UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT, LOWER SNAKE RIVER DISTRICT OFFICE
EA TITLE PAGE, FONSI, AND DECISION RECORD

Applicant (if any) Agricultural Research Service			Proposed Action: Prescribed Fire Related Research	RIPs Project No.: 9654 Funding Code: 2823	EA # 01065 FA67
State IDAHO	Counties OWYHEE	District LSRD	Field Office OFO	Authority: Federal Land Policy and Management Act of 1976	
Prepared By (signature)			Title: Fire Use Specialist	Field Exam Date(s) various	Report Date: 07-15-02

LANDS INVOLVED

Project. name	Township	Range	Section(s)		Acres
Reynolds Creek Experimental Watershed Prescribed Fire Research Plan	3 S. 3 S.	4 W. 3 W.	2, 14, 34 32		2,195

FINDING OF NO SIGNIFICANT IMPACT

The proposed action is tiered to the 1999 Owyhee Resource Management Plan (RMP) which adequately analyzes the impacts of the proposed actions and indicates there will be no significant adverse effects on the quality of the human environment. Therefore, no Environmental Impact Statement will be prepared.

DECISION RECORD

The decision is to implement the research burns as described in the attached environmental assessment. Burned areas on public land will be rested from livestock use for at least two growing season following burning. Additional rest will occur if needed.

Rationale: This research will increase understanding of fire's influence on hydrology, soils, and vegetation.

The proposed actions are in conformance with Objectives: "AIRQ 1, SOIL 1, WATR 1, VEGE 1, VISL 1, WDLF 1, RECT 1, RECT 4, & FIRE 3" of the 1999 Owyhee Resource Management Plan.

Appeals: This decision may be appealed to the Interior Board of Land Appeals, Office of the Secretary, in accordance with the regulations contained in 43 CFR 4. If an appeal is filed, your notice of appeal must be filed in this office within 30 days of the date of this decision. The appellant has the burden of showing the decision appealed from is in error. If you wish to file a petition pursuant to regulations found in 43 CFR 4.21(a)(2) for a stay of the effectiveness of this decision during the time your appeal is being reviewed by the Board, you need to submit it concurrently with filing your appeal, and it must address the *Standards and Procedures for obtaining a Stay* identified in 43 CFR 4.21(b). Copies of the notice of appeal and petition for stay must also be submitted to the Interior Board of Land Appeals and to the appropriate office of the Solicitor at the same time the documents are filed with this office. If you request a stay, you have the burden of proof to demonstrate that a stay should be granted.

/s/ Jenna Whitlock
Jenna Whitlock Owyhee Field Manager

July 19, 2002
Date

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT, BOISE FIELD OFFICE

ENVIRONMENTAL ASSESSMENT FACE SHEET

EA No. 01065 Reynolds Creek Experimental Watershed Prescribed Fire Research Plan

Consideration of Critical Elements

	Not Present	Present, No Impact	Present, Discussed in EA
Air Quality Concerns			x
Areas of Critical Environmental Concern	x		
Cultural Resources			
Prime or Unique Farm Land	x		
Floodplains	x		
Native American Religious Concerns	x		
Special Status Species			x
Hazardous Substances or Solid Wastes	x		
Water Quality Concerns		x	
Wetlands/Riparian Zones		x	
Wild and Scenic Rivers (eligible)	x		
Wilderness Study Areas	x		
Wild Horse Herd Management Areas	x		
Environmental Justice	x		
Noxious Weeds			

Clearances Survey Worksheets

	Worksheet Status	
	Attached	Pending
Cultural Resource Worksheet (ID-01-8100-3)		x
Special Status Animal Worksheet (ID-01-6840-10)		x
Special Status Plant Worksheet (ID-01-6850-1)		x

Visual Resource Evaluation

VRM Class: II, III, IV Visual Contrast Rating completed: _____ Photo included: ____
Visual impacts of action: _____

Reynolds Creek Experimental Watershed
Prescribed Fire Research Plan
Environmental Assessment
EA No. 01065

Lower Snake River District
Owyhee Field Office
July 19, 2002

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I. INTRODUCTION

A. Background

Wildland fire played a fundamental role in the development and maintenance of mountain big sagebrush and mountain shrub communities of the Intermountain West. Prior to European settlement in the mid-to-late 1800's, these sites burned approximately every 10 to 30 years (Burkhardt and Tisdale 1976). After settlement, wildfires were suppressed and fine fuels were consumed by livestock, thereby interrupting the natural fire cycle and facilitating juniper encroachment into these sites (Miller and Rose 1999). Without fire, these sites eventually cross a threshold into fire-resistant juniper communities that exhibit low levels of structural and species diversity (Bates et al 2000; Miller et al 2000).

Prescribed fire is widely used for maintaining and restoring mountain big sagebrush and mountain shrub communities, which are undergoing juniper encroachment. Fire is most successful when it is used in the earlier stages of juniper encroachment. These sites usually contain adequate fine fuels to carry a fire, compared to more established juniper stands. These young trees are more susceptible to fire and can be controlled with lower intensity fires and under a wider burning window.

Little data exist on the effects of juniper encroachment and prescribed fire on the soil-water balance (the balance among precipitation, infiltration, evaporation, and transpiration by plants, as related to soil moisture). Brown (2000) suggests that additional research into the use of prescribed fire is needed to evaluate the primary and secondary effects of fire on ecological processes, such as soil microclimate, plant establishment and runoff. Hydrologic assessments of fire effects have typically been limited to plot rather than the landscape scales (Gifford 1982; Hester et al. 1997; Reid et al.. 1999).

The research proposed in this project would address fire impacts on juniper encroachment, post-fire livestock management, soil properties, water balance, water quality, and the spatial pattern of fire impacts at the landscape scale. Research results would be directly applicable to fire management planning in the Reynolds Creek Experimental Watershed (RCEW), Owyhee county, southern Idaho and eastern Oregon sagebrush ecosystems, that are currently subject to encroachment by western juniper.

The USDA Agricultural Research Service (ARS) Northwest Watershed Research Center (NWRC) has been conducting hydrologic and rangeland research at the Reynolds Creek Experimental Watershed (RCEW) since 1960. Research cooperation between NWRC, private-land owners, BLM and the State of Idaho has been essential because the ownership pattern at RCEW is 23% private and 77% federal and state. NWRC and BLM cooperative efforts are outlined in an interagency agreement, which was initiated in 1992.

Research proposed for this project is complementary to previous and ongoing work in the area of fire effects, rangeland restoration, juniper management and hydrologic processes conducted by ARS rangeland research units (Boise, ID; Burns, OR; Reno, NV; Logan, UT; Dubois, ID)

and their collaborators in the intermountain west (Bureau of Land Management, U.S. Forest Service, Natural Resources Conservation Service, University of Idaho, Oregon State University). This project would contribute to a longer-term research and management plan under development by NWRC for assessing prescribed-fire impacts in the RCEW. NWRC has a long-term commitment to collaboration with BLM and private landowners at RCEW to address current and future scientific issues pertaining to western rangeland management. NWRC is currently expanding its network of collaborators and encouraging additional research that can take advantage of the monitoring infrastructure and long-term data collection activities at the RCEW.

B. Purpose and Need

The ARS has requested the BLM Lower Snake River District to conduct four prescribed burns in the Reynolds Creek Experimental Watershed to accommodate their research efforts. The purpose and need of this proposed action is to allow ARS to conduct research that will add to the knowledge base of using prescribed fire to manage intermountain rangelands. Information acquired through this research could be used in planning future prescribed fires.

This EA analyzes the effects of proposed prescribed fires for research in the Reynolds Creek Experimental Watershed. The research is a cooperative effort with the ARS NWRC RCEW (Boise, ID), Eastern Oregon ARS (Burns, OR), grazing permittees, and private land owners in the Reynolds Creek Experimental Watershed.

C. Objectives of the Proposed Activity (Refer to Appendix A for details of proposed research)

1. Measure prescribed fire influence on vegetation diversity, wildlife habitat, weed response, and forage productivity in mountain big sagebrush, and mountain shrub communities.

2. Measure and model prescribed fire effects on soil properties, infiltration, runoff, surface erosion and downstream water quality.

3. Evaluate the effects of prescribed fire on the water balance of upland soils and streamflow through field measurements and application of hydrologic models.

4. Assess vegetation recovery after prescribed fire relative to post-fire livestock management, and fire severity.

5. Evaluate airborne remote sensing as a tool for assessing pre- and post-fire vegetation status, fuel characteristics and fire severity patterns.

D. Conformance with Land Use Plan and Interagency Agreement

The proposed actions in this document are in conformance with the 1992 Interagency Agreement between the United States Department of Interior, Bureau of Land Management Idaho State Office and the United States Department of Agriculture, Agricultural Research Service, Northwest Watershed Research Center for hydrologic and rangeland research conducted at the Reynolds Creek Experimental Watershed. This EA also conforms to objectives under the December 30, 1999 Owyhee Resource Management Plan (RMP), with specific objectives to address vegetation, fire and grazing management, as they affect water quality, invasive weeds and plant community structure.

E. Scoping

A scoping letter (dated June 04, 2002) that described this and other proposed burn projects on the BLM Lower Snake River District was mailed to interested publics. The scoping letter is on file at the BLM Lower Snake River District Office (3948 Development Ave, Boise, ID 83705).

II. PROPOSED ACTION AND ALTERNATIVE

A. Proposed Action

The proposed action would implement a total of four prescribed burns on four study sites (The Breaks, Whiskey Hill, Upper Sheep, and Johnston Draw; see Appendix E) in the Reynolds Creek Experimental Watershed. Approximately 50-75% of the ground surface within the proposed burn area is expected to burn in a mosaic pattern, with light fire intensity and severity. Small pockets within this mosaic may burn with a moderate fire intensity and severity. The remainder of the area is not expected to burn. The following table outlines the size, time, and land ownership of each proposed study burn.

Study Area	Proposed Prescribed Burn Area (Acres)	Allowable Burn Area (Acres)*	Proposed Burn Date	Land Ownership
The Breaks	166	559	Fall 2002	private
Whiskey Hill	897	3190	Fall 2004	private
Upper Sheep Cr.	64	327	Fall 2005	public
Johnston Draw	451	1473	Fall 2007	public, state, private

*All proposed burns require establishing an allowable burn area outside a proposed project area. The allowable burn area acts as a buffer, in case the fire burns outside the project area. If this happens, the fire would be suppressed in the allowable burn area and burning operations could then continue in the project area. If the fire burns outside the allowable burn area, it would be considered an escape fire situation. Prescribe burn efforts would be halted for the day and all resources on the site would be diverted to suppressing the fire.

The Breaks, Whiskey Hill and Upper Sheep Creek study areas would be burned in fall of 2002, 2004, and 2005 respectively. The Johnston Draw site would first be instrumented with a weir (for flow and sediment sampling) and would be monitored for 4-5 years before implementation of prescribed fire treatments in 2007. The Upper Sheep Creek study area is already instrumented to record runoff and has a 10-year, pre-burn hydrologic record (Flerchinger and Cooley 2000). The Breaks and Whiskey Hill sites would be monitored only for upland, hillslope processes, which do not require as extensive pre-burn monitoring as the Upper Sheep Creek and Johnston Draw sites. Each study site would have essentially the same experimental approach, except for those related to streamflow processes, which would only be addressed at Upper Sheep Creek and Johnston Draw.

Standard Operating Procedures:

Methods used to keep the fire contained in the proposed burn perimeter and to achieve the landscape mosaic burns would include, but are not limited to, the following:

- using topographical features, trails and sparse vegetation to control the scope of the fire
- roads and rock out crops would be used when possible to establish burn perimeters
- some hand line may be constructed to create burn perimeters where no other features exist
- burning during September or October when the burning period is typically shorter
- burning later in the day, which uses night time humidity to extinguish the fire
- burning black lines at night to control boundaries of daytime ignition
- using weather forecasts, on-site weather readings, as well as, monitoring fuel moisture on-site to determine when to start ignition

Pre- and post-fire livestock management would occur as follows:

- each burn area would be rested from livestock use during its respective burn-treatment year to allow accumulation of fine fuels needed to carry a fire
- burned areas located on public land would then be rested for at least two growing seasons following burning to allow plant recovery

Design Elements Specific to this Project:

- because the proposed action is designed as a research project, extensive monitoring will be conducted (Appendix A discusses the research questions to be addressed during this project)
- no changes would need to be made to current grazing permits in order to incorporate the pre- and post-burn rest periods
- the public land in the Johnston Draw burn would be protected from livestock by excluding them from the pasture or by constructing temporary electric fence on private land
- the existing Upper Sheep Creek exclosure would protect that burn from livestock
- intensive post-fire research by the ARS would ascertain when recovery had occurred and when grazing could resume in the burned areas.

