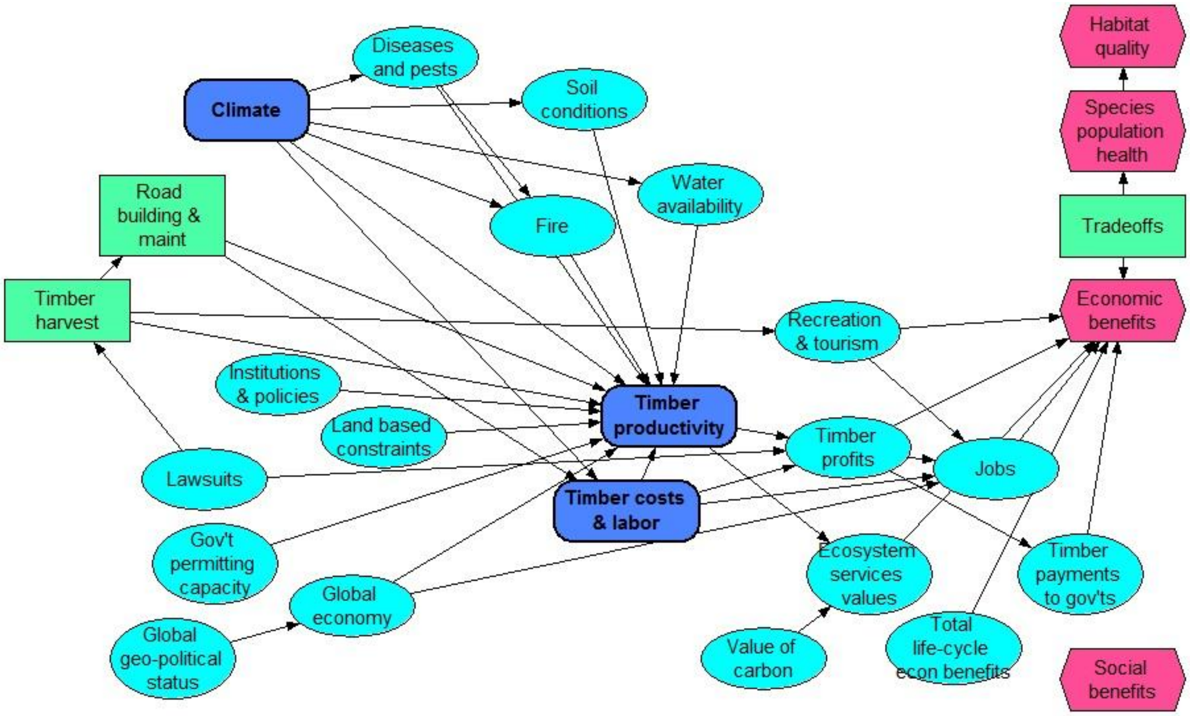

Habitat quality
Diseases and pests
Soil conditions
Climate
Species population health
Water availability
Road building & maint
Fire
Tradeoffs
Timber harvest
Recreation & tourism
Economic benefits
Institutions & policies
Timber productivity
Land based constraints
Timber profits
Jobs
Lawsuits
Timber costs & labor
Gov't permitting capacity
Ecosystem services values
Timber payments to gov'ts
Global economy
Global geo-political status
Value of carbon
Total life-cycle econ benefits
Social benefits

Figure 3: Influence diagram of Timber Harvest decision

The use of influence diagrams is especially good for ensuring that the links to management decisions and outcomes of interest are fully considered, and ensuring that information needs identified are decision-relevant, and not simply factors of interest to the research community. However, constructing detailed models of this type for the full range of potential management decision types would be time consuming. The benefit of such an exercise is to illustrate how these links work so that the connection to management decisions and outcomes is considered by participants when using any of the approaches to identifying information needs.

3) Brainstormed list of potential information needs

Another approach often used to identify information needs is to simply build a list through discussion with the various decision-making entities, asking them for their information needs.

