Identification of Conservation Priorities for and Threats to Palouse Grassland and Canyon Grassland Remnants in Idaho, Washington, and Oregon

prepared by Bertie J. Weddell
and Juanita Lichthardt

TECHNICAL BULLETIN NO. 98-13 IDAHO BUREAU OF LAND MANAGEMENT October 1998

Identification of Conservation Priorities for and Threats to Palouse Grassland and Canyon Grassland Remnants in Idaho, Washington, and Oregon

Prepared by
Bertie J. Weddell
and
Juanita Lichthardt
Palouse Land Trust
Kenworthy Plaza
109 South Washington
Moscow, Idaho
83843

September 30, 1998

for the

Bureau of Land Management
Cottonwood District
Route 3, Box 181
Cottonwood, ID 83522
Order No. 1422D065P980006

Table of Contents

Abstract ---- ii
Acknowledgments ---- iii
Introduction ---- 1
Methods ---- 3
Prioritization of conservation sites ---- 3
Monitoring ---- 7
Reconnaissance surveys ---- 7
Results ---- 7
Prioritization of conservation sites ---- 7
Monitoring ---- 14
Reconnaissance surveys ---- 23
Recommendations ---- 23
Conservation sites ---- 23
Monitoring ---- 29
Stewardship ---- 29
Literature Cited ---- 30
Appendix 1 ---- 34
Appendix 2 ---- 48

Abstract

This report summarizes the results of Phase 1 of a project designed to assess threats to Palouse Grassland and Canyon Grassland communities and associated sensitive plant taxa and to increase the number of high quality occurrences of these elements that are protected through private conservation agreements. This work was funded through a challenge cost-share agreement between the Bureau of Land Management, Cottonwood Resource Area, and the Palouse Land Trust of Moscow, Idaho.

Data on element occurrences of plant communities and rare or endemic plant taxa associated with Palouse Grasslands or Canyon Grasslands of Washington, Oregon, or Idaho were obtained from the Idaho Fish and Game Conservation Data Center, the Washington Department of Natural Resources Natural Heritage Program, and the Oregon Division of State Lands/Oregon Nature Conservancy Natural Heritage Program. A total of 308 of these elements occurred on sites that currently are not protected. These sites were ranked in terms of size, proximity to other occurrences of Palouse or Canyon Grassland elements, number of elements at the site, and quality of occurrence. Twenty sites were identified as conservation priorities that are currently unprotected. In addition baseline monitoring at five sites, reconnaissance visits to eight sites, and comparisons with data obtained at three sites a minimum of 35 years ago, indicated that exotic species are a widespread threat to Palouse and Canyon Grassland communities.

Acknowledgments

This project was funded through a challenge cost-share agreement between the Bureau of Land Management (BLM), Cottonwood Resource Area, and the Palouse Land Trust of Moscow, Idaho. Data on element occurrences were contributed by the Idaho Fish and Game Conservation Data Center (CDC), the Washington Department of Natural Resources Natural Heritage Program (WNHP), and the Oregon Division of State Lands/Oregon Nature Conservancy Natural Heritage Program (ONHP). Rex Crawford, Robin Estes, John Gamon, and Jack McMillen, of the WNHP; Jimmy Kagan and Eleanor Gaines of the ONHP; Bob Moseley, Steve Rust, and George Stephens of the CDC; Barbara Benner of the Spokane District of the BLM; and Roger Holland of the Washington Department of Fish and Wildlife, provided information and helpful suggestions. Spatial analysis and mapping of element occurrences was contributed by the University of Idaho Gap Analysis Program's Landscape Dynamics Laboratory, where Eva Strand was very helpful. Janice Hill of the Idaho Nature Conservancy provided information on rare plant populations on the George property. Archie and Mary George, Jacie and Wayne Jensen, Washington State University, Washington Department of Transportation, and Washington Department of Fish and Wildlife granted permission for lands to be used as monitoring sites. Karen Gray and Melinda Trask assisted with some portions of the field work. Jim Roberts and Jim Croft contributed information on recent changes in the flora of Kamiak Butte. All of these contributions are gratefully acknowledged. The support and assistance with all aspects of this project provided by Craig Johnson of the Cottonwood District of the BLM are especially appreciated.

Introduction

The portion of the Intermountain West where perennial grassland, or steppe, vegetation occurs on zonal soils is designated the northern Section of the *Agropyron spicatum* Province by Daubenmire (1978). Steppe vegetation of this region can be further subdivided on the basis of physiognomy into three zones: shrub steppe, true steppe, and meadow steppe (Figure 1) (Daubenmire 1970; Franklin and Dyrness 1988). Principal diagnostic characteristics of true steppe vegetation are the caespitose growth form of *Agropyron*, and "the overwhelming dominance of perennial grasses over forbs" (Daubenmire 1942:65). In contrast to this, in meadow steppe, located along the eastern and northern borders of Washington's true steppe, the perennial grasses are accompanied by "an infusion" of large perennial forbs (Daubenmire 1942:65).

In 1942 Daubenmire referred to the steppe and meadow steppe of Washington as "Palouse grasslands" (Daubenmire 1942:78). In this usage, Palouse grasslands was an ecological term defined on the basis of vegetation rather than a geographic term (Figure 2A). Subsequent authors tended to define the Palouse as a geographic region encompassing southeastern Washington, adjacent northern Idaho, and northeastern Oregon, and to define it more narrowly than the region denoted by Daubenmire (Figure 2B). (See Lichthardt and Moseley 1997 for discussion.) In this usage, the Palouse region includes the eastern portions of Washington's steppe and meadow steppe zones, which occur on relatively mesic loessal soils (Thiele and Omernik 1993; Bailey 1995; Lichthardt and Moseley 1997). Steppe and meadow steppe zones outside of the Palouse region occur to the west (Poulton 1955), north (Tisdale 1983), and in a disjunct area to the east in Montana (Mueggler and Stewart 1980). Tisdale termed these "Pacific Northwest Bunchgrass grasslands" (PNBG). The PNBG have been subdivided into several ecological divisions, one of which is the Palouse Grassland (Idaho Natural Heritage Program et al. 1986; The Nature Conservancy et al. 1987).

Another division of PNBG has been termed Canyon Grassland (The Nature Conservancy et al. 1987). This division occurs throughout canyons of the Columbia Plateau. Excellent examples occur in the canyons of the Snake and Salmon rivers and their major tributaries (Tisdale 1986; Johnson and Simon 1987). The grassland communities of the Canyon Grassland are steppe or meadow steppe, similar in structure to (although somewhat different in composition from) communities of other parts of the PNBG. This term does not designate a unique physiognomic type of grassland; rather, Canyon Grassland is distinguished by its characteristic topography and flora. The steep contours of the deeply dissected canyons result in pronounced habitat diversity due to differences in elevation, aspect, and soil depth over short distances (Tisdale 1986; Johnson and Simon 1987).

Palouse Grassland was dramatically reduced in extent when its deep, fertile soils were converted to cropland (Buss and Dziedzic 1955). Most remnants of this vegetation type are small, privately-owned parcels surrounded by cultivated fields, and Palouse Grassland is now considered a critically endangered ecosystem (Noss et al. 1995). Many of the elements that remain on unprotected sites are threatened by rural residential development and invasion of exotic weeds (Lichthardt and Moseley 1997).

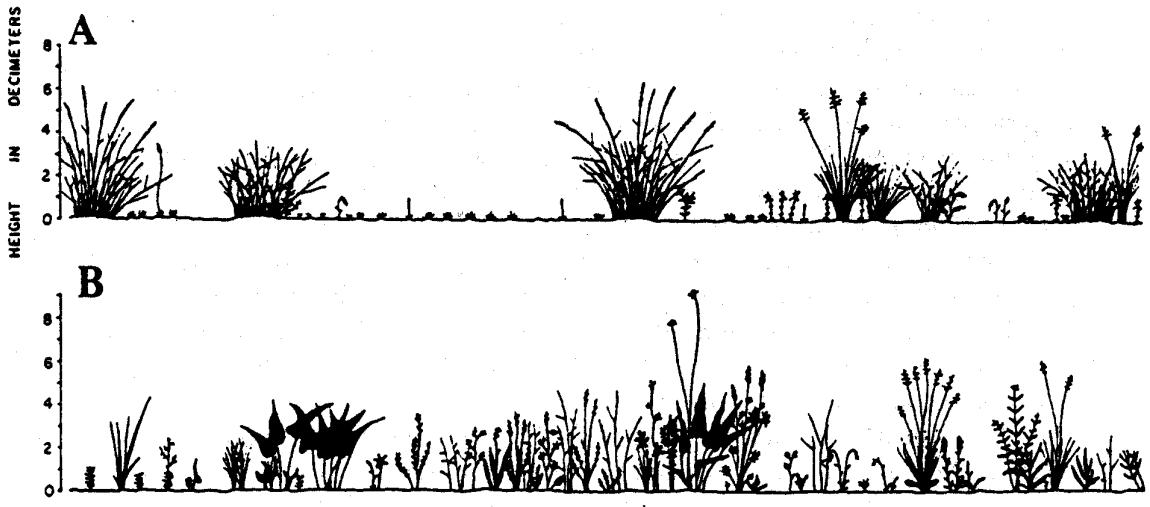


Figure 1. Physiognomy of steppe (A) and meadow steppe (B) vegetation in Washington. Based on Daubenmire 1970.

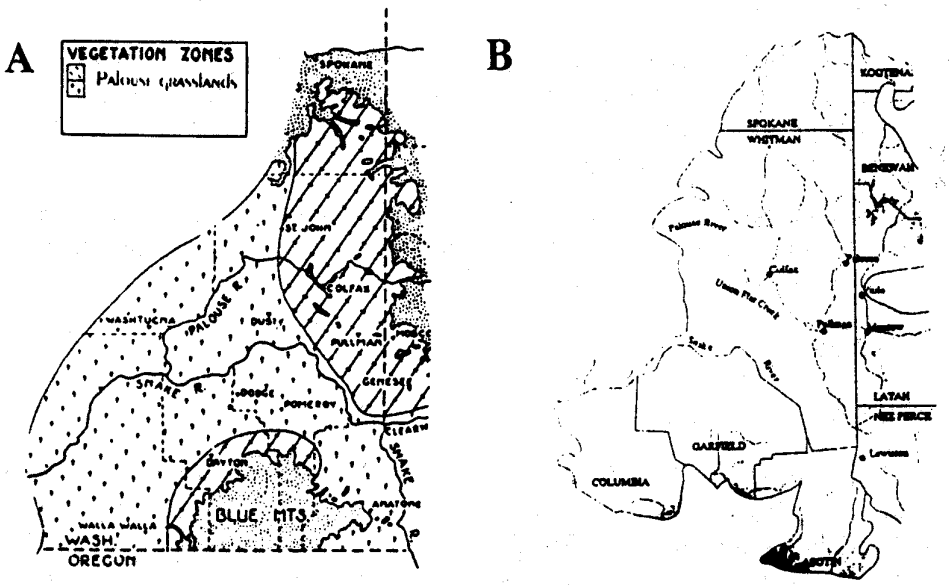


Figure 2. A. Zones of Washington referred to as Palouse grasslands by Daubenmire (1942). B. Portion of Bailey's Palouse Bioregion in Washington (Bailey 1995). Note that Bailey's Palouse Bioregion does not extend as far west as the Palouse grasslands designated by Daubenmire.

Canyon Grassland, because of its steepness, has not been extensively converted to other uses, but much of the native Canyon Grassland vegetation has been altered by extensive grazing (Daubenmire 1940; Young 1943; Tisdale 1961); nevertheless, there remain substantial areas that have not received heavy grazing pressure because of their steep slopes, shallow soils, inaccessibility, and distance from water (The Nature Conservancy et al. 1987). These are well represented in natural areas owned by The Nature Conservancy and state and federal agencies (Mancuso and Moseley 1994, Hill 1995a,b, 1996; Hill and Gray 1998a,b).

As early as 1942 Daubenmire noted a high degree of endemism in plants of the Palouse grasslands (Daubenmire 1942:77). Currently, over a dozen sensitive plant taxa occur in the Palouse and Canyon grasslands (Table 1). All of these have geographic ranges that are restricted to the PNBG, and several are restricted to the Palouse or Canyon Grasslands. (See Results, below.)

This report summarizes the results of Phase 1 of a project designed to assess threats to Palouse Grassland and Canyon Grassland communities and associated sensitive plant taxa and to increase the number of high quality occurrences of these elements that are protected through private conservation agreements. The objectives of Phase 1 of this project were:

1) to rank in terms of their conservation value known locations of native Palouse Grassland and Canyon Grassland communities and associated rare plant taxa that are not currently protected;
2) to establish baseline monitoring on five selected examples of native Palouse Grassland or Canyon Grassland communities in order to track changes in community composition such as invasion by exotic species, shrub encroachment, and changes in plant species diversity at these sites; and
3) to conduct reconnaissance surveys of eight additional Palouse Grassland or Canyon Grassland sites to obtain information on the presence of sensitive plant taxa and threats from non-native species.

Methods

Prioritization of conservation sites

Our study area consisted of the Palouse Ecoregion of Bailey (1995) plus the portions of Idaho and northeastern Oregon to the south and east that contain Canyon Grasslands and Palouse Grasslands (western and southern Asotin County in Washington; Adams and Washington counties and southern Nez Perce, Lewis, and Idaho counties in Idaho; and Wallowa County in Oregon) (Figure 3).

We requested information on element occurrences (EOs) of 29 plant communities and 14 plant taxa found in the Palouse Grasslands or Canyon Grasslands of Washington, Oregon, or Idaho (Table 2). The plant associations we requested information on were those in the *Symphoricarpos albus* (common snowberry), *Agropyron spicatum* (bluebunch wheatgrass), *Festuca idahoensis* (Idaho fescue), and *Festuca scabrella* (rough fescue) alliances that occurred in the study area and were tracked in at least one state.

		State ranks			Federal ranks	
Taxon	**Global rank**	**Idaho**	**Washington**	**Oregon**	**US Fish and Wildlife Service**	**BLM**
Aster jessicae	G2	S2	Endangered S1S2	not present	Species of concern	Sensitive
Astragalus arrectus	G2G3	not considered rare	Sensitive S2	not present	--	--
Astragalus ripartus	G2G3	Extirpated?	Sensitive S2	not present	--	Watch
Calochortus macrocarpus var. maculosus	G4G5 T2	S2	Sensitive S1	S?	--	Sensitive
Calochortus nitidus	G3	S3	Threatened S1	S3	Species of concern	Sensitive
Chrysothamnus nauseosus ssp. nanus	G5 T4	Monitor, S2	Watch	not considered rare	--	Sensitive
Crepis bakeri spp. idahoensis	G4 T2	S2	not present	not present	--	Sensitive
Haplopappus liatriformis	G2	S2	Threatened S2	not present	Species of concern	Sensitive
Leptodactylon pungens ssp. hazeliae	G5 T1T2	S1	not present	Candidate S1	Species of concern	Sensitive
Lomatium dissectum var. dissectum	G5 T5	Monitor, S3	not present in study area in WA	not present in study area in OR?	--	Watch
Mirabilis macfarlanei	G2	S2	not present	Endangered S1	Threatened	Threatened
Silene spaldingii	G2	S1	Threatened S2	Endangered S1	Species of concern	Sensitive
Thelypodium laciniatum var. streptanthoides	G5 T4	Monitor, S2	not considered rare	not considered rare	--	Sensitive
Trifolium plumosum var. amplifolium	G4 T2	S2	not present in study area in WA	not present	--	Sensitive

Table 1. Fourteen plant taxa associated with Palouse Grassland and/or Canyon Grassland and considered rare or sensitive in Idaho, Washington, and/or Oregon. Explanation of symbols: G=global status, T=trinomial (infraspecific) status (used in conjunction with global rank), S=state status. 1=Critically imperiled because of extreme rarity or because of particular vulnerability to extinction or extirpation; typically 5 or fewer occurrences; 2=Imperiled because of rarity or because of vulnerability to extinction or extirpation; typically 6-20 occurrences; 3=Either very rare and local throughout its range or found locally (or even abundantly) in a restricted range; typically 21-100 occurrences; 4=Apparently secure; typically more than 100 occurrences; 5=Demonstrably widespread, abundant, and secure.

Scientific name	Common name
SPECIES	
Aster jessicae	Jessica's aster
Astragalus arrectus	Palouse milk-vetch
Astragalus riparius	Piper's milk-vetch
Calochortus macrocarpus var. *maculosus*	Green-band mariposa lily
Calochortus nitidus	Broad-fruit mariposa
Chrysothamnus nauseosus ssp. *nanus* [*Chrysothamnus nauseosus* var. *nanus*]	Dwarf gray rabbitbrush
Cirsium brevifolium	Palouse thistle
Crepis bakeri ssp. *idahoensis*	Idaho hawksbeard
Haplopappus liatriformis	Palouse goldenweed
Leptodactylon pungens var. *hazeliae*	Hazel's prickly phlox
Lomatium dissectum var. *dissectum*	Fern-leaved desert parsley
Silene spaldingii	Spalding's silene
Thelypodium laciniatum var. *robustior*	Purple thick-leaved thelypody
Trifolium plumosum var. *amplifolium* [*Trifolium plumosum* ssp. *amplifolium*]	Plumed clover
COMMUNITIES	
Agropyron spicatum-Festuca idahoensis	Bluebunch wheatgrass-Idaho fescue
Agropyron spicatum-Poa secunda [*Agropyron spicatum-Poa sandbergii*]	Bluebunch wheatgrass-Sandberg's bluegrass
Agropyron spicatum-Poa secunda basalt variant	Bluebunch wheatgrass-Sandberg's bluegrass basalt variant
Agropyron spicatum-Poa secunda granite variant	Bluebunch wheatgrass-Sandberg's bluegrass granite variant
Agropyron spicatum-Poa secunda scabland (lithosol)	Bluebunch wheatgrass-Sandberg's bluegrass scabland (lithosol)
Agropyron spicatum-Poa secunda/Astragalus cusickii	Bluebunch wheatgrass-Sandberg's bluegrass/Cusick's milk-vetch
Agropyron spicatum-Poa secunda/Balsamorhiza sagittata	Bluebunch wheatgrass/Arrowleaf balsamroot
Agropyron spicatum-Poa secunda/Erigeron pumilis	Bluebunch wheatgrass-Sandberg's bluegrass/shaggy fleabane
Agropyron spicatum-Poa secunda/Phlox colubrina	Bluebunch wheatgrass-Sandberg's bluegrass/Snake River phlox
Agropyron spicatum-Poa secunda/Scutellaria angustifolia	Bluebunch wheatgrass-Sandberg's bluegrass/narrow-leaved skullcap
Agropyron spicatum/Eriogonum heracleoides	Bluebunch wheatgrass/Wyeth buckwheat
Agropyron spicatum/Opuntia polyacantha	Bluebunch wheatgrass/starvation cholla
Festuca idahoensis-Agropyron spicatum	Idaho fescue/bluebunch wheatgrass
Festuca idahoensis-Agropyron spicatum Balsamorhiza sagittata variant	Idaho fescue/bluebunch wheatgrass arrowleaf balsamroot variant
Festuca idahoensis-Agropyron spicatum Lupinus sericeus variant	Idaho fescue/bluebunch wheatgrass silky lupine variant
Festuca idahoensis-Agropyron spicatum Phlox colubrina variant	Idaho fescue/bluebunch wheatgrass Snake River phlox variant
Festuca idahoensis-Agropyron spicatum ridgetop variant	Idaho fescue/bluebunch wheatgrass ridgetop variant
Festuca idahoensis-Danthonia californica	Idaho fescue/California oatgrass
Festuca idahoensis-Danthonia intermedia-Carex	Idaho fescue/timber oatgrass-sedge
Festuca idahoensis-Koeleria cristata	Idaho fescue-prairie Junegrass
Festuca idahoensis-Koeleria cristata high elevation variant	Idaho fescue-prairie Junegrass high elevation variant
Festuca idahoensis-Koeleria cristata low elevation variant	Idaho fescue-prairie Junegrass low elevation variant
Festuca idahoensis-Koeleria cristata mounds variant	Idaho fescue-prairie Junegrass mounds variant
Festuca idahoensis-Koeleria cristata ridgetop variant	Idaho fescue-prairie Junegrass ridgetop variant
Festuca idahoensis/Eriogonum caespitosum	Idaho fescue/mat buckwheat
Festuca idahoensis/Potentilla diversifolia	Idaho fescue/diverse-leaved cinquefoil
Festuca idahoensis/Rosa nutkana	Idaho fescue/Nootka rose
Festuca idahoensis/Symphoricarpos albus	Idaho fescue/common snowberry
Festuca scabrella-F. idahoensis [*Festuca idahoensis-Festuca scabrella*]	Rough fescue-Idaho fescue [Idaho fescue-rough fescue]

Table 2. Taxa and plant communities for which element occurrences were considered in the prioritization of sites for conservation value.

