

**INVENTORY AND ASSESSMENT OF RIPARIAN AREAS
ON THE 45 RANCH ALLOTMENT**

**Robert K. Moseley
Conservation Data Center**

April 1999

**Idaho Department of Fish and Game
600 South Walnut, P.O. Box 25
Boise, Idaho 83707
Jerry Mallet, Interim Director**



**Prepared for:
Idaho Field Office, The Nature Conservancy
Contract No. IDFO-052898-TK**

SUMMARY

In November 1996, The Nature Conservancy (TNC) purchased the 45 Ranch in the Owyhee Uplands of extreme southwestern Idaho. The ranch area includes 240 acres of deeded land and nearly 70,000 acres of a surrounding BLM grazing allotment. The Conservancy contracted the Idaho Department of Fish and Game's Conservation Data Center (CDC) to conduct an ecological inventory and assessment on the deeded ranch property as well as the BLM allotment. TNC was interested in this assessment for two reasons: (1) to catalog the biological diversity that they were now at least partially responsible for maintaining and managing, and (2) to provide a basic ecological understanding for the collaborative allotment planning process that they began in 1997. The CDC assessment is being done in two phases: (1) the first phase began in 1998 and focused on the riparian communities, and (2) the second phase will focus on the upland habitats and will be conducted during the 1999 field season.

The goals of the riparian phase are to characterize and map communities, assess the ecological condition, compile a checklist of riparian plants, survey for rare plant species, and recommend a monitoring strategy based on inventory data.

We observed a relatively diverse riparian flora of 275 species. Seventeen percent of the flora is non-native, but only two, relatively minor weed problems were found on the allotment. Populations of seven rare plant species were found, including two species that apparently have never been documented from Idaho before. We identified 21 riparian and wetland plant communities on the 45 Allotment, derived from 55 sample plots. Six communities are considered rare throughout their range and should be priorities for management.

The discussion of riparian community patterns and ecological condition is broken down into four broad geohydrological settings: South Fork Owyhee River, Little Owyhee River, Canyon Spring Systems, and Intermittent Lakes and Creeks.

South Fork Owyhee - We consider the floodway of the South Fork to be in Proper Functioning Condition throughout its run through the 45 Allotment. We mapped 46 river terraces along the South Fork, dominated almost entirely by the rare basin big sagebrush/basin wildrye community type. Ecological condition of these terraces varied, depending on accessibility to cattle. Fifty-seven percent of the terraces, however, were in good to excellent condition. This concentration of high quality examples of the basin big sagebrush/basin wildrye community is the greatest of anywhere in Idaho. The poor condition of the water quality in the South Fork results from upstream land use on ranches in Nevada.

Little Owyhee River - The Little Owyhee is an intermittent river that is unique in Idaho. It's difficult to assess the condition of the floodway without running water, but it is probably in Proper Functioning Condition. The 12 river terraces along the Little Owyhee are all in fair condition, with a good cover of sagebrush, but an understory of cheatgrass

Canyon Spring Systems - All except one of the spring creek segments were in Proper Functioning Condition. The exception is a 1.1-mile segment of the North Fork Spring Creek, which we rated as Functional-At Risk. This is the only perennial stream segment on the 45 Allotment that is of concern because of livestock grazing impacts.

Intermittent Lakes and Creeks - Forage is often limited in these settings, so most livestock grazing impacts are the result of trampling or trailing. Two rare communities occur here, the silver sagebrush/mat muhly and Owyhee sagebrush types. The only area of possible concern is in the vicinity of Bull Lake and the adjacent intermittent creek that drains the north side of Spring Butte. This is the largest intermittent creek on the allotment and it and Bull Lake have a high diversity of community types, including the rare ones. We noted some impacts during a brief visit, but more investigation is needed.

I make some preliminary recommendations relative to allotment management and monitoring. These should be integrated with recommendations resulting from the upland assessment to design an efficient monitoring program for the 45 Allotment.