Whereas the influence diagram approach begins with decisions and outcomes of interest, and then seeks to identify information needed to link decision to outcomes, this approach begins first with listing of information needs followed by consideration of relevant decisions and outcomes of interest. This approach takes advantage of how scientists often think about information-related problems. The weakness in this approach in general is that it may lead to a list of information of interest to scientists but not relevant to management decisions; in this exercise workshop participants made that connection explicitly. However, this less structured approach to may not provide a comprehensive list of information needed to inform any given decision. When done in combination with influence diagram and conceptual model development, one can better ensure that all linkages are considered and it helps provide another perspective from which to develop a more complete list of information needs.

After the development of the influence diagram above, workshop participants developed a list of potential information needs, with the decision and outcome links identified, as summarized in Table 2. Again, this list was developed as a starting point and to illustrate another approach for identifying information needs; it is not intended to be comprehensive.

The list below is sorted by relevant decision. Even though the list is not yet complete, it is also useful to sort also by outcomes of interest. Table 3 contains the same list, but is sorted by outcome of interest, which helps to identify more directly what information would be needed to predict a specific outcome.

Table 2. Examples of potential information needs identified during workshop discussions, sorted by relevant decision

Relevant decision(s)	Uncertainty (Information/Science Need)	Outcome(s) of interest
• Priorities for information collection	• Inventory of existing information (semantics, ontology, interoperability)	• All
• Priorities for information collection • Information sharing	• Framework to identify what is currently known and not known	• All
• Land management • Species management	• Methods for prioritizing and making tradeoffs	• Maximize habitat quality and species population health
• Education and outreach	• Current public perceptions; effectiveness of different communication strategies	• Maximize public awareness and education
• Restoration and mitigation decisions	• Effect of changes in ocean and near-shore water conditions (e.g., temperature, currents, level on the lifecycle of fish and other animal species	• Maximize habitat quality and species population health
• Land management / forest management • Species management • Restoration and mitigation decisions	• Effect of habitat fragmentation on species population health	• Maximize habitat quality and species population health
• Zoning and land protection • Investments • Restoration activities	• Vulnerability of the near-shore to sea level rise	• Maximize economic well-being • Maximize habitat quality
• Changes in land use	• Identification of at-risk habitats and the sources of risk to those habitats	• Maximize habitat quality and species population health • Maximize community stability
• Mitigation and restoration	• Ocean acidification: extent, timing, effects, and the availability and effectiveness of mitigations	• Maximize habitat quality and species population health

Relevant decision(s)	**Uncertainty (Information/Science Need)**	**Outcome(s) of interest**
		• Maximize economic benefits
• Mitigation and restoration decisions • Priority setting • Internal resource allocation	• Relative risk from different stressors; ability to compare stressors and their effects over time	• Maximize habitat quality and species population health
• Species management	• What is causing decline in [various migratory bird] species?	• Maximize habitat quality and species population health
• Species management (e.g., fish passage) • Water allocation , use, and management	• Hydrological information, especially at elevation; snow/rain phase, bed load stability, channel stability	• Maximize habitat quality and species population health
	• Understanding of how partner organizations set priorities and make funding decisions	
	• Appropriate / most useful spatial and temporal resolution for multi-agency issues	
	• Maintenance of TEK	
	• Relationships between restoration activities at various scales (and related joint information development)	
• Species management • Mitigation	• Species sensitivity to climate change	• Species population health
• Fisheries management • Land use/protection • Establishment of water pollution targets	• Effects of hydrologic changes on fish population health (e.g. bioenergetics	• Species population health
	• Shared data sets (e.g.,, rainfall intensity)	
	• Ethical use of TEK, local knowledge, preserve and protect tribal ownership	
	• Incorporating soil properties into downscaled climate models, to more easily connect to biological models	
	• Understanding effects of “new normal” climate	
• Priority landscapes for habitat conservation	• Regional and LCC-wide trends in land use	
• Land management – many	• Inventory of existing conservation tools	
	• Effects of human activities on ecosystem health	