We ranked unprotected element occurrences in terms of their conservation value. Sites on land owned by federal or state agencies, county governments, or The Nature Conservancy were considered protected. In addition, element occurrences registered with the Washington Register of Natural Areas Program, a voluntary, non-binding protection program, were considered protected. If information on ownership of a site was unavailable or ambiguous, the site was considered unprotected.

Unprotected EOs were ranked on the basis of four variables: size, proximity to other element occurrences, EO abundance (number of species or community elements at the same site), and quality of occurrence (EO rank, a subjective measure of EO quality that considers population size, disturbance, and degree of alteration) (Table 3). Large EOs and those that were near other EOs were considered to have higher conservation value than small, isolated EOs, because large EOs would be expected to support large populations and clusters of EOs could exchange propagules and mutualists. Information on proximity was obtained by calculating the distance from each EO to the nearest EO, using Arc/INFO. This spatial analysis was conducted by the University of Idaho Gap Analysis Program's Landscape Dynamics Laboratory. EOs with the same latitude and longitude or that were judged to be the same location on the basis of their site descriptions were considered a single site. Information on the other three variables was obtained from the files of the state heritage programs. If more than one element was present at a site, we used the highest ranked element for that site's rank score. For each site, scores were averaged for each variable for which information was available. Occurrences of historic or extirpated records were deleted.

Variable	Categories	Point values
Size	0-40 acres	0
	40-80 acres	1
	80-160 acres	2
	160-320 acres	3
	>320 acres	4
Proximity to nearest EO	>2250 m	0
	1050-2250 m	1
	450-1050 m	2
	150-450 m	3
	0-150 m	4
EO rank	C, CD, or D	0
	BC	1
	B	2
	AB	3
	A	4
EO abundance		Rank = number of EOs present at site

Table 3. Scales for variables used to rank EOs in terms of conservation priority.

Monitoring

We established baseline monitoring at five locations (Figure 3; Appendix 1). Two of the sites are privately owned (Paradise Ridge and Waha), and three are owned by state agencies (Smoothing Iron Ridge: Washington Department of Natural Resources; Colfax: Washington Department of Transportation; and Kramer Prairie: Washington State University). At the Kramer Prairie, Daubenmire had set up transects with one permanently-marked endpoint and obtained vegetation data in the 1950s. We were able to find the markers for two of these, and we repeated the vegetation sampling using the methods described in Daubenmire (1970). A 20 x 50-cm plot frame was placed at 0.5-m intervals along each 20-m transect, and the canopy coverage of all species of vascular plants was recorded using six coverage classes (0-5%, 5-25%, 25-50%, 50-75%, 75-95%, and 95-100%). At the other four monitor sites, the same methods were used except that transects were 25 m in length and the plots were spaced at 1-m intervals. Transects were placed in relatively undisturbed stands, because these are more useful for determining the potential natural vegetation of a site.

Sampling was carried out twice—once between April 11 and May 5 and once between June 8 and June 19, 1998—except at Paradise Ridge, which was sampled once in July. When vegetation sampling was conducted more than once, the highest coverage value for each taxon is reported. In addition, at the Waha site on June 8, we established three 50-m "weed transects" in disturbed vegetation, and the locations to the nearest 0.1 m of the start and end of each patch of non-native canopy intercepted by a meter tape stretched along the transect were recorded. We also initiated photomonitoring and censused any populations of sensitive plant taxa at each of the monitored sites.

Reconnaissance surveys

We conducted reconnaissance surveys of eight sites (Figure 3; Appendix 1). A partial list of vascular plant taxa occurring at each site was compiled, paying particular attention to rare plants and exotic taxa. In addition, at six of the sites vascular plant species coverage was recorded in one to four reconnaissance plots measuring approximately 5 x 5 m (Daubenmire 1970). Reconnaissance sites were subjectively ranked on the basis of size, presence of sensitive taxa, and plant community condition.

Results

Prioritization of conservation sites

Data were available for species and communities of interest in Idaho and Washington and for species in Oregon. We obtained data on 591 occurrences of the elements of interest in our study area. A subset of these occur on 308 sites that are currently believed to be unprotected (Figure 4). Twenty sites had conservation value ranks equal to or greater than 2.5 (Table 4).

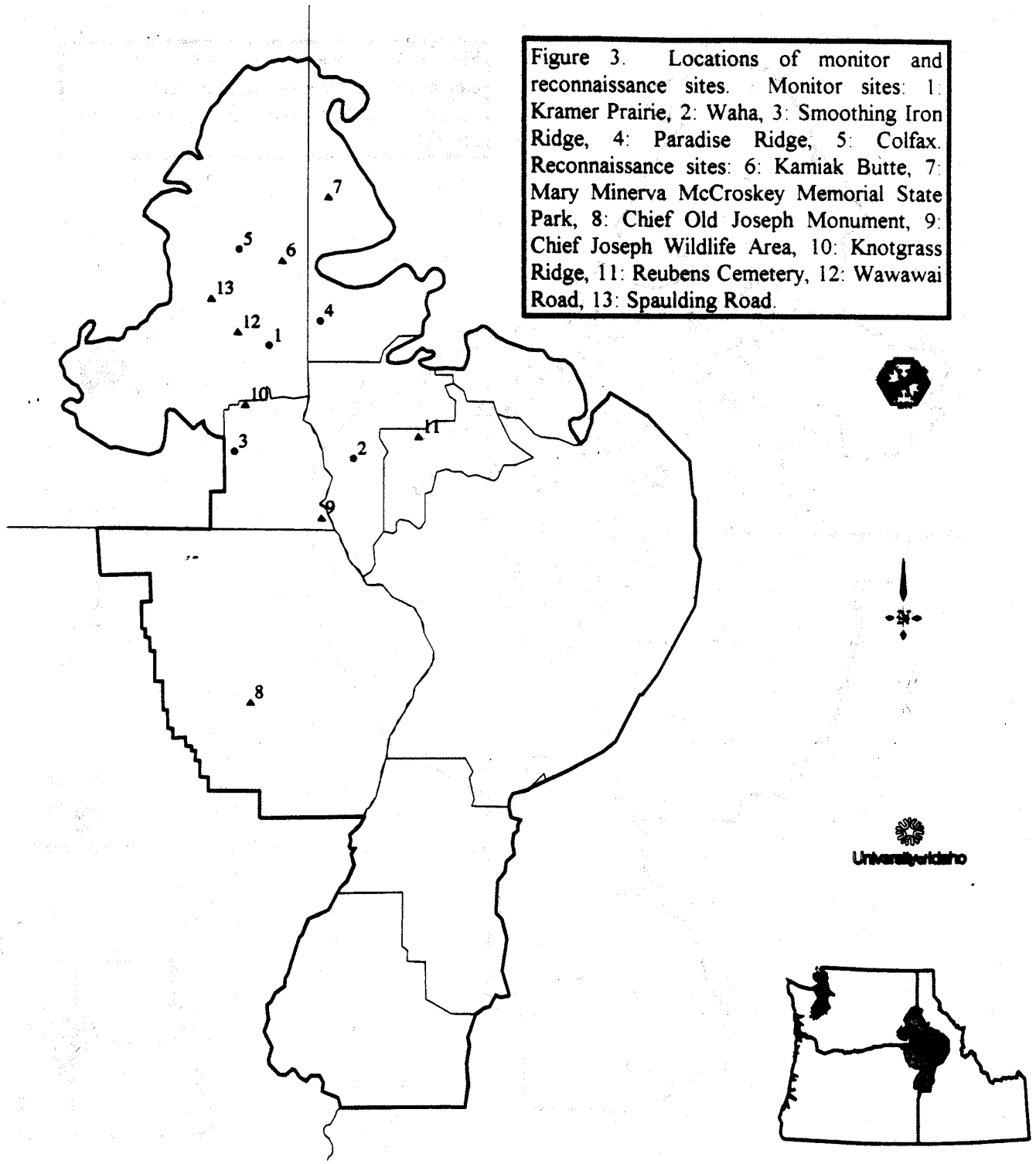


Figure 3. Locations of monitor and reconnaissance sites. Monitor sites: 1: Kramer Prairie, 2: Waha, 3: Smoothing Iron Ridge, 4: Paradise Ridge, 5: Colfax. Reconnaissance sites: 6: Kamiak Butte, 7: Mary Minerva McCroskey Memorial State Park, 8: Chief Old Joseph Monument, 9: Chief Joseph Wildlife Area, 10: Knotgrass Ridge, 11: Reubens Cemetery, 12: Wawawai Road, 13: Spaulding Road.

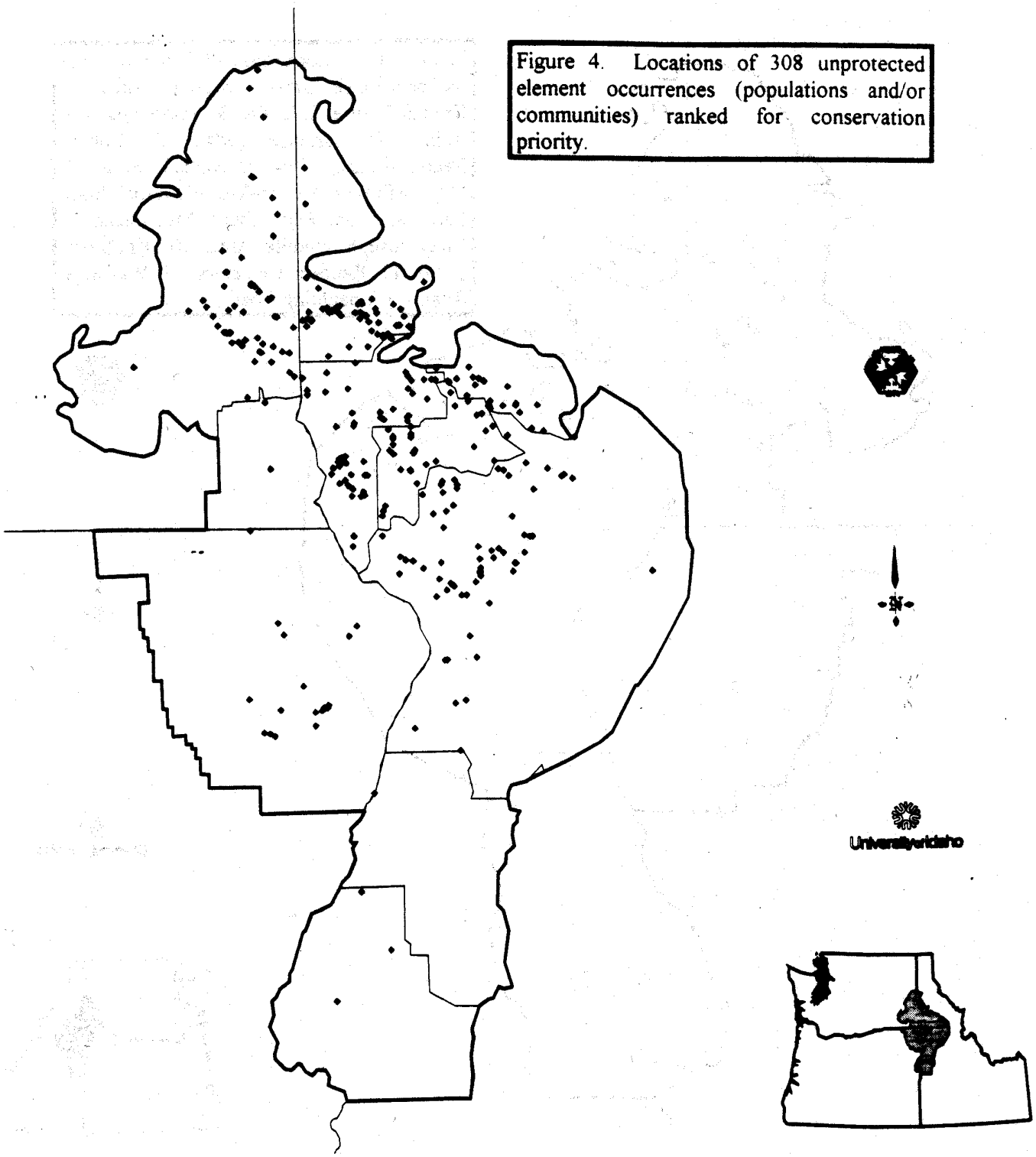


Figure 4. Locations of 308 unprotected element occurrences (populations and/or communities) ranked for conservation priority.

Site #	Elements Present	Points				Conservation Value Rank
		Distance	Area	# of EOs	Quality	
1	CREPIS BAKERI SSP IDAHOENSIS	4		1		**2.50**
2	TRIFOLIUM PLUMOSUM VAR AMPLIFOLIUM	4		1		**2.50**
3	HAPLOPAPPUS LIATRIFORMIS	4		1		**2.50**
4	FESTUCA IDAHOENSIS/SYMPHORICARPOS ALBUS FESTUCA IDAHOENSIS/ROSA NUTKANA TRIFOLIUM PLUMOSUM VAR AMPLIFOLIUM HAPLOPAPPUS LIATRIFORMIS CALOCHORTUS NITIDUS	1		5	2	**2.67**
5	FESTUCA IDAHOENSIS/SYMPHORICARPOS ALBUS HAPLOPAPPUS LIATRIFORMIS	3		2	3	**2.67**
6	FESTUCA IDAHOENSIS-KOELERIA CRISTATA CALOCHORTUS NITIDUS	2		2	4	**2.67**
7	HAPLOPAPPUS LIATRIFORMIS	3		1	4	**2.67**
8	LOMATIUM DISSECTUM VAR DISSECTUM	3		1	4	**2.67**
9	ASTER JESSICAE	3		1	4	**2.67**
10	HAPLOPAPPUS LIATRIFORMIS	3		1	4	**2.67**
11	FESTUCA IDAHOENSIS/SYMPHORICARPOS ALBUS	3		1	4	**2.67**
12	CALOCHORTUS MACROCARPUS VAR MACULOSUS	2	4	1	4	**2.75**
13	FESTUCA IDAHOENSIS/ROSA NUTKANA TRIFOLIUM PLUMOSUM VAR. AMPLIFOLIUM HAPLOPAPPUS LIATRIFORMIS CALOCHORTUS NITIDUS	2		4	3	**3.00**
14	CALOCHORTUS NITIDUS	4		1	4	**3.00**
15	FESTUCA IDAHOENSIS/SYMPHORICARPOS ALBUS	4		1	4	**3.00**
16	TRIFOLIUM PLUMOSUM VAR. AMPLIFOLIUM	4		1	4	**3.00**
17	FESTUCA IDAHOENSIS/SYMPHORICARPOS ALBUS	4		1	4	**3.00**
18	HAPLOPAPPUS LIATRIFORMIS	4		1	4	**3.00**
19	AGROPYRON SPICATUM-POA SECUNDA SCABLAND FESTUCA IDAHOENSIS-KOELERIA CRISTATA LOW ELEVATION VARIANT FESTUCA IDAHOENSIS-KOELERIA CRISTATA HIGH ELEVATION VARIANT FESTUCA IDAHOENSIS-AGROPYRON SPICATUM LUPINUS SERICEUS VARIANT AGROPYRON SPICATUM-POA SECUNDA/SCUTELLARIA ANGUSTIFOLIA	1		5		**3.00**
20	HAPLOPAPPUS LIATRIFORMIS SILENE SPALDINGII	4		2	4	**3.33**

Table 4. Unprotected sites ranked as having high conservation value. See text for explanation of ranking procedure.

All the sites identified as conservation priorities were in Idaho (Figure 5). This is primarily because most of the sites of high conservation value in the Palouse Grasslands of Washington are already registered with the Natural Areas Program, and relatively little information was available for Oregon. Most of the sites that received high conservation value rankings had high EO ranks and were located near other sites; many also contained more than one species or community of interest.

The species and communities we considered in our study vary in the degree to which they are associated with Palouse Grasslands or Canyon Grasslands. As noted above, steppe vegetation in Washington, typified by the *Agropyron spicatum-Poa secunda* and *Agropyron spicatum-Festuca idahoensis* zones, extends to the west of the Palouse Bioregion defined by Bailey. As expected, there were substantial numbers of EOs of these communities outside our study area. Similarly, the ranges of *Astragalus arrectus*, *Silene spaldingii*, and *Thelypodium laciniatum* var. *streptanthoides* extend west of the study area. In contrast to this, *Aster jessicae*, *Astragalus riparius*, *Calochortus macrocarpus* var. *maculosus*, *Calochortus nitidus*, *Crepis bakeri* spp. *idahoensis*, *Haplopappus liatriformis*, *Leptodactylon pungens* ssp. *hazeliae*, and *Mirabilis macfarlanei* are virtually endemic to the Palouse and/or Canyon grasslands; each of these taxa had fewer than six occurrences outside the study area.

The level of protection accorded to plant species within the study area varied greatly (Figure 6). For most species of interest, fewer than 15 populations in each state are protected. *Calochortus nitidus* and *Lomatium dissectum* var. *dissectum* in Idaho are exceptions, with 53 and 15 protected populations respectively. For some species the number of occurrences is fairly large, but the level of protection is very low. For example, none of the 56 occurrences of *Aster jessicae* within the study area in Idaho are protected, and only 7 of 43 occurrences of *Haplopappus liatriformis* in Idaho are protected. Although *Cirsium brevifolium* is endemic to southeast Washington, northeast Oregon, and adjacent Idaho, it is not tracked by the heritage programs in any of these states, so data were unavailable on the degree of protection it is currently receiving.