TABLE OF CONTENTS

Summary	i
Table of Contents	iii
List of Tables	iv
List of Figures	iv
List of Appendices	iv
Introduction	1
Methods	
Logistics	2
Flora	2
Riparian Plant Community Sampling	2
Riparian Plant Community Mapping	2
Ecological Condition Assessment of Riparian Communities	3
Riparian Communities	4
South Fork Owyhee River	
Physical and Hydrological Setting	5
River Floodway	
Riparian Plant Communities	12
Ecological Condition	14
River Terraces	
Riparian Plant Communities	15
Ecological Condition	16
Little Owyhee River	
Physical and Hydrological Setting	16
River Floodway	
Riparian Plant Communities	17
Ecological Condition	19
River Terraces	
Riparian Plant Communities	20
Ecological Condition	20
Canyon Spring Systems	20
North End Springs	21
South Fork Canyon Springs	21
Spring Creek Basin	22
Main Fork	23
North Fork	23
Intermittent Lakes and Creeks	24
Intermittent Lakes	25
Intermittent Creeks	26
Riparian Flora	
Checklist	26
Rare Species	27

Weeds	29
Conclusions and Recommendations	30
References	32

LIST OF TABLES

Table 1. Definitions for occurrence ranks/ecological condition of river terraces occupied by the basin big sagebrush/basin wildrye plant community	4
Table 2. Riparian plant communities on the 45 Allotment	6
Table 3. Distribution and habitats of rare riparian species on the 45 Allotment	27

LIST OF FIGURES

Figure 1. Historical streamflow daily values for South Fork Owyhee River near Whiterock, Nevada, water years 1956 to 1981 (USGS station 13177800)	8
Figure 2. Historical streamflow daily values for South Fork Owyhee River near Whiterock, Nevada, water years 1969 to 1978	9
Figure 3. Valley bottom profiles and distribution of plant communities at low water along the South Fork Owyhee River, Idaho	11
Figure 4. Valley bottom profiles and distribution of plant communities along the Little Owyhee River, Idaho.	18

LIST OF APPENDICES

Appendix 1. Riparian and wetland communities of the 45 Allotment, 1997 and 1998 sampling plots.
Appendix 2. Hydrogeomorphic stream data and Proper Functioning Condition checklists for the South Fork Owyhee River and the forks of Spring Creek.
Appendix 3. Riparian plant species of the 45 Allotment.

INTRODUCTION

In November 1996, The Nature Conservancy (TNC) purchased the 45 Ranch in the Owyhee Uplands of extreme southwestern Idaho. For an ecological overview of the Owyhee Uplands see Vander Schaaf (1996) and for a similar discussion of a portion of the Owyhee canyonlands see Dean (1960). Two broad-scale ecological and conservation assessments identified this portion of Idaho, Oregon, and Nevada as ecologically significant, largely because of the sizable block of intact sagebrush-steppe habitat (USDA Forest Service 1996; The Nature Conservancy, in preparation). The 45 Ranch includes 240 acres of deeded land and nearly 70,000 acres of a surrounding BLM grazing allotment.

The Conservancy contracted the Idaho Department of Fish and Game's Conservation Data Center (CDC) to conduct an ecological inventory and assessment on the deeded ranch property as well as the BLM allotment, hereafter referred to simply as the 45 Allotment. TNC was interested in this assessment for two reasons: (1) to catalog the biological diversity that they were now at least partially responsible for maintaining and managing, and (2) to provide a basic ecological understanding for the collaborative allotment planning process that they began in 1997. The CDC assessment is being done in two phases. The first phase began in 1998 and focused on the riparian communities. This report is the summary of that work. The second phase will focus on the upland habitats and, except for a reconnaissance conducted in 1998, will largely be done during the 1999 field season.

The goals of the riparian phase are to:

1. characterize and map communities
2. assess the ecological condition
3. compile a checklist of riparian plants
4. survey for rare plant species in the canyons
5. recommend a monitoring strategy based on inventory data

The layout of this report is as follows: First I briefly describe the methods we used in the inventory and assessment. Then I give an overview of the riparian plant communities on the 45 Allotment that will aid in later discussions of riparian conditions. A bulk of the report addresses riparian conditions in four broad geohydrological units on the 45 Allotment: South Fork Owyhee River, Little Owyhee River, Canyon Spring Systems, and Intermittent Lakes and Creeks. For each unit I give an overview of the hydrologic and physical setting, riparian plant communities, and the ecological condition of the riparian zone. This is followed by a discussion of the riparian flora, including rare and weed species, and finally a summary of major conclusions and suggestions for monitoring and management planning..

METHODS

Logistics

CDC biologists spent five weeks conducting riparian inventories on the 45 Allotment between June 29 and August 27, 1998. We spent three weeks floating the South Fork in inflatable kayaks, one being a reconnaissance trip on the lower river below the 45 Ranch, one week sampling the lower river from the ranch to the confluence, and one week sampling the upper portion from the Nevada border down to the ranch. We spent two weeks in vehicles and on foot surveying the Little Owyhee River, Spring Creek Basin, and the uplands.