Table 3. Examples of potential information needs, sorted by outcomes of interest

Relevant decision(s)	Uncertainty (Information/Science Need)	Outcome(s) of interest
• Priorities for information collection • Information sharing	• Inventory of existing information (semantics, ontology, interoperability) • Framework to identify what is currently known and not known	• All
• Land management / forest management • Species management • Restoration and mitigation decisions • Zoning and land protection • Investments • Restoration activities • Changes in land use • Priority setting • Internal resource allocation • Species management (e.g., fish passage) • Water allocation , use, and management	• Methods for prioritizing and making tradeoffs • Effect of changes in ocean and near-shore water conditions (e.g., temperature, currents, level on the lifecycle of fish and other animal species • Effect of habitat fragmentation on species population health • Vulnerability of the near-shore to sea level rise • Identification of at-risk habitats and the sources of risk to those habitats • Ocean acidification: extent, timing, effects, and the availability and effectiveness of mitigations • Relative risk from different stressors; ability to compare stressors and their effects over time • What is causing decline in [various migratory bird] species? • Hydrological information, especially at elevation; snow/rain phase, bed load stability, channel stability	• Maximize habitat quality and species population health
• Species management • Mitigation • Fisheries management • Land use/protection • Establishment of water pollution targets	• Species sensitivity to climate change • Effects of hydrologic changes on fish population health (e.g. bioenergetics	• Maximize species population health
• Education and outreach	• Current public perceptions; effectiveness of different communication strategies	• Maximize public awareness and education
• Zoning and land protection • Investments • Restoration activities • Mitigation and restoration	• Vulnerability of the near-shore to sea level rise • Ocean acidification: extent, timing, effects, and the availability and effectiveness of mitigations	• Maximize economic well-being
• Changes in land use	• Identification of at-risk habitats and the sources of risk to those habitats	• Maximize community stability

Relevant decision(s)	Uncertainty (Information/Science Need)	Outcome(s) of interest
• Priority landscapes for habitat conservation • Land management – many	• Understanding of how partner organizations set priorities and make funding decisions • Appropriate / most useful spatial and temporal resolution for multi-agency issues • Maintenance of TEK • Relationships between restoration activities at various scales (and related joint information development) • Shared data sets (e.g.,, rainfall intensity) • Ethical use of TEK, local knowledge, preserve and protect tribal ownership • Incorporating soil properties into downscaled climate models, to more easily connect to biological models • Understanding effects of "new normal" climate • Regional and LCC-wide trends in land use • Inventory of existing conservation tools • Effects of human activities on ecosystem health	Not specified

The intent of creating these tables and developing initial conceptual models is to *begin* the identification of information needs for decision makers in the NPLCC. One of the next steps is to gather more information to more fully populate the list of information needs before consideration of how to prioritize such a list.

Request for review and input: The list above is not intended to be complete. Please give some thought to how best to elicit a more complete list of information needs and be prepared to discuss at the next meeting.

2.4 Possible extensions: using the framework to prioritize information needs

One of the responsibilities of LCCs articulated in the DOI's Plan for a Coordinated, Science-based Response to Climate Change Impacts on our Land, Water, and Wildlife Resources (*http://www.doi.gov/whatwedo/climate/loader.cfm?csModule=security/getfile&PageID=23288*) is to prioritize science (and information) needs, as they pertain to supporting resource management decisions. Several other LCCs are addressing this responsibility through development of a "Science Plan." Anticipating that a science plan might be a product the NPLCC aims to produce, the facilitators briefly described several alternative approaches for prioritizing information needs for decision support. Approaches include highly formal value-of-information (VOI) modeling and analysis, other analytical approaches that combine the conceptual modeling approaches shown above with multi-objective valuation, and informal approaches such as surveys and voting mechanisms. Time did not permit detailed discussion of these approaches during the workshop; here we elaborate somewhat on what these approaches entail.