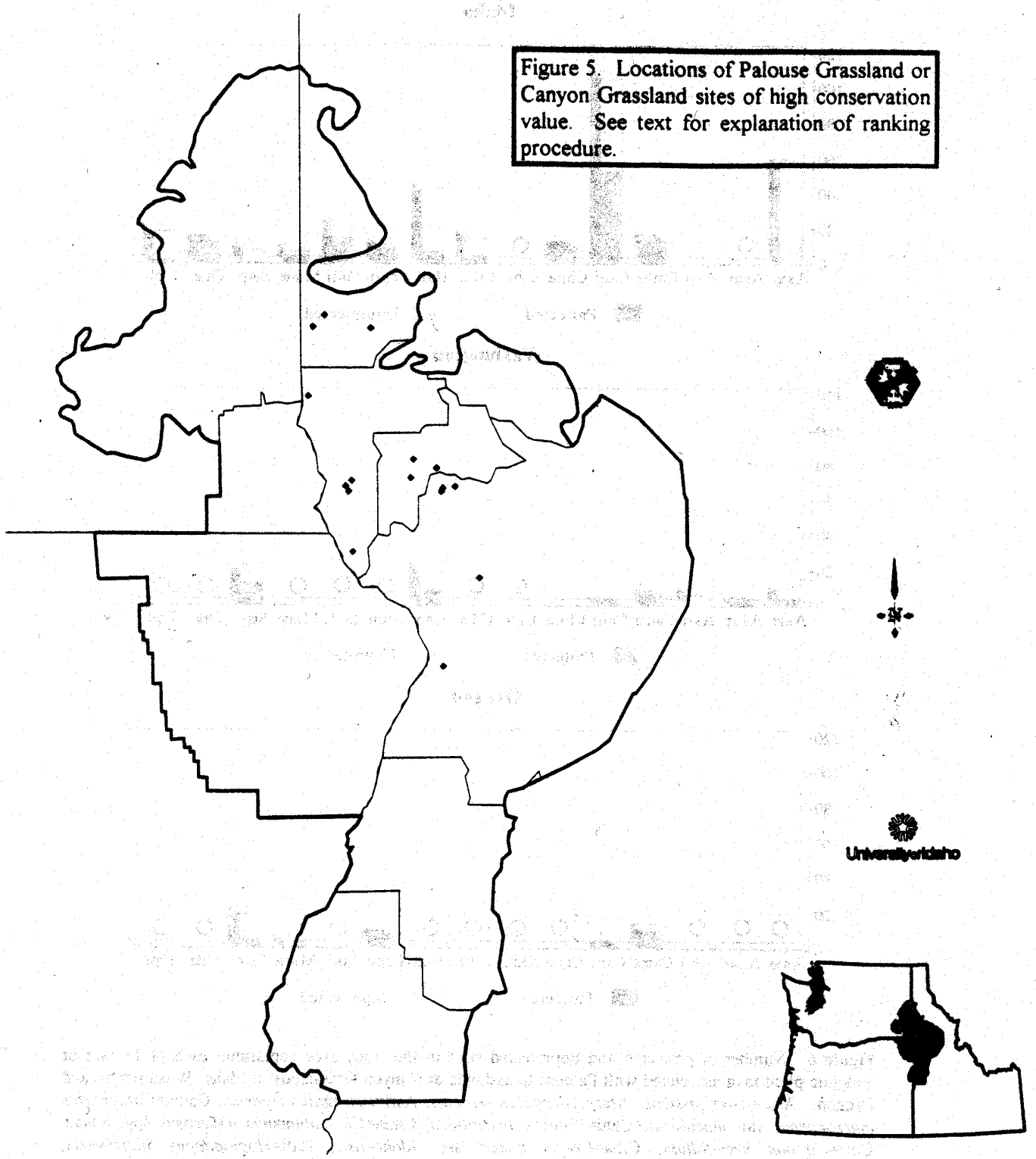


Figure 5. Locations of Palouse Grassland or Canyon Grassland sites of high conservation value. See text for explanation of ranking procedure.

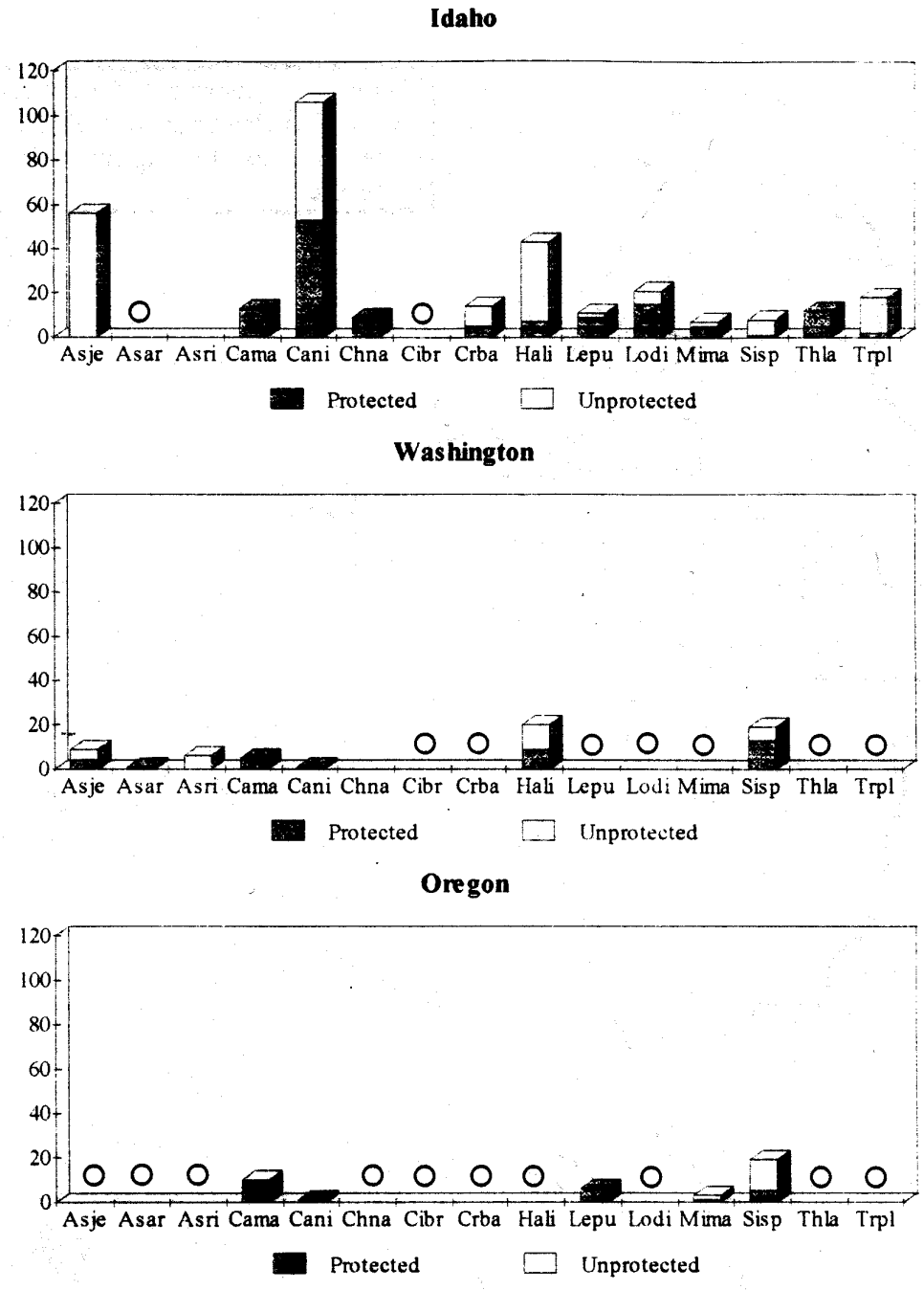


Figure 6. Number of protected and unprotected sites in the study area containing each of 15 rare or endemic plant taxa associated with Palouse Grasslands or Canyon Grasslands in Idaho, Washington, and Oregon. Asje=*Aster jessicae*, Asar=*Astragalus arrectus*, Asri=*Astragalus riparius*, Cama=*Calochortus macrocarpus* var. *maculosus*, Cani=*Calochortus nitidus*, Chna=*Chrysothamnus nauseosus* spp. *nanus*, Cibr=*Cirsium brevifolium*; Crba=*Crepis bakeri* ssp. *idahoensis*, Hali=*Haplopappus liatriformis*, Lepu=*Leptodactylon pungens*, Lodi=*Lomatium dissectum* var. *dissectum*, Mima=*Mirabilis Macfarlanei*, Sisp=*Silene spaldingii*, Thla=*Thelypodium laciniatum* var. *streptanthoides*, Trpl=*Trifolium plumosum* var. *amplifolium*. Open circles indicate that the taxon does not occur or is not considered rare in the indicated state.

Monitoring

The results of the monitoring transects are presented in Tables 5-10. We monitored two sites (Kramer Prairie and Paradise Ridge) in meadow steppe, with *Festuca idahoensis/Symphoricarpos albus* associations (*sensu* Daubenmire 1968), one site (Smoothing Iron Ridge) with true steppe vegetation (*Agropyron spicatum-Festuca idahoensis* association), and two sites (Waha and Colfax) with shallow-soil steppe associations (*Agropyron spicatum-Poa secunda* scabland or lithosol). Although we placed transects in portions of the study sites that were in relatively good condition, exotic species were present at all five sites. Smoothing Iron Ridge was in the best condition of the sites examined. At this site the coverage and diversity of exotics were low, and several of the exotic taxa were inconspicuous annual forbs such as *Draba verna*, *Alyssum alyssoides*, and *Myosotis micrantha.* At Paradise Ridge and Waha, alien annual grasses occurred at high frequencies. At Paradise Ridge, *Bromus japonicus* was the principal grass in this category, whereas at Waha we found *Ventenata dubia* in 88% of the plots. *Galium pedemontanum*, a recent invader of the Pacific Northwest, was also present at the Waha site. At Waha, 66% of the total length of the weed transects intercepted the canopies of non-native species, including yellow star-thistle (*Centaurea solstitialis*), field morning glory (*Convolvulus arvensis*), medusahead (*Elymus caput-medusae*), ventenata (*Ventenata dubia*), annual bromes (*Bromus* spp.), *Galium pedemontanum*, and erect cinquefoil (*Potentilla recta*).

Rare plants were present at three of the sites we monitored. At Paradise Ridge, approximately 300 *Haplopappus liatriformis* plants were counted on the south end of the ridge on Sept. 29. In 1990 the population size of this species at Paradise Ridge was estimated to be 101-1,000 (Gamon and Lorain 1991). At Kramer Prairie, approximately 240 *Haplopappus liatriformis* plants and 3 *Silene spaldingii* plants were counted on Aug. 14, 1998. An estimated 550 *H. liatriformis* were present in 1981 and again in 1990 (Gamon and Lorain 1991). No individuals of *Silene spaldingii* were found during a visit to the site in Aug. of 1995, although this species had previously been reported at the Kramer Prairie (WNHP record #PDCAR0U1S0*006). At the Waha site, 245 *Calochortus nitidus*, 5 *Crepis bakeri* ssp. *idahoensis*, and 47 *Haplopappus liatriformis* plants were counted on Aug. 27, 1997 (Janice Hill, personal communication). Several other populations of *Haplopappus liatriformis* are located within a few miles of this population (Gamon and Lorain 1991, Janice Hill, personal communication).

At Colfax and Kramer Prairie, a comparison with earlier data obtained at the same sites by Daubenmire allowed us to assess changes in community integrity. These data indicate substantial increases in the number and coverage of alien plants at both sites. At both transects in the Kramer Prairie, *Poa pratensis* was the most abundant exotic species in 1998, although this species was not recorded along either transect in the 1950s, and other exotics such as *Hypericum perforatum* and *Myosotis micrantha* had appeared. In addition, we found that the south-facing slope of the Kramer site is now virtually covered with yellow star-thistle. At Colfax, *Poa bulbosa* and *Vicia villosa* both appeared in over 70% of our plots, although these species had not been recorded in 1963 along a transect with similar species composition in the neighboring section.

Stand: Kramer 73; Association: *Festuca idahoensis Symphoricarpos albus* (Daubenmire 1970); T13N R44E S25, Whitman County, Washington; Ownership: Washington State University.

	Apr. 11-14, Jun. 18, 1998		May 1, Jun. 5, 1958	
MEDIUM SHRUBS	% Coverage	% Frequency	% Coverage	% Frequency
Crataegus douglasii	+	3	0	0
LOW SHRUBS				
Phlox speciosa/longifolia	+	5	0	0
Rosa nutkana/woodsii	4	23	3	21
Spiraea betulifolia	2	23	1	18
Symphoricarpos albus	10	68	6	94
PERENNIAL GRAMINOIDS				
Agropyron spicatum	6	70	56	99
Bromus carinatus var. carinatus	3	65	0	0
Carex rossii	0	0	1	18
Carex sp.	+	5		
Festuca idahoensis	19	90	58	99
Koeleria cristata	1	40	14	65
Poa ampla [=P. secunda]	0	0	3	12
Poa pratensis	**26**	**98**	**0**	**0**
PERENNIAL FORBS				
Achillea millefolium var. lanulosa	4	48	2	57
Agastache urticifolia	+	3	0	0
Balsamorhiza sagittata	7	18	12	24
Besseya rubra	2	43	2	27
Brodiaea douglasii	+	13	1	28
Calochortus macrocarpus	0	0	+	12
Castilleja lutescens	3	48	5	60
Erigeron corymbosus	0	0	1	6
Frasera albicaulis	1	13	4	30
Gaillardia aristata	5	15	+	2
Galium boreale	5	60	2	49
Gentiana affinis	+	3	0	0
Geranium viscosissimum	16	75	+	30
Geum triflorum var. ciliatum	27	90	20	64
Haplopappus liatriformis	1	18	10	57
Helianthella uniflora	2	10	2	12
Hieracium albertinum	+	10	3	15
Hypericum perforatum	+	**3**	**0**	**0**
Lithophragma parviflora	1	25	1	22
Lithospermum ruderale	1	10	+	3
Lomatium dissectum var. multifidum	4	75	0	0
Lomatium triternatum	1	28	+	5
Lupinus sericeus	+	5	4	40
Lupinus wyethii	0	0	+	2
Perideridia gairdneri	+	15	0	0
Potentilla arguta	+	3	0	0
Potentilla gracilis	9	50	46	88
Senecio integerrimus var. exaltata	5	88	1	18
Sidalcea oregana	1	10	0	0
Silene spaldingii	0	0	1	24
Sisyrinchium inflatum	2	65	2	60
Solidago missouriensis	2	30	5	21
Taraxacum officinale	**0**	**0**	**0**	**0**
Viola adunca	3	38	+	2
Zigadenus venenosus var. gramineus	0	0	1	5

Table 5. Comparison of frequency and coverage of vascular plant taxa at Kramer Prairie Transect #73, in 1958 and 1998. Taxa shown in bold type are non-native. + indicates coverage value ≤0.5%. N=40 subplots for 1958 and 1998 data. Information on 1958 coverage is from Daubenmire (1970) and field notebooks of Rexford Daubenmire, housed in Washington State University's Manuscripts, Archives, and Special Collections.

	Apr. 11-14, Jun. 18, 1998		May 1, Jun. 5, 1958	
ANNUALS AND BIENNIALS	% Coverage	% Frequency	% Coverage	% Frequency
Bromus brizaeformis	+	3	0	0
Bromus japonicus	2	55	2	58
Collinsia parviflora	2	85	4	95
Draba verna	+	5	3	95
Epilobium brachycarpum	2	48	2	78
Festuca microstachys	0	0	1	5
Galium aparine	2	65	+	2
Holosteum umbellatum	+	8	0	0
Lactuca serriola	2	48	+	2
Montia linearis	+	5	1	42
Montia perfoliata	+	8	0	0
Myosotis micrantha	3	78	0	0
Phlox gracilis ssp. gracilis	+	13	0	0
Sisymbrium altissimum	+	3	0	0
Stellaria nitens	+	8	1	22
Tragopogon dubius	+	18	1	12
Veronica arvensis	+	10	0	0
Veronica sp.	+	3	0	0
Vicia villosa	+	3	0	0

Table 5. Continued.

Stand: Kramer 71; Association: *Festuca idahoensis-Symphoricarpos albus* (Daubenmire 1970); T13N R44E S25, Whitman County, Washington; Ownership: Washington State University.

	Apr. 14, Jun 11-12, 1998		Apr. 12, Jun. 15, 1959	
LOW SHRUBS	% Coverage	% Frequency	% Coverage	% Frequency
Rosa nutkana/woodsii	27	95	2	22
Spiraea betulifolia	1	5	0	0
Symphoricarpos albus	8	70	15	92
PERENNIAL GRAMINOIDS				
Agropyron spicatum	3	55	57	88
Bromus carinatus	+	8	0	0
Calamagrostis rubescens	3	13	0	0
Carex sp.	1	8	0	0
Carex rossii	0	0	1	25
Festuca idahoensis	+	5	30	72
Koeleria cristata	+	13	3	28
Poa ampla [=P. secunda]	0	0	53	92
Poa pratensis	**39**	**100**	**0**	**0**
Stipa columbiana	1	18	0	0
PERENNIAL FORBS	0	0	0	0
Achillea millefolium var. lanulosa	8	70	10	82
Agastache urticifolia	1	28	0	0
Arnica sorana	1	23	5	85
Besseya rubra	2	38	2	20
Calochortus elegans	0	0	+	18
Frasera albicaulis	0	0	1	12
Gaillardia aristata	+	15	+	2
Galium boreale	3	63	11	72
Gentiana affinis	+	5	+	2
Geranium viscosissimum	14	83	21	78
Geum triflorum var. ciliatum	29	100	14	48
Hieracium albertinum	9	60	+	10
Hypericum perforatum	+	**10**	**0**	**0**
Iris missouriensis	4	83	29	92
Lithophragma parviflora	+	3	+	2
Lithospermum ruderale	0	0	1	8
Lomatium dissectum var. multifidum	+	15	0	0
Lomatium triternatum	+	10	0	0
Lupinus sericeus	2	15	1	15
Microseris nutans	0	0	+	2
Penderdia gairdneri	0	0	1	5
Potentilla arguta	1	3	2	4
Potentilla gracilis	10	48	21	82
Senecio integerrimus var. exaltata	2	43	0	0
Senecio serra	+	15	0	0
Sidalcea oregana	1	18	8	50
Taraxacum officinalis	**0**	**0**	+	**5**
Viola adunca	10	68	2	35
Zigadenus venenosus var. gramineus	0	0	+	2
ANNUALS AND BIENNIALS			0	0
Bromus mollis	**1**	**25**	**0**	**0**
Cerastium sp.	+	3	0	0
Collinsia parviflora	1	48	1	52
Draba verna	+	**3**	+	**8**
Epilobium brachycarpum	1	35	+	10
Galium aparine	4	80	1	12

Table 6. Comparison of frequency and coverage of vascular plant taxa at Kramer Prairie Transect #71, in 1958 and 1998. Taxa shown in bold type are non-native. + indicates coverage value ≤0.5%. N=40 subplots for 1958 and 1998 data. Information on 1958 coverage is from Daubenmire (1970) and field notebooks of Rexford Daubenmire, housed in Washington State University's Manuscripts, Archives, and Special Collections.

ANNUALS AND BIENNIALS--cont.	Apr. 14, Jun 11-12, 1998		Apr. 12, Jun. 15, 1959	
	% Coverage	% Frequency	% Coverage	% Frequency
Lactuca serriola, seedling	+	13	+	2
Montia linearis	0	0	-	5
Myosotis micrantha	6	100	0	0
Sisymbrium altissimum	0	0	+	8
Stellaria nitans	0	0	-	5
Tragopogon dubius	+	10	0	0
Veronica arvensis	+	5	0	0
Veronica sp.	+	5	0	0

Table 6. Continued.

Stand: Colfax; Association: *Agropyron spicatum-Poa secunda* lithosol (Daubenmire 1970); T16N R43E S11 and T16N R43E S2, Whitman County, Washington; Ownership: Washington Department of Transportation.

