Final Memo 1-C

Northern Basin and Range and Snake River Plain Ecoregion Rapid Ecoregional Assessment

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NORTHERN BASIN AND RANGE

AND

SNAKE RIVER PLAINS ECOREGION

Rapid Ecoregional Assessment

FINAL MEMORANDUM I-C

This document was submitted for review and discussion to the Bureau of Land Management (BLM) and does not reflect BLM policies or decisions

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List of Acronyms, Abbreviations, and Definitions

AFB	Air Force Base
AMT	Assessment Management Team
BLM	Bureau of Land Management
CA	change agent
CAFO	concentrated animal feeding operation
CE	conservation element
CBR	Central Basin and Range Ecoregion
CRP	Conservation Reserve Program
DOD	Department of Defense
DOE	Department of Energy
ESA	Endangered Species Act
GAP	Gap Analysis Program
GIS	geographic information system
HUC	Hydrologic Unit Code
km	kilometer
km^2	square kilometers
LCC	Landscape Conservation Cooperative
mi^2	square miles
MQ	management question
NBR	Northern Basin and Range and Snake River Plain Ecoregion
NCA	National Conservation Area
NREL	National Renewable Energy Laboratory
NVCS	National Vegetation Classification System
NWI	National Wetland Inventory
OHV	off-highway vehicle
P-J	Pinon-Juniper
REA	Rapid Ecoregional Assessment
ReGAP	Part of the Gap Analysis Program
RFP	request for proposal
SAIC	Science Applications International Corporation
SOW	statement of work
SWAP	state wildlife action plan
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service
WHRC	Woods Hole Research Center
WGA	Western Governors Association
WUI	Wildland Urban Interface

The following definitions were provided from the Statement of Work (SOW) and amended based on input from the Assessment Management Team.

Assessment Management Team (AMT): The AMT consists of Bureau of Land Management (BLM) Branch Managers for renewable resources, other natural resource scientists from all of the BLM states involved, and also includes representatives from the Western Governors Association (WGA) and state fish and game agencies.

Change Agent (CA): An environmental phenomenon or human activity that can alter/influence the future status of resource condition. Some CAs (e.g., roads) are the result of direct human actions or influence. Others (e.g., climate change, wildland fire, invasive species) may involve natural phenomena or be partially or indirectly related to human activities.

Coarse Filter: A level of ecoregional analysis that is based on conserving resource elements that occur at coarse scales, such as ecosystems, rather than on finer scale elements, such as specific species. The intent behind a coarse-filter approach is that preserving coarse-scale conservation elements will preserve elements occurring at finer spatial scales.

Conservation Element (CE): A renewable resource object of high conservation interest often called a conservation target by others (e.g., The Nature Conservancy). For purposes of this Task Order, CEs will likely be types or categories of areas and/or resources, including ecological communities or larger ecological assemblages.

Ecological Integrity: The ability of an ecological system to support and maintain an assemblage of organisms that have the species composition, diversity, and functional organization comparable to those of natural habitats within the ecoregion.

Ecological Systems: Defined as "groups of plant community types that tend to co-occur within landscapes with similar ecological processes, substrates and/or environmental gradients" (Comer et al. 2003). The ecological system concept emphasizes existing dominant vegetation types, but also incorporates physical components, such as landform position, substrates, hydrology, and climate (Lowry et al. 2005).

Fine Filter: A level of ecoregional analyses that is based on conserving resource elements that occur at fine scale, such as specific species. A fine-filter approach is often used in conjunction with a coarse-filter approach (i.e., a coarse-filter/fine-filter framework) because coarse filters do not always capture some concerns, such as when a threatened and endangered species is a CE.

Hazard: Any real or potential condition that can cause injury or damage to life, property, or other value that is assigned by people for a particular event.

Rapid Ecoregional Assessment (REA): REAs look across an ecoregion to understand more fully ecological conditions and trends; natural and human influences; and opportunities for resource conservation, restoration, and development. They seek to identify important resource values and patterns of environmental change that may not be evident when managing smaller, local land areas. By utilizing and synthesizing current knowledge and data applicable to all lands and waters within the ecoregion, REAs describe and map areas of high ecological value. REAs then gauge the potential of these values to be affected by environmental CAs. REAs are called "rapid" assessments because they synthesize existing information, rather than conduct research or collect new data, and are generally completed within 18 months.

Regionally Significant: A native plant, wildlife, or fish resource or assemblage that has a range of distribution and affects management concerns across two or more BLM field office boundaries and is more than locally important. Being more than locally important could include having qualities that give the resource special worth, meaning, or value.

Risk: The chance (probability) of an event starting (i.e. wildfire, bark beetle infestation, landslide, etc.) as determined by the presence and activity of causative agents.

1 Introduction

The Bureau of Land Management (BLM) is currently evaluating a wide variety of environmental challenges to western ecosystems. These challenges transcend land ownership and administrative jurisdictions, and necessitate a landscape-scale approach to evaluation of these ecosystems. Rapid Ecoregional Assessment (REA) is the BLM's first step toward a broader initiative to systematically develop and incorporate landscape-scale information into the evaluation, and eventual management, of public land resources.

REAs look across an ecoregion to understand more fully ecological conditions and trends; natural and human influences; and opportunities for resource conservation, restoration, and development. They seek to identify important resource values and patterns of environmental change that may not be evident when managing smaller, local land areas. REAs describe and map areas of high ecological value. REAs then gauge the potential of these values to be affected by environmental change agents (CAs). REAs are called "rapid" assessments because they synthesize existing information, rather than conduct research or collect new data, and are generally completed within 18 months.

REAs are organized into various phases, with specific tasks in each phase (Table 1-1). Phase I is the pre-assessment, and includes four tasks beginning with Task 1 to refine the management questions (MQs) that the REA will attempt to answer. MQs identify (implicitly or explicitly) information needed to formulate management responses to regional or landscape-scale resource management issues or concerns. Conservation elements (CEs) and CAs specific to the Northern Basin and Range and Snake River Plains (NBR) ecoregion will also be identified during Task 1. A CE is an element of conservation interest or action. A CA is an environmental phenomenon or human activity that can influence the future progression and condition of CEs. This memo presents the findings of Phase I Task 1. Phase I also includes the development of conceptual models (Task 2) and the development of geoprocessing models, methods and tools (Task 3). Phase I culminates in the Task 4 REA work plan that will provide a roadmap for the completion of Phase II.

Table 1-1. REA Phases and Tasks

Phase	Task #	Product
I. Pre-assessment	1	**Refine Management Questions**
	2	Identify, Evaluate, and Recommend Conceptual Models
	3	Identify, Evaluate, and Recommend Geoprocessing Models, Methods, and Tools
	4	Prepare REA work plan
II. Assessment	1	Compile and Generate Source Datasets
	2	Conduct analyses and generate findings
	3	Prepare REA report, maps, and supporting documents

Phase II is the ecoregional assessment that includes three tasks including compiling of available datasets (Task 1), analysis of the data relative to the identified CAs and CEs (Task 2), and culminates in the preparation of the REA document, which will guide BLM and other land managers in developing and prioritizing planning and management strategies (Task 3).

1.1 Management Questions (MQs)

The BLM specifically designed the REA approach to start with MQs. These questions identify current or anticipated landscape-scale problems or issues concerning resource management. MQs need to provide clear direction concerning the information needed to answer the question, and without this direction a REA can become merely an expensive data collection effort (Johnson et. al., 1999). The BLM

Assessment Management Team (AMT) for this ecoregion developed 55 initial questions or applications of questions that were used as a basis in developing the final list of questions presented in Section 3 of this memorandum. Most of the MQs are consistent or similar to MQs developed as part of the Central Basin and Range (CBR) REA (in progress).

1.2 Conservation Elements (CEs) and Change Agents (CAs)

Although the MQs are key drivers of this REA, the REA could not be completed without the identification of CEs and CAs. In order to answer the most important MQ, which is "What resources do we have in the REA?" the CEs must be identified early in the process. In addition to the CEs, in order to answer another important MQ, which is "What is happening to what we have?" the CAs must also be identified early in the process. Identification of the CEs and CAs in each ecoregion also assists with the development of conceptual models for the ecoregion.

1.3 Memorandum 1

This memorandum documents the activities completed under Task 1 of Phase I. The objectives of this task were to identify the boundaries of the NBR ecoregion, refine and finalize the MQs, identify the CEs and CAs for evaluation within this ecoregion, and complete this memorandum as an initial basis for the REA work plan that will be completed under Task 4 of this Pre-assessment phase.

2 REA Study Area and Landscape Reporting Units

2.1 Study Area

The study area for this Rapid Ecoregional Assessment (REA) is comprised of two ecoregions, the Northern Basin and Range and the Snake River Plains (NBR) as shown in Figure 2-1. A short description of each ecoregion will follow.

