West Paradox Land Health Assessment
2008-2009

Uncompahgre Field Office - BLM

Land Health Assessment
West Paradox Area 2008-2009

SUMMARY

This land health assessment evaluated over 70,000 acres of public land. The evaluation resulted in a determination of the acreage meeting Colorado BLM's Rangeland Health Standards, the acreage not meeting, and the nature and location of the problems on the landscape. A small amount of the landscape area was not evaluated due to inaccessibility, or because it was located on ecological sites which were not commonly occurring in the area. The following table and chart show the amount of land meeting or not meeting the Standards.

Acres Meeting Standards 1, 3,& 4	**Acres Not Meeting Standards 1,3,& 4**	**Acres Unknown Or N/A**
66,459 (94%)	2,069 (3%)	2,118 (3%)
Stream Miles Meeting Standards 2&5	**Stream Miles Not Meeting Standards 2&5**	**Stream Miles Unknown or N/A**
25.7 (78%)	7.0 (22%)	0

In order to make the above determination, the West Paradox Area was first rated according to each of the five Rangeland Health Standards separately. The following table better indicates the general nature of problems in the assessment area.

Standard	**Meeting**	**Meeting With Problem Areas**	**Not Meeting**	**Unknown or N/A**
Standard 1-Soils (acres)	33,355 (47%)	35,173 (50%)	0	2,118 (3%)
Standard 2-Riparian (miles) Perennial and intermittent streams	11.2 (64%)	6.4 (36%)	0	0
Standard 3-Healthy Communities (acres)	49,552 (70%)	16,907 (24%)	2,069 (3%)	2,118 (3%)
Standard 4-T&E Species (acres)	61,565 (87%)	6,841 (10%)	122 (0.2%)	2,118 (3%)
Standard 5-Water Quality (miles) All streams	16.1 (49%)	9.7 (30%)	7 (21%)	0

The West Paradox Land Health Assessment should serve as BLM's foundation for managing lands in the unit so that health standards are met. To this end, the results of this assessment will be used in the livestock grazing permit renewal process, for Resource Management Plan revision, and as a basis for Budget and Planning System projects ranging from

travel management to weed control, to prairie dog colony mapping.

Major Land Health Problems

Standard 1 Soils: Soils across nearly half of the area met Standard 1 without any problems. A slightly larger area had some soil problems, but still met Standard 1, while there were no lands which did not meet this standard. Soil erosion was accelerated above natural levels in only few areas as evidenced by isolated occurrences of gully erosion or excessive runoff drainage patterns. A portion of the West Paradox Area is at increased risk of soil erosion because levels of plant basal area and litter are too low to adequately protect the soil surface from erosion, and there is too much bare, exposed soil. The network of old uranium exploration and development roads is also contributing to soil problems.

Standard 2 Riparian Areas: The majority of stream miles fully met this standard, and exhibited healthy riparian vegetation, and normal channel morphology and hydrologic processes. Around 36% of streams had some riparian vegetation or channel problems ranging from minor to significant, and mostly related to channel and floodplain alterations from flow diversions, flow regulations from upstream dams, and tamarisk.

Standard 3 Healthy Native Communities: The majority of areas (70%) fully met this standard. A little under a quarter of the unit had minor problems, and about 3% of the unit had significant problems. Primary problems included low levels of cool and warm season grasses and perennial forbs in many areas. Low shrub vigor was a problem in some parts of the unit, and there were isolated problems with exotic plants. Problems with the existing vegetation mosaic are present in some parts of the unit as well.

Standard 4 Special Status Species: Nearly 90% of the upland areas met this standard, and 10% met with problems. Less than one percent of the area did not meet this standard. Common habitat problems included weed and exotic plant cover, low cover of perennial vegetation, and poor vigor of native shrubs. There was inadequate data for some sensitive species—particularly animals--and recommendations are made to address this data gap.

Standard 5 Water Quality: About half of the streams and drainages in the West Paradox Area fully met this standard. The remaining stream segments either met this standard with problems or failed to meet it because the surrounding watersheds had multiple problems with high levels of bare soil and poor vegetation cover. Such watersheds are vulnerable to accelerated erosion and associated sedimentation of waterways, which may ultimately violate Colorado Clean Water laws and regulations. Because of the impact that roads have on hydrology and the additional bare ground associated with roads, watersheds which contained the network of old uranium exploration and development roads were also rated as having problems.

Recommendations (note that these are paraphrased from the detailed recommendations made at the end of this report.)

Standard 1 Soils

Implement grazing practices that leave more litter on the soil surface, prevent grazing on regrowth by limiting time of use to 2 weeks or less, and minimize instances where livestock graze the same areas in both the spring and fall seasons. Provide for occasional, year-long rest.

Develop a complete road map, use GIS to identify road-caused soil loss, and use to direct road maintenance and rehab areas so that road and travel related erosion is reduced. Complete RMP

amendment to limit travel to existing routes. Pursue route designation to further limit road-related damage to soils.

Reduce erosion by identifying and maintaining or decommissioning eroding range and watershed projects.

Re-introduce fire or simulate its effects on some sites that are losing herbaceous vegetation cover so that communities with more herbaceous plants and higher plant basal area can be established. Reseed erosion-prone disturbances such as natural fires.

Investigate cheatgrass control options, experiment with different methods.

Implement monitoring system that will address trends in soils indicators.

Standard 2 Riparian

Acquire updated instream flow and water rights map. Identify stream segments still needing protection. Promote instream flow protection and gages in Rights of Ways stipulations. Develop instream flow recommendations to ensure all perennial and intermittent streams have some flow protected.

Continue and increase weed management in riparian zones, work in coordination with our partners, and follow strategic weed management plans for efficient use of weed control resources.

Reduce grazing use on native riparian woody species to 30%. Limit livestock utilization of woody riparian plant communities during the fall and winter periods.

Implement a monitoring system that will address trends in riparian indicators.

Standard 3 Native Plant and Animal Communities

Implement grazing practices that improve perennial grass, cool season grass and forb cover by limiting time of use to 2 weeks during the active growing season, minimize instances where livestock graze the same areas in both spring and fall seasons, and provide for occasional, year-long rest.

Continue support of the native seed development project. Whenever possible, use seeds from this project to reseed fires and similar disturbances with native, adapted species where threat of weed invasion is likely, or the native community is depleted.

Improve perennial grass, cool season grass and forb cover, shrub vigor and vegetation mosaic by reintroducing fire, or simulating its effect consistent with the mosaic objectives in the UFO Fire Management Plan.

Increase knowledge of small mammals, herptiles, birds, and predators, their habitat needs and the existing condition of their habitats.

Support neotropical migratory birds by improving and maintaining riparian and oakbrush habitat, supporting the Breeding Bird Survey, and following best management practices.

Work with the Colorado Division of Wildlife through their Habitat Partnership Program and private landowners (individually and through Natural Resource Conservation Service) to encourage participation in habitat improvement programs.

Increase weed management activities across the unit; work in coordination with our partners, follow and expand existing strategic weed management plans. Improve funding for weed control from uses which contribute to the weed problem.

Restore seriously degraded plant communities.

Revise the Resource Management Plan to include protections or special designations for CNHP, TNC or SREP Potential Conservation Areas, biodiversity conservation areas, remnant or relic sites, or wildlife movement corridors.

Develop complete road map, use GIS to identify road-related habitat and weed problems, and use to direct road maintenance and rehab areas. Complete RMP amendment to limit travel to existing routes. Pursue route designation to further limit road-related damage to vegetation and to control the spread of weeds.

Implement a monitoring system that will address trends in native community indicators.

Standard 4 Special Status Species:

Work with CDOW, CNHP, and other partners to improve information, improve monitoring methodologies and best management practices for special status species in the area

Continue to assess the potential for increasing the amount of sage grouse suitable habitat within the unit (i.e., mesa-top sagebrush parks).

Monitor grazing, recreation, mining, and other impacts on Payson's lupine, sandstone milkvetch, and Paradox breadroot.

Expand baseline data for raptor nests, habitats, and territories.

Continue to monitor peregrine falcon eyries and territories.

Monitor/ inventory for hanging garden sensitive species: Eastwood's monkeyflower, Kachina daisy, etc.

Consider amending the San Juan/San Miguel Resource Management Plan with special designations for CNHP, TNC or SREP Potential Conservation Areas, biodiversity conservation areas or wildlife movement corridors.

Enhance the management of those streams that are functioning at risk in order to improve habitat conditions for sensitive fish species (see recommendations for Standard 2.)

Evaluate sites for possible pinyon-juniper thinning to restore sagebrush parks and healthy understories.

Standard 5 Water Quality:
Improve upland plant basal cover and reduce levels of bare soil through improving management of grazing, travel, etc.

Perform road maintenance and/or closures on roads, trails and range projects identified with drainage or erosion problems.

Reseed burns and consider mulching, rollerchopping, or hydroaxing of burned areas that are prone to accelerated sediment production where existing vegetation or rock is unlikely to stabilize the site, or if the invasion of cheatgrass is a threat.

Continue to assess the condition of stream and riverine environments to identify potential impacts to water quality. Additionally, pursue instream flow recommendations to the state of Colorado on streams needing flow protection to sustain flow-related resource values.

TABLE OF CONTENTS

Introduction and Background ..... ***Pg. 8***

Methods ..... ***Pg. 45***

Results **Standard 1** ..... ***Pg. 47***
Standard 2 ..... ***Pg. 56***
Standard 3 ..... ***Pg. 59***
Standard 4 ..... ***Pg. 82***
Standard 5 ..... ***Pg. 84***

Causative Factors ..... ***Pg. 94***

Recommendations ..... ***Pg. 94***

References ..... ***Pg. 98***

Preparers ..... ***Pg. 100***

Appendix 1 ..... ***Pg. 101***

Causative Factors ..... ***Attachment 1***

Land Health Assessment
West Paradox Area, 2008-2009

INTRODUCTION AND BACKGROUND

Overview

The West Paradox Land Health Assessment (LHA) area is located in western Montrose County in west-central Colorado (Figure 1.1). The LHA area is primarily centered around the northern and western ends of Paradox Valley. Colorado State Highway 90 cuts the LHA unit in half, and State Highway 141 runs along the northeastern boundary of the unit. The unit is bounded to the northwest by Manti-La Sal National Forest. The Colorado-Utah State line forms the boundary on the west, while the Dolores River forms the boundary to the south and southeast (see Figure 1.2). Towns in the area include Bedrock and Paradox. The West Paradox Landscape boundary encompasses just over 90,000 acres, with BLM lands making up the majority of the unit. It is made up of parts of three Level 5 watersheds: Blue Creek, and two unnamed watersheds. The unit was identified in 1998, prior to the directive to base units on fifth order watershed boundaries. However, it is centered in the extreme western part of the Uncompahgre Field office around a large and distinctive landscape feature—Paradox Valley--thereby forming a cohesive landscape "chunk".

The West Paradox unit is the tenth and final landscape unit in the Uncompahgre Field Office to undergo the initial, generalized land health evaluation process. From this point onward, each units will be reevaluated every ten years, using a process based on more specific and specialized sampling procedures as a follow up to the initial evaluation process.

Land Ownership Pattern

The West Paradox Land Health Assessment boundary encompasses about 90,000 acres of which 70,646 acres are public land. These public lands are distributed across the area in large blocks which are separated by the private agricultural lands in the bottom of Paradox Valley and along La Sal Creek. There are also a few isolated patented mining claims scattered within the blocks of BLM land (see Fig.1.2).

BLM Resource Management Plan Guidance

All public lands in the unit are covered by the San Juan/San Miguel Resource Management Plan (RMP, USDI BLM 1985), as shown in Figure 1.3. The area falls into five main RMP management emphasis units. The largest management emphasis unit in the LHA area is for livestock grazing. General management is the direction for much of the lower elevation BLM land that lies adjacent to private lands in Paradox Valley. Wilderness emphasis is identified for the areas in the northeast near Sewemup Mesa, and the Dolores Canyon on the western side of the LHA unit. There are small areas of forestry emphasis where ponderosa pine grows at the highest elevation areas, and areas of aquatic/riparian emphasis along Roc and La Sal Creeks.

Grazing Allotments

There are 16 grazing allotments in the West Paradox LHA unit. Allotment name, number, class of livestock, season of use and federal acres are depicted in Table 1.1. See Figure 1.4 for a map of allotments and location within the West Paradox LHA area.

Table 1.1 Grazing Allotments and Management.

Allotment Name and Number	Class of Livestock	Season of Use	Federal Acres per Allotment	AUMs
Ray Mesa #17048	Cattle	Spring/Winter	48,797	802
Mesa Creek CRMP #17014	Cattle	Spring/Winter /Fall	94,524	4,255
Carpenter Ridge #17100	Cattle	Spring/Fall	7,135	265
Roc Creek #17020	Cattle	Winter	1,268	28
Lower Roc Creek #07216	Cattle	Winter	145	5
Buckeye #17033	Cattle	Spring/Fall	835	48
Pocket Individual #17085	Cattle	Spring/Fall	1,375	5
Sunrise Gulch #17102	Cattle	Winter	1,597	63
River #17079	Cattle	Winter/Spring	1,300	22
Nyswonger #17082	Cattle	Fall/Winter/ Spring	3540	57
Feedlot #17078	Cattle	Fall/Winter/ Spring	510	13
Swain Bench #17081	Cattle	Fall/Winter/ Spring	5,422	23
Rowher Canyon #17080	Cattle	Fall/Winter/ Spring	680	30
Lion Creek Basin #17044	Cattle	Spring/Fall	5,247	350
Lion Canyon #17012	Cattle	Spring/ Summer/Fall	313	14
Rawlings Individual #17021	Cattle	Spring/ Summer/Fall	353	18

Figure 1.1 West Paradox LHA general location map.

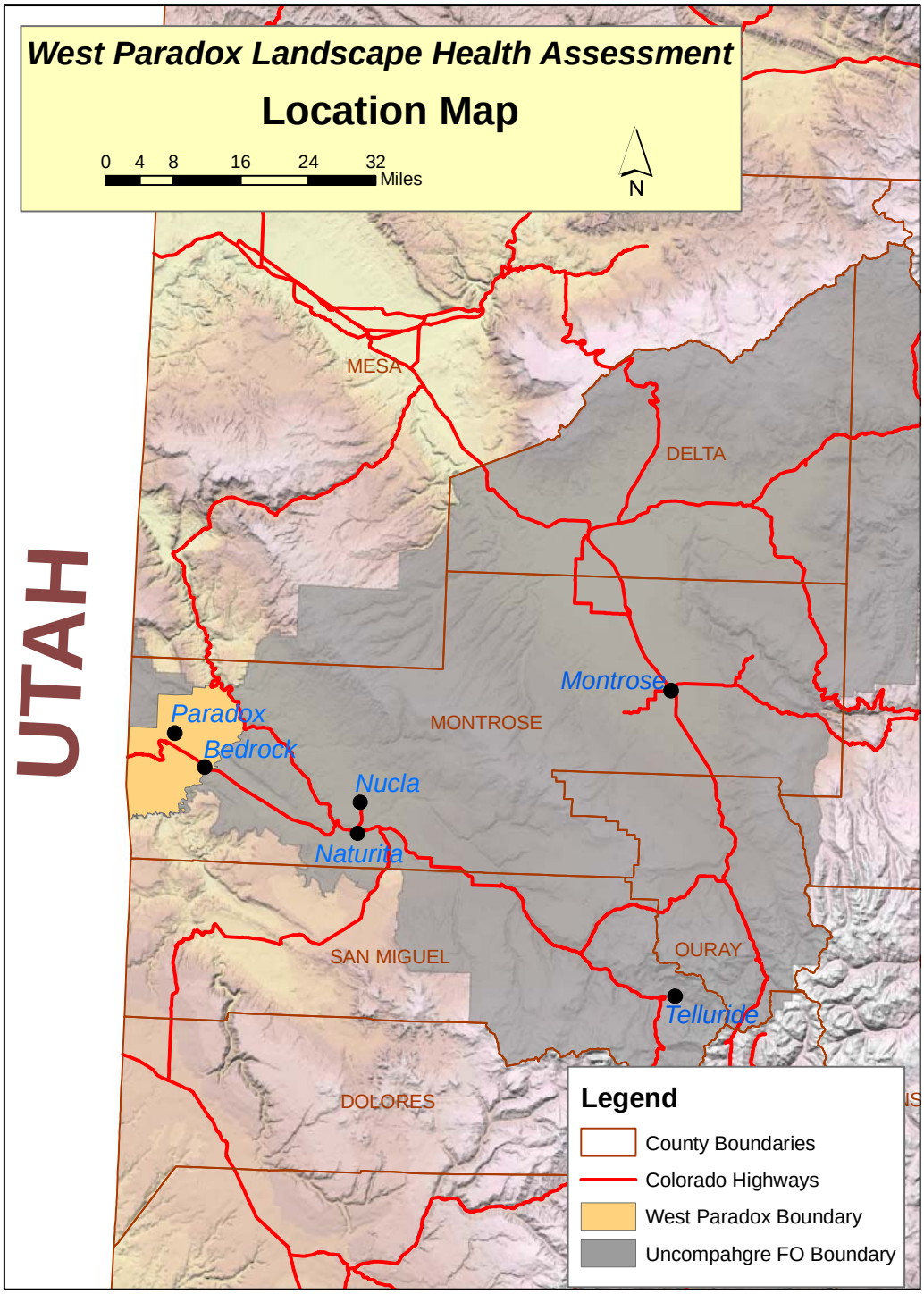


Figure1.2 West Paradox LHA land ownership.

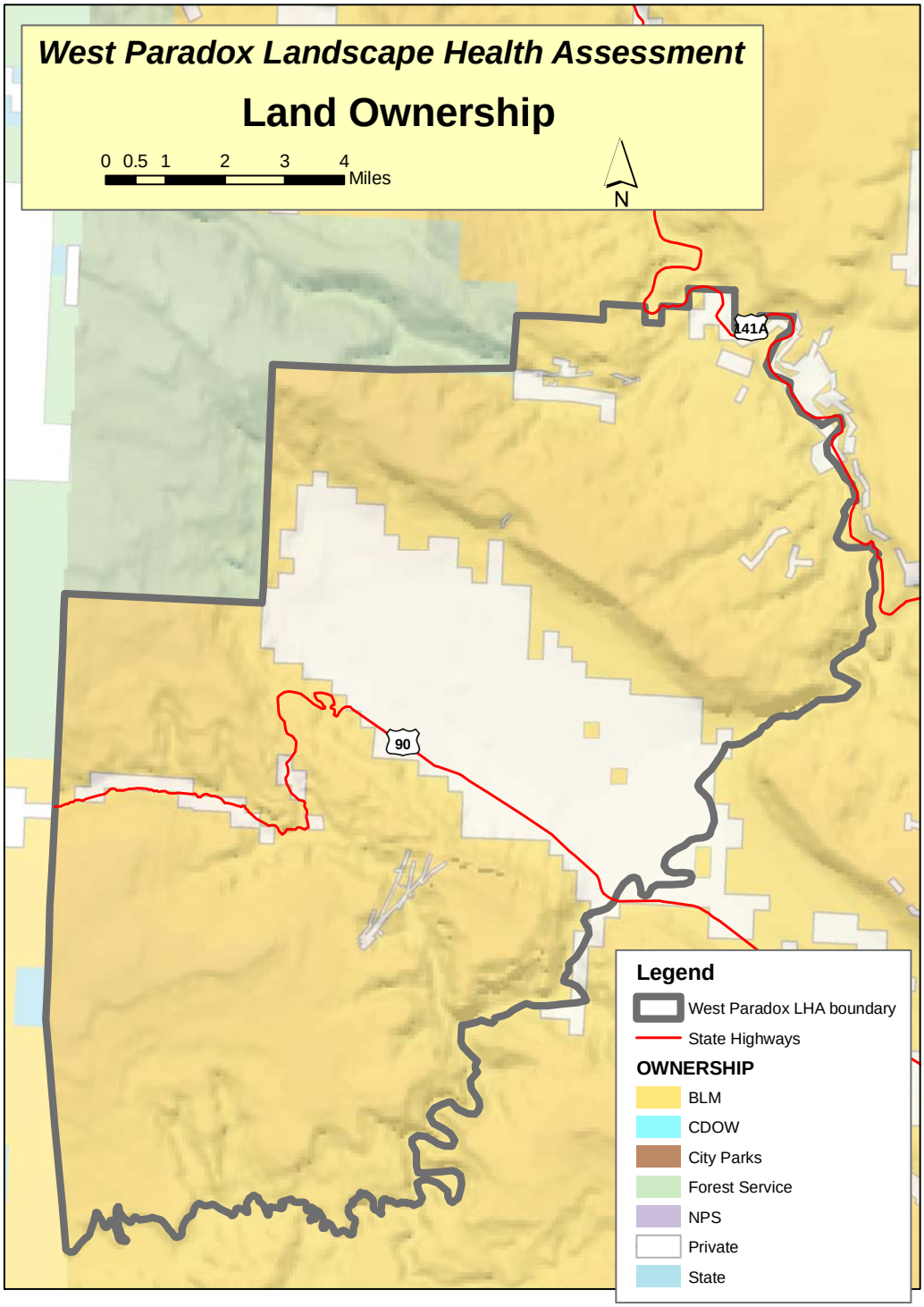


Figure 1.3 West Paradox LHA land management designations from the San Juan/San Miguel Resource Management Plan. Non-BLM lands appear as tinted white.

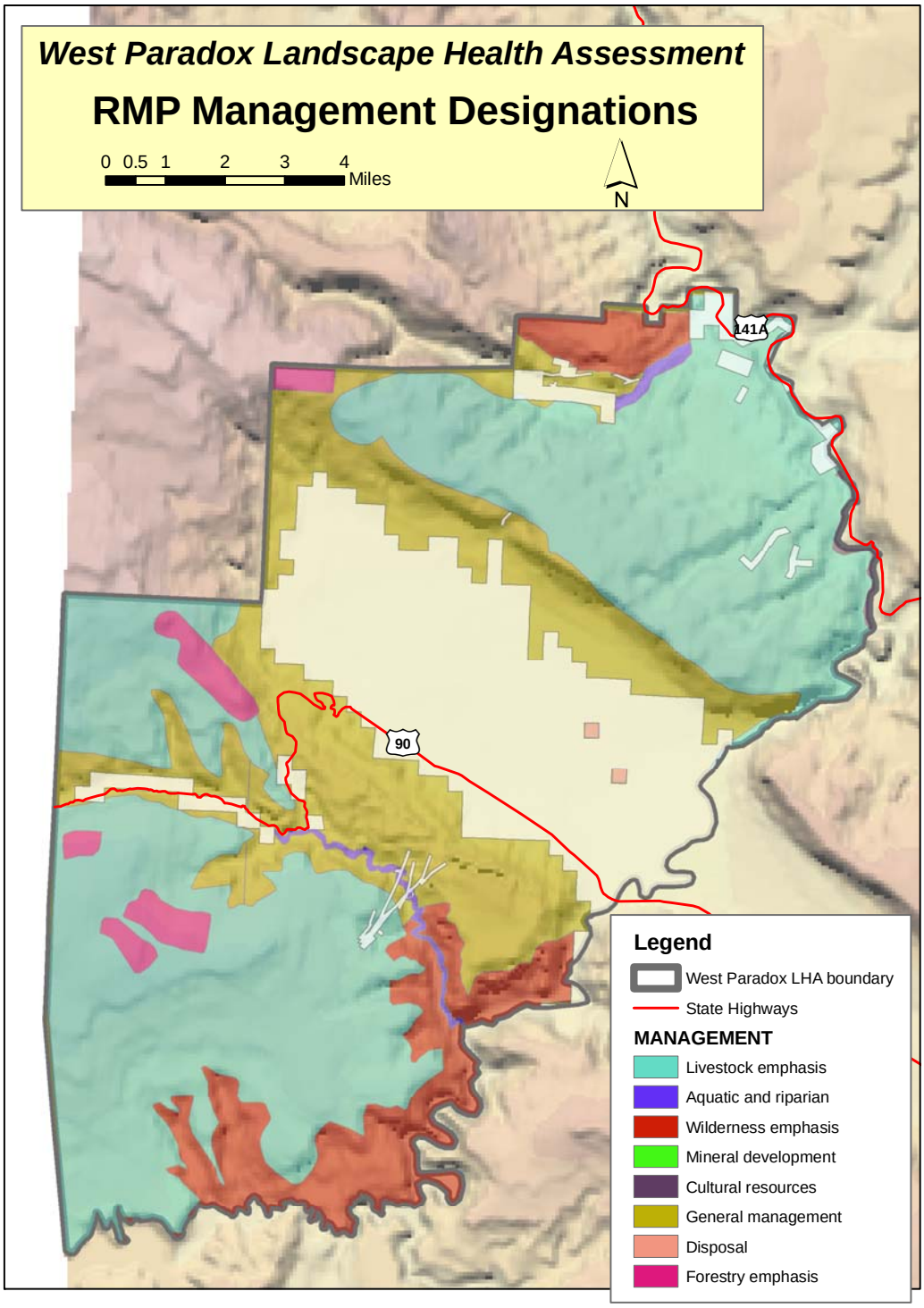
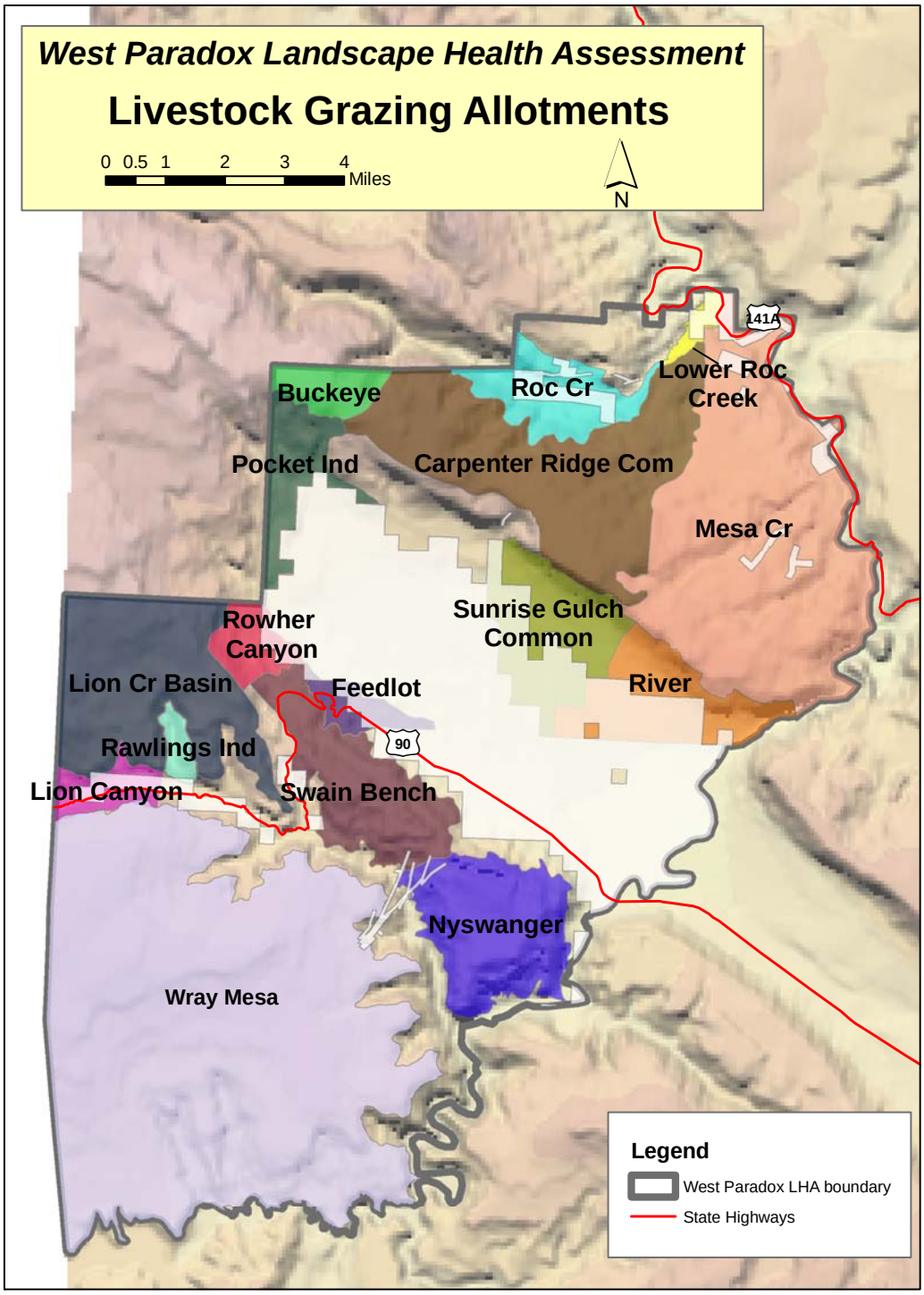


Figure 1.4 West Paradox LHA Area grazing allotment boundaries. Private portions of allotments appear as tinted white, unalloted BLM or allotments which have already been analyzed in another LHA as tan.



Landform and Topography

Elevations range between 4,800 feet in the northeastern part of the unit along the Dolores River to 7,800 feet above Carpenter Ridge in the northern part of the unit (Figure 1.5). Paradox Valley—which is a collapsed salt dome forming a dramatic valley walled in by steep cliffs—forms the most notable part of the LHA unit. The Dolores River flows perpendicular to the axis of Paradox Valley, and creates a deep canyon on either side of the valley where it has cut down through the high mesa country. The La Sal Mountains rise up to the northwest, and have formed high elevation plateaus which include Carpenter Ridge. The other surrounding plateaus are subdivided into Nyswonger, Wray, and Martin Mesas. These have been isolated from one another by steep drainages such as La Sal Creek, Roc Creek, and Red Canyon (Figure 1.6). Because of variety of landforms, slopes in the LHA unit range across the spectrum from flat valley bottoms to sheer escarpments.

Geology

The LHA area is located west of the Colorado Plateau physiographic province in the vicinity of the Paradox Valley. The area is typical of Colorado Plateau geology: gently dipping sedimentary rocks, altitudes exceeding 5,000 feet, the climate is semi-arid to arid, erosion has produced innumerable escarpments and structural benches and relief is the result of the incision of deep canyons below moderately flat terrain. The Paradox Valley was formed when an underlying salt dome collapsed and the central portion partially eroded away.

The primary formations that outcrop in the area are Cretaceous and Jurassic sedimentary formations. These consist of the Mancos Shale, Dakota sandstone, Morrison Formation, and Triassic age Entrada, Moenkopi, and Chinle Formations. Quaternary age deposits consist of alluvium, colluvium and landslide deposits primarily of fluvial and aeolian origin.

Geologic hazards include landslides, rock falls, debris flows, soil creep, and slumping of large blocks of material. Areas susceptible to landslides are found on steep slopes, saturated soils and mesas that are capped with resistant rock that overlie weaker, more easily erodible rocks.

A portion of the LHA unit lies in the Uravan Mineral Belt, with commercial deposits of uranium and vanadium. Natural gas has been found in many of the sedimentary formations occurring in Colorado, and there is exploratory natural gas drilling in the LHA unit at this time. Other mineral resources in the LHA are sand and gravel, dimension stone and clay.

Figure 1.5 West Paradox LHA Area elevations, from 30 meter Digital Elevation Model (US Geological Survey).

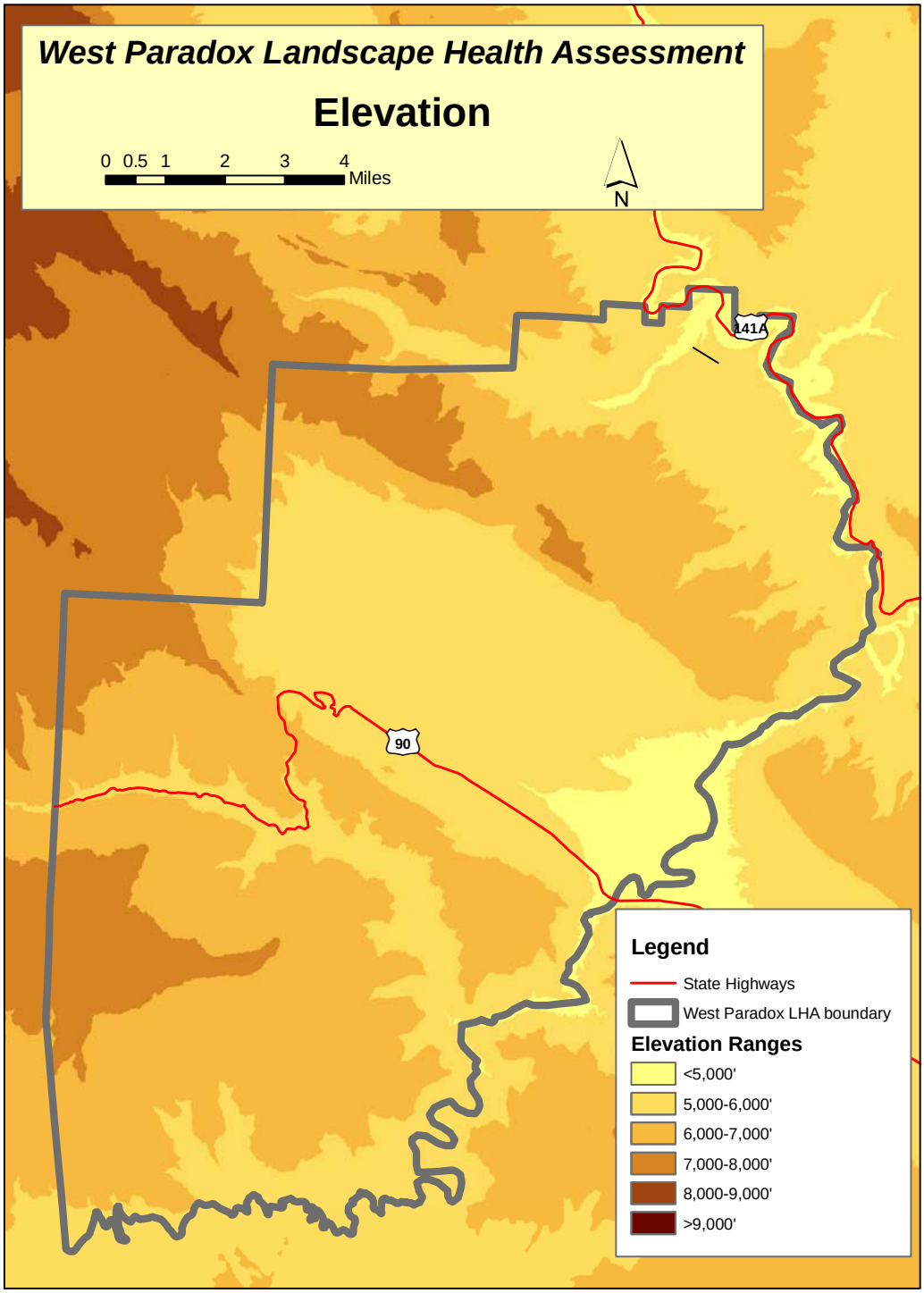


Figure 1.6 West Paradox LHA Area slopes and landforms. (From 30 meter Digital Elevation Model, US Geological Survey).

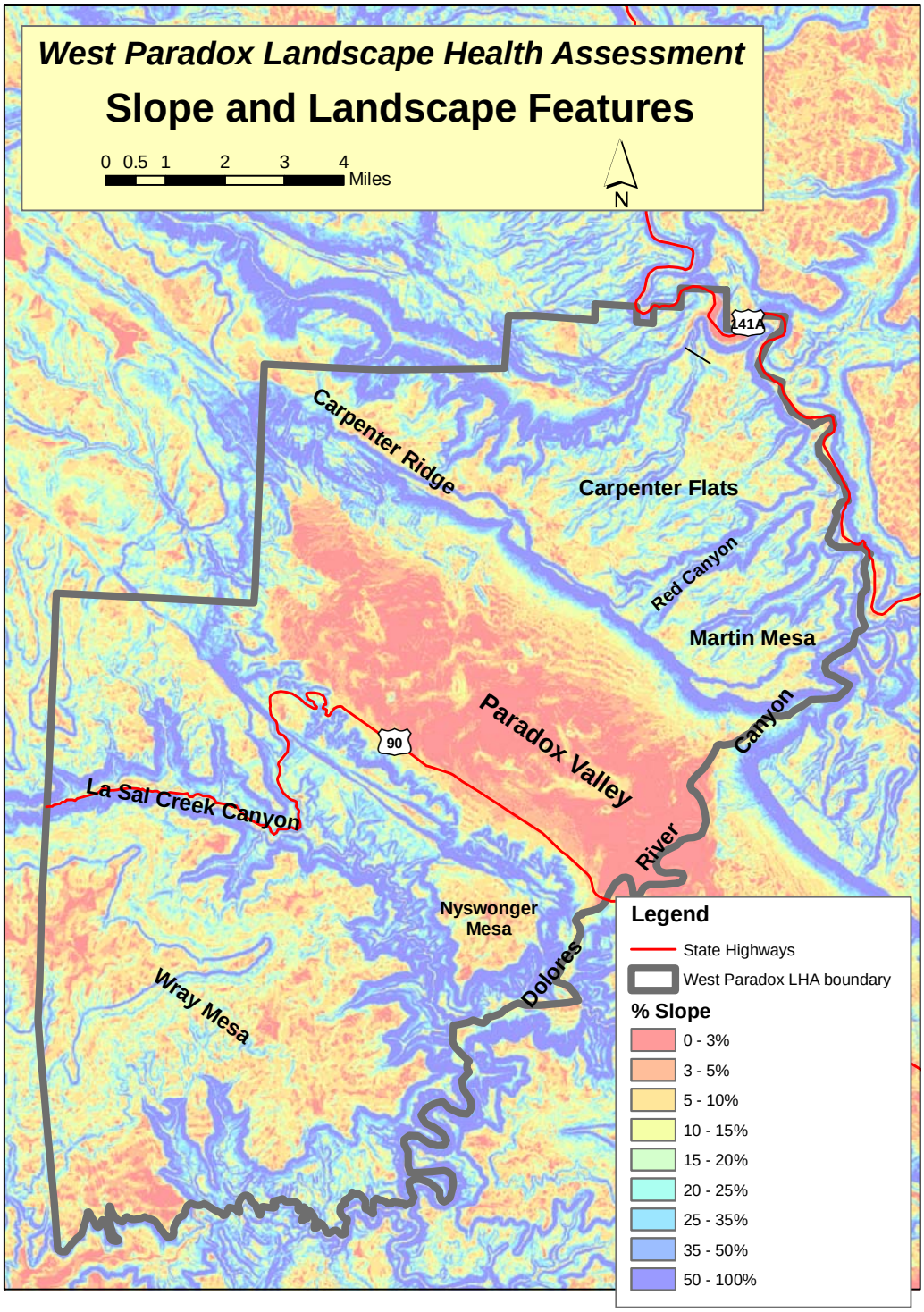
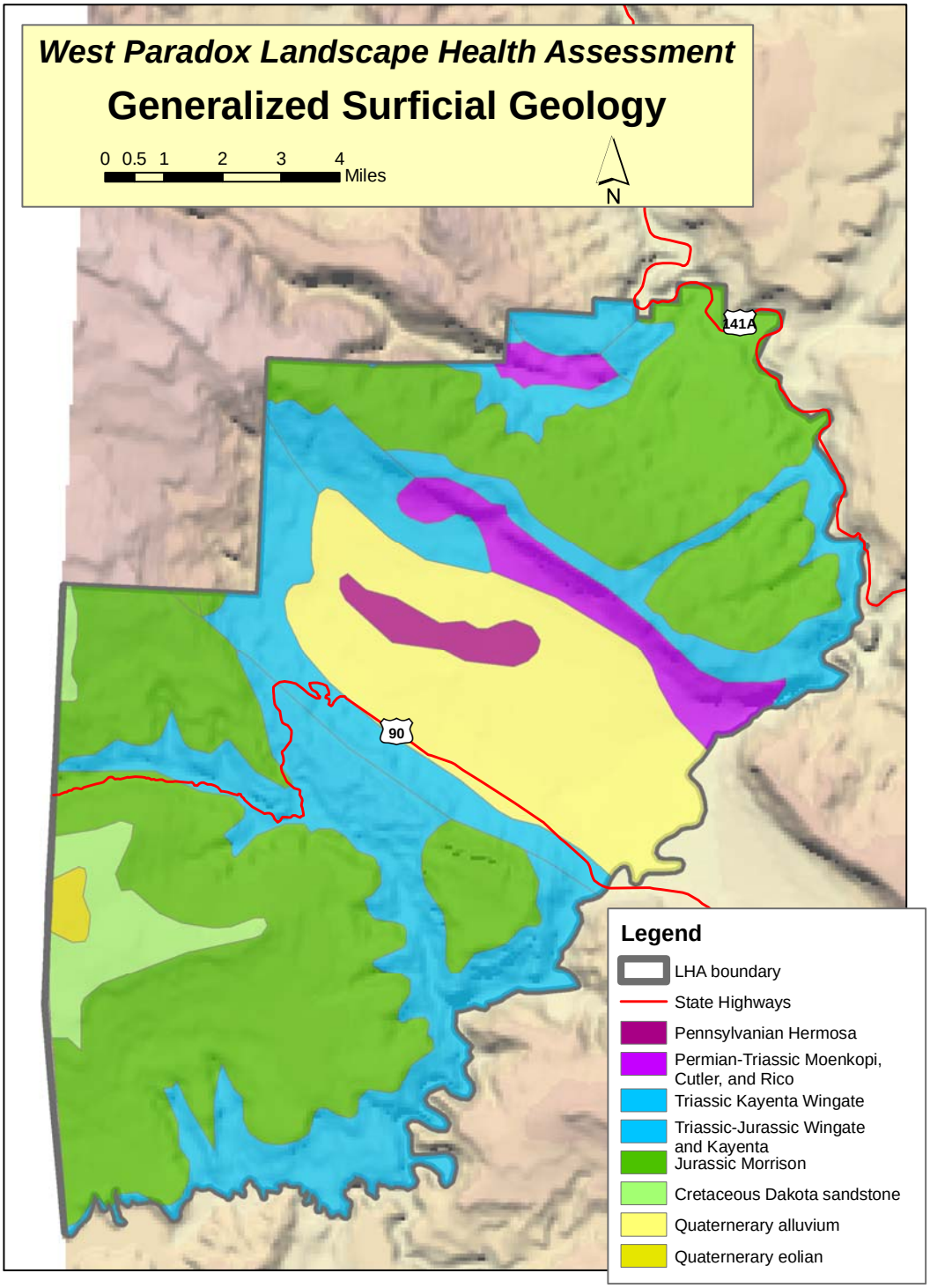


Figure 1.7 Surficial geology of the West Paradox LHA area.