	T16N R43E S11		T16N R43E S2	
	May 1, Jun. 13, 1998		Apr. 30, May 28, 1963	
LOW SHRUBS	% coverage	% frequency	% Coverage	% Frequency
Eriogonum heracleoides	1	4	1	10
Eriogonum niveum	+	4	+	2
PERENNIAL GRAMINOIDS				
Agropyron spicatum	21	88	70	99
Poa bulbosa	**13**	**72**	**0**	**0**
Poa secunda	10	92	18	99
PERENNIAL FORBS				
Allium acuminatum	2	60	5	70
Balsamorhiza sagittata	5	8	+	2
Lithophragma bulbifera	1	28	2	70
Lomatium sp.	+	20	0	0
Lupinus sp.	1	4	0	0
ANNUALS AND BIENNIALS				
Agoseris heterophylla	0	0	1	28
Amsinckia retrorsa	+	8	0	0
Arabidopsis thaliana	**0**	**0**	**1**	**30**
Bromus brizaeformis	+	20	1	22
Bromus japonicus	**0**	**0**	+	**18**
Bromus mollis	**3**	**76**	**0**	**0**
Bromus tectorum	**8**	**60**	**3**	**99**
Descurainia sp.	+	16	0	0
Draba verna	**9**	**100**	**10**	**99**
Epilobium brachycarpum	1	40	0	0
Erodium cicutarium	+	**8**	**0**	**0**
Festuca microstachys	5	56	1	30
Idahoa scapigera	0	0	+	2
Lactuca serriola	+	**4**	**1**	**28**
Lithospermum arvense	+	**8**	+	**2**
Madia gracilis	+	8	0	0
Myosotis micrantha	+	**8**	0	0
Polygonum sp.	+	4	0	0
Tragopogon dubius	+	**8**	+	**8**
Verbenata dubia	+	**4**	0	0
Vicia villosa	7	**88**	0	0

Table 7. Frequency and coverage of vascular plant taxa at Colfax site in spring 1998 with coverage along Daubenmire transect in adjacent section in 1963. Taxa shown in bold type are non-native. + indicates coverage value ≤0.5%. N=25 subplots for 1998 data and 40 subplots for 1963 data. Information on 1963 coverage is from Daubenmire (1970) and field notebooks of Rexford Daubenmire, housed in Washington State University's Manuscripts, Archives, and Special Collections.

Stand: Waha; Association: *Agropyron spicatum-Poa secunda* [=*sandbergii*] scabland (Johnson and Simon 1987); T33N R4W S4, Nez Perce County, Idaho; Ownership: Private.

	Apr. 20, Jun. 8, 1998	
LOW SHRUBS	% Coverage	% Frequency
Symphoricarpos albus	1	4
PERENNIAL GRAMINOIDS		
Agropyron spicatum	47	96
Danthonia intermedia	5	48
Festuca idahoensis	+	4
Poa secunda	1	28
PERENNIAL FORBS		
Astragalus sheldonii	3	32
Balsamorhiza incana	2	12
Brodiaea douglasii	+	8
Lithophragma bulbifera	3	84
Lomatium cous	4	72
Lupinus sericeus	4	8
Orobanche uniflora var. purpurea	+	4
Ranunculus glaberrimus	+	4
Scutellaria angustifolia	3	48
Sisyrinchium inflatum	27	92
ANNUALS		
Amsinckia retrorsa	+	4
Arabidopsis thaliana	+	**16**
Arenaria serpyllifolia	+	20
Bromus sp.	+	**4**
Collinsia parviflora	1	28
Draba verna	**1**	**48**
Epilobium brachycarpum	+	20
Galium pedemontanum	+	**4**
Lactuca serriola	+	**8**
Myosotis micrantha	**1**	**56**
Phlox gracilis ssp. gracilis	1	36
Polygonum sp.	2	40
Stellaria sp.	1	4
Tragopogon dubius	+	**8**
Ventenata dubia	**9**	**88**

Table 8. Frequency and coverage of vascular plant taxa at Waha site in spring 1998. Taxa shown in bold type are non-native. + indicates coverage value ≤0.5%. N=25 subplots.

Stand: Smoothing Iron Ridge; Association: *Agropyron spicatum-Festuca idahoensis*; (Daubenmire 1970); T9N R43E S36, Asotin County, Washington; Ownership: Washington Department of Natural Resources.

	May 5, Jun. 19, 1998	
LOW SHRUBS	% Coverage	% Frequency
Eriogonum heracleoides	4	24
Phlox speciosa	1	12
PERENNIAL GRAMINOIDS		
Agropyron spicatum	40	100
Festuca idahoensis	9	72
Poa cusickii	5	40
Poa secunda	8	88
PERENNIAL FORBS		
Achillea millefolium	+	4
Astragalus sheldonii	4	52
Balsamorhiaza sagittata	3	8
Balsamorhiza serrata	9	60
Brodiaea sp.	+	4
Calochortus elegans	+	8
Castilleja thompsonii	1	8
Crepis sp.	+	12
Delphinium nuttalianum	1	36
Fritillaria pudica	+	4
Lithophragma bulbifera	1	40
Lomatium cous	3	56
Lomatium triternatum	5	56
Lupinus sulphureus var. sulphureus	4	28
Lupinus sp.	+	4
Sedum sp.	+	8
Senecio integerrimus exaltata	1	4
Sisyrinchium sp	+	4
ANNUALS AND BIENNIALS		
Alyssum alyssoides	**1**	**40**
Bromus brizaeformis	**1**	**48**
Bromus mollis	**1**	**28**
Bromus tectorum	**+**	**4**
Clarkia pulchella	4	48
Collinsia parviflora	2	72
Draba verna	**2**	**72**
Galium aparine	+	4
Holosteum umbellatum	1	32
Lactuca serriola	**+**	**8**
Myosotis micrantha	**2**	**96**
Phlox gracilis ssp. gracilis	1	44

Table 9. Frequency and coverage of vascular plant taxa at Smoothing Iron Ridge site in spring 1998. Taxa shown in bold type are non-native. + indicates coverage value ≤0.5%. N=25 subplots.

Stand: Paradise Ridge; Association: *Festuca idahoensis Symphoricarpos albus* Daubenmire (1970); T38N R5W S4, Latah County, Idaho; Ownership: Private.

	Jul 27, 1998	
MEDIUM SHRUBS	% Coverage	% Frequency
Crataegus douglasii	4	4
Prunus virginiana	2	20
LOW SHRUBS		
Eriogonum heracleoides	1	8
Rosa nutkana/woodsii	4	24
Spiraea betulifolia	21	64
Symphoricarpos albus	30	92
PERENNIAL GRAMINOIDS		
Agropyron spicatum	19	48
Carex sp.	2	4
Poa secunda	+	4
PERENNIAL FORBS		
Achillea millefolium var. lanulosa	3	28
Balsamorhiza sagittata	3	4
Besseya rubra	1	4
Helianthella uniflora var. douglasii	12	36
Lomatium dissectum var. multifidum	2	8
Lomatium sp.	1	4
Solidago missouriensis	5	24
Zigadenus venenosus var. gramineus	+	8
ANNUALS		
Agoseris heterophylla	+	4
Agrostis interrupta	+	**20**
Alyssum alyssoides	+	**4**
Bromus japonicus	**14**	**96**
Collomia linearis	+	12
Cryptantha sp.	2	24
Epilobium brachycarpum	16	100
Galium aparine	3	24
Lactuca serriola	+	**8**
Madia gracilis	1	24
Phlox gracilis ssp. gracilis	+	4
Polygonum convolvulus	+	**4**
Tragopogon dubius	+	**4**
Ventenata dubia	+	**20**

Table 10. Frequency and coverage of vascular plant taxa at Paradise Ridge site in July 1998. Taxa shown in bold type are non-native. + indicates coverage value ≤0.5%. N=25 subplots.

Reconnaissance surveys

The results of our reconnaissance surveys (Table 11, Appendix 2) also indicate that exotic species are widespread and varied in Palouse and Canyon grasslands. The alien taxa are primarily annual grasses—such as rattlesnake brome (*Bromus brizaeformis*), cheatgrass (*B. tectorum*), other annual bromes, ventenata, and interrupted apera (*Agrostis interrupta*)—or forbs, such as yellow star-thistle, common St. John's-wort (*Hypericum perforatum)*, Canada thistle (*Cirsium arvense*), field morning-glory, prickly lettuce (*Lactuca serriola*), erect cinquefoil, and hairy vetch (*Vicia villosa*). On mesic sites, such as Spaulding Road, Reubens Cemetery, and Chief Old Joseph Monument, Kentucky bluegrass (*Poa pratensis*) is widespread, whereas on drier sites such as Knotgrass Ridge, Chief Joseph Wildlife Area, and Wawawai Canyon, annual bromes and yellow star-thistle are problematic. Relatively recent invaders such as white bryony, *Bryonia alba* (Engle 1988), yellow star-thistle, and bur chervil (*Anthriscus caucalis*) are of particular concern.

At Kamiak Butte County Park we were able to compare species lists from 1933, 1979, and 1998 (Table 12). These data indicate that new alien taxa continue to appear at Kamiak Butte. In 1933 Mullen listed 17 alien taxa present at "Kamiak Mountain"; an additional 23 non-native taxa were reported at Kamiak Butte by Fiely in 1979. Twenty-four additional alien taxa have since been recorded in the park (Table 12, Jim Croft and Jim Roberts, personal communications). These lists include both the forest and the grassland habitats of the butte; however, most of the exotic species occur in the grassland.

Recommendations

Conservation sites

The Palouse Land Trust has begun contacting landowners of priority conservation sites we identified. We recommend that this work be continued. Using the information provided by this study, land trust members should discuss the unique values that give the landowner's property its high conservation value, inform the landowner of options for voluntary protection (e.g., establishment of a conservation easement restricting development rights, donation of property to a land trust) and the tax benefits of such agreements to the landowner, and offer assistance to landowners who wish to consider private conservation agreements.

Some sites that were not identified as priority conservation sites in our analysis because of their small size nevertheless merit consideration because of the presence of two or more rare plant taxa. Two of our reconnaissance sites, Spaulding Road and Reubens Cemetery, are in this category. The Spaulding site was recommended for protection by Gamon and Lorain (1991).

A. Kamiak Butte County Park

Date: Jul. 28, 1998	Stand #: Association		
SHRUBS	*1: Syal phase*	*2: Agsp-Feid*	*3: Agsp-Pose*
Prunus emarginata	1	0	0
Spiraea betulifolia	1	1	0
Symphoricarpos albus	5	1	0
PERENNIAL GRAMINOIDS			
Agropyron spicatum	0	5	3
Festuca idahoensis	0	2	0
Poa secunda	0	0	1
PERENNIAL FORBS			
Achillea millefolium	2	1	1
Antennaria luzuloides	0	0	1
Arenaria capillaris	0	0	1
Balsamorhiza sagittata	1	2	0
Calochortus maculosus	0	1	0
Cirsium brevifolium	1	0	0
Geranium viscosissimum	1	0	0
Helianthella uniflora	2	1	0
Haplopappus carthamoides	0	1	0
Hieracium albertinum	1	0	0
Lithospermum ruderale	1	0	0
Lomatium dissectum	1	2	0
Lomatium grayi	0	0	1
Lupinus sericeus	0	1	0
Potentilla gracilis	1	1	0
Wyethia amplexicaule	0	1	0
Zigadenus venenosus	0	1	0
ANNUALS AND BIENNIALS			
Agrostis interrupta	**0**	**1**	**0**
Bromus japonicus	**2**	**1**	**1**
Bromus tectorum	**1**	**0**	**0**
Clarkia pulchella	0	1	0
Epilobium brachycarpum	1	1	1
Festuca microstachys	0	0	1
Lactuca serriola	**1**	**0**	**1**
Tragopogon sp.	**0**	**0**	**1**
Ventenata dubia	**0**	**1**	**2**

Table 11. Reconnaissance plot data for selected sites. A: Kamiak Butte County Park, B: Mary Minerva McCroskey Memorial State Park, C: Wawawai Road, D. Spaulding Road, E. Knotgrass Road, F. Chief Joseph Wildlife Area. Agsp=*Agropyron spicatum*, Arri =*Artemisia rigida*, Feid=*Festuca idahoensis*, Fesc=*Festuca scabrella*, Pipo=*Pinus ponderosa*, Pose=*Poa secunda*, *Rosa=Rosa nutkana/woodsii*, Syal=*Symphoricarpos albus*. Numbers represent coverage classes (1=0-5%, 2=5-25%, 3=25-50%, 4=50-75%, 5=75-95%, 6=95-100%) in a single 5 x 5-m plot. See Appendices 1 and 2 for locations and descriptions of reconnaissance sites.

B. Mary Minerva McCroskey Memorial State Park

Date: Jul. 31, 1998	Stand #: Association			
SHRUBS	*1: Agsp-Feid*	*2: Agsp-Pose*	*3: Feid-Fesc*	*4: Pipo-Syal*
Eriogonum heracleoides	1	1	1	2
Spiraea betulifolia	2	0	2	1
Phlox sp.	1	0	1	3
Symphoricarpos albus				
PERENNIAL GRAMINOIDS				
Agropyron spicatum	1	3	1	1
Festuca idahoensis	3	0	2	0
Festuca scabrella	0	0	2	0
Poa secunda	1	1	1	1
PERENNIAL FORBS				
Achillea millefolium	1	1	1	1
Arenaria capillaris	1	0	1	0
Balsamorhiza sagittata	3	2	2	2
Lomatium sp.	1	1	2	0
Silene sp.	0	0	1	0
ANNUALS AND BIENNIALS				
Alyssum alyssoides	**0**	**0**	**0**	**1**
Arenaria serpyllifolia	**0**	**0**	**0**	**1**
Bromus sp.	**0**	**1**	**0**	**2**
Collomia sp.	0	0	0	1
Epilobium brachycarpum	0	0	0	1
Lactuca serriola	**0**	**1**	**0**	**0**
Polygonum majus	0	0	0	1
Tragopogon sp.	**0**	**1**	**0**	**1**
Ventenata dubia	**1**	**2**	**0**	**3**
Vicia villosa	**0**	**0**	**0**	**1**

C. Wawawai Road

Date: Aug. 3, 1998	Stand # : Association
SHRUBS	*1: Rosa phase*
Rosa woodsii	3
PERENNIAL FORBS	
Anthriscus caucalis	**1**
Hyericum perforatum	**2**

Table 11. Continued.

D. Spaulding Road

Date: Aug. 4, 1998	Stand #: Association
SHRUBS	*1: Feid/Syal*
Rosa woodsii/nutkana	1
Symphoricarpos albus	2
PERENNIAL GRAMINOIDS	
Agropyron spicatum	3
Koeleria cristata	1
Poa pratensis	**1**
PERENNIAL FORBS	
Achillea millefolium	1
Anthriscus caucalis	**3**
Balsamorhiza sagittata	2
Frasera albicaulis	1
Galium boreale	1
Geranium viscosissimum	2
Haplopappus liatriformis	1
Hieracium albertinum	1
Hypericum perforatum	**1**
Iris missouriensis	2
Lithospermum ruderale	2
Lomatium sp.	1
Lupinus sericeus	1
ANNUALS	
Agrostis interrupta	**1**
Bromus japonicus	**1**
Lactuca serriola	**1**

E. Knotgrass Road

Aug. 14, 1998	Stand #: Association		
	1. Agsp-Pose	*2. Agsp-Pose*	*3. Arri/Pose*
SHRUBS		highly disturbed	
Artemisia rigida	0	0	1
Chrysothamnus nauseosus	1	2	2
PERENNIAL GRAMINOIDS			
Agropyron spicatum	1	0	1
Poa secunda	1	1	1
PERENNIAL SHRUBS			
Achillea millefolium	2	2	1
Hypericum perforatum	**1**	0	0
Helianthus annuus	1	1	0
ANNUALS			
Bromus sp.	**3**	**3**	**1**
Epilobium brachycarpum	1	1	0
Euphorbia sp.	1	1	0
Lactuca serriola	**1**	**0**	**0**
Lagophylla ramosissima	1	1	0
Sisymbrium altissimum	**1**	**0**	**0**
Verbascum blattaria	**1**	**0**	**0**

Table 11. Continued.

F. Chief Joseph Wildlife Area

Aug. 17, 1998	Stand #: Association		
	Agsp-Feid	*Agsp-Pose*	*Agsp-Feid*
SHRUBS		highly disturbed	
Phlox sp.	0	0	1
PERENNIAL GRAMINOIDS			
Agropyron spicatum	4	1	1
Festuca idahoensis	0	0	1
Poa secunda	0	0	1
Sitanion hystrix	0	1	0
PERENNIAL FORBS			
Achillea millefolium	1	0	1
Apocynum cannabinum	1	1	0
Arenaria capillaris	0	0	1
Centaurea solstitialis	**0**	**5**	**0**
Cirsium undulatum	0	1	0
Epilobium brachycarpum	1	0	0
Grindelia squarrosa var. squarrosa	**0**	**1**	**0**
Helianthella uniflora	0	1	0
Hypericum perforatum	**1**	**1**	**1**
Lithospermum ruderale	1	0	0
Lupinus sp.	1	0	1
ANNUALS			
Agrostis interrupta	1	0	0
Alyssum alyssoides	**1**	**1**	0
Amsinckia sp	0	0	1
Bromus japonicus	**1**	**0**	**1**
Lactuca serriola	**1**	**0**	**1**
Madia sp.	0	0	1

Table 11. Continued.

1933	1979	1998
Anthemis arvensis	*Alyssum alyssoides*	*Agrostis interrupta*
Bromus brizaeformis	*Anthemis cotula*	*Anthriscus caucalis*
Bromus hordeaceus [=mollis]	*Bromus japonicus*	*Aquilegia sp. (cultivar)*
Bromus tectorum	*Capsella bursa-pastoris*	*Arctium minus*
Cerastium vulgatum	*Cerastium tomentosum*	*Artemisia absinthium*
Cirsium lanceolatum [=vulgare]	*Dactylis glomerata*	*Asperugo procumbens*
Draba verna	*Digitalis purpurea*	*Bryonia alba*
Erodium cicutarium	*Dipsacus sylvestris*	*Campanula rapunculoides*
Malva rotundifolia [=neglecta]	*Elymus caput-medusae*	*Centaurea solstitialis*
Marrubium vulgare	*Hypericum perforatum*	*Chrysanthemum leucanthemum*
Nepeta cataria	*Myosotis micrantha*	*Cirsium arvense*
Rumex acetosella	*Phleum pratense*	*Convolvulus arvensis*
Sisymbrium altissimum	*Plantago major*	*Cynoglossum officinale*
Spergularia rubra	*Poa bulbosa*	*Hesperis matrionalis*
Thlaspi arvense	*Poa pratensis*	*Lactuca serriola*
Valerianella macrocera	*Polygonum convolvulus*	*Linaria dalmatica*
Verbascum thapsus	*Stellaria media*	*Lithospermum arvense*
	Tanacetum vulgare	*Papaver argemone*
	Taraxacum officinale	*Phleum pratense*
	Tragopogon dubius	*Plantago lanceolata*
	Trifolium hybridum	*Plantago major*
	Trifolium repens	*Sonchus asper*
	Vicia villosa	*Ventenata dubia*
		Veronica officianalis

Table 12. Non-native vascular plant taxa first reported at Kamiak Butte in 1933, 1979, and 1998. Based on data in Mullen (1933), Fiely (1979), and J. Roberts and J. Croft, personal communications. Note that rate at which new alien taxa being discovered at Kamiak Butte has shown no tendency to level off.

Monitoring

A major consideration in selecting the procedure we used to sample vegetation along our monitoring transects was the fact that we sought to repeat as precisely as possible the methods used by Daubenmire (1970), so that our results could be compared to his in order to assess changes in vegetation over a time scale of several decades. This method—recording all vascular plant taxa in small subplots spaced at 0.5-m or 1.0-m intervals along 20-m or 25-m transects—has both advantages and disadvantages. Its advantages are that it provides very detailed information on community composition along the transect and can be repeated periodically to obtain precise information on changes in community composition. Its disadvantages are that it is very time-consuming and provides information over only a very small area. We recommend that sampling along the monitoring transects be repeated at 5-year or 10-year intervals to track changes in community composition and that this be combined with photomonitoring to provide information on changes over a larger spatial scale. Repeated sampling along the monitoring transects at shorter intervals is unlikely to justify the effort that would be required.