Flora

We developed a list of riparian plant species from field observations and plot data. Nearly all the species were identified using technical floras, but only a few were vouchered with specimens that will be deposited in herbaria. For rare species, CDC observation forms were filled out and these data were entered into our element occurrence data base.

Riparian Plant Community Sampling

Sampling and characterization of riparian communities on the 45 Allotment took place in the context of a much larger, multi-year effort by the CDC to inventory diversity and distribution patterns of riparian communities in southwestern Idaho (Moseley 1998; 1999). The riparian and wetland communities of this portion of Idaho are the least known of anywhere in the state, in terms of classification of plant associations for management and biodiversity conservation purposes. Knowledge gained through this larger project will contribute to the standardized classification system for Idaho plant communities maintained by the CDC (see Jankovsky-Jones et al. 1999 for an overview of the riparian portion of the classification). The methods for community sampling are fully explained in Moseley (1998).

Riparian Plant Community Mapping

Mapping riparian communities along the South Fork and Little Owyhee rivers turned out to be problematic. My original plan was to use the National Wetland Inventory (NWI) maps produced by the U.S. Fish and Wildlife Service as the mapping base and assign labels from our classification system to the Cowardin classes used by NWI. Because the BLM digitized the NWI layer for its Resource Management Plan for the Owyhee Resource Area (BLM-Lower Snake River District 1996), we could then use that GIS coverage to produce a map of community types. Two problems arose:

1. During field work we found that the NWI mapping did not actually reflect what we observed on the ground in terms of the distribution of riparian plant communities. This probably results from error associated with photo interpretation and the dynamic nature of the

floodplain, which has experienced big flood events since the 1983 air photos used to prepare the maps.

2. The second major problem is that the BLM has apparently lost the digital NWI layer for the Owyhee Resource Area. They have been unable to unearth it since my first request last summer. I'm still hopeful that it will be found and can be used to represent riparian systems on the 45 Allotment in the final maps prepared after the upland mapping.

All is not lost, however. Riparian communities in the floodways of the Little Owyhee and South Fork occur in relatively small-scale patches that are difficult to map on 1:24,000-scale topo maps. They are, however, not diverse and occur in a readily recognized, repeatable pattern that is easily described and characterized. We were able to map the stream terrace vegetation along these two rivers on topos, as well as riparian vegetation along perennial watercourses in Spring Creek Basin. Intermittent drainages, pools, and lakes were not mapped consistently by NWI, so they were mapped on USGS quads and will be digitized and included on the final map for the 45 Allotment after the upland vegetation inventory is complete.

Ecological Condition Assessment of Riparian Communities

Riparian and wetland communities on the 45 Allotment can be divided into two broad limnological classes: (1) lentic systems, which include lakes and ponds, and (2) lotic systems, which include streams and rivers. Our ecological assessment methods for each of these is described briefly below:

Lentic Systems - The only lentic systems present on the 45 Allotment are internally-drained lakes and ponds that are intermittently wet, usually in the winter and spring, and are bone-dry by late June. We did not assess the ecological condition of lentic systems, due largely to the lack of established methods for intermittent basins.

Lotic Systems - Two major types of lotic systems occur on the 45 Allotment. The first are those with perennial water flows, which occur along the South Fork and the spring-fed creeks. The other major types include those with intermittent flows, including the Little Owyhee River and numerous creeks on the plateau and in Spring Creek Basin. Also associated with lotic systems on the 45 Allotment are large river terraces along the South Fork and Little Owyhee.

For perennial watercourses we used the Proper Functioning Condition (PFC) assessment used by the BLM (Prichard 1995; 1998). We received PFC training from the BLM state office in early July and applied it to our work on the 45 Allotment during July and August. We used the Standard Checklist (Lotic) developed by the BLM for PFC assessments in Idaho. We also collected hydrogeomorphic data from the streams to support the PFC assessment.

We did not assess the ecological condition of intermittent drainageways. Existing PFC assessment methodology does not work well for these situations on the 45 Ranch and no ecological condition ratings have been developed for these communities.

The terrace communities are important and unique and, although marginally riparian, their distribution is restricted to landforms associated with the rivers. On the 45 Allotment nearly all terraces support the basin big sagebrush/basin wildrye plant community (Moseley 1999; see discussion in next section). The PFC methodology does not apply here, so we developed ecological condition ranks, defined in Table 1.