The formal VOI methods would require development of conceptual models and at least partial quantification of those models for every category of end user decision that the NPLCC supports. While that level of model development may be useful, it is also relatively complex and time consuming, and thus may not be the best first step in such a prioritization exercise. Some of the less formal approaches for identifying information needs are described above in section 2.3; prioritization of a completed list can be done with multi-objective techniques that often capture much of the value of VOI methods but with considerably less effort. Informal survey or voting methods require the least effort, but suffer from a lack of rigor.

As an example of a potentially useful approach for the NPLCC to consider, the facilitators described the multi-objective approach currently being pursued by the Plains and Prairie Potholes LCC for identifying and then prioritizing science and information needs. There was no discussion during the workshop about whether this or any other approach was preferred by the participants; it was presented as an example, and is described briefly below as a prelude to further discussion.

The approach involves six detailed steps:

1. Identify “candidate” information needs
2. Define a set of criteria that will describe or determine the priority of a science need; these criteria can include both the value of the information for end-users and NPLCC-level objectives
3. Develop metrics for each of those criteria that can be used to evaluate or “score” the identified needs in terms of how well they meet the criteria
4. Develop a set of weights representing NPLCC management judgments about the relative importance of each criterion in establishing the overall importance or priority of an information need
5. Score each identified information needs using the metrics defined, and
6. Calculate a priority based on the scores and value weights.

Additional discussion of this approach is planned for the next meeting of the Charter Steering Committee.

3 Framing NPLCC Decisions

The remainder of the workshop shifted from discussion of the end-user decisions and focused instead on decisions the NPLCC itself needs to make, and what the objectives of the Charter Steering Committee are for the NPLCC as it makes those decisions. The same process used to structure the discussion of end-user decisions was used to add structure and focus to the discussion of NPLCC decisions.

3.1 NPLCC Decision Types

As stated previously, the NPLCC does not make or execute resource management decisions, those decisions are made by many of the NPLCC partners and other agencies and entities discussed above. The NPLCC has a unique role as a partnership, with the ability to provide information and support for the agencies and entities who are engaged in near-term and long-term conservation delivery, and to help those entities coordinate their actions should they choose to do so. The *decision-making* authority of the NPLCC is significantly more limited than that of the decision makers described above. Workshop participant brainstormed and then organized a list of decisions and decision types that are within the purview of the NPLCC.

- **Establishing priorities**
  - Decisions about which human and environmental stressors to focus on
  - Decisions about ranking / priority of conservation needs
  - Decisions about ranking / priority of information needs
  - Decisions about focus of LCC activities (given the priorities)
  - Decisions about the how to allocate LCC resources among different types of activities
- **Delivery and sharing of LCC products**
  - Decisions about how to deliver science and science applications
  - Decisions about what information to coordinate and how to collect it into a clearinghouse
  - Decisions about how to share information among partners
  - Decisions about which partners or agencies have the lead for different types of information
- **Coordination / cooperation**
  - Decisions about how to coordinate and cooperate with other science providers
  - Decisions about how to coordinate and cooperate with other climate change coordinating groups
- **Communication / outreach**
  - Decisions about how to communicate, both internal communication among partners and external communication with end users
  - Decisions about if, how and what outreach and education to engage in
- **LCC governance / operations**
  - Decisions about LCC governance
  - Decisions about which NGOs to engage and how to engage
  - Decisions about geographic focus
  - Decisions about the role to play in identifying and addressing policy, legislative, legal and regulatory impediments and opportunities
  - Decisions about when to align with neighboring LCCs

The NPLCC has two basic avenues for implementing any of the decisions that it makes. One is through direct funding and implementation of specific activities, for example, through the funding of science- and science-delivery projects. And the second is through the partnership itself, by providing a formal organization for entities engaged in conservation delivery to discuss and coordinate their activities. It was made clear that any NPLCC decisions about issues such as the prioritization of conservation needs would be recommendations only, and are not "binding" on partner agencies, who have and retain the authority for natural, cultural, and water resource management in the North Pacific region.