Stewardship

It is clear that exotic species are a serious threat to Palouse Grassland and Canyon Grassland remnants. Further studies should be conducted to assess the effectiveness of different practices for minimizing this threat. Field studies in 1999 should focus on the five monitored sites for three reasons: 1) we have good baseline data for these sites; 2) the owners of these sites are supportive of this study, 3) the five sites all contain at least some areas with native vegetation in moderately good condition but are threatened to varying degrees by non-native species, so they present an excellent opportunity to study methods of protecting and restoring native grasslands. Experiments should be set up to test the effectiveness of a variety of treatments to control non-native species (e.g., herbicide application, hand-weeding) and to restore native vegetation (e.g., inoculation with soil microorganisms). The latter approach is particularly promising because in prairie soils, microorganisms affect soil structure, stability, and nutrient status and enhance seedling establishment. Consequently, they are extremely important in the restoration of disturbed steppe communities (Dhillion and Friese 1992; Belnap 1993, 1994).

Literature Cited

Bailey, R. G., compiler. 1995. Description of the ecoregions of the United States, 2nd edition. USDA Forest Service, Miscellaneous Publication 1391. Washington, D.C. 108 pp. + map.

Belnap, J. 1993. Recovery rates of cryptobiotic crusts: Inoculant use and assessment methods. Great Basin Nat. 53:89-95.

Belnap, J. 1994. Potential role of cryptobiotic soil crusts in semiarid rangelands. Pp. 179-185 *in* S. B. Monsen and S. G. Kitchen, eds. Proceedings--Ecology and Management of Arid Rangelands. USDA Forest Service, General Technical Report INT-GTR-313.

Buss, I. O. and E. S. Dziedzic. 1955. Relation of cultivation to the disappearance of the Columbian sharp-tailed grouse from southeastern Washington. Condor 57:185-187.

Daubenmire, R. F. 1940. Plant succession due to overgrazing in the *Agropyron* bunchgrass prairies of southeastern Washington. Ecology 21:55-64.

Daubenmire, R. 1942. An ecological study of the vegetation of southeastern Washington and adjacent Idaho. Ecol. Monogr. 12:53-79.

Daubenmire, R. F. 1968. Plant communities. Harper and Row, New York. 300 pp.

Daubenmire, R. F. 1970. Steppe vegetation of Washington. Washington Agricultural Experiment Station, Wash. St. Univ., Tech. Bull. 62.

Daubenmire, R. 1978. Plant geography. Academic Press, New York. 338 pp.

Dhillion, S. S. and C. F. Friese. 1992. The occurrence of mycorrhizas in prairies: Application to ecological restoration. Pp. 103-114 *in* R. G. Wickett, P. D. Lewis, A. Woodliffe, and P. Pratt, eds. Proceedings of the Thirteenth North American Prairie Conference: Spirit of the Land, Our Prairie Legacy. Dept. Parks and Recreation, Windsor, Ontario.

Engle, J. L. 1988. The spread and effect of the vine *Bryonia alba* in Whitman County, Washington. M.S. thesis, Wash. St. Univ., Pullman. 76 pp.

Fiely, J. R. 1979. Floristic study of Kamiak Butte, M.S. thesis, Wash. St. Univ., Pullman. 95 pp.

Franklin, J. F. and C. T. Dyrness. 1988. Natural vegetation of Oregon and Washington. Oregon State Univ. Press, 452 pp.

Hill, J. 1995a. Vegetation analysis and botanical survey for Wapshilla Ridge Research Natural Area/Area of Critical Environmental Concern, Craig Mountain, Idaho. Unpublished report for the USDI Bureau of Land Management on file at Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 50 pp + appendices.

Hill, J. 1995b. Vegetation analysis and botanical survey for Captain John Creek Research Natural Area/Area of Critical Environmental Concern, Craig Mountain, Idaho. Unpublished report for the USDI Bureau of Land Management on file at Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 72 pp. + appendices.

Hill, J. 1996. Alien plant species and botanical inventory/vegetation mapping of China Garden Creek at the Garden Creek Ranch, Craig Mountain, Idaho. Unpublished report for the USDI Bureau of Land Management on file at Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 79 pp. + appendices.

Hill, J. and K. Gray. 1998a. Alien and rare plant inventory and vegetation mapping, Upper Corral Creek, Garden Creek Ranch, Idaho. Unpublished report for the USDI Bureau of Land Management on file at Department of Fish and Game, Conservation Data Center, Boise, ID. 57 pp. + appendices.

Hill, J. and K. Gray. 1998b. Alien and rare plant inventory and vegetation mapping, Lower Corral Creek and the North Benches, Garden Creek Ranch, Idaho. Unpublished report for the USDI Bureau of Land Management on file at Department of Fish and Game, Conservation Data Center, Boise, ID. 74 pp. + appendices.

Idaho Natural Heritage Program, Oregon Natural Heritage Data Base, and Washington Natural Heritage Program. 1986. Final report, Phase I, 1986 National Natural Landmarks Program, Pacific Northwest Region, National Park Service. Unpublished report on file at Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 48 pp.

Johnson, C. G. and S. A. Simon. 1987. Plant associations of The Wallowa-Snake Province, Wallowa-Whitman National Forest. USDA Forest Service, Pacific Northwest Region, R6-ECOL-TP-225A-86.

Lichthardt, J. 1997. Revised report on the conservation status of *Silene spaldingii* in Idaho. Unpublished report for the USDI Fish and Wildlife Service on file at Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 19 pp. + appendices.

Lichthardt, J. and R. K. Moseley. 1997. Status and conservation of the Palouse grassland in Idaho. Idaho Department of Fish and Game. 28 pp. + appendices.

Lorain, C. C. 1991a. Report on the conservation status of *Aster jessicae*, in Idaho and Washington. Unpublished report for the Idaho Department of Parks and Recreation

on file at Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 57 pp. + appendices.

Lorain, C. C. 1991b. Report on the conservation status of *Silene spaldingii*, in Idaho. Unpublished for the Idaho Department of Parks and Recreation on file at Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 29 pp. + appendices.

Gamon, J. and C. Lorain. 1991. Report on the status of *Haplopappus liatriformis* (Greene) St. John. Unpublished report for the USDI Fish and Wildlife Service, on file at Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 29 pp. + appendices.

Mancuso, M. and R. Moseley. 1994. Vegetation description, rare plant inventory and vegetation monitoring for Craig Mountain, Idaho. USDOE Bonneville Power Administration Division of Fish and Wildlife, Contract No. DE-FG79-92BP62547. 146 pp. + appendices.

Mueggler, W. F. and W. L. and Stewart. 1980. Grassland and shrubland habitat types of western Montana. USDA Forest Service Intermountain Forest and Range Experiment Station Gen. Tech. Rep. INT-66..

Mullen, L. A. 1933. An ecological survey of Kamiak Butte. Ph.D. thesis, Wash. St. Univ., Pullman. St. Coll. Wash. 52 pp.

Noss, R. F., E. T. LaRoe III, and J. M. Scott. 1995. Endangered ecosystems of the United States: A preliminary assessment of loss and degradation. USDI National Biological Service, Biological Report 28. Washington, D.C. 58 pp.

Poulton, C. E. 1955. Ecology of the non-forested vegetation in Umatilla and Morrow Counties, Oregon. Ph.D. thesis, St. Coll. Wash. 166 pp.

The Nature Conservancy, Idaho Natural Heritage Program, and Oregon Natural Heritage Database. 1987. Final Report, Phase I, 1987 National Natural Landmarks Program, Pacific Northwest Region, National Park Service. Unpublished report on file at Idaho Department of Fish and Game, Conservation Data Center, Boise, ID. 47 pp.

Thiele, S. A. and J. M. Omernik. 1993. Subregions of the Columbia Plateau Ecoregion. Draft. Unpublished manuscript on file at USDI Environmental Protection Agency, Corvallis. 19 pp. + maps.

Tisdale, E. W. 1961. Ecologic changes in the Palouse. Northwest Sci. 35:134-138.

Tisdale, E. W. 1983. Grasslands of western North America: The Pacific Northwest Bunchgrass. Pp. 223-245 *in* A. C. Nicholson, A. McLean, and R, E, Baker, eds. Grassland ecology and classification symposium proceedings, Ministry of Forest, Province of British Columbia, Victoria, BC.

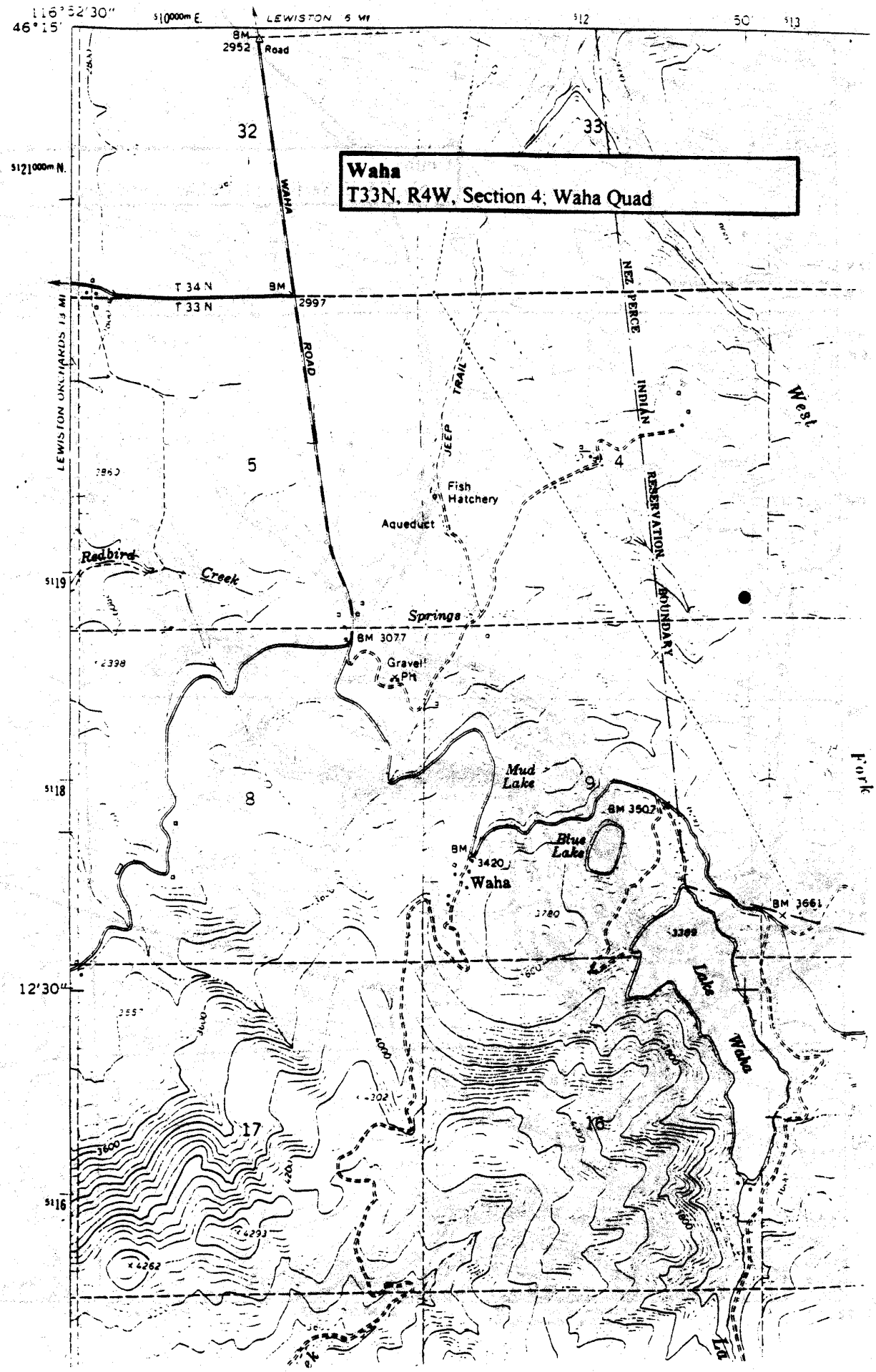
Tisdale, E. W. 1986. Canyon grasslands and associated shrublands of west-central Idaho and adjacent areas. Forest, Wildlife, and Range Experiment Station, Univ. Idaho. Bulletin No. 40.

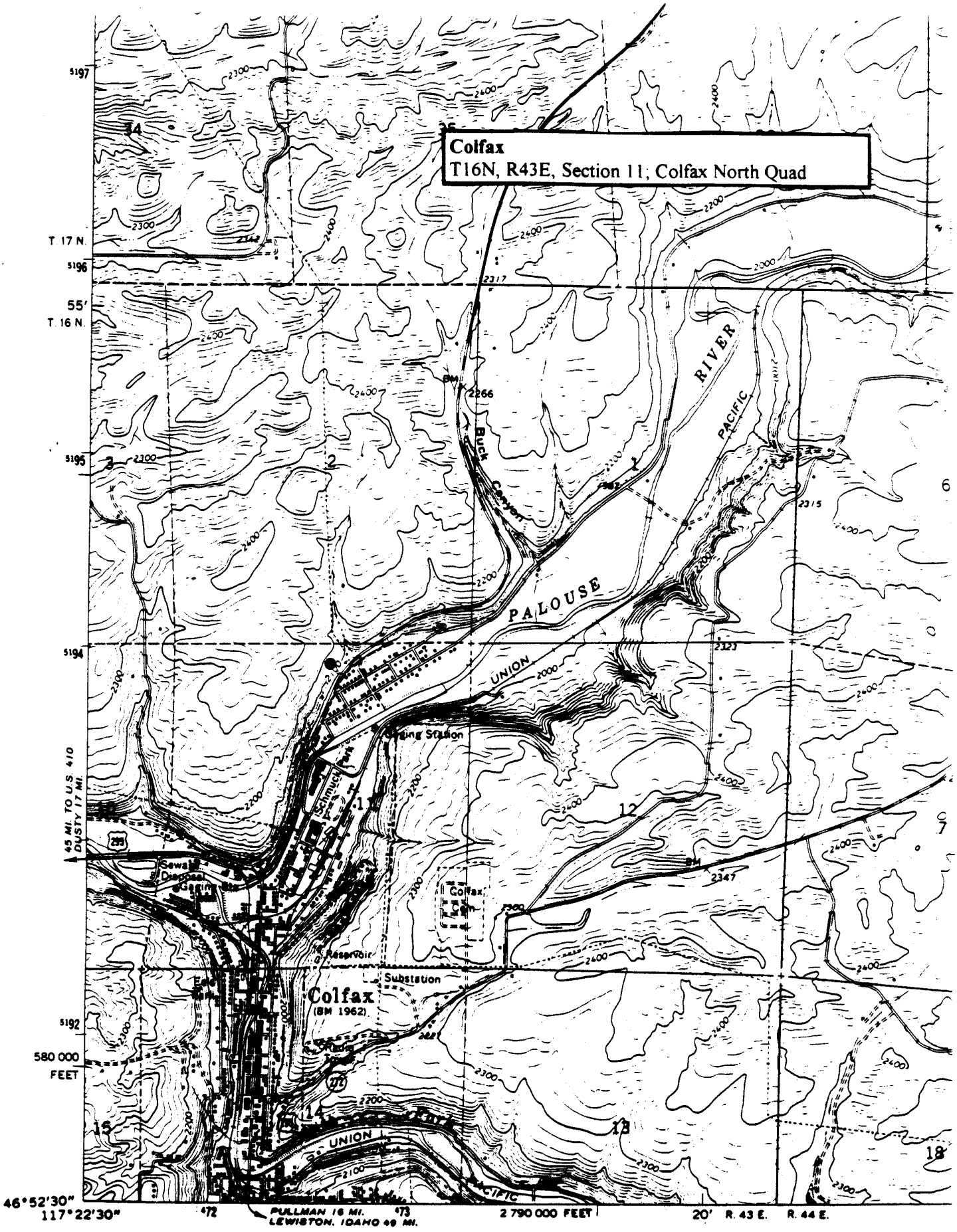
Young, V. A. 1943. Changes in vegetation and soil of Palouse prairie caused by overgrazing. J. Forestry 41:834-838.

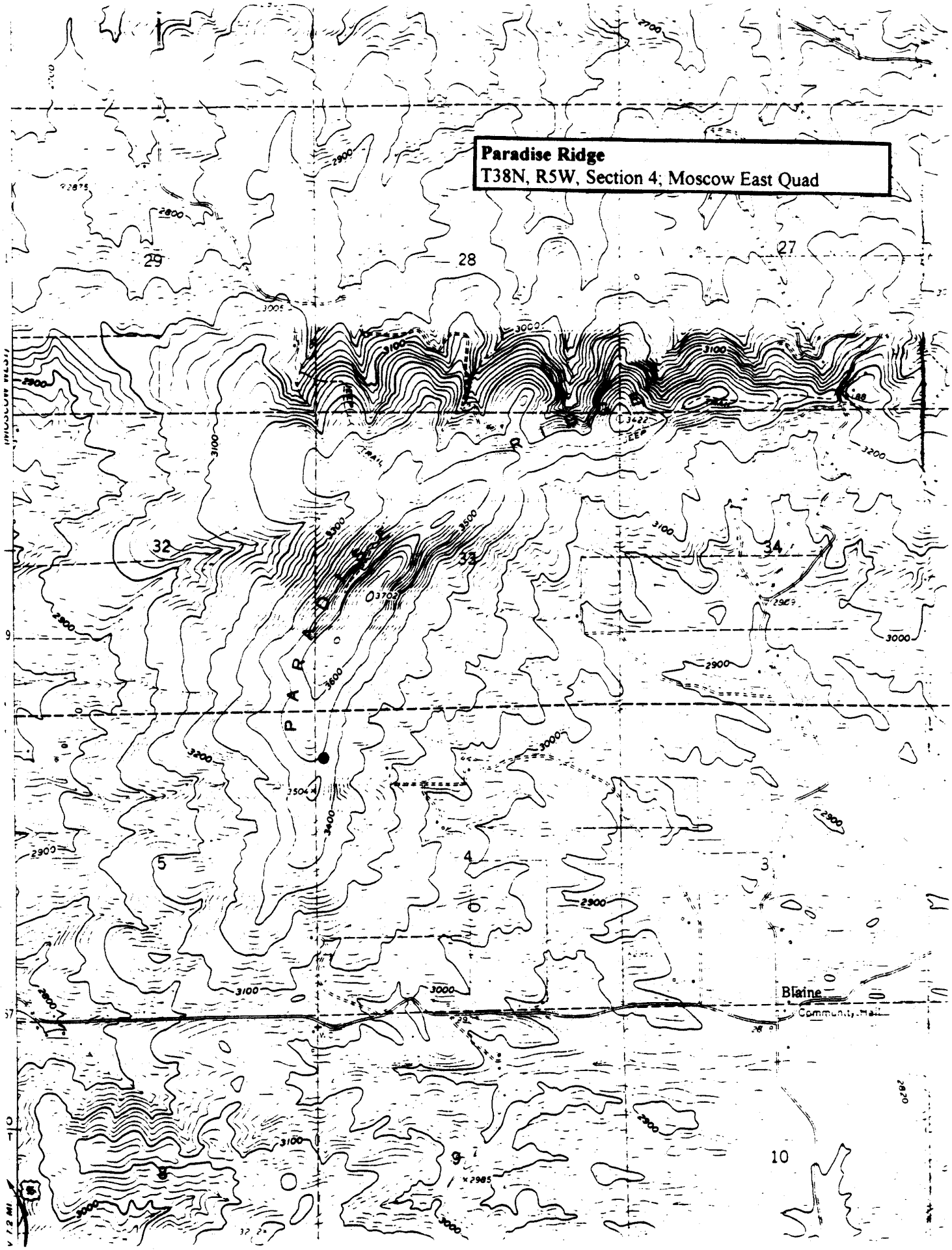
Tisdale, E. W. 1986. Canyon grasslands and associated shrublands of west-central Idaho and adjacent areas. Forest, Wildlife, and Range Experiment Station, Univ. Idaho. Bulletin No. 40.