Table 1. Definitions for occurrence ranks/ecological condition of river terraces occupied by the basin big sagebrush/basin wildrye plant community.

RANK	CONDITION	DEFINITION
A	Excellent	Basin wildrye dominates the understory (>50% cover, often >80%); basin big sagebrush usually > 20%; cheatgrass nearly always present but in low cover, never dominating stand.
B	Good	Basin wildrye has moderate cover (10-50%); sagebrush same as above; cheatgrass can dominate portions of the stand.
C	Fair	Sagebrush cover still about the same; Nearly complete cover of cheatgrass in understory (>80% cover); basin wildrye <10% cover.
D	Poor	Little or no sagebrush cover; dominated by exotic herbaceous species.

RIPARIAN COMMUNITIES

We sampled riparian communities on the 45 Allotment briefly in 1997 (Moseley 1998) and more thoroughly in 1998 (Moseley 1999). The 1999 reference is the best summary of our two-year inventory of riparian community diversity in southwestern Idaho. It contains the results of our sampling and characterizations of the communities we encountered, including information on distribution, identification, ecological and environmental characteristics, succession and management, and wildlife values. Our results from the 45 Allotment sampling are briefly reviewed below, but Moseley (1999) should be consulted for a more detailed discussion.

I identified 21 riparian and wetland plant communities on the 45 Allotment, derived from 55 samples. Appendix 1 contains a list of all the plots and their locations, which are also mapped on

USGS quads (on file at CDC and TNC) as well as entered into the GIS. Table 2 contains a list of the riparian communities, their conservation ranks (Master 1991; Jankovsky-Jones et al. 1999), and the corresponding classification code used in NWI mapping (Cowardin et al. 1979). The distribution and ecological condition of these communities is discussed in later sections for each of the four geohydrological units mentioned previously, South Fork Owyhee River, Little Owyhee River, Canyon Spring Systems, and Intermittent Lakes and Creeks.

SOUTH FORK OWYHEE RIVER

Physical and Hydrological Setting

The South Fork Owyhee River is a major tributary of the Owyhee River encompassing the tri-state region of southeastern Oregon, southwestern Idaho, and adjacent Nevada. The South Fork watershed has an area of 2795 sq. mile (1.8 million acres), with 84% in Nevada, 11% in Idaho, and 5% in Oregon (EPA 1999). Its headwaters lie in the mountains of north-central Nevada and include the Bull Run Mountains, Independence Mountains, Tuscarora Mountains, and an eastern fore-ridge of the Santa Rosa Range known as the Calico Hills. Tributaries flow north out of this semi-circle of interconnected ranges onto the volcanic plains of the Owyhee Uplands. They eventually coalesce and become confined to two canyons upon reaching the Idaho border, the canyons of the South Fork and the Little Owyhee River. According to the Environmental Protection Agency, 4% of the watershed is forested and 9% is in crop use (EPA 1999). Most of the forests are in the Bull Run and Independence mountains on the southeast side of the watershed. At 168,348 acres, I believe that the EPA estimate of crop use in the basin is high. Whatever the acreage, it is comprised almost entirely of irrigated hayfields. The remaining 1.6 million acres of the South Fork basin is covered with sagebrush-steppe vegetation in varying successional stages. This section addresses ecological characteristics of the riparian vegetation along the South Fork in Idaho. The Little Owyhee River, as it traverses the 45 Allotment, is discussed in the next section.

The South Fork flows for 30.2 miles through Idaho, entirely within the 45 Allotment, between the NV border and the confluence with the East Fork at the northern edge of the allotment. It flows through a canyon, ranging from 650 to 950 feet deep, cut into the gently rolling volcanic plains the Owyhee Uplands. Canyon walls are comprised of various basalt, tuff, and sedimentary layers of Miocene and early Pliocene age, interrupted occasionally by Quaternary landslide material (Ekren et al. 1981). The canyon rim varies from 0.5 mile wide below Coyote Hole to 4 miles wide in the vicinity of Spring Creek Basin.

The South Fork represents the only perennial stream of any size on the 45 Allotment and, aside from 13 small springs, there are no perennial tributaries; they are all intermittent. Elsewhere on the allotment, there are only two small perennial creeks in Spring Creek Basin, which eventually disappear and become intermittent before reaching the South Fork. They are discussed in a later section.

Table 2. Riparian plant communities on the 45 Allotment. See text for explanation of conservation rank and NWI classification columns.