Soils

Soils on public lands in the LHA area reflect the diverse geology and climate of the area. The soils are described in detail in the San Miguel Soil Survey (UDSA NRCS 2003.) The soil units in the LHA area are listed and described in Table S1 in the Appendix of this document, and are shown in Figure 1.8. The soils at the lower elevations of the LHA area are dominated by soils classified in the orders of Aridisols and Entisols, and collectively these soils make up about 70% of the land area of the LHA unit. These soils have limited development from their parent material due to low climatic intensity, and have a limited potential for vascular plant establishment and growth. Many of these lower elevation soils either support or have the potential to support significant populations of Biological Soil Crusts (BSC).

At the higher elevations of the LHA area the soils are in the Mollisol order. These soils have a higher degree of development with distinct horizons in the soil profile. Surface soil horizons are typically darkened by accumulations of organic matter. The potential for vegetation production on these higher elevation soils is much greater than the lower elevation soils. On these higher elevation soils, competition from vascular plants limits the establishment of BSC.

Soil resource issues the resource staff was aware of prior to the LHA evaluation include: insufficient plant cover and composition to protect the soil surface from accelerated erosion, and poorly located and maintained roads that are commonly a source of erosion and concentrated runoff. High road densities in some areas of the LHA are a result of historic uranium mining activity.

Vegetation

At least 18 distinct vegetation classes occur at significant levels on BLM land in the landscape unit (Figure 1.9). These are tied to soil type as well as elevation and precipitation. Of the 18 classes, 14 cover substantial acreage, or are otherwise notable within the LHA unit.

The drainages with intermittent or perennial water contain riparian vegetation, which is most prevalent where there is reliable flow of water. On BLM these include the Dolores River, and La Sal, Lion Canyon, Lion, Ice Lake, Spring, and Roc Creeks. Small pockets of riparian vegetation are also present along some of the ephemeral drainages.

Within the broad category of riparian vegetation are many distinct, interwoven native plant communities. Among the most widespread are communities dominated by sandbar willow (*Salix exigua*) occurring alone or in combination with strapleaf willow (*Salix ligulifolia*). River birch (*Betula occidentalis*) and box elder (*Acer negundo*) are fairly common along some streams and form the primary tree community. There are also small areas of narrowleaf cottonwood (*Populus angustifolia*) either in combination with sandbar willow or skunkbush sumac (*Rhus trilobata*), and Wood's rose (*Rosa woodsii*). On some of the higher stream terraces shrub-dominated communities including skunkbush sumac and New Mexico privet (*Forestiera pubescens*) are found. Small pockets of scouringrush horsetail (*Equisetum hyemale*) and common reed (*Phragmites australis*) can also be found in some locations. Ephemeral and lower elevation drainages are often dominated by the alien tamarisk (*Tamarix chinensis).* Detailed descriptions of these communities can be found in the Field Guide to the Wetland and Riparian Plant Associations of Colorado (Colorado Natural Heritage Program 2003).

Figure 1.8 Soils of the West Paradox Area (From San Miguel Soil Survey NRCS 2003).

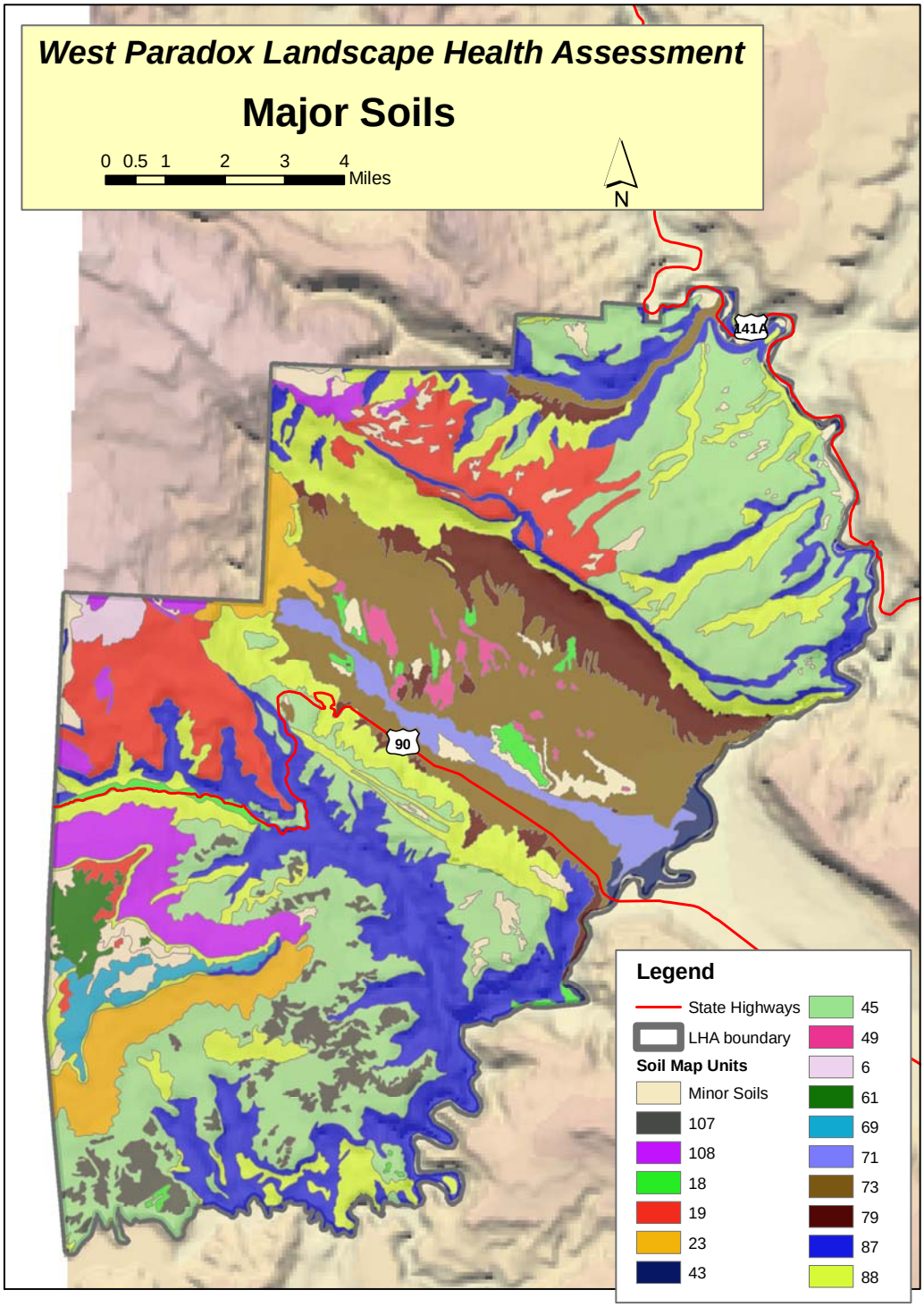
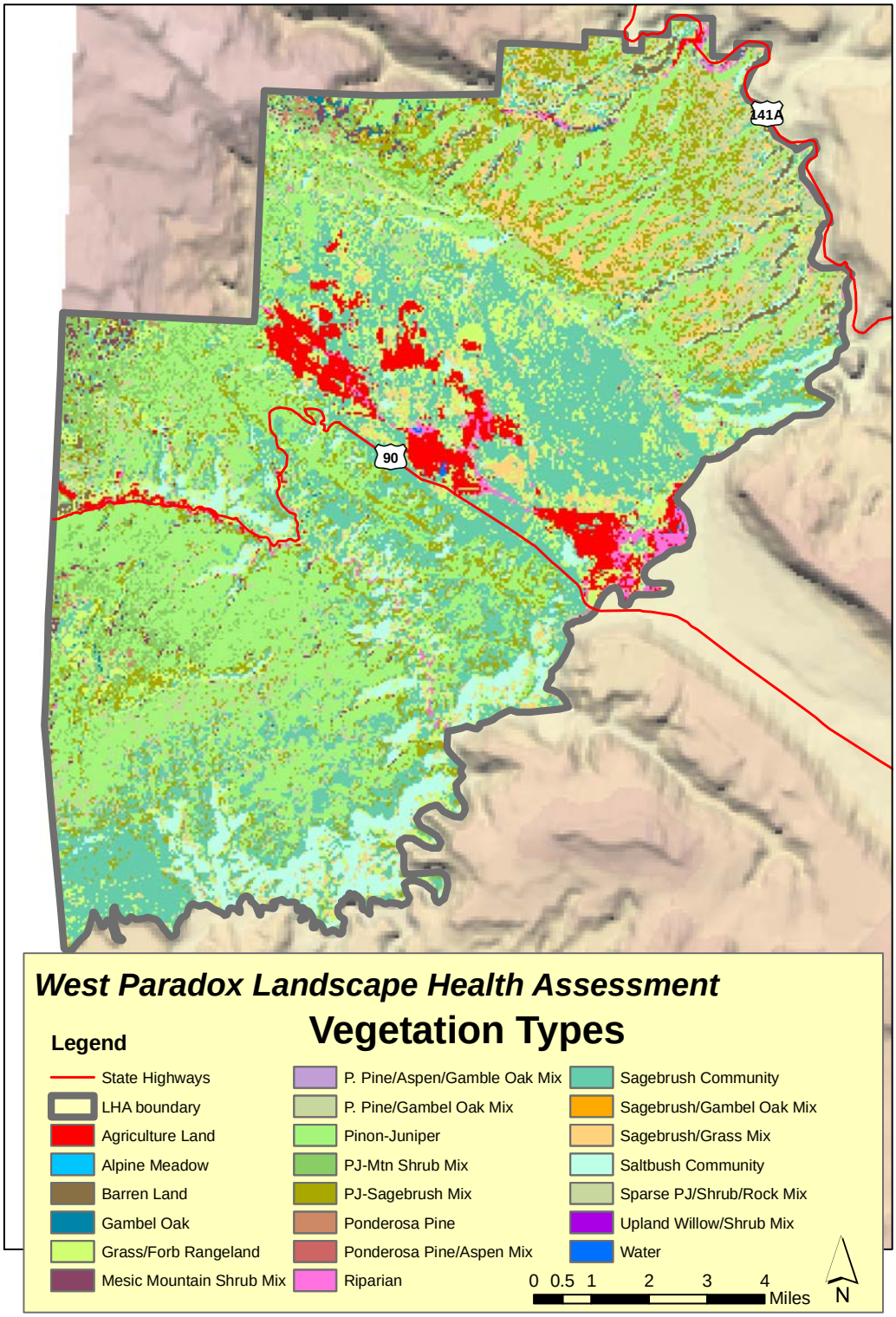


Figure 1.9 West Paradox LHA Area vegetation classes derived from 1993 Landsat Imagery.



The drought tolerant vegetation class described as saltbush community occurs in limited amounts at the lowest elevations and some of the steep, south facing slopes of the LHA unit, typically on more saline soils. This community includes the following shrubs in varying amounts: shadscale (*Atriplex confertifolia*), black greasewood (*Sarcobatus vermiculatus*), four-wing saltbush (*Atriplex canescens*), black sagebrush (*Artemesia nova*), snakeweed (*Gutierrezia sarothrae*) and prickly pear cactus (*Opuntia polycantha*). Native grasses including galleta grass (*Pleuraphis jamesii*), bottlebrush squirreltail (*Elymus elymoides*), Salina wildrye (*Leymus salinus*) and Indian ricegrass (*Achnatherum hymenoides*) are found on better condition sites. Many different forbs occur, but some of the most common are wild buckwheats (*Eriogonum* spp.), milkvetches (*Astragalus* spp.), cat's-eye (*Cryptantha* spp.), breadroot (*Pediomelum* spp.) and biscuitroots (*Lomatium* and *Cymopterus* spp.) In some areas, weedy exotic species are also present, with cheatgrass (*Bromus tectorum*) the most common.

With increasing elevation and precipitation, drought tolerant plant communities grade into the pinyon-juniper woodland class or the sparse pinyon-juniper/shrub mix on rocky, steeper soils and the pinyon-juniper/sagebrush mix, sagebrush community, and sagebrush/grass mix classes on less rocky or deeper soils. The pinyon-juniper woodland is dominated by Utah juniper (*Juniperus osteosperma*), with Colorado pinyon (*Pinus edulis*) in most areas. There is typically a sparse and variable understory that may contain remnant shrubs like Wyoming big sagebrush (*Artemesia tridentata wyomingensis*), birchleaf mountain mahogany (*Cercocarpus montanus*), Utah serviceberry (*Amelanchior utahensis),* cliffrose (*Purshia stansburiana*), snakeweed, yucca (*Yucca harrimaniae* and *Yucca baccata*), Cutler's jointfir (also known as green mormontea or *Ephedra cutleri*), potato cactus (*Opuntia fragilis*), muttongrass (*Poa fendleriana*), and bottlebrush squirreltail.

The sagebrush community is dominated by Wyoming big sagebrush or black sagebrush. Frequently snakeweed, yellow rabbitbrush (*Chrysothamnus viscidiflorus*) or four-wing saltbush are secondary shrubs in these communities, and there is an understory of the same native grasses found in the saltdesert shrub zone, with the addition of blue grama (*Bouteloua gracilis*), Sandberg bluegrass (*Poa secunda*) muttongrass, needleandthread (*Heterostipa comata*) and western wheatgrass (*Pascopyrum smithii*). Primary forbs in this zone are scarlet globemallow (*Sphaeralcea coccinea*), rock goldenrod (Petradoria pumila), rose heath (*Chaetopappa ericoides*), Fendler's sandmat (*Chamaesyche fendleri*), and numerous species of *Penstemon*, *Arabis*, *Astragalus*, *Lomatium*, *Erigeron*, *Castilleja*, and *Machaeranthera*. Nonnative forbs are limited with filaree (*Erodium cicutarium*) among the most common. Nonnative grasses are very common with cheatgrass very widespread, and crested wheatgrass (*Agropyrum cristatum*) persisting in areas where it has been seeded in the past. In some areas, sagebrush may be a successional stage that follows fire or other major natural disturbance. Several fire scars of varying ages are evident in parts of the LHA unit.

In limited areas at higher elevations the pinyon-juniper/mountain shrub mix, mesic mountain shrub mix, sagebrush-Gambel oak mix, and Gambel oak classes are found. The pinyon-juniper community contains birchleaf mountain mahogany, Utah serviceberry and Gambel oak (*Quercus gambelii*). With increasing elevation, Utah juniper and pinyon trees drop out of the community, and the mountain shrubs dominate the vegetation. In some areas Gambel's oak forms almost closed stands. Where there are openings between the typically dense shrub canopies, or in areas where the canopy is significantly above the ground surface, a productive

understory of forbs and grasses exists. Commonly found species include elk sedge (*Carex geyeri*), muttongrass, Sandberg bluegrass, bottlebrush squirreltail, and western wheatgrass. Forbs are abundant and there are many species. The most widespread and dominant include pussytoes (*Antennaria rosea*), western yarrow (*Achillea millefolium*), ballhead sandwart (*Arenaria conjesta*), lupine (*Lupinus* spp.), biscuitroot (*Lomatium* spp.), and northern sweetvetch (*Hedysarum boreale*).

At the very highest elevations in the LHA unit, ponderosa pine (*Pinus ponderosa*) occurs on BLM. The understory in this community is sparse and includes some of the species found in the high elevation pinyon-juniper woodland sites. There are small areas of green manzanita (*Arctostaphylos patula*) on inclusions of sandy soil in this elevation zone as well.

Grass-forb rangeland is a vegetation class that occurs across the range of elevations. In some cases it is related to soil characteristics, in others it is a result of disturbance, and is a successional stage to other vegetation classes. The species are typically those grasses and forbs found in each of the different community types listed above.

In addition to the non-native species listed above, state listed noxious weeds are scattered in still isolated infestations across the unit. Russian knapweed (*Acroptylon repens*) is the most common in disturbed areas at lower elevations. Tamarisk (*Tamarix chinensis*) is present in some of the lower elevation drainages, and Canada thistle (*Cirsium arvense*) is also found along some drainages and in higher elevation disturbances. Musk thistle (*Carduus nutans*) occurs sporadically throughout the area. Isolated occurrences of houndstongue (*Cynoglossum officinale*) and Dalmation toadflax (*Linaria dalmatica*) have been documented. A complete weed inventory of the area has not been carried out to date.

Prior to the land health assessment, the UFO staff considered the extent of noxious weeds and invasive species to be a significant vegetation problem in the area. Partly due to this, BLM has seeded all vegetation treatments and disturbances to provide competition against weeds, and is working with Montrose County to control some of its noxious weed infestations as well, but treatment has been minimal in this remote part of the county. The staff also believes that fire suppression, heavy winter wildlife use and historic grazing (1890s-1960s) have impacted the vegetation, leading to age class distribution and browse plant condition problems. A few vegetation treatment projects have taken place in this unit. These have been largely driven by the desire to increase forage for livestock and big game. A concern over low levels of desirable grasses and forbs has also been addressed by seeding these habitat projects.

Wildlife

General: The Paradox LHA area supports a diversity of upland, riparian, and aquatic wildlife species. Common species, other species of interest, and their habitats are listed below in Table 1.2. Some species are year-long residents while others are migrants. A variety of small mammals, birds, and herptiles occur throughout the unit where habitat is suitable. Habitat in the Paradox area varies based on precipitation, elevation, topography, slope, aspect, geology, soils, and other variables. The vegetation section of this report provides an apt description of most wildlife habitats that occur in the area of interest.

Table 1.2 West Paradox LHA common or noted terrestrial wildlife species, groups of species, their occurrence, and basic habitat types in which they are found.

Species (Common Name)	Habitat Type	Occurrence
Mule deer	Mixed conifer/Douglas fir and spruce-fir, aspen/mesic mountain shrub mix, alpine meadow, pinyon-juniper, oak-mountain shrub, riparian, sagebrush, grassland.	Common, year-long with seasonal altitude and habitat type variation
Elk	Mixed conifer/Douglas fir and spruce-fir, aspen/mesic mountain shrub mix, alpine meadow pinyon-juniper, oak-mountain shrub, riparian, sagebrush, grassland.	Mostly winter use of Paradox Valley and Wray Mesa, move down from La Sal Mts. in Utah
Bighorn Sheep	Canyon benches, mesa tops, and valley bottoms	Uncommon, small herd present in the Dolores River Canyon, Martin Mesa edge
Cougar	All types, mostly along rim-rock areas.	Common, year-long
Bobcat	All types	Uncommon, year-long
Canada lynx	Mixed conifer/ Douglas fir and spruce-fir, aspen/mesic mountain shrub mix, riparian, alpine meadow	Rare, no habitat present in LHA area
Coyote	All types	Common, year-long
Jackrabbit, White-tailed	All types	Infrequent, year-long
Cottontail, Mountain	All types	Common, year-long
Porcupine	Pinyon-juniper, riparian	Common, year-long
Prairie Dog (Gunnison)	Sagebrush, desert shrub, grassland	Common, year-long
Raptor; Eagles, Hawks, Falcons.	All types	Common, year-long
Merriam's Turkey	Riparian forests, pinyon-juniper, oak-mountain shrub	Riparian communities and PJ in the winter and oak-mtn. shrub spring and fall.
Blue grouse	Oak/Serviceberry	Common, year-long
Chukar	Salt desert	Uncommon, year-long
Neo-tropical birds	All types	Common, warm season
Small mammals	All types	Common, year-long
Amphibians-Reptiles	All types	Common year-long
Bats	All types	Common, mostly warm season

Deer, Elk and Desert Bighorn: Mule deer are probably the most recognized wildlife species that occur in the LHA area due to their historic prominence in the ecosystem and economic value. Deer summer and winter ranges are scattered throughout the Paradox LHA region. Elk use the Paradox LHA area primarily as winter range, spending summers in the La Sal Mountains in Utah, and migrating into the Paradox area as snow levels increase. There is a small population of mule deer and elk that have become year-round residents of agricultural land in the Paradox Valley. The intensity of use by each species varies widely from year to year and is controlled primarily by population size and the timing and amount of snowfall. Elk generally stay above 8,000 feet during the warm season, and move down to pinyon juniper and mountain shrub zones for winter. Deer will migrate to lower elevations than the elk for winter, into sagebrush and desert shrublands. During most winters there is spatial segregation of deer and elk except for the most severe winters. Elk tend to dominate food resources where winter ranges overlap.

The Colorado Division of Wildlife (CDOW) has classified the Paradox Valley as mule deer and elk severe winter range. Elk winter concentration areas occur outside the West Paradox LHA boundary to the northeast, in the Dolores River corridor and bordering mesas to the east. There is a mule deer winter concentration area at the western tip of the valley, near the town of Paradox. Mule deer and elk severe winter range is primarily on private lands, and the majority of this is irrigated agricultural property. Crop damage in these agricultural areas is a concern, as increasing numbers of mule deer and elk become year-round residents of the valley. Figure 1.10 shows areas identified by CDOW as winter range and winter concentration areas for elk and mule deer.

The Colorado Division of Wildlife manages big game on a herd, or population basis, using Data Analysis Units (DAU), with sub-regions of Game Management Units (GMU) (Figure 1.11). A DAU is the geographic area representing the year-round (includes seasonal) range of a big game herd. Herds are expected to move within one or more GMUs in the DAU. Portions of GMUs 60 and 70 occur within the Paradox LHA area. These GMUs occur in the following DAUs: D-23 and D-24 for mule deer; and E-40 and E-24 for elk. For this LHA analysis, the data for D-23 (the Gateway-Paradox deer herd, GMU 60) and E-40 (Paradox elk herd) were used, as these are considered the most representative of the area.

The current population for deer in D-23 is 2,020 animals with a buck to doe ratio of 35 to 100. Since 1995, the total population and sex ratio have been stable to slightly increasing. The population low was estimated at 1,660 in 1995 and 2,400 in 2006. CDOW recommends a long-term population objective for D-23 below 3,000 to avoid deterioration of winter range, increased susceptibility to disease, and conflicts with private landowners. Current population estimates and buck to doe ratios are within the herd management objective ranges. Hunting pressure has decreased in GMU-60 as the number of licenses issued for the area has gone down. Chronic wasting disease (CWD) is a concern in this area, as it has been found in mule deer in the La Sal Mountains; this area is one of the hot spots for CWD in Utah, with an infection rate of 2% in the mule deer buck population. Since a high percentage of the Paradox mule deer herd migrates from the La Sals seasonally, a close watch is being kept on this disease in the Paradox area (CDOW 2008).

The West Paradox elk population is currently meeting objectives with an estimated 1,060 individuals. There has been a gradual increase from 70 to the current number over the last twenty years. The ratio of bull to cow elk is also at objective with 25-30:100. Hunting pressure varies widely in this unit depending on the weather conditions, as more severe winter weather pushes the herd down from the La Sals. Hunting success rates are also variable, as this unit presents difficult terrain. There has been an increase in available licenses recently to keep the herd from increasing and to maintain winter range in good condition. As with the mule deer population, chronic wasting disease is a concern in the Paradox elk herd, since the Utah hot spot for CWD in deer is the La Sal Mountains, where this elk herd summers (CDOW 2008).

The Paradox area provides some mule deer fawning and elk calving habitat at higher elevations within oak/serviceberry and big sage/aspen communities. These mountain shrub/aspen areas are primarily in the northern and western fringes of the Paradox LHA area, and continue up into Forest Service lands that are contiguous with BLM land in these areas.

Desert bighorn sheep territory is on the fringes of the LHA, in the Dolores River Canyon and its connecting mesas and canyons. The Dolores herd (S-63) population has remained stable at approximately 30 animals for the past several years. The herd is in fair to poor condition, and

Figure 1.10 West Paradox LHA mule deer and elk crucial winter ranges, and overall bighorn sheep range.

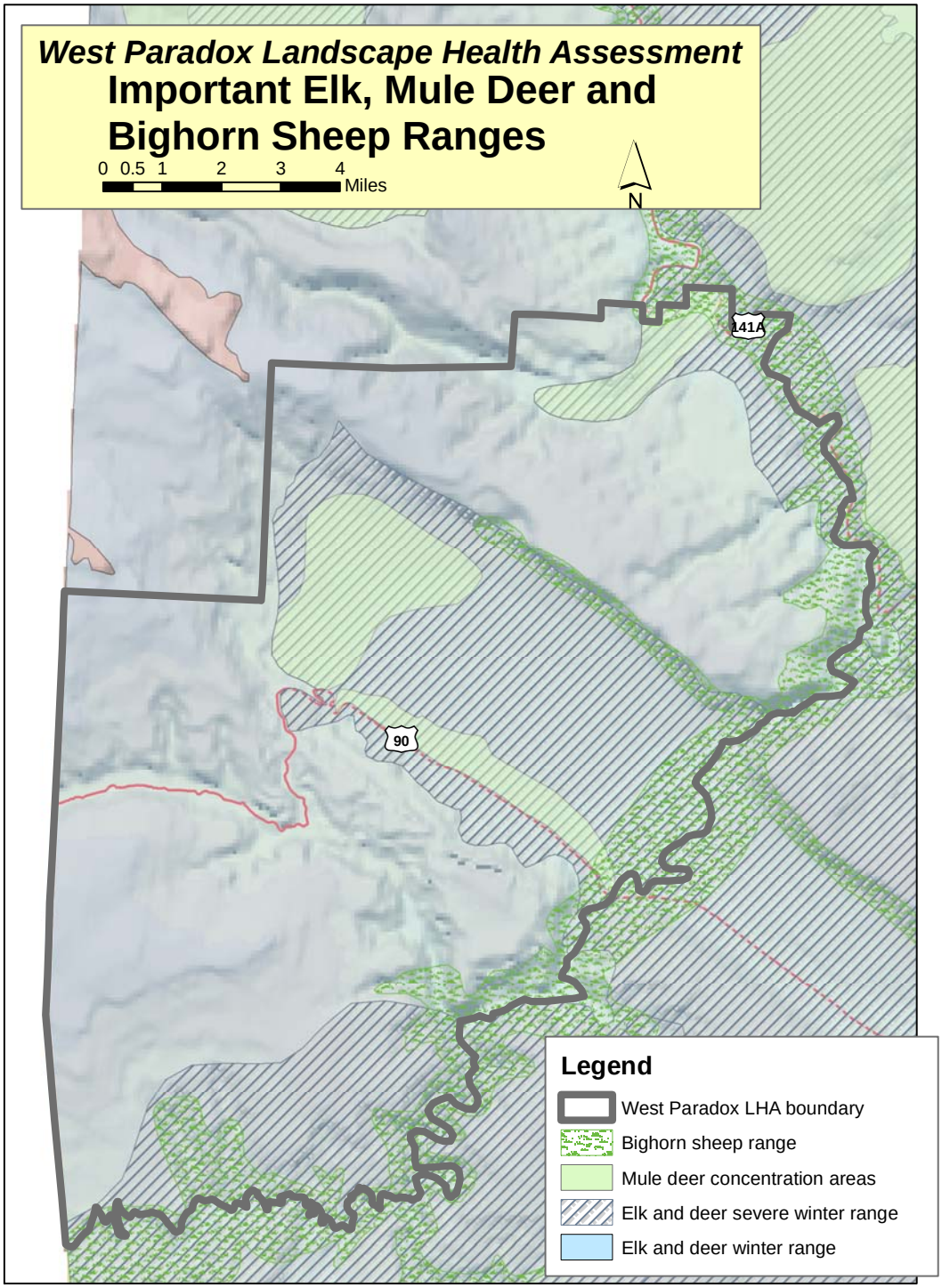
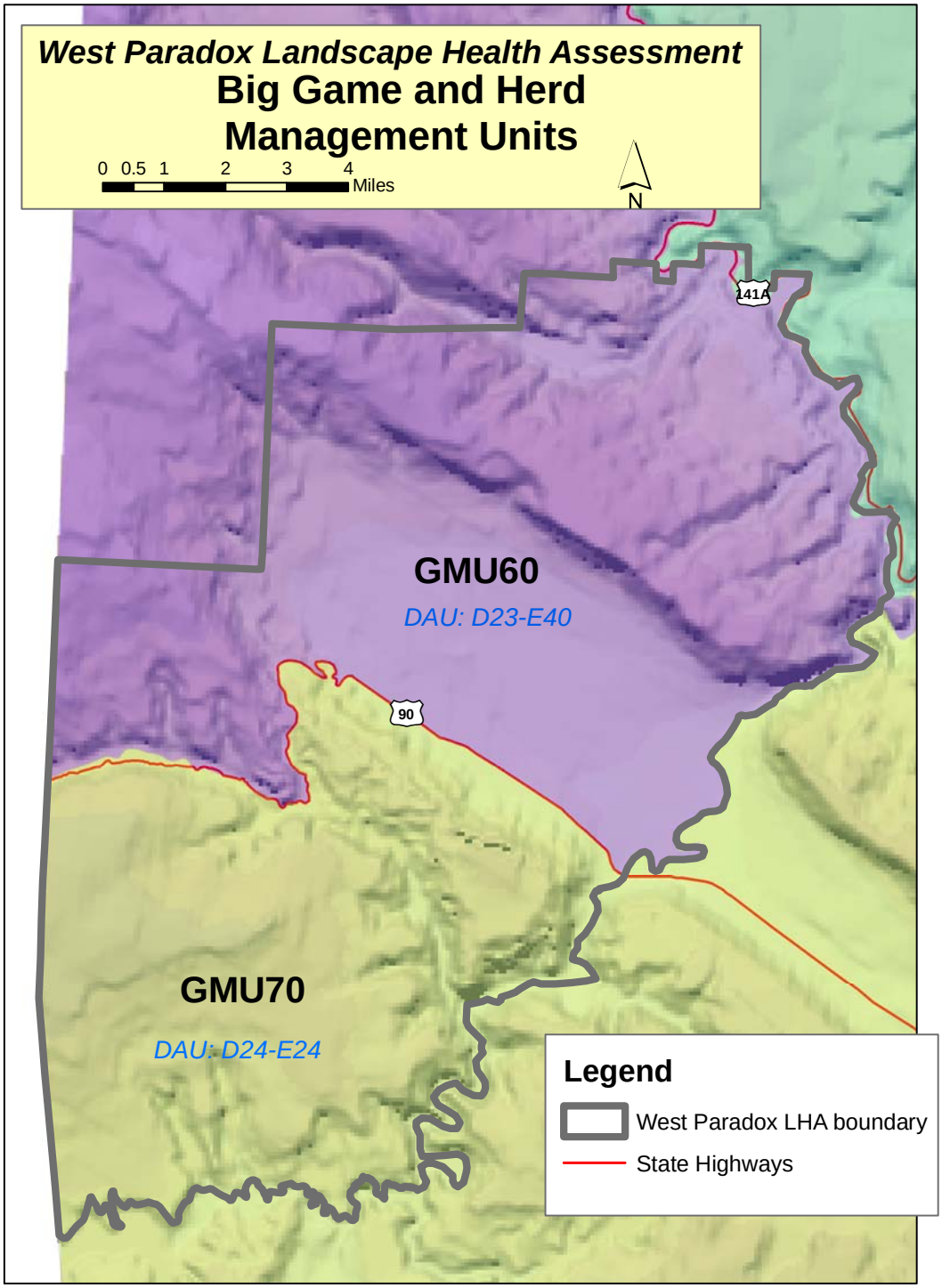


Figure 1.11 Colorado Division of Wildlife Game Management Units within the West Paradox LHA.



under constant predation pressure from the thriving local mountain lion population (Brad Banulis, CDOW biologist, personal communication). Habitat within the LHA area is marginal.

Merriam's turkey: Merriam turkey habitat within this LHA area is found mostly on the higher mesas with woody habitat, and along the major stream drainages. They use the larger canyon bottoms at lower elevations as winter range and the pinyon-juniper, oak/serviceberry areas at higher elevations for breeding, nesting, and brood rearing. The turkey population suffered a decrease after the long cold winter of 2008, but is considered generally stable and abundant.

Carnivores: Large predators, such as coyotes, cougars, and black bears use the LHA area regularly as parts of their larger overall ranges. Of the predators, coyotes are the most numerous and widespread, and the population appears to be stable or increasing at this time. Cougars are common in the region due to the prime habitat and plentiful mule deer as prey. Since 2000, hunting quotas for cougar have been about 50% of objective. Black bear primarily use the higher elevation oak/serviceberry areas northwest of Paradox in the Manti La Sal Forest, especially during spring, late summer, and fall for feeding. They are not often found within the Paradox LHA area. In general, black bear populations in the region have been stable.

Prairie dogs: Gunnison's prairie dogs (GUPD) are found in the lower elevation areas of the LHA. Generally, they occur in areas characterized by open grassland, grass/sagebrush, or salt desert shrub where soils are conducive for building burrow systems. Information on prairie dogs can be found in the CDOW draft Gunnison's and White-tailed Prairie Dog Conservation Plan, found on the CDOW website (CDOW 2009). This population of GUPD is in the Southwest Individual Population Area (IPA), and historic population data for the area is spotty. There are no current population estimates for the Paradox area. The largest areas of prairie dog activity are in the Paradox Valley, in agricultural and natural areas, mostly in small fragmented populations. Gunnison's prairie dogs are divided into montane and prairie population segments, and the Paradox colonies are considered prairie species. While the montane populations of GUPD are currently under consideration for listing under the Endangered Species Act, the GUPD prairie populations are not being considered for listing. In the Paradox LHA area, as elsewhere in the western slope, there has likely been a general reduction in the total number of prairie dogs living in the area. Surveys in the Montezuma County area of the Southwest IPA have shown periodic die-offs not associated with intentional control measures. It is likely that much of this apparent trend is due to sylvatic plague, although other factors such as shooting, habitat fragmentation and drought may also have contributed.

Aquatic wildlife: Aquatic wildlife are present in and adjacent to perennial streams, tributaries, and some intermittent streams. The LHA borders the Dolores watershed on the north and west. Perennial water features include La Sal, West Paradox, and lower Roc Creeks. Dolores River flows in the Paradox area are regulated and modified by discharge from McPhee Reservoir. The watershed is populated by warm water native fishes including the bluehead sucker, flannelmouth sucker, and roundtail chub. Due to extreme fluctuations in flow caused by reservoir releases (especially low summer flows), the Dolores River fishery is in generally poor condition. The non-native channel catfish and common carp also inhabit the Dolores. The upstream portions of the Dolores (within the wilderness study area) provide better habitat for the native fish. La Sal Creek includes healthy populations of native mottled sculpin and speckled dace in addition to the above native species, and will be sampled by CDOW in 2009 (Dan Kowalski, CDOW fisheries biologist, personal communication). Northern leopard frogs, canyon

treefrogs, Great Basin spadefoot toads, and many snake species also occur here.

Riparian habitat along the La Sal Creek, Dolores River and other waterways is extremely important for a variety of wildlife, including songbirds, mammals, amphibians, and raptors. The Colorado Natural Heritage Program (CNHP, 2000) indicates there is a diverse array of riparian habitats in the LHA area and at least 4 birds, 2 plants, 2 fish and 2 amphibian species on the Program's list of tracked species. Most of these species have not been inventoried, and their status is unknown.

Threatened, Endangered and Special Status Species

Within the LHA area there are several species listed as threatened or endangered, as well as species that are candidates for listing under the Endangered Species Act, as amended. For this analysis, the species list for Montrose County was obtained from the U.S. Fish and Wildlife Service. Descriptions of these species are found in *TES Species Descriptions for the Uncompahgre Field Office* (VanReyper 2006). Also, based on the inventory data maintained by the UFO, and available from the Colorado Natural Heritage Program, there are other special status species present in the LHA area. Table 1.3 below presents a list of the Threatened, Endangered, and special status species that are found, or potentially found within the LHA area. Note: It was not intended as part of this land health assessment to identify new locations of rare plants or animals, or to determine their status. However, if conflicts with rare plants or animals on public land had been detected, they would have been documented and discussed in this report.

Table 1.3 List of potential Threatened, Endangered or Special Status Species for the Paradox LHA[1].