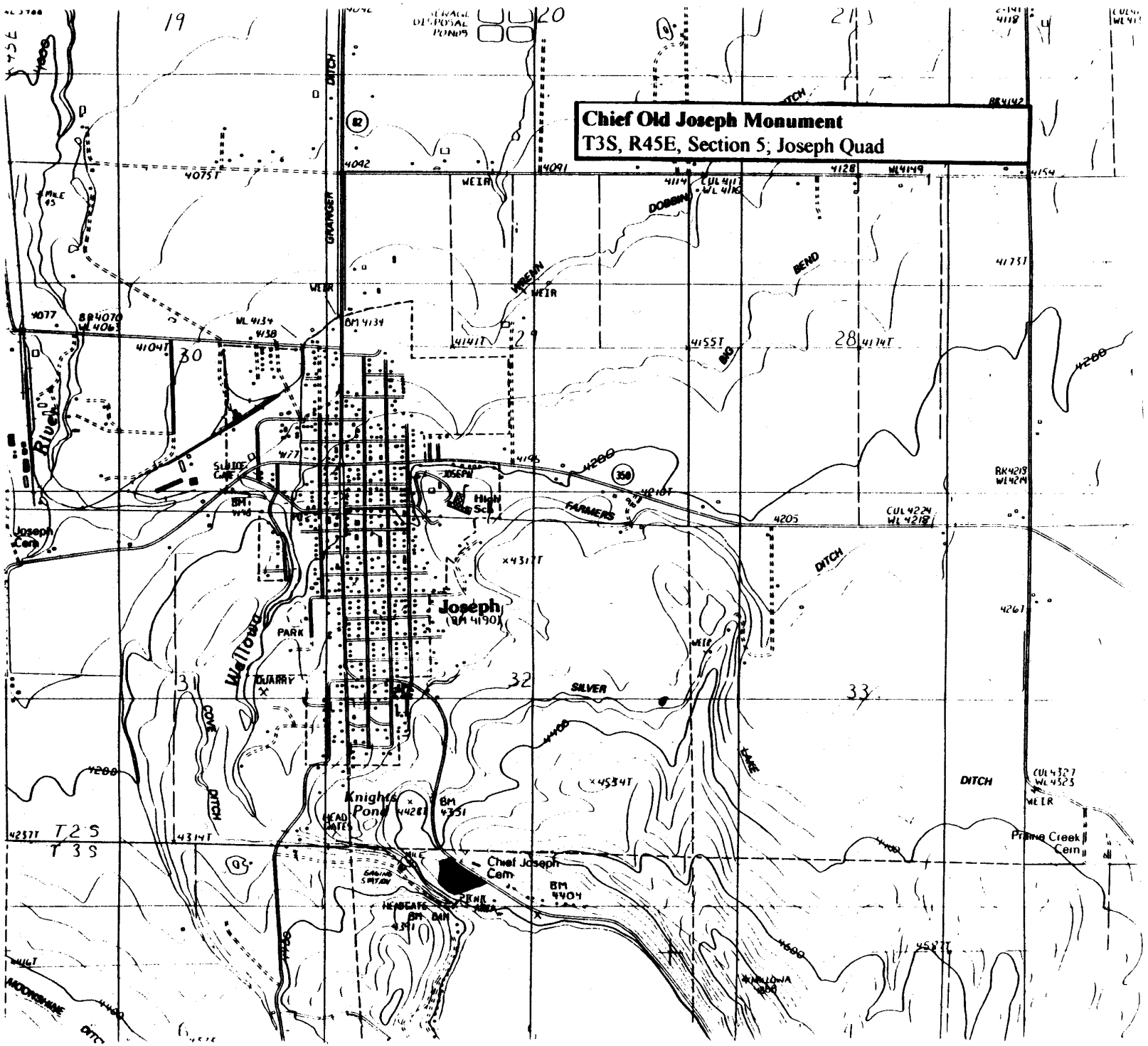
Young, V. A. 1943. Changes in vegetation and soil of Palouse prairie caused by overgrazing. J. Forestry 41:834-838.

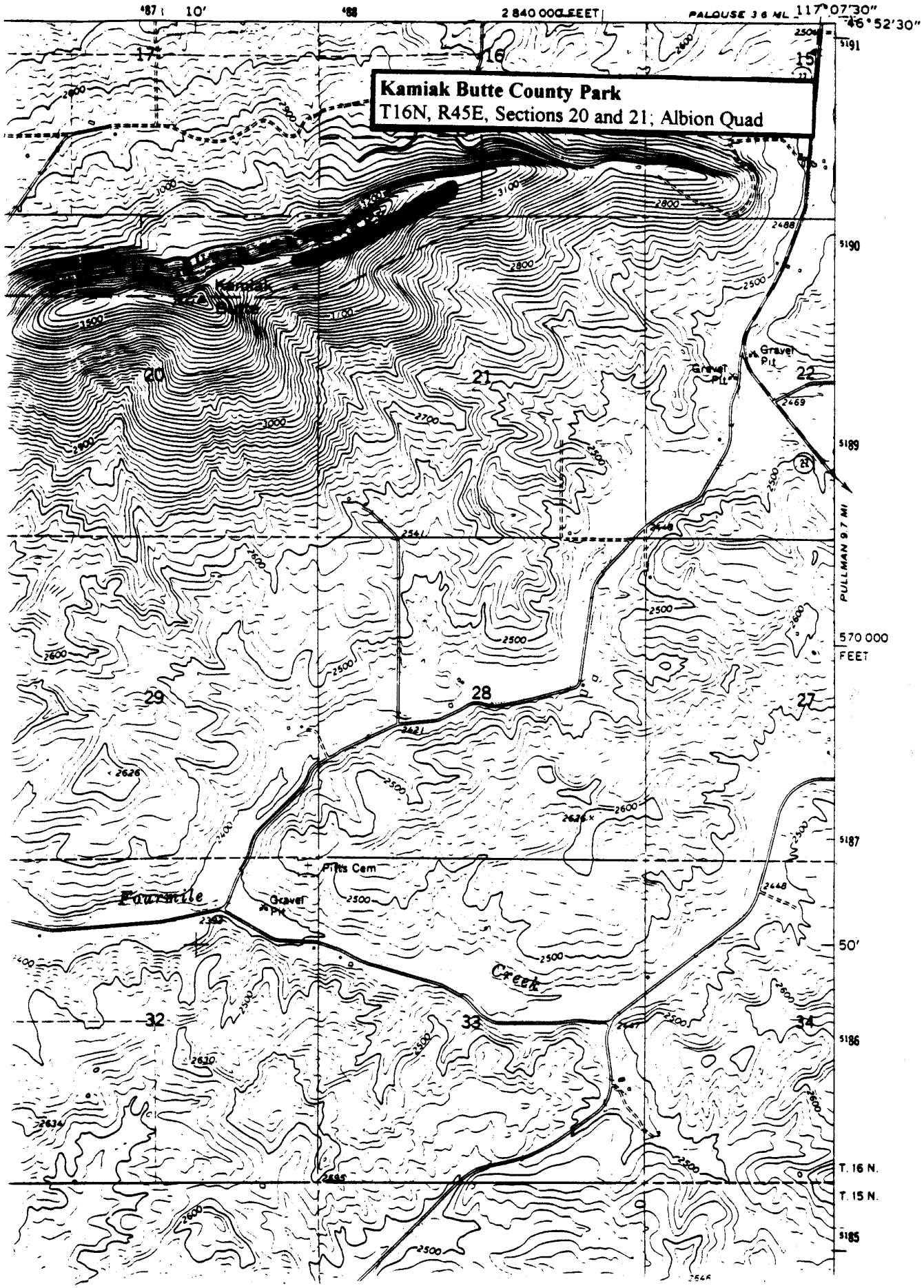
Appendix 1: Topographic Maps Showing Locations of Transects at Monitor Sites and Areas Surveyed at Reconnaissance Sites

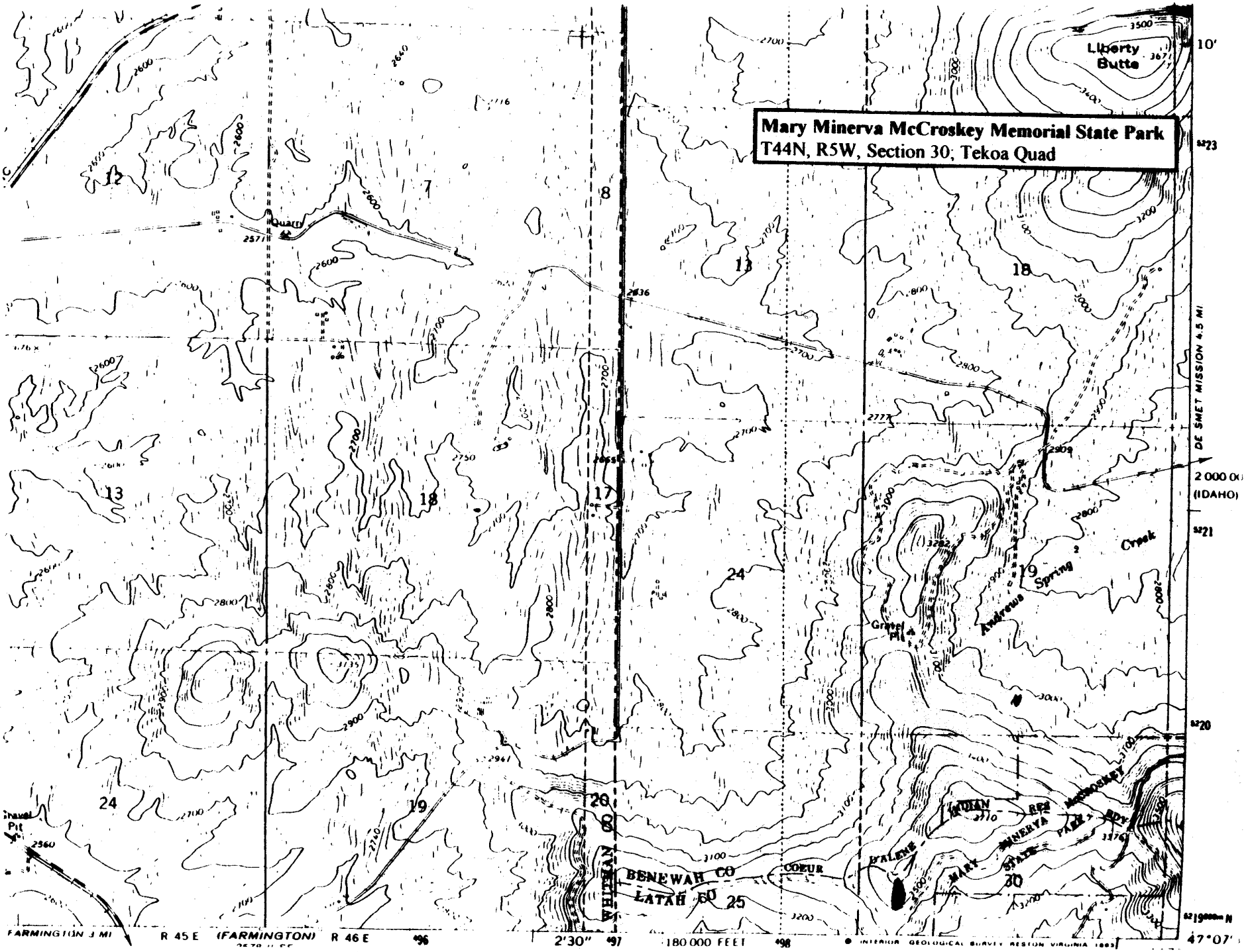

Waha
T33N, R4W, Section 4; Waha Quad
116°52'30"
46°15'
LEWISTON 5 MI
BM 2952
Road
32
33
WAHA
ROAD
T 34 N
T 33 N
BM 2997
NEZ PERCE
INDIAN
RESERVATION
BOUNDARY
JEEP
TRAIL
West
Fork
5
4
Fish Hatchery
Aqueduct
Redbird
Creek
Springs
BM 3077
Gravel Pit
8
9
Mud Lake
BM 3502
Blue Lake
BM 3420
Waha
BM 3661
Lake Waha
17
16
12'30"

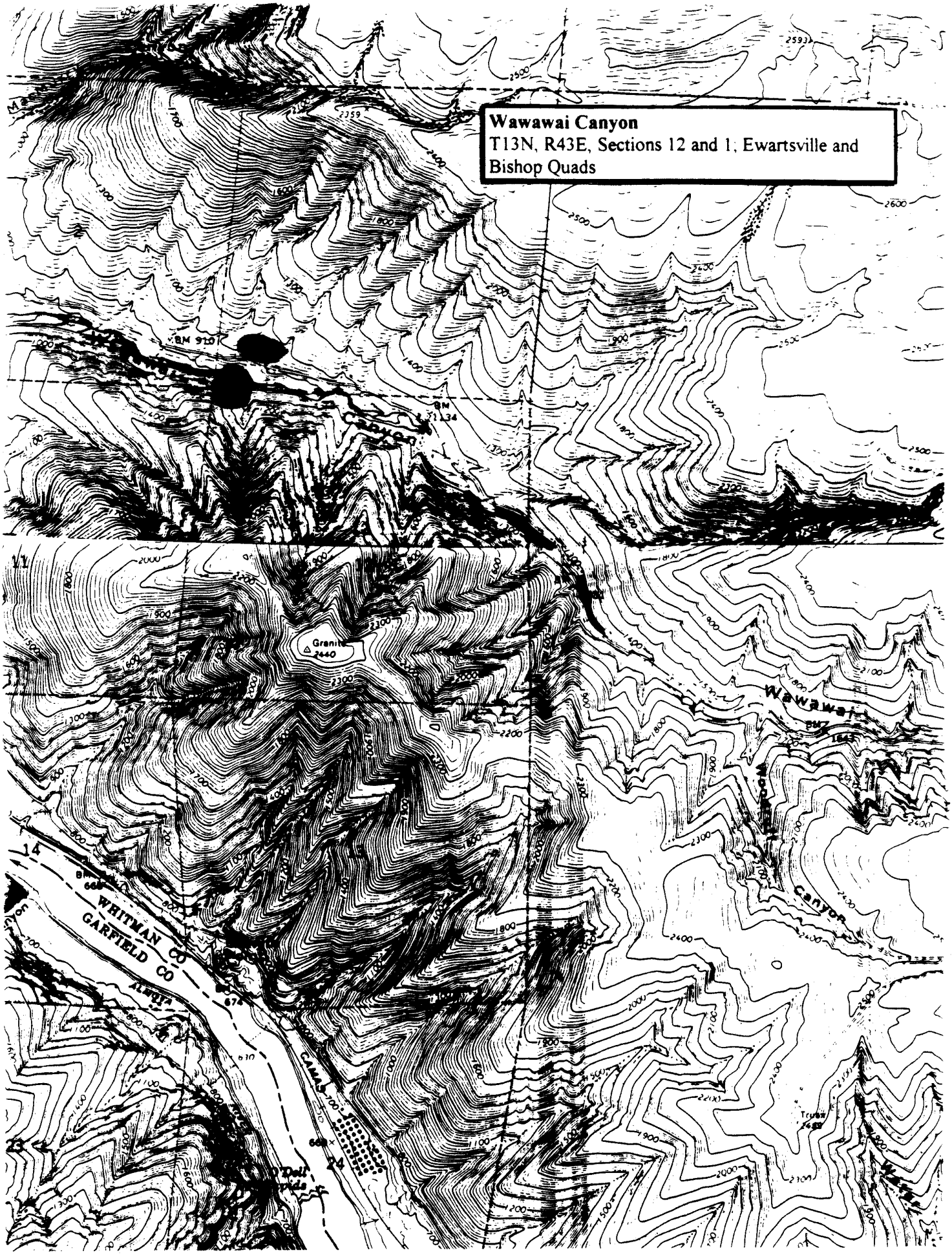

Colfax
T16N, R43E, Section 11; Colfax North Quad
T. 17 N.
T. 16 N.
55'
PALOUSE
RIVER
PACIFIC
UNION
Buck Canyon
Gaging Station
Schmuck Park
Sewage Disposal Gaging Sta
Colfax Cem
Reservoir
Substation
Colfax
(BM 1962)
45 MI. TO U.S. 410
DUSTY 17 MI.
580 000 FEET
46°52'30"
117°22'30"
PULLMAN 16 MI.
LEWISTON, IDAHO 49 MI.
2 790 000 FEET
20'
R. 43 E.
R. 44 E.