3.2 Outcomes of interest to the NPLCC

As a first step to clearly defining the goals of the NPLCC, workshop participants considered the types of NPLCC decisions they identified (above), and asked what types of outcomes they would like to see accomplished by the NPLCC. Each participant was asked to look ahead many years and identify an outcome that would indicate to them that the NPLCC had been a success. This list was then organized into a set of objectives for the NPLCC.

- Address issues the LCC is uniquely qualified to address
- Maximize conservation and restoration of priority resources subject to climate change and related large-scale stressors in the NPLCC region.
    - Identify legislative, policy, and regulatory impediments to achieving landscape/marine level conservation.
    - Partners consider LCC priorities when making a decision / maximize number of agency actions consistent with LCC priorities.
    - Maximize non-LCC funding dedicated to addressing LCC priority needs.
    - Maximize restoration of the natural resource base in the NPLCC.
    - Address Trust obligations.
- Maximize the benefits and use of LCC-supported products by Partner agencies in support of conservation decisions and adaptive management
    - Maximize quality, quantity , availability, and usability of the products and information
    - Maximize number and variety of partners and stakeholders that are using (and trust) LCC-provided information
    - Maximize ease of access to LCC information
- Maximize coordination among natural and cultural resource management entities and research organizations when addressing shared priorities and LCC priorities
    - Minimize duplication of activities and efforts among partners, research, and conservation delivery entities
    - Maximize economies of scale in activities

    - Maximize collaboration and mutual respect among all partners (consider tribal co-management)
- Maximize sharing and dissemination of data and information among Partners
    - Make LCC findings widely available.
- Maximize awareness and understanding of the effects of climate change on ecosystems, resources, cultures, and economies
    - Maximize understanding by managers of climate change, climate impacts, landscape level impacts & connections
    - Maximize understating of the relative vulnerability of high priority resources and economies.
    - Maximize understanding of the impacts of climate change on those who rely on subsistence resources.
- Maximize use of more information of the impacts of human and environmental stressors on the landscape, including consideration of long-term impacts, cumulative impacts and potential adverse impacts of conservations actions themselves

These outcomes of interest formed the basis for a draft list of goals for the NPLCC to be described in the draft Charter and Operating Guidelines for the NPLCC.

4 Draft NPLCC Purpose and Organization Document

The third morning of the workshop, discussion turned to NPLCC organizational and governance issues. Members of the Charter Steering Committee discussed:

- Internal decision making processes: whether to operate on the basis of consensus only, majority vote, or some combination of the two. All agreed that the Steering Committee should strive for consensus, but a decision was not reached on whether consensus is the only acceptable way to move forward.

- Elements of the Draft Proposal for the Purpose and Organization of the NPLCC, distributed prior to the May meeting of the Charter Steering Committee. Each element of that charter (the mission, goals, guiding principles, function and membership of the Steering Committee) was discussed in light of the work of the previous two days, and suggestions were made for modifications to each.

- Potential subcommittees. Several ideas for the use of subcommittees to accomplish the NPLCC's mission were raised and noted. It was agreed that each such committee should have a set of responsibilities determined by the Steering Committee, but the composition and the exact number and responsibilities of such committees was deferred for discussion at the next meeting. A preliminary list of four subcommittees was proposed by NPLCC staff, with possible geographically defined subcommittees to be added to the list.

- Science / Traditional Ecological Knowledge Subcommittee
- Tribal / First Nations Subcommittee
- Stakeholder Subcommittee
- Communications Subcommittee
- Possible Geographic Subcommittees (to be determined)