B. Alternative 1 - No Action Alternative

Under this alternative, there would be no prescribed-fire research in the RCEW. The proposed ARS fire related research efforts would not occur.

III. AFFECTED ENVIRONMENT

The Reynolds Creek Experimental Watershed is located in the Owyhee Mountains, approximately 50 miles southwest of Boise, Idaho. RCEW encompasses 90 square miles (239 km^2) and has an elevation range from 3600 - 7400 ft (1098 m to 2254 m). Annual precipitation ranges from less than 10 inches (250 mm) at lowest elevations to over 40 inches (1000 mm) at higher elevations.

Description of the Proposed Study Areas

1. **Breaks Study Area** consists of 516 acres of private land on an east-facing hillslope dissected by 4 swales. Elevation ranges from 4,911 to 5,741 ft (1,497 to 1,750 m). Soils are a complex of Takeuchi (coarse, loamy, mixed, frigid Typic Haploxerolls) and Kanlee (fine, loamy, mixed, frigid Typic Argixerolls) soil series. Low sagebrush and native bunchgrasses dominate the ridgetop vegetation. Native bunchgrasses and mountain brome are dominant in the swales of the mid slope while mountain big sagebrush, bitterbrush, and low sagebrush occupy the divides between swales. Toe slope vegetation is dominated by a dense overstory of mountain big sagebrush-bitterbrush with native bunchgrasses and some cheatgrass in the understory. Western juniper is expanding into this location from adjacent sites. The burn would consist of 166 acres within this area. This area is within VRM Class II. A map of this proposed burn is found in Appendix F.

2. **Upper Sheep Creek Watershed Study Area** consists of a 64 acre exclosure, located on public land on the east side of Reynolds Creek. The area is not grazed by livestock. Elevation ranges from 5,980 to 6,617 ft (1,840 to 2,036 m). Vegetation is composed of encroaching western juniper, aspen, mountain big sagebrush, mountain snowberry, low sagebrush, native bunchgrasses and forbs. This site was the subject of an intensive, 10-year, water-balance study, which will provide a pre-burn comparison for prescribed fire effects on runoff and streamflow. The proposed burn would include all 64 acres in this exclosure. This area is within VRM Class IV. A map of this proposed burn is found in Appendix G.

3. **Whiskey Hill Study Area** is a 1160 acre, east-facing hillslope, containing the headwaters of 3 intermittent streams that flow northeast into Reynolds Creek. Elevation ranges from 4,921 to 6,161 ft (1,500 to 1,878 m). Vegetation is composed of encroaching western juniper, mountain mahogany, mountain big sagebrush, antelope bitterbrush, green rabbitbrush, low sagebrush, serviceberry, native bunchgrasses and forbs, and some cheatgrass. The proposed burn would occur on 897 acres of fenced private property located within the Whiskey Hill Study Area. This area is within VRM Classes II and III. A map of this proposed burn is found in Appendix H.

4. **Johnston Draw Study Area** is a 451 acre sub-drainage of the Dobson Creek basin, with an intermittent stream that flows east-southeast. The proposed prescribed burn would occur within this 451 acre area. The area contains private, public, and state land. Elevation ranges from 4,872 to 6,109 ft (1,485 to1,862 m). A map of this proposed burn is found in Appendix I. Soils are a complex of Takeuchi (coarse, loamy, mixed, frigid Typic Haploxerolls) and Kanlee (fine, loamy, mixed, frigid Typic Argixerolls) soil series. Vegetation in the head of the drainage is dominated by mountain big sagebrush and mountain snowberry in the snow drift areas and/or sites with deeper soil and low sagebrush and perennial bunchgrasses in the shallower site. Mountain big sagebrush, mountain snowberry, bitter cherry, western juniper, mountain mahogany, and aspen occupy the northern exposures in the middle reach of Johnston Draw. Mountain big sagebrush, bitterbrush, and juniper with an understory of perennial bunchgrasses and some cheatgrass dominate the benches and southern exposures in the middle reach. The riparian vegetation in the middle reach is primarily black cottonwood, willow, alder, and dogwood. Vegetation in the lower reach of the drainage is dominated by western juniper with a sparse shrub layer of low sagebrush and bitterbrush and a sparse herbaceous understory. This area is within VRM Class II.

General Description of Affected Resources

A. Vegetation

Vegetation is described in more detail above, in the section titled "Description of the Proposed Study Areas". Rangeland plant communities are dominated by mountain sagebrush, the short or decumbent form of bitterbrush, encroaching juniper, mountain shrubs of aspen, mountain maple, and snowberry, and perennial and annual grasses and forbs. Juniper is expanding into the western half of the watershed extensively, and more slowly into the eastern half. Some older trees in rocky upland areas have been cored and dated to the 1930's. Many of the smaller junipers expanding in other areas range in age from saplings to 15-20 years old. (Please see RCEW vegetation map in Appendix B).

No known noxious weeds or sensitive plant species occur in the project areas. An inventory would be conducted of the area prior to burning. Pre-burn vegetation studies have already been completed on the Breaks study area, scheduled for burning in fall of 2002, and no noxious weeds were found.

B. Soils

Soil resources are described above in the section titled "Description of the Proposed Study Areas". (Please see RCEW topography, soils, and geology maps in Appendix C).

C. Wildlife and Fish

The diverse plant communities of the Upper Reynolds Creek provide important habitat for a wide variety of wildlife species. The proposed project area contains spring/summer/fall habitat for mule deer, elk, and pronghorn antelope and some winter habitat for deer and, possibly, elk. The area also provides habitat for a large diversity of raptors, songbirds,

mammals, reptiles, and amphibians. The area drains to Reynolds Creek, which is a perennial, fish-bearing stream, including redband trout.

D. Species of Concern

Sage Grouse: Sage grouse use the mountain big sagebrush communities for late brood-rearing habitat. During this time period, from late June to early November, sage grouse will use a variety of moist and mesic habitats where succulent forbs are found. These habitats include riparian areas, wet meadows, lake beds, farmlands, and uplands, including sagebrush and recently burned areas (Sather-Blair et al. 2000).

There are several potential wintering areas for sage grouse within the project area. They occur on high ridges that are covered with low sagebrush. This vegetation type typically does not burn easily and is not expected to burn under the prescribed fire prescription.

Redband Trout: Redband trout (*Oncorhynchus mykiss gairdneri*), which are a State of Idaho species of special concern and a BLM sensitive species, inhabit the Reynolds Creek drainage (Allen et al. 1998). They are commonly found in Reynolds Creek, and likely inhabit Dobson Creek, during periods of higher stream flows. Dobson Creek is a tributary to Reynolds Creek, and the Johnston Draw project site is located immediately adjacent to Dobson Creek.

Other Species: A number of other special status animal species classified as either BLM "Sensitive Species" or State of Idaho "Species of Special Concern", are also known or likely to occur within or near the proposed project area. These include the prairie falcon, northern harrier, ferruginous hawk, calliope hummingbird, rufous hummingbird, dusky flycatcher, gray flycatcher, willow flycatcher, loggerhead shrike, yellow warbler, MacGillivray's warbler, Wilson's warbler, yellow-headed blackbird, green-tailed towhee, grasshopper sparrow, sage sparrow, Brewer's sparrow, pygmy rabbit, western, and several bat species.

E. Cultural Resources

The diverse ecological environments which comprise the proposed study areas have supported human activities both prehistorically and historically. Cultural surveys within the area are limited, with only a few sites recorded. Recorded sites, however, are predominantly prehistoric. These areas have not yet been systematically surveyed over the full extent of the project areas. A cultural inventory to identify historic properties (specifically, burnable historic artifacts, structures, or features including prehistoric rock art and historic arborglyphs on aspens) would be completed prior to project implementation. Native American sites include a range of lithic scatters from limited to extensive possibly representing temporary use to long term occupation. Information is insufficient to quantify usage types for these site types. Historic use of the areas include homesteads and mining operations, a review of the USGS maps indicates the majority of these appear in the Whiskey Hill and The Breaks study areas. In The Breaks, the former town site of Democrat is shown on the USGS Quad, and remains unrecorded. Historic properties would be avoided or mitigated by recording and determination of significance. The potential exists for additional sites of both periods.

F. Recreation and Visual Resources Management

Recreational use within the area includes hunting, hiking, horse riding, OHV use, and sightseeing. The proposed project lies within recreation opportunity Class III area (opportunity to have a high degrees of interaction with the natural environment, moderate challenge and risk and to use outdoor skills; opportunity to use motorized equipment).

Visual resources Management Classes II, III, and IV occur within the proposed burn area. Class II objectives allow management activities that may cause low-level change to the characteristic landscape. Class III objectives allow moderate-level change to the characteristic landscape. Class IV objectives allow management activities that may cause a high-level of change to the existing character of the landscape.

G. Water Quality

RCEW has been used as a field site for hydrologic and rangeland research by the ARS NWRC since 1960. The current network of precipitation sites, climate stations, snow courses, stream gaging stations and sediment sampling stations is linked to a relational data-base and archive in Boise via real-time radio telemetry (Please see map of streams and instrumentation network in Appendix D). The historical data for weather and climate, soils, geology, snow, vegetation, runoff, soil moisture, and suspended sediment discharge have been published as a series of 9 data reports in Water Resources Research (Hanson 2001; Hanson et al. 2001; Marks et al. 2001; Pierson et al. 2001 Seyfried et al. 2001a; Seyfried et al. 2001b; Seyfried et al. 2001c; Seyfried et al. 2001d; Slaughter et al. 2001). These data are also available for download from the NWRC FTP site at: *ftp.nwrc.ars.usda.gov* in the directory "publicdatabase".

The proposed project area lies within the Reynolds Creek drainage. Approximately 11 miles downstream of the proposed burn, Reynolds Creek is listed on the State of Idaho's 1998 303(d) List of Water Quality Limited Water Bodies, for sediment.

H. Air Quality

The proposed burn area is a Clean Air Act Class II attainment area.

I. Socio-Economic

Land ownership is 23% private, 77% public. Hay production and grazing are primary uses of private lands. Livestock grazing is an important economic and cultural use of private and public lands within the proposed project area. BLM administered public land grazing allotments included within the proposed project area are listed below:

Allotment Name	Pasture #	Pasture Acres	Rx Burn Area (Ac)	Allowable Burn Area (Ac)
Evans FFR*	06192	4361	600	1499
Jaca FFR	06241	3719	872	1418
East Reynolds Creek	06515	4869	25	1326
Reynolds Creek	05086	2004	9	492
Gaging Station FFR	04791	598	11	276
Rabbit Creek	05178	3763	70	252
Unnamed	06162	1906	0	201
Rabbit Creek	05177	2359	0	50
Silver City	05695	24015	3	25
Unnamed	06517	1732	0	13

* FFR = Fenced Federal Range, public lands and private lands intermixed and with unfenced boundaries

J. Other Resources

The proposed area contains no ACECs, prime or unique farmlands, floodplains, known native American religious sites, known federal threatened or endangered species, known hazardous materials, national wild and scenic rivers, wilderness study areas, or wild horse management areas. A cultural survey will be conducted before the burn and consultation with the Shoshone-Paiute Tribes is an ongoing process.

K. Cumultative Impacts

Historic and/or current cumulative impacts to natural and cultural resources within the proposed project area include: wildlife grazing, livestock grazing, wildfire, exclusion of wildfire, road construction, and OHV use.

IV. ENVIRONMENTAL CONSEQUENCES

For a more thorough general discussion of potential prescribed fire effects on vegetation and wildlife in this area, refer to the Environmental Assessment for the Pixley Basin prescribed burn (EA# 01066, Lower Snake River District, Owyhee Field Office, dated July 19, 2002.) These two areas are both on the northern Owyhee front, at similar elevations, with similar vegetation and wildlife, and with similar degrees of juniper expansion. The general discussion about fire effects in that EA apply to this area as well.