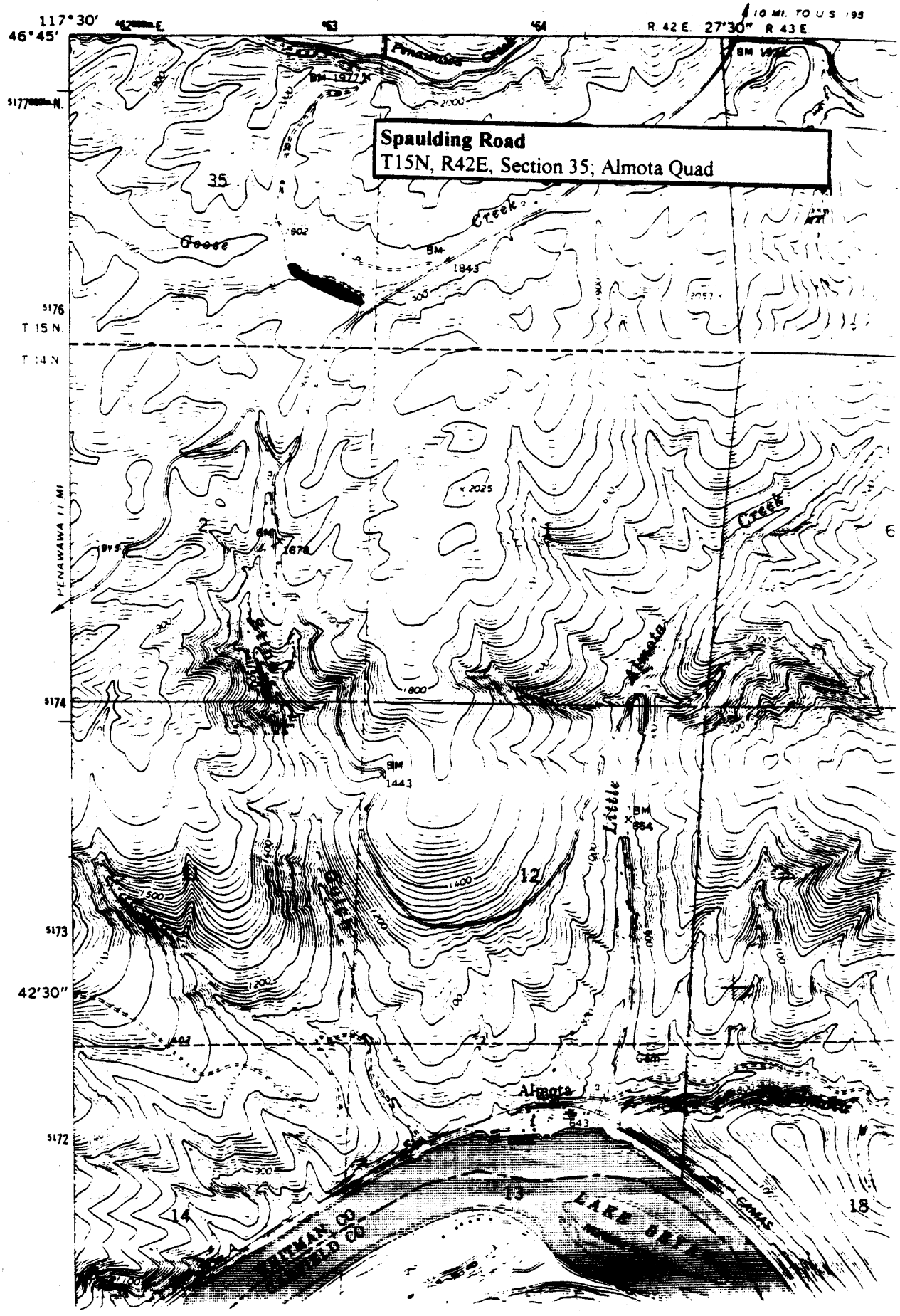

Paradise Ridge
T38N, R5W, Section 4; Moscow East Quad
29
28
27
32
33
34
5
4
3
9
10
Blaine
Community Hall
3422
3702
3504
2985
2900
3000
3100
3200
3300
3400
3500
3600
2800
2700
2820


Chief Old Joseph Monument
T3S, R45E, Section 5; Joseph Quad
Joseph
(BM 4190)
Knights Pond
Chief Joseph Cem
Joseph Cem
Prairie Creek Cem
High Sch
Wallowa
River
GRANGER
DITCH
FARMERS
SILVER
LAKE
DOBBIN
BEND
BIG
COVE
DITCH
PARK
QUARRY
HEAD GATES
SLUICE GATE
WEIR
T2S
T3S
19
20
21
28
29
30
31
32
33

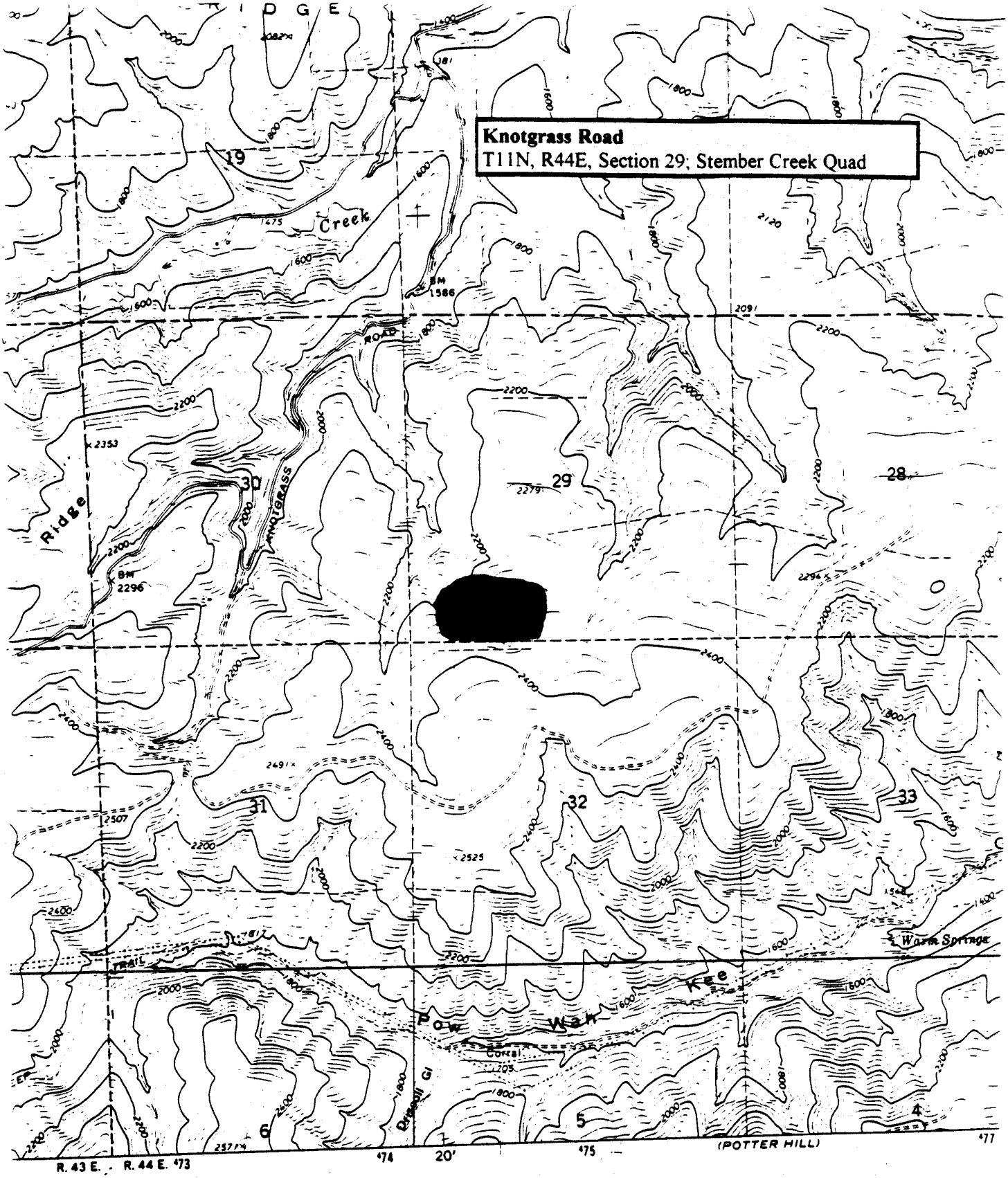

Kamiak Butte County Park
T16N, R45E, Sections 20 and 21; Albion Quad
117°07'30"
46°52'30"
PULLMAN 9.7 MI
570 000 FEET
T. 16 N.
T. 15 N.
Gravel Pit
Pitts Cem
Gravel Pit
Fourmile
Creek

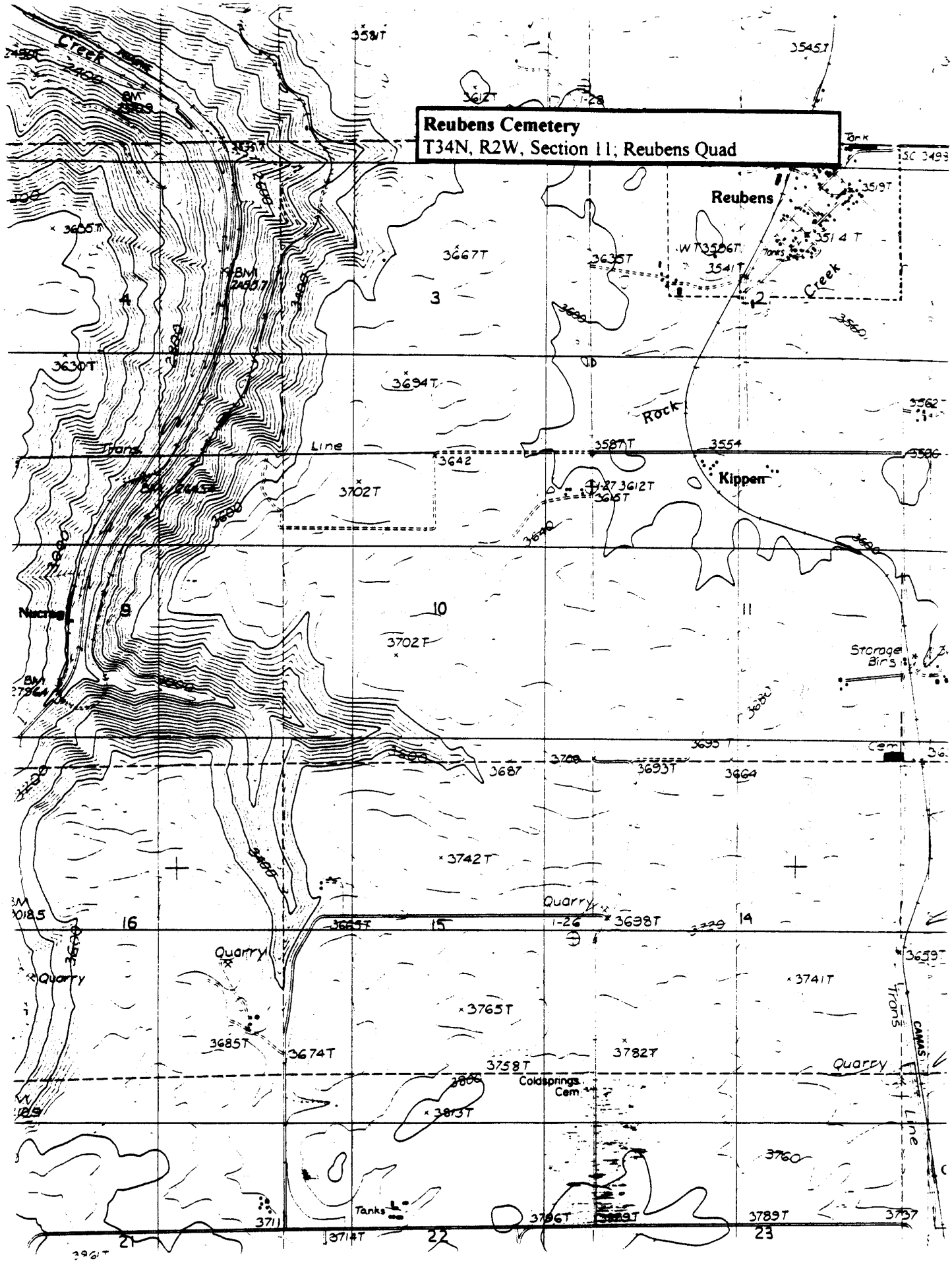

Mary Minerva McCroskey Memorial State Park
T44N, R5W, Section 30; Tekoa Quad
Liberty Butte
Quarry
Gravel Pit
Andrews Spring Creek
BENEWAH CO
LATAH CO
WHITMAN CO
COEUR D'ALENE INDIAN RES
MARY MINERVA McCROSKEY STATE PARK
DE SMET MISSION 4.5 MI
2 000 00
(IDAHO)
FARMINGTON 3 MI
R 45 E
(FARMINGTON)
R 46 E
2'30"
180 000 FEET
47°07'
INTERIOR GEOLOGICAL SURVEY RESTON VIRGINIA 1983

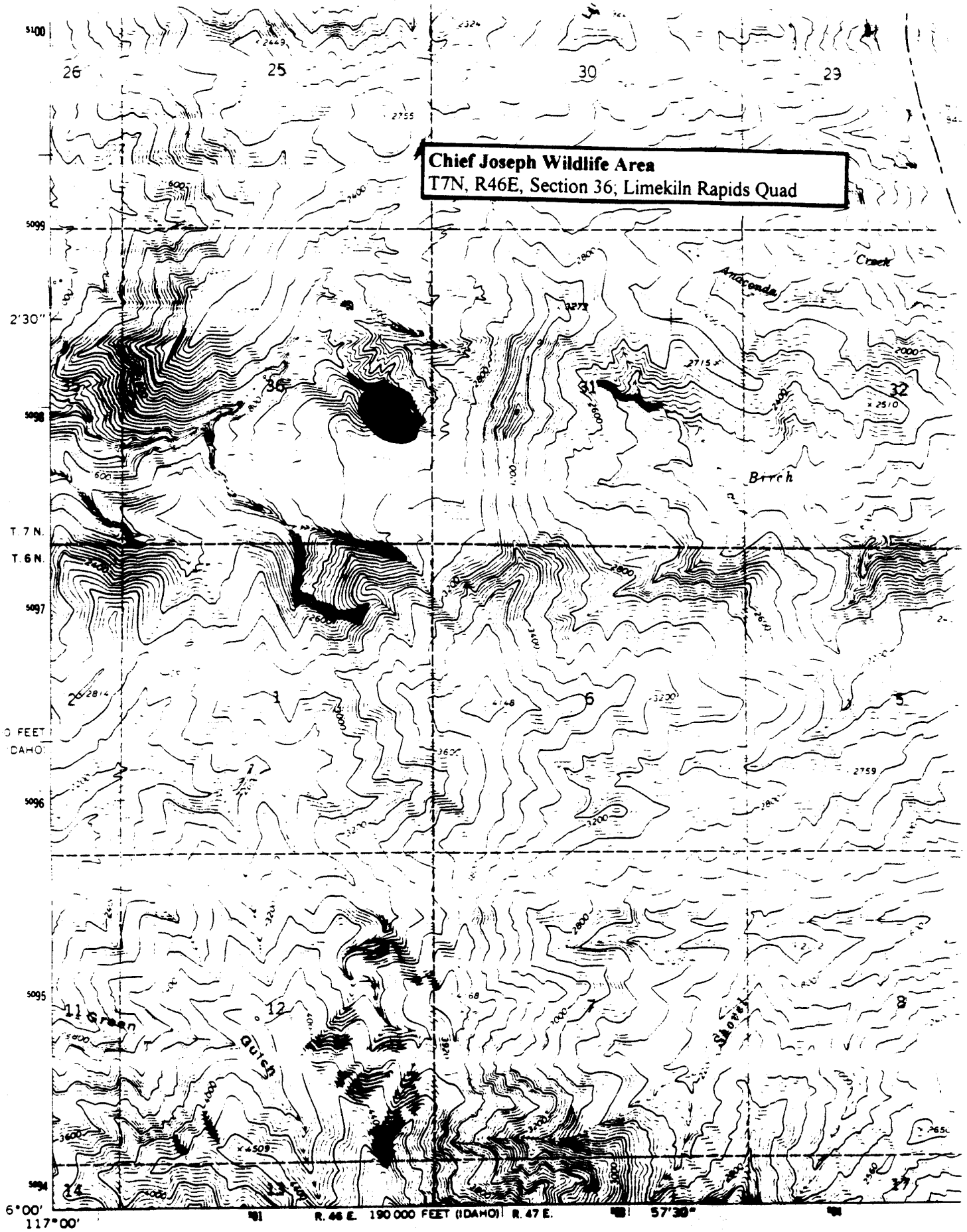

Wawawai Canyon
T13N, R43E, Sections 12 and 1; Ewartsville and Bishop Quads
Wawawai
Canyon
WHITMAN CO
GARFIELD CO
Granite
2440
BM 910
BM 1134
Truax
2489
Dell
Rapids