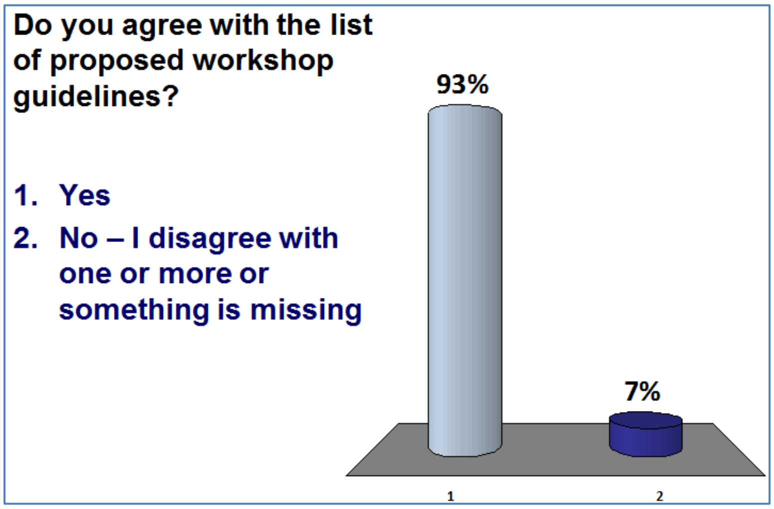
The NPLCC staff agreed to take the results of the morning's discussion and prepare draft Charter and Operating Guidelines documents. These documents will be shared with the Charter Steering Committee prior to the next meeting, and will be reviewed, modified and approved at that meeting.

Appendix 1. Workshop Attendees

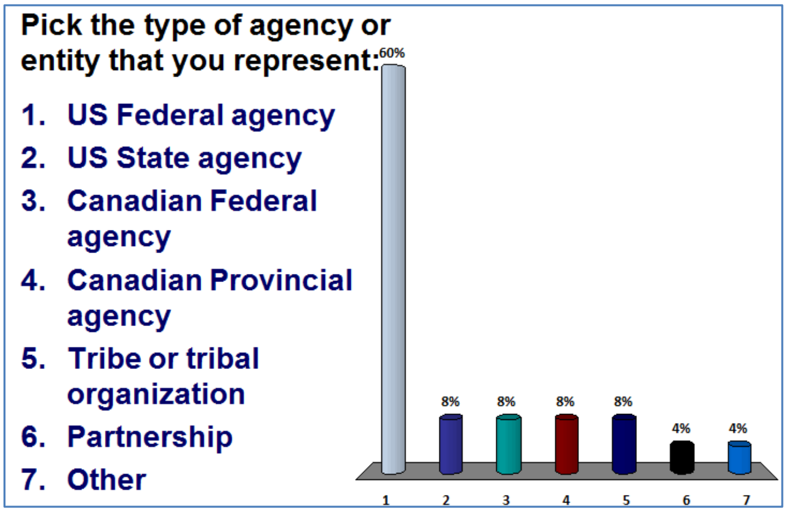
NPLCC Charter Steering Committee Members (or alternatives)	
Whitney Albright	Cal. Dept Fish and Game
Rory Annett	Province of British Columbia
Brett Brownscombe	State of Oregon
Brendan Cain	Bureau of Land Management
Peter Dederich	National Parks Service
Jim Fincher	Bureau of Land Management
Greg Hayward	US Forest Service
Joyce Kelly	Env. Protection Agency - Reg. 10
Steve Klosiewski	US Fish and Wildlife Service
Marc Kramer	US Forest Service
John Laurence	US Forest Service
Mary Mahaffy	US Fish and Wildlife Service
Madeline Maley	Province of British Columbia
John Mankowski	US Fish and Wildlife Service
Bruce Newton	Natural Resources Cons. Ser.
David Redhorse	Bureau of Indian Affairs
Mike Roy	US Fish and Wildlife Service
Tasha Sargent	Canadian Wildlife Service
Frank Shipley	US Geological Survey
Barry Smith	Canadian Wildlife Service
Barry Thom	NOAA
Lyman Thorsteinson	US Geological Survey
Mike Tranel	National Park Service
Doug Vincent-Lang	ADF&G
Andrea Woodward	US Geological Survey
Additional participants not on the NPLCC Charter Steering Committee	
Debora Cooper	National Park Service, AK
Josh Foster	NOAA RISA
Stephen Gray	US Geological Survey
Preston Hardison	
Joe Hostler	Yurok
Bill Iyall	Cowlitz
Terry Williams	Tulalip