COMMON NAME	SCIENTIFIC NAME	RANK	NWI CLASS
Woodlands			
Western juniper/California oatgrass	<i>Juniperus occidentalis</i> / <i>Danthonia californica</i>	G?/S2?	R4SBA
Tall Shrub			
Sandbar willow/Barren	<i>Salix exigua</i> /Barren	G3?/S4	PSSA,PSSC, PSSJ
Sandbar willow/Mesic graminoid	<i>Salix exigua</i> /Mesic graminoid	G3/S3?	PSSA,PSSC, PSSJ
Low Shrub			
Silver sagebrush/Dry graminoid	<i>Artemisia cana</i> /Dry graminoid	G3?/S1	PSSA
Silver sagebrush/Mat muhly	<i>Artemisia cana</i> / <i>Muhlenbergia richardsonis</i>	G2/S1	PSSJ
Owyhee sagebrush shrubland comm	<i>Artemisia papposa</i> shrubland comm.	G1/S1	N/A
Basin big sagebrush/basin wildrye	<i>Artemisia tridentata</i> ssp. <i>tridentata</i> / <i>Elymus cinereus</i>	G2/S1	N/A
Greasewood/Sandberg bluegrass	<i>Sarcobatus vermiculatus</i> / <i>Poa secunda</i>	?	N/A
Graminoid			
Nebraska sedge	<i>Carex nebrascensis</i>	G4/S3	PEMC
California oatgrass	<i>Danthonia californica</i>	?	N/A
Creeping spike-rush - vernal pool	<i>Eleocharis palustris</i> (vernal pool)	?	PEMA,PEMC, PUSJ,L2USA
Creeping spike-rush - palustrine	<i>Eleocharis palustris</i> (palustrine)	G5/S3	PEMA,PEMC
Wandering spike-rush	<i>Eleocharis rostellata</i>	G2/S2	PEMA,PEMB
Baltic rush	<i>Juncus balticus</i>	G5/S4	PEMA,PEMC
Common reed	<i>Phragmites australis</i>	G4/S4	PEMA
Threesquare bulrush	<i>Scirpus americanus</i>	G1/S1	PEMC
Sharp bulrush	<i>Scirpus pungens</i>	G?/S3?	PEMA

Forb			
Prairie sage	<i>Artemisia ludoviciana</i>	G3/S2	R4SBC
Cut-leaved water-parsnip	<i>Berula erecta</i>	?	PEMB,PEMC
Davis peppergrass vernal pool	<i>Lepidium davisii</i> vernal pool community	G1?/S1	PSSA,PUSJ

Most of the South Fork's flow originates in the mountains of Nevada, where snow accumulates in the winter. This snow accumulation zone constitutes a small percentage of the South Fork basin, however, with most of it being arid lowlands of the plains. There is virtually no snowpack on the plains and streams tend to be intermittent and ephemeral, largely flowing during winter and spring and in summer only during storms. This makes for a very flashy hydrologic regime where the river rises rapidly and dramatically in response to spring snow melt patterns and episodic storm events, quickly returning to near base flow.

The discharge pattern, as measured by a gauging station in Nevada, reflects this flashy regime. The USGS operated a station on the South Fork in Nevada from October 1, 1955 to October 15, 1981, yielding 26 water years of discharge data. The gage was located immediately below the YP Ranch, approximately 18 air miles southeast of the allotment boundary/Idaho border (USGS 1999). The Hydrology and Hydraulics Committee (1976) lists the station at river mile (rm) 45.5, although our calculations would put it closer to rm 55. This gage probably well represents the regime on the 45 Allotment upstream of the Little Owyhee River confluence. Fourmile Creek (Nevada) is the only significant tributary in this segment and it is probably intermittent. Below the Little Owyhee, the hydrologic regime is probably more flashy than is represented by the gage data. The Little Owyhee is a 915 sq. mile watershed (EPA 1999) that does not drain any snow accumulation area and its channel is entirely intermittent in Idaho (as described later in this report).

Over the period of record, discharge varied from near zero cfs during many summers to 3200 cfs in 1957 (see Figure 1 for the 26 year hydrograph and Figure 2 for a higher resolution view of water years 1969-1978). Summer base flows are usually less than 50 cfs. Except for severe drought years (e.g., 1959 and 1977), peak discharge rates on the South Fork during winter and spring often vary by as much as 20 times over summer base flows. In extreme events (i.e., 1957, 1962, 1963, and 1975), peak flows of the South Fork were more than 60 times greater than summer flows. The rate of change surrounding these peak flows is very rapid, often lasting only a few days. Although not recorded by the South Fork station, an unusually high discharge event took place in the Owyhee River drainage during the winter of 1993. The USGS gauging station at Rome, Oregon, recorded a flow of nearly 48,000 cfs. On quick observation, the hydrographs for the Rome and South Fork stations appear similar. If this is (statistically) true, the 1993 discharge on the South Fork was around 9300 cfs, three times greater than the recorded high in 1957.