Common Name	***Scientific name***	***Status***[2]	***May be Present***
ENDANGERED,THREATENED, and CANDIDATE ANIMALS			
Black-footed ferret	*Mustela nigripes*	E	
Bonytail	*Gila elegans*	E	✓
Canada lynx	*Lynx canadensis*	T	
Colorado pikeminnow	*Ptychocheilus lucius*	E	
Gunnison's prairie dog[4]	*Cynomys gunnisoni*	C	✓
Greenback cutthroat trout	*Oncorhynchus clarkia stomias*	T	
Humpback chub	*Gila cypha*	E	
Mexican spotted owl	*Strix occidentalis*	T	
Razorback sucker	*Xyrauchen texanus*	E	
Southwestern willow flycatcher	*Epidonax trailii existima*	E	
Uncompahgre fritillary butterfly	*Boloria acrocnema*	E	
Yellow-billed cuckoo	*Coccyzus americanus*	C	✓
ENDANGERED AND THREATENED PLANTS			
Clay-loving wild buckwheat	*Eriogonum pelinophilum*	E	
Colorado hookless cactus	*Sclerocactus glaucus*	T	

Common Name	***Scientific name***	***Status***[2]	***May be Present***
SENSITIVE ANIMALS			
Bat, Allen's big-eared	*Idionycteris phyllotis*		✓
Bat, big free-tailed	*Nyctinomops macrotis*	G5, S1	✓
Bat, Townsend's big-eared	*Corynorhinus townsendii*	G4/S2, FS	✓
Bat, spotted	*Euderma maculatum*	G4/S2, FS	✓
Butterfly, Great Basin silverspot	*Speyeria nokomis nokomis*	G3T1, S1	✓
Chub, Roundtail	*Gila robusta*	G2G3/ S2, SC	✓
Curlew, Long-billed	*Numenius americanus*	G5/S2BSZN, FS, SC	✓
Eagle, Bald[3]	*Haliaeetus leucocephalus*	G5, S1B, S4N, Delisted	✓
Falcon, peregrine	*Falco peregrinus anatum*	G4T3, S2B	✓
Fox, Kit	*Vulpes macrotis*	SC	
Frog, Northern leopard	*Rana pipiens*	G5/ S3, FS, SC	✓
Goshawk, northern	*Accipter gentilis*	G5/S3S3BS2N, FS	✓
Grouse, Gunnison sage	*Centrocercus minimus*	G1/S1, SC	✓
Grouse, sharp-tailed	*Tympanuchus phasianellus columbian*	G4T3, S2	✓
Hawk, ferruginous	*Buteo regalis*	G4/ S3BS4N, FS, SC	✓
Ibis, white-faced	*Plegadis chihi*	G5/S2BSZN, FS	✓
Lizard, longnose leopard	*Gambelia wislizenii*	G5, S1	✓
Lizard, Texas horned	*Phrynosoma cornutum*	G4G5, S1	
Myotis, fringed	*Myotis thysanodes*	G5/S3	✓
Myotis, Yuma	*Myotis yumanensis*		✓
Otter, River	*Lutra canadensis*	SC	✓
Rattlesnake, midget faded	*Crotalus viridis concolor*	G5T4, S3?	✓
Sucker, bluehead	*Catostomus discobolus*	G4/S4, SC	✓
Sucker, flannelmouth	*Catostomas latipinnis*	G3G4/S3S4, SC	✓
Tern, black	*Chlidonias niger*		
Treefrog, canyon	*Hyla arenicolor*	G5, S2	✓
Trout, Colorado River cutthroat	*Oncorhynchus clarki pleuriticus*	G5T3/S3, SC	✓
SENSITIVE PLANTS			
Grand Junction milkvetch	*Astragalus linifolius*	G3Q/S3	
Naturita milkvetch	*Astragalus naturitensis*	G3/S3	✓
San Rafael milkvetch	*Astragalus rafaelensis*	G3Q/S1	✓
Sandstone milkvetch	*Astragalus sesquiflorus*	G3/S1	✓
Rocky Mountain thistle	*Cirsium perplexans*	G3/S1	
Kachina daisy	*Erigeron kachinensis*	G2/S1	✓

Common Name	***Scientific name***	***Status***[2]	***May be Present***
Montrose bladderpod	*Lesquerella vicina*	G1/S1	
Colorado desert parsley	*Lomatium concinnum*	G2/S1	
Payson lupine	*Lupinus crassus*	G2/S2	✓
Dolores skeleton plant	*Lygodesmia doloresensis*	G1G2/S1	✓
Eastwood monkey-flower	*Mimulus eastwoodiae*	G3/S1	✓
Paradox breadfruit	*Pediomelum aromaticum*	G3/S2	✓

[1]Updated species list provided by Allen Pfister of the USFWS Ecological Services, Grand Junction, CO.
[2]STATUS: The source used to assign status is from: Colorado's Natural Heritage: Rare and Imperiled Animals ,Plants, and Plant Communities; Vol.3, No.1, 10/1997.;Colorado's Threatened, Endangered, and Special Concern Wildlife; May/98.Conservation Status Handbook: Colorado's Animals, Plants and Plant Communities of Special Concern Vol. 3, No.2, 5/1999

FEDERAL STATUS: T- Threatened, E-Endangered, C-Candidate
GROUP: Colorado Natural Heritage Program (CNHP)

CNHP - Global Rarity Ranking is based on the range-wide status of a species: G1- Critically imperiled globally because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extinction. (Critically endangered throughout its range); G2-Imperiled globally because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extinction throughout its range (Endangered throughout its range); G3-Very rare or local throughout its range or found locally in a restricted range (21 to 100 occurrences) (Threatened throughout its range); G4-Apparently secure globally, though it might be quite rare in parts of its range, especially at the periphery; G5-Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery. T- Taxa of subspecies or varieties, ranked on same criteria as G1-G5. CNHP - State Rarity Ranking is based on the status of a species (relative abundance of individuals) in each state. S1- Critically imperiled in state because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extirpation from the state. (Critically endangered in state); S2- Imperiled in state because of rarity (6 to 20 occurrences), or because of other factors demonstrably making it very vulnerable to extirpation from the state. (Endangered or threatened in state); S3- Rare in state (21 to 100 occurrences).

[3] On June 28, 2007, Secretary of the Interior Dirk Kempthorne announced the removal of the bald eagle from the list of threatened and endangered species. For a description of bald eagle distribution and status within the Colona LHA, refer to the sensitive species section below.
[4]Gunnison's prairie dog montane populations are a candidate species, not including the prairie segment populations.
[5]Southwestern willow flycatcher not known to occur in UFO, but species retained on list.
[6]Uncompahgre fritillary butterfly is not known to occur in UFO, but species retained on list.
[7]DeBeque phacelia is not known to occur in UFO, species removed from list.

Threatened and Endangered Species

Black-footed ferret: Black-footed ferrets depend on prairie dogs for food and shelter. For the Uncompahgre Field Office, this includes Gunnison's and white-tailed prairie dogs. Based on bioenergetics, the basic requirements for suitable ferret habitat include prairie dog towns 200 acres or greater in size with an average density of 8 active burrows/acre. In general, prairie dog communities have either been abandoned or reduced in size in Montrose County over the past 10 years (Hunt 2007). It is unlikely black-footed ferrets could survive in the area due to the small size and fragmentation of the prairie dog locations. The black-footed ferret is believed to have been extirpated from the area.

Canada lynx: Canada lynx are adapted to higher altitude forests and riparian areas. The species was in considered extirpated in Colorado by the mid 1970's. A lynx reintroduction program was initiated in 1999 in the San Juan Mountains (south of Montrose, Colorado) with 200 adult animals released by 2005. Reproduction was first noted in Colorado lynx in 2003 and recorded for subsequent years. In 2007 and 2008 however, no successful reproduction was discovered. No potential habitat for lynx is found in the West Paradox LHA area, although some potential exists in the nearby La Sal Mountains and northeast of the valley in the upper reaches of the Uncompahgre Plateau (known occurrence on the Plateau). There is also a possibility for migrating or dispersing individuals to travel through the area.

Greenback cutthroat: These trout are inhabitants of small high elevation creeks, and have been re-introduced to stream systems throughout Colorado as part of the recovery effort. They are not present in any of the West Paradox area stream systems at this time.

Gunnison's prairie dog: As discussed in the wildlife section above, there are prairie dog populations in the West Paradox area. These are members of the prairie subspecies of Gunnison's prairie dog, and it is the montane subspecies that are candidates for listing at this time.

Mexican spotted owl: Mexican spotted owls typically inhabit areas having a component of old-growth/mature forest of mixed evergreen, conifer, Douglas-fir, ponderosa pine, pine-oak, riparian or others. Rocky, steep canyons often near water are another selected habitat type for nesting. The Paradox LHA area is within range for this subspecies and contains typical habitat types for breeding, dispersal, and migration. Although potential habitat occurs in the LHA, no birds have been documented in the area. Areas surveyed in the early 90's included La Sal Creek, Coyote Wash, and other side canyons of the Dolores River in the West Paradox area. There is one account of a sighting near Buckeye Reservoir on USFS lands north of the LHA. This was thought to be a migrant or dispersing individual. The only areas with confirmed spotted owls in Colorado are the Pike-San Isabel National Forest and nearby BLM lands (Canon City area) and Mesa Verde National Park and adjacent Ute Mountain Ute tribal land. (Boyle and Franklin 1993).

Razorback sucker, Colorado pikeminnow, Humpback chub: The West Paradox LHA area is in the Dolores River watershed. The only known populations of these fish species are the Upper Colorado River Basin watershed in Mesa and Delta Counties. Changes in stream flow and water temperatures, direct loss of habitat due to inundation by reservoirs, blockage of migration routes and the introduction of non-native fish species are primarily responsible for the decline of the endangered fish species. These species are not expected within the LHA area.

Southwestern willow flycatcher: The flycatcher was returned to the TES list for Montrose County in 2009. They are residents of dense woody riparian areas, but there are no records of them in the West Paradox area. This species is considered extirpated from the Uncompahgre Field Office area (A. Pfister USFWS, pers. comm.)

Uncompahgre fritillary butterfly: This butterfly is a resident of high elevation mountain tundra in the San Juans where there are dwarf willow patches. It is not found in the West Paradox LHA area.

Yellow-billed cuckoo: An extensive survey of yellow-billed cuckoos in the western slope of Colorado was conducted in 2008. Eighty locations along the Colorado, Dolores, Gunnison, San Miguel, Uncompahgre, and Yampa Rivers were surveyed. Cuckoos were found at 11 of these, including one near Nucla on the San Miguel River. The highest concentration of breeding birds (6) was reported along the North Fork of the Gunnison near Hotchkiss. The cuckoos are neotropical migrants in western Colorado often associated with open woodlands and riparian areas with low shrubby cover usually near watercourses. Potential habitat appears to be present in a few areas along the Dolores River, La Sal Creek, and tributaries (RMBO 2008).

Clay-loving wild buckwheat: Clay-loving wild buckwheat is confined to whitish alkaline clay soils in Montrose and Delta Counties. In the Paradox LHA, there is no habitat and no known populations of this species.

Uinta Basin hookless cactus: The Uintah Basin hookless cactus occurs in Mancos shale-derived river terraces and dry slopes. It is documented in Mesa, Delta and northern Montrose

Counties. The West Paradox LHA area is outside of the range for this species.

Sensitive Species

Bald eagle: Bald eagles may be found foraging in the West Paradox region during winter, but there are no winter concentration areas found in the LHA region. The bald eagle was removed from the Endangered Species list in July of 2007 [72 Federal Register (FR) 37345-37372]. Management of eagles and habitat are still subject to guidance under the delisting monitoring plan (5-year duration) and the Bald and Golden Eagle Protection Act.

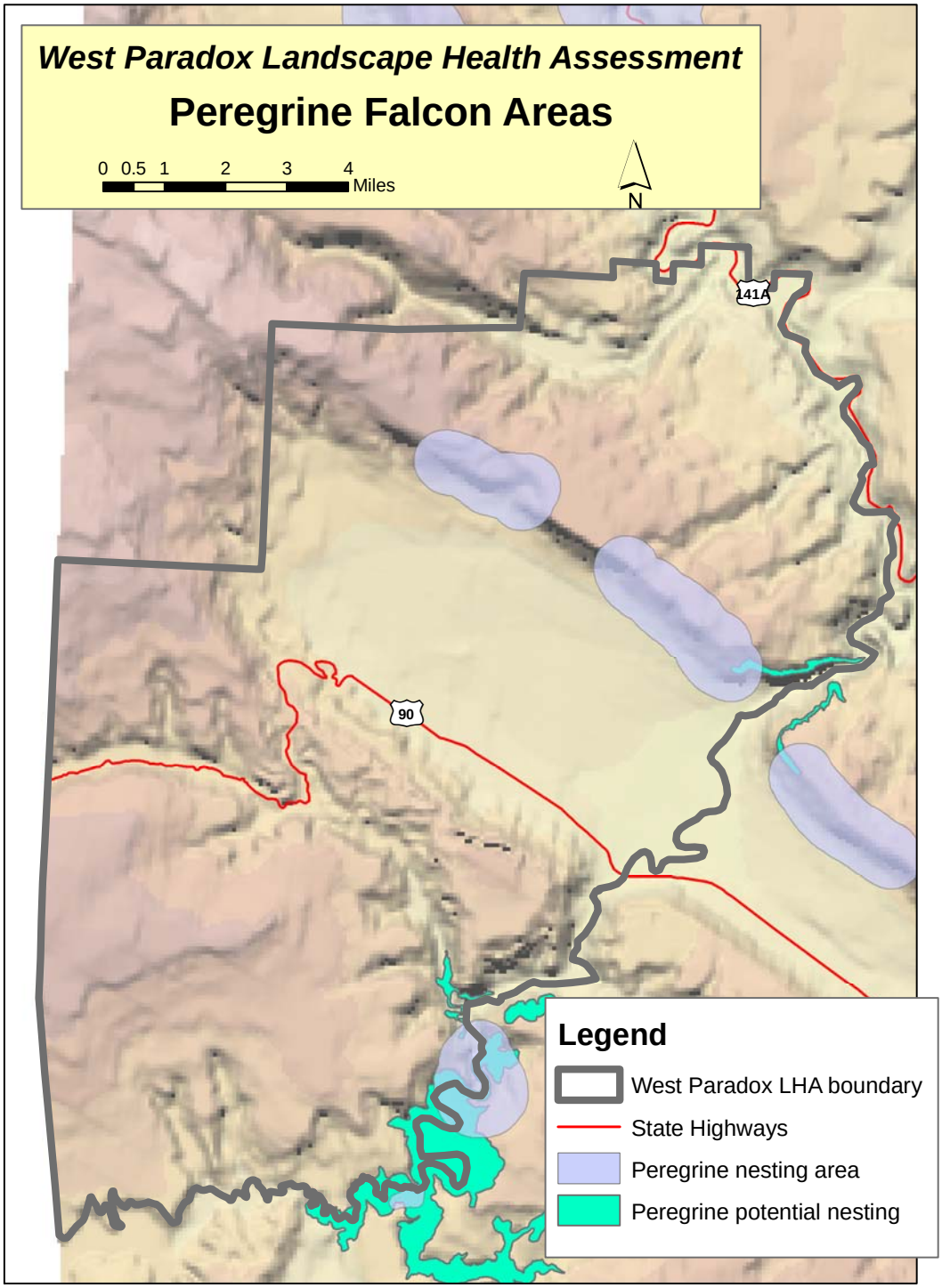
Peregrine falcon: Peregrine falcons were removed from the Endangered Species list in 1999 and are still managed under the delisting monitoring plan (64FR 46541-46558, 71FR60583). The UFO considers the peregrine a sensitive species. Peregrine nesting areas are identified in the Paradox Valley and Slick Rock Canyon along the Dolores River in association with high-elevation cliffs and rock faces (Fig. 1.12). Peregrine populations are considered stable in the area and nest sites should be kept protected from human intrusion (CNHP 2000).

Gunnison sage grouse: The Gunnison sage grouse is found in sagebrush communities with a diversity of grasses and forbs and associated riparian systems. Sagebrush is an essential habitat feature and provides cover and forage throughout the year. In the current highly fragmented distribution of the Gunnison sage grouse, only eight small populations occur in Colorado – Pinon Mesa, Crawford, San Miguel Basin, Gunnison Basin, Dove Creek, Cerro Summit-Cimarron-Sims Mesa, and Poncha Pass. There are no documented occurrences of the Gunnison Sage Grouse within the Paradox LHA area at this time. The closest known population is in Dry Creek Basin, in northern San Miguel County. Historical habitat occurs in Paradox Valley to the east of the Paradox LHA.

Other sensitive birds: Higher altitude forest could provide nesting habitat for northern goshawks, and the entire LHA area may be used during the winter by foraging birds. Ferruginous hawks are considered a migrant in this area, with potential habitat in open country with sagebrush, saltbush-greasewood shrubland, and the periphery of pinyon-juniper. Wintering ferruginous hawks concentrate in areas with high densities of small mammals such as prairie dog colonies or rabbits. They generally avoid areas of intensive agriculture or human activity. White-faced ibis are known to breed in Montrose County but no locations have been identified in the West Paradox LHA unit. However, wetland habitat is present within the area. Columbian sharp-tailed grouse inhabit areas of both open grasslands and grasslands with a shrub component. Presence of this species within the UFO has not been recently observed or documented, and is assumed to be extirpated from the area. Black terns are semicolonial, nesting in emergent vegetation in freshwater. The LHA is included in the breeding range for black terns, but no breeding has been recorded in Montrose or Ouray Counties. Both breeding and migration habitats occur in the area. The West Paradox LHA area is unlikely habitat for most of these sensitive species, as it has limited areas of wetland and forest habitat.

Fish: Roundtail chub, bluehead sucker, and flannelmouth sucker occur in the La Sal Creek and Dolores Rivers. There are healthy reproducing populations of the native suckers in La Sal Creek. Although historically wide-ranging, the Colorado River cutthroat is confined to isolated headwaters and lakes including upper drainages of the watershed, most notably Roc Creek. Restoring natural river flow regimes is important for the survival of all these species. Introduced, non-native fish are another concern because of their ability to outcompete and prey

Figure 1.12 Important peregrine falcon habitat in the West Paradox LHA area.



on native species. Carp and channel catfish are both introduced species present in the Dolores River (Dan Kowalski, CDOW, personal communication).

Amphibians: Northern leopard frogs inhabit springs, slow-moving streams, marshes, reservoirs, and lakes. There are numerous small wetlands created by manmade ponds, creeks and rivers in the West Paradox area. Throughout its range, leopard frog populations have declined due to habitat loss and degradation, non-native species invasion, and undetermined causes. The canyon treefrog is another sensitive species that has been documented in the lower Dolores watershed including La Sal Creek, but its population status at this time is unknown.

Reptiles: The longnose leopard lizard and midget faded rattlesnake are both inhabitants of low elevation desert areas, and can be expected in the Paradox area, although not documented there. The Texas horned lizard range is southeastern Colorado, and not expected in the Paradox area (Colorado Herpetological Society, 2009).

Bats: Several sensitive bat species have been documented in the West Paradox LHA area. These include the fringed myotis, Yuma myotis, spotted bat, big free-tailed bat, Townsend's big-eared bat, and Allen's big eared bat. Foraging habitat for Townsend's big-eared bat includes juniper woodlands, sagebrush steppe, and mountain shrub areas, which are found throughout the area. Roosting habitat includes caves, mines, and buildings. Townsend's big-eared bats were identified by echolocation in the 2008 survey. Allen's big-eared bat is found in pinyon juniper, riparian and rocky cliff areas, with brooding/roosting in mines and crevices. Echolocation calls of this species were documented near La Sal Creek in 2006, and spotted bats were also documented through call identification during surveys in the Paradox area in 2008 (Hayes and Hall, 2008). Spotted bats forage in pinyon-juniper woodland, canyon bottoms, open pasture, and hayfields found throughout the LHA; roosting habitat is typically rock crevices in cliffs. Yuma myotis were captured in the Paradox area during the 2008 survey (Hayes and Hall 2008). Yuma myotis are closely associated with water, and also prefer to inhabit buildings, bridges, cliff crevices and trees. Fringed myotis foraging habitat in the area includes ponderosa pine, pinyon/juniper, greasewood, saltbush, and scrub oak. They roost in caves, mines, rock crevices, buildings, and other protected sites found throughout the West Paradox LHA area. During the 2008 bat survey, big free-tailed bats were documented by call identification. Big free-tailed bats roost in crevices on cliff faces or buildings. Foraging is primarily in sagebrush and semi-desert shrub.

River otter: River otters are believed to have historically ranged throughout Colorado but never in abundance. The species was thought to be close to extirpation in Colorado resulting from water pollution and altered stream flows. Otters were reintroduced to the Dolores River in 1989. Since then, populations have been monitored and surveyed periodically by CDOW, and the Dolores population appears to be doing well (CDOW interagency reports, UFO files).

Naturita milkvetch: The Naturita milkvetch has been found on mesas adjacent to the Dolores River, and in Little Gypsum Valley. In 2008 CNHP mapped a new population on the east side of the Dolores near Roc Creek (Lyon 2008). Its habitat is mainly rocky shallow soils on and near sandstone cliffs and in pinyon juniper, so there may be additional populations around the Paradox LHA area. Based on recent surveys and clearance results, the species may be more ubiquitous than previously thought.

San Rafael milkvetch: Found on soils derived from Morrison formation, the San Rafael milkvetch prefers the banks of sandy clay gulches, pockets at the foot of sandstone outcrops, or boulder areas along dry watercourses. It has not been documented within the Paradox LHA, but

has potential habitat in the area.

Sandstone milkvetch: The sandstone milkvetch has been found in the Dolores and Roc Creek drainages and in the West Paradox area on Entrada sandstone rock ledges and fissures, on talus at the base of cliffs, and sometimes in sandy washes. It is associated with pinyon juniper and desert shrub habitat.

Kachina daisy: Cliff seeps known as hanging gardens are the habitat for the Kachina daisy. CNHP has documented populations of this plant in Coyote Wash at the southern boundary of the West Paradox LHA, also along the edge of Sewemup Mesa near the Dolores River.

Payson's lupine: Paradox is one of the prime locations for Payson's lupine, also known as Paradox Valley lupine. It occurs on dark red Chinle formation alluvial soils, particularly in draws. Its key identification features are white flowers and rhizomes, and it is associated with scattered junipers. Populations were observed during LHA field surveys in the Paradox valley near the Dolores River.

Dolores skeleton plant: Although there have been no populations of the Dolores skeleton plant reported in the West Paradox LHA area, it has been found to the north near Gateway and in the Dolores River valley. It prefers sandy reddish-purple alluvial soils derived from sandstone outcrops (Cutler Group), desert shrub and pinyon juniper communities.

Eastwood monkey-flower: Found in the same hanging garden habitats as the Kachina daisy, the Eastwood monkey-flower can also be found in Coyote Wash in the Paradox LHA area, and in seeps along Sewemup Mesa.

Paradox breadroot: The Paradox breadroot is often associated with Payson's lupine, and is found in the West Paradox LHA area on red clay, clay outcrops, sandy or rocky soils, and rock outcrops. Associated vegetation is pinyon juniper, sagebrush and desert shrub. Populations have been documented in La Sal and Paradox Creek drainages. This plant was seen during LHA field surveys in 2008 near the Dolores River.

Sensitive Birds, Including Migratory Birds

The U.S. Fish and Wildlife Service uses data from Partners In Flight (PIF) to identify migratory and non-migratory species that are not currently listed as threatened, endangered or candidate species. The following table lists the most recent U.S. Fish and Wildlife Service Birds of Conservation Concern (USFWS, 2008). Bird Conservation Region (BCR) No. 16 (Southern Rockies/Colorado Plateau) includes the West Paradox LHA area.

Table 1.4 Birds of Conservation Concern for Bird Conservation Region 16, Southern Rockies/Colorado Plateau

Common Name	*Scientific Name*	*Habitat/Status in Colorado*	*May be Present*
[Gunnison Sage-Grouse]	*Centrocercus minimus*	Resident	✓
American Bittern	*Botaurus lentiginosus*	Wetland/breeding	✓
Bald Eagle	*Haliaeetus leucocephalus*	Riparian/resident	✓
Bendire's Thrasher	*Toxostoma bendirei*	Mixed woodland/ breeding	✓
Common Name	*Scientific Name*	*Habitat/Status in Colorado*	*May be Present*

Black Rosy-Finch	*Leucosticte arctoa*	Resident	✓
Brewer's Sparrow	*Spizella breweri*	Shrub-steppe/breeding	✓
Brown-capped Rosy-Finch	*Leucosticte arctoa*	Resident	✓
Burrowing Owl	*Athene cunicularia*	Grassland/breeding	✓
Cassin's Finch	*Carpodacus cassinii*	Mixed woodland/resident	✓
Chestnut-collared Longspur	*Calcarius ornatus*	Annual, grassland/ migration	✓
Ferruginous Hawk	*Buteo regalis*	Grassland, shrub-steppe/ winter	✓
Flammulated Owl	*Otus flammeolus*	Open ponderosa/ breeding	✓
Golden Eagle	*Aquila chrysaetos*	Open woodland/resident	✓
Grace's Warbler	*Dendroica graciae*	Mixed woodland/breeding	✓
Grasshopper Sparrow	*Ammodramus savannarum*	Grassland/breeding	
Gray Vireo	*Vireo vicinior*	Pinyon juniper/breeding	✓
Juniper Titmouse	*Baeolophus ridgwayi*	Pinyon juniper/resident	✓
Lewis's Woodpecker	*Melanerpes lewis*	Open woodland/resident or breeding	✓
Long-billed Curlew	*Numenius americanus*	Grassland/migration	✓
Mountain Plover	*Charadrius montanus*	Grasslands/migration	✓
Peregrine Falcon	*Falco peregrinus*	Generalist/resident	✓
Pinyon Jay	*Gymnorhinus cyanocephalus*	Pinyon juniper/resident	✓
Prairie Falcon	*Falco mexicanus*	Annual, grassland/resident	✓
Snowy Plover	*Charadrius alexandrinus*	Riparian/migration	✓
Veery	*Catharus fuscescens*	Woodland-Riparian/breeding	✓
Willow Flycatcher	*Empidonax traillii*	Riparian/breeding	✓
Yellow-billed Cuckoo	*Coccyzus americanus*	Riparian/breeding	✓

Migratory birds are protected under numerous federal laws and executive orders including the Migratory Bird Treaty Act, Bald Eagle Protection Act, Lacey, Act and Wild Bird Conservation Act. To that end, the UFO strives to conserve these species and their habitat and minimize impacts by applying avoidance measures and other mitigation to project design.

The variety of habitats in the Paradox LHA offers opportunities for breeding, foraging, roosting and migratory stopovers for most of the birds on the species of conservation concern list that potentially occurring in the UFO area. Riparian areas are particularly important for migrating birds, and many resident/breeding birds nest and forage in deciduous vegetation associated with water systems. These systems as well as seepage from irrigation canal activities support willow and cottonwoods critical for nesting and roosting birds.

Pinyon juniper woodlands and sagebrush areas are important breeding habitats for corvids, sparrows, and numerous warbler species. These vegetation types also support a diversity of base prey including lagomorphs and rodents important to raptors.

Throughout their range and including the LHA area, migratory bird populations are threatened by loss of habitat due to residential development, mining activities, increased OHV

use, overgrazing by livestock, water diversion, and possibly drought. Agricultural use of pesticides may contribute to direct poisoning and can have indirect impacts by reducing invertebrate prey populations.

Biodiversity Focal Areas

Several efforts to identify and conserve regional and global biodiversity have been initiated by non-governmental groups. The Colorado Natural Heritage Program has been inventorying Colorado counties for the past several years to identify sites containing high-value plant communities, rare plants and/or animals that they feel warrant protection and management for biodiversity conservation at a statewide level. Western Montrose County, including the West Paradox LHA area, was inventoried in 2000 (Lyon et al). Each PCA was ranked for its biodiversity values, protection urgency, and management urgency.

The Nature Conservancy (TNC) has sponsored ecoregional assessments to identify areas important for regional biodiversity conservation. The West Paradox LHA area falls into the Colorado Plateau regional analysis (Tuhy et al. 2002). While similar to the CNHP effort in many respects, this assessment is broader in scope in that a region-wide network for biodiversity conservation is identified using computer-based optimization models to identify areas which would most efficiently and cost effectively conserve all of an ecoregion's known biodiversity. Because the ecoregional assessments are done at a large scale and not ground-truthed, the areas identified provide only loose guidance as to what the targets for conservation in a given area are, and what the actual location on the ground might be.

The Southern Rockies Ecosystem Project (SREP) is focused on preserving and restoring connectivity across the ecoregion, primarily to provide for the safe movement and migration of various wildlife species (Southern Rockies Ecosystem Project 2005). Using wildlife experts from throughout Colorado, they have put together a map of important corridors and landscape linkages across the state. These linkages are not highly detailed, but indicate the general locations, types of animals using the corridors, the degree of threat and statewide priority for securing or enhancing each of these corridors. No important corridors for movement of wildlife species were identified in the West Paradox LHA area.

Figure 1.13 shows 9 PCAs and two TNC recommended conservation areas in the LHA area. Table 1.5 shows the important resource values in each of the identified biodiversity conservation areas, and their relative ranking in terms of conservation importance.

At the present time, the San Juan/San Miguel RMP, as amended, does not place any of these areas into special management categories that directly benefit the specific resources of the PCA. The BLM land is open to off-highway vehicle travel, mineral material disposal, locatable mineral activities, construction of rights-of-ways, and permitted livestock grazing.

Figure 1.13 West Paradox LHA area locations identified as being important for biodiversity conservation across the ecoregion, as recommended by the Colorado Natural Heritage Program and The Nature Conservancy.

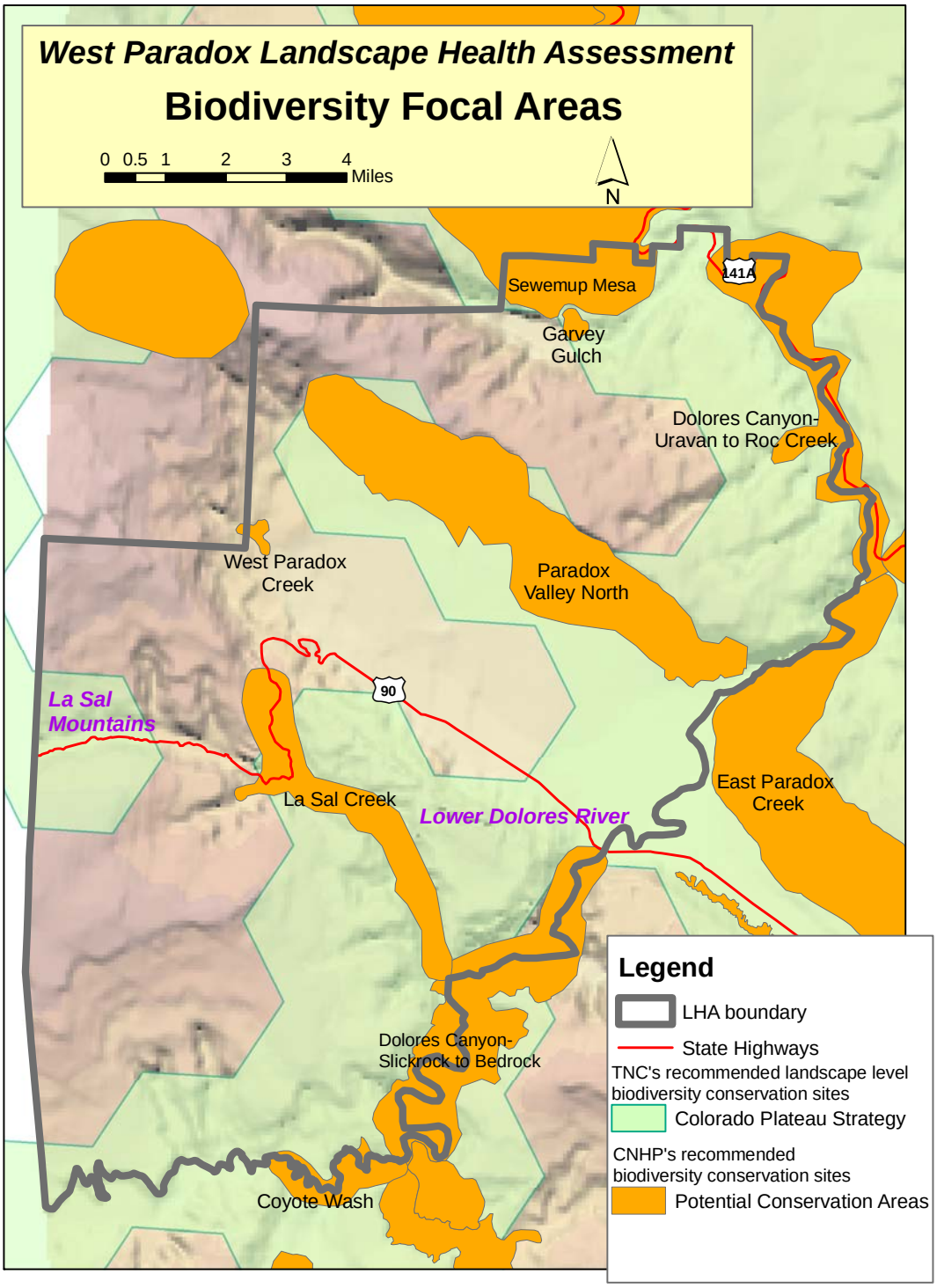


Table 1.5 Recommended conservation areas in the West Paradox LHA area

Site Name	Resource Values	Biodiversity or Conservation Value Rank [1]	Management/ Protection Urgency Rank [2, 3]
CNHP: Coyote Wash	Best CO occurrence of kachina daisy, also has needleandthread grass community, Eastwood monkey flower, helleborine orchid and spotted bat	B2	M4, P4
CNHP: Dolores Canyon-Slickrock to Bedrock	An excellent occurrence of globally imperiled New Mexico privet riparian community, also kachina daisy, needleandthread grass community, roundtail chub, Naturita milkvetch, hanging gardens, paradox breadroot, Eastwood monkey flower, flannelmouth sucker, helleborine orchid, gray vireo, Abajo Penstemon, peregrine falcon, Yuma skipper, canyon tree frog, Plateau striped whiptail, tree lizard, coyote willow community, and smooth cliff-brake	B1	M4, P4
CNHP: Dolores Canyon-Uravan to Roc Creek	Two good occurrences of San Rafael milkvetch, and roundtail chub, sandstone milkvetch, flannelmouth sucker, helleborine orchid, and pale lump-nose bat	B3	M3, P3
CNHP: East Paradox Creek	The best occurrence of Payson lupine, along with needleandthread grass community, pinyon/needleandthread community, roundtail chub, Paradox breadroot, blue grama-galleta shortgrass prairie, flannelmouth sucker, cold desert shrublands, gray vireo, peregrine falcon, sage sparrow, Plateau striped whiptail, and mesic western slope pinyon-juniper woodlands	B2	M2, P4
CNHP: Garvey Gulch	Values not described	B3	M?, P?
CNHP: La Sal Creek	The only known location of box elder/river birch community, and needleandthread grass community, Payson lupine, Paradox breadroot, xeric western slope pinyon-juniper woodlands, Plateau striped whiptail, and tree lizard	B1	M2, P3
CNHP: Paradox Valley North	An excellent occurrence of Payson lupine, and Paradox breadroot, Abajo penstemon, and peregrine falcon	B2	M2, P4
CNHP: Sewemup Mesa	A good occurrence of Kachina daisy, and xeric western slope pinyon-juniper woodlands, roundtail chub, hanging gardens, Eastwood monkey flower, which is imperiled on a global scale and hanging gardens, blue grama-galleta shortgrass prairie, flannelmouth sucker, great plains salt meadows, Grand Junction milkvetch, helleborine orchid, Mesa dropseed, smooth cliff-brake, Plateau striped whiptail, and southern maiden-hair	B2	M4, P4
CNHP: West Paradox Creek	A good to excellent occurrence of Douglas fir/red osier dogwood community	B4	M4, P4

Site Name	Resource Values	Threats to Values
TNC: La Sal Mountains	Little-leaf mountain mahogany sparse shrubland, Isely milkvetch, Franklin's ceanothus, La Sal daisy, yellowish phlox, spotted bat, Abert's squirrel, dwarf shrew, Lewis's woodpecker, three-toed woodpecker, Williamson's sapsucker, Virginia's warbler, gray vireo, smooth green snake, Colorado River cutthroat trout, stonefly, alpine/subalpine bare substrate/meadow, aspen forest, foothill and desert riparian woodland/ shrubland, lower montane shrubland, montane riparian woodland and shrubland, pinyon-juniper and juniper woodland, ponderosa pine woodland, sagebrush shrubland, sagebrush steppe, sandstone-mixed bedrock cliff and tableland, subalpine spruce-fir forest, headwater and creek, low and intermediate, and montane and above, intermittent and perennial-Upper Colorado River	Very high threats from energy and mineral development , high threats from vehicles, roads and recreation and timber/woodland management, moderate threats from fire and hydrologic regime alteration and habitat loss, and low threats from exotic species
TNC: Lower Dolores River	Fisher milkvetch, Kachina daisy, Payson lupine, Dolores River skeletonplant, Paradox breadroot, Townsend's big-eared bat, spotted bat, desert bighorn sheep, western yellow-billed cuckoo, southwestern willow flycatcher, peregrine falcon, gray vireo, roundtail chub, ash leaf maple/water birch woodland, columbine-Eastwood monkey flower hanging garden, wild privet shrubland, two-needle pinyon/needleandthread woodland, narrowleaf cottonwood/fragrant sumac woodland, eastern cottonwood/skunkbush sumac woodland, skunkbush sumac-sandbar willow shrubland, needleandthread grass community, foothill and desert riparian woodland/shrubland, lower montane shrubland, pinyon-juniper and juniper woodland, ponderosa pine woodland, sagebrush shrubland, headwater and creek, low and intermediate, and montane and above, intermittent and perennial Upper Colorado River streams	Very high threats from energy and mineral development and exotic species, high threats from vehicles, roads and recreation and hydrologic regime alteration, moderate threats from fire regime alteration, habitat loss, and improper grazing, and low threats from timber/woodland management

[1] Biodiversity Rank: B1= Outstanding significance such as the only known site for a globally species. B2= Very high significance, such as one of the best examples of a community type, or good occurrence of a globally imperiled species or a species with very restricted range. B3= High significance, such as an excellent example of any community type or a good occurrence of any species with very restricted range or a good occurrence of a state rare species, B4 is an occurrence of moderate or regional significance

[2] Management Urgency Rank: M1=Management action required at once to prevent the loss or irreversible degradation of one or more of the species or communities for which the PCA was identified. M2= Management action required within 5 years to prevent the loss of one of the items for which the PCA was identified. M3= Management action needed within 5 years to maintain the current quality of identified resources. M4= Management actions may be needed in the future to maintain the quality of the identified resources. M5= No serious management needs identified. U=Uncategorized.

[3] Protection Urgency Rank: P1: Immediately threatened by severely destructive forces, within 1 year of rank date; protect now or never. P2: Threat expected within 5 years. P3: Definable threat but not in the next 5 years. P4: No threat is known for the foreseeable future. P5 Land protection complete or adequate reasons exist not to protect the site; do not act on this site.

Surface and Ground Water

The West Paradox Landscape Unit includes portions of both the Lower and Upper Dolores 4th Field River Basins. Table 1.6 and Figure 1.14 show the Hydrologic Unit subdivision of the LHA area by 4th and 5th field (Hydrologic Unit Codes) watersheds and the associated area included in this assessment. Water quality designations and classifications, on the LHA area's streams, are listed and described in Table 1.7. These designations and classifications became effective in July, 2007, by the Colorado water Quality Control Commission, and are reviewed and updated every 3 years (the next tri-annual review for the Lower Dolores is scheduled for 2010).