Demographic information of workshop attendees

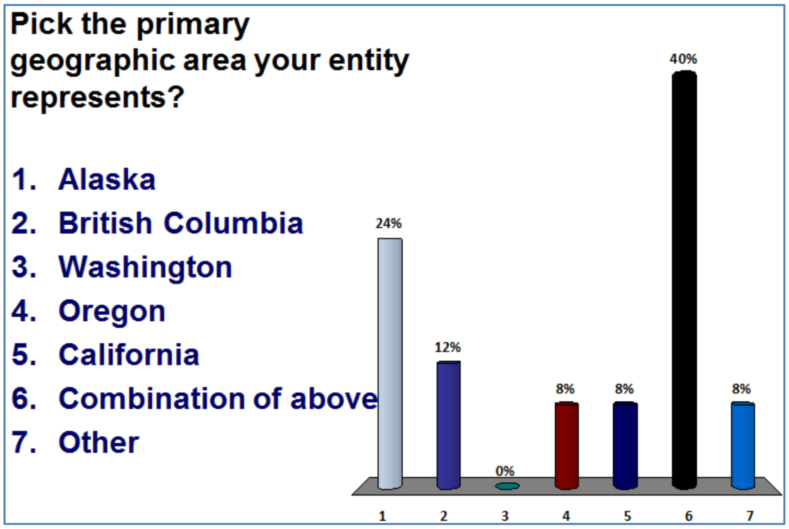
Participants were asked during the opening introductions to respond to various questions about themselves and their involvement in the NPLCC. The following results were obtained from the group.


Do you agree with the list of proposed workshop guidelines?

1. Yes
2. No – I disagree with one or more or something is missing

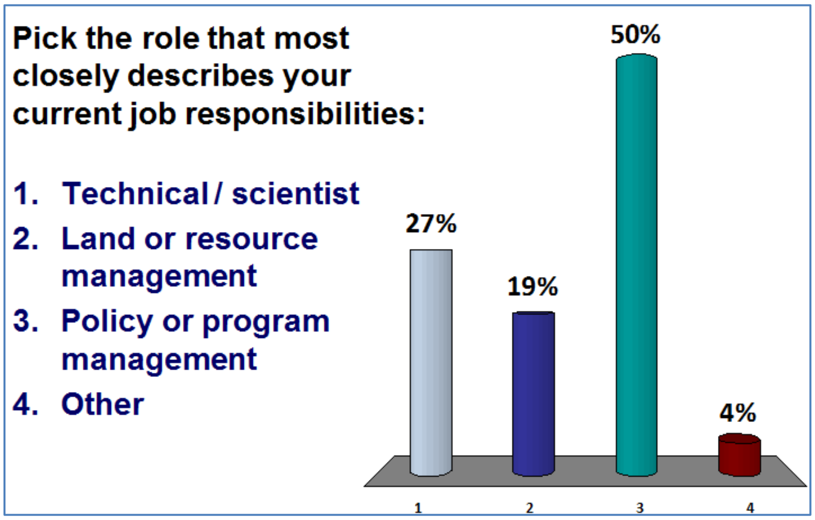

Pick the type of agency or entity that you represent:

1. US Federal agency
2. US State agency
3. Canadian Federal agency
4. Canadian Provincial agency
5. Tribe or tribal organization
6. Partnership
7. Other