Figure 1. Historical streamflow daily values for South Fork Owyhee River near Whiterock, Nevada, water years 1956 to 1981 (USGS station 13177800).

Figure 2. Historical streamflow daily values for South Fork Owyhee River near Whiterock, Nevada, water years 1969 to 1978.

We measured water temperature in the South Fork at several places throughout its length in Idaho during July and August. It was consistently around 78⁰ F. This high temperature may be due to several naturally-occurring factors, such as open riparian vegetation, intense solar radiation, and the heat sink created by the canyon. It is probably exacerbated, however, by the tremendous amount of straightened channel upstream in Nevada. During a quick tour in August, we observed the South Fork, as well as the lower portions of many tributaries emanating from the Bull Run Mountains, to be flowing through broad, open ditches. This channelization has taken place in broad valley bottoms that are now converted to irrigated hay meadows. I measured nearly 65 miles of straightened channels on the BLM Surface Management Status map (1:100,000, Bull Run Mtns. quad, 1978), including portions of the South Fork and Bull Run, Silver, Sheep, and Indian creeks. This severe channel alteration may also accentuate the flashy nature of the hydrologic regime by eliminating meanders through the broad floodplains. Water quality is probably also affected by this. In Idaho, there is a small diversion dam ca. 0.25 mile upstream from the 45 Ranch at rm 12.3. The water diverted here is used for surface irrigation of hayfields on the ranch. We observed no other channel alterations on the allotment.

Throughout its length in Idaho, the South Fork flows through a narrow valley bottom, confined by steep canyon walls. It is mostly less than 300 feet wide, including the channel, point bars, and terraces. The canyon bottom widens beyond this in only three places, the 45 Ranch (rm 11.3), Coyote Hole (rm 19.6), and Bull Camp (rm 26.7). Figure 3a presents an idealized valley bottom profile of a narrow, straight river segment, compiled from several profiles taken throughout the allotment. Figure 3b presents similar information for an idealized profile on a river bend that includes a point bar and cut bank. As can be seen in these profiles, the river is entrenched deeply into the river terraces and there is little floodplain development beyond a bankfull discharge (ca. 1-3 year return interval). We observed no evidence that high flows leave the “trench” and flow over adjacent river terraces.

Selected river and hydrologic data were recorded separately for segments of the South Fork above and below the confluence of the Little Owyhee River (Appendix 2). In almost all attributes measured the two segments are similar. The river gradient below the mouth of the Little Owyhee is slightly less than the segment above (0.18% vs. 0.22%). Average river channel width was measured to be greater in the upstream segment, but this is probably an artifact of where we ran the profiles. I observed that the actual channel widths are similar above and below the Little Owyhee. Width of the riparian zone, sinuosity, bankfull width:bankfull depth ratio, and entrenchment ratio are similar. The upstream segment had a greater percentage of channel bottom covered with coarse material (cobbles and gravel) than the lower segment. This may reflect sediment input from the Little Owyhee system that would tend to dump sand and silt into the South Fork during flash floods. In terms of Rosgen’s (1996) stream channel classification, the South Fork appears to best fit into the F stream type due to high entrenchment. Throughout most of its length, it would classify as a F5 stream due to the predominance of sandy channel material, although some segments have gravel bottoms and would be F4.

Figure 3. Valley bottom profiles and distribution of plant communities at low water along the South Fork Owyhee River, Idaho. River channel geometry was not measured. 3a. Profile for a straight river segment. 3b. Profile of a river bend. Plant community abbreviations: Artrt/Elci = basin big sagebrush/basin wildrye; Scpu = sharp bulrush; Eqla = smooth scouring rush; Saex/Barren = sandbar willow/barren; Brin = smooth brome.

Valley bottom vegetation along the South Fork can be divided into two major categories based on their location. Community types occurring in the floodway of the South Fork are very different from those occurring on adjacent stream terraces. The floodway types are the more typical riparian communities comprised of obligate and facultative wetland species (*sensu* Reed 1988). The river terrace communities never flood and are marginally riparian, but their distribution is restricted to valley bottoms along the South Fork and Little Owyhee rivers because of alluvial substrates and higher water table than surrounding uplands.