Proposed Action

A. Vegetation

The long term results of the proposed actions would be the maintenance of the desirable shrub and herbaceous communities, and a reduction of juniper within the proposed burn project areas. The short term effects would be a temporary loss of shrubs, decreased vigor of herbaceous species, and increased risk of accelerated soil erosion.

The prescribed fires are expected to burn in a mosaic pattern, dictated by landform, slope aspect, vegetation, local weather and microsite factors (such as soil properties and moisture). Because of these factors, approximately 60% of the proposed burn areas within the four study sites is expected to be blackened by the prescribed fires. This equates to approximately 20% burned within the allowable burn areas. The mosaic of burned and unburned areas would provide diversity to this small portion of the landscape and would provide a diversity of habitats for the various wildlife species.

Fire intensity on the proposed fall prescribed burns would be lower than expected from a summer wildfire. These mountain big sagebrush communities developed with, and are maintained with, periodic fire. Plant diversity is expected to increase in areas currently dominated by dense shrub cover. Bitterbrush, mountain big sagebrush, aspen, and mountain shrub cover would be reduced in the short term, but would return to preburn levels over time, due to resprouting and new seedling establishment. The bitterbrush is mostly the decumbent form, which sprouts readily after fires, compared to the columnar form which has high mortality after fires.

Mountain mahogany, which occurs on the hilltops of the Whisky Hill study area, has been increasing there since 1917. Landscape photographs taken in 1917 have been retaken in 1962 and recently. Analysis of mountain mahogany cover within the view of the photos shows an increase from 11% in 1917 to 30% currently. There was a large fire in the western half of the Reynolds watershed in the 1930s. This history indicates that fire does not damage the mahogany community in this area.

Encroaching junipers would be reduced substantially within the burns, but only in areas that have historically been juniper-free, as a result of natural fire processes. Juniper trees in rocky, upland areas, that have historically resisted wildfire, do not have sufficient understory fuels to carry a fire. We do not anticipate any fire impacts in these relict areas. Annual weeds should not increase on the burned areas. The described study areas are in mountain big sagebrush sites, that are less subject to invasion by annual weeds, than lower elevation Wyoming big sagebrush communities.

Study Project 1 would explicitly examine the effects of prescribed fire on the vegetation in this area. (Study Project 1 and the other fire related studies associated with this project are described in Appendix A - Research Questions.) The study's findings would be used to better predict prescribed fires effects for future burns on similar areas of the Owyhee Uplands.

The temporary electric fence protecting the Johnston Draw burn may cause more livestock use along the edge of the fence on private land. These effects should be minor and temporary. If hand lines are used as fire barriers, they would result in some soil disturbance and the removal of some plants. These areas would become naturally revegetated by the adjacent vegetation.

B. Soils

Erosion potential would increase in the year following a burn. Reduction in juniper density would eliminate potential erosion problems associated with the elimination of ground cover in more mature, dense juniper stands. We anticipate that relatively low intensity prescribed fires would not cause on soil hydrophobicity. Increased herbaceous ground/canopy cover in areas currently dominated by dense shrubs would improve soil stability after vegetation recovery.

C. Wildlife and Fish

Reintroducing fire into the area would increase plant diversity by providing varied seral stages of plant communities. The resulting vegetation mosaics would provide improved habitat for most wildlife species and would approximate the natural conditions that occurred in this area prior to Euro-American settlement. The long term effect would be the maintenance of the mountain sagebrush/bitterbrush, aspen, and birch communities.

Fire Effects on Wildlife Habitat: "Fires affect animals mainly through effects on their habitat... The extent of fire effects on animal communities generally depends on the extent of change in habitat structure and species composition caused by fire. . . Animal species are adapted to survive the pattern of fire frequency, season, size, severity, and uniformity that characterized their habitat in pre-settlement times. When fire frequency increases or decreases substantially, or fire severity changes from pre-settlement patterns, habitat for many animal species declines" (USDI, 2002, p37).

Big Game Animals: Prescribed burning in the proposed project area would improve habitat for elk, deer, and antelope in the long term by creating successional mosaics within the various shrub communities, and by reducing encroaching juniper. An immediate increase in forbs would improve foraging habitat for antelope. In the short term, the burn would reduce big game cover on the burned areas, and reduce browse for deer for approximately five to ten years, but would result in healthy sustained big game habitat in the long term. In the 15-20 year old burn, within the project area, more deer pellets were found within the fire, in the younger bitterbrush and sagebrush, than in the denser, old bitterbrush stands adjacent to the fire.

Sagebrush Dependent Songbirds: Some sagebrush obligate (dependent) species such as sage thrasher, sage sparrow, and Brewer's sparrow, would lose nesting habitat for the short term. In the long term this habitat would be maintained by controlling the juniper and allowing sagebrush re-establishment back into burned upland areas.

Juniper Songbirds: Gray flycatchers, chipping sparrows, mountain chickadees, American robins, and cassin's finches are the most abundant species in old-growth and seral juniper stands in the Owyhees (Challenge Cost Share Study, Golden Eagle Audubon Society, 1993). In prescribed-burned juniper stands, Northern flickers, mountain bluebirds, vesper sparrows, and brewer's sparrows were the most abundant species. By burning the expanding juniper in Pixley Basin, we would be preventing an increase in juniper habitat for some species, while maintaining habitat for others. All of the species using the juniper woodlands are also common in many other habitat types, (except the gray flycatcher, which uses mainly pinyon-juniper and sagebrush), and juniper habitats are abundant in the Owyhees. Thus, reducing and preventing the expansion of juniper in the project area would not have any significant effects on the viability of any songbird populations.

Fish Habitat: There is no proposed burning of vegetation adjacent to any perennial stream channels. Smaller scale prescribed fires are expected to have less impact on water quality for fish habitat than larger scale wildfires. Indirect effects include a potential increase in sediment delivery to streams in the year following the burn. Stream temperature may be increased by lowered soil albedo and increased solar loading of ephemeral stream channels. Conversely, stream temperatures may be reduced if flow volume increases, as a result of vegetation changing from sagebrush/juniper to grass.

D. Species of Concern

There are no known threatened or endangered species in the area. Therefore, no adverse impacts to these species are anticipated.

Sage grouse: The burn would have long term benefits for sage grouse which use the area as late brood rearing habitat. The 1997 Idaho Sage Grouse Management Plan recommends managing late summer brood rearing habitat by providing "a good variety of succulent vegetation adjacent to sagebrush escape and loafing cover". The availability of forbs in the late summer is the most important common denominator for good brood-rearing habitat (Sather-Blair et al. 2000). The increased forb component adjacent to unburned sagebrush would provide a good variety of succulent vegetation alongside sagebrush escape and loafing cover as recommended in the Idaho Sage Grouse Management Plan.

"Sage grouse population dynamics are dependent on landscape and temporal habitat disturbance patterns, as well as on long-term vegetation change such as movement of conifers into sagebrush grass communities where fire has been excluded. The restoration of sage grouse habitat requires reestablishment of native rangeland grasses, shrubs, and forbs. To accomplish this, fire frequency must be reduced in landscapes that have become dominated by cheatgrass and increased where tree encroachment has replaced sagebrush grass communities" (USDI 2002, p37-38).

Raptors: Northern goshawk, Cooper's hawks, red-tailed hawks, long-eared owls, and great-horned owls are likely to or are known to use the project area, and could benefit from the long-term maintenance of prey habitat.

Sensitive Plants: No known sensitive plant species occur in the proposed treatment area. A botanical investigation would occur prior to any treatments.

Redband trout are a State of Idaho species of special concern and BLM sensitive species. Impacts to redband trout are expected to be negligible, due to the small size of the treatment areas, and, the fact that only one area would be burned in a given year. Water temperature and sediment levels in portions of Reynolds Creek may increase immediately following the prescribed fire treatments (see section G). Expected improvement in long term water quality, relative to pre-burn conditions (see section G), would benefit redband trout. Water quality monitoring planned as part of the research project would provide needed information on the overall effect of prescribed fire on fisheries and aquatic habitats.

The study areas would be surveyed for sensitive plants, noxious weeds, and animal species before burning. If any other sensitive species are found, they would be avoided or mitigated. If noxious weeds are found they would be treated, monitored, and retreated, if needed.

E. Cultural Resources

Prescribed fire study areas will undergo a survey for cultural resources prior to treatment. Previously and newly recorded prehistoric sites will be located and monitored for impacts. Research indicates that surface lithic scatters are not impacted by cooler prescribed fires. Historic sites, including mining prospects, typically include combustible materials. Survey to locate these sites will be followed by recording, and, where necessary, combustible elements will be protected by appropriate means (to be determined) or avoided by changing project design. Recordation will represent partial mitigation. Sites overlooked during survey will be recorded when exposed by treatments. There will be no adverse impacts to cultural resources if the above conditions are observed.

Direct impacts from fire on combustible resources would represent irretrievable commitment of resources and would require detailed recording of the site and approval of management to proceed. Direct impacts to other classes of artifacts and features include exposing them to possible unauthorized collection and alteration of chemical properties of lithic materials, which limit dating techniques. Indirect impacts are possible from erosion, due to vegetation removal, repeated travel to evaluation stations involved in the project design, and spacial displacement by these same factors.

F. Recreation and Visual Resources Management

There will be minimal impacts on recreational uses caused by the proposed prescribed fire treatments. The public land component of the study sites are relatively inaccessible, except for the Upper Sheep Creek site, which is the smallest study area (64 acres). The Upper Sheep Creek location has also been enclosed by a fence and already contains a number of instrumentation sites used in previous and ongoing hydrologic research studies. Because of these factors, road closures are not anticipated.

The proposed project area is contained within Class II, III, and IV viewsheds, which permit management activities that may cause low- to high-level changes to the characteristic landscape. Because wildland fire was an important component of the project area, the re-introduction of small- to moderate-sized fire to the landscape is compatible with VRM objectives. Post-fire visual resources are expected to recover within one year of the treatment event.

G. Water Quality

All of the study areas are either upland sites or contain only stream channels with intermittent or ephemeral surface flows. Downstream sediment, temperature, and, possibly, nutrient loads are expected to increase in the year immediately following prescribed fire treatment. These water quality parameters are expected to improve relative to pre-burn conditions, as herbaceous ground cover and draw bottom vegetation increase after treatment. The amount, timing, and duration of runoff from the burned areas will depend on the timing and intensity of the first major runoff-producing event (rainfall or snowmelt) before the site revegetates.

Water temperature and suspended sediment would be monitored continuously at all weir sites downstream from prescribed fire locations (Tollgate, Dobson, Johnston Draw, Upper Sheep, Outlet). These weir locations are part of the long-term experimental infrastructure at Reynolds Creek and would continue to be monitored in the future. Data collected from pre- and post-fire monitoring will add to the existing knowledge base of prescribed fire effects. These data will aid in the design and implementation of future prescribed fire projects on similar landscapes and climate.

H. Air Quality

On the average, under 1 ton of fuel per acre is expected to be consumed. Particulate emission is expected to be less than 13 pounds per acre. A burn of 1000 acres would yield 6.5 tons of PM emissions. No violations of the NAAQS (National Ambient Air Quality Standards) are anticipated.

The desired burning condition would be an unstable atmosphere favoring a rising smoke column. Burning would proceed during stable and unstable atmospheric conditions with expected smoke suspension to be short lived and scattered over wide areas. Any wind speed below15 mph from a northwest or westerly direction is acceptable.

Smoke from the project burn would be visible over a wide area of western Owyhee County. The communities of Murphy and Silver City may be briefly impacted by the smoke from this burning. Notifications would be made to area residents and local authorities prior to burning. Smoke would be noticeable for 1-2 days following the burn. Typically, smoke production is not noticeable three to four days following a burn project of this size.

Daytime haze would predominate over the landscape closest to the project site. Nighttime inversions may trap residual smoke from smoldering fuels in drainages and valley bottoms until prevailing winds or a weather system change purges smoke from these areas.

I. Socio-Economic

Scientific information and management tools developed in this project would be of benefit to private land owners and public land managers in the intermountain western United States.

No changes to current grazing permits are needed to accommodate the proposed burn. Resting the burned areas for a year before burning and at least two growing seasons following burning on the areas grazed by livestock would create a temporary forage loss for livestock operators in these areas.

J. Effects on Other Resources

The proposed action and alternatives would have no impact on national wild and scenic rivers, prime or unique farmlands, floodplains, Native American religious concerns, environmental justice, federal threatened or endangered species, and hazardous materials management.