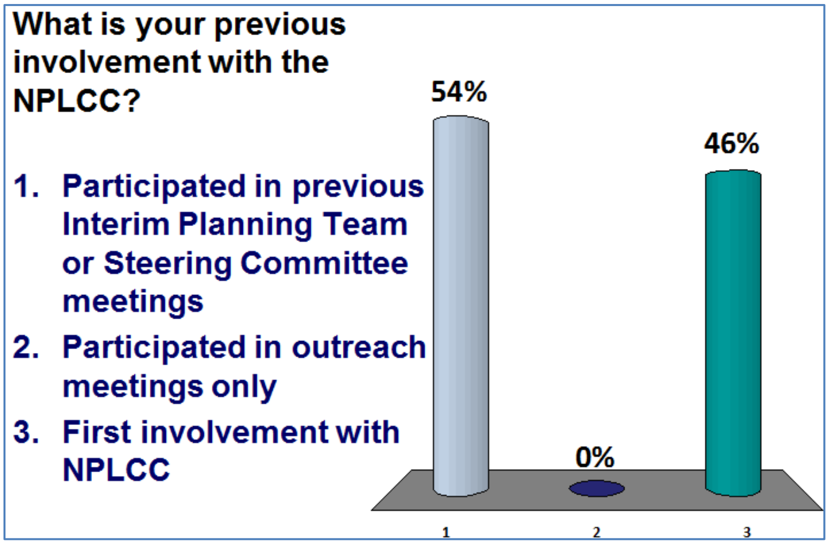
Pick the primary geographic area your entity represents?

1. Alaska
2. British Columbia
3. Washington
4. Oregon
5. California
6. Combination of above
7. Other



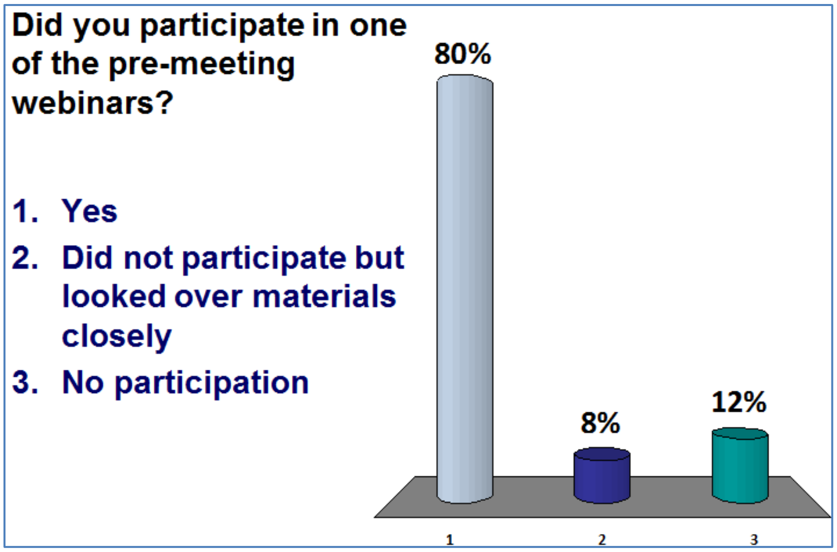
Pick the role that most closely describes your current job responsibilities:

1. Technical / scientist
2. Land or resource management
3. Policy or program management
4. Other



What is your previous involvement with the NPLCC?

1. Participated in previous Interim Planning Team or Steering Committee meetings
2. Participated in outreach meetings only
3. First involvement with NPLCC



Did you participate in one of the pre-meeting webinars?

1. Yes
2. Did not participate but looked over materials closely
3. No participation

Appendix 2. Common themes across the NPLCC

The following shows the common themes developed first by the USGS and then expanded upon during the workshop. The list includes valued human, ecological and cultural resources, existing stressors, and current and potential climate change impacts.

Valued human, ecological, and cultural resources

- Forest products
- Old growth forests
- Freshwater quality, timing, availability
- Anadromous fish populations
- Migratory birds
- Carbon sequestration capacity
- Cultural resources
- Habitat connectivity
- Near shore / coastal / estuarine habitats
- Community stability / human well-being (scenario planning tool is useful)
- Recreation / tourism

Climate-related stressors and potential climate change impacts

- Climate change
- Infrastructure development
- Energy development
- Invasive species
- Sea level rise
- Ocean acidification
- Ocean current changes
- Food web dynamics
- Phenological mismatches
- Disturbed regimes
- High sensitivity to land-sea interactions
- Global economic dynamics

Note: Many issues are cross-cutting – across traditional discipline boundaries. Need for life-cycle scale analyses – full spectrum of costs and benefits.