River Floodway

Riparian Plant Communities

Riparian plant communities in the floodway of the South Fork are not diverse. Along this 30-mile stretch of river only four types were sampled and one is of minor occurrence. This lack of diversity probably results from a combination of the deep entrenchment of the river, intense scouring from flash floods, and the limited fluvial landforms in the floodway. There are two herbaceous communities dominated by rhizomatous graminoids and two shrub communities, both dominated by sandbar willow. Their distribution and ecological characteristics on the 45 Allotment are described below (see also Moseley 1998 and 1999 for a broader discussion of the functions and values of these community types). We were not able to map the distribution of each stand due to their small areal extent, but they are easily recognizable in the field and occur in a predictable, repeating pattern throughout the length of the South Fork on the 45 Allotment.

Sharp bulrush (*Scirpus pungens*) - This community has nearly continuous cover along river's edge at low water throughout the allotment (Figure 3). It is intensely rhizomatous and forms near-monocultures. Our plots had less than 12 associated species and all but creeping spike-rush had more than trace cover. Here's what Hall and Hansen (1997) wrote about this community in eastern Idaho: "It occupies some of the wettest sites on the landscape and tolerates prolonged flooding better than most riparian species. These highly saturated conditions, coupled with an extremely dense rhizomatous growth form, allow this aggressive species to colonize sites at an early successional stage and maintain dominance on undisturbed sites as the climax vegetation." Sharp bulrush is known to establish in areas of heavy wave action and can effectively stabilize reservoir and lake shorelines (Elzinga and Rosentreter 1999). In the case of the 45 Allotment, this translates to resistance to flash flooding and stabilization of river banks. Palatability for big game and livestock is considered poor (Elzinga and Rosentreter 1999; NRCS no date). We observed only minimal grazing in this community along the South Fork, usually of young shoots. Stands of sharp bulrush along the South Fork are the only ones known from southwestern Idaho (Moseley 1998; 1999). It is more common in eastern Idaho (Hall and Hansen 1997).

Common reed (*Phragmites australis*) - Dense stands of this tall grass (10+ feet!) occur on a few river bars upstream from the Little Owyhee confluence. This is a minor type along the

South Fork, having little areal cover. Elsewhere on the allotment, it dominates several small spring creeks, which are discussed later. Oddly, this species is nearly absent below the Little Owyhee confluence. The largest stands are around the corner from the diversion dam (rm 12.6) and possibly in the slack water created by it. Similar to sharp bulrush, common reed is a strongly rhizomatous perennial that forms dense, monotypic stands. The stands are flooded annually, each time depositing a new layer of silt due to flow resistance created by this community. Species diversity is very low in this community, probably due to deep shading and near-annual alluvial deposition in the understory.

Sandbar willow (*Salix exigua*) communities - Sandbar willow is the only woody species with significant cover in the floodway of the South Fork. Yellow willow (*S. lutea*) and whiplash willow (*S. lasiandra*) are the only other native woody species and they only occur as isolated sprouts, never more than three feet tall (usually only a few inches). Five tamarisk plants were also observed, as was a single patch of red-osier dogwood (*Cornus sericea*) near the mouth. This lack of shrub diversity probably results from the same factors that limit community diversity: deep entrenchment, intense scouring, and limited fluvial landforms in the floodway.

Stands of sandbar willow are small and widely scattered along the South Fork. Two sandbar willow community types occur on this segment that are distinguished by their understory: sandbar willow/barren and sandbar willow/mesic graminoid. The sandbar willow/barren type has exposed alluvium beneath the willow canopy. On an annual basis, these stands either get scoured, exposing a cobble substrate, or sand and silt is deposited. There can be a diversity of weedy herbaceous species that inhabit the understory but they are always in trace amounts.

The sandbar willow/mesic graminoid type has a high cover of herbaceous species in the understory, especially graminoids such as sharp bulrush, redtop (*Agrostis stolonifera*), quackgrass (*Agropyron repens*), woolly sedge (*Carex lanuginosa*), and forbs such as smooth scouring rush (*Equisetum laevigatum*) and western goldenrod (*Euthamia occidentale*). The willow canopy is significantly less here than the sandbar willow/barren community.