2.1.1 Description of Northern Basin and Range Ecoregion

The Northern Basin and Range ecoregion encompasses southeastern Oregon, portions of southern Idaho, northern Nevada, and a small extension into northeastern California. It is the northern extent of the larger Basin and Range physiographic province, and is characterized by high arid basins alternating with isolated fault block mountains including Steens Mountain and Hart Mountain. Repeated glaciations and stream erosion have carved dramatic valleys in these mountains and in the Owyhee High Plateau. Most of the ecoregion is dominated by sagebrush steppe ecosystems on the desert floor, but distinct vegetation zones related to relief and elevation also exist. The desert floor is characterized by big sagebrush (*Artemisia tridentata*) or low sagebrush-bunchgrass systems. With increasing elevation, the higher plateaus and rocky areas support western juniper (*Juniperus occidentalis)* and curlleaf mountain mahogany (*Cercocarpus ledifolius*) communities. Aspen (*Populus tremuloides*) communities grow along streams and drainages in the mountain gorges and riparian zones, providing an important source of forage for deer and other wildlife. Isolated stands of Douglas-fir (*Pseudotsuga menziesii*) and whitebark pine (*Pinus albicaulis*) also occur in the mountains. The subalpine zone supports low-growing shrubs, grasses, and wildflowers such as mountain meadow knotweed (*Polygonum bistortoides*) and false hellebore (*Veratrum viride*).

Wildlife species of concern include bighorn sheep (*Ovis canadensis*), mule deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), pronghorn (*Antilocapra americana*), pygmy rabbit (*Brachylagus idahoensis*), snowshoe hare (*Lepus americanus*), golden eagle (*Aquila chrysaetos*), and greater sage-grouse (*Centrocercus urophasianus*). Important habitats in the ecoregion include migration corridors and areas for overwintering pronghorn, as well as key habitat for greater sage-grouse. The Northern Basin and Range ecoregion also supports thousands of migratory waterfowl in the Malheur Lake area, and populations of the Endangered Species Act (ESA) threatened Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi*), redband trout (*Oncorhynchus mykiss*), warm water fish, bat species, and spotted frog (*Rana luteiventris*).

Federal agencies manage the majority of land in this ecoregion. Historical and current land use includes mining, livestock grazing, and recreation. Current management priorities include energy development (geothermal, solar and wind development), wild horse and burro management, and invasive plant species. Potential wind development sites under consideration by land management agencies must resolve concerns involving disturbance to and mortality of sage-grouse, pygmy rabbit, mule deer winter range, golden eagles (including their nest locations), other raptors, and bats.

2.1.2 Description of Snake River Plains Ecoregion

The Snake River Plain ecoregion occupies a large swath of land in southern Idaho formed by volcanic lava flows and dissected by the Snake River drainage system, resulting in well developed terraces along the river. Native upland vegetation cover is dominated by sagebrush-bunchgrass communities. Important wildlife species of concern in this ecoregion are mule deer, pronghorn, sage-grouse, bald eagle (*Haliaeetus leucocephalus*), and golden eagle. The Snake River is an important habitat and migration route for fish species including white sturgeon (*Acipenser transmontanus*) and redband trout.

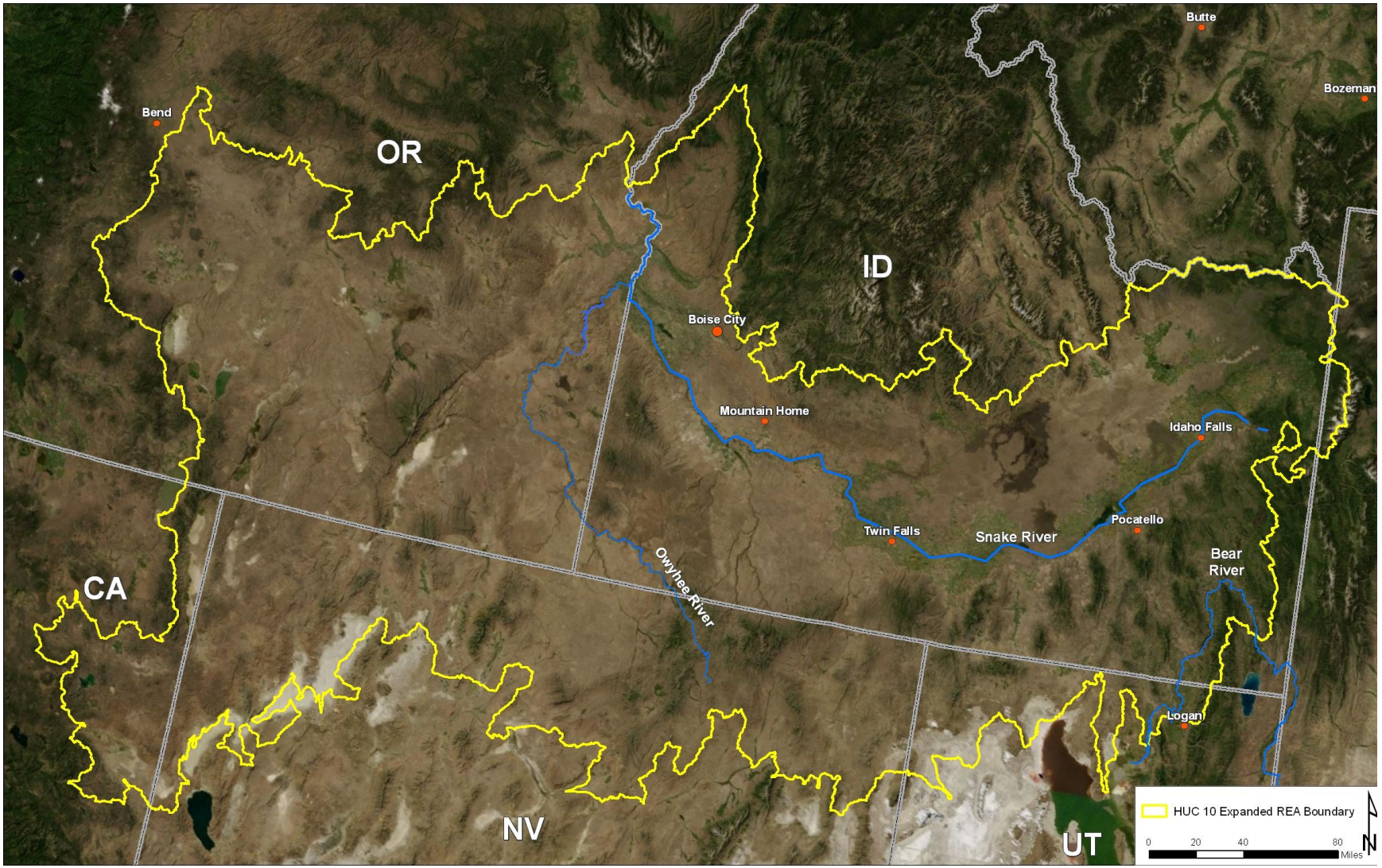

Figure 2-1. Northern Basin and Range and Snake River Plain Ecoregion with HUC 10 Expanded Boundary

Several areas in this ecoregion have been designated to protect and manage regionally significant wildlife resources including the Snake River Birds of Prey National Conservation Area.

The largest human populations of the ecoregion are concentrated along the Snake River corridor and land development remains an important change agent (CA). Much of the Snake River Plains ecoregion is used as cropland and federally managed rangeland, in which the distribution and extent of native vegetation communities have been significantly altered. Land use issues focus on the impacts of farming and livestock grazing, residential and commercial development, invasive annual grasses, dispersed recreation, surface water and groundwater withdrawal for irrigation, and soil erosion.

Issues identified in early workshops for the Bureau of Land Management's (BLM's) REA process for these ecoregions included conversion of sagebrush communities to cheatgrass (*Bromus tectorum*), salt desert shrub conversion, loss of greater sage-grouse habitat, and loss of mule deer winter use areas.

2.2 Landscape Reporting Units

Throughout this REA process, a wide variety of data will be collected and evaluated, and, depending on source, will vary in size and scale within the region covered. Uniform landscape reporting units will provide common assessment reporting throughout the process. Landscape reporting units are predefined areas that are specific enough to provide useful information about species and communities, but general enough to provide appropriate context and avoid mapping at an inappropriately small scale. Although collected datasets will be maintained at their native resolution, the primary landscape unit for this REA will be at least the 6th level hydrological unit (HUC) of the National Watershed Boundary Dataset (USGS 2009), with ecological integrity assessed at the 5th level unit. Thirty meter pixel raster data will be utilized in the geospatial analysis and modeling in support of answering the management questions (MQs). For raster data, 30 meter pixel resolution refers to the resolution of the raster data derived from satellite imagery. In addition to the landscape reporting units listed above, the downscaled regional climate model data that will be provided by BLM will be at the 15 kilometer (km) resolution level. The reporting units may change per direction from the AMT in later tasks based on data availability and quality for this ecoregion or to keep consistency with neighboring REAs, in progress.

3 Management Questions

3.1 Introduction

Rapid Ecoregional Assessments (REAs) begin as management questions (MQs) and culminate with determining how completely the questions were answered by the analysis. MQs need to provide clear direction concerning the information necessary to answer the question; without this direction a REA can become merely an expensive data collection effort (Johnson et. al., 1999). In their simplest form, MQs should be specifically framed toward landscape-scale issues and address resource values (species, populations, communities, or ecological values) and change agents (CAs), or phenomena that influence or affect the resource values.