K. Cumulative Impacts

Shorter-term effects on vegetation, soil and water resources are the subject of this scientific study. Results of this research would contribute to improved management strategies for implementation of prescribed fire treatments in mountain big sagebrush plant communities.

The four proposed burns would occupy a small portion of the Reynolds Creek Watershed. No other BLM prescribed burn projects have occurred in the watershed for many years. The predominance of public land in this area has also prevented private land owners from conducting many prescribed burns over the years. Therefore, the cumulative impacts from these four research burns should be minimal. The desired cumulative impact is to contribute to a vegetation mosaic of different age-classes across the RCEW. The water quality limited reach of Reynolds Creek occurs approximately 11 miles downstream of the proposed burn area. The risk of the proposed burn to short- and long-term water quality impacts in Reynolds Creek is low.

Cumulative impacts to cultural resources would be incurred by repeated burning of areas, and vehicular and pedestrian travel. These forces could alter, destroy or displace artifacts.

Alternative 1 - No Action

Under this alternative, there would be no prescribed-fire research in the RCEW. The proposed ARS fire related research efforts would not occur. The experimental study sites would continue on the current successional path from mountain big sagebrush-bunchgrass communities to juniper woodland ecosystems. A juniper dominated system would be expected to result in lower site productivity, lower biodiversity and higher soil loss. A no-action alternative would not yield any information that could be used for management planning and assessment of prescribed fire impacts in other mountain big sagebrush plant communities.

A. Vegetation

Plant communities in each of the study areas would continue to progress through stages of dense shrub and, ultimately, to western juniper dominance. Delaying prescribed fire treatment may require additional cultural practices for juniper control when they reach a stage where they become fire resistant (approximately 40 years of age).

B. Soils

Erosion potential would remain the same in the short term, as adequate vegetation cover exists to prevent soil loss. In the longer-term, erosion potential may increase, due to the increased potential of large-scale, high severity wildland fire. Higher intensity wildfire may affect soil properties, sterilize upper soil layers and remove organic horizons. Soil resources would be further at risk should juniper become the dominant plant community, because eventual loss of understory plant species would increase the erosion risk.

C. Wildlife and Fish

Wildlife habitat would diminish for species that rely on early seral, herbaceous vegetation. Wildfires in areas allowed to build up heavy fuel loads may result in more widespread habitat loss over a larger area and longer time than under the proposed plan. Potential juniper dominance may reduce fish and wildlife habitat diversity in the long-term.

D. Species of Concern

Because no known threatened or endangered species occupy the area, no impacts are anticipated. Upland habitats for most special status species and other wildlife would likely remain in acceptable condition. In the longer term, conversion to juniper woodlands would favor those species adapted to this habitat type.

Redband Trout: Long term water quality may become degraded by sedimentation, as conversion to juniper woodlands occur. These effects will occur during the course of decades and redband trout habitat may become adversely impacted, as a result.

E. Cultural Resources

There would be no impacts to cultural resources.

F. Recreation and Visual Resources Management

There would be no impact on recreational resources from prescribed fire effects. Potential juniper dominance may reduce recreational opportunities in the long-term., by reducing landscape and wildlife diversity.

As the site converts to juniper woodlands, the Class II, III, and IV visual objectives would be retained.

G. Water Quality

Water quality would be unaffected by fire impacts in the short-term. Long-term water quality may be reduced in the event of either high severity, large-scale wildfire or juniper dominance, if upland erosion is transported to stream channels.

H. Air Quality

Air quality will continue to meet NAAQS.

I. Effects on Other Resources

The proposed action and alternatives would have no impact on national wild and scenic rivers, prime or unique farmlands, floodplains, Native American religious concerns, environmental justice, federal threatened or endangered species, noxious weeds, or hazardous materials management.

J. Socio-Economic

Scientific information and management tools that would be of benefit to private land owners and public land managers in the Intermountain western United States will not be developed.

K. Cumulative Impacts

Cumulative impacts to natural resources within the proposed project area include: wildlife grazing, livestock grazing, wildfire, exclusion of wildfire, road construction, and OHV use. These historic and current activities and processes will continue to affect the natural resources of the project area. Continued exclusion of fire from these areas may result in buildup of high fuel levels during the shrub-dominated seral stage, or eventual canopy dominance by western juniper. Habitats and forage species will change as this conversion occurs, and long-term water quality may become degraded by sedimentation. Higher intensity fire more significantly alters the chemical properties of certain datable artifact classes (obsidian) decreasing the accuracy of scientific dating.

V. CONSULTATION WITH OTHERS

ARS-NWRC, Boise, ID-Reynolds Creek Experimental Watershed (RCEW)
Owyhee County Commissioners
Shoshone-Paiute Tribes
Private land owners, Reynolds Creek, Idaho
University of Idaho, Department of Rangeland Resources
Oregon State University, Eastern Oregon Agricultural Research Center
Agricultural Research Service, Burns, OR
Bureau of Land Management, Idaho State Office
Idaho State Historic Preservation Office - Pending
Idaho Department of Lands
Idaho Department of Agriculture
Idaho Department of Fish and Wildlife
Natural Resources Conservation Service
The Nature Conservancy

VI. PARTICIPATING STAFF

ARS Staff:
Stuart Hardegree, Research Leader, Plant Physiologist
Fred Pierson, Hydrologist
Gerald Flerchinger, Hydraulic Engineer
Danny Marks, Hydrologist
Pat Clark, Rangeland Scientist
Clayton Hanson, Agricultural Engineer
Mark Seyfried, Soil Scientist
Ken Spaeth, Rangeland Hydrologist

BLM Staff:
Steven Jirik, Fire Use Specialist
Mike Ford, Fire Operations Specialist
Zig Napkora, Hydrologist
Juanita Allen, Cultural Resource Specialist
Sheri Hagwood, Botanist
Frank Jenks, Recreational Specialist
Paul Seronko, Soils
Jon Haupt, Rangeland Management Specialist
Helen Ulmschneider, Wildlife
Bruce Zoellick, Fisheries

VII. APPENDICES

A. Research Questions
B. RCEW Vegetation
C. RCEW Topography, Soils, Geology

D. RCEW Streams, Instrumentation Network
E. Fire Study Regions
F. Breaks Study Area
G. Upper Sheep Study Area
H. Whisky Hill Study Area
I. Johnston Draw Study Area
J. Literature Cited

Appendix A. Research Questions

<u>Study Project 1</u>: Prescribed fire effects on vegetation

Management Questions: Is late summer/fall burning an efficient method for controlling juniper encroachment? What effect does prescribed fire have on vegetation diversity and productivity, forage values for livestock, and wildlife habitat? What is the impact of prescribed fire on invasive weeds?

Existing spatial databases and field monitoring will be used to stratify the study areas by slope, aspect, soils, and vegetation cover type. Plant production, canopy and basal cover, Leaf Area Index (LAI), species composition, and frequency will be measured within each strata before prescribed fire is applied, during the first 3 years following fire, and at 5-year intervals throughout the recovery period . Pre- and post-fire data will be compared to evaluate the response of herbaceous, shrub, and tree species (including juniper, bitterbrush, mountain mahogany and invasive weeds) to prescribed fire. Species diversity, abundance, productivity, and forage-availability indices will be used for statistical comparison. Multispectral digital aerial photography and ground measurements will be used to classify habitat types, and delineate habitat-type boundaries, before and after prescribed fire. Habitat patch size, connectivity, edge length and other habitat parameters will be compared between sampling periods using GIS techniques. The following hypotheses/questions will be evaluated statistically with the sampled data:

1. Was the density of juvenile and mature juniper reduced significantly and was the reduction correlated with fire severity patterns?

2. How was diversity, abundance and productivity of herbaceous species; sprouting and non-sprouting shrubs; and invasive weeds affected by prescribed fire?

3. How did prescribed fire affect the seedbed microclimate and seedbank of both native and invasive-weed species?

4. How do spatial and temporal patterns of forage availability for livestock, and wildlife habitat change subsequent to prescribed fire?

<u>Study Project 2</u>: Prescribed fire effects on soil properties, infiltration, runoff, surface erosion and down-stream water quality

Management Questions: What is the impact of prescribed fire on soil properties, infiltration, runoff, erosion and water quality? How are these impacts distributed over space and for how long do the effects persist?

The impact of prescribed fire on infiltration and erosion rates will be studied using simulated rainfall techniques. Plant communities and soil surface characteristics within the proposed fire boundaries will be studied immediately before, after, and for 2-3 years following fire with $0.5m^2$ replicated plots. Simulated rainfall will be applied to each plot at a rate of 75 mm/hr (3 in/hr) for a 60-minute duration. Sub-samples of runoff and sediment concentration will be collected throughout the rain event. Rill erosion will be measured before and after the fire using simulated rilling techniques. Flowing water will be released at a single point at rates of 3, 7, 12, 15 and 21 l/min for 12 minutes at each rate. Sub-samples of runoff and sediment concentration will be collected throughout the duration of each flow rate. Flow velocity, flow width and flow depth will also be measured for each flow rate. Surface soil and vegetation parameters such as hydrophobicity, infiltration rates, bulk density, particle size, aggregate stability, root content, ground cover, canopy cover and vegetative biomass will be sampled for each plot. Suspended sediment and stream temperature will be monitored at the Dobson Creek, Tollgate, Upper Sheep, Johnston Draw and Outlet weirs. The following hypotheses/questions will be evaluated statistically with the sampled data:

1. How does prescribed fire affect the spatial and temporal distribution of soil properties such as organic carbon, bulk density, aggregate stability and hydrophobicity?

2. How do changes in soil properties affect infiltration capacity, overland flow dynamics and sediment yields?

3. How are these soil impacts affected by fire severity?

4. Can fire impacts on overland flow and erosion be predicted with process-based model simulations?

5. What are the short and long-term effects of prescribed fire on stream water quality parameters of temperature and suspended sediment?

<u>Study Project 3:</u> Prescribed fire effects on water balance

Management Questions: What effect does prescribed fire have on soil water balance and streamflow and are these effects predictable?

Weather and climate parameters will be monitored throughout the study period at 19 meteorological measurement sites distributed within the Reynolds Creek basin. These sites measure precipitation, air temperature, relative humidity, solar radiation, wind speed and wind direction every hour. Evapotranspiration data will be collected to assess immediate and temporal differences in water uptake between burned and unburned areas. Time domain reflectometry (TDR) instrumentation will be used to monitor changes in soil water content over time throughout the soil profile on burned and unburned sites. Rooting density will also be measured as a function of depth at these sites. Effective rooting depth will be inferred from patterns of soil water content change. Plant (LAI), soil (depth and texture), and weather data will be used to develop and parameterize models to predict fire-effects on hydrologic processes. These models will be tested and refined using soil moisture and E/T (eddy correlation) data. Historic streamflow and ground water measurements (Upper Sheep and Johnston Draw study areas) will be compared to post-fire measurements to quantify changes in hydrologic response and to assess the ability of hydrologic models to predict these changes. Hydrologic measurements at the Upper Sheep and Johnston Draw weirs are expected to continue for the very long-term as they are part of the base experimental infrastructure at the watershed. Vegetation measurements will also routinely monitored in the long-term. The following hypotheses/questions will be evaluated statistically and/or modeled from the -fire sampled data:

1. How does prescribed fire and subsequent vegetation change affect water resource utilization by vegetation, deep percolation of water and streamflow?

2. Can prescribed fire effects on water resources be predicted using Hydrologic analysis and models?

<u>Study Project 4:</u> Post-fire grazing management

Management Question: What factors affect when livestock grazing can resume following prescribed burning in mountain big sagebrush communities?