Table 1.6 Watershed Subdivisions (Hydrologic Unit Codes) and Water Quality Designations and Classifications for the West Paradox Landscape Unit.

4th Field Watershed	***5th Field Watershed***	***Land Status Acres***	
		BLM	***Other***
Upper Dolores Basin 14030002	Paradox Creeks 1403000215	34,345	17,990
	Big Gypsum Valley 14003000214	15,764	0
Lower Dolores Basin 14030004	Blue Creek 1403000442	19,223	1,425

The major waterway in the assessment area is the Dolores River. The more prominent tributaries to the Dolores in the LHA area include: La Sal Creek, Roc Creek, and West Paradox Creek. Many of the low order tributaries to the Dolores River flow intermittently or ephemerally, due to both the semi-arid climate and water diversions. Both Roc Creek and La Sal Creek headwater in the La Sal Mountains and experience seasonal high flow from snow melt in the spring. Short duration flood flows occur from high intensity precipitation events associated with monsoonal air flow patterns in mid to late summer. Typically, these summer floods are localized and more significant on the smaller, low order drainages.

Annual precipitation varies from less than 12 inches at the lower elevations in the Paradox Valley to more than 15 inches at the higher elevations on Wray Mesa and Carpenter Ridge (PRISM Group at Oregon State University). From 25 to 50% of the annual precipitation falls as snow during the colder months, depending on elevation. Most of the precipitation outside of the mid to late summer season occurs from frontal type storm systems, which are typically regional in size. Precipitation from frontal events occurs over a relatively long duration but at

Table 1.7 Water Quality Designations and Classifications for the West Paradox Landscape Unit.

Stream Segment	***Stream Designation[4]***	***Stream Classification[1,2,3]***
Dolores River		Aquatic Life Warm 1 Recreation E Agriculture
Tributaries to Dolores River except for West Paradox Creek	Use protected	Aquatic Life Warm 2 Recreation E Agriculture
West Paradox Creek		Aquatic Life Warm 2 Recreation E Agriculture

1 - Waters are designated either warm or cold based on water temperature regime. Class 1 water's are capable of sustaining a wide variety of cold or warm water biota, while class 2 waters are not.
2 -Class E - Existing Primary Contact Use - These surface waters are used for primary contact recreation or have been used for such activities since November 28, 1975.
3 - Waters suitable for irrigating crops usually grown in Colorado.
4 - The Colorado Water Quality Control Commission designates waters of the state, "Use Protected" if they do not warrant special protection provided by the outstanding waters designation or the antidegradation review process.

low intensity rates. In contrast, summer precipitation is commonly associated with the southwest monsoon air flow pattern, which can produce localized, short duration, and intense precipitation events.

The Colorado's Unified Watershed Assessment (Table 1.8), 12/1998, ranked both the Uncompahgre Basin as Category 1, defined as "Watersheds in Need of Restoration", due to salinity management issues and lower reaches of the Uncompahgre on the state's 3030(d) list. Table 1.9 shows the Dolores River to be water quality limited, or in violation of state water quality standards for total recoverable iron. This standard is established by the US Environmental Protection Agency to protect aquatic life. Much of the iron in the Dolores River is considered to be from natural sources such as ground water inflow and/or eroded into streams from the local geology. The BLM, Colorado Public Land Health Standards, which require land management activities minimize soil erosion and sediment yields would also limit any accelerated iron contributions to the Dolores River from public lands. There are no stream segments in the LHA area on the Colorado Monitoring and Evaluation List.

Figure 1.14 West Paradox LHA area streams and 5th level watersheds.

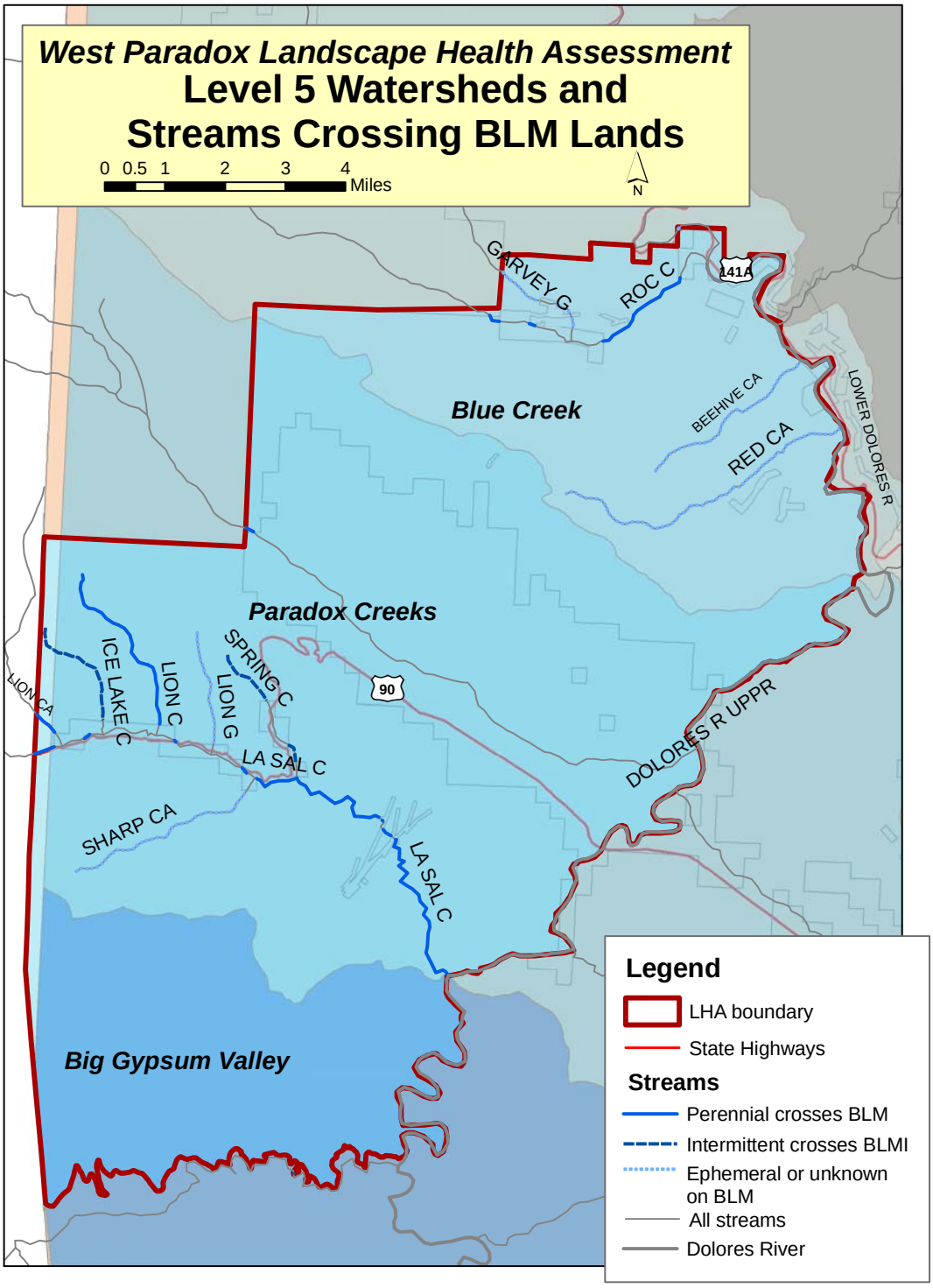


Table 1.8 Colorado Unified Watershed Assessment Ranking[1]

4th Field Watershed	Category Ranking for BLM Portion of Watersheds	Rationale for ranking
14030002 Upper Dolores	Category 2 – Watersheds meeting goals	- 50% federally managed - Moderate salinity potential - Unit predominantly in Colorado
14030004 Lower Dolores	Category 4 – Insufficient data to make an assessment.	- 50% federally managed - BOR project Paradox Valley - Healthy waters that need to be maintained for fish species of concern (flannel mouth, blue head sucker, and round tail chub - Unit predominantly in Colorado

1. Colorado Unified Watershed Assessment, Colorado Department of Public Health and Environment, Water quality Control Division, and USDA Natural Resources Conservation Service, November, 1998

Table 1.9 Water Quality Limited Stream Segments Requiring the Implementation of the Total Maximum Daily Load Process (TMDLs) – (303)d List

Segment Description	Portion	Impairment	Priority
Dolores River from Little Gypsum Valley bridge to Colorado/Utah border	all	Fe(Trec) (iron)	High

The Town of Paradox manages a spring and pipeline to supply domestic water to local residents (public Water System ID 143600). The spring source, pipeline, and the source water assessment area are not located on public lands. The Source Water Assessment report showed a total susceptibility rating to potential contaminants as “Moderately Low”.

METHODS

The land health assessment was conducted on public lands in the West Paradox LHA Unit during the period spanning May through June of 2008. The following procedures were used:

1). The area was first broken apart into 32 different polygons. Polygons were based on ecological sites (NRCS-USDA 2003) derived from soil mapping units (where available) and allotment boundaries. Polygons ranged from 53 to 11,274 acres in size. Some ecological sites within allotments were too small or minor to evaluate, and are categorized as "Unknown". Other areas were not sampled because they were on steep and rocky slopes. These were generally considered to be meeting the Land Health Standards. Other areas were not upland, so were not evaluated for Standards 1 or 3.

2). The interdisciplinary team made up of range, wildlife, ecology, hydrology, and T&E specialists ranged between 6-8 people. At the beginning of the field work period, the entire team worked together collecting data in order to gain consistency. Afterwards data was collected primarily by interdisciplinary teams of two to three people.

3). Each polygon was visited in the field, and land health assessment forms were used to describe the plant community characteristics, and various soil and community health attributes. Polygons were evaluated at two to five sites spread across the polygon. The sites were predetermined on maps, and not subjectively chosen in the field. Data collection occurred in the field. Most points were mapped by a GPS unit in the field. A photo of each site was also taken.

4). Riparian Proper Functioning Condition (PFC) data was collected at points along nearly all perennial and intermittent streams within each grazing allotment during the summer of 2007. Where data was not collected, PFC data from 1995-1997 was used. This data was used to address Standard 2.

5). In addition to the PFC data, water chemistry was analyzed, and macroinvertebrate samples were collected in 2007 at the PFC points where there was live water. Qualitative data on sediment and water quality was also collected at these points. On ephemeral or intermittent drainages, qualitative data on likely sediment production was also collected. Standard 5 was evaluated using this data in association with the PFC data and upland health assessment data. This data was evaluated against Colorado's stream water quality designations.

6). Data from the field forms and location data were entered into an ARCGIS personal geodatabase. The databases were linked to the polygons and to the stop points to provide a system that allows maps to be made based on any of the data attributes collected. Based on the data collected in the field, mean values of groundcover and plant growth form cover were also calculated for each ecological site type (unique combinations of ecological site, slope and aspect).

7). A final determination for Standard 1 and for the vegetation portion of Standard 3 for each polygon was made by the ID team. This was done by evaluating all the sites in each polygon, and identifying problems with the range health indicators or by finding substantially lower than average values for the ecological site type. Problems were defined as a score of 1 or 2 for the following health indicators: runoff drainages, pedestals, plant distribution, community diversity, exotic plants, or noxious weeds; or for scores of substantially more than 10% worse than average for soil cover or plant cover. Browse plant vigor attributes were also considered. The ID team judged each polygon as to whether it was meeting the standard (no substantive problems at any site in the polygon), not meeting the standard (substantive problems at one half or the majority of sites in the polygon), or meeting with problem areas (substantive problems at less than half of the

stops in polygon), based on a preponderance of evidence. The “meeting with problem areas” category has been used in past land health assessments, and denotes polygons which on balance meet a health standard, but have some indicators or locations within them that the ID team would like to see tracked and managed for improvement. Reasons for the rankings, and likely causes were documented. Riparian Functioning at Risk ratings were directly translated into “Meeting with Problems”, as they had been in past land health assessments.

8). Polygon ratings (Meeting, Not Meeting, Meeting with Problems) were then entered into the geodatabase, along with land health problems and causes. Causes for polygons not meeting or meeting with problems for any standard were discussed by an ID team. The team considered evidence which included observations of possible disturbances made on the site, grazing dates, reported livestock Actual Use, records of past treatments, and proximity to roads and recreational or mining related disturbance.

9). Numerous maps were created showing the locations of different types of problems across the assessment area, based on the data collected at sample points.

10). Large scale health issues were assessed by using a remotely sensed vegetation map (from 1993 Landsat imagery) and the desired landscape map that has been developed through the fire planning process, in addition to wildlife population data. In some cases this information may have influenced the final ratings for Standard 3 for the polygons.

11). Standard 4 was rated based on existing location data of special status species and Colorado BLM’s listed species of concern, together with habitat needs data and the data from the Health Evaluation.

12). The overall stream rating for Land Health Standard 5 was determined by the number of surrogate, soil surface indicators occurring on any given area, those being: amount of bare soil surface, density of plant basal cover, amount of plant litter, and the density of secondary roads on sites having a severe erosion potential. On areas that have two soil surface indicators showing problems, the intersecting drainages are rated as meeting standard 5 with problems (Figure 6.1, 6.4, and 6.5). The streams intersecting areas that showed problems with three of the four soil surface indicators, do not meet Public Land Health Standard 5.

RESULTS

Standard 1:
Upland soils exhibit infiltration and permeability rates that are appropriate to soil type, climate, land form, and geologic process. Adequate soil infiltration and permeability allows for the accumulation of soil moisture necessary for optimal plant growth and vigor, and minimizes surface runoff.

*Indicators used to assess this standard include: rills and **pedestals**, active **gullies**, appropriate **groundcover** and plant canopy cover, **litter accumulation**, **litter movement**, appropriate soil organic material, plant species diversity and vigorous, desirable plants.*[*]

[*] *bold text identifies the indicators which were most important for this assessment*

Acreage Figures

Meeting Standard 1		**Not Meeting Standard 1**	**Unknown**	**Water or other N/A**
Meeting	Meeting with problems			
33,355	35,173	0	1,863	255

See figure 2.1 for map showing polygon ratings.

Specific Problems
Active Soil Erosion-Pedestals and Gullies

Soil erosion is a concern because it reflects loss of site productivity and potential that usually cannot be regained for centuries or more. Gullies along with other downcutting or widening drainage channels, and the formation of pedestals on the soil surface were the primary indicators used to evaluate active soil erosion. Pedestal problems were insignificant, as was gullying across nearly all of the West Paradox area (see Figure 2.2). There were only a few isolated areas with gullies observed. Gullies follow an evolutionary process which includes headcutting that pushes the gully upstream of its initial starting point. Because of this characteristic, the presence of a gully at a site may or may not be attributable to other characteristics or management of the site. It does however reflect a loss of soil at the site, which is very important to site productivity.

Active Soil Erosion–Runoff Drainages

Runoff drainages occur where water fails to infiltrate into the soil and instead runs off the site as overland flow. Water running over the soil surface is an important source of soil erosion, carrying off soil particles as it goes. An additional concern is that water which does not enter into the soil is unavailable for plant growth. This reduces productivity in an area that is already constrained by a dry climate. Runoff drainage problems were minor across the unit (Figure 2.3), with only a few isolated sites having pronounced overland flow and drainage patterns.

Figure 2.1 West Paradox LHA Standard 1 Polygon Ratings.

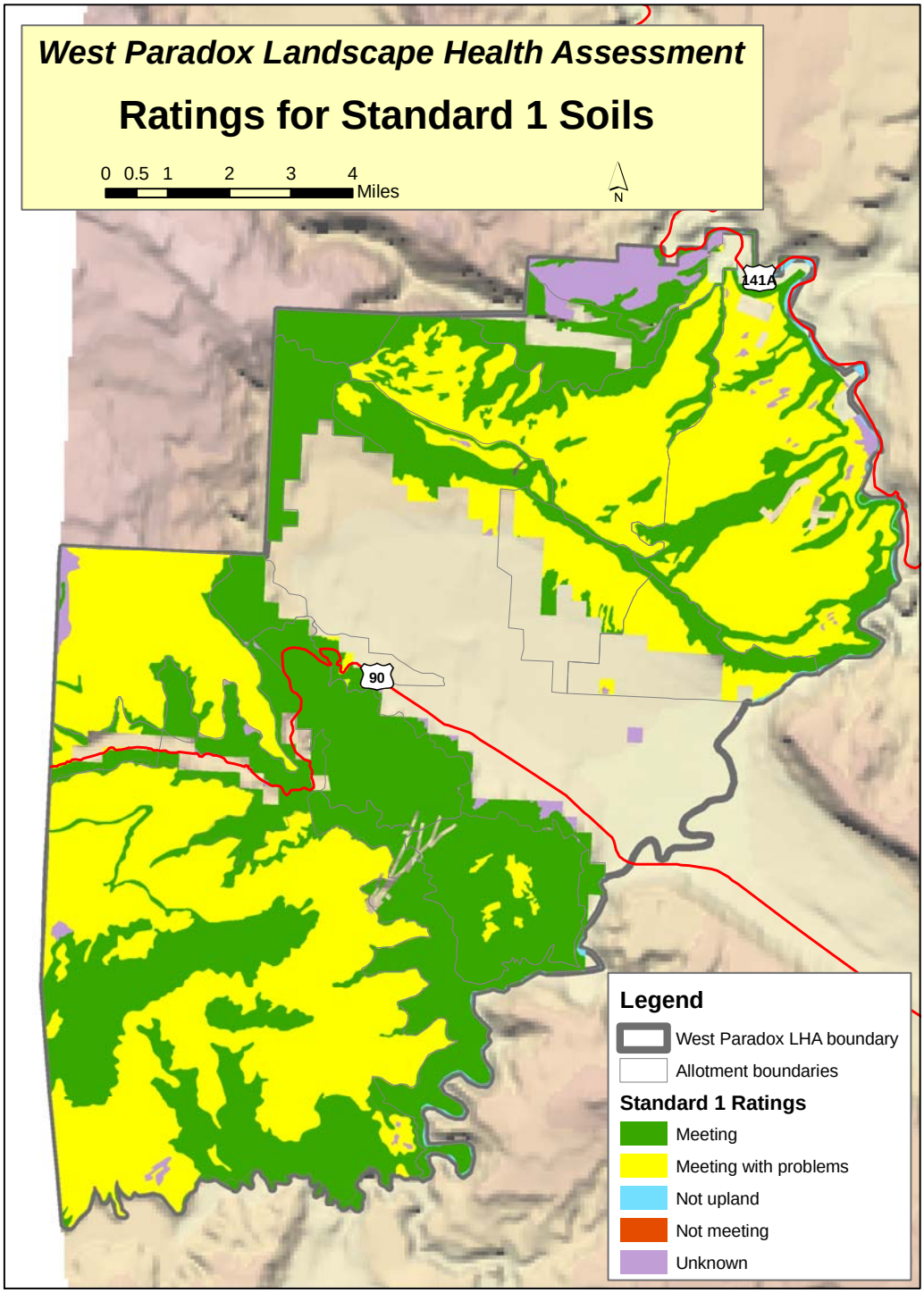


Figure 2.2 West Paradox LHA Area soil erosion problems: map shows all sites with gully activity (Rosgen type F and G channels), and soil pedestals (sites with scores of 1 or 2 on the Rangeland Health Indicators data sheet.)

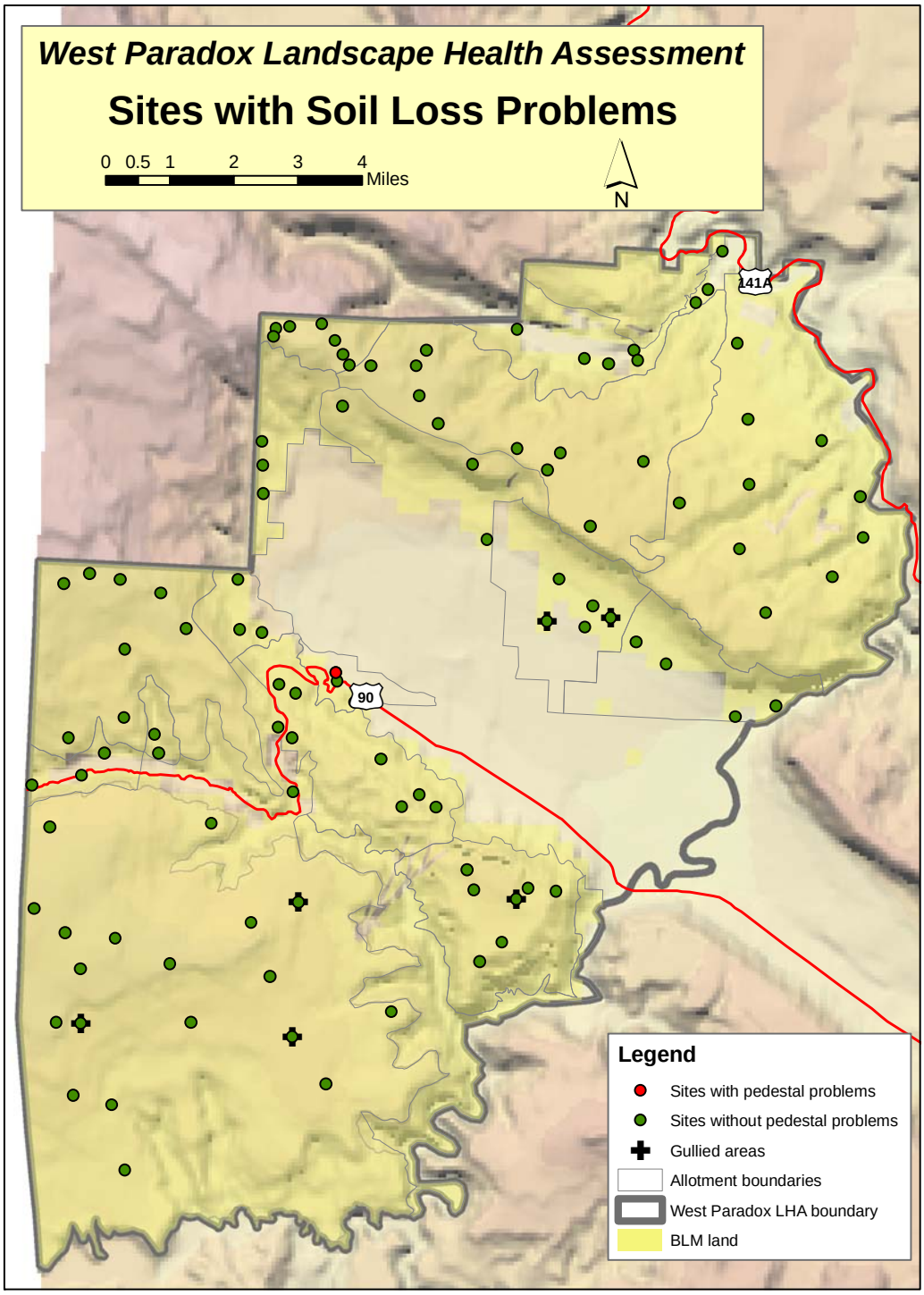
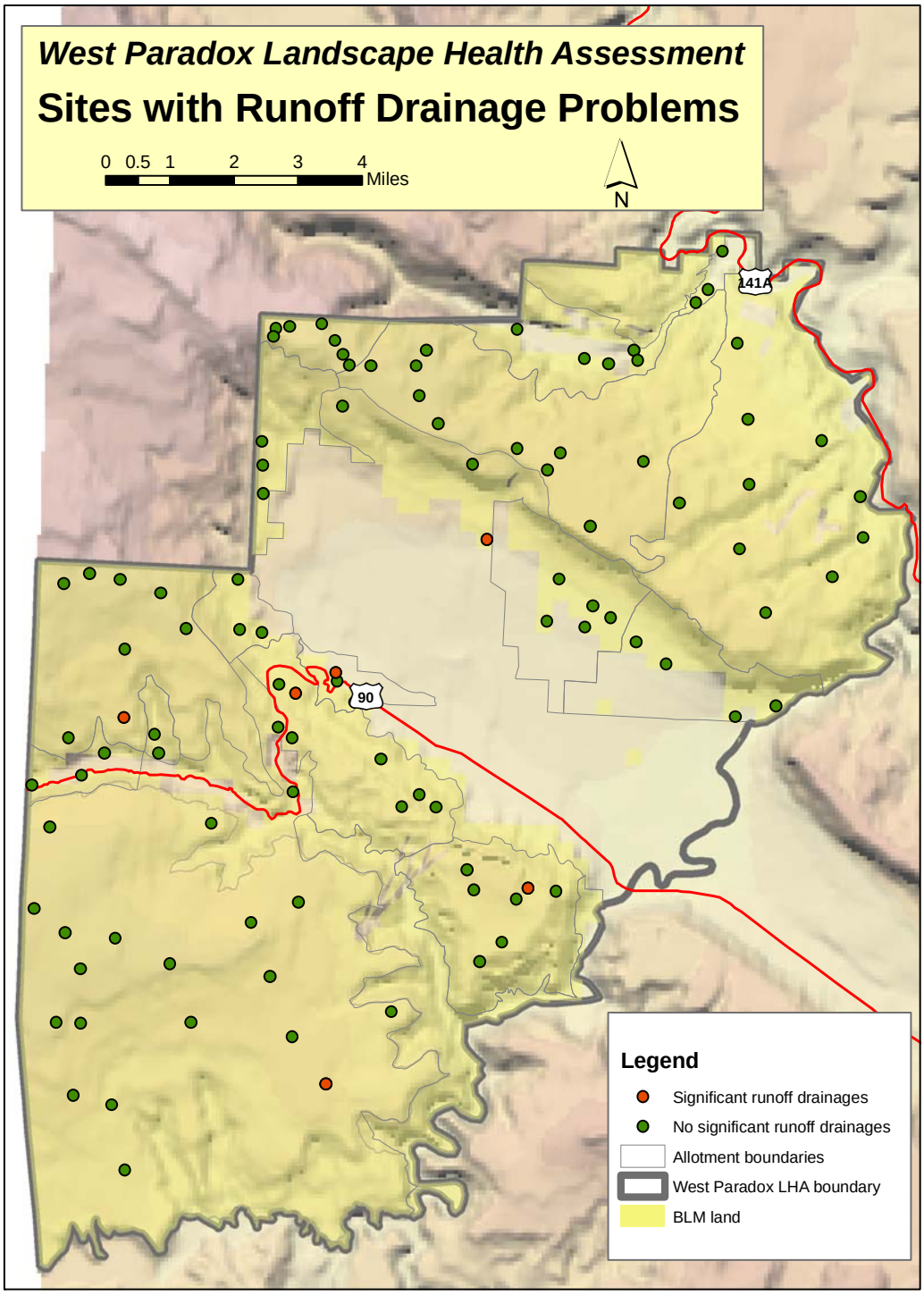


Figure 2.3 West Paradox LHA Area runoff related problems. Sites with erosion associated with overland flow: runoff drainage scores of 1 or 2 on the Rangeland Health Indicator sheet are considered problem sites.



Elevated Bare Soil Levels

Bare soil is that part of the ground surface that is not protected by rock, plant basal area, cryptogamic crust, or litter. Bare soil is vulnerable to the erosive forces of water and wind. The percent cover of bare soil was an important indicator used to evaluate the soil's vulnerability to erosion. High levels of bare soil were found at a number of sites throughout the West Paradox unit (Figure 2.4). These sites had substantially higher bare soil than the average values for the ecological sites. Two large regions with concentrations of problem sites were found and are identified by blue circles in Figure 2.4.

Low Plant Basal Cover

Plant basal cover is one of the best sources of soil protection since it protects the soil surface from wind and water erosion, and binds soil particles together with roots. The percent of ground covered by the crowns of perennial plants (basal area) was used as an important indicator of the level of soil protection. In addition to elevating the risk of soil erosion, low basal cover is a concern because the site is producing less vegetation, less vigorous vegetation, or a different type of vegetation than it is capable of producing. Low basal cover was found at numerous sites throughout the LHA area, to a greater degree than bare soil (Figure 2.5). Several regions were found with concentrations of sites having low plant basal area. These regions occur throughout the LHA area, and are identified by the blue circles in Figure 2.5.

Low Litter Cover

Litter (the term for dead plant parts on the soil surface) is another plant-related source of soil protection. Litter is made up of persistent or long term litter which is typically the larger and woodier component, and nonpersistent litter which is finer and quickly degrades. Although the nonpersistent portion of litter tends to be less permanent than plant basal cover, persistent and nonpersistent together serve to protect the soil surface and enhance water infiltration by slowing movement of overland flow of water. In addition, as litter decomposes it adds to the organic material in the soil, increasing soil productivity.

Low litter cover was found to occur at a number of sites throughout the unit, although to a lesser degree than low basal and high bare areas (Figure 2.6). Some regions having concentrations of sites with low litter cover were identified by the blue circles in Figure 2.6.

High Road Density Areas

Within the LHA there are locations where access and operations for historic uranium mining have resulted in high densities of secondary roads, many of which receive little or no maintenance. Additionally, the steep topography and physical properties of the soils on much of the LHA area result in a high erosion potential, which is often accelerated in areas having a dense network of secondary roads. Figure 2.7 highlights the areas where the combination of high road density and "severe" erosion potential occur, primarily in the La Sal Creek and Martin Mesa/Red Canyon Watersheds.

Figure 2.4 West Paradox LHA Area sites vulnerable to soil erosion because of high levels of bare soil. On this map red dots denote sites with bare soil levels worse than 10% higher than average for the ecological site.

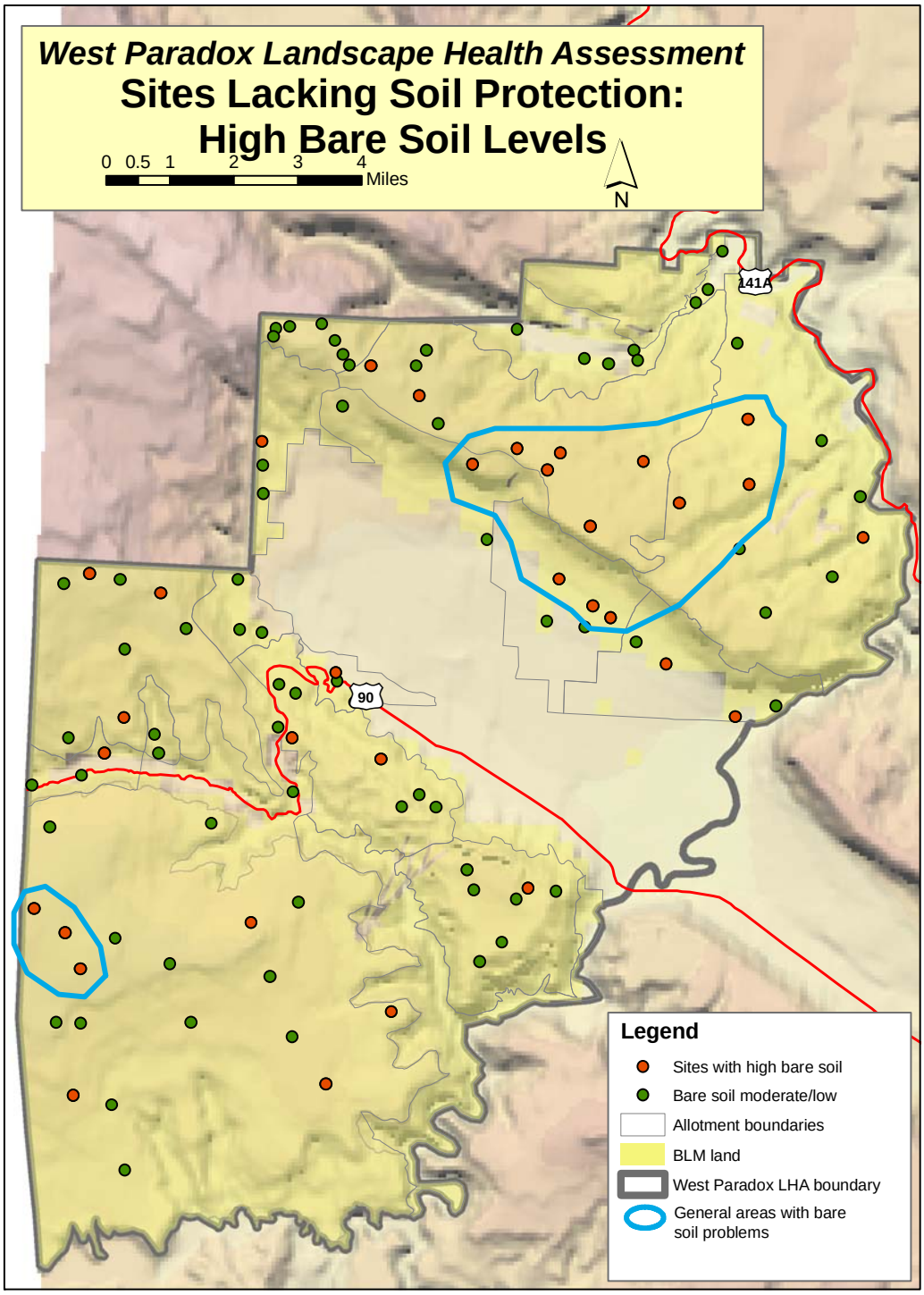


Figure 2.5 West Paradox LHA Area sites with low plant basal cover. On this map red dots denote sites with basal cover worse than 10% below average for the ecological site.

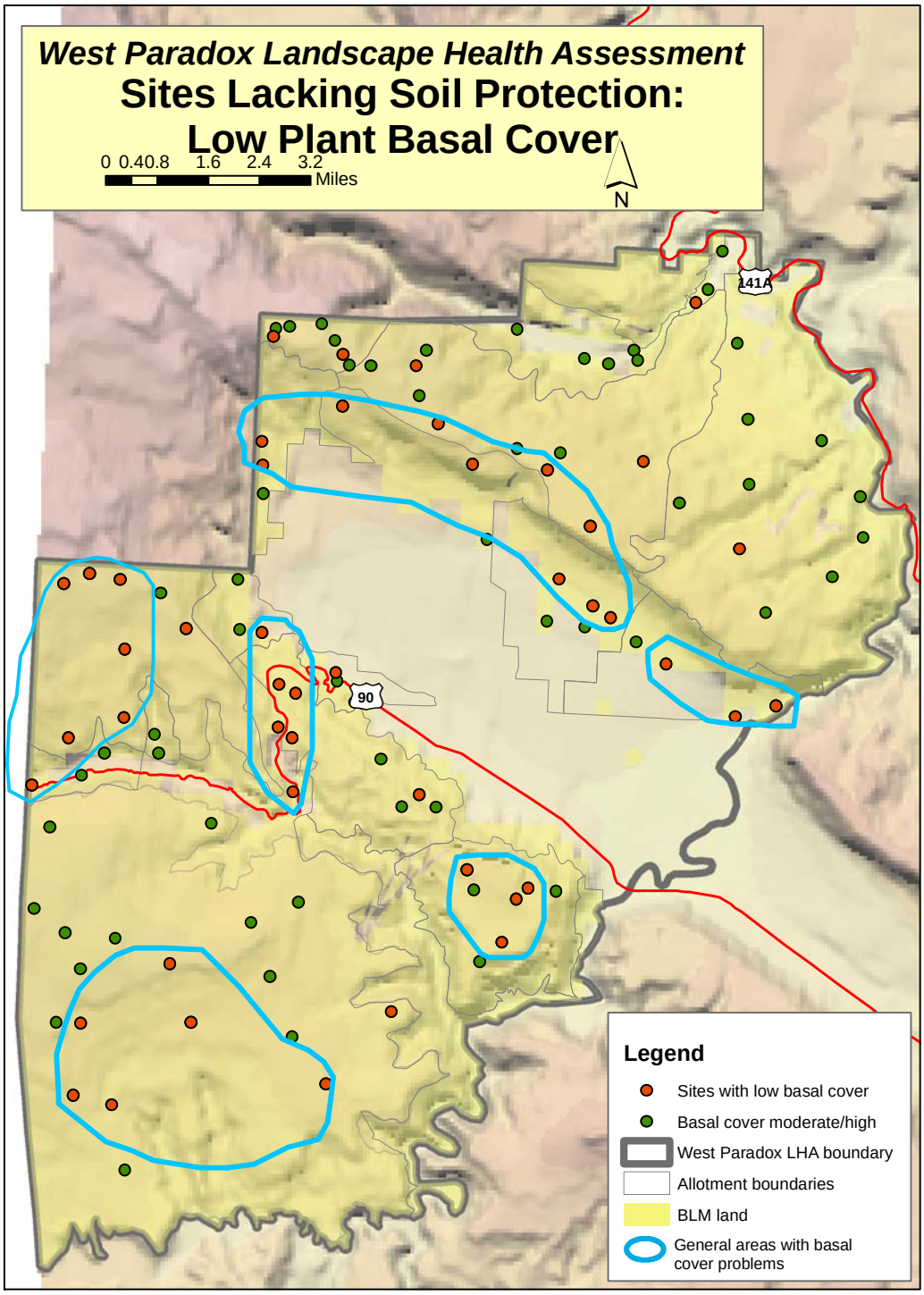


Figure 2.6 West Paradox LHA Area sites with low litter cover. On this map red dots denote sites with litter cover worse than 10% below average for the ecological site.