3.2 Management Question Screening Criteria

The Assessment Management Team (AMT) for this ecoregion developed 55 different MQs or applications of MQs grouped into nine categories in the statement of work (SOW). Because a diversity of interests are involved in every ecoregion, the Bureau of Land Management (BLM) recommended that MQ screening criteria be developed to ensure that the MQs are not only focused, but can be answered by the analysis completed as part of this project. The six criteria are listed below:

1. Is the MQ clear, focused, and relevant to the ecoregion?
2. Can the MQ be answered if data are available?
3. Does the MQ address regional-scale issues?
4. Does the MQ help to answer the following: what resource do we have, what is its condition, and what is happening or likely to happen to what we have?
5. Do the conceptual models respond to the MQs?
6. Is the MQ amenable to geospatial analysis

3.3 Management Questions

The Science Applications International Corporation (SAIC) Team presented the screened list of 55 MQs to the AMT in the pre-meeting memo. Although the SAIC Team used the initial BLM MQ list as a basis, it was determined at the AMT Workshop 1 that using the MQs developed for the adjacent and similar ecoregion - Central Basin and Range (CBR) - REA would best represent the Northern Basin and Range and Snake River Plain Ecoregion (NBR) as well. The MQs from Central Basin and Range have already undergone refinement (rewording, removals, and additions) throughout that REA process so they can be considered well-defined and can serve as a good starting point. This list was discussed and further refined during the AMT. The final draft list of MQs is presented in Table 3-1. It should be kept in mind that MQs may evolve as the REA process continues and some may even be removed as their feasibility to use is evaluated. Final MQs are decided prior to Task 4.

In addition to CBR MQs, the NBR AMT determined that it was appropriate and necessary to include MQs related to grazing both as a CA and conservation element (CE). As a result, eight additional grazing-focused MQs were developed and are included. A more detailed discussion of grazing and the application of the REA process to grazing is included in section 5.2.5.

Table 3-1. Management Questions for the NBR

MQ #	MQ Group	Final Management Question
Questions Related to Conservation Elements (CEs)		
1	Species	What is the current distribution of potential habitat for each species CE?
2	Species	Where are current locations of species CEs that are potentially affected by existing CAs (and thus potentially at risk)?
3	Species	What is the current distribution of suitable habitat, including seasonal habitat and movement corridors, for each landscape species and species assemblage CE?
4	Species	Where are existing CAs potentially affecting this current habitat and/or movement corridors, for landscape species and species assemblage CEs?
5	Species	Where are species CEs whose current locations or suitable habitats overlap with the potential future distribution of CAs (other than climate change)?
6	Species	Given current and anticipated future locations of CAs, which habitat areas remain as opportunities for habitat enhancement/ restoration?
7	Species	Where are potential areas to restore connectivity for landscape species and species assemblage CEs, based on current locations of CAs?
8	Species	Where will landscape species and species assemblage CEs experience climate outside their current climate envelope?
9	Native Plant Communities	Where are intact (i.e., minimally disturbed by human activities) CE vegetative communities located?
10	Native Plant Communities	Where are the likeliest current locations for high-integrity examples of each major terrestrial ecological system?
11	Native Plant Communities	Where are existing and potential future CAs (aside from climate change) likeliest to affect current communities?
12	Native Plant Communities	Where will current locations of these communities experience significant deviations from normal climate variation?
13	Terrestrial Sites of High Biodiversity	Where are sites identified as having high biodiversity characteristics? Which designated sites are protected?
14	Terrestrial Sites of High Biodiversity	Where will CAs (aside from climate change) potentially affect sites of high biodiversity?
15	Terrestrial Sites of High Biodiversity	Where will locations of these high biodiversity sites experience significant deviations from normal climate variation?
16	Aquatic Sites of High Biodiversity	What has been the general level of survey effort (ecoregion-wide, not site-specific) for spring snails and other species of concern?
17	Aquatic Sites of High Biodiversity	Where are areas representing unique aquatic lineages or assemblages or other areas of high aquatic biodiversity (considering both local [alpha] and regional [beta or gamma] diversity)?
18	Aquatic Sites of High Biodiversity	Where will these aquatic high biodiversity sites (as defined in MQ 17) be potentially affected by CAs (aside from climate change)?
19	Aquatic Sites of High Biodiversity	Where will current locations of these aquatic high biodiversity sites (as defined in MQ 17) experience significant deviations from normal climate variation?
20	Specially Designated Areas of Ecological Value	Where are specially designated areas of ecological or cultural value?
21	Wild Horse and Burro Management Areas	Where are the current wild horse and burro Herd Management Areas (HMAs)?
22	Wild Horse and Burro Management Areas	Where will CAs (excluding climate change) overlap HMAs, under each time scenario?
23	Wild Horse and Burro Management Areas	Which HMAs will experience climate outside their current climate envelope?
24	Grazing	Where are the current livestock grazing allotments?

Table 3-1. Management Questions for the NBR

MQ #	MQ Group	Final Management Question
Questions Related to CEs (continued)		
25	Grazing	Where will CAs (excluding climate change) overlap grazing allotments under each time scenario?
26	Grazing	Which grazing allotments will experience climate change outside their current climate envelope?
27	Vulnerable Soils	Where are vulnerable (e.g., erodible, slickspot) soil types within the ecoregion?
28	Vulnerable Soils	Where will vulnerable soil types overlap with CAs (aside from climate change) under each time scenario?
29	Vulnerable Soils	Where will current vulnerable soil types experience significant deviations from normal climate variation?
30	Surface and Subsurface Water Availability	Where are current natural and man-made surface water resources, and which are perennial ephemeral, etc?
31	Surface and Subsurface Water Availability	What is the natural variation of monthly discharge and monthly base flow for streams and rivers?
32	Surface and Subsurface Water Availability	Where are the likely recharge areas within a HUC?
33	Surface and Subsurface Water Availability	Where will the recharge areas (relating to aquatic CEs) identified in MQ 32 potentially be affected by CAs?
34	Aquatic Ecological Function and Structure	What is the condition (ecological integrity) of aquatic CEs?
Questions Related to Change Agents (CAs)		
35	Fire History	What is the frequency, size, and distribution of wildfire on the landscape?
36	Fire Potential	What areas now have (high, medium, low) potential for fire based on fuels composition (e.g., invasive plants)?
37	Fire Potential	Where are areas that in the future will have high potential for fire?
38	Invasive Species	What is the current distribution of invasive species included as CAs?
39	Invasive Species	What areas are significantly affected by invasive species?
40	Invasive Species	Focusing on the distributions of terrestrial and aquatic CEs that are significantly affected by invasive species, which areas have restoration potential?
41	Invasive Species	Given current patterns of occurrence and expansion of the invasive species included as CAs, what is the potential future distribution of these invasive species?
42	Development	Where are current locations of development CAs?
43	Development	Where are areas of planned or potential development CAs?
44	Development	Where do development CAs cause significant loss of ecological integrity?
45	Development	Where do current locations of CEs overlap with development CAs?
46	Recreation	Where are areas with significant recreational use?
47	Recreation	Where have designated recreation areas, such as for off-highway vehicle (OHV) use, affected CEs and invasive species?
48	Recreation	Where are other areas of likely high OHV use [as determined by modeling] that may affect CEs and invasive species?
49	Oil, Gas, and Mining Development	Where are the current locations of oil, gas, and mineral extraction?
50	Oil, Gas, and Mining Development	Where will locations of oil, gas, and mineral extraction potentially exist by 2025?

Table 3-1. Management Questions for the NBR

MQ #	MQ Group	Final Management Question
Questions Related to CAs (continued)		
51	Oil, Gas, and Mining Development	Where are the areas of potential future locations of Oil, Gas, and Mining (including gypsum) development (locatable, salable, and fluid and solid leasable minerals)?
52	Oil, Gas, and Mining Development	Where do locations of current CEs overlap with areas of potential future locations of non-renewable energy development?
53	Renewable Energy Development	Where are the current locations of renewable energy development (solar, wind, geothermal, transmission)?
54	Renewable Energy Development	Where are the areas identified by the National Renewable Energy Laboratory (NREL) as potential locations for renewable energy development?
55	Renewable Energy Development	Where are the areas of low renewable and non-renewable energy development that could potentially mitigate impacts to CEs from potential energy development?
56	Renewable Energy Development	Where do current locations of CEs overlap with areas of potential future locations of renewable energy development (MQ 65)?
57	Renewable Energy Development	Where will locations of renewable energy [development] potentially exist by 2025?
58	Groundwater Extraction and Transportation	Where will CAs potentially impact groundwater-dependent aquatic CEs?
59	Groundwater Extraction and Transportation	What is the present distribution of municipal and agricultural water use of groundwater resources in relation to the distribution of aquatic CEs?
60	Groundwater Extraction and Transportation	Where are the aquatic CEs showing degraded ecological integrity from existing groundwater extraction?
61	Surface Water Consumption and Diversion	Where are artificial water bodies including evaporation ponds, etc.?
62	Surface Water Consumption and Diversion	Where are the areas of potential future change in surface water consumption and diversion?
63	Surface Water Consumption and Diversion	Where are the CEs showing degraded ecological integrity from existing surface water diversion?
64	Climate Change: Terrestrial Resource Issues	Where will changes in climate be greatest relative to normal climate variability?
65	Climate Change: Terrestrial Resource Issues	Given anticipated climate shifts and the direction shifts in climate envelopes for CEs, where are potential areas of significant change in extent such as ecotones?
66	Climate Change: Terrestrial Resource Issues	Where are vegetation CEs that will experience significant deviations from normal climate variation?
67	Climate Change: Terrestrial Resource Issues	Where are wildlife CE habitats that will experience significant deviations from normal climate variation?
68	Climate Change: Aquatic Resource Issues	Where will aquatic CEs experience significant deviations from historic climate variation that potentially could affect the hydrologic and temperature regimes of these aquatic CEs?
69	Military Constrained Areas	Where are areas of planned expansion for military use?
70	Atmospheric Deposition	Where are areas affected by atmospheric deposition of pollutants, as represented specifically by nitrogen deposition, acid deposition, and mercury deposition?
71	Livestock Grazing	Where is structure of vegetation CEs affected by livestock grazing?