Following prescribed fires, on private-land areas, at the Breaks and Whiskey Hill study areas, livestock exclosure sets will be constructed in areas representing unburned (2 sets) and high (2 sets) and low fire intensity (2 sets). Each exclosure set will contain 4 adjoining exclosures (0.1 ha each). Four grazing treatments within each set will be applied in June (peak growth) of treatment years by sequentially removing exclosure fences from the set. These treatments will include: 1) moderate cattle stocking, 1 year post-fire (unfenced, no rest), 2) moderate cattle stocking, 2 years post-fire (1-year rest), 3) moderate cattle stocking, 3 years post-fire (2-year rest), and 4) moderate cattle stocking, 4 years post-fire (3-year rest). The remaining exclosure per set will be retained throughout the project as an ungrazed control for the current study and to serve as reference areas for future studies on the long-term impacts of livestock grazing on native plants and juniper encroachment. Livestock distribution and activity patterns before, during and after treatment implementation will be monitored with GPS collars attached to a subset of grazing animals. Plant production, canopy and basal cover, composition, and frequency will be monitored at 1 year post-fire (pre-grazing baseline), immediately prior to each grazing treatment application, and for at least 2 years following each grazing treatment. Pre- and post-treatment data will be used to evaluate treatment effects on plant diversity, abundance, and productivity. The following hypotheses/questions will be evaluated statistically with the sampled data:

1. What is the impact of different post-fire grazing strategies on plant species diversity, abundance, frequency, basal and canopy cover, and aboveground biomass production?

2. What are the interactions between fire severity and grazing strategies on plant species diversity, abundance, frequency, basal and canopy cover, and aboveground biomass production?

3. Is long-term plant diversity, abundance, cover and productivity higher in ungrazed controls than in other grazing treatments?

4. What are the patterns of grazing animal distribution before and after a given fire treatment and do these patterns yield information that would be useful in prescribed fire planning and post-fire management?

<u>Study Project 5:</u> Remote sensing tools for fire planning and management

Management Questions: Can remote sensing tools be developed to provide cost-effective, accurate spatial information describing pre- and post-fire vegetation diversity, cover, and productivity, quantifying fuel characteristics, characterizing fire severity patterns, and identifying soil erosional features?

High resolution, multispectral digital aerial photography of study areas will be acquired during peak growth (June) of the fire treatment year, immediately before and after the prescribed fire treatment (September) and during peak growth for at least 2 years following fire. Classification techniques will be used to stratify imagery into dominant species, bare, rock, and other classes. Classification accuracy will be evaluated using species-level canopy cover data collected in the field at the time of the remote sensing flights. Post-fire imagery will be classified based on fire severity. Classification accuracy will be evaluated using flame characteristic, fire-residence time and rate of spread, fuel consumption, and soil temperature field data collected during or immediately after the fire treatment. Relationships will be investigated between fuel biomass and moisture data collected in the field and remote sensing-derived vegetation index values. The following hypotheses/questions will be evaluated statistically with the sampled data:

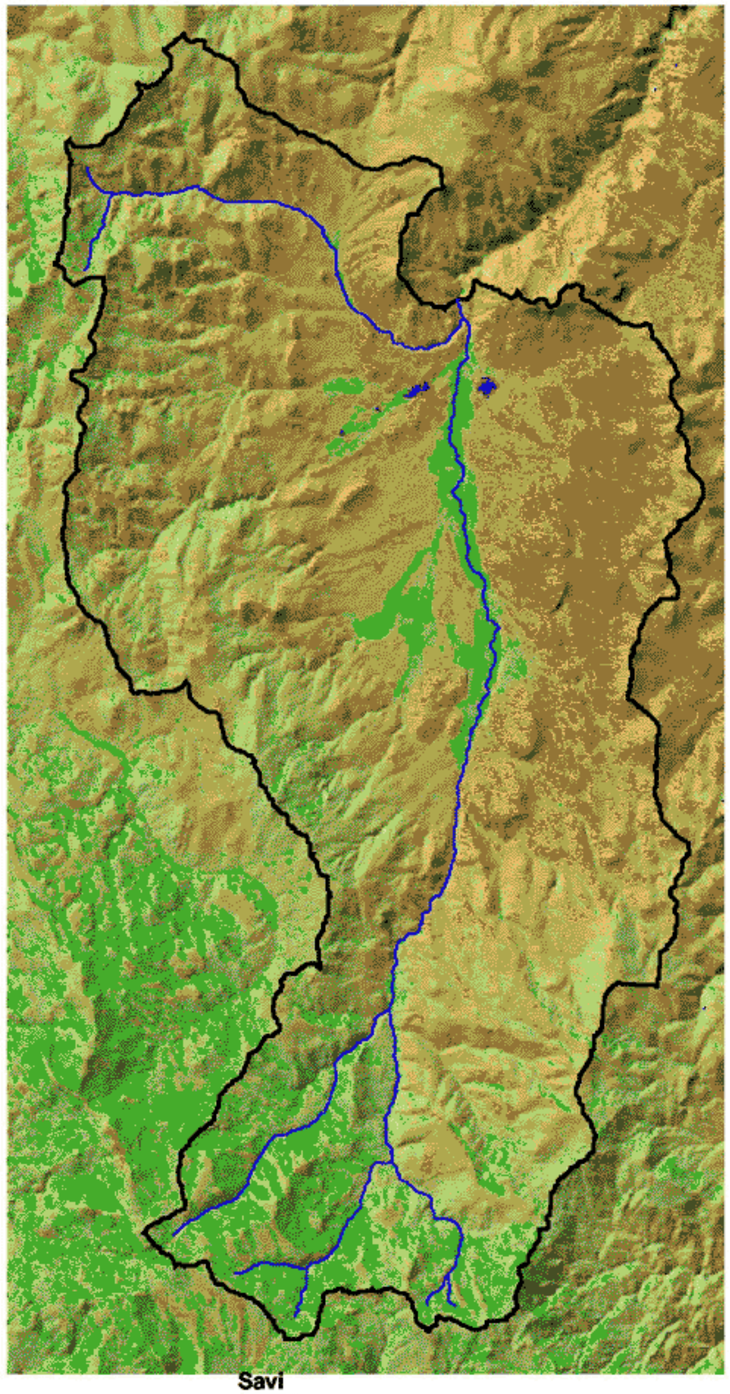
1. Can multispectral remote sensing imagery be used to evaluate changes in vegetation diversity, cover and productivity following prescribed fire?

2. Can multispectral remote sensing imagery be used to classify and map fuel types and quantify fuel moisture and fuel load levels before prescribed fire?

3. Can multispectral remote sensing imagery be used to classify and map fire severity patterns and to identify soil erosional features after prescribed fire?

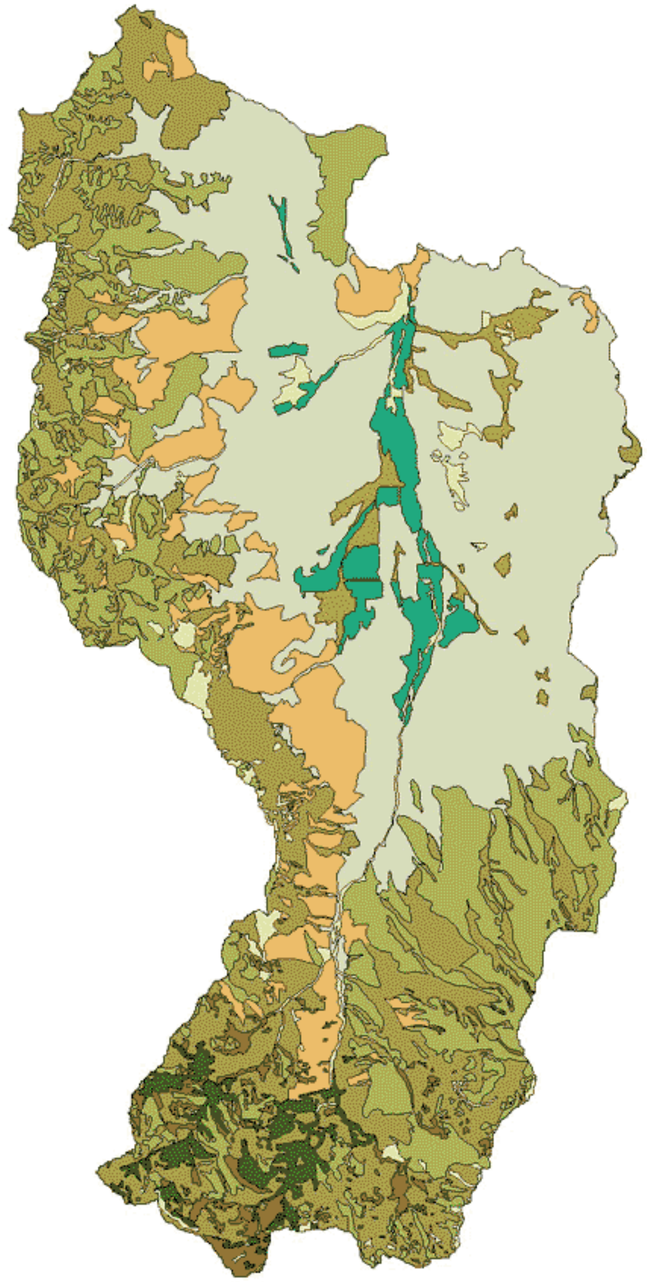
Reynolds Creek Experimental Watershed

Soil Adjusted Vegetation Index



Savi
- Water
- < 0.13 Low Veg Cover
- 0.14- 0.21
- 0.22 - 0.29
- 0.30 - 0.37
- 0.38 - 0.45
- > 0.45 High Veg Cover

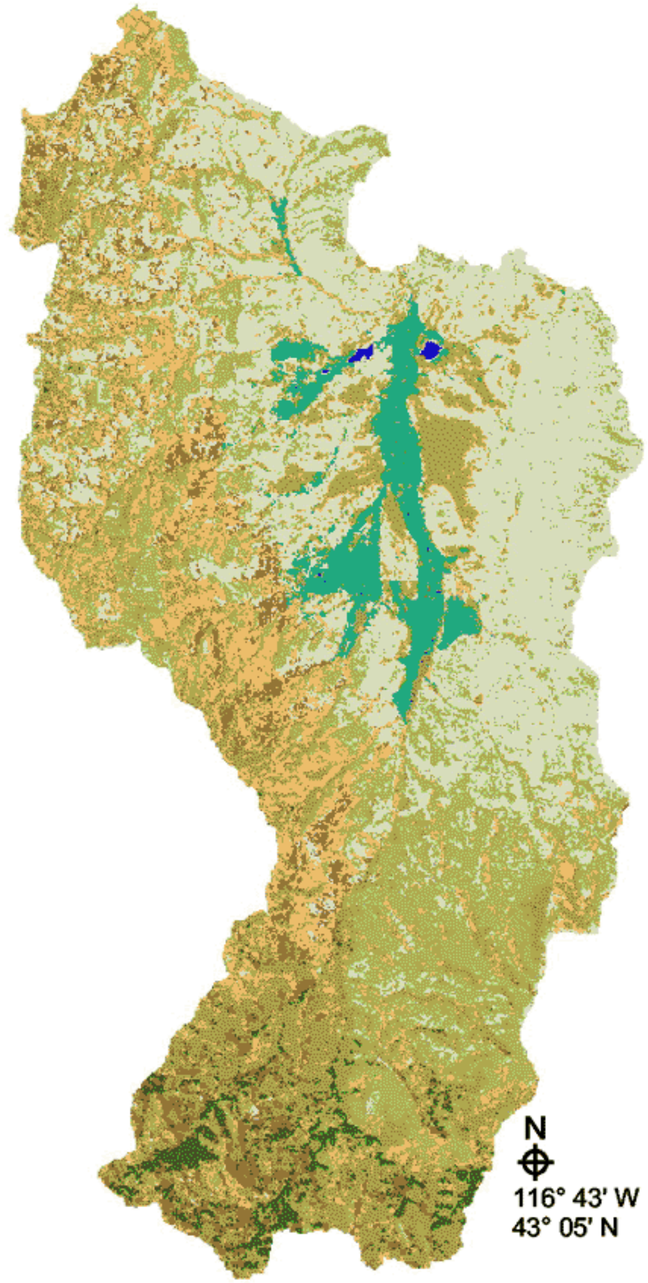
Consolidated Vegetation



Consolidated Vegetation
- Wyoming Sagebrush
- Low Sagebrush
- Wyoming Sagebrush-Bitterbrush
- Mountain Sagebrush-Snowberry
- Greasewood
- Quaking Aspen
- Conifer
- Cultivated
- Other Vegetation