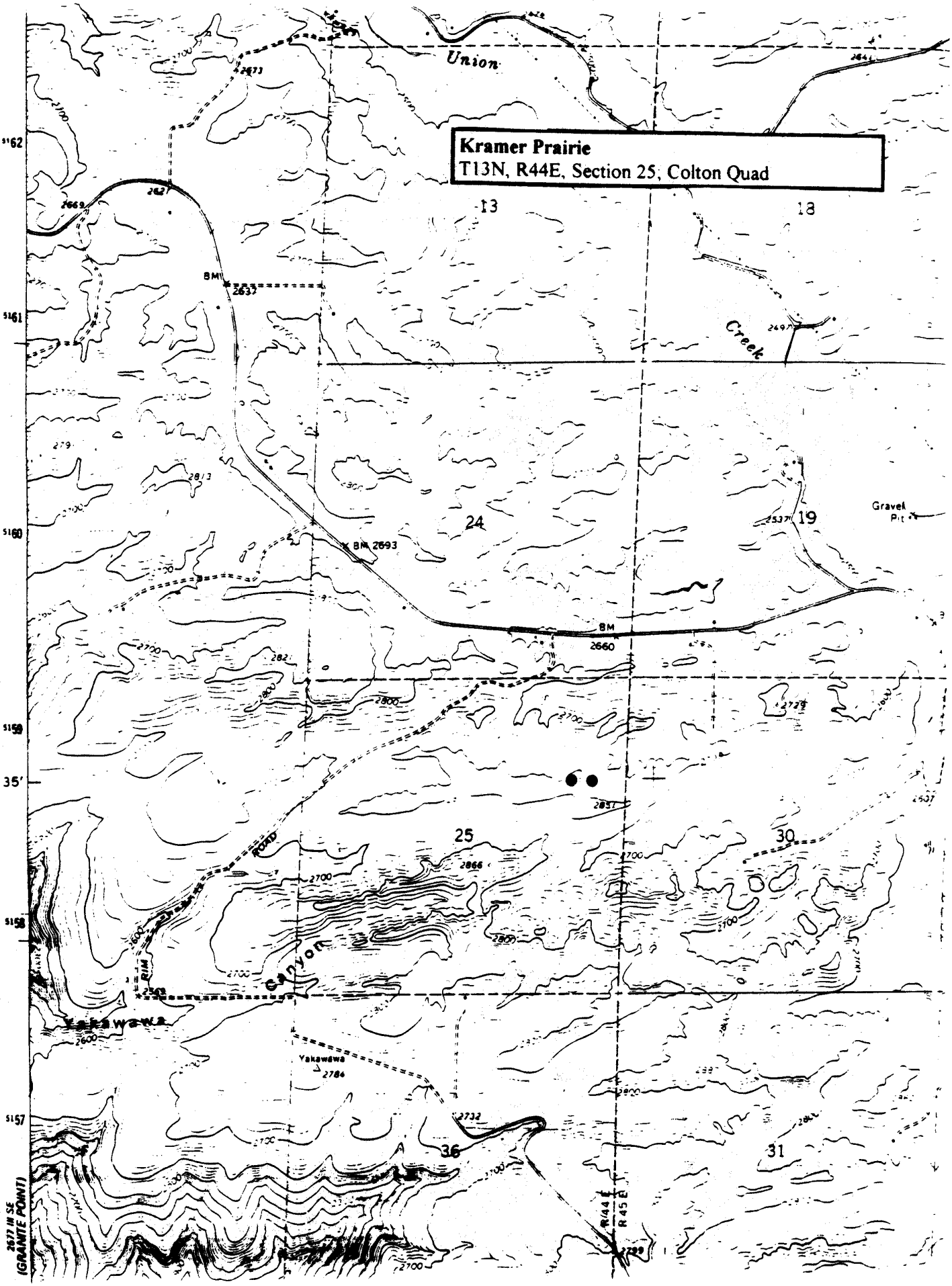


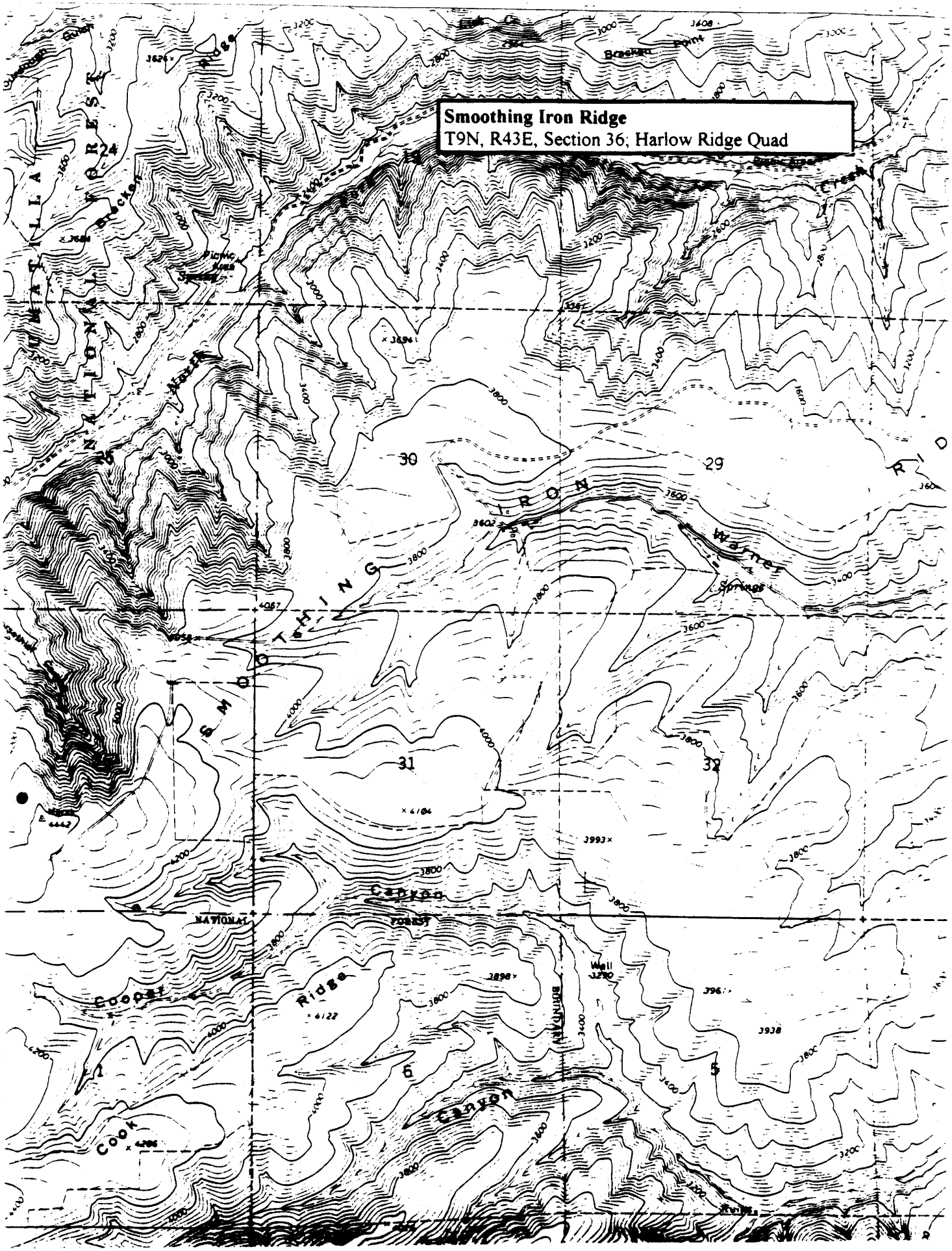
Spaulding Road
T15N, R42E, Section 35; Almota Quad
117°30'
46°45'
R 42 E.
27'30"
R 43 E.
10 MI. TO U.S. 195
5177000m.N.
5176
T 15 N.
T 14 N
5174
5173
42'30"
5172
PENAWAWA 11 MI
35
Goose
Creek
BM 1843
BM 1977
2025
Creek
Almota
BM 1443
Little
BM 854
12
Almota
643
13
14
18
LAKE BEVER
CAMAS


Knotgrass Road
T11N, R44E, Section 29; Stember Creek Quad
RIDGE
Creek
Ridge
KNOTGRASS
ROAD
TRAIL
Pow Wah Kee
Corral
Warm Springs
(POTTER HILL)
R. 43 E.
R. 44 E.
20'
19
30
29
28
31
32
33
6
5
4


Reubens Cemetery
T34N, R2W, Section 11; Reubens Quad
Reubens
Kippen
Nucrag
Creek
Rock
Trans. Line
Storage Bins
Cem
Quarry
Coldsprings Cem
Tanks
Tank
CAMAS
3667T
3635T
3694T
3702T
3642
3587T
3554
3612T
3615T
3702T
3687
3693T
3664
3742T
3698T
3741T
3765T
3685T
3674T
3758T
3782T
3813T
3711
3714T
3796T
3789T
3737
3659T
3545T
3519T
3514T
3541T
3630T
3635T
3612T
3560
3562
3640
3680
3695T
3665T
3659T
3760
3961T
1-26
1-27
1-28
2
3
4
9
10
11
14
15
16
21
22
23


Chief Joseph Wildlife Area
T7N, R46E, Section 36; Limekiln Rapids Quad
26
25
30
29
36
31
32
1
6
5
11
12
7
8
14
13
17
Anaconda
Creek
Birch
Green
Gulch
Shovel
T. 7 N.
T. 6 N.
2'30"
6°00'
117°00'
R. 46 E.
190 000 FEET (IDAHO)
R. 47 E.
57'30"


Kramer Prairie
T13N, R44E, Section 25, Colton Quad
Union
Creek
Canyon
Yakawawa
Yakawawa
ROAD
RIM
Gravel Pit
BM 2637
BM 2693
BM 2660
13
18
24
19
25
30
36
31
R44E
R45E
2677 III SE (GRANITE POINT)
35'


Smoothing Iron Ridge
T9N, R43E, Section 36; Harlow Ridge Quad
UMATILLA NATIONAL FOREST
Brackett Point
Picnic Area
Spring
North
SMOOTHING IRON RID
Warner
Springs
Canyon
NATIONAL FOREST
Cooper Ridge
Cook Canyon
BOUNDARY
Well
30
29
31
32
6
5
24
3993
3938
4122
4104
3898
3602
3694
4067
4442
4206

Appendix 2: Descriptive Data for Reconnaissance Sites

Site name: **Chief Old Joseph Monument**

County and state: Wallowa County, Oregon

Location: T3S, R45E, Section 5: N ¼ of NW ¼

Elevation: 4,400-4,420'

Ownership: Federal

Communities present: *Artemisia ludoviciana/Festuca idahoensis* bottomland, *Festuca idahoensis-Koeleria cristata* grassland, *Festuca idahoensis/Rosa* sp. moist soil type

Rare or endemic taxa: *Silene spaldingii*

Exotic species concerns: *Poa pratensis*, annual bromes, *Potentilla recta*

Records: Oregon Natural Heritage Program PDCAR0U1S0*001

Additional sources of information: Site visit Jul. 14, 1998

Comments: Species observed on Jul. 14, 1998: Shrubs: *Artemisia ludoviciana, Berberis* sp., *Eriogonum heracleoides, Ribes* sp., *Rosa nutkana, Symphoricarpos albus*; Perennial graminoids: *Agropyron smithii, Bromus carinatus, Elymus cinereus, Festuca idahoensis, Koeleria cristata, **Poa pratensis***, Perennial forbs: *Achillea millefolium, Antennaria* sp., *Arnica soraria, **Cynoglossum officinale**, Erigeron* sp., *Fragaria virginiana, Geranium viscosissimum, Helianthella uniflora, Hieracium albertinum, Lithospermum ruderale, Potentilla gracilis, **P. recta**, Solidago missouriensis*; Annuals and biennials: ***Bromus mollis**, Collomia* sp., *Galium aparine, **Tragopogon dubius.***

Site ranking: Meadow steppe communities in fair condition.

Site name: **Kamiak Butte County Park**

County and state: Whitman Co., Washington

Location: T16N, R45E, Section 20: NE ¼ of NE ¼; Section 21: NW ¼ of NW ¼

Elevation: 3,100-3,480'

Ownership: County

Communities present: *Agropyron spicatum-Festuca idahoensis, Festuca idahoensis Symphoricarpos albus, Agropyron spicatum-Poa secunda* lithosol

Rare or endemic taxa: 1 individual of *Astragalus arrectus* reported by Fiely (1979)

Exotic species concerns: See Table 11A and Table 12.

Data records: Washington Natural Heritage Program CTEJ.BBA00*019

Additional sources of information: Mullen 1933; Fiely 1979; site visits Jul. 28, Aug. 25, 1998; Jim Roberts, Jim Croft personal communications

Comments: See Table 11A for reconnaissance plot data and Table 12 for a comparison of non-native species observed at Kamiak Butte in 1933, 1979, and 1998.

Site ranking: Some stands are very disturbed, while others are in good condition. On the basis of the large size of the protected area and the fact that there are some stands with relatively little invasion of exotic species, the site was rated as fair to good.

Site name: **Mary Minerva McCroskey Memorial State Park**

County and state: Benewah County, Idaho

Location: T44N, R5W, Section 30: SW ¼ of NW ¼

Elevation: 3,500-3,600'

Ownership: State

Communities present: *Festuca idahoensis/Symphoricarpos albus*, *Festuca scabrella-Festuca idahoensis*

Rare or endemic taxa: None reported

Exotic species concerns: Annual bromes, *Ventenata dubia*, *Vicia villosa*

Records: Idaho Conservation Data Center CEGL001628*002

Additional sources of information: Lichthardt and Moseley 1997, Site visit Jul. 31, 1998

Comments: See Table 11B for reconnaissance plot data.

Site ranking: Some stands are very disturbed, while others are in good condition. On the basis of the large size of the protected area and the fact that there are some stands with relatively little invasion of exotic species, this reconnaissance site was rated as fair to good.

Site name: **Wawawai Canyon**

Date visited: Aug. 3, 1998

County and state: Whitman County, Washington

Location: T13N, R43E, Section 12: NW ¼ of NW ¼; Section 1: SW ¼ of SW ¼

Elevation: 900-1,300'

Ownership: Private

Communities present: *Agropyron spicatum-Poa secunda* (very disturbed), ***Rosa*** thickets, riparian deciduous trees and shrubs

Rare or endemic taxa: *Astragalus arrectus* historic record (1941), not found in 1998; *Astragalus riparius* recorded in 1980, not found in 1998

Exotic species concerns: Many, including annual bromes, *Anthriscus caucalis*, *Bryonia alba*, *Centaurea solstitialis*, *Convolvulus arvensis*, *Cynoglossum officinale*, *Elymus caput-medusae*, *Hypericum perforatum*, *Lactuca serriola*, *Onopordum acanthium*, *Potentilla recta*, *Dipsacus fullonum* ssp. *sylvestis*, *Sisymbrium altissimum*, *Vicia villosa*

Records: Washington Natural Heritage Program PDFAB0F0V0*007; PDFAB0F7M0*010

Additional sources of information: Site visit Aug. 3, 1998, landowner personal communication

Comments: Steppe: Section 12--Shrubs: *Artemisia dracunculus*, *Chrysothamnus nauseosus*, *Crataegus douglasii*, *Holodiscus discolor*, *Philadelphus lewisii*, *Prunus* sp., *Rosa nutkana woodsii*, *Sambucus cerulea*, *Symphoricarpos albus*; Perennial graminoids: *Agropyron spicatum*, ***Poa pratensis***; Perennial forbs: *Achillea millefolium*, *Apocynum cannabinum*, *Clematis* sp. *Eriophyllum lanatum*, *Heuchera cylindrica*, ***Convolvulus arvensis***, ***Cynoglossum officinale***, ***Hypericum perforatum***, *Lupinus* sp., ***Potentilla recta***, ***Rumex crispus***, *Solidago missouriensis*; Annuals and biennials: *Amsinckia* sp., ***Anthriscus caucalis***, ***Bromus japonicus***, ***Bromus* sp.**, ***Bromus tectorum***, *Chenopodium album*, ***Cichorum intybus***, *Conyza canadensis*, ***Dipsacus fullonum* spp. *sylvestris***, ***Elymus caput-medusae***, *Epilobium brachycarpum*, *Festuca megalura*, ***Lactuca serriola***, ***Onopordum acanthium***, ***Sisymbrium altissimum***, ***Tragopogon dubius***, ***Vicia villosa***. Section 1, Steppe--Shrubs: *Eriogonum niveum*; Perennial graminoids: ***Agropyron cristatum***, *Agropyron spicatum*, *Poa secunda*; Perennial forbs: *Achillea millefolium*, ***Cichorium intybus***, ***Convolvulus arvensis***, *Gaillardia aristata*, *Helianthus annuus*, ***Hypericum perforatum***, *Lomatium* sp., *Lupinus* sp., ***Rumex crispus***; Annuals and biennials: ***Alyssum alyssoides***, *Amaranthus albus*, *Amsinckia* sp., ***Bromus brizaeformis***,

Bromus japonicus, Bromus mollis, Bromus tectorum, *Conyza canadensis,* ***Elymus caput-medusae,*** *Epilobium brachycarpum, Euphorbia glyptosperma, Festuca microstachys,* ***Lactuca serriola,*** *Madia gracilis,* ***Poa bulbosa,*** *Polygonum douglasii var. douglasii,* ***Sisymbrium altissimum, Tragopogon sp., Vicia villosa.*** Riparian: Trees and shrubs: ***Acer negundo,*** *Almus* sp., *Cornus stolonifera,* ***Juglans nigra, J. regia,*** *Juniperus* sp., ***Parthenocissus quinquefolia,*** *Philadelphus lewisii, Populus trichocarpa,* ***Prunus*** sp. (cultivar), *Rhus glabra,* ***Robinia pseudo-acacia,*** *Rosa* sp., ***Rubus discolor***; Perennial graminoids: ***Dactylis glomerata, Phalaris arundinacea, Phleum pratense,*** Perennial forbs: *Ambrosia* sp., ***Arctium minus, Bryonia alba, Cirsium arvense,*** *Epilobium* sp., ***Melissa officinalis, Nepeta cataria, Rorippa nasturtium-aquaticum, Rumex crispus, Solanum sp.,*** *Urtica dioica, Veronica* sp.; Annuals and biennials: ***Bromus tectorum, Cirsium vulgare, Cynoglossum officinale, Dipsacus fullonum*** **spp.** ***sylvestris, Lactuca serriola, Lunaria annua, Polypogon monspeliensis.***

See Table 11C for reconnaissance plot data.

Site ranking: Rated as poor, due to the large number and extensive coverage of exotic taxa.

Site name: **Spaulding Road**

County and state: Whitman County, Washington

Location: T15N, R42E, Section 35: SE ¼ of SE ¼

Elevation: 1,880-1,960'

Ownership: Private

Communities present: *Festuca idahoensis/Symphoricarpos albus, Crataegus douglasii/Symphoricarpos albus*

Rare or endemic taxa: *Haplopappus liatriformis* (over 80 plants seen Aug. 4, 1998), *Silene spaldingii* (5 plants seen on Aug. 4, 1998), *Aster jessicae*? (J. Arnett site record 1990: "There is some question about the identification of these plants-putative hybrids with *Aster occidentalis* have previously been reported here.")

Exotic species concerns: Annual bromes, *Agrostis interrupta, Anthriscus caucalis, Arrhenatherum elatius, Bryonia alba, Cirsium vulgare, Convolvulus arvensis, Hypericum perforatum, Lactuca serriola, Poa pratensis, Sisymbrium altissimum, Verbascum thapsus*

Records: Washington Natural Heritage Program PDASTDT0C0*012, PDCAR0U1S0*010, PDAST0T1M0*10

Additional sources of information: Site visit Aug. 4, 1998

Comments: Coverage of *Anthriscus caucalis* is approximately 50% in the *Festuca idahoensis/Symphoricarpos albus* community. This site was recommended for protection by Lorain (1991a).

See Table 11D for reconnaissance plot data.

Site ranking: Fair to poor. This site is small and exotics are extensive, but it does contain two (or three) rare taxa and some stands in which native shrubs, grasses, and forbs are well represented.

Site name: **Knotgrass Road**

County and state: Asotin County, Washington

Location: T11N, R44E, Section 29: SE ¼ of SW ¼

Elevation: 2,200-2,320'

Ownership: Bureau of Land Management

Communities present: *Agropyron spicatum-Poa secuda*, *Artemisia rigida-Poa secunda*

Rare or endemic taxa: None

Exotic species concerns: Annual bromes, *Centaurea solstitialis*, *Hypericum perforatum*, *Lactuca serriola*, *Sisymbrium altissimum*, *Verbascum blattaria*

Records: None

Additional sources of information: Site visit Aug. 14, 1998

Comments: See Table 11E for reconnaissance plot data.

Site ranking: Poor, due to high degree of invasion by annual bromes.

Site name: **Reubens Cemetery**

County and state: Lewis County, Idaho

Location: T34N, R2W, Section 11: SE ¼ of SE ¼

Elevation: 3,640'

Ownership: Roman Catholic Diocese, Pine City Cemetery

Communities present: Early seral stage of Pinus regeneration in *Pinus ponderosa/ Symphoricarpos albus* association

Rare or endemic taxa: *Aster jessicae*, *Lomatium dissectum* var. *dissectum*. *Haplopappus liatriformis* has been reported at this site (Lorain 1991c) but was not observed in 1998.

Exotic species concerns: *Cirsium arvensis*, *C. vulgare*, *Dactylis glomerata*, *Hypericum perforatum*, *Phleum pratensis*, *Poa pratensis*, *Verbascum thapsus*

Records: Idaho Conservation Data Center PDAST0T1M0*018, PDASTDT0C0*25

Additional sources of information: Lichthardt 1997, Lorain 1991a,b,c; site visit Aug. 15, 1998.

Comments: Trees and shrubs: *Amelanchier alnifolia*, *Pinus ponderosa* (mostly 2-4 m tall), *Rosa nutkana woodsii*, *Symphoricarpos albus*; Perennial graminoids: *Agropyron spicatum*, *Bromus carinatus*, ***Bromus inermis***, *Carex* sp., ***Dactylis glomerata***, *Elymus glaucus*, *Festuca idahoensis*, *Koeleria cristata*, ***Poa pratensis***, ***Phleum pratense***; *Perennial forbs*: *Achillea millefolium*, *Aster jessicae*, *Astragalus arrectus*, ***Cirsium arvense***, ***Dianthus deltoides***, *Fragaria virginiana Galium boreale*, *Geranium viscosissimum*, *Geum triflorum*, *Haplopappus carthamoides*, ***Hypericum perforatum***, *Iris missouriensis*, *Lomatium dissectum* var. *dissectum*, *Lithospermum ruderale*, *Lupinus sericeus*, *Perideridia gairdneri*, *Penstemon* sp., ***Plantago lanceolata***, *Potentilla arguta*, *Potentilla gracilis*, ***Rumex acetosella***, *Sidalcea oregana*, *Silene scouleri*, *Solidago missouriensis*, *Veratrum californicum*, *Wyethia amplexicaulis*; Annuals and biennials: ***Cirsium vulgare***, *Epilobium brachycarpum*, ***Lactuca serriola***, ***Tragopogon dubius***, ***Verbascum thapsus***.

Site ranking: Fair. This site is very small and but invasive exotics are not extensive except for a large population of *Cirsium arvense* at the west end, and at least two rare taxa are present.

Site name: **Chief Joseph Wildlife Area**

County and state: Asotin, Washington

Location: T7N, R46E, Section 36: E½

Elevation: 2,200-2,520'

Ownership: Department of Natural Resources (administered by Washington Department of Fish and Wildlife)

Communities present: Primarily *Agropyron spicatum-Festuca idahoensis* (Daubenmire 1970), with *Symphoricarpos albus* thickets (Tisdale 1986) and *Agropyron-spicatum-Poa secunda* lithosol

Rare or endemic taxa: None

Exotic species concerns: *Poa pratensis*, *Centaurea solstitialis*, *Bromus tectorum* and other annual bromes, *Hypericum perforatum*, *Lactuca serriola*

Records: None

Additional sources of information: Site visit, Aug. 17, 1998

Comments: This area is grazed. See Table 11F for reconnaissance plot data.

Site ranking: Although some parts of this site have substantial coverage of exotic taxa, some areas are in good condition. On this basis and the fact that the area is of state land is quite large, this site was rated as fair to good.