Table 3-1. Management Questions for the NBR

MQ #	MQ Group	Final Management Question
Questions Related to CAs (continued)		
72	Livestock Grazing	Where can livestock grazing be used to reduce wildfire risk in areas with herbaceous fuel loads and proximity to high-probability ignition locations (roads, train tracks, lightning etc.)
73	Livestock Grazing	Where will livestock grazing have the potential to increase fire from vegetation cover type conversion (high, medium, low)?
74	Livestock Grazing	Where are areas in the landscape with various (low, medium, high) levels of resilience to livestock grazing (based upon ecological site and existing vegetation)?
75	Livestock Grazing	Where has the landscape been modified for purposes of livestock grazing and management (sagebrush elimination, fences, plantings, water sources, etc)?
76	Livestock Grazing	What areas of the landscape are low density vs. high density livestock grazed (streams, water developments, corrals, steep slopes, etc)?
77	Livestock Grazing	Where are areas best suited to potential livestock cattle and sheep grazing based on environmental factors (such as slope, aspect, water availability, wild ungulate grazing)?
78	Livestock Grazing	Where do grazing areas have the highest potential to increase invasive and/or noxious species occurrences?

4 Conservation Element Selection

4.1 Introduction

The Northern Basin and Range and Snake River Plain Ecoregion (NBR) Rapid Ecoregional Assessment (REA) is intended to characterize the current status (baseline conditions) and forecast the future condition of ecological resources in this ecoregion. Because it is not feasible to study the entire ecoregion and all its components, conducting the REA requires that important, specific resource values throughout the ecoregion be identified. These will be referred to as conservation elements (CEs) and will be the objects of assessment that represent current condition and future status and trends. As stated in the REA statement of work (SOW), "Conservation elements are the 'what' that are to be conserved and/or restored." The SOW further defines classes of CEs as species, ecosystems and landscapes, and scenery/special values recognized as warranting conservation/protection.

Identification of the CEs included consideration of the following Core Ecological Values identified by Bureau of Land Management (BLM) and discussed with the Assessment Management Team (AMT). These Core Ecological Values include:

1. Native fish, wildlife, or plants of regional conservation concern (e.g., populations, species, or communities identified in state wildlife action plans [SWAPs]; species listed under the Endangered Species Act (ESA); species and communities identified through other agency/non-governmental organization assessments; etc.).
2. Regionally-important, terrestrial ecological features, functions, and services (e.g., large areas of native vegetation providing important cover, fiber, and forage; habitat strongholds and corridors; upland areas important for water quality or water supply; areas capable of significant carbon sequestration; etc.).
3. Regionally-important, aquatic ecological features, functions, and services (e.g., habitat strongholds and corridors; wetland, riparian, and other aquatic areas important for water quality, water supply, stream bank stability, flood control, and similar purposes).

In this section we propose a limited suite of CEs that will be used to represent the entirety of ecological resources and values within the ecoregion. Through the REA analyses of the condition of these CEs within the NBR ecoregion in Phase II of the project, we will ultimately evaluate ecological integrity at the watershed level across the ecoregion.

Our approach to selecting CEs is based on identifying an effective set of ecosystems, species assemblages, and individual species that will adequately represent the ecoregion's resources and be suitable gauges of the effects of change agent (CA) impacts. The selected CEs must assist us in clearly articulating our understanding of the roles of key ecological drivers of the region's natural systems. Information in existing databases on selected CEs must be adequate to permit us to characterize the current condition of these resources. For example, thousands of species are present in the region, but for most of them existing documentation would not permit us to account for all aspects of their geographic range, life histories, and responses to CAs. The CEs must also be useful in depicting the effects of CAs on these resources (i.e., it must be possible to clearly state what the potential change in status of these resources would be in terms of trends, magnitude, or scope of change, and likelihood of change over the required time horizons).

To ensure that our suite of CEs adequately represents the ecoregion's resources of conservation concern, we will use the "coarse-filter/fine-filter" approach recommended in the SOW. This approach focuses on

ecosystem representation, complemented by a limited subset of focal species assemblages and individual species. The objective of this dual approach is to include the ecosystems and ecological functions (coarse-filter) that are required for biotic integrity, while also providing for biodiversity and species of concern (fine-filter).

4.2 Conservation Elements

4.2.1 Coarse-Filter Ecological Systems

4.2.1.1 Coarse-filter Selection

Coarse-filter CEs will include all of the major ecosystem types that occur within the assessment area, and should represent all of the predominant natural ecosystem functions and services in the ecoregion. The desired outcome of coarse-filter selection is to provide coverage for the vast majority of species that occur in the ecoregion. The AMT provided a list of coarse-filter CEs to be used for the NBR in the SOW. These are presented in Table 4-1.

The selected suite of coarse-filter CEs encompasses the habitat requirements of most characteristic native species, and ecological functions and values in the region. As explained below, careful selection of fine-filter species as CEs will ensure that resources of particular interest to the AMT and local agency managers that may not be obvious within coarse-filter CEs are included in the REA.

4.2.2 Fine-filter Conservation Elements

4.2.2.1 Introduction

Applying a finer filter to the ecoregion focuses on native wildlife, fish, or plant species and species assemblages that may not be adequately represented by coarse-filter systems and includes rare and landscape species. Species assemblages are groups of species whose habitats and distribution are sufficiently similar and who may be co-dependent that they may be treated as a single unit of analysis. Landscape species are defined by their use of large, ecologically diverse areas and their impacts on the structure and function of natural ecosystems (Sanderson et al. 2002). Selecting these species involves considering whether they have habitat requirements that are adequately represented by the coarse-filter elements, or whether they are likely to be overlooked in the assessment, for example, because of distinctive habitat requirements or particular vulnerability to certain CAs. In other words, species that are strongly associated with a major coarse-filter CE may be adequately represented by assessment of that CE. Other species, however, should be addressed as individual elements because they have more specific habitat requirements, or they range over wide areas that encompass more than one coarse-filter CE, such as landscape species.

4.2.2.2 Selection Approach

Our selection approach involved evaluating the AMT's initial list of native fish, wildlife, and plants of conservation concern (as stated in the SOW) for consideration as fine-filter CEs, recognizing that the AMT and agency partners had given considerable thought to the species CEs in this ecoregion. We then considered additional species that have been identified in the literature as widely distributed across the landscape, vulnerable to the CAs that will be evaluated in the REA, and whose habitat needs may be inadequately represented by the coarse-filter CEs. For example, some landscape species occupy or require habitat within more than one ecosystem. Our review included federal, state, and agency lists of species of conservation concern, including:

Table 4-1. Coarse-filter Conservation Elements Chosen for the NBR Ecoregion

CE	Rationale	Action
Regionally Important Terrestrial Ecological Features, Functions, and Services (e.g., large areas of native vegetation providing important cover, fiber, and forage; habitat strongholds and corridors; upland areas important for water quality or water supply; areas capable of significant carbon sequestration (CS); etc.)		
Sagebrush	• Covered in pilot REA. • Ecoregional significance. • Need to caveat results, given inaccuracies of available Gap Analysis Program (GAP), Rapid Ecoregional Gap Analysis Program (ReGAP), and Landfire vegetation coverages for these ecosystems. • Carbon sequestration	**Cover in this REA.**
Salt desert shrub	• Covered in pilot REA. • Ecoregional significance. • Need to caveat results, given inaccuracies of available GAP, ReGAP, and Landfire vegetation coverages for these ecosystems. • Carbon sequestration	**Cover in this REA.**
Utah Juniper	• Covered in pilot REA. • Ecoregional significance. • Need to caveat results, given inaccuracies of available GAP, ReGAP, and Landfire vegetation coverages for these ecosystems. • Include expansion into shrub-steppe communities • Carbon sequestration	**Cover in this REA.** Distinguish between areas dominated by Utah juniper and western juniper.
Western Juniper	• Covered in pilot REA. • Ecoregional significance. • Need to caveat results, given inaccuracies of available GAP, ReGAP, and Landfire vegetation coverages for these ecosystems. • Include expansion into shrub-steppe communities • Carbon sequestration	**Cover in this REA.** Distinguish between areas dominated by Utah juniper and western juniper.
Aspen	• Need to caveat results, given inaccuracies of available GAP, ReGAP, and Landfire vegetation coverages for these ecosystems. • Much of Aspen-dominated acreage would be in ecoregion buffers upslope from BLM-managed lands. • Carbon sequestration	**Cover in this REA.**
Pinyon	• Indirectly covered in pilot REA (as P-J). • Need to caveat results, given inaccuracies of available GAP, ReGAP, and Landfire vegetation coverages for these ecosystems.	**Not covered in REA.** **AMT guidance: Pinyon communities are rare in this ecoregion.**