2 0 2 4 6 Kilometers

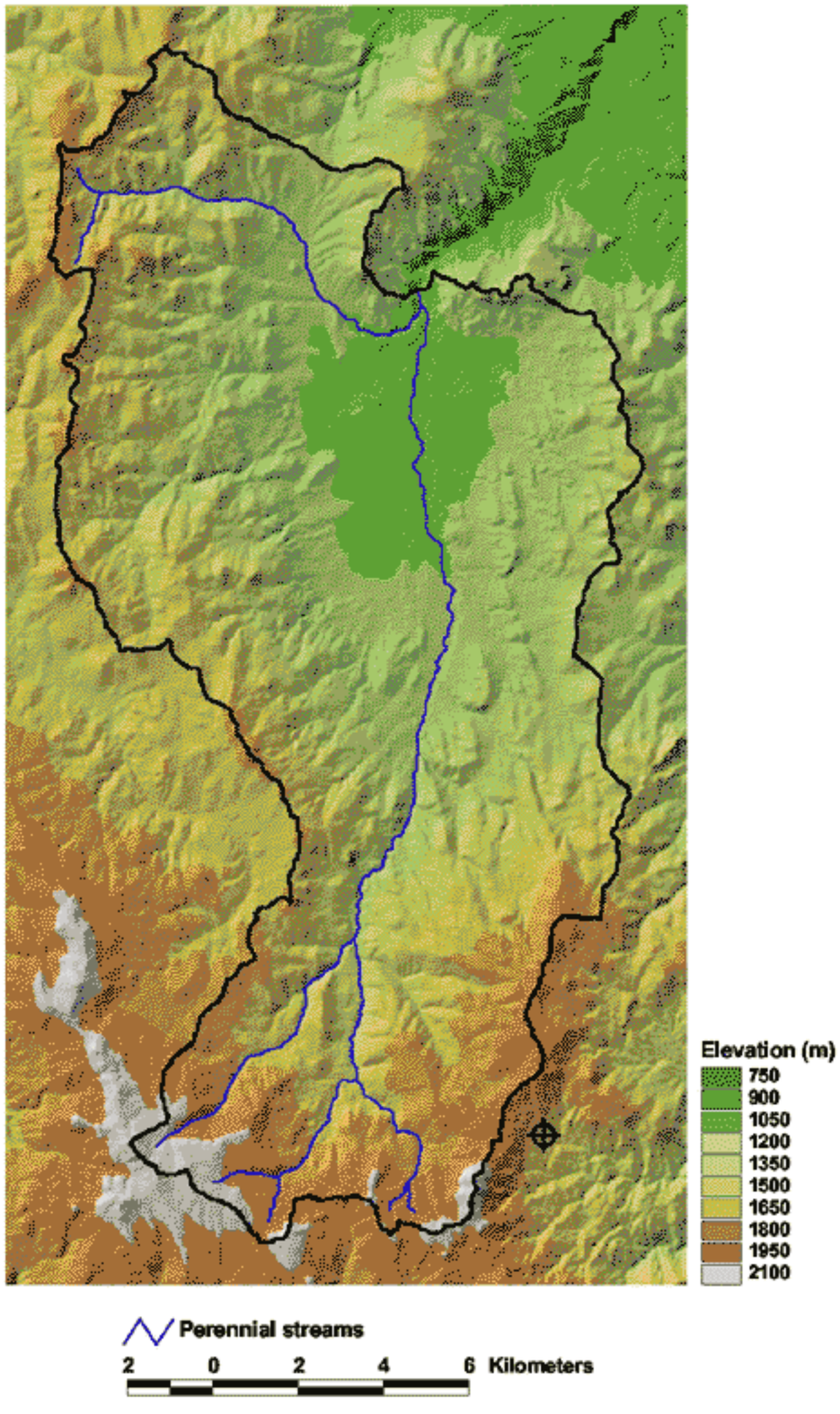
Maximum Likelihood Vegetation



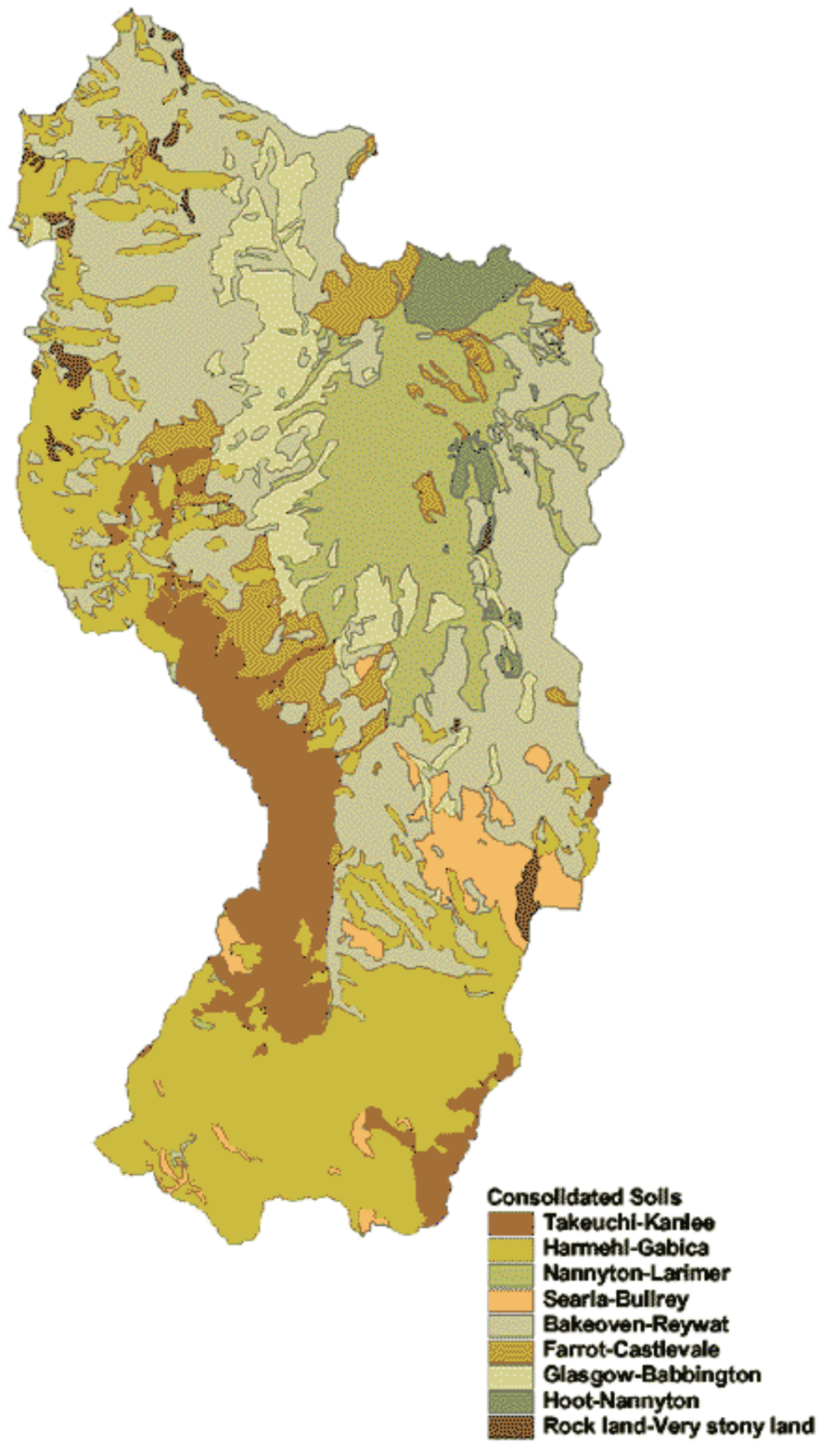
Maximum Liklihood Vegetation
- Wyoming Sagebrush
- Low Sagebrush
- Wyoming Sagebrush-Bitterbrush
- Mountain Sagebrush-Snowberry
- Burned and Seeded
- Quaking Aspen
- Conifer
- Cultivated
- Water