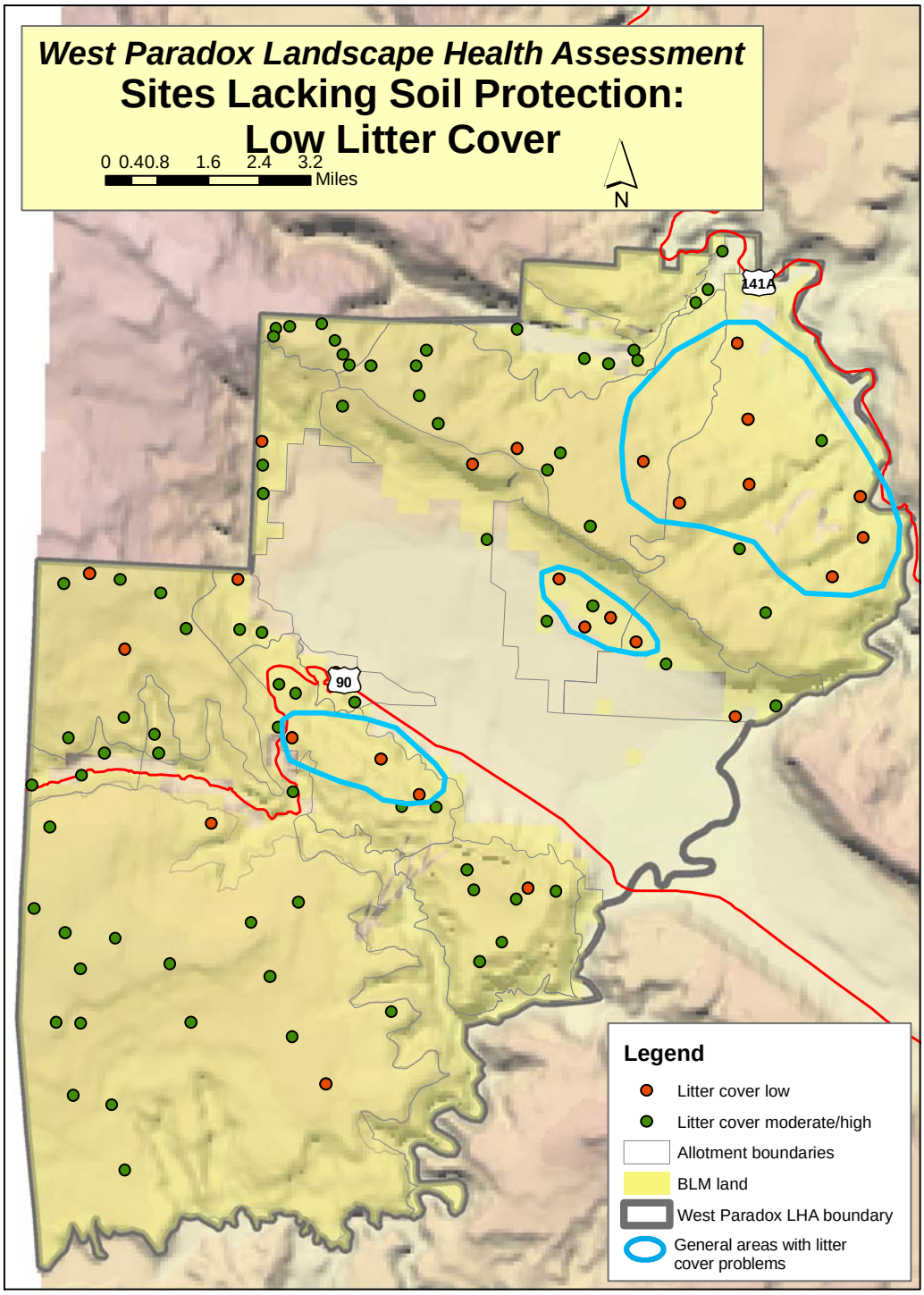
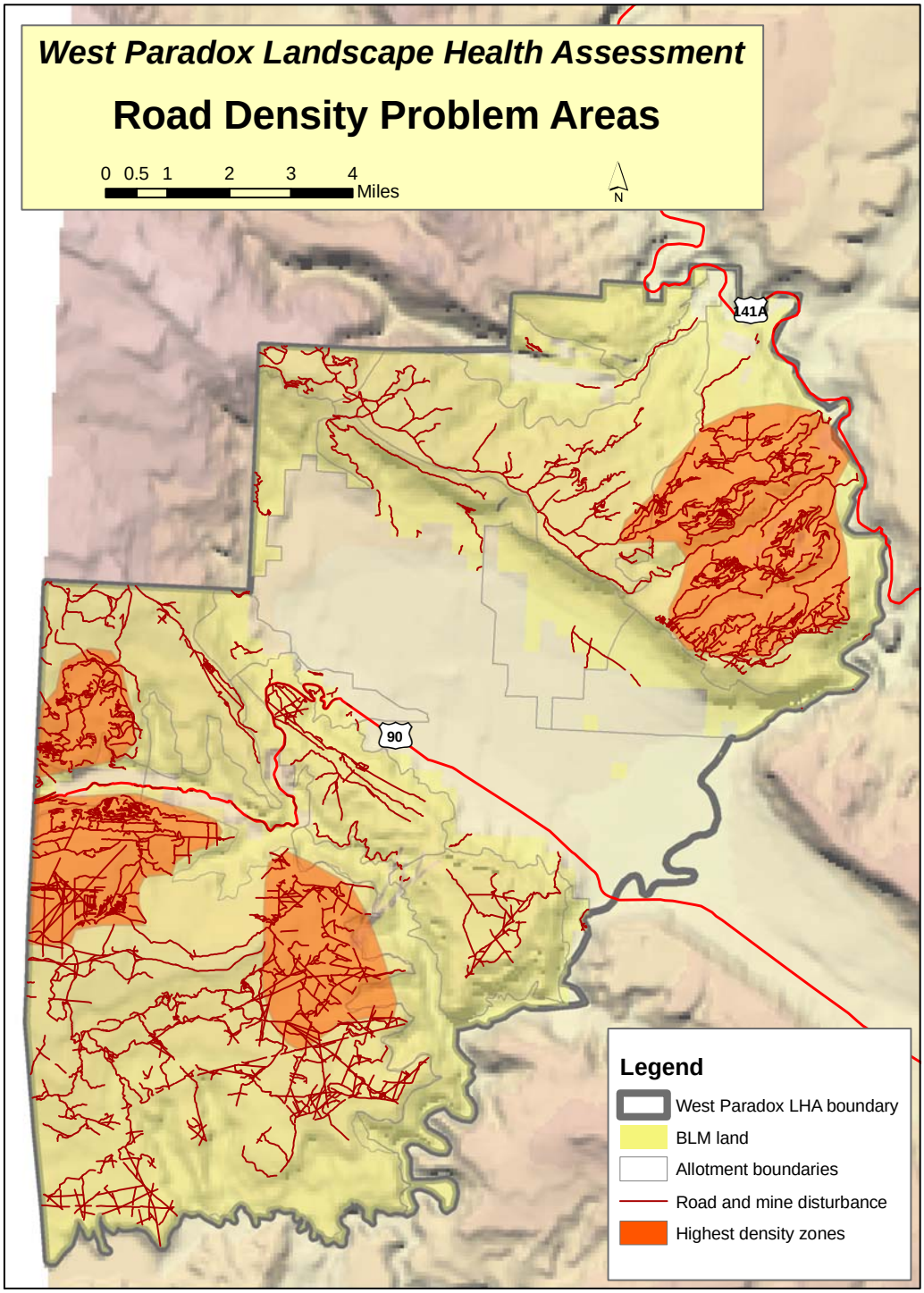


Figure 2.7 West Paradox LHA Area areas with high road and mine disturbance density.



Standard 2: *Riparian systems associated with both running and standing water function properly and have the ability to recover from major disturbance such as fire, severe grazing, or 100 year floods. Riparian vegetation captures sediment, and provides forage, habitat and biodiversity. Water quality is improved or maintained. Stable soils store and release water slowly.*

Indicators used to assess this standard include: native or desirable vegetation dominant, vigorous vegetation, diversity of vegetation age classes, vertical and compositional structure, vegetation that has root systems capable of withstanding high stream flows, species that indicate maintenance of riparian moisture, stream in balance with water and sediment supplied from watershed, indications of high water tables, point bars colonized by vegetation in range of age classes, active floodplain, floodplain vegetation available to capture sediment and dissipate flood energies, appropriate channel meander patterns, woody debris a part of stream morphology where appropriate.

Mileage Figures[1]

Meeting Standard 2		**Not Meeting Standard 2**	**Unknown**
Meeting	Meeting with problems		
11.2 miles	6.4 miles	0 miles	0 miles

[1] The majority of LaSal Creek has already been analyzed in the East Paradox LHA.

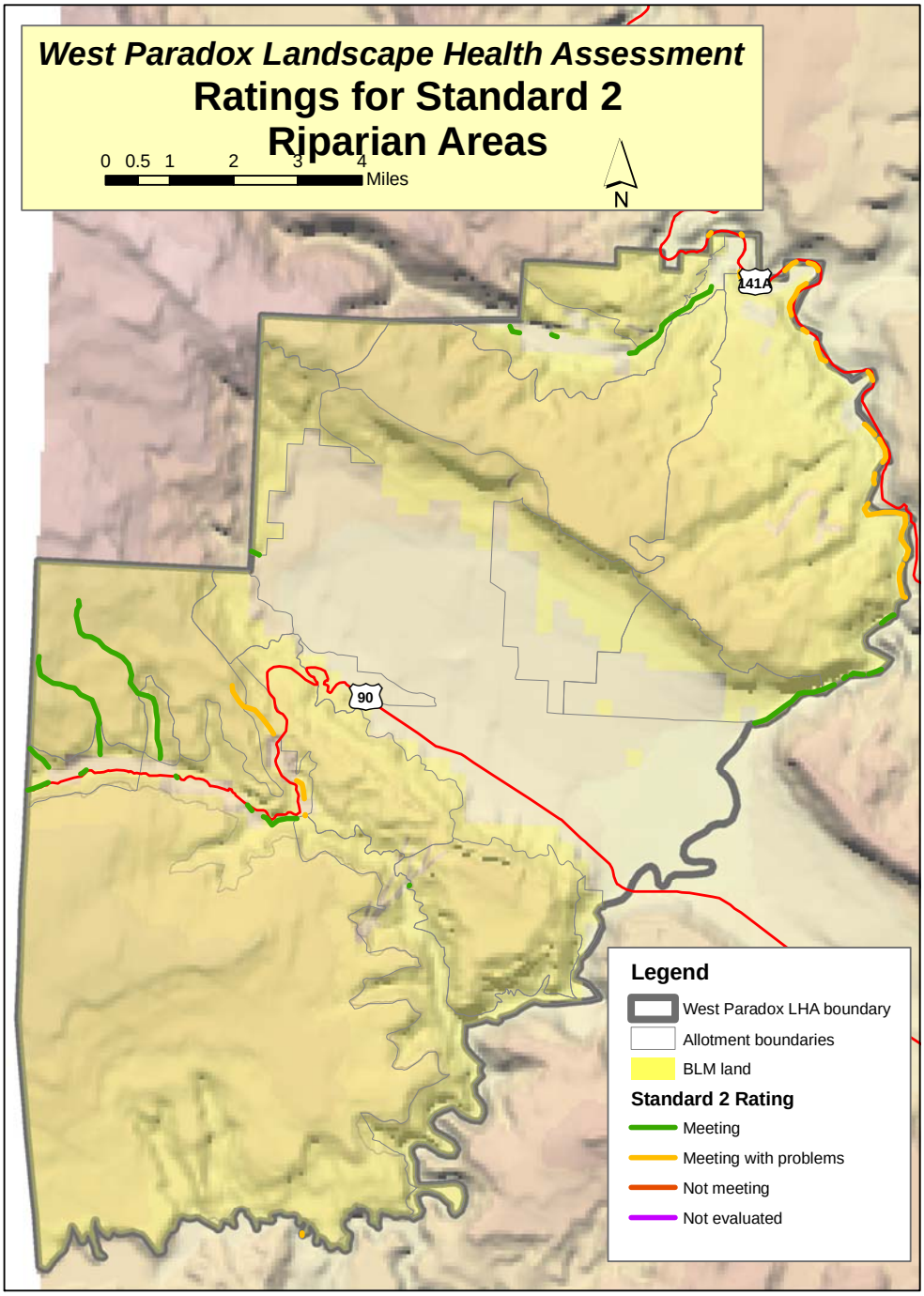
See figure 3.1 for stream segment ratings.

Specific Problems

The majority of riparian areas on public land in the landscape unit fully meet Standard 2. These streams have no evident problems with hydrology, vegetation, or excessive erosion and deposition from either the stream channel or from the watershed. While some of these streams do have minor weed problems, they are not yet affecting stream functionality. This is the case despite some of the streams having significant flow alterations from upstream dams or water diversions. Out of the total 17.6 miles of perennial or intermittent streams, 6.4 miles were rated as “functioning at risk”, which we have translated into “meeting Standard 2 with problem areas”. There are no streams which did not meet Standard 2. All problem streams are detailed below.

Lower Dolores River: Segments of this river have been assessed in the Mesa Creek Land Health Assessment as well, because the river forms the dividing line between the two landscape units. The public land segments which were assessed in the West Paradox LHA total 4.9 miles. Problems identified along this reach included some lateral and vertical instability, a floodplain that cannot dissipate energy effectively, riparian plants in poor vigor, problems with sinuousity and the width:depth ratio, a constricted riparian area, water and sediment imbalance with the channel, and upland watershed problems. Causes were cited as flow regulations from McPhee Reservoir, and the noxious weeds which are common along this river. McPhee Reservoir has greatly reduced spring floods and overall flows in the river throughout much of the year because it and associated water management for agricultural activities have diverted water out of the watershed. Tamarisk is common along this reach of river, as is Russian knapweed (see Figure 3.1). These species are known to create unsuitable growing conditions for native species, and greatly degrade the function and resilience of the native vegetation.

Figure 3.1 West Paradox LHA Standard 2 ratings. Only streams with perennial or intermittent flow are considered for this standard.



Spring Creek: Approximately 1.4 miles of the entire length of Spring Creek on BLM land was rated as meeting Standard 2 with problems. A number of problems were found along this stream, but it was still considered to be functioning at risk. The problems included some areas of lateral and vertical channel instability, lack of flooding on the floodplain, inadequate energy dissipation, and not enough vegetation cover to protect streambanks. Other problems were areas with riparian plants in poor vigor and species composition, apparent lack of soil moisture, water and sediment imbalances with the channel, roots not capable of withstanding flooding, channel morphology problems, a constrained riparian zone, and point bars that are not revegetating. These problems were thought to be related to upstream water diversions, which may also have blown out and caused channel downcutting.

Figure 3.1 Top: Lower Dolores River showing tamarisk, a noxious weed, bank-cutting and channel morphology problems. Bottom: Spring Creek showing a problem area with down-cut channel and lack of riparian species.

Standard 3 (Vegetation): *Healthy productive plant and animal communities of native and other desirable species are maintained at viable population levels commensurate with the species' and habitats' potentials. Plants and animals at both the community and population level are productive, resilient, diverse, vigorous, and able to reproduce and sustain natural fluctuations, and ecological processes.*

Indicators used to assess this standard include: native plant and animal communities distributed adequately to assure sustainability, age class diversity to sustain recruitment and mortality fluctuations, adequate habitat connectivity, photosynthetic activity throughout the growing season, resilience to human activities, appropriate plant litter accumulations, and landscapes composed of a variety of successional stages.

Acreage Figures

Meeting Standard 3		**Not Meeting Standard 3**	**Unknown**	**Water**
Meeting	Meeting with problems			
49,552	16,907	2,069	1,863	255

See figure 4.1 for map showing polygon ratings.

Specific Problems

Plant Diversity

Native plant diversity indicates that the soil and water resources are being efficiently and maximally used by the vegetation. A diverse community also has greater resilience to disturbance, since the various species represent more survival and reproductive strategies and capabilities than would be present in monocultures. Figure 4.2 shows that diversity problems are not a widespread problem throughout the West Paradox LHA unit. However, there are several low diversity sites along Highway 90 where it climbs up out of Paradox Valley.

Cool Season Grass Cover

Perennial grass is an important if not dominant plant type in most of the plant communities occurring in the unit, particularly in the non-forested communities. It is also one of the plant community components most reduced by historic and present day uses, especially grazing. Cool season perennial grasses are those which are actively growing in the spring and fall months, and are generally dormant during the heat of the summer. On the majority of public lands managed by the Uncompahgre Field Office, low cool season grass cover is a particular problem because most grazing on BLM has historically taken place during the fall and spring. This coincides with the cool season grasses' vulnerable, active growing period. When these species are reduced in a plant community, the community loses productivity because spring and fall resources (sunlight and moisture) are not being fully used. In addition, cool season grasses are important for the competition they provide against cheatgrass and many other annual invasive species, because they use the same growing period. The percent canopy cover of cool season perennial grass was used as an indicator of plant community health and wildlife habitat quality (Figure 4.3).

Figure 4.1 West Paradox LHA Area Standard 3 ratings.

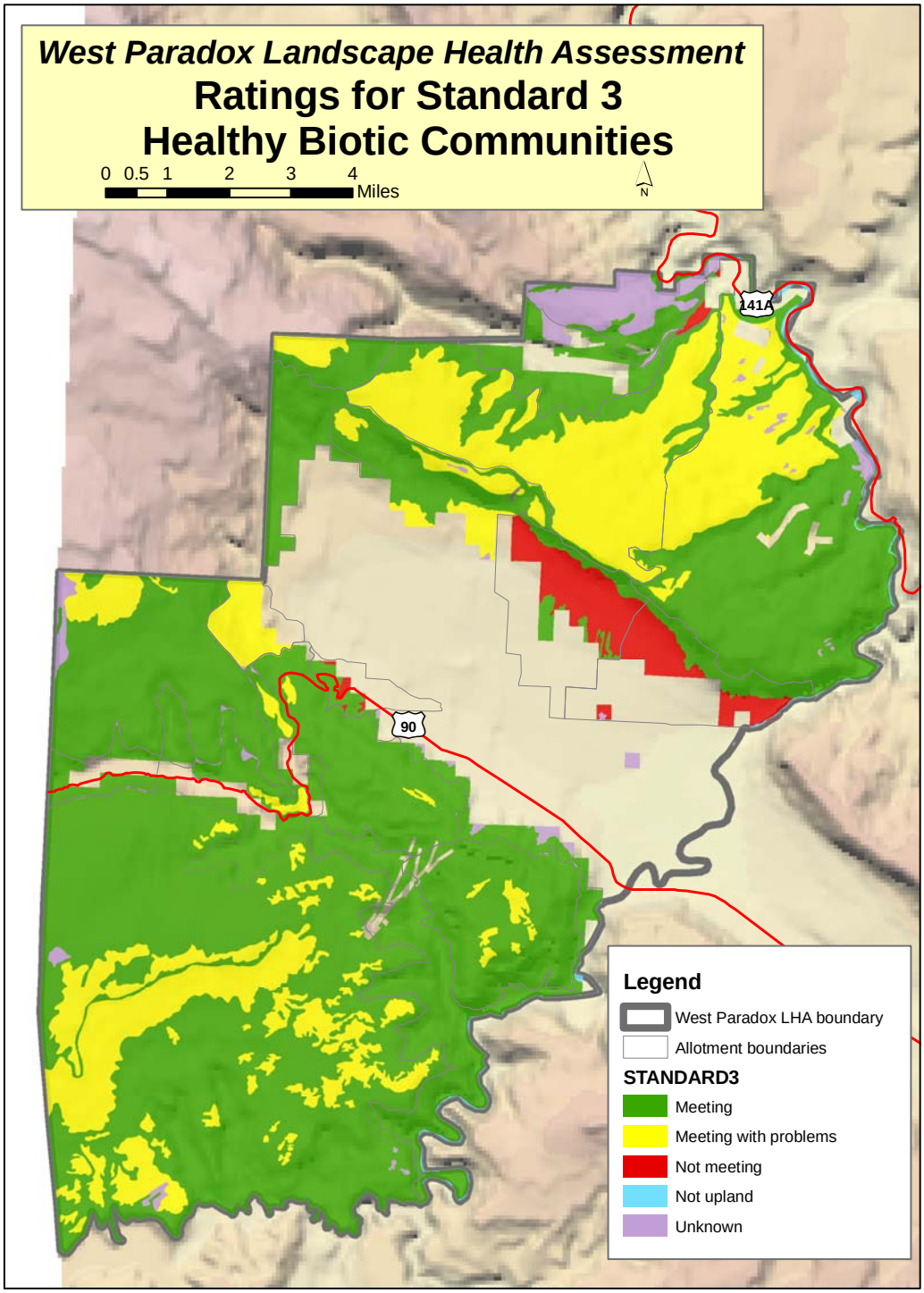


Figure 4.2 West Paradox LHA Area plant diversity. This map shows sites with Rangeland Health Sheet scores of 1 or 2 as diversity problem sites, scores of 3, 4 or 5 as adequate to good diversity.

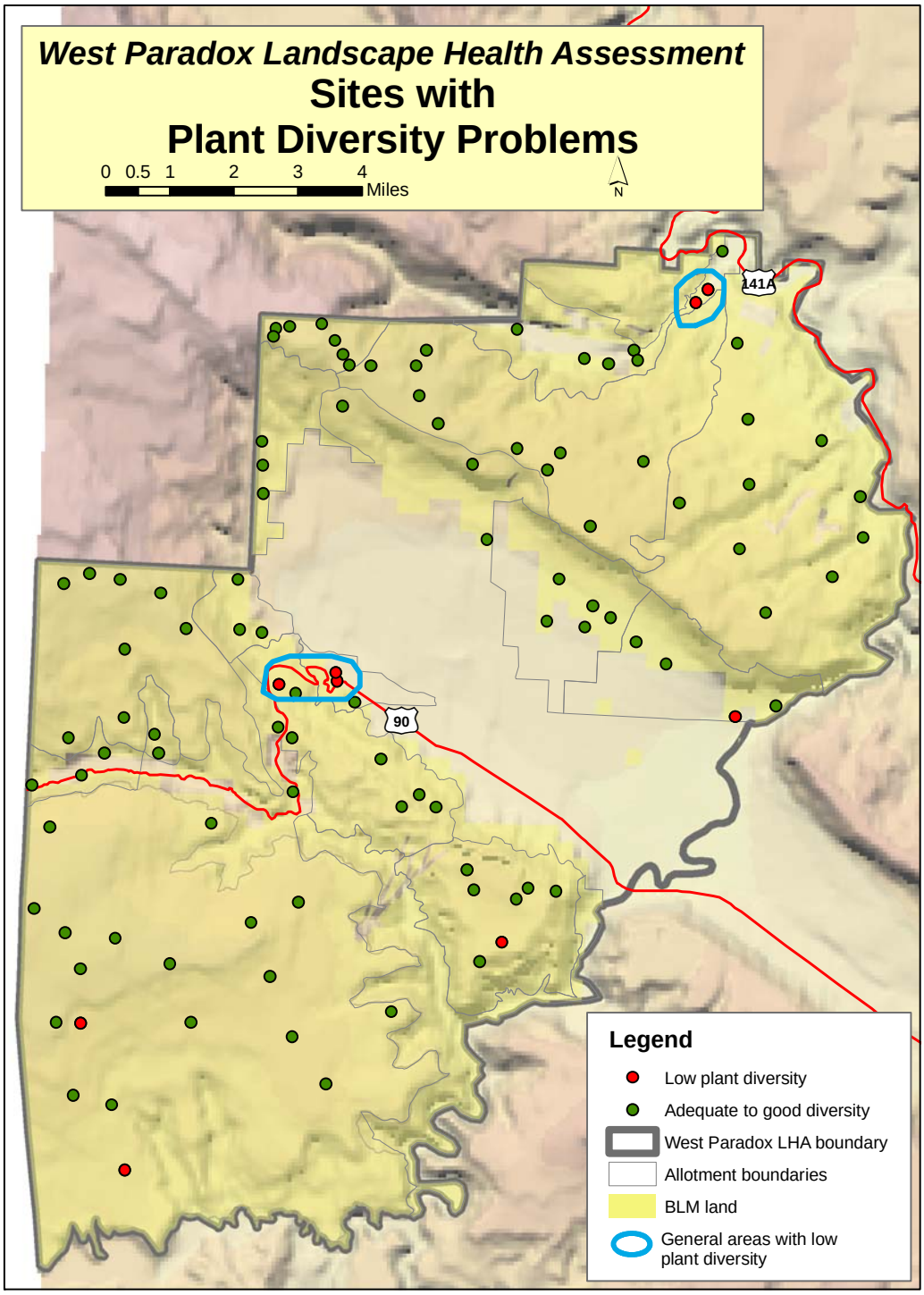
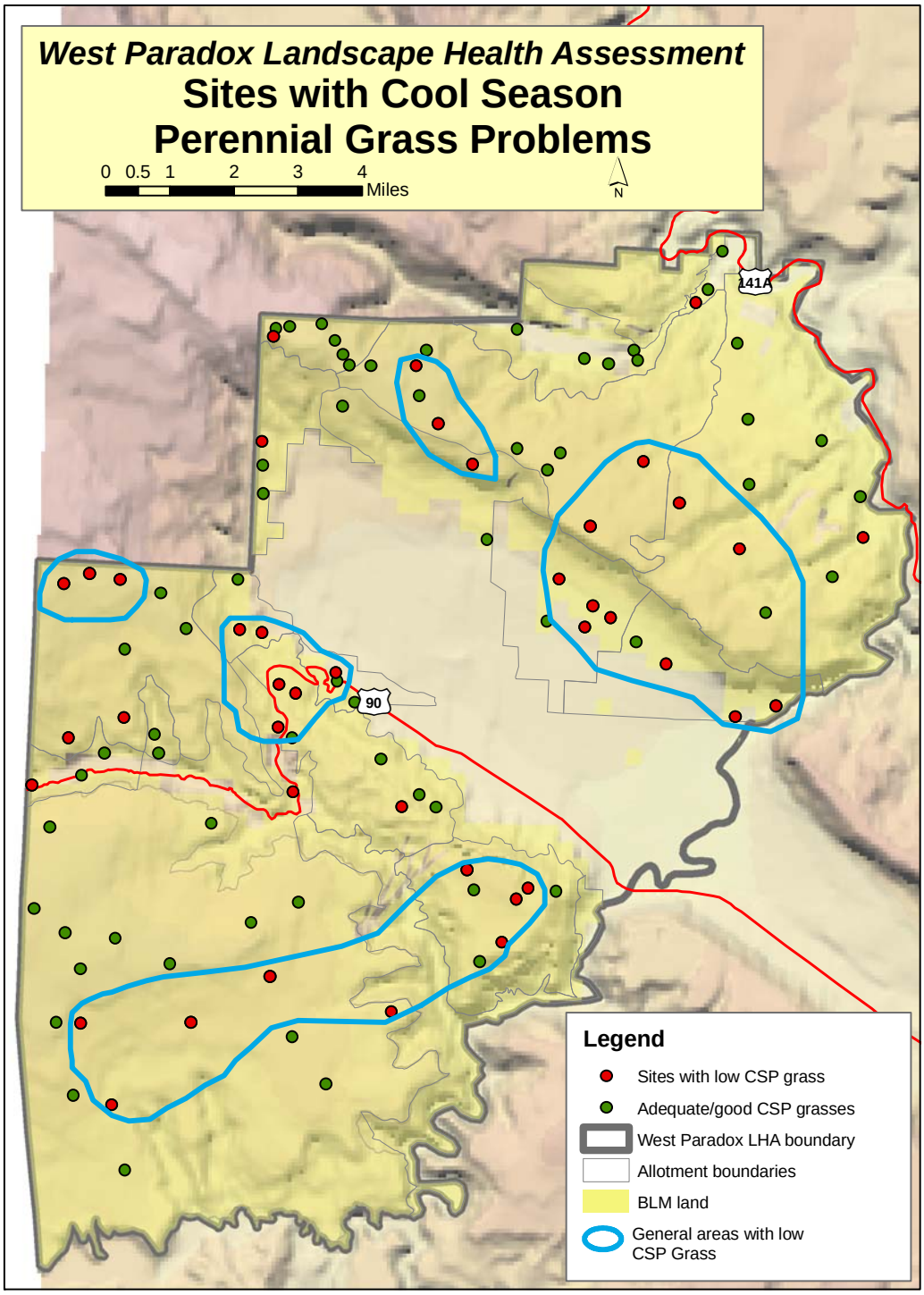


Figure 4.3 West Paradox LHA Area perennial cool season grass cover. On this map red dots denote sites with perennial cool season grass canopy cover worse than 10% below the average value for the ecological site.



Problems with low cool season grass cover were observed in many parts of the West Paradox unit. These problems were concentrated along the lower part of Highway 90, the Paradox Valley floor, near the southernmost part of the Forest boundary, and on parts of Carpenter Bench, and Martin, Wray and Nyswonger Mesas.

Warm Season Grass Cover

Warm season grasses germinate and grow during periods of summer moisture. This capability enables them to use monsoonal moisture during warm periods when cool season grasses are mostly dormant. Warm season grasses are growing and vulnerable to grazing during the summer, a season in which only higher elevation BLM lands are grazed. Historically, vegetation treatments and seedings have reduced warm season grasses in many areas across BLM lands. The West Paradox area has had a number of vegetation treatments where the topography permitted. Several broad areas that had problems with warm season grasses were observed across the LHA unit (Figure 4.4).

Perennial Forb Cover

Perennial forbs are a source of diversity, nectar, seeds, palatable forage, varied photosynthetic periods and root morphologies. These characteristics increase a community's water and sunlight capturing capabilities, biomass production, and ability to support animals. Although typically not a dominant plant type, forbs fill many important niches in a plant community. Like the cool season perennial grasses, perennial forbs are one of the native plant types that appear to have been most impacted by historic grazing, especially at lower elevations. Native perennial forbs have also been reduced in many areas by past BLM treatments and seedings. Percent perennial forb canopy cover is used as an indicator of plant community health and wildlife habitat quality.

Low perennial forb cover was found across many parts of the West Paradox LHA unit (Figure 4.5). Problems with forbs were found in many of the same locations where both warm and cool season grasses were at low levels.

Pinyon-Juniper Invasion and Decline

Pinyon and juniper trees are native species which live for centuries and have been common in the region for thousands of years. However, historic photos and tree stand structure indicate that in some areas across the Uncompahgre Field Office, pinyon-juniper woodlands are becoming denser than they were in the past and are expanding into other plant communities. As this occurs, herbaceous and shrub species visibly decline in dominance and vigor, and the landscape loses patch diversity at the larger scale. Pinyon and juniper invasion (as evidenced by young age classes of trees dominating a site) is used as an indicator of plant community health and wildlife habitat quality. Tree invasion was found in two parts of the unit (Figure 4.6), and was occurring mainly as tree reestablishment in formerly chained woodland or what appeared to be old burns.

Recent long-term drought has brought on an ips beetle epidemic in much of southwestern Colorado. Many other pinyon pathogens have also combined with these to create "pinyon decline" which kills the pinyon trees. Because pinyon are such an important part of the plant communities in western Colorado, pinyon decline was used as an indicator of health, and captured by evaluating pinyon tree vigor at each site. Only two sites had

Figure 4.4 West Paradox LHA Area perennial warm season grass cover. On this map red dots denote sites with canopy cover values worse than 10% below the average value for the ecological site. WSP is used in the map legend for Warm Season Perennial.

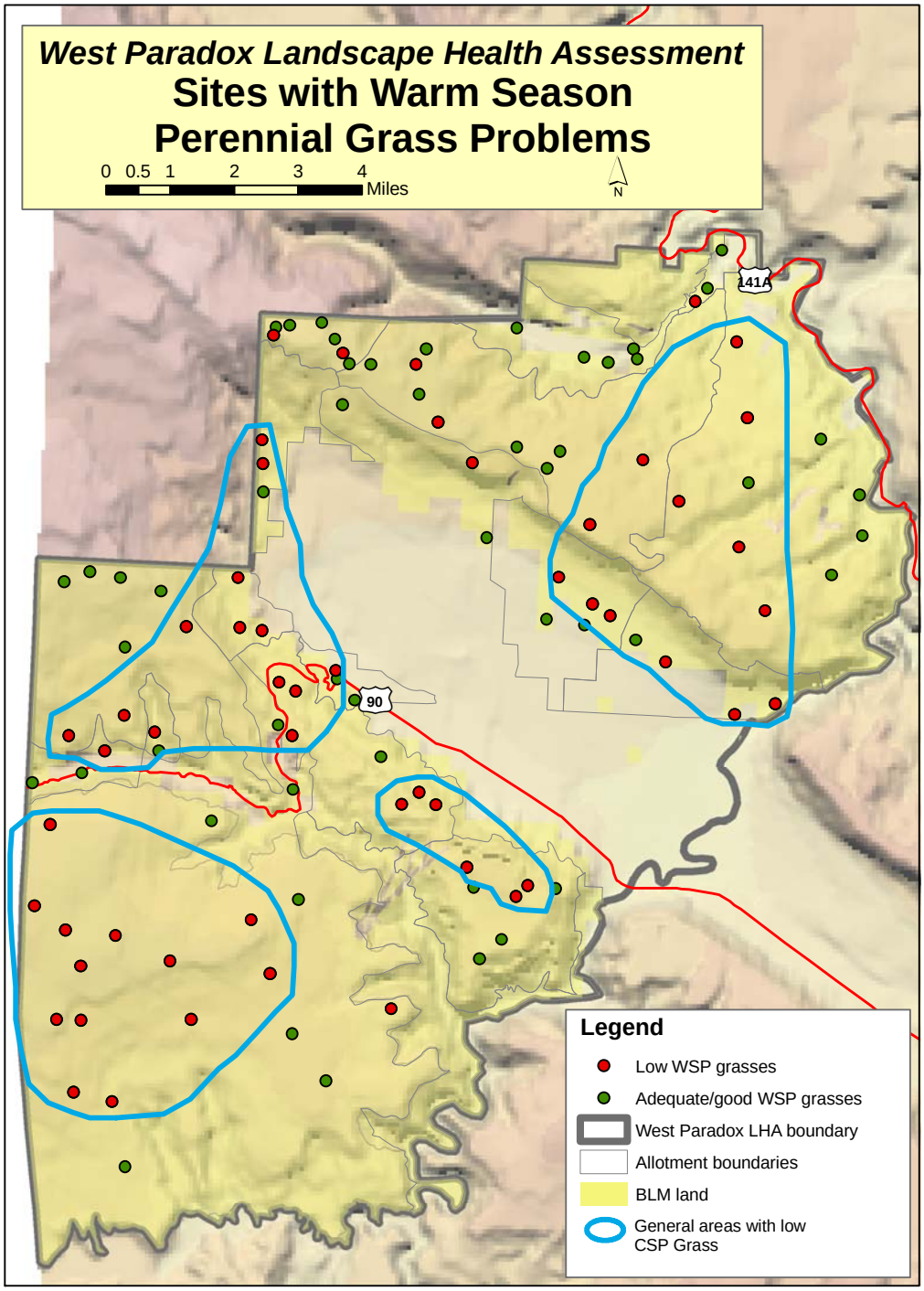


Figure 4.5 West Paradox LHA Area perennial forb cover. On this map red dots denote sites with perennial forb canopy cover values worse than 10% below the average value for the ecological site.

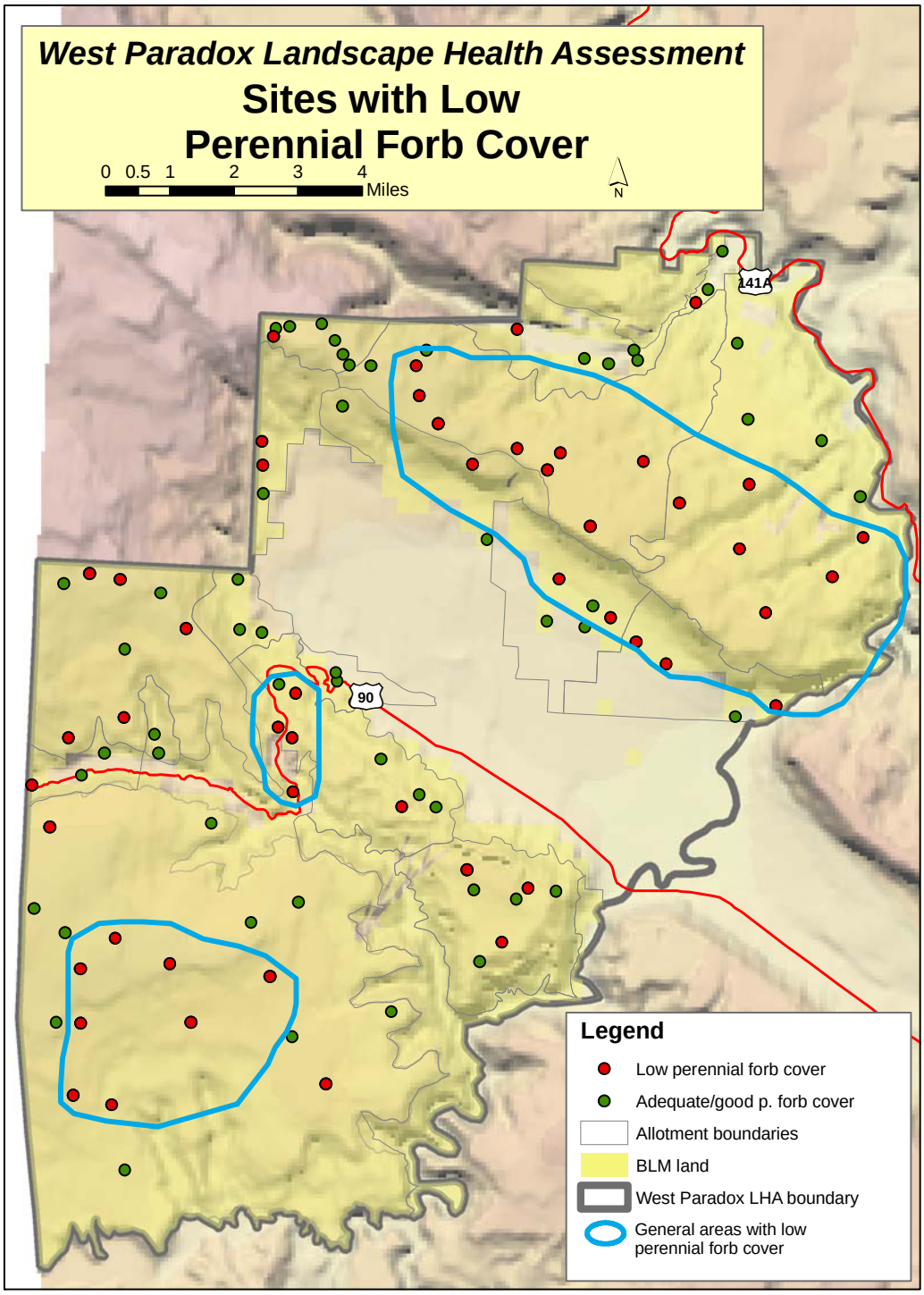
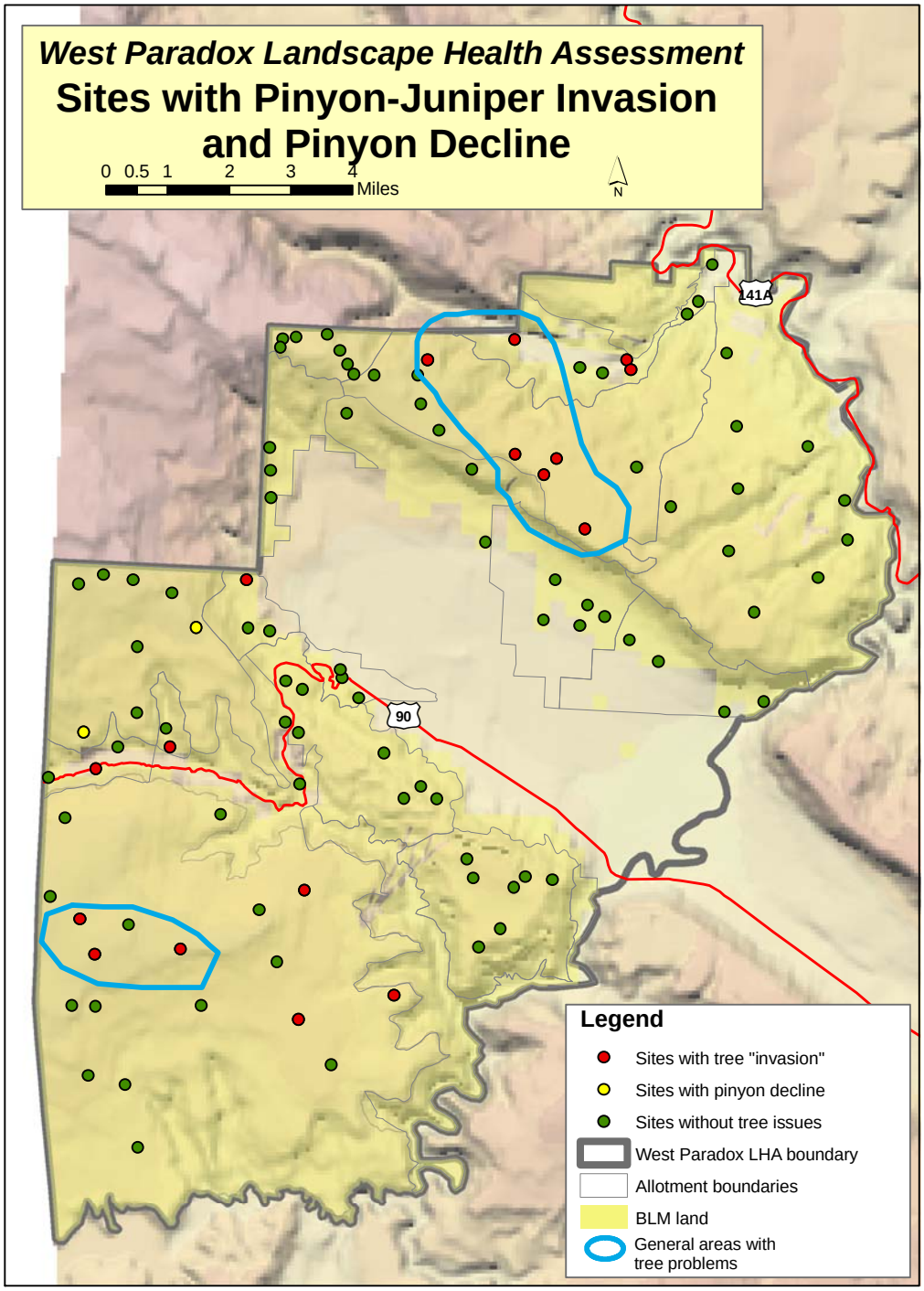


Figure 4.6 West Paradox LHA Area pinyon-juniper invasion and pinyon decline. Red dots denote sites where young age classes of either pinyon or juniper are the dominant tree age classes on the site. Yellow dots denote sites where most of the living pinyon trees are in a state of low vigor.



much evidence of dying trees. This indicates that most of the pinyon decline has bypassed this part of western Colorado.