Table 4-1. Coarse-filter Conservation Elements Chosen for the NBR Ecoregion

CE	Rationale	Action
Regionally Important Terrestrial Ecological Features, Functions, and Services (continued)		
Other conifer	• Ecoregion-wide significance. • Douglas-fir and subalpine forests are present in the mountains under U.S. Forest Service (USFS) management. With notable exceptions, these tend to be mostly in ecoregion buffers upslope and upstream from BLM lands. • Fire is most likely potential factor potentially originating on BLM lands that could affect these forests, which would generally be at higher elevations and upstream from BLM lands. Healthy cover in these upslope communities is important to maintaining water quality and streamflow to BLM lands below the forest and may be important in conveying fire. Climate change has the potential to cause substantial elevational shifts in boundaries between montane communities. • Carbon sequestration	**Cover in this REA.**
Vulnerable soils	• Sparsely vegetated shrublands where cryptogamic crusts stabilize soils are vulnerable to trampling, vehicular traffic, and subsequent erosion. • Plowed soils and shrubland/grassland soils after wildland fire are vulnerable to wind and water erosion. • Ecoregional importance of edaphic endemism, such as slickspot soils • Need direction from AMT.	**Cover in this REA** Use consistent approach with Central Basin and Range
Caves	• Ecoregional significance? Possibly important as hibernacula for bats (along with abandoned mines), for endemic cave organisms, and for recreation. • Little interaction with most CAs. Is there a clear management handle for BLM? • Lack of data availability may make this impractical to address at an ecoregional scale.	**Not Covered in REA** AMT Guidance: Consider as step-down issue (e.g. avoid during transmission line siting to protect bats)
Carbon sequestration (CS) potential	• CS potential is related to CAs including climate change and wildland fire but data problems may preclude analysis or make analysis impractical. • Sequestration potential is related to the type of vegetation and the age of the stand (CS depends on biomass accretion rates, longevity of plants, and frequency of wildland fire). Consult recent national map prepared by Woods Hole Research Center (WHRC). • Sequestration potential is also a property of the chemical and organic composition of soils.	**Not covered in this REA.** AMT guidance: Embed carbon sequestration as a function of coarse filter plant community CEs
Areas of high biodiversity	• Uneven data sets related to non-biological issues such as differences in accessibility of lands for species surveys, state-to-state differences in number of species considered sensitive, and need to normalize data for size of reporting unit create problems in objectively assessing this important characteristic. • Available data appear to be inadequate to carry forward on an ecoregional basis despite the importance of high biodiversity. Analysis at the state level is of interest to AMT members. • Protected areas (below) may provide a partial surrogate.	**Cover in this REA.** BLM to provide data.
Livestock grazing allotments	• Not in task order • Economically important in the ecoregion. • Provides open lands for other biological resources including wildlife CEs, wild horses and burros.	**Cover in this REA.**

Table 4-1. Coarse-filter Conservation Elements Chosen for the NBR Ecoregion

CE	Rationale	Action
Regionally Important Aquatic Ecological Features, Functions, and Services (e.g., habitat strongholds and corridors; wetland, riparian, and other aquatic areas important for water quality, water supply, stream bank stability, flood control, and similar purposes)		
Perennial streams/rivers	• Data challenges due to small dimensions of these key features.	**Cover in this REA.**
Springs/seeps	• Data challenges due to small dimensions of these key features will cause underreporting of these systems, whose high ecological significance is disproportionate to their small size. • Need to caveat the results.	**Cover in this REA.**
Wetlands	• Data challenges due to small dimensions of these key features will cause underreporting of these systems whose high ecological significance disproportionate to their small size. • Need to caveat the results. • Consider including open water habitat, < 5 acres with the wetland CE. • This would enable extensive shallow lakes that are important to wildlife to be accounted for and would help address the underrepresentation of wetland habitats due to their small size. • Closely linked to climate/water use changes	**Cover in this REA.** Use National Wetland Inventory (NWI) data as one source.
Open water habitat	• Analyze > 5-acre habitats in this CE. Not included in request for proposal (RFP).	**Cover in this REA.**
Cottonwood galleries	• Data challenges due to small dimensions of these key features whose high ecological significance is disproportionate to their small areal extent (many are less than a pixel in width). • Need to caveat the results.	**Cover in this REA.**
Riparian habitat	• Data challenges due to small dimensions of these key features (ditto above).	**Cover in this REA**
Groundwater	• Linkage to surface waters (springs, seeps) or specific vegetation features constitutes the importance of this in an REA. • Likely to have difficulty with data uniformity and availability making it impractical to address on an ecoregional scale.	**Cover in this REA.** Use Phase V MQs from CBR
Specially Designated Areas of Ecological Value		
Specially Designated Areas of Ecological Value (all categories)	• Use uniform analysis approach for CAs in each type of SDA, but identify areas where direct impacts from development CAs or other CAs are influenced by management rules and policies. Consider treating SDAs as a special overlay on other coarse filter CEs where level of protection may preclude certain CE effects. • Include other protected area types (NWRs, National Natural Landmarks, RNAs, state-protected lands such as WMAs, LTER sites, State Land Trust or Conservancy Lands, other protected lands) from PAD database.	**Cover the individual types of areas listed below as CEs in this REA**

Table 4-1. Coarse-filter Conservation Elements Chosen for the NBR Ecoregion

CE	Rationale	Action
Specially Designated Areas of Ecological Value (continued)		
Areas of Critical Environmental Concern	• Management emphasis for resource protection. • Linkages to CAs including wildland fire, climate change are important because these CAs may affect the ability of the ACEC to support the resources for which the ACECs were originally established.	**Cover in this REA.**
Historic Districts	• Carry forward in REA if certain protected historic districts support substantial habitat or other attributes relevant to REA	**Cover in this REA** (to the extent that the historic districts have high natural resource values).
National Monuments	• Management for resource protection. • Linkages to CAs including wildland fire, climate change are important because these CAs may affect the ability of the protected area to support the resources they currently protect.	**Cover in this REA** **(**unless they lack high natural resource values)
National Conservation Areas (NCA)	• Management emphasis for resource protection (e.g., Snake River Birds of Prey NCA). • Linkages to CAs including wildland fire, climate change are important as described above.	**Cover in this REA.**
State Parks	• Management for resource protection. • Linkages to CAs including wildland fire, climate change are important as described above.	**Cover in this REA** (to the extent that they have high natural resource values).
Wild and Scenic Rivers	• Wild and Scenic River designation provides resource protection (e.g., Owyhee River). • Linkages to CAs including wildland fire, climate change are important as described above.	**Cover in this REA.**
Study Rivers (candidates for Wild and Scenic status)	• Study Rivers are candidates for Wild and Scenic status and need to be managed for resource protection consistent with Wild and Scenic status until a decision is reached.	**Cover in this REA**
Wilderness Areas	• Management emphasis provides resource protection. • Linkages to CAs including wildland fire, climate change are important as described above.	**Cover in this REA.**
Wilderness Study Areas	• Management emphasis provides temporary resource protection until a decision is reached. • Linkages to CAs including wildland fire, climate change are important as described above.	**Cover in this REA.**
Other specially designated areas of ecological value	• NWRs, National Natural Landmarks, RNAs, state-protected lands such as WMAs, LTER sites, State Land Trust or Conservancy Lands, other protected lands from PAD database	**Cover in this REA** (to the extent data are available and areas have substantial resource values).
Wild Horse and Burro Herd Management Areas	• Pursuant to the Wild and Free Roaming Horses and Burros Act of 1971, BLM is required to protect, manage and control Wild Horses and Burros in designated Herd Management Areas. • Linkages to CAs including vegetation change, wildland fire, climate change are important as described above.	**Cover in this REA.** (Develop very focused MQs).

1. Species listed as federally endangered, threatened, or candidate status;
2. G1-G3 (critically imperiled to vulnerable) ranked species;
3. Species listed by applicable SWAPs with habitat in these ecoregions; and
4. BLM sensitive species.

At Workshop 1, SAIC presented recommendations on the initial set of species and our suggested additional species to the AMT for review with the ultimate goal of selecting the group of fine-filter CEs to be carried through the REA process. Fine-filter species CEs that were presented to the AMT, a rationale for their inclusion in the REA, and AMT direction for each proposed CE are presented in Table 4.2.

4.2.2.3 Final Fine-filter CE Selections

The primary criterion for selecting fine-filter CEs is that they should be native species of regional management concern. Other guidance included focusing on species for which management by one BLM field office may affect management concerns of other BLM field offices (i.e., these species have trans-boundary management issues). CE species are not only surrogates for other species of concern, they should be of concern themselves. The following additional criteria reflect AMT workshop guidance and were used to refine the list of candidate fine-filter CEs:

- Appropriateness of the CE for answering management questions (e.g., vulnerability to CAs that can be readily measured or categorized in the REA);
- Strong association with one or more coarse-filter CEs (e.g., species that require sagebrush habitat);
- Association with a species group or assemblage being carried forward as a CE (e.g., fish species included in the cold water fish species assemblage); and
- Lack of consensus among the AMT to carry the species forward as a fine-filter CE also affected fine-filter CE selections. Discussion points for not carrying a species forward included:
    - insufficient ecological knowledge;
    - not a landscape species;
    - not particularly susceptible to CAs covered in this REA; and/or
    - not of regional significance or strong agency concern throughout the ecoregion.