Reynolds Creek Experimental Watershed

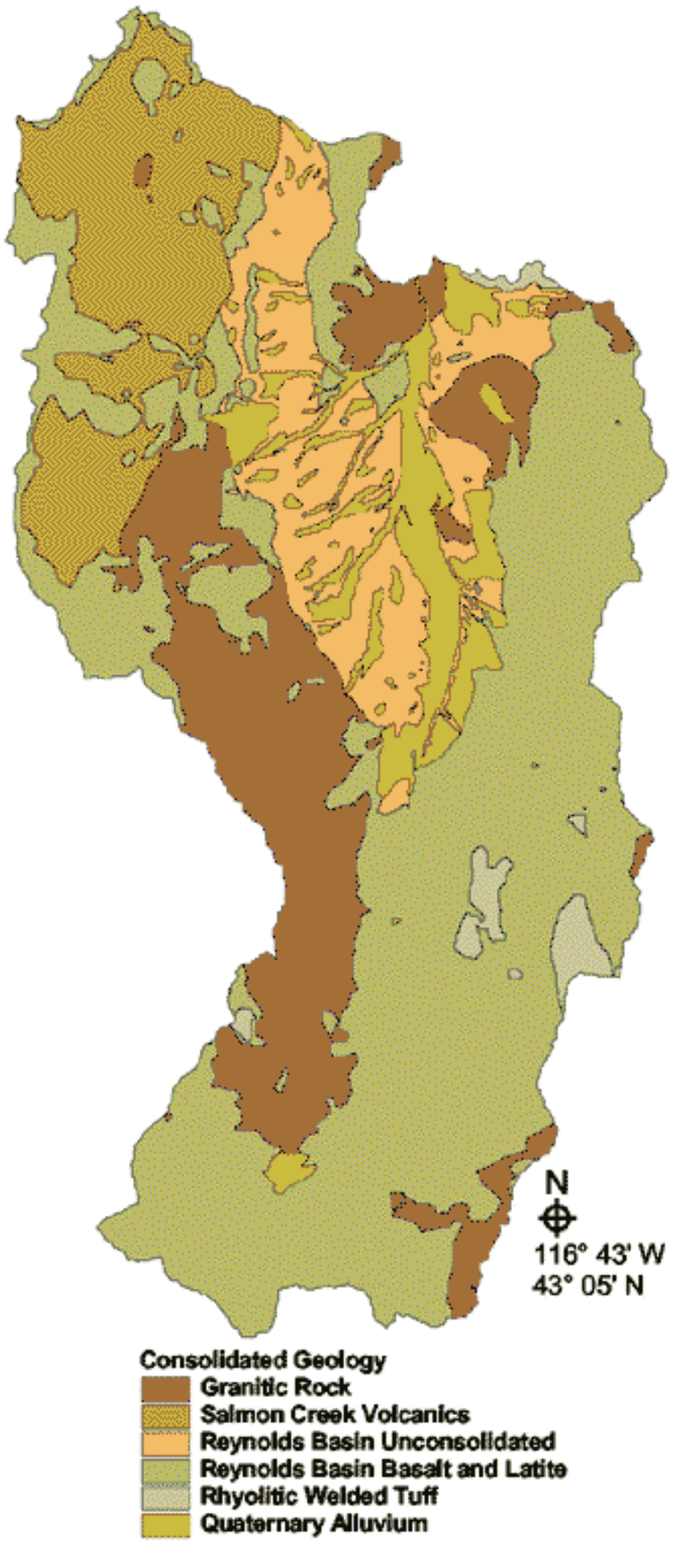
Topography



Soils

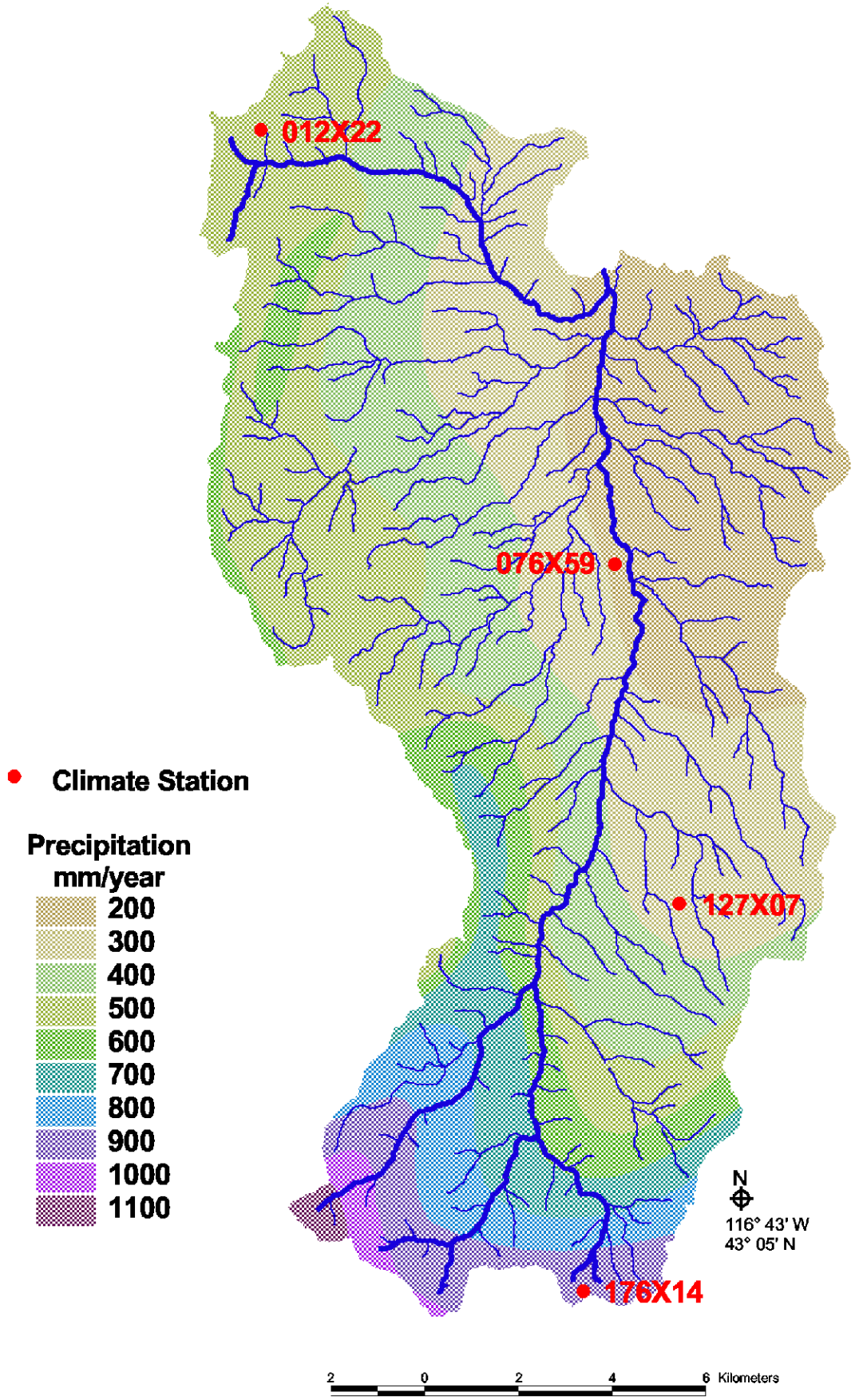


Geology

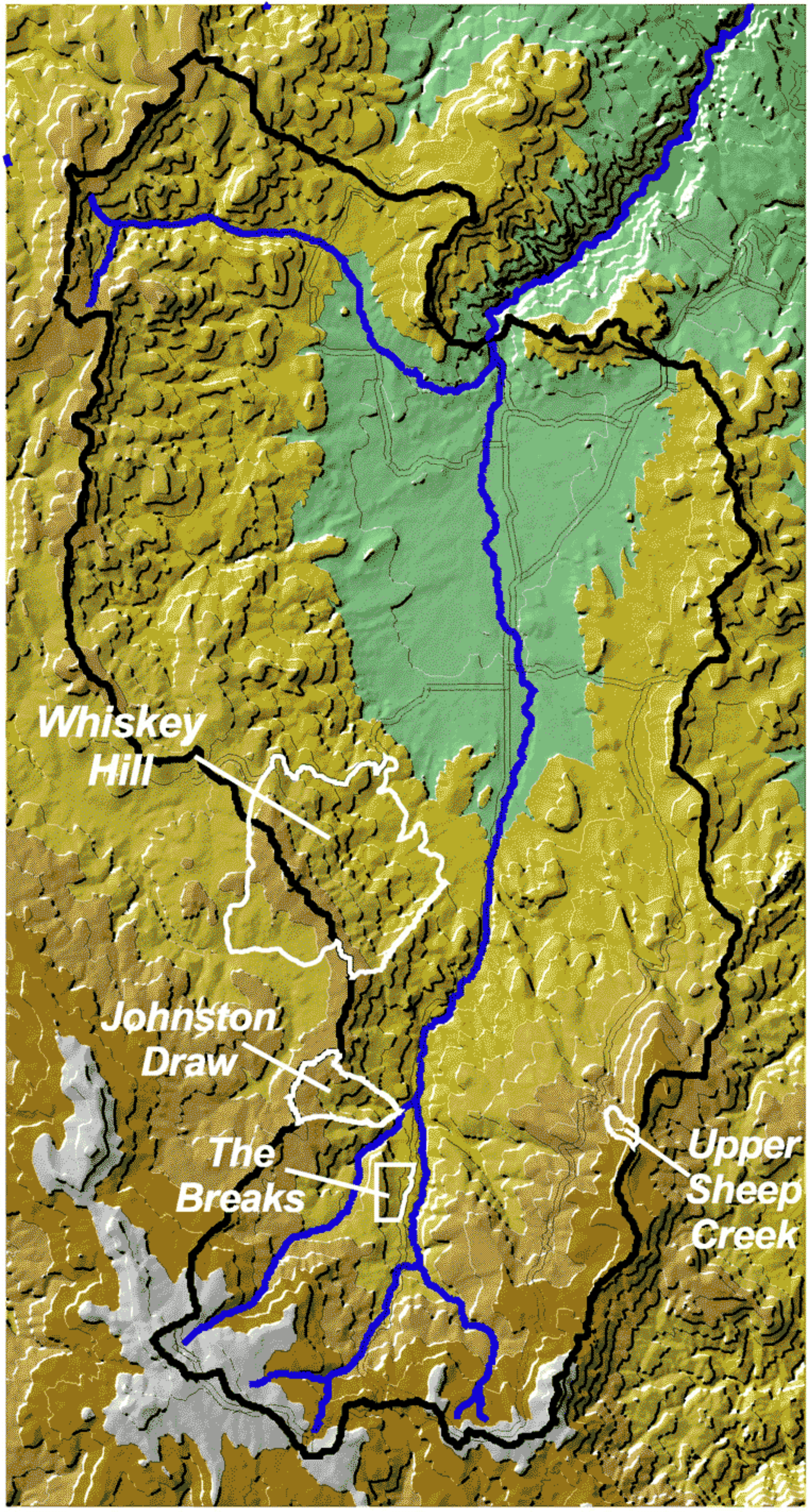


Reynolds Creek Experimental Watershed

Climate Stations, Annual Precipitation, and Stream Network



Reynolds Creek Experimental Watershed: Fire Study Areas



Elevation (m)

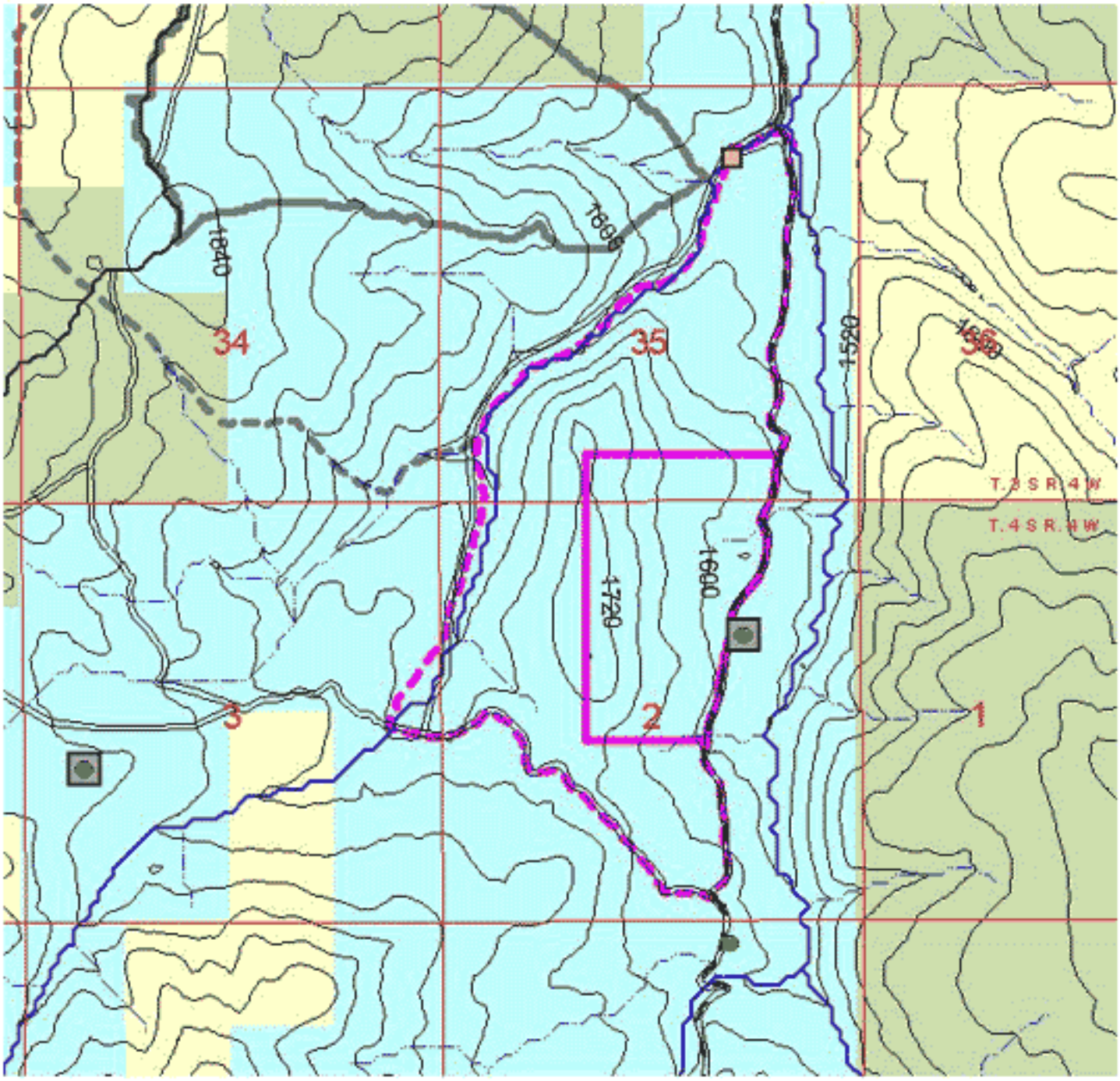
- 773 - 960
- 960 - 1120
- 1120 - 1280
- 1280 - 1440
- 1440 - 1600
- 1600 - 1760
- 1760 - 1920
- 1920 - 2080
- 2080 - 2259