Exotic Plant Cover

Exotic plants are those species which were not present in the region prior to European settlement of the area, and were brought in from other countries or regions. Therefore, they have not co-evolved with the plants and animals that are native to the area. In some cases, this provides the exotic plants with a competitive advantage allowing them to push out native species. In other cases, the exotics are weedy species associated with disturbance of the native plant community or soil. Prevalence of exotic plant species was used as an indicator of poor plant community health and wildlife habitat quality.

Exotics are presently a problem in only localized areas across the LHA unit (Figure 4.7). Under 7% of the sites visited were dominated by exotic plants, and these were located in fairly isolated areas in the northern and central parts of the unit. Exotics were present at significant levels within the communities, but not dominant at an additional 20% of the sites.

The primary exotic species encountered were cheatgrass (*Bromus tectorum*), and the seeded species crested wheatgrass (*Agropyron cristatum*). Cheatgrass is an exotic species of particular concern, as it has completely overtaken and transformed many plant communities in the Great Basin. Land managers in the Colorado Plateau region are concerned that this area may be on the threshold of a similar level of cheatgrass invasion. Of the 104 sites visited in the West Paradox LHA area, cheatgrass occurred at very high levels at about 3% of the sites, and an additional 7% had significant cover of cheatgrass. Cheatgrass was present at low canopy cover levels in 19% of the remaining sites, and was at trace amounts at another 22% (Figure 4.8). The remaining 49% of sites were free of cheatgrass. The cheatgrass problems were found throughout the unit except at the upper elevations. Burned and other heavily disturbed areas in the West Paradox unit appear to have the most widespread and densest infestations of cheatgrass.

Noxious Weed Infestations

Noxious weeds are those exotic species which are formally designated by the state of Colorado as noxious. On or very near to West Paradox area BLM lands, the following noxious weed species are established: Russian knapweed (*Acroptylon repens*), Canada thistle (*Cirsium arvense*), Russian olive (*Eleagnus angustifolia*), tamarisk (*Tamarix chinensis*), Siberian elm (*Ulmus pumila*), bull thistle (*Cirsium vulgare*), field bindweed (*Convolvulus arvensis*), and dalmation toadflax (*Linaria dalmatica*). Of these species, Russian knapweed and tamarisk are the most widespread.

Although a comprehensive weed inventory has not yet been completed for this LHA area, noxious weeds appear to be infrequent across the unit (Figure 4.9). Most of the sites visited during the LHA were completely free of noxious weeds, and very few were noted en route to these sites. Incidental inventory information shows few noxious weeds known from the area. The most heavily infested areas appear to occur along the Dolores River, Highway 90, and Carpenter Ridge Road. Work in other LHA areas has shown a strong relationship between the presence of noxious weeds and stock ponds, roads (particularly frequently maintained roads) and drainages. This unit also has a very high density of old mining roads in some areas, which would be another disturbance vulnerable to weed invasion. Once these disturbed areas are inventoried, we will have a more complete idea of the severity of the noxious weed problem in this unit.

Figure 4.7 West Paradox LHA Area exotic plants. This map shows sites with Rangeland Health Sheet scores of 1 or 2 as exotics dominant, scores of 3 as exotics present, and scores of 4 or 5 as exotics minimal.

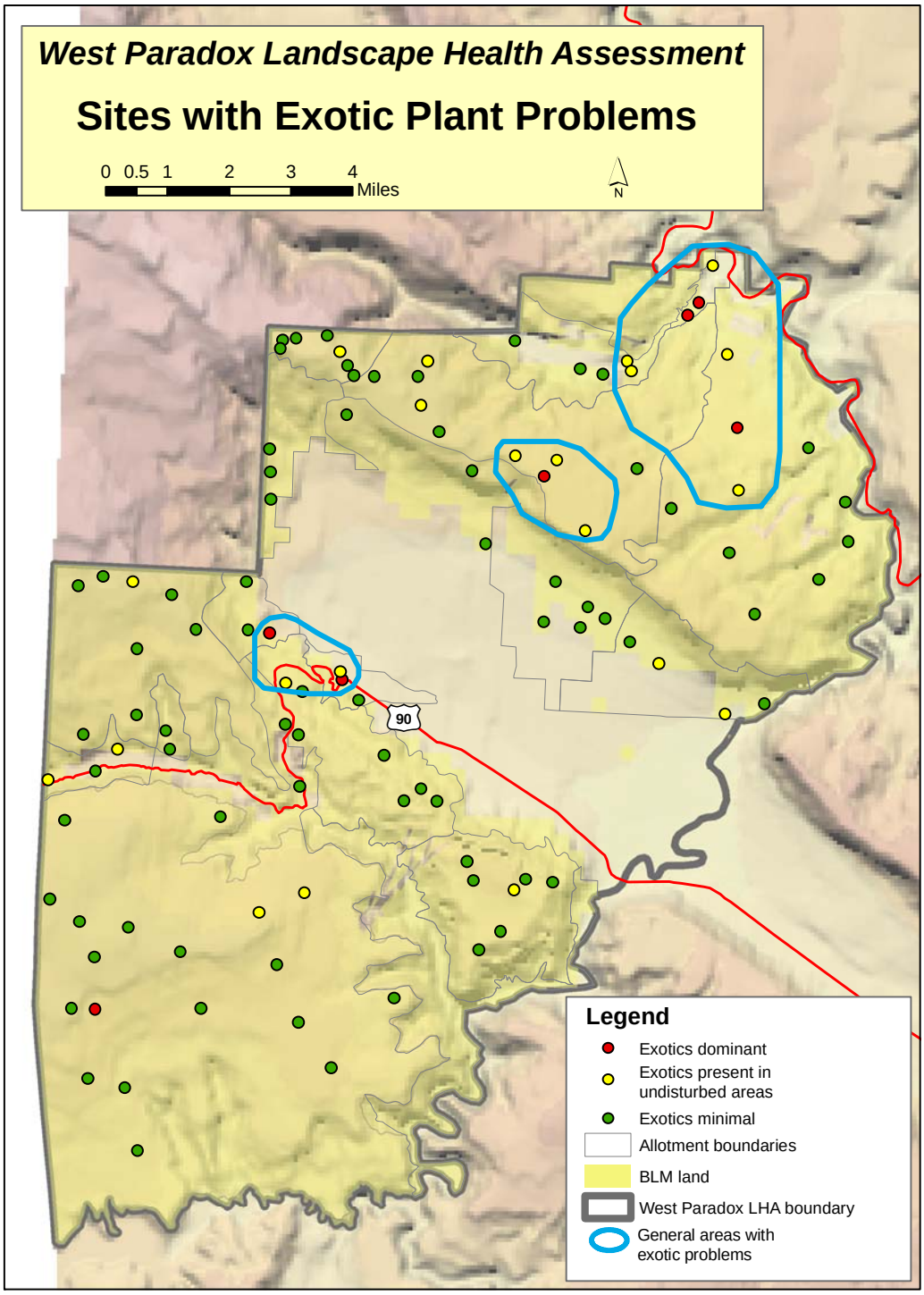


Figure 4.8 West Paradox LHA Area cheatgrass infestations. This map shows sites with cheatgrass at varying levels of canopy cover.

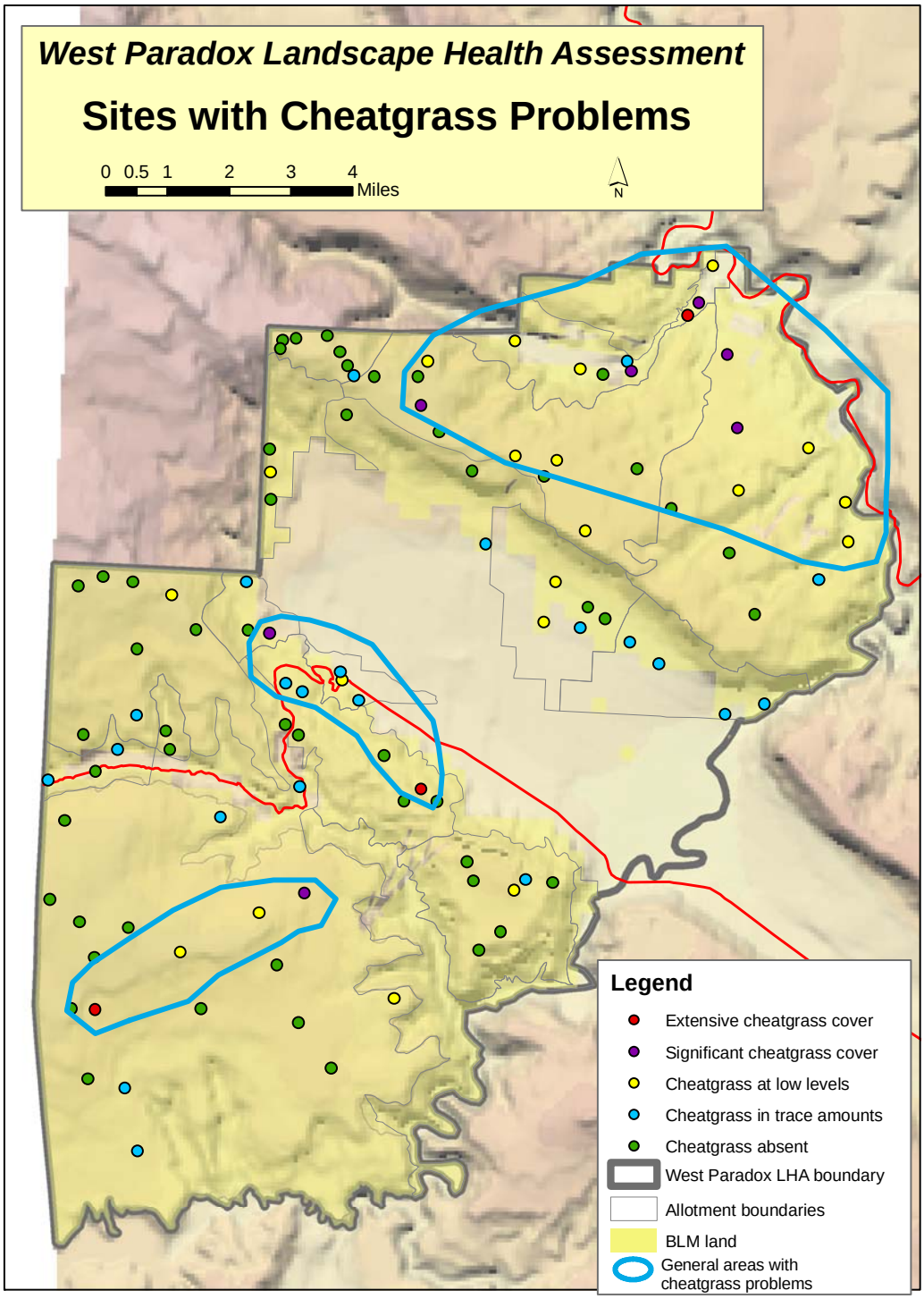
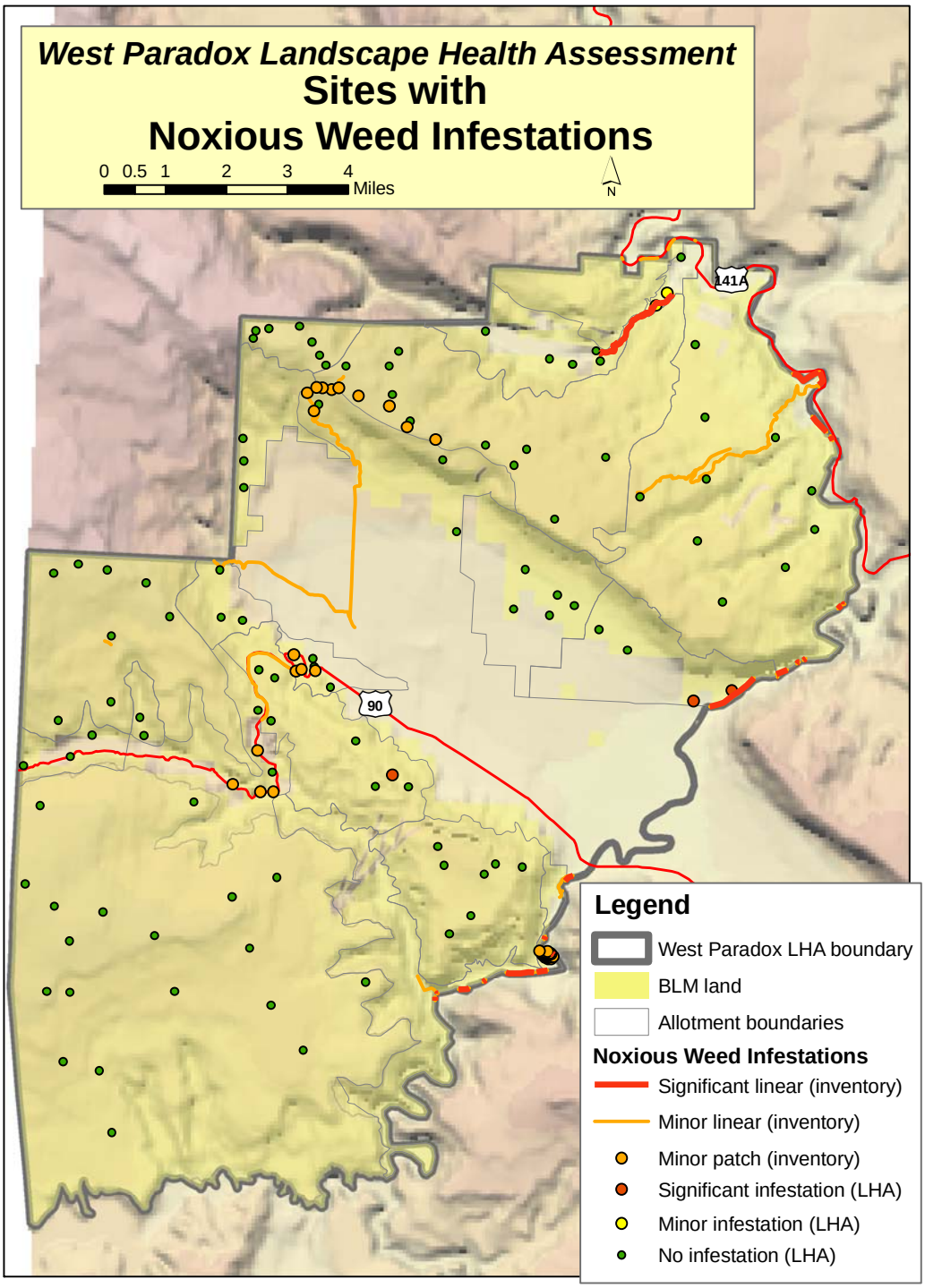


Figure 4.9 West Paradox LHA Area noxious weed occurrences. This data comes from two sources-an ongoing weed inventory which maps large patch infestations, linear weed infestations and small point infestations. The LHA data collection points also generated weed data.



Shrub Utilization

Hedging is the alteration of a shrub's growth form into a compact, dense growth of twigs. Hedging on shrubs is caused by repeated browsing by wildlife or livestock, and can result in reduced productivity and vigor of the shrub, or even death. Hedging is indicative of the balance between browsers and habitat carrying capacity. It is used here as one indicator of plant and animal community health. Problems with shrub hedging are limited in this unit. Two areas which have moderate to high levels of hedging are identified in the northern part of the unit (Figure 4.10). Browsing animals appear to concentrate here because of the numbers of sites with heavy and moderate hedging in these areas. As a result, shrub hedging in these areas has the potential to become a problem if an imbalance develops between vegetation and browsing animals.

Shrub Vigor

Shrubs are an important component of most plant communities across the unit. They are often the dominant life form of the plant community and also provide structure, diversity and food, thus shaping many aspects of the plant and animal community. Shrub vigor, (or health and productivity) is used as an indicator of plant community health and wildlife habitat quality. Low vigor indicates the plants are stressed, more vulnerable to disease, unlikely to reproduce successfully, and produce less food for wildlife. We observed only limited problems with shrub vigor across the unit (Figure 4.11). Vigor problems were only observed with Wyoming big sagebrush, green mormon-tea, and snakeweed at a scattering of sites across the range of elevations.

Native Plant Distribution

One hundred seventy three different plant species were found to occur in the unit. Of those native species which occurred in significant amounts on at least one site, Utah juniper was the most widespread species. It was at 62 out of a total of 104 sites where data was collected. Colorado pinyon was the second most widespread species occurring in significant amounts on 52 sites, with Wyoming big sagebrush the third most common on 30 sites, followed by snakeweed at 24 sites The most common perennial cool season grass was muttongrass—a dominant at 20 sites, while blue grama was the most common perennial warm season grass, and a dominant at 18 sites. The most common perennial forb was rock goldenrod which was significant on 14 sites. Thirty four species occurred at substantial levels on only one site, and another 41 occurred on less than 10 sites as a significant component of the plant community. This distribution of plant species reflects the general dominance of the community by a few species, with the majority of species being comparatively infrequent and sporadically distributed, or at very low levels across the landscape.

As expected, both elevation and soils appear to drive where most of the plant species are located. Deeper soils typically support some different species than shallow and rocky soils, although many species also occur on both soil types. Elevation and aspect also affect plant distribution, with the moist, higher elevations and aspects typically supporting a greater variety of species.

The most obvious problems observed with plant populations are associated with the ongoing climatic influences such as the 2001-2003 drought and series of years with late spring freezes. While these have been much more pronounced in other LHA units, there was some evidence of these processes occurring here as well in isolated areas. However, both pinyon and Gambel oak are still persisting as a dominant plants, and do not appear threatened to this point.

Figure 4.10 West Paradox LHA Area shrub utilization and hedging levels. Sites with shrubs falling in hedge classes 3 or 6 depicted as seriously hedged, sites with shrubs in hedge class 2 or 5 are moderately hedged, and sites with shrubs in hedge class 1 or 4 are not hedged.

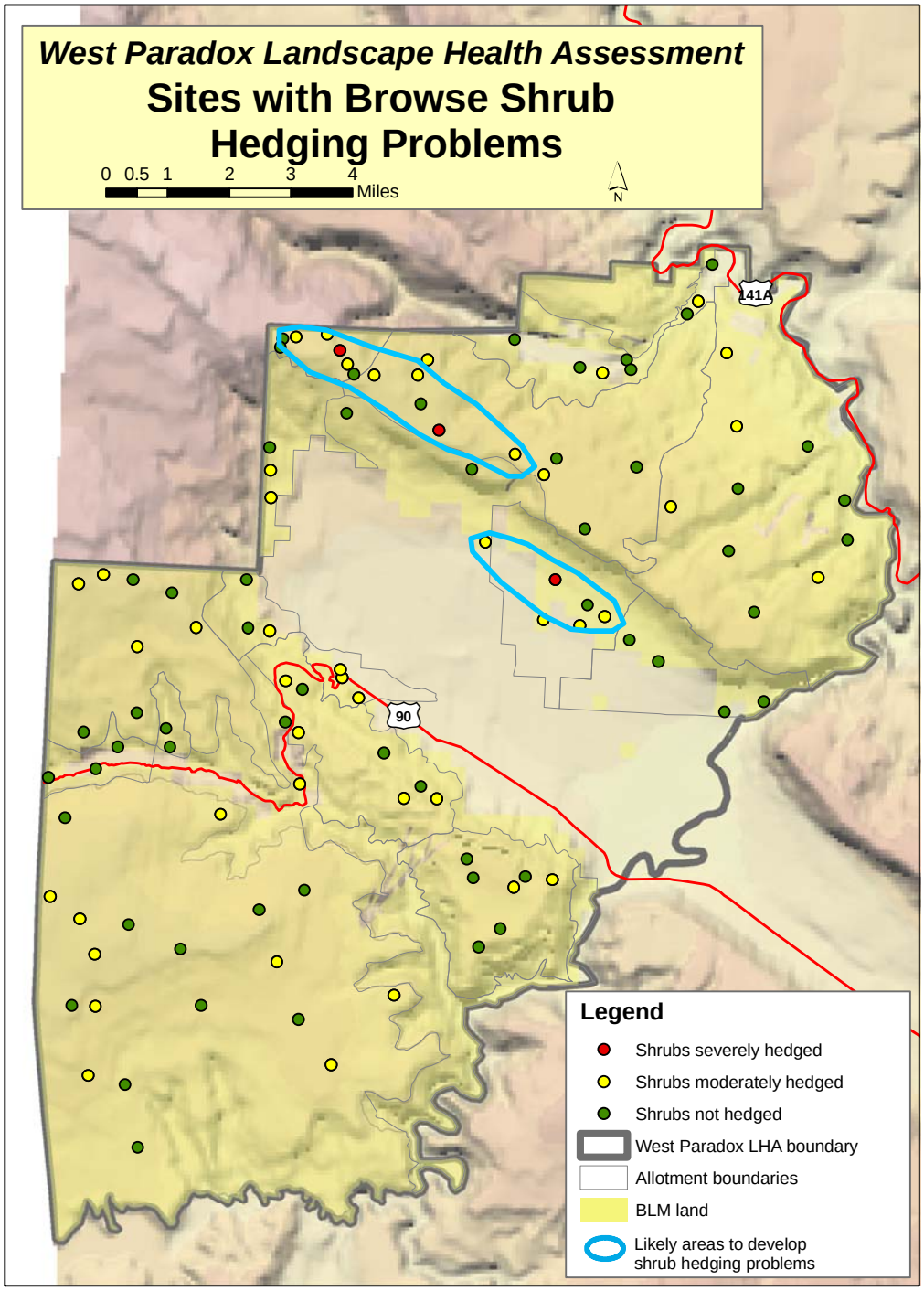
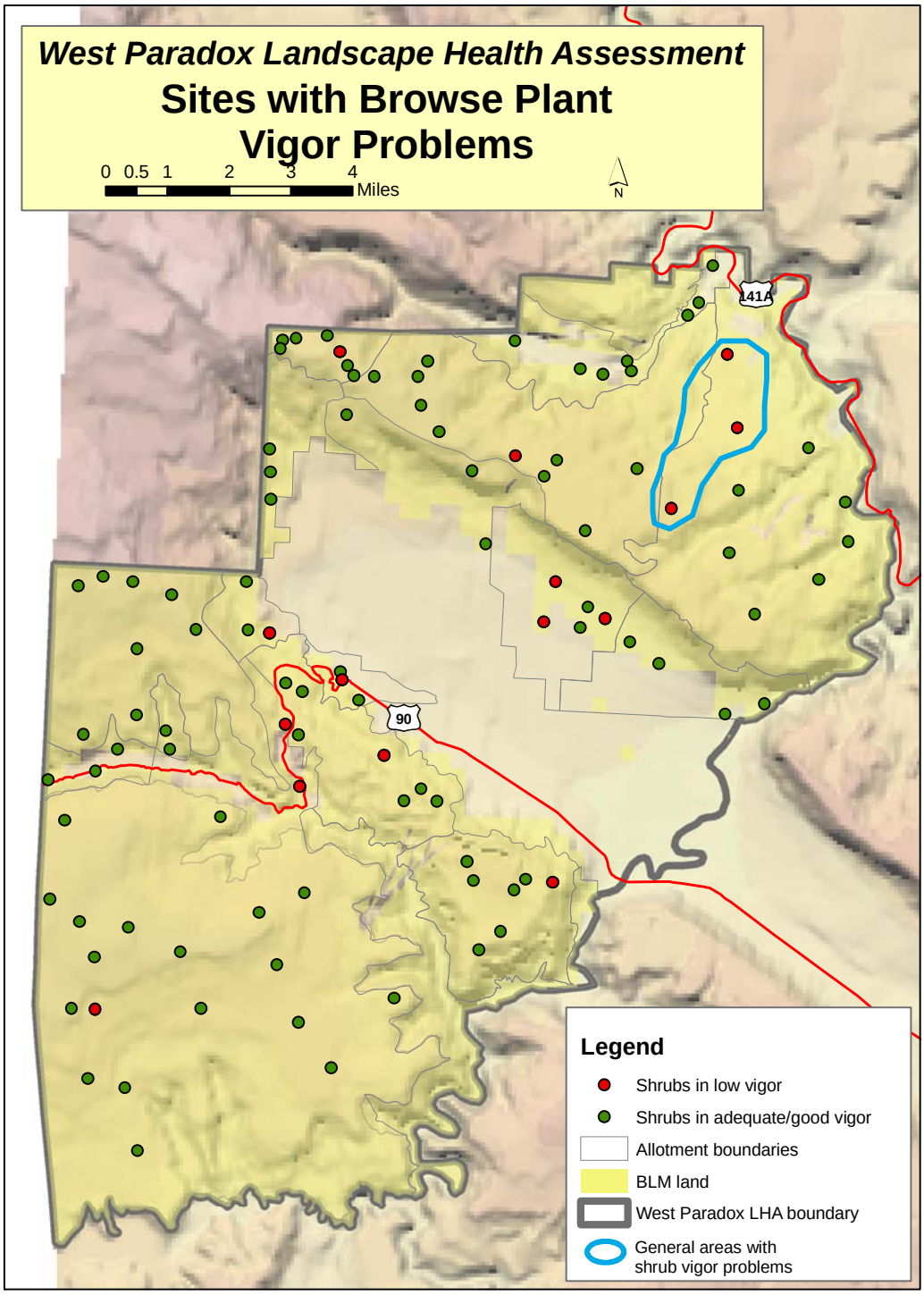


Figure 4.11 West Paradox LHA Area browse plant vigor. Red dots denote sites with at least one major browse shrub species that is in predominantly low vigor across the site.



At the level of data collection, it appears that the major plant species appropriate to soil and elevation are found broadly scattered across their available habitat. This evidence suggests that major plant distribution problems are not occurring which would interfere with region-level population viability or resilience among the more common species.

Connectivity

Not much information is available, nor are we aware of formal procedures that are outlined for assessing connectivity of habitat in dry woodland, mountain shrub or semi-desert shrubland vegetation types, particularly in very rough terrain. Because the West Paradox area is highly fragmented by topography, we assume that land uses like agriculture, and residential areas together with manmade constructs like roads interact with natural barriers or corridors to alter wildlife movement. A map of likely barriers and dispersal routes is included (Figure 4.12). Possible barriers and dispersal routes are outlined below.

Steep rock outcrops and rocky slopes: While steep rocky areas typically do not cover much area within the West Paradox unit, there are several areas of vertical cliffs which are impassable to wildlife which can't fly. These cliffs are found along the western and eastern reaches of the Dolores River as it passes through the LHA area, and rimming the northeastern edge of Paradox Valley. These are continuous bands that completely cut off movement from mesa top to drainage bottom. They are substantial enough to funnel movement of migratory animals into passable areas, and to isolate populations of non-migratory species above and below the cliffs. It is unlikely that seed dispersal is affected by these cliffs.

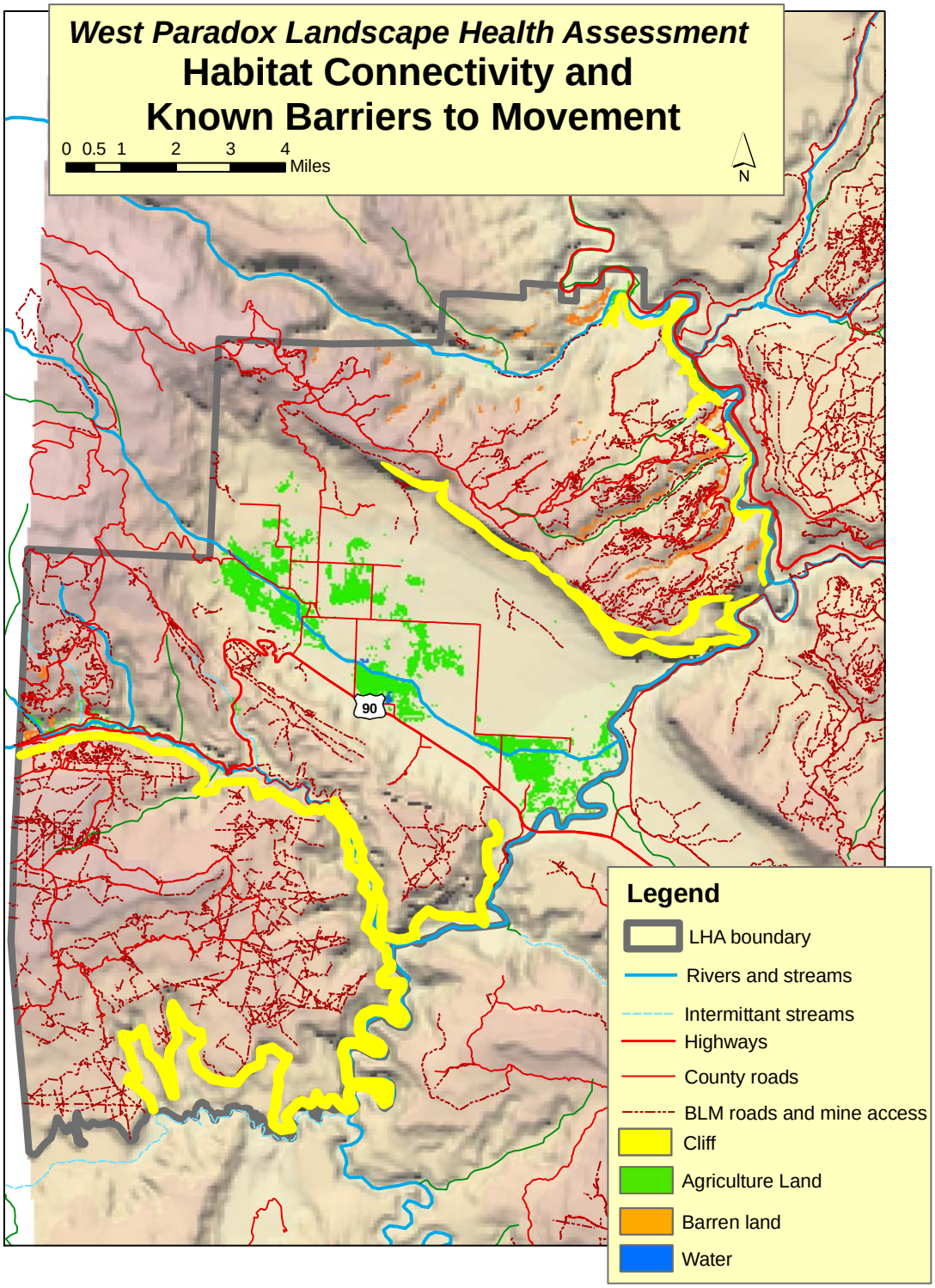
Barren areas: There are very few areas of barren land which are not cliffs in the West Paradox unit. These small areas are unlikely to influence connectivity of the larger landscape.

Rivers, streams, and dams*:* The Dolores River (Upper and Lower) is a small river that forms the eastern boundary of the West Paradox LHA area. It may present some barrier to movement, especially for smaller animals which are not able to swim across it. However, it is often nearly dried up as a result of upstream reservoir management and out-of-basin water diversion. This reduces its ability to form a barrier to terrestrial plant and animal movement. However, this management and diversion of river flows may form a barrier to fish movement. The smaller streams within the unit do not present significant barriers to terrestrial plant and animal movement because they are narrow, and often dry in places during some parts of the year. As with the Dolores River, water diversions for irrigation have probably restricted fish movement.

In addition to being a barrier for some animals, rivers, streams and canals act as dispersal and movement corridors for both plant and animal species. Weed species often move along streams because water transports their seeds, and because they find a similar habitat to irrigated cropland or landscaping (which are often sources of weeds) in the riparian zone. Russian knapweed and tamarisk form numerous infestations along drainages throughout the LHA unit, and particularly along the river.

Agriculture and intensive human land uses*:* Agriculture and residential use of land can act as a barrier to movement by species that don't use the nonnative vegetation, tolerate the presence of humans and domesticated animals like dogs, need hiding cover, or cannot travel long distances in unsuitable habitat. Agriculture and residential development can also act as corridors for other species. For example, species that thrive in disturbed areas, those that are transported by domestic species, others that benefit from the irrigation systems and more abundant moisture, or those that use crop species are able to move through agricultural lands and populate the areas adjacent to them. Species like the European starling, raccoon, domestic cats, red fox, cockleburr,

Figure 4.12 West Paradox Area landscape and habitat connectivity. Map shows potential barriers and corridors to plant and animal movement (roads, barren areas, cliffs, rivers or streams, and irrigated agriculture)



and Russian olive are spreading in the West. They are present in the private, developed part of the unit, and probably utilizing neighboring BLM land. Deer and elk also feed on the irrigated lands, and their behavior and movement patterns are altered by the presence of these fields. Irrigated agriculture and residential development are the dominant land uses along a 2-3 mile wide swath which follows the bottom of Paradox Valley and bisects the LHA unit. The location and position of these lands in addition to the presence of cliffs to the northeast undoubtedly create a substantial barrier to movement from southwest to northeast. The presence of intermingled rangeland in between tracts of more intensive agriculture may reduce this effect somewhat.

Roads and trails: Roads can be a barrier to movement because they are a strip of bare or altered ground, and because they are a focus of human activity and disturbance. In the case of heavily traveled roads, they can be a major cause of mortality for animals trying to cross. State Highways 90 and 141 are lightly travelled, two-lane, 65 mile per hour roads which pass through the unit. At the current level of use, these probably present only a minor barrier.

Because of the historic uranium mining activity, an extremely dense road network has developed on BLM lands in some areas of this unit. Most of these roads are lightly traveled dirt roads, or else bulldozer scrapes which have eroded into impassability. These probably do not act as a barrier in this ecosystem. Instead, they probably facilitate spread of some species, such as elk and coyote in the pinyon-juniper woodland, and weed species, which spread along the disturbed ground, particularly where the roads are maintained and graded or graveled.

Livestock, wildlife, people, vehicles, and pets: Livestock, deer and elk provide a mechanism for dispersal of seeds, insects, and disease. They are likely a principal source of weeds in native communities because they can transport seeds in their fur or digestive tracts, and because they often move between heavily disturbed or agricultural private lands, up into native rangelands. They can also reduce the competitive capabilities of native plant species through grazing, and are a source of soil disturbance. People, their vehicles and their pets transport weed seeds in the same way.

Wildlife Habitat and Wildlife Communities

Problems related to wildlife and habitats parallel those described under the vegetation section. Polygons with a rating less than "meeting" typically exhibited one or more of the following symptoms:

1) Degraded or unsuitable habitat due to past vegetation treatments

Certain vegetation treatments within the LHA have rendered some areas poor or unsuitable for wildlife. LHA observers noted invasion by cheatgrass, annuals, and/or noxious weeds at several treatment sites. Crested wheatgrass plantings create a monoculture that typically results in poor habitat structure and diversity for wildlife (with some exceptions—e.g. big game) and are in part to blame for declines in sagebrush obligate species (Reynolds and Trost 1980). Some treatment areas within the LHA are recovering well and have apparently resulted in improved conditions for wildlife.

2) Overbrowsed shrubs and trees

Much of the West Paradox LHA contains severe winter range and/or winter concentration areas for elk and deer. These areas can experience relatively heavy pressure from big game, particularly during harsh winters and in areas where livestock graze. Wild ungulates have the ability to cause dramatic shifts in vegetation, impacting birds, small mammals, and other

wildlife. Some shrub overbrowsing and damage by big game was observed at some sites, suggesting a possible imbalance between big game numbers and habitat carrying capacity. However, this does not appear to be as big a problem with the West Paradox LHA as has been the case in other LHAs. Furthermore, deer and elk herd sizes are meeting population objectives for carrying capacity (refer to CDOW DAUs information in the Wildlife section). Shrub vigor was generally good across the LHA although some drought stress problems were noted.

3) Habitat fragmentation, degradation and loss due to anthropogenic disturbances

Road expansion, recreation (primarily ORV), agriculture, mining, and residential developments are increasing habitat fragmentation and are degrading some habitats through the introduction of weeds.

4) Excessive weeds and/or threat of invasion

Weeds including cheatgrass, annuals, and noxious species are at moderate levels in some areas and also occur at undisturbed sites. In some cases, weed presence was at levels which pose a risk for invasion if a major disturbance was to occur (i.e., fire). For most wildlife, exotic and noxious weeds result in degraded or unsuitable habitat through displacement of native vegetation.

5) Low plant community diversity

Plant community diversity at several sites was lower than expected for the ecological type. This problem was often observed in connection with other indicators (weeds, vegetation treatments, overbrowsing, etc.) Diverse plant communities and mosaics are typically more resilient and provide habitat components and features for a greater number of wildlife species.

6) Poor cover by perennial cool and warm season grasses and forbs

This condition was noted at a few sites. Good cover by native perennial grasses and forbs provides essential cover and forage for multiple wildlife species.

***Please refer to the introductory Wildlife Section in this document for a discussion on species' population status and trends.**

The Vegetation Mosaic

It is commonly thought that disruptions in the amounts and types of disturbances in the landscape have changed the vegetation mosaic from what existed prior to European settlement. In order to manage for a healthy vegetation mosaic and coordinate activities that affect the mosaic, large scale plans and strategies have been developed that set objectives for the how the mosaic should look. The Uncompahgre Field Office Fire Management Plan (FMP) (USDI 2002) states objectives for vegetation mosaics for vegetation management subunits and polygons within them. These mosaic objectives describe desired proportions for each seral stage and patch sizes within the mosaic for different types of management polygons on various parts of the landscape. This plan is not only for fire planning and management, but it also is used to direct vegetation management as a whole. The objectives were based on the best information available at the time, but were designed to be flexible if assumptions proved wrong. Recent studies on fire history and the range of natural variability in pinyon woodlands (Eisenhart 2004), and input from fire ecologists (USDI Bureau of Land Management 2003) may cause the existing objectives to change soon, and reduce the amount of early and early mid seral stages prescribed. These adjustments will be made to this plan's recommendations if they come to pass, and/or will be incorporated into the upcoming Resource Management Plan revision.