These criteria were used to refine the candidate list of fine-filter CEs in the SOW that will be carried forward in subsequent tasks of this REA. Table 4-2 provides the rationale and AMT guidance on including or eliminating CEs from the preliminary list of CEs. In some cases, for example, cold water fish species, individual species were combined into assemblages following discussion with AMT fisheries experts. The AMT also provided guidance on emphasizing life cycle stages for certain CEs based on their vulnerability to CAs at those times, (e.g., migratory corridors for golden eagle).

Table 4-2. Fine-Filter Conservation Elements Chosen for the NBR Ecoregion

CE	Rationale	Action
Mule Deer	• Game species of ecoregional importance. Covered in pilot REA[1]. Focus on winter range. • Include year-round crucial habitat (i.e., fawning and summer range) in addition to winter range.	**Cover in this REA**
Greater Sage-grouse	• Ecoregional importance. Covered in pilot REA. Ongoing parallel efforts by others.	**Cover in this REA** Attempt to assimilate WGA crucial habitat data with BLM priority habitat and general habitat, (as defined by Instructional Memo), and states' habitat mapping.
Golden Eagle	• Knowing occurrence and nesting areas is important to management. • Include migratory corridors, which are of interest due to wind energy development.	**Cover in this REA**
Bald Eagle	• Large wintering populations; scattered nesting. • Numbers in the ecoregion peak in January-February with influx of birds that breed in the north. • Focus analysis on wintering areas.	**Cover in this REA**
Pygmy Rabbit	• Associated with sagebrush-steppe habitat. • Potential to use soils types and topography to identify habitat • Pygmy rabbit distribution is centered on the NBR ecoregion. Isolated DPS in Washington listed under ESA.	**Cover in this REA.** There is mapping of suitable habitat, but occurrence data are probably sparse.
Sagebrush Obligates	• Is mapped data for sagebrush reliable enough to serve as a coarse filter? Mapped sagebrush, even if recognition of the dominant species is reliable, may not distinguish between different understories and associated species sufficiently to be valuable as a predictor of presence/absence of sagebrush obligate species. • Consider viewing this as a species assemblage including sage-grouse, pygmy rabbit, others. • No species assemblage identified; some wildlife and plant species are tied to different sagebrush types.	**Not covered in this REA as fine-filter species CE.** Sagebrush communities will be used as coarse filter for sagebrush obligate species other than pygmy rabbit and greater sage-grouse, which are treated as individual fine filter CEs. Tim Bottomley and Don Major will consider how to achieve consistency with CBR for this CE. Key issue is concern about disappearing sagebrush as a result of many factors including fire/cheatgrass invasion.
Bighorn Sheep	• Native subspecies has very patchy distribution in ecoregion. • California bighorn sheep subspecies has been introduced to portions of Idaho (not native to this area).	**Cover in this REA.** Include all subspecies, as they hybridize.
Pronghorn	SAIC recommended that American pronghorn be considered for addition to the REA: • Characteristic species of ecoregional significance • Game species	**Cover in this REA**
Bull Trout (*Salvelinus confluentus*)	• See below	**Cover in this REA** Include critical habitat, but evaluate separately from other coldwater fishes.

Table 4-2. Fine-Filter Conservation Elements Chosen for the NBR Ecoregion

CE	Rationale	Action
Northern Leatherside Chub (*Snyderichthys copei*)	Characteristic of quality habitats in the Snake River drainage. Location of "pure populations" versus introduced occurrences is unclear. Former candidate species -- listing recently determined as not warranted (October, 2011).	**Not Covered in this REA** Not likely to be listed and its range is very limited. AMT guidance: Omit from this REA.
Warm Water Fish Assemblage	• Baseline data and management monitoring/plans/actions available are unlikely to be sufficient for native warm water species so that status and population trends within the ecoregion can be assessed. • If carried forward, assemblage could include Klamath smallscale sucker (*Catostomus rimiculus*), speckled dace (*Rhinichthys osculus*), peamouth chub (*Mylocheilus caurinus*), Utah sucker (*Catostomus ardens*), species for with some data are available for some parts of range. • Aquatic habitat types treated below may serve as a coarse filter.	**Not Covered in this REA** Some of proposed species widely distributed, with generalized habitats, but less sensitive to CAs, and adequate distribution mapping is probably not available. AMT guidance: Omit from this REA.
Yellowstone Cutthroat Trout (*Oncorhynchus clarkii bouvieri*)	• See below	**Cover in this REA** AMT guidance: Treat Yellowstone cutthroat trout, Lahontan cutthroat trout, redband trout, mountain whitefish (*Prosopium williamsoni*) as a coldwater fish assemblage.
Lahontan Cutthroat Trout	Added by AMT: • Unique high temperature (>27°C) tolerance (http://www.fws.gov/oregonfwo/Species/Data/LahontanCutthroatTrout/) • ESA-listed as threatened • Sensitive to habitat degradation. • Completed 1995 recovery plan available: http://ecos.fws.gov/speciesProfile/profile/speciesProfile.action?spcode=E00Y	**Cover in this REA** AMT guidance: Treat Yellowstone cutthroat trout, Lahontan cutthroat trout, redband trout, and mountain whitefish as a coldwater fish assemblage.
Cold Water Fish Assemblage	• Eliminate anadromous species (Chinook [*Oncorhynchus tshawytscha*], sockeye [*Oncorhynchus nerka*], summer steelhead) as they do not occur upstream of Hells Canyon Dam. Drop Pacific lamprey (*Lampetra tridentata*) along with other anadromous spp. Combined the species identified in the column to the right are expected to have sufficient baseline data and management monitoring/plans/actions that status, population trends, and likely response to CAs within the ecoregion can be assessed.	**Cover in this REA** AMT guidance: Treat Yellowstone cutthroat trout, Lahontan cutthroat trout, redband trout, and mountain whitefish as a coldwater fish assemblage.
White Sturgeon	• White sturgeon are present within the ecoregion--landlocked in the upper Columbia River drainage including the Snake River. • Although not present in Nevada, sturgeon are widespread in the Snake River and of landscape-level concern despite small population sizes. • The population in the Kootenai drainage (north of the ecoregion) is listed as endangered and has very low resilience, with a minimum population doubling time more than 14 years. As a result, their vulnerability is considered very high.	**Cover in this REA**

Table 4-2. Fine-Filter Conservation Elements Chosen for the NBR Ecoregion

CE	Rationale	Action
Bats	• Data deficiencies make it impractical to address bats on an ecoregional scale.	**Cover in this REA** Subject to Bat Grid, mine closure, and other data availability.
Slickspot Pepperweed (*Lepidium papilliferum*)	• Critical Habitat proposed in Idaho (four counties). Found only in Snake River Plain (Boise Foothills and Owyhee Plateau). Inhabits microsites within sagebrush ecosystem. • Consider feasibility of carrying this forward with sagebrush obligate species assemblage.	**Not Covered in REA** Not a landscape species but slickspot soils may be captured in vulnerable soils data. AMT guidance: Omit as a CE, consider in step-down analyses
Spotted Frog	• Widespread species sensitive to factors related to disease, climate change, water use, introduced species, and isolated habitats. • Isolated populations are present in the Northern Great Basin • Locality records may be good indicator of perennial aquatic habitats with associated wetlands. • May respond to restoration of certain habitats. • Threatened by loss/degradation of wetland habitats and predation by non-native bullfrogs.	**Cover in this REA.**
Note: 1. Unless noted, species/resources on this list are not covered in the Pilot REA.		

5 Change Agents

5.1 Introduction

Successful completion of this Rapid Ecoregional Assessment (REA) will in part be based on a sound understanding of the ecoregional or landscape-scale change agents (CAs) and their potential impact on ecological values throughout this ecoregion. CAs are natural or anthropogenic disturbances that influence the current and future status of conservation elements (CEs). The initial CAs for this ecoregion were outlined by the Assessment Management Team (AMT) in the statement of work (SOW). The REA process focuses on regionally significant CAs that operate and impact on large scales, not on a site-by-site basis. Science Applications International Corporation (SAIC) included these CAs and consulted sources such as state wildlife action plans (SWAPs), existing literature on threats, and regional experts to develop the CAs described below (Table 5-1).

Historically, a variety of CAs in the Northern Basin and Range and Snake River Plain Ecoregion (NBR) included natural fire cycles, mining, hydrologic alteration, and grazing and other agricultural uses. More recently, the suppression of fire, urban development, energy resource development and infrastructure, recreation in natural areas, non-native species invasions, and the changes in climate patterns have played larger roles.