2 0 2 4 6 Kilometers

N

The Breaks

Appendix F



Scale 1:24,000

0.5 0 0.5 1 Kilometers

Contour interval is 40 m

N

Federal
State
Private

Weir
Precipitation Gauge
Climate Station

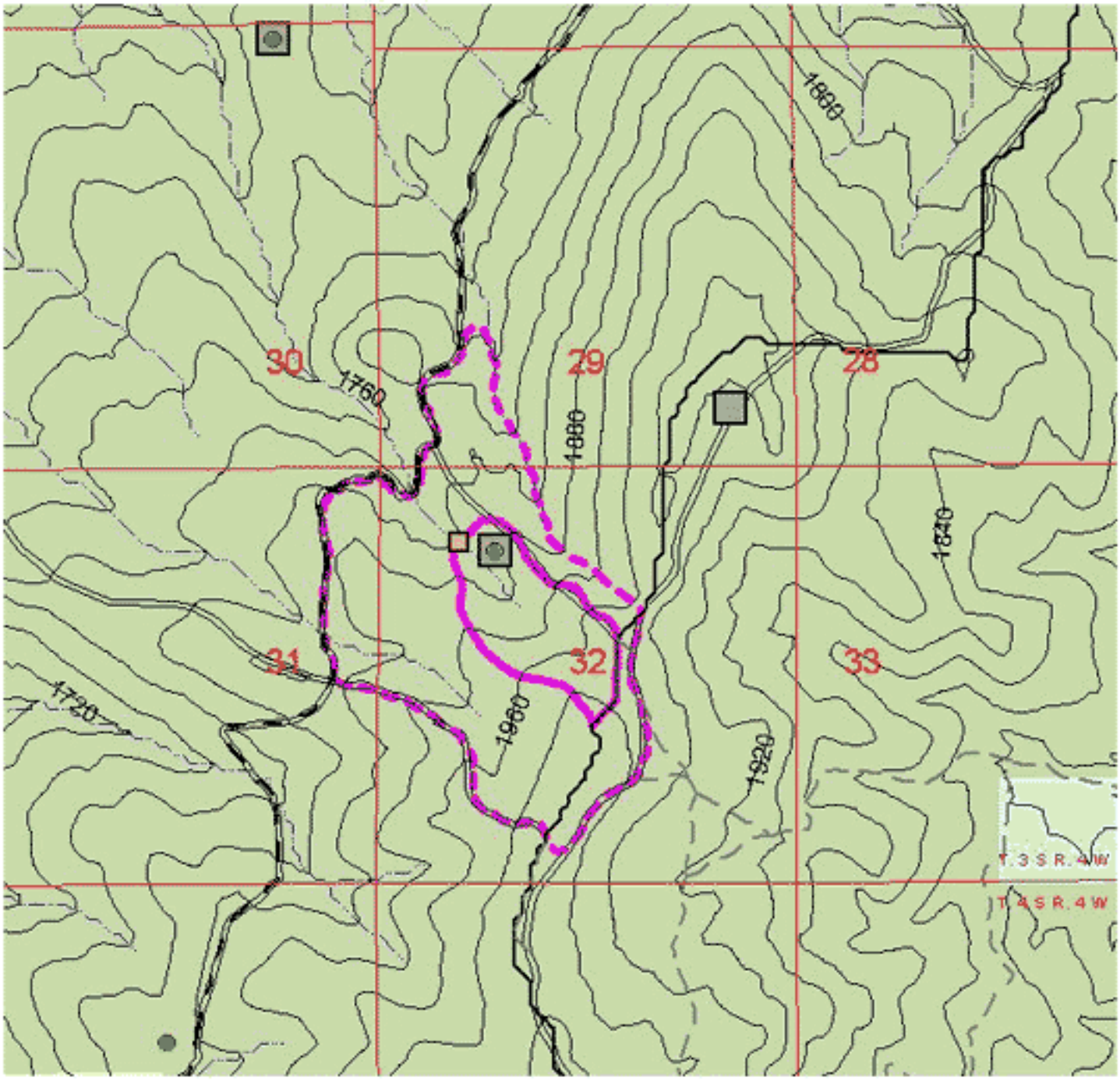
Improved Roads
Unimproved Roads
4WD Roads

Section Line
RCEW Boundary
Breaks Prescribed Burn Project Boundary (166 Ac.)
Johnston Draw Boundary
Breaks Allowable Burn Area (559 Ac.)
Johnston Draw Allowable Burn Area

Reynolds Creek Experimental Watershed, The Breaks fire Study Area
Produced by: USDA-ARS, Northwest Watershed Research Center, Boise, ID. June, 2002.

Upper Sheep Creek

Appendix G



Scale 1:24,000

0.5 0 0.5 1 Kilometers

Contour interval is 40 m

N

Federal
State
Private

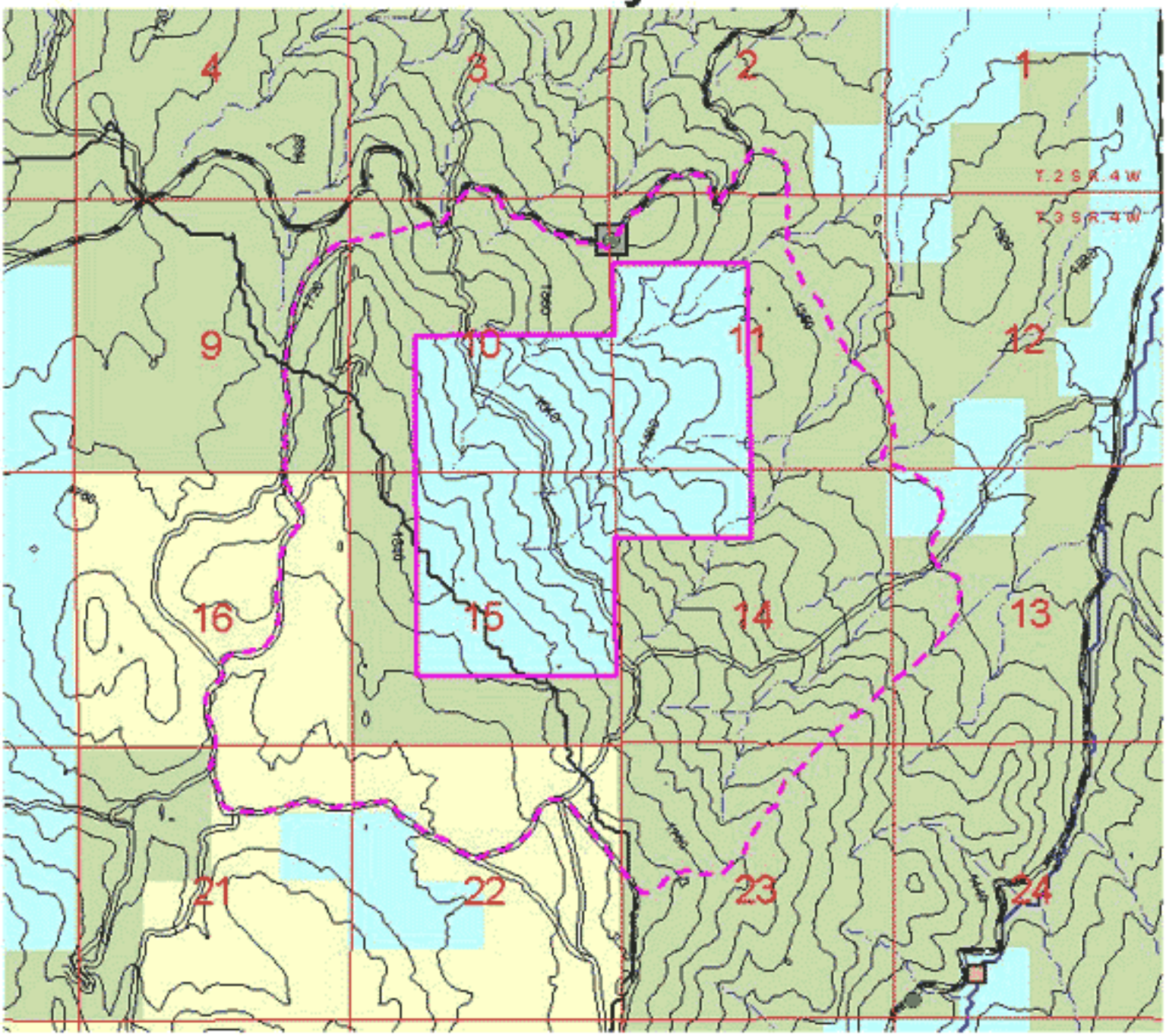
Weir
Precipitation Gauge
Climate Station

Improved Roads
Unimproved Roads
4WD Roads

Section Line
RCEW Boundary
Upper Sheep Creek Boundary (64 Ac.)
Upper Sheep Creek Allowable Burn Area (327 Ac.)

Reynolds Creek Experimental Watershed, Upper Sheep Creek Fire Study Area
Produced by: USDA-ARS, Northwest Watershed Research Center, Boise, ID. June, 2002.

Whiskey Hill



Scale 1:48,000

1000 0 1000 Meters

Contour interval is 40 m

N

Federal
State
Private

Weir
Precipitation Gauge
Climate Station

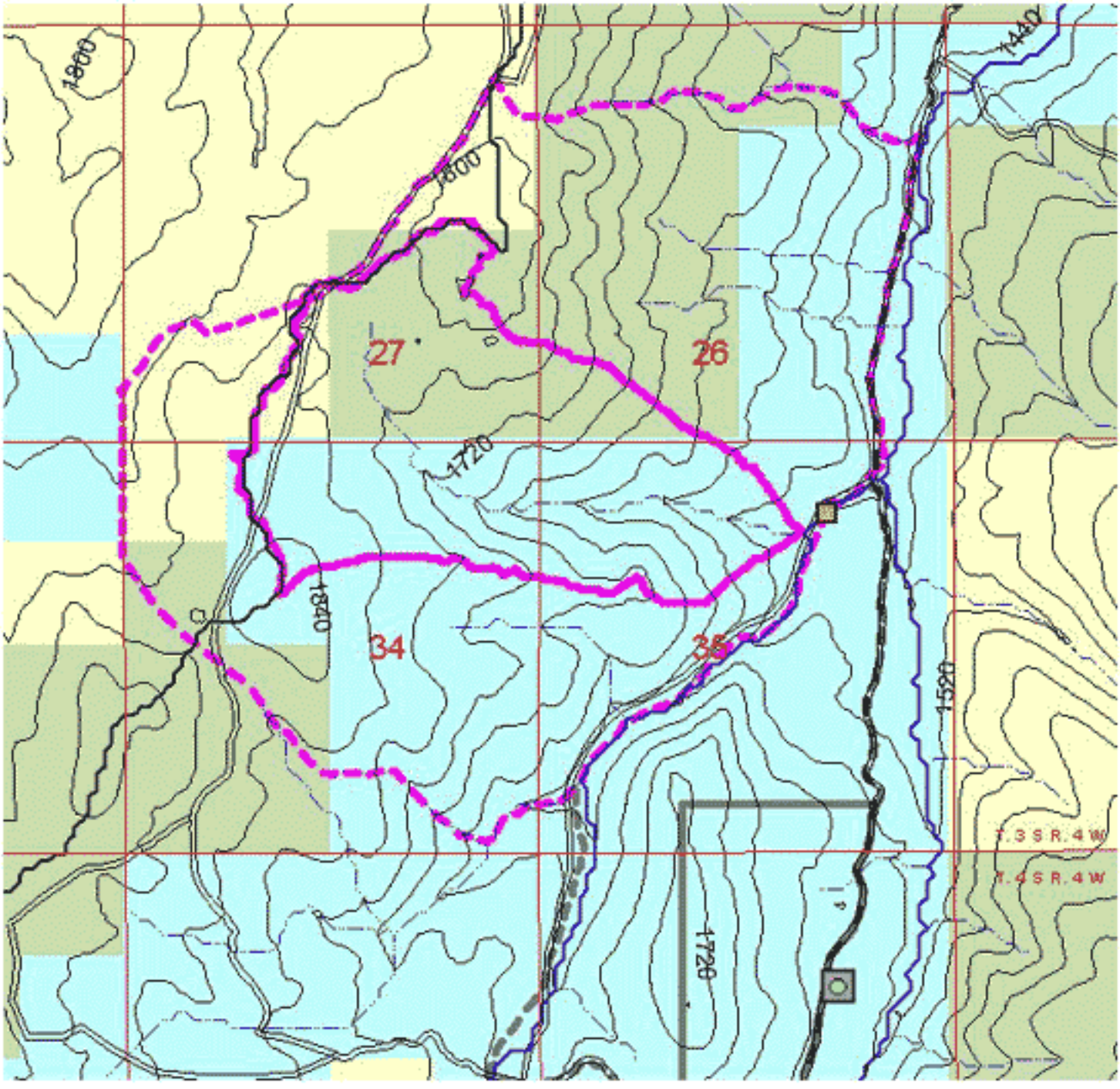
Section Line
RCEW Boundary
Whiskey Hill (897 Ac.)
Whiskey Hill Allowable Burn Area (3190 Ac.)

Improved Roads
Unimproved Roads
4WD Roads

Reynolds Creek Experimental Watershed, Upper Sheep Creek Fire Study Area
Produced by: USDA ARS, Northwest Watershed Research Center, Boise, ID. June, 2002.

Johnston Draw

Appendix I



Scale 1:24,000

0.5 0 0.5 1 Kilometers

Contour interval is 40 m

N

Federal
State
Private

Weir
Precipitation Gauge
Climate Station

Improved Roads
Unimproved Roads
4WD Roads

Section Line
RCEW Boundary
Johnston Draw Proposed Burn Area (451 Ac.)
Breaks Boundary
Johnston Allowable Burn Area (1473 Ac.)
Breaks Allowable Burn Area

Reynolds Creek Experimental Watershed, Johnston Draw Fire Study Area
Produced by: USDA-ARS, Northwest Watershed Research Center, Boise, ID. June, 2002.

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