The West Paradox LHA assessment area is broken into two vegetation management subunits (Figure 4.14): Ray Mesa and West Paradox. These units are further subdivided into polygons, each representing different landscape mosaic objectives (Figure 4.13). The existing vegetation mosaic on BLM lands is shown in Figure 4.14. Table V1 in the Appendix compares the existing seral stage proportions on BLM lands with the desired amounts specified by objectives from the Fire Management Plan. Please see this appendix for a more graphical representation of discrepancies between the mosaic objectives and the existing habitat. Patch sizes for each of the vegetation management subunits in the West Paradox LHA area are also compared with objectives.

Ray Mesa Unit

The largest portion of this unit (98%) is made up of the "Southwest Paradox Mesas and Canyons Natural Mosaic" polygon. This polygon is located in the high country to the southwest of Paradox Valley which shares similar topographic and storm (including lightening and to a lesser extent precipitation) patterns. The objective behind this unit is to restore a natural and appropriate vegetation mosaic that can be maintained over time through natural processes as opposed to intensive vegetation management practices. Existing vegetation in this subunit is somewhat divergent from the vegetation mosaic objectives described in the Fire Management Plan. Early seral vegetation is short of objectives by about 5,800 acres while early mid seral vegetation is in excess by over 10,700 acres. Late mid vegetation is short by 6,600 acres while late stage vegetation is meeting objectives. Some of the extra early mid seral vegetation should develop over time to fill the void in late mid seral vegetation. Some of the early mid could also be converted to early seral vegetation, especially through the use of prescribed or natural fire. The current matrix of late seral vegetation is meeting objectives, and patch size distribution of the other vegetation stages also seems appropriate.

The other polygon in this unit is the Urban Interface polygon which has the objective of creating a mosaic which impedes fire spread and enables fire fighters to better manage wildfire. The existing vegetation in this unit deviates substantially from the mosaic objective. Over 100 additional acres of early seral vegetation and 100 acres of early mid seral vegetation are needed, while there is an over abundance of 300 acres of late stage vegetation. The current matrix of late stage vegetation needs to be broken into late seral patches which are mostly no larger than 5 acres in size. Additional early mid seral vegetation should be created so as to make it the matrix stage. In addition, the current small patches of early seral stage should be enlarged to average 50 acres in size.

West Paradox Unit

The majority of this unit (82%) is comprised of the "Northeast Paradox Natural Mosaic" polygon. This polygon is located in the high country to the northeast of Paradox Valley which shares similar topographic and storm behavior patterns. The objective behind this unit is to restore a natural and appropriate vegetation mosaic that can be maintained over time through natural processes as opposed to intensive vegetation management practices. The current vegetation mosaic deviates somewhat from mosaic objectives as specified in the Fire Management Plan. There are presently about 3,800 too many acres of early mid seral vegetation, and 3,100 too few acres of late mid seral stage. As the vegetation ages, this discrepancy should be reduced, as long as large-scale fires do not occur. The current arrangement of patches seems appropriate, with late stage vegetation forming the matrix, as specified in the objective. Early and early mid seral patches are currently somewhat larger than called for, but this does not seem

Figure 4.13 West Paradox LHA Area Vegetation management subunits and polygons within them that prescribe various desired vegetation mosaics. From BLM, 2002: UFO Fire Management Plan.

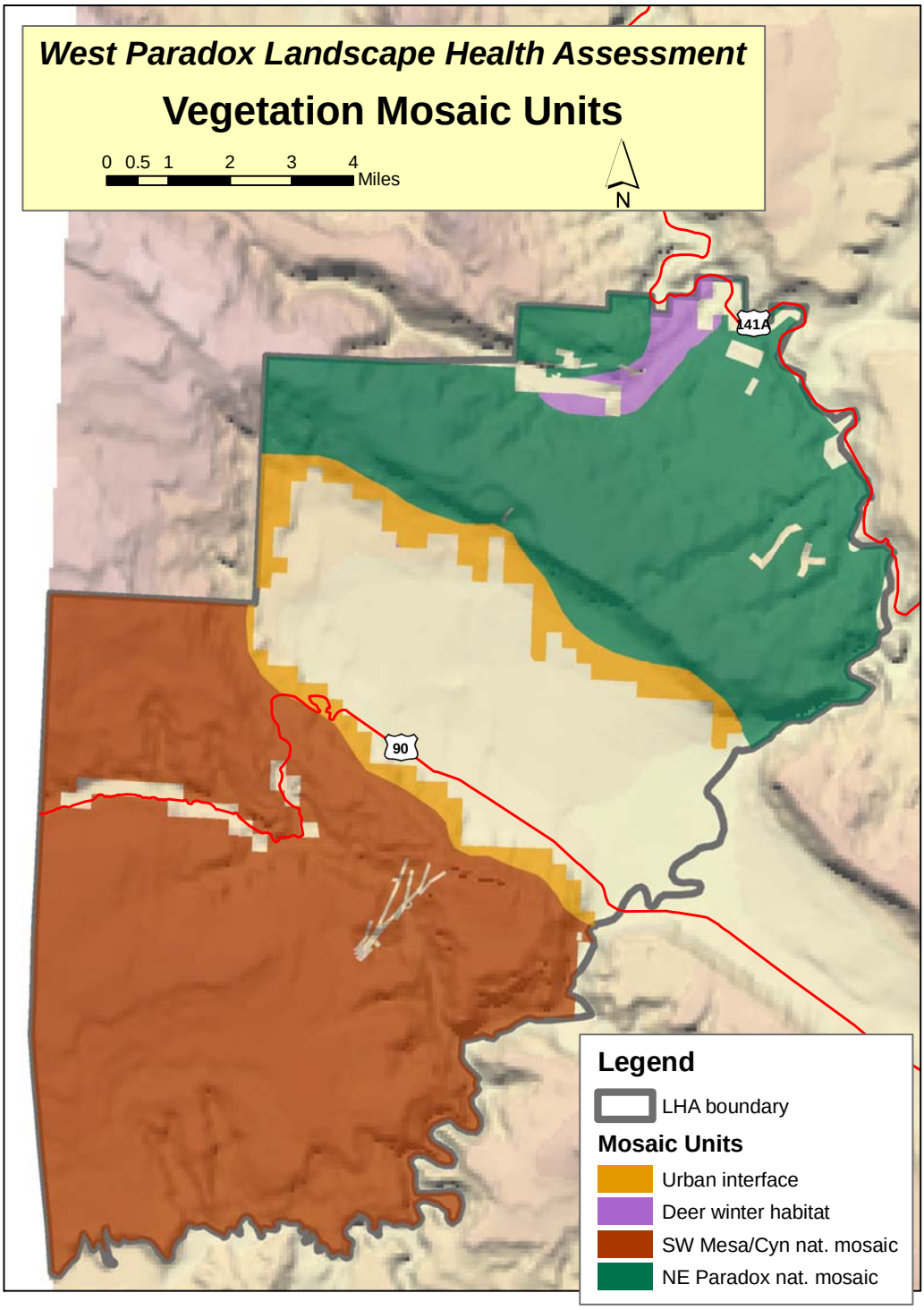
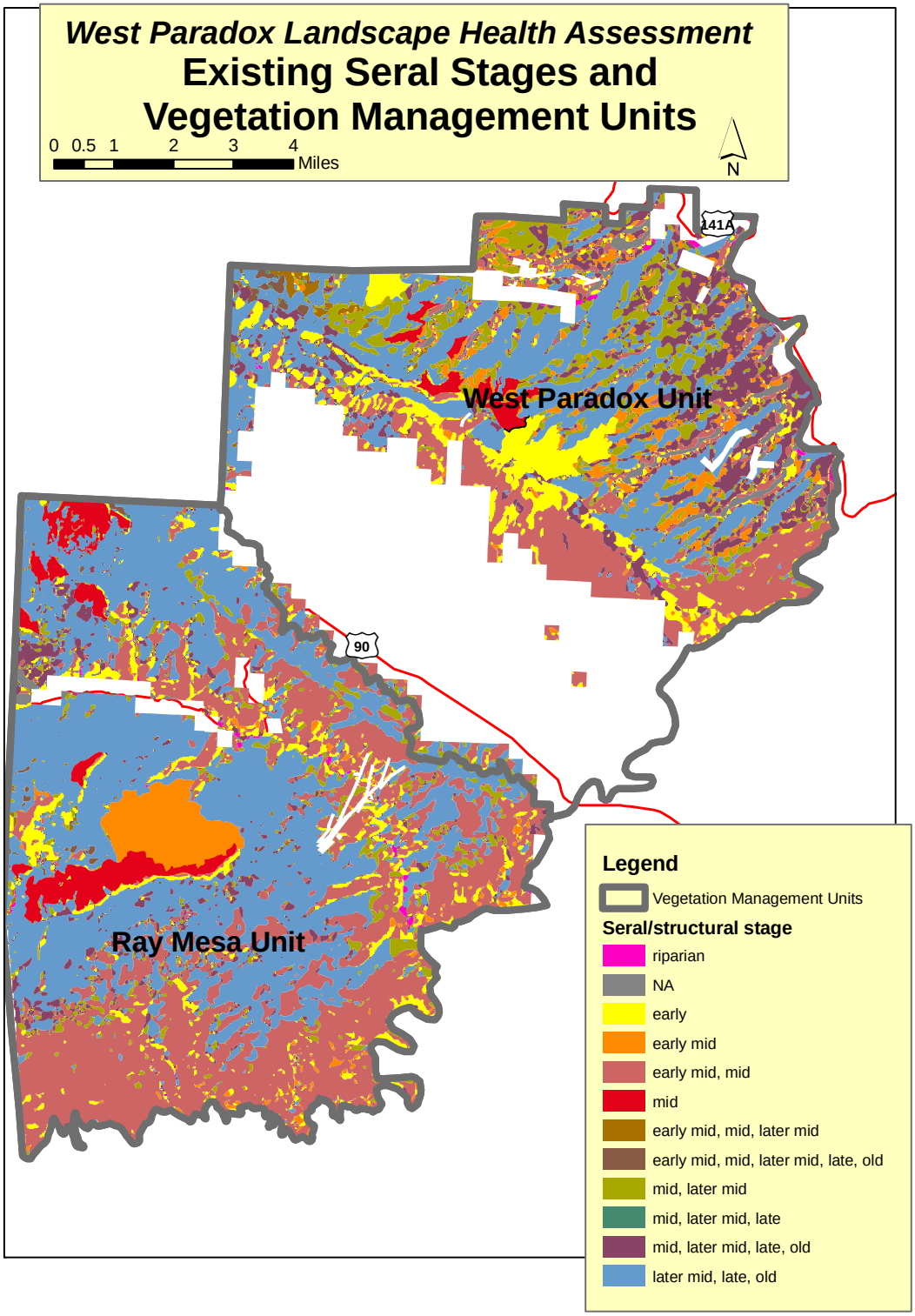


Figure 4.14 West Paradox LHA Area existing vegetation seral and structural stages. Colors that denote more than one stage indicate areas where the exact seral stage is uncertain so the range of possible stages for the area is shown.



to be a problem. Past fire and vegetation treatments appear to be skewing this distribution, but inspection of the seral stage map shows that the large treatment and fire polygons are many-lobed resulting in a smaller effective patch size.

The next largest polygon in this unit is the Urban Interface polygon, as described above. The existing vegetation is close to meeting objectives for seral stage proportions, with only 500 too many acres of late stage vegetation. Early mid seral vegetation forms the matrix, as specified in the mosaic objective. Late stage vegetation is currently in patches which are larger than called for by the objective. The large late stage patches should be broken down into smaller patches that are mostly less than 5 acres in size.

The remaining polygon in this unit is the “Deer Winter Habitat” polygon. It makes up 5% of this unit. It is also close to meeting Fire Management Plan mosaic objectives, but in this case the objective is for optimal deer winter habitat. Currently, there are about 200 too few acres of early seral vegetation, while the other stages are in the correct ranges. Late stage vegetation is most abundant, so this should probably be the main source of additional early patches. The existing arrangement of patches is about right, with late and late mid stage vegetation forming the matrix. The current patch sizes of early and early mid vegetation are appropriate, with small patches dominating, and very few patches greater than 25 acres in size.

Standard 4:

Special status, threatened and endangered species (federal and state), and other plants and animals officially designated by the BLM, and their habitats are maintained or enhanced by sustaining healthy, native plant and animal communities.

Indicators used to assess this standard include: stable and increasing populations of endemic and protected species, suitable habitat is available, minimal levels of undesirable or noxious plants, native plant and animal communities distributed adequately to assure sustainability, age class diversity to sustain recruitment and mortality fluctuations, adequate habitat connectivity, photosynthetic activity throughout growing season, community exhibits resilience to human activities, appropriate plant litter accumulations, and landscapes are composed of a variety of successional stages.

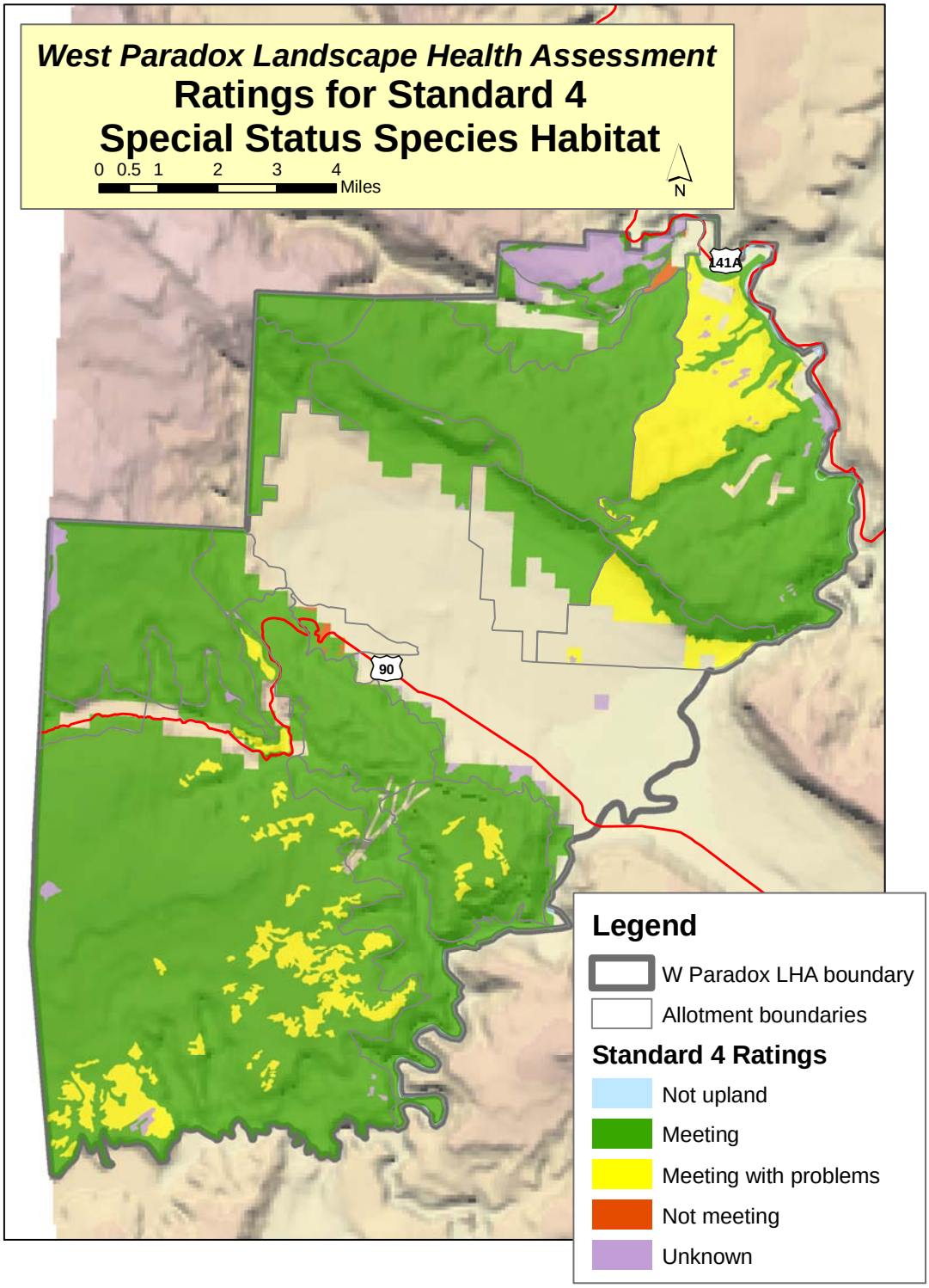
Acreage Figures

Meeting Standard 4				
Meeting	Meeting with problems	**Not Meeting Standard 4**	**Unknown**	**Water**
61,565	6,841	122	1,863	255

Note on Standard 4 Rating

Healthy plant communities typically translate to healthy habitats for wildlife and plants, particularly for wide-ranging or generalist species. However, because endemic and special status wildlife are typically restricted in their range and have more specific habitat requirements, those portions of the polygon containing habitat for these species were evaluated independently. As a result, in some cases, a particular polygon may have been found to be meeting Standard 3 for native animal communities but not meeting or meeting with problems for Standard 4, or vice-versa. The indicators listed in the "Specific Problems" subsection for Standard 3 (Wildlife) are also the basis for this evaluation. Please refer to the introductory Wildlife Section in this document for a discussion on species' population status and trends.

Figure 5.1 Standard 4 Ratings for West Paradox LHA area.



Standard 5: *The water quality of all water bodies, including groundwater where applicable, located on or influenced by BLM lands will achieve or exceed the Water Quality Standards established by the state of Colorado. Water Quality Standards for surface and ground waters include the designated beneficial uses, numeric criteria, narrative criteria, and antidegradation requirements set forth under State law as found in (5 CCR 1002-8), as required by Section 303(c) of the Clean Water Act.*

Indicators used to assess this standard include: appropriate populations of macroinvertebrates, vertebrates, and algae, pollutants and sedimentation attributable to human activity is within amounts specified by the Water Quality Standards established by the State of Colorado.

Mileage Figures: Stream Miles Evaluated Against Standard 5 [1,2]

Stream Type	Meeting Standard 5		Miles Not Meeting	Unknown
	Miles Meeting	Miles Meeting but Problem Areas		
Perennial	9.9	4.2	0	0
Intermittent	1.4	2.1	0	0
Ephemeral	4.8	3.4	7.0	0
Total	16.1	9.7	7.0	0

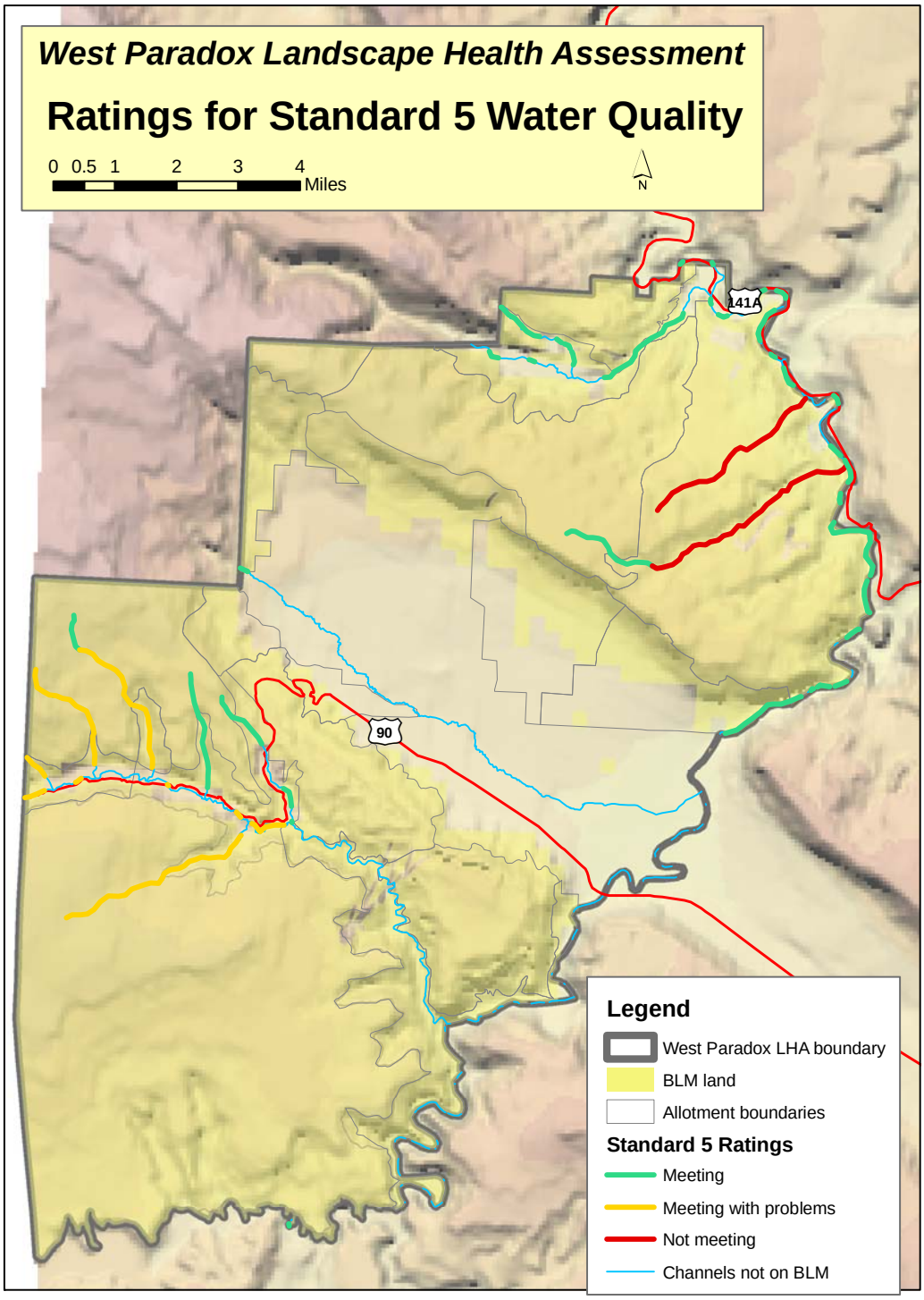
1. See figure 6.1 for map showing polygon ratings.
2. The majority of LaSal Creek has already been analyzed in the East Paradox LHA.

Table 6.1 shows chemical water quality characteristics of the landscape areas surface waters. The electrical conductivity (EC) values, which correlates with total dissolved solids, is highest in Roc Creek which appears to be influenced from a saline, ground water seep that discharges into the stream channel, at an approximate location being in the NW1/4 of section 8, T. 48 N, R 18 W., NMPM. The electrical conductivity of the seep water when measured on April 25, 2001, was 85,000 uS/cm. The Roc Creek drainage does contain isolated, remnants of the highly gypsiferous, Paradox formation, the most likely source of the saline groundwater. The Paradox formation is also the source of the saline inflow to the Dolores River as it crosses the Paradox valley.

La Sal Creek and its tributaries have electrical conductivity values implying low to moderate salinity concentrations. These creeks receive flow contributions from groundwater that most likely has a source area associated with the La Sal Mountains. Many of the springs listed in Table 6.2 are in the vicinity of La Sal Creek and its tributaries and similarly reflect moderate to low electrical conductivity values.

Nitrate and phosphate concentrations, being largely responsible for eutrophication of aquatic environments, are in relatively low concentrations in most streams sampled within the landscape area. Data from USGS Open File report 97-233 showed average nitrate and phosphate concentrations average 0.81 mg/l (2,076 samples) and 0.09 mg/l (287 samples), respectively, in

Figure 6.1 West Paradox LHA area Standard 5 Polygon Ratings.



the Upper Colorado Basin. All of the streams sample averages in the LHA are lower than the Upper Colorado Basin average (Table 1.10).

Table 6.1 Water Quality Chemistry Summaries for Streams in the West Paradox LHA Area

Stream	Date	Flow Rate (CFS)	EC umhos/cm	Temp. C	Dominant Ions	Nitrate mg/l	Phosphate mg/l
Roc Creek	6/29/2007	1.36	1809	23	sodium-chloride	0.03	0.02
Ice lake Creek	6/27/2007	0.19	222	12	calcium-bicarbonate	0.19	0.02
Lion Canyon	6/26/2007	0.13	248	NA	calcium-bicarbonate	0.16	0.02
Lion Creek	6/27/2007	0.44	198	15	calcium-bicarbonate	0.17	0.02
La Sal Creek, Upper	7/12/2006	5.07	406	20	calcium-bicarbonate	0.05	0.01
La Sal Creek, Lower	7/12/2006	7.23	436	18	calcium-bicarbonate	0.03	not detected
Spring Creek	6/29/2007	0.13	334	13	calcium-bicarbonate	0.08	not detected

Groundwater in the LHA area occurs in sedimentary, bedrock aquifers, and in unconsolidated surface deposits of alluvium and colluvium. Groundwater in the bedrock aquifers flows in the direction of the geologic dip. On public lands within the LHA area, there are about 20 known springs, several of which discharge from aquifers at impervious geologic contacts (table 6.2). On average these springs have Total Dissolved Solids concentrations less than 1,000 ppm. as implied by the conductance values.

Macroinvertebrates

Aquatic macroinvertebrate population density and composition are commonly evaluated to assess the stream health. Macroinvertebrates are good indicators of stream health, as there are usually many species that are relatively immobile, many invertebrates are sensitive to pollutants and because of their year round presence in the stream environment and they are capable of reacting to intermittent discharges.

Several instream factors control the composition and abundance of stream invertebrates, including: river flow rate and water velocity, channel substrate size and concentration of suspended solids, winter processes such as river icing, the composition and density of aquatic and riparian vegetation, and the chemistry of the river's water.

Table 6.3 summarizes the macroinvertebrate composition of selected stream sites within the LHA. The sample results are compared against average indicators for 524 samples taken at 245 stream sites in the Colorado Plateau Ecoregion. La Sal, Spring, and Ice lake Creeks show the majority of their indicators rate higher than the ecoregion average. Lion Canyon and Roc Creek show the majority of their values are below the ecoregion average. The invertebrate population in Roc Creek is most likely influenced from the highly saline, groundwater inflow. Lion Canyon Creek experiences drainage from historic uranium mining, and has low base flows which may limit suitable habitat for macroinvertebrates.

Table 6.2 Springs within the West Paradox LHA Unit.

Spring name	Flow rate cfs	Elevation feet	Location	Sample Date	Temperature Degrees C	Conductance (umhos/cm)	pH (su)
Lizard Spring	0.001	5260	T47N, R19W, NENE 36	6/27/1985	15	820	6.7
Fir Spring	0.0006	5400	T46N, T19W, NWSE 2	5/16/1985	15	800	8.0
Big Bowl Seep	0.0006	5860	T47N, R19W, NENE 18	7/31/1986	18	760	7.8
Lion Creek Spring	0.004	6520	T47N, R20W, NESW 1	9/18/1986	12	220	8.5
Richards Spring	0.25	6400	T47N, R20W, NESW 1	9/18/1986	10	215	8.0
Reed House Spring	0.002	6000	T47N, R20W, SWSW 12	6/25/1981	17	140	8.2
Road X2 Seep #1	0.0006	6600	T47N, R20W,NESE 11	7/29/1986	29	840	8.8
Ice lake Creek Spring	0.0006	6600	T47N, R20W,SWNE 11	7/29/1986	18	760	7.8
Road X2 Seep #2	0.0006	6500	T47N, R20W,SWNE 11	7/29/1986	29	925	8.8
Lion Canyon Springs	0.2	6200	T47N, R20W,NWNW 14	7/29/1986	21	290	8.5
Veda Springs	0.02	6160	T47N, R20W,NENE 15	5/7/1986	11	180	7.8
Lion Spring Reservoir	0.001	7140	T47N, R20W,NENW 2	5/13/1987	11	550	7.3
Canyon Wren Spring	NA	4700	T49N, R18W, NESE 33	8/3/1981	18	500	8.0
Rock Grotto Spring	0.007	5000	T48N,R18W, SWNW 4	6/24/1987	16	920	8.0
Garvey Gulch Spring	0.003	5160	T48N, R18W, NWNW 7	6/24/1987	16	1020	7.5
Tree Trunk Spring	0.001	6870	T48N, R18W, SWSW 8	6/11/1987	24	900	8.0
Short Draw Spring	0.0003	5300	T48N, R18W, NENE 15	8/3/1981	22	700	8.6
Slow Go Spring	NA	5400	T48N, R18W, NESW 23	8/4/1981	19	1000	8.3
Two Owl Spring	0.0006	5100	T48N, R18W, SENW 23	6/24/1986	28	900	9.0
Air Plant Spring	0.005	4980	T48N, R18W, NESW 14	6/23/1986	16	780	7.7

Table 6.3 Summary of aquatic macroinvertebrate metrics in West Paradox LHA area streams, compared to the average for the Colorado Plateau Ecoregion. Data collected summer 2007.

Stream	Lat .	Long.	Dominant Family	Total[2] Abundance	EPT[3] Taxa	EPT[4] Abundance	Intolerant[5] Abundance	Tolerant[6] Abundance
La Sal Creek	38.309	108.952	Mayfly - Baetidae	5276	13	925	586	0
Lion Canyon	38.333	109.055	Mayfly- Baetidae	500	4	262	13	0
Spring Creek	38.381	107.954	Stonefly - Nemouridae	14136	8	11755	7688	0
Lion Creek	38.337	109.023	Diptera - Chironomidae	1804	10	925	286	24
Ice Lake Creek	38.335	109.039	Mayfly - Baetidae	3634	11	2546	435	5
Roc Creek	38.442	108.878	Caddisfly - Hydropsychidae	948	14	487	24	0
Colorado Plateau Ecoregion Average (mean of 524 samples taken at 245 sites)				1953	9	848	148	10

1. Values in RED rate higher than the Colorado Plateau Ecoregion average. Tolerant Abundance rates, rate higher with lower values.
2. The number of invertebrates per 0.74 square meters of stream bottom.
3. Number of invertebrate families in the Orders: Ephemeroptera (mayflies), Plecoptera (stoneflies), and Tricoptera (caddisflies).
4. The total number of invertebrates in the Orders: Ephemeroptera (mayflies), Plecoptera (stoneflies), and Tricoptera (caddisflies).
5. The total number of invertebrates rated as intolerant to pollution.
6. The total number of invertebrates rated as tolerant to pollution.

Watershed Condition

Accelerated yield of sediment from the erosion of upland soil is the most widespread water quality issue in the LHA area. Much of the sediment derived from the LHA uplands is detached and transported during intense rainfall events in the summer months. These rainfall events are usually short duration, typically lasting from less than one to no more than three hours. The resultant runoff in the LHA area's streams is also short duration, making quantitative water quality assessments difficult. Thus, to assess a stream's potential for suspended sediment loading in the LHA area, surrogate indicators (soil surface conditions) in place of water quality analyses were used. The specific surrogate indicators used for this assessment, include the amount of bare soil surface, live plant basal coverage, amount of plant litter on the soil surface, and the density of secondary roads on erodible sites. Low amounts of plant litter and plant basal cover, and high amounts of bare soil surface (soil surface with no plant, rock, or litter cover) are indicative of soils susceptible to high rates of erosion.

The LHA process did not include an evaluation of the condition of roads and trails in the area but did take note of problem areas when encountered. It was observed that several travel routes associated mostly with historic uranium mining are in need of maintenance or rehabilitation. Presently, many of these routes are not maintained and are sources of accelerated sediment yield into receiving surface waters, possibly increasing the total recoverable iron concentration in the 303(d) listed reach of the Dolores River. An example would be the secondary road in Lion Canyon shown in Figures 6.2 and 6.3. Roads in this condition intercept

surface runoff from lands upslope and route sediment-laden, channelized water to downstream receiving streams. Figure 6.4 shows secondary road locations throughout the LHA area and their respective soils' erosion potential. The erosion potential was evaluated using the soil Kw factor, land surface slope, and rock content in the surface soil (US Forest Service). Table 6.3 shows road and soil erosion potential metrics by 6th level watersheds in the LHA area. The La Sal Creek Watershed (# 2415) and the Martin Mesa/Red Canyon Drainages (# 2360) have both the highest road density and total road miles on soils with severe erosion potential.

Figure 6.2 Historic mine related roads are often in poor condition and contributing to downstream sediment yields.

Figure 6.3 Road network in Lion Canyon Drainage (location of road in Figure 3 highlighted by red circle).

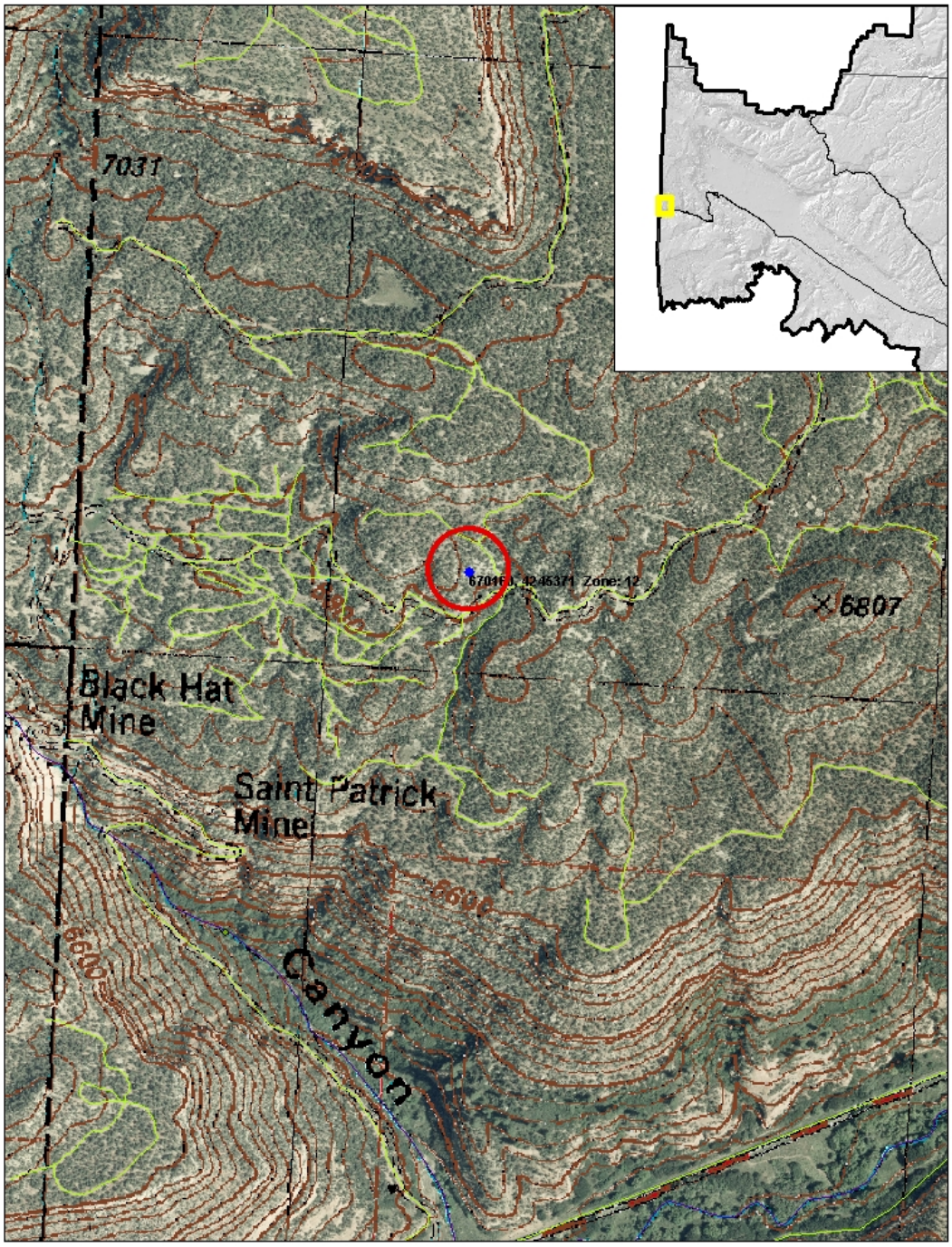


Figure 6.1 West Paradox LHA area showing network of secondary roads, the potential for erosion on unsurfaced roads, and the 6th level drainage delineations.