5.2 Change Agent Categories

For the purpose of this analysis, CAs were divided into five categories (wildfire; climate change; development; invasive species, and livestock grazing) (Table 5-1). Several of these categories were subsequently divided into subcategories, as shown below, when the details of how a CA affects CEs are important to explore. As the SAIC Team refines the data evaluation, CAs important to the ecoregion will be addressed in more detailed analysis and conceptual models. For example, specific invasive species will be selected that impact the CEs selected for this REA.

5.2.1 Fire

Human-influenced changes in the ecoregion have affected fire frequency, severity, and seasonality. Additional effects are expected in the future from climate change influences as well as a new awareness of allowing fires to burn, utilizing controlled burns, and new sources of ignition (e.g., more people moving into the Wildland Urban Interface [WUI]) expanding development into forest edges). All of these affect the ecoregion's biota, making it important to identify areas with the greatest present and potential departure from historical fire regimes. In addition, connectivity of fire-prone areas with aquatic features will also be evaluated. In many areas of the NBR ecoregion, fire frequency has declined due to fire suppression and road networks acting as firebreaks.

Some CE plant assemblages, including aspen, sagebrush, and riparian gallery forests, are not maintained by fire and may be degraded by it. Certain sagebrush communities have poor adaptations to recover from high frequency fire and are vulnerable to being replaced by cheatgrass under conditions of high fire frequency, resulting in a flashy annual grassland community maintained by fire. The presence of invasive species, such as cheatgrass, in these and other arid lands ecoregions has made fire more problematic in vegetation that historically experienced occasional to periodic burning. In the more xeric sagebrush and salt-desert shrub systems, the primary woody species are not fire-adapted or fire-dependent. In the most fuel-limited, (i.e., driest) systems, fire may have almost never occurred. In other areas, fire may have occasionally burned these ecosystems historically (e.g., every few hundred years or more on average), especially after periods of significantly above-average moisture that may have increased fuel loads. These rare disturbance events *could be* considered ecologically beneficial at landscape scales, given the resulting mosaic of shrub and herbaceous dominated communities. However, this does not mean these

Table 5-1. Refinement of Change Agents for the NBR

Change Agent	Rationale	AMT Conclusion
Wildland Fire	Covered in pilot REA	**Cover in this REA.** Example: • Consider evaluating prescribed fire in the context of Range Developments/Land Treatments CA, (subject to data availability).
Climate Change		**Cover in this REA.**
Development:		
Energy. Note: some of the CAs in this category, e.g. solar energy, may not be significant developments (current or future) but will be carried through subsequent REA tasks in order to evaluate datasets.		
Oil & Gas		**Cover in this REA.**
Wind Energy		**Cover in this REA.**
Geothermal Energy		**Cover in this REA.**
Solar Energy	Although the National Renewable Energy Laboratory (NREL) maps indicate moderate potential is present in the ecoregion, large-footprint solar development may be limited due to distance from load centers and transmission costs.	**Cover in this REA**
Pumped Storage		**Cover in REA.**
Non-transportation Linear Features	Transmission CAs would cover overhead transmission, subsurface transmission, and associated infrastructure.	**Cover in this REA.** Examples: • Service roads (for pipelines, transmission lines,) • Pipelines (gas, oil) • Communication lines • Power transmission lines • Cell towers
Urban	Separate treatment will distinguish habitat loss related to large development footprint vs. habitat degradation due to indirect proximity effects around small dispersed development. Exurban development is noted as having small footprint but big impact due to corridors, fragmentation, etc. Ski resort areas, golf-centric developments cause induced growth of second homes.	**Cover in this REA.** Examples: • Dense Urban/Industrial • Exurban (Dispersed)

Table 5-1. Refinement of Change Agents for the NBR

Change Agent	Rationale	AMT Conclusion
Mining	Abandoned mines and mining waste can be a source of pollutants many years after mines have been abandoned. Infrastructure for mines?	**Cover in this REA** Examples: • active mines • abandoned mines • mining waste management • gravel pits
Transportation	Include road categories based on traffic volume or other designation, and railroads.	**Cover in this REA**
Recreation	Proposed divisions recognize recreational uses with a discernable footprint vs. recreation uses that involve motorized or non-motorized transportation, off-road uses, and fishing/boating.	**Cover in this REA** Examples: • Developed Areas (Ski resorts) • Motorized dispersed (OHV) • Non-motorized dispersed • Aquatic recreation
Agriculture	Cropland would include irrigated and dryland cropland, and water quality effects. Also of concern are the use of concentrated animal feeding operations (CAFOs).	**Cover in this REA with caveats.** Examples: • Cropland (including contaminants such as run-off pesticides, herbicides, and fertilizers) • Pastureland and CAFO issues (including animal treatment, run-off, and odors)
Hydro Diversions	Proposed diversions address surface and subsurface withdrawal and associated infrastructure (pipelines, ditches, canals, other conveyances).	**Cover in this REA** Examples: • Groundwater withdrawal • Surface water withdrawal • Water transmission (ditches, canals, etc.)
Hydro Impoundments	Effects of linear infrastructure likely to be different from impoundment effects. Pumped storage for wind energy mentioned.	**Cover in this REA** Examples: • Hydropower impoundments • Irrigation impoundments • Supporting infrastructure (roads and pipelines)

Table 5-1. Refinement of Change Agents for the NBR

Change Agent	Rationale	AMT Conclusion
Military and other Federal Land Managers	Evaluate whether military and Department of Energy (DOE) uses of these ecoregions are significant agents of change. DOE facility (Idaho National Energy Lab) is a significant feature in the upper Snake River Plain. Department of Defense (DOD) land ownership and future expansion of existing facilities (Mountain Home Air Force Base [AFB] and Sierra Army Depot), may not be significant acreage. Evaluate existing and future military use of public land, if data available.	**Cover in this REA.** Example: • Military Plans and Operation Use Areas (Western Regional Partnership) • DOE facility and land use effects
Rangeland Treatments	Intended to cover programs for range management and improvement practices. More information is needed on programs on public and private land.	**Cover in this REA** Examples: • traditional livestock management tools and land treatments including seeding, fences, and livestock water sources • fuel treatment • mechanical treatment of vegetation • prescribed fire
Invasives:		
Cheatgrass	Covered in pilot REA; data and model(s) assumed to be available.	**Cover in this REA**
Medusahead		**Cover in this REA** (subject to data availability**)**
Other Exotic Grasses		**Cover in this REA** AMT guidance: Group cheatgrass, medusahead, other invasive grasses (subject to data availability)
Exotic Forbs		**Cover in this REA** (subject to data availability)
Russian olive, tamarisk and other Invasive Woody Plants	Potential habitat and predicted range expansion with climate change predict that tamarisk may be an upcoming issue.	**Recommended by U.S. Geological Survey (USGS) reviewer. Cover in this REA.**
Aquatic Invasives		**Cover in this REA** (subject to data availability)
Grazing: Livestock	Address narrowly focused management questions, e.g., evaluate sensitivity of areas that are subject to certain constraints such as low precipitation to grazing pressure in concert with climate change predictions	**Cover in this REA**
Wild Horses & Burros	Treatment as a CA refers to grazing impacts. Data availability? Link to Wild Horse and Burro Management Areas.	**Cover in this REA** Will be considered as part of larger grazing evaluation.

communities were fire-dependent, or that burning these arid systems more often as a management tool will "restore" them. In this age of invasive species, changing climate, and the already reduced extent of these natural communities, such actions could do more harm than good. Although fire was a natural disturbance in sagebrush systems, no process that requires fire to be sustained or maintained has been identified. There also is no literature support for the idea that shrubs will totally fill in an area and crowd out all understory in the absence of unusual grazing or browsing pressures. Instead, the long-term studies demonstrate that some stable community gets established relative to climate and soils, and that other processes contribute to shrub die-off and replacement.

5.2.2 Climate Change

Global climate change has the potential to directly and indirectly affect organisms and communities by changing the locations where species and communities can exist. Climate change may include changes in precipitation amounts, distribution, and seasonality; frequency and duration of drought episodes; and temperature regimes. Climate change is also likely to affect species and communities by affecting the frequency and distribution of fire and threats from invasive species, disease, and insect outbreaks. Although there is a view that climate change toward warmer-drier conditions, for example, would cause communities to move northward (or, in some localized instances, to higher elevations), species are likely to respond individually, as they have in past geologic epochs. Additionally, human-caused barriers to movement may affect the ability of species or communities to move in response to changing conditions or become genetically isolated. Similarly, potential climate change effects on carbon sequestration and water supply or quality may need to be considered.

5.2.3 Development

5.2.3.1 Energy Development

Analysis of development CAs will focus on a number of human uses of the landscape listed in Table 5.1. Energy exploration and development, both fossil fuel and renewable, remain a large and important economic factor for this ecoregion and usually occur in areas that are isolated from existing urban/industrial infrastructure. Thus energy-related development requires supporting linear features such as new roads, pipelines, and transmission lines. Because of the potential for habitat loss and fragmentation, disturbance to wildlife, and establishment of invasive species following construction of facilities and associated infrastructure, particular attention will be focused on planned, permitted, and leased development, and proposed or projected development under reasonably foreseeable scenarios.

5.2.3.2 Urban Development and Recreation

Similarly, urban development displaces and fragments native habitats, creates adverse disturbance-related effects on native wildlife, and promotes invasive species. “Exurban development” includes the expansion and change of neighborhoods outside of urban areas into commuter communities and the addition of new communities, often second and vacation homes, into open areas that are bordered by natural ecosystems. Ski resort areas and golf-centric developments cause induced growth of second homes and transportation corridors that fragment and encroach on surrounding natural habitats. Dispersed recreational use of land in the NBR has grown significantly with increased use of off-road vehicles and increased backcountry recreation, resulting in disturbance issues for sensitive wildlife species.

5.2.3.3 Agriculture

The Snake River Plains include a large proportion of irrigated cropland in which potatoes, grain, sugar beets, beans, and alfalfa are the principal crops, in addition to rangeland (see Section 5.2.5). A recent

topic of controversy in the region is the use of CAFOs, especially for dairy cattle, with regard to animal treatment, manure run-off, and odors. Other issues associated with agricultural use of land include wind and water soil erosion, invasion of undesirable plants, and movement of fertilizers and pesticides to surface water and groundwater.

5.2.3.4 Hydrological Uses

Surface water impoundments including dams, diversions, and other water table drawdowns for residential, commercial and industrial uses affect the timing and amounts of downstream flows. This is turn may reduce connectivity and gene flow by affecting passage and survival of fish and other aquatic biota, and curtailing flood scour/deposition events necessary to replenish gravel bars and regenerate cottonwood (*Populus* spp.) and willow (*Salix* spp.) riparian communities. In addition to physical habitat disturbance, groundwater extraction impacts the height and fluctuations of groundwater tables, affecting regeneration of riparian communities and often the presence of surface waters such as seeps, springs, or live stream segments. Lowering groundwater tables can affect sensitive aquatic invertebrate and vertebrate species, as well as plant species and entire habitats dependent on surface water or elevated groundwater tables (e.g., most riparian and wetland species). The health of these aquatic and riparian communities is essential in arid and semi-arid regions for the survival of a great variety of resident and migratory wildlife species. Many listed and sensitive species in the ecoregion utilize riparian habitats for essential life stages such as breeding or migration, and their decline can be tied to the general degradation of water-dependent habitats in the West. Effects on these habitats can also lead to soil destabilization and erosion.

5.2.3.5 Military and Other Federal Land Managers

Evaluation of military activities as a change agent in the NBR ecoregion may include land use and disturbance-related effects of existing facilities, planned expansion of existing facilities and uses of non-DOD public land for training missions. Effects of land management by other Federal agencies will also be evaluated, e.g., the land-use footprint of the DOE's Idaho National Energy Lab located in the upper Snake River Plain.

5.2.3.6 Rangeland Treatments

Some of the traditional rangeland treatments that will be evaluated in this REA as a type of land development activity (separate from grazing effects) are listed in Table 5.1. Altered vegetation communities (e.g., sagebrush suppression) and the presence of fences and water sources have affected the distribution and migration and dispersal corridors of wildlife species. Evaluation of the use of these rangeland treatments and others such as prescribed fire may identify opportunities for habitat management and restoration.

5.2.4 Invasive Species

Expansion of invasive species is associated with human activity, such as development of roads, clearing ground for well pads, addition of pipelines and transmission lines, alteration of fire regimes, and other disturbances in native habitat. Annual grass species such as cheatgrass and medusahead (*Taeniatherum caput-medusae*) have the potential to cause serious ecological effects in terrestrial environments, displacing native bunchgrasses and creating conditions that promote wildfire. In addition, woody, invasive non-native species such as Russian-olive (*Elaeagnus angustifolia*) and tamarisk (*Tamarix* sp.) have spread through riparian areas and continue to threaten areas throughout the NBR ecoregion.

Invasive species with the potential to impact aquatic resources include New Zealand mudsnails (*Potamopyrgus antipodarum*), whirling disease, didymo (*Didymosphenia geminata*), quagga/zebra

mussels (*Dreissena bugensis, D. polymorpha*), Eurasian milfoil (*Myriophyllum spicatum*), Asian clam (*Corbicula fluminea*), and amphibian chytrid fungus (*Batrachochytrium dendrobatidis*).

5.2.5 Livestock, Wildlife, and Wild Horse and Burro Grazing and Management

The AMT made the decision to include management questions and an analysis of the effects of grazing in the NBR REA. This decision recognizes the historic and future importance of grazing as a CA and management tool in the western United States. Since the REA process is a landscape level data-intensive effort utilizing geospatial tools but grazing is managed locally through grazing allotments, the AMT struggled with how best to understand and analyze locally managed but regionally important grazing effects within the framework of the REA. For this ecoregion specifically, it is important to include livestock, wild horse and burro, as well as wildlife grazing effects in the analysis. Specific challenges to evaluating grazing within the REA process include: 1) the availability and consistency of data scaled for the ecoregion is questionable; 2) the historic and current effects on the landscape are ubiquitous in the west; 3) available data may be limited to identified allotments and authorized potential grazing intensity, but may not reflect actual or future use especially in wild horse and burro and wildlife areas; and 4) the management and decision process related to types, intensity, and ecological considerations likely differ across field offices. Nonetheless, because of the undeniable historic and future importance of grazing, the AMT developed a series of grazing-oriented MQs (see Table 3-1) and the AMT determined that grazing was appropriately identified both as a CA and a CE. This is due to the fact that if monitored properly grazing can be managed to improve the health of native rangelands and grasslands, or when mismanaged, can reduce the quality of those lands. Livestock grazing can affect the vegetation community structure and composition, woody plant regeneration, riparian area health, fire fuel availability, wildlife forage amounts, soil stability and compaction, invasive species spread, and many other ecosystems aspects. In addition, livestock rangeland improvements (as discussed in Section 5.2.3.6) such as the addition of fencing, development of springs, and woody plant reduction may have adverse effects on other grazers including wild horses and burros and wildlife habitat availability and access.

Management questions were intentionally developed to be answerable utilizing geospatial data; however, the AMT concluded that at this point in the REA process, MQs should be developed and included independent of the known availability of specific data sets. The AMT noted that although MQs should be quantitatively answerable, the lack of specific data sets should not undermine or preclude the importance of the MQ but serve as a data gap to be identified and data pursued. Finally, the AMT determined that additional "driver" questions, which may be in themselves unanswerable utilizing geospatial data, were important and should be identified in the REA process and qualitatively evaluated. In addition to the MQs listed in Table 3-1, the following questions specific to grazing are included for further consideration:

- Where does livestock and other grazing affect wildlife resources on the landscape such as forage quality and quantity, behavioral/disturbance effects, disease, , migration (fences), predation, soil erosion and compaction, cover/structure?
- Where does grazing affect fire potential across the landscape?
- What areas have been most and least impacted by grazing (temporal and density and habitat measures)?
- Where may grazing be affecting water quality and quantity (streams, diversions, etc.)?

6 Summary

This memorandum documents the work completed under Phase I Task 1, which included the Assessment Management Team (AMT) Workshop 1 and the development of the management questions (MQs), change agents (CAs), and conservation elements (CEs) for the Northern Basin and Range and Snake River Plain Ecoregion (NBR). The AMT established a comprehensive set of MQs, using those initially provided by the Bureau of Land Management (BLM) and updating the list to be consistent with the MQs developed for the adjacent Central Basin and Range ecoregion.

Questions were reviewed to ensure that they could be answered through the geospatial analysis to meet the goals of the Rapid Ecoregional Assessment (REA). However, the AMT recognized that there are CAs and CEs of historic and future importance within the NBR where available data do not exist or the questions are not readily answerable through geospatial analysis. As a result, the known availability of specific data sets necessary to answer a MQ was not a primary factor when developing all of the questions. The AMT expects that some MQs will be treated qualitatively in the final reporting and used to identify potential data needs or future research opportunities. For CEs, proposed candidate lists of coarse and fine-filter resources were discussed with the AMT at the first workshop. These resources included ecosystems, dominant plant species in the principal ecosystems of the region, landscape-level species taken from the BLM statement of work (SOW), Endangered Species Act (ESA) listed species, and state wildlife action plan (SWAP) species.

After direction from the AMT, 28 division level coarse-filter elements were carried forward. Ecological models for these coarse-filter elements will form a major focus for this REA. The AMT also reduced the number of the fine-filter CEs by focusing on species of regional significance.

Finally, CAs were discussed in broad categories including fire, invasive or non-native species, climate change, development, and grazing, and the AMT began the discussion of the stressor processes that they impose on ecoregion resources. Development is further defined in sub-categories, including oil and gas and several types of renewable energy, linear features such as pipelines, urban and exurban, mining, transportation, recreation, hydrological, military, and development associated with agricultural such as croplands, rangeland treatments and improvements. CAs were also considered based on their interactions; for example, effects of climate change on wildfire frequency, severity, and seasonality.

The number and variety of MQs included in this document also indicates that the REA process for this ecoregion will be comprehensive and broad in scope. It will be imperative that the Science Applications International Corporation (SAIC) Team and the AMT maintain focus on landscape-scale applications that are relevant to resources across the ecoregion. Because a wide variety of local, state, federal agencies, stakeholders and non-governmental organizations have substantial interests in the resources of this ecoregion, a clear landscape-scale vision must be maintained throughout the process.

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