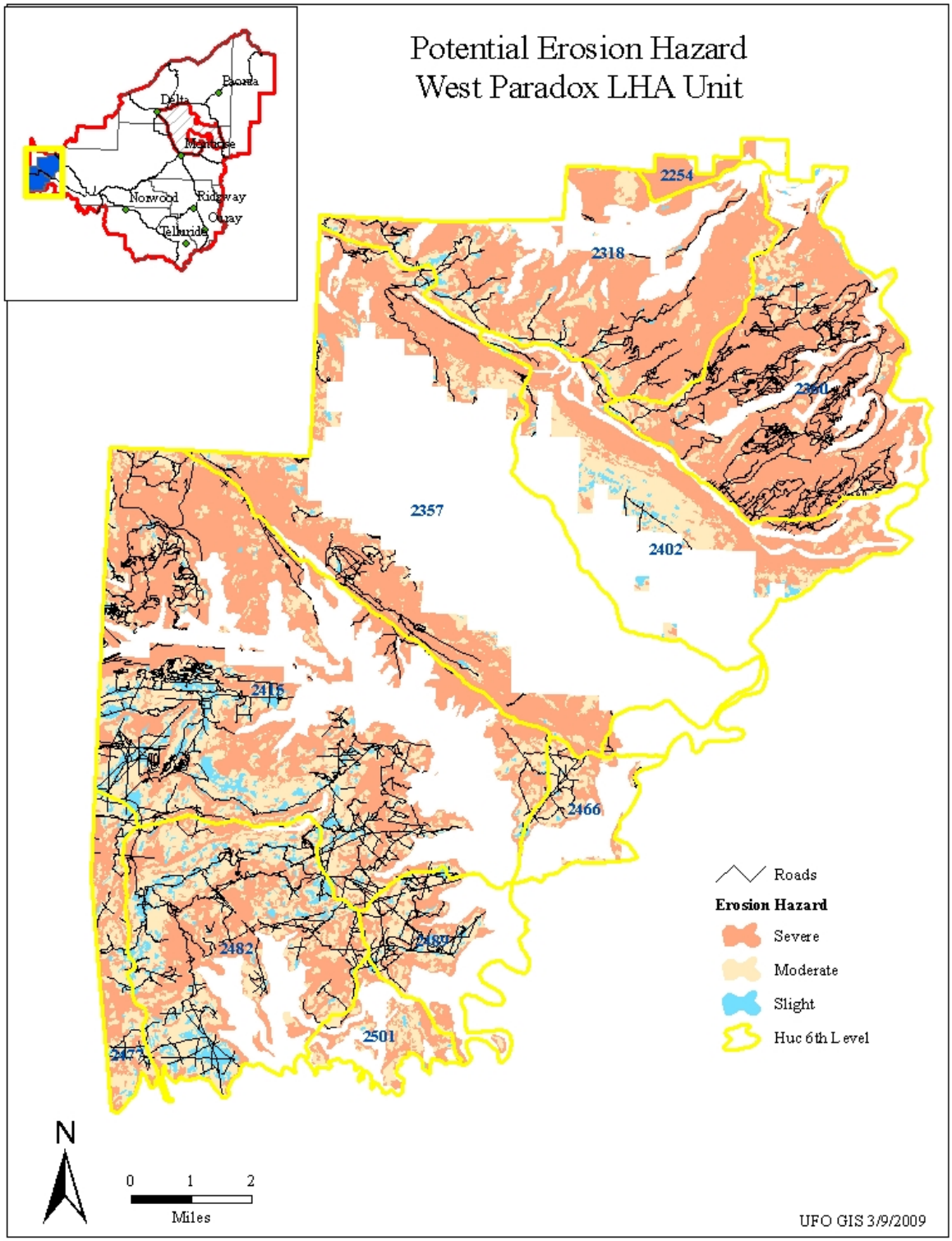
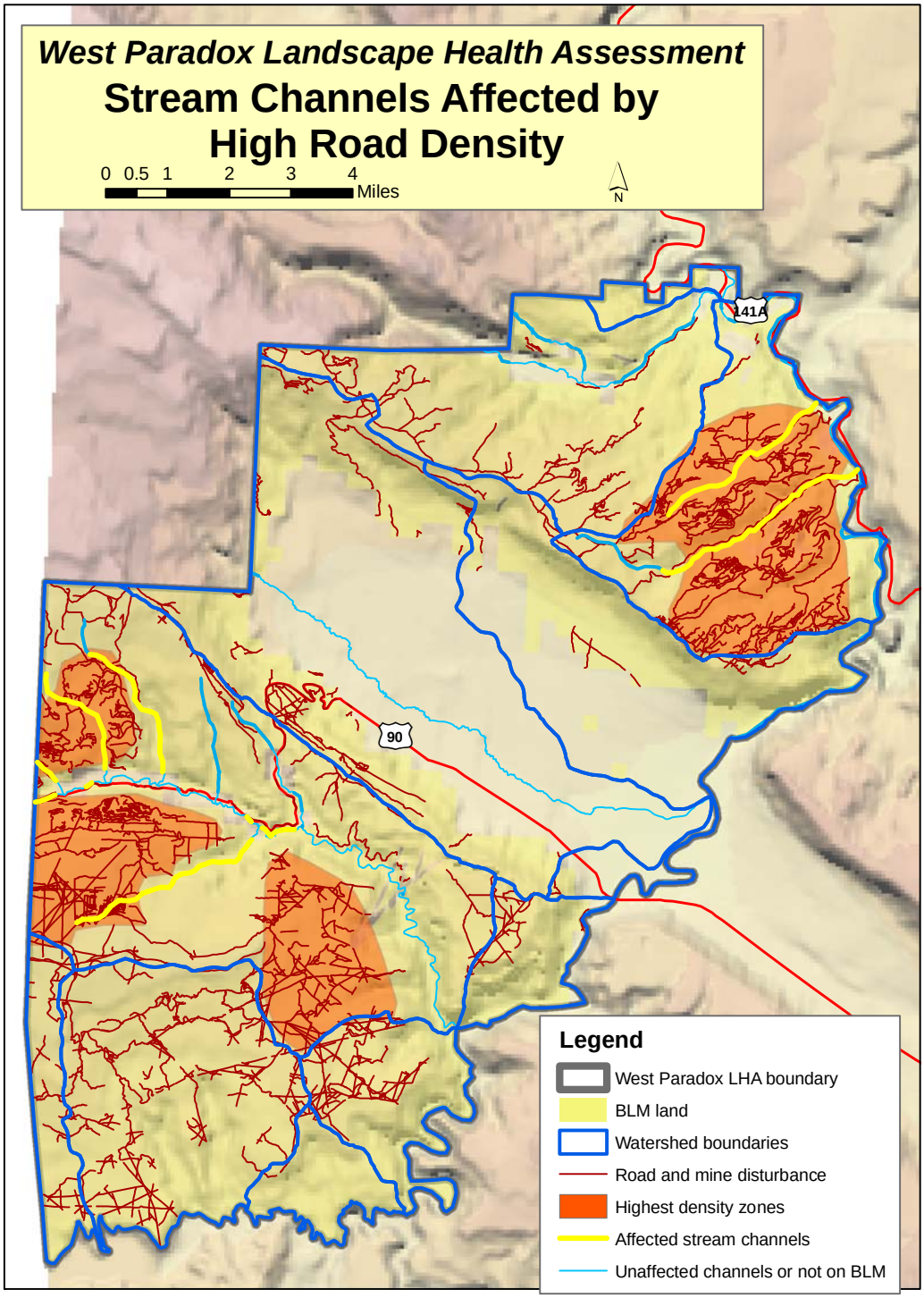


Table 6.3 Secondary road metrics on the LHA area, by 6 level watershed and potential soil erosion category.

	HUC Metrics BLM Only			Erosion Rating (sq. Miles)			Road Miles by Rating		
HUC 6 Unique ID	Miles of Road	Area of HUC 6 (sq Miles)	Road Density Miles/Sq Miles	Slight	Moderate	Severe	Slight	Moderate	Severe
2360	114.13	14.75	7.74	0.13	1.78	10.99	0.63	15.81	92.72
2415	173.99	32.18	5.41	1.67	8.56	14.02	20.68	84.77	60.62
2357	36.12	11.67	3.10	0.22	2.32	8.50	1.00	11.07	23.42
2318	32.92	14.51	2.27	0.27	2.47	9.19	1.70	12.03	18.37
2482	69.24	14.23	4.86	1.37	5.58	5.11	12.34	38.60	17.93
2402	12.12	8.37	1.45	0.33	2.53	3.91	0.78	4.35	6.54
2489	26.35	5.26	5.01	0.19	1.45	1.21	3.78	16.70	5.87
2477	12.62	3.02	4.17	0.20	1.42	1.38	2.14	8.18	2.21
2466	8.54	3.00	2.85	0.05	0.78	0.52	0.54	6.98	1.02
2501	1.47	2.67	0.55	0.05	0.62	0.82	0.37	0.72	0.38
2254	0	0.78	n/a	0.00	0.0002	0.68	n/a	n/a	n/a

Figure 6.5 West Paradox stream channels affected by the high density road and mine disturbance network.



Causal Discussion and Determinations

For discussion and analysis of probable causes for land health problems, see the separate document entitled "Causal Determinations for West Paradox LHA"

Recommendations

Standard 1 Soils

In areas with elevated bare soil levels, leave more plant litter on the soil surface. Limit grazing season utilization during the dormant season to 50% use on palatable species.

In areas with low plant basal cover, minimize grazing impacts to plants during periods when the grasses are actively growing. Prevent grazing on regrowth by limiting time of use to 2 weeks or less in a given pasture or grazing area. Minimize instances where livestock graze the same areas in both spring and fall seasons. Provide for occasional, year-long rest.

Use the range project inventory information in combination with the map of high erosion risk areas to identify projects contributing to accelerated soil erosion. Identify and implement corrective measures for project maintenance, management, or deconstruction.

Ensure that existing mosaic objectives (UFO Fire Management Plan [USDI BLM 2002]) are reasonable and consistent with recent information concerning regional historic ranges of variability. Subsequently reevaluate existing mosaics, and then implement measures to ensure objectives are met by allowing natural disturbances to take place, simulating natural disturbances, and restoring past vegetation treatments to increase herbaceous cover and minimize vegetation stages that provide little soil protection.

Reseed burns and consider mulching/rollerchopping/hydroaxing burned areas that are prone to erosion where existing vegetation or rocks on the soil surface are unlikely to stabilize the site within the first 1-2 years post fire.

Coordinate or participate in research on controlling cheatgrass invasions in new disturbances as well as reducing existing invasions. Implement measures/mitigation to reduce spread of cheatgrass and other invasive annuals for all permitted activities.

Complete the road and trail map (also see Figure 2.7), and use it in a GIS to identify road-caused soil loss. This analysis should be used to direct road maintenance and rehab areas so that road and travel related erosion is reduced. Monitor use to better understand soil impacts from OHVs. Where necessary, close and rehab abandoned roads and trails to prevent further erosion. Complete RMP amendment to limit travel to existing routes. Pursue route designation to further limit road-related damage to soils.

Standard 2 Riparian

Continue to work on the control of tamarisk, knapweed, and other invasive exotics that infest riparian communities in the LHA area. Continue active involvement in and implementation of UP's weed management plan for the Paradox area, and the TNC project to restore the Dolores River.

Prevent additional damage to existing native riparian species by limiting livestock grazing use on willows and cottonwoods to 30% where grazing is found to exceed that level. Reducing stress on native woody species should make them more competitive with tamarisk and other invasive plants.

Acquire an updated map of water rights and instream flows (online from the Colorado Water Conservation Board) within the West Paradox area to better understand controls on stream flows, to identify segments still needing protection, and to help ensure existing water rights are being correctly managed. Incorporate mitigation in BLM issued rights of ways associated with private water right developments that includes installing equipment to monitor instream flow rights and make sure they are upheld.

Advocate for additional instream flows in the Dolores River to maintain riparian values through active involvement in the Dolores River instream flow group.

Put into place a comprehensive series of riparian cross-section studies to monitor riparian condition changes over the long term.

Standard 3 Native Plant and Animal Communities

Improve cool season perennial grass and forb cover by adjusting livestock grazing where it is a contributing factor to low cover. Prevent grazing on regrowth during the growing season (which can start in early February) by limiting time of use to 2 weeks or less in a given pasture or grazing area. Minimize instances where livestock graze the same areas in both spring and fall seasons. Provide for occasional, year-long rest to improve plant vigor.

Promote and support the native seed development program to generate a source of adapted, truly native species for rehabilitating damaged areas in the LHA unit.

Complete route mapping across the LHA area. Implement more intensive monitoring of OHV use focusing on the potential for loss of native plant and animal species, and the increase in invasive plants. Use this information to help develop regional Best Management Practices for road and trail placement and management. Complete RMP amendment to limit travel to existing routes, and then pursue route designation to further limit travel-related damage to vegetation and weed spread.

Prevent disturbed areas—particularly fires—from transitioning to dominance by invasive annuals. Evaluate findings from the UFO treatment studies, Goetz (2006), and Shinneman (2006) to determine whether seeding is correlated with cheatgrass, and their other conclusions on factors associated with cheatgrass spread. Based on review of data, determine best management practices including seeding, spraying with Roundup or Plateau, and priority areas for combating cheatgrass. When seeding, use the best adapted seed possible as determined by treatment monitoring studies, and use the products of the UP native plant material development effort as they become available.

Where the spread of weeds is not a threat, improve warm and cool season grass and forb cover, shrub vigor and abundance, and the vegetation mosaic by reintroducing fire and other natural

disturbances, or simulating their effects:

1) Review Fire Management Plan landscape units and objectives.
2) Develop vegetation management strategies for each vegetation management unit. Use mosaic analysis (Chapter 4, this document) to guide vegetation treatment design, both in terms of quantity and pattern.
2) Review findings by Eisenhart (2004) and Shinneman (2006) and retool mosaic descriptions in the UFO Fire Management Plan (USDI BLM 2002) for natural landscape conditions based on this new data.
3) Where new mosaic objectives are developed, reevaluate existing mosaic versus desired mosaics to develop acreage figure recommendations for treatment.

Improve weed management by:

1) Following a strategic approach to first contain spread then reduce existing infestations by implementing the Paradox Weed Management Plan and broadening it to include the LHA area.
2) Utilizing existing partnership with Montrose County to help implement this strategy.
3) Incorporating weed management responsibilities into grazing permits on allotments for new range projects. Develop mechanism to get greater involvement of range permittees, the range budget, and the Grazing Advisory Board to help fight weeds where grazing or livestock management are contributing factors.
4) Enforcing Right of Way weed control stipulations.

In seriously degraded plant communities implement vegetation restoration activities to reduce competition from weeds or woody species, and seed with native species. Conduct literature review and trials to investigate restoration of challenging areas including crested wheat seedings and semidesert sites.

During revision of the Resource Management Plan, consider how to include special designations to protect CNHP, TNC or SREP Potential Conservation Areas, biodiversity conservation areas, relict or remnant plant communities, and wildlife movement corridors.

Put into place a comprehensive series of monitoring transects (several per grazing allotment) to track plant community changes over time, and to monitor effects of management on Standard 3.

Work with CNHP, Black Canyon Audubon, Rocky Mountain Bird Observatory and academic partners to better understand small mammals, herptiles, birds, and predators, their habitat needs and the existing condition of their habitats.

Work with the Colorado Division of Wildlife through their Habitat Partnership Program and private landowners (individually and through Natural Resource Conservation Service) to encourage participation in habitat improvement programs.

Promote Neotropical Migratory Bird (NTMB) species by:

1) Continuing control work on noxious weeds to improve habitat for NTMB species
2) Following the Best Management Practices developed for woodland and sage dependent species when implementing vegetation treatments.

3) Maintaining support for the Rocky Mountain Bird Observatory to continue with Breeding Bird Survey transects on BLM land
4) Reduce or eliminate activities that degrade the structure and quality of the overstory or understory of riparian systems.
5) Monitor livestock grazing to ensure tree and shrub regeneration in riparian areas. Design recreational facilities such as roads, trails, and campgrounds to allow the long-term persistence of wooded riparian areas. Include plant species that attract large numbers of insect pollinators as prey in rehabilitation schemes in lowland riparian areas.
6) Maintain stands of large-diameter Gambel oaks, which produce acorns for deer, bears, wild turkeys, and band-tailed pigeons and which provide shade and access to elk sedge understory production for deer and elk, and benefit Virginia's warblers as well.
7) Defer grazing in a rotation that has some pastures with flowering forbs at all times through the growing season. This should benefit the security of the forage resource for both livestock and hummingbirds.

Standard 4 Special Status Species:
Monitor grazing, recreation, mining, and other impacts on Payson's lupine, sandstone milkvetch, and Paradox breadroot.

Expand baseline data for raptor nests, habitats, and territories.

Continue to monitor peregrine falcon eyries and territories.

Monitor/inventory for hanging garden sensitive species: Eastwood's monkeyflower, Kachina daisy, etc.

Evaluate the potential for increasing the amount of suitable habitat within the unit for reintroduction and expansion of Gunnison sage grouse populations (i.e., mesa top sagebrush parks to enhance connectivity between Dry Creek Basin and Paradox Valley historical habitat).

Implement BLM surveys and monitoring to fill data gaps. Support habitat inventories and surveys for yellow-billed cuckoo within the major riparian areas in the LHA area. Update plant species maps for sensitive plant species in the area (see list and descriptions in the Special Status Species section).

Consider amending the Uncompahgre Resource Management Plan to include special designations and management decisions for the CNHP, TNC, or SREP Potential Conservation Areas, biodiversity conservation areas, and wildlife movement corridors.

Enhance the management of those streams that are functioning at risk in order to improve habitat conditions for sensitive fish species (see recommendations for Standard 2.) Investigate the opportunities for natural flow regimes to improve stream habitat for native fish.

Standard 5 Water Quality:

Implement management strategies to maintain or increase plant litter, and basal vegetation cover

across the LHA area, and decrease amount of bare soil surface on the uplands in the areas rated as "Not Meeting" or "Meeting with Problems".

Assess the network of roads as to their needed maintenance and/or closures to reduce soil erosion and sediment yield. The priority watersheds are the La Sal Creek and Red Canyon/Martin Mesa 6th level watersheds.

Reseed burns and consider mulching/rollerchopping/hydroaxing burned areas that are prone to accelerated sediment production where existing vegetation is unlikely to stabilize the site within the first 1-2 years post fire, or if the invasion of cheatgrass is a threat.

Continue to assess the condition of stream and riverine environments to identify potential impacts to water quality, including the annual thermal regime. Additionally, pursue instream flow recommendations to the state of Colorado on streams needing new or enlarged flow protection to sustain flow-related resource values.

References

Banulis, B. 2008. La Sal Deer Management Plan. Unpublished report. Colorado Division of Wildlife, Montrose, Colorado.

Banulis, B. 2008. Paradox Elk Management Plan. Unpublished report. Colorado Division of Wildlife, Montrose, Colorado.

Boyle, S. and S. Franklin. 1993. Mexican spotted owl surveys in Colorado by all agencies and companies (UFO files).

Colorado Natural Heritage Program (CNHP). 2003. Field Guide to the Wetland and Riparian Plant Associations of Colorado. Colorado State University.

Colorado Division of Wildlife (CDOW). 2006a. Gunnison sage grouse range-wide conservation plan.

Colorado Division of Wildlife (CDOW). 2009. Draft Gunnison's and white-tailed prairie dog conservation plan. Avaliable: http://wildlife.state.co.us/WildlifeSpecies/GunnisonWhitetailPrairieDogConsPlanlhtm. Accessed 6/16/2009.

Colorado Herpetological Society website: http://webspinners.com/coloherp/index.php.

Colorado Natural Heritage Program (CNHP). 2003 Field Guide to the Wetland and Riparian Plant Associations of Colorado. Colorado State University.

Colorado Partners in Flight. 2000. Colorado Landbird Conservation Plan, website http://www.rmbo.org/pif/bcp/phy87/87.htm, accessed 3/30/2009.

Colorado Water Quality Control Commission, The Basic Standards and Methodologies for Surface Water, (5 CCR 1002-31), Amended 8/8/2005, effective 12/31/05 and 12/31/07.

Eisenhart, Karen. 2004. Historic Range of Variability of Pinyon-Juniper Woodlands in Pinon-Juniper Woodlands of Western Colorado. PhD Dissertation submitted to the University of Colorado.

Federal Register. 2008. 12-month finding on a petition to list the Gunnison's prairie dog as threatened or endangered (Feb. 5, 2008).

Federal Register, July, 1999. Proposed delisting of bald eagle from threatened status.

Goetz, Hillary, 2006. MSc. Thesis on the relationship between cheatgrass, wildfires, and fire rehabilitation. 2006. University of Wyoming.

Hayes, M. and M. Hall. 2008. Bats in the Paradox Valley Area and Gunnison Gorge National Conservation Area. Results of Mist Netting and Acoustic Surveys During 2008.

Hunt, G. 2007. Parliamentary [*sic*] findings of prairie dog status on BLM land within the Uncompahgre district. BLM unpublished report. 17 September.

Lyon, Peggy. 2008. Rare Plant Survey of BLM Lands. Gateway, Colorado. Colorado State University, Colorado Natural Heritage Program.

Lyon, Peggy and J Sovell 2000. A Natural Heritage Assessment San Miguel and Western Montrose Counties, Colorado. Colorado Natural Heritage Program. Ft. Collins, CO.

PRISM Group at Oregon State University. June, 2006. United States Average Monthly or Annual Precipitation, 1971 – 2000. Corvallis, Oregon, USA.

Reynolds, T.D., and C.H. Trost. 1980. The response of native vertebrate populations to crested wheatgrass planting and grazing by sheep. Journal of Range Management 33:122-125. *From:* Beck, JL, DL Mitchell. 2000. Influences of livestock grazing on sage grouse habitat. Wildlife Society Bulletin 28:993-1002.

Rocky Mountain Bird Observatory. 2008. The Primary Source, October newsletter.

San Miguel Basin Gunnison Sage Grouse Working Group. 2009. Gunnison Sage Grouse Conservation Plan, San Miguel Basin, draft March 2009. http://www.freewebs.com/sanmiguelsagegrouse/conservationplan.htm.

Shinneman, Doug 2006. PhD thesis on restoration opportunities for sagebrush and pinyon-juniper communities on the Uncompahgre Plateau. University of Wyoming.

Southern Rockies Ecosystem Project, 2005. Linking Colorado's landscapes: phase 1 report.

Tuhy, J.S., P. Comer, D. Dorfman, M. Lammert, J. Humke, B. Cholvin, G. Bell, B. Neely, S. Silbert, L. Whitmam, and B. Baker. 2002. A conservation assessment of the Colorado Plateau ecoregion. The Nature Conservancy, Moab Project Office, Moab UT. 110 p. + appendices.

USDA-NRCS 2003 Ecological Sites, information available at http://nasis.nrcs.usda.gov/documents/help/Ecological_Sites_(NASIS - 2003-08-07).

USDA-NRCS 2003. Soil Survey of San Miguel Area, Colorado. Parts of Dolores, Montrose and San Miguel Counties. USDA NRCS in cooperation with USDI BLM and Colorado Agricultural Experiment Station. 499 p.

USDI Bureau of Land Management, 1985. San Juan, San Miguel Resource Management Plan. Uncompahgre Field Office, Montrose, Colorado.

USDI Bureau of Land Management, 2002. Uncompahgre Field Office Fire Management Plan. Uncompahgre Field Office, Montrose, Colorado.

US Geological Survey Digital Elevation Model 30 meter pixels. Information at http://edc.usgs.gov/products/elevation/dem.html

US Department of Agriculture-NRCS 2003. Soil Survey of San Miguel Area, Colorado. Parts of Dolores, Montrose and San Miguel Counties. USDA NRCS in cooperation with USDI BLM and Colorado Agricultural Experiment Station. 499 p.

US Forest Service, Rocky Mountain Region, Soils Group, Interpretations Rating Guide (page 66)

US Geological Survey, Nitrogen and Phosphorus Data for Surface Water in the Upper Colorado River Basin, Colorado, 1980-94. Open-File report 97-233, Denver, Colorado, 1997.

US Geological Survey, Nitrogen and Phosphorus Data for Surface Water in the Upper Colorado River Basin, Colorado, 1980-94. Open-File report 97-233, Denver, Colorado, 1997

Van Reyper G. 2006. TES Species Descriptions for the Uncompahgre Field Office, BLM Uncompahgre Field Office, Montrose, CO.

List of Preparers

Amanda Clements: Ecologist	Plant Communities, Soils, Riparian areas
Dennis Murphy: Hydrologist	Climate, Watersheds and Water Quality
Robb Ernst: Geologist	Geologic resources
Dean Stindt: Rangeland Specialist	Domestic Livestock Grazing Weeds
Charlie Sharp, Melissa Siders and	Special Status Species, Wildlife

Gretchen VanReyper	
Lynae Rogers	Weed Input
Ken Holsinger	Forestry Input

APPENDIX

Table S1 Dominant soil units in the West Paradox LHA area and descriptions of their characteristics.

Soil Map Unit	Soil Description and Attributes	BLM Acreage in Unit
6	Acree loam, 6 to 12 percent slopes Elevation:7,400 to 8,500 feet Mean Annual precipitation:17 to 19 inches Acree and similar soils: 85% of unit Soil Order: Mollisol Landform: Mesa, structural bench Depth to restrictive feature: greater than 60 inches Drainage class: well drained Permeability: slow Available water capacity: high Runoff class: Very high Water erosion potential: Slight Wind erosion potential: Low Ecological site: Mountain loam Potential native vegetation: Arizona fescue, Patty's danthonia, mountain muhly, western wheatgrass, mountain big sagebrush, nodding brome, slender wheatgrass	813
18	Begay fine sandy loam, 1 to 6 percent slopes Elevation: 4,900 to 6,200 feet Mean annual precipitation: 9 to 12 in. Begay and similar soils: 85% of unit Soil Order: Aridisol Landform: Old terrace Depth to restrictive feature: Greater than 60 inches Available water capacity: moderate Runoff class: very low Water erosion potential: Slight Wind erosion potential: Moderate Ecological site: Semidesert Sandy loam Potential native vegetation: galleta, Wyoming big sagebrush, Indian ricegrass, needleandthread, blue grama, bottlebrush squirreltail, sand dropseed	7,284
19	Beje fine sandy loam, 3 to 25 percent slopes Elevation: 6,200 to 9,700 feet Mean Annual precipitation: 15 to 17 inches Beje and similar soils 80% of unit Soil Order: Mollisol Landform: Mesa Permeability: moderately slow Available water capacity: very low Runoff class: Very high Water erosion potential: Slight Wind erosion potential: Moderate Ecological site: Pinyon-Juniper Potential native vegetation: Utah juniper, twoneedle pinyon, black sagebrush, blue grama, bottlebrush squirrel, muttongrass, true mountain mahogany, Gambel's oak, Utah serviceberry, antelope bitterbrush, hairy goldenaster, prairie Junegrass.	3,272

23	Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes Elevation:5,400 to 6,800 feet Mean annual precipitation: 10 to 12 inches Bodot and similar soils 45% of unit Soil Order: Entisol Landform: Terrace, structural bench, landslide Drainage class: Well drained Permeability: slow Available water capacity: low Depth to restrictive feature: 20 to 40 inches Runoff class: Very High Water erosion potential: Moderate Wind erosion potential: Low Ecological site: Basin shale Potential native vegetation: black sagebrush, galleta, western wheatgrass, winterfat, Wyoming big sagebrush, bottlebrush squirreltail, fourwing saltbush shadscale saltbush. Ustic Torriorthents and similar soils: 40 percent of unit Soil Order: Entisol Landform: Structural bench, landslide, terrace Drainage class: Well drained Permeability: Moderately slow Available water capacity: low Depth to restrictive feature: greater than 72 inches Runoff class: Very High Water erosion potential: Moderate Wind erosion potential: Moderate Ecological site: Pinyon-Juniper Potential native vegetation: Utah juniper, two needle pinyon, Indian ricegrass, Wyoming big sagebrush, blue grama, bottlebrush squirreltail, galleta, Salina wildrye	31
43	Fluvaquents, 0 to 6 percent slopes Elevation: 5,100 to 6,200 feet Mean annual precipitation: 10 to 12 inches Fluvaquents and similar soils: 90 percent of unit Soil Order: Entisol Landform: Flood plains Drainage class: Somewhat poorly drained Slowest permeability: Moderately slow Available water capacity: high Runoff class: Low Water erosion potential: Slight Wind erosion potential: Low Potential native vegetation: narrowleaf cottonwood, inland saltgrass, rush, sedge, willow, tamarisk	21,454

45	Gladel-Bond-Rock outcrop complex, 1 to 50 percent slopes Elevation: 5,500 to 6,800 feet Mean Annual precipitation: 10 to 14 inches Gladel and similar soils: 35% of unit Soil Order: Entisol Landform: Mesa, structural bench, escarpment Depth to restrictive feature: 5 to 15 inches Drainage class: Well drained Slowest permeability: moderately rapid Available water capacity: very low Runoff class: Very high Water erosion potential: Moderate Wind erosion potential: Moderate Ecological site: Pinyon-Juniper Potential native vegetation: Utah juniper, twoneedle pinyon, Indian ricegrass, bluebunch wheatgrass, galleta, blue grama, bottlebrush squirreltail Bond and similar soils: 30% of unit Soil Order: Aridisol Landform: Escarpment, mesa, structural bench Depth to restrictive feature: 6 to 20 inches Drainage class: Well drained Slowest permeability: Moderately slow Available water capacity: very low Runoff class: Very high Water erosion potential: Moderate Wind erosion potential: Moderate Ecological site: Pinyon-Juniper Potential native vegetation: Utah juniper, twoneedle pinyon, galleta, Indian ricegrass, Wyoming big sagebrush, blue grama, true mountain mahogany, antelope bitterbrush, big sagebrush, singleleaf ash, squaw apple Rock outcrop: 30% of unit Landform: Mesa, escarpment, structural bench Runoff class: Very high	233
49	Gypsiorthids, 3 to 25 percent slopes Elevation: 4,900 to 6,600 feet Annual precipitation: 10 to 12 inches Gypsiorthids and similar soils 85% of unit Soil Order: Aridisol Landform: Valley floor, terrace Depth to restrictive feature: Greater than 60 inches Drainage class: Well drained Slowest permeability: Moderate Available water capacity: low Runoff class: Medium Water erosion potential: Moderate Wind erosion potential: Moderate Potential native vegetation: Indian ricegrass, Greene's rabbitbrush, sand dropseed, New Mexico feathergrass, Wyoming big sagebrush, bottlebrush squirreltail, cryptantha, fourwing saltbush, galleta, scarlet globemallow, winterfat	46

61	Monticello-Witt loams, 1 to 3 percent slopes Elevation: 6,800 to 7,400 feet Annual precipitation: 13 to 15 inches Monticello and similar soils: 60% of unit Soil Order: Mollisol Landform: Mesa, ridge Depth to restrictive feature: Greater than 74 inches Drainage class: Well drained Slowest permeability: Moderate Available water capacity: moderate Runoff class: Low Water erosion potential: Slight Wind erosion potential: Low Ecological site: Loamy Foothills Potential native vegetation: muttongrass, western wheatgrass, Indian ricegrass, Utah serviceberry, black sagebrush, bottlebrush squirreltail, green rabbitbrush Witt and similar soils: 30% of unit Soil Order: Aridisol Landform: Mesa, ridge Depth to restrictive feature: Greater than 74 inches Drainage class: Well drained Slowest permeability: moderately slow Available water capacity: high Runoff class: Medium Water erosion potential: Slight Wind erosion potential: Low Ecological site: Loamy Foothills Potential native vegetation: western wheatgrass, muttongrass, Indian ricegrass, Wyoming big sagebrush, needleandthread	406
69	Nortez-Fivepine loams, 1 to 2 percent slopes Elevation: 7,400 to 8,500 feet Annual precipitation: 16 to 19 inches Nortez and similar soils 45% of unit Soil Order: Mollisol Landform: Mesa, structural bench Depth to restrictive feature: 20 to 40 inches Drainage class: Well drained Slowest permeability: slow Available water capacity: low Runoff class: High Water erosion potential: Slight Wind erosion potential: Low Ecological site: Pine Grasslands Potential native vegetation: ponderosa pine, Arizona fescue, needleandthread, parry's danthonia. Mountain muhly, western wheatgrass, Gamble's oak, antelope bitterbrush, mountain big sagebrush, mountain brome, prairie Junegrass Fivepine and similar soils: 40% of unit Soil Order: Mollisol Landform: Mesa, structural bench Depth to restrictive feature: 10 to 20 inches Drainage class: Well drained Slowest permeability: slow Available water capacity: very low Runoff class: Very high Water erosion potential: Slight Wind erosion potential: Low Ecological site: Ponderosa Pine Potential native vegetation: Rocky mountain juniper, ponderosa pine, twoneedle pinyon, Gambel's oak, mountain muhly, prairie Junegrass, elk sedge, muttongrass	1,794

71	Nyswonger silty clay loam, 1 to 4 percent slopes Elevation: 4,900 to 6,800 feet Annual precipitation: 10 to 14 inches Nyswonger and similar soils: 90% of unit Soil Order: Mollisol Landform: Alluvial fan, valley floor, terrace Depth to restrictive feature: Greater than 60 inches Drainage class: Moderately well drained Slowest permeability: slow Available water capacity: high Runoff class: High Water erosion potential: Slight Wind erosion potential: Moderate Ecological site: Foothill Swale Potential native vegetation: basin wildrye, basin big sagebrush, streambank wheatgrass, western wheatgrass, fourwing saltbush	10,732
73	Paradox fine sandy loam, 1 to 4 percent slopes Elevation: 4,900 to 6,500 feet Annual precipitation: 10 to 12 inches Paradox and similar soils: 85% Soil Order: Entisol Landform: Valley floor, alluvial fan Drainage class: Well drained Slowest permeability: Moderate Available water capacity: high Runoff class: Low Water erosion potential: Slight Wind erosion potential: Moderate Ecological site: Semidesert sandy loam Potential native vegetation: Indian ricegrass, galleta, fourwing saltbush, needleandthread, Wyoming big sagebrush, sand dropseed	83
79	Pojoaque-Chilton complex, 5 to 30 percent slopes, extremely stony Elevation: 5,400 to 5,900 feet Annual precipitation: 10 to 12 inches Pojoaque and similar soils: 50% of unit Soil Order: Entisol Landform: Alluvial fan Depth to restrictive feature: Greater than 72 inches Drainage class: Well drained Slowest permeability: Moderately Available water capacity: moderate Runoff class: Medium Water erosion potential: Slight Wind erosion potential: Low Ecological site: Pinyon-Juniper Potential native vegetation: Utah juniper, twoneedle pinyon, Utah serviceberry, true mountain mahogany, Indian ricegrass, New Mexico feathergrass, blue grama, galleta Chilton and similar soils: 30% of unit Soil Order: Entisol Landform: Alluvial fan Depth to restrictive feature: Greater than 72 inches Drainage class: Excessively drained Slowest permeability: Moderate Available water capacity: low Runoff class: Medium Water erosion potential: Slight Wind erosion potential: Moderate Ecological site: Pinyon-Juniper Potential native vegetation: Utah juniper, twoneedle pinyon, Utah serviceberry, true mountain mahogany, Indian ricegrass, New Mexico feathergrass, blue grama, galleta	14,966

87	Rock outcrop (40 to 120 percent slopes) Elevation: 4,700 to 10,000 feet Annual precipitation: 10 to 22 inches Rock outcrop 90% of unit Landform: Canyon, mesa Runoff class: Very high	12,576
88	Rock outcrop-Orthents complex, 40 to 90 percent slopes Elevation: 4,700 to 9,200 feet Annual precipitation: 10 to 19 inches Rock outcrop: 50% of unit Orthents and similar soils: 45% of unit Soil Order: Entisol Landform: Structural bench, canyon, mesa Depth to restrictive feature: Greater than 60 inches Drainage class: Well drained Slowest permeability: Moderately slow Runoff class: High Water erosion potential: Very Severe Wind erosion potential: Low Ecological site: Douglas-Fir Potential native vegetation: Rocky mountain Douglas-fir, twoneedle pinyon, Utah juniper, ponderosa pine, Indian ricegrass, Salina wildrye, Bigelow's sagebrush, bottlebrush squirreltail, galleta, blue grama, bluebunch wheatgrass	71
107	Witt loam, dry, 1 to 12 percent slopes Elevation: 6,000 to 6,800 feet Annual precipitation: 11 to 13 inches Witt and similar soils: 85% of unit Soil Order: Aridisol Landform: Mesa, structural bench, ridge Depth to restrictive feature: Greater than 72 inches Drainage class: Well drained Slowest permeability: Moderately slow Available water capacity: high Runoff class: High Water erosion potential: Slight Wind erosion potential: Low Ecological site: Semidesert loam Potential native vegetation: Wyoming big sagebrush, galleta, needleandthread, Indian ricegrass, blue grama, muttongrass	3,127
108	Wrayha stony clay loam, 3 to 40 percent slopes Elevation: 7,000 to 7,800 feet Annual precipitation: 14 to 16 inches Wrayha and similar soils: 85% of unit Soil Order: Entisol Landform: Ridge Depth to restrictive feature: Greater than 72 inches Drainage class: Well drained Slowest permeability: Slow Available water capacity: High Runoff class: Very High Water erosion potential: Moderate Wind erosion potential: Moderate Ecological site: Pinyon-Juniper Potential native vegetation: Utah Juniper, twoneedle pinyon, Gambel's oak, muttongrass, Indian ricegrass, elk sedge, Saskatoon serviceberry, true mountain mahogany	340

Table V1. Existing vegetation mosaic versus desired vegetation mosaic for major Fire Management Plan units. The estimated % seral stages are more accurately portrayed along a spectrum from young to old in the top row, and classified for analysis in the bottom row in the green blocks. Where percentages do not add up to 100, the balance is made up of rock, water, etc. These are approximations of what exists due to inaccuracies in the vegetation mapping.

Polygons from UFO Fire Management Plan																	
Subunit, Polygon type, Acreage	**% of Sub-unit**	**Desired % of each Vegetation Seral Stage** e=early (herbaceous) em=early mid (shrub/grass) m-mid (shrub/young tree) lm=late-mid (tree-shrub; tall shrub) l=late (tree) * designates matrix stages					**Estimated % of each Vegetation Seral Stage** e=early (herbaceous) em=early mid (shrub/grass) m=mid (shrub/young tree) lm=late-mid (shrub/mature tree; tall shrub) l=late (mature/old tree) top numbers are an accurate portrayal of estimated percentages along the seral stage spectrum, while bottom bolded numbers have been interpreted to fit into a single seral stage								
		e	**em**	**m**	**lm**	**l**	**e----------em----------m---------lm----------l**										
Ray Mesa **Southwest Paradox Mesas and Canyons Natural Mosaic** **41,229 acres** **Patch Sizes:**	98%	20	20		20*	40*	6 **6**	5 **38**	33	4 **8**	4 **4**		4	43 **43**			
	Early seral patches range from 1-175 acres in size with an average size of about 6 acres. Early mid seral vegetation is found in a near matrix in the southern part of the unit, with patch sizes from 1-6,341 acre patches and a mean patch size of 35 acres. Mid seral vegetation ranges from 1-636 acres with a mean patch size of 70 acres. Late mid stage vegetation ranges from 1-117 acre patches, averaging 4 acres in size. Late seral vegetation forms the matrix throughout most of the unit. The prescription calls for a matrix of late mid and late stages, with half the early and early mid seral acreage in small (<20 acre) patches, and the remainder in patches larger than 20 acres.															
Ray Mesa **Urban Interface** **714 acres** **Patch Sizes:**	2%	20	55*		15	10	5 **5**	1 **33**	32	7 **7**		2 **2**		53 **53**			
	Early seral patches range from 1-6 acres, with a mean patch size of 3 acres. Early mid (and mid seral) patches range from 1-55 acres with a mean patch size of 15 acres. Late mid seral vegetation ranges from 1-8 acres with an average patch size of 5 acres. Late stage vegetation forms the matrix stage. The prescription calls for a matrix of early-mid stage with early seral acreage distributed equally between patches smaller than 50 acres and patches larger than 50 acres (20% of early seral patches should be less than five acres in size). Late mid and late stage vegetation should mainly occur as small (<5 acre) patches.															
West Paradox **Northeast Paradox Natural Mosaic** **24,041 acres** **Patch Sizes:**	82%	10	20		30	40*	13 **13**	6 **20**	14	3 **16**	13	1 **17**	16	31 **31**			
	The early seral patches range in size from <1-442 acres, with a mean size of 14 acres. Early mid patches range from <1-1,157 acres with a mean patch size of 9 acres . Mid seral vegetation occurs in patches ranging from 1-279 acres with a mean patch size of 10 acres. Late mid seral stage patches range in size from 1-305 acres. Old age class vegetation forms the matrix in the unit. The prescription calls for the matrix to be formed from a combination of late mid and late stage vegetation, with half of the earlier vegetation stages in patches under 5 acres, 40% between 5-25 acres, and 10% over 25 acres in size.															

Subunit, Polygon type, Acreage	% of Sub-unit	Desired % of each Vegetation Seral Stage See top of table for definitions					Estimated % of each Vegetation Seral Stage See top of table for definitions					
		e	**em**	**m**	**lm**	**l**	**e----------em----------m---------lm----------l**					
West Paradox	13%	20	55*		15	10	14	1	50	4	6	24
							14	**51**	**4**	**6**		**24**
Urban Interface **3,800 acres** **Patch Sizes:**	Early seral patches range from 1-73 acres, with a mean of 8 acres. Early mid and mid seral vegetation forms the matrix. Later mid vegetation occurs in patches ranging from 1-27 acres with a mean patch size of 5 acres. Late stage vegetation ranges from 1-435 acre patches with a mean patch size of 23 acres. The prescription calls for a matrix of early-mid stage with early seral acreage distributed equally between patches smaller than 50 acres and patches larger than 50 acres (20% of early seral patches should be less than five acres in size). Late mid and late stage vegetation should mainly occur as small (<5 acre) patches.											
West Paradox	5%	25	25		25*	25*	6	7	12	13	16	32
							6	**19**	**13**	**16**		**32**
Deer Winter Habitat **1,118 acres** **Patch Sizes:**	Early seral vegetation ranges from <1-8 acres, with an average patch size of 3 acres. Early mid vegetation patches range from 1-31 acres in size with a mean patch size of 5 acres. Later mid and late vegetation form the matrix stage when taken together. The prescription for this unit calls for late mid and late vegetation to form the matrix together, while numerous small (1-5 acre) and medium (6-25 acre) patches of early and early mid vegetation dominate. Only 20% percent of early and early mid stage vegetation should occur in larger patches of 26-100 acres.											