Sandbar willow is a pioneer species which colonizes relatively recent alluvial deposits on islands and river bars and can withstand intense flooding (Figure 3). The sandbar willow/barren community occurs on sites that experience greater hydraulic energy and may be maintained at an early seral stage. The sandbar willow/mesic graminoid type occurs on lower energy sites. Most willow stands are not grazed, except on the streambars immediately downstream from the 45 Ranch.

A strip of herbaceous vegetation often occurs in the narrow transition zone of the river banks, between the floodway communities described above and the terrace communities described below. Smooth scouring rush (*Equisetum laevigatum*) and the non-native smooth brome (*Bromus inermis*) form near monocultures on the upper half of the banks (Figure 3). Both of these are strongly rhizomatous and appear to withstand at least some flooding. Smooth scouring rush, especially, appears to stabilize steep banks during floods. We observed many banks with a

thick mat of intact scouring rush rhizomes exposed by erosion during high flows. Smooth scouring rush is probably similar to other *Equisetum* species in being a pioneer invader on newly exposed fluvial surfaces. In some places, golden currant (*Ribes aureum*) and especially Wood's rose (*Rosa woodsii*) form dense, narrow stands in this transition area.

Ecological Condition

The riparian vegetation of the South Fork floodway is represented by communities in high ecological condition. The sharp bulrush community, especially, armors most of the river banks along the South Fork. The maintenance and condition of these communities is more affected by the larger fluvial (river) processes of the watershed than by local livestock grazing, which currently is minimal on the 45 Allotment. We assessed both South Fork segments to be in Proper Functioning Condition (see Appendix 2 for the PFC standard checklists and associated hydrogeomorphic data).

A BLM stream habitat inventory was conducted at the mouth of the South Fork on May 26, 1978 (BLM unpublished data). Discharge at the time of the inventory was 600 cfs at the gauging station in Nevada, a typical spring flow. The Overall Rating for stream habitat was Fair, largely due to low scores for instability of banks and high percentage of fine sediments on the stream bottom. Low in-stream cover was also a factor. Stream bank cover and channel stability were rated as Good. As mentioned previously, we classify most of the South Fork as Rosgen's F5 because of the sandy sediments covering the stream bottom. Also, there is little in-stream cover, except for boulders and deep pools in a few places. There is virtually no overhanging vegetation or stable overhanging cutbanks to provide cover. Our data indicate that their estimate of greater than 20% active erosion of stream banks is high. We mapped all active cutbanks larger than 30 feet in length on the 45 Allotment. To be measured, the cutbank had to be unvegetated to the waters edge during the low flows of July and August. We measured 33 of these large cutbanks for total length of 5820 feet (mean length = 176 feet; range = 30 feet to 500 feet) or 1.8% of the South Fork (30.2 miles x 2 banks). This obviously underestimates active cutbanks because we didn't measure the small ones, but as can be seen from the mean length, active cutbanks were generally large. There weren't many small ones. Banks are actively eroding in areas where the river flow is diverted into a terrace. The terraces are uniformly fine-textured (sandy to sandy-loam) and the active cuts are vertical, 8 - 15 feet tall. The cuts erode all year due to river energy and/or sloughing of the lower 2 - 3 feet saturated by hydraulic lift. The rapid rise and fall of the river probably significantly contributes to this instability.

It is difficult to know if the upper watershed is having deleterious affects on the fluvial geomorphic processes along the South Fork in Idaho, but it appears to me that the erosional and depositional processes are in balance. The terraces are actively being degraded to a moderate degree and contribute to the sediment load of the river, including both bed load and suspended load. Bed load deposits are being laterally accreted (minimal vertical accretion) in the deeply entrenched floodplain and are colonized by the sandbar willow communities. Some of the suspended load settles out within the channel below bankfull stage. If it's deposited in slack

water or eddies, it creates the fine-textured substrates colonized by the sharp bulrush community. Cattle have virtually no effect on these processes on the 45 Allotment.

River Terraces

Riparian Plant Communities

River terraces are found throughout the length of the South Fork on the 45 Allotment. They are more common and generally larger, however, below the confluence of the Little Owyhee, probably as a result of greater sediment input from this intermittent drainage. Terraces consist of deep sandy and silty alluvial deposits, with little coarse-textured material. Their surface elevation is up to 13 feet above summer flows and probably six to eight feet above mean high flows. Apparently they never flood, even during episodic discharges. With few exceptions, all terraces are occupied by the basin big sagebrush/basin wildrye community type (Figure 3), described below. We were able to map the distribution of these stands on the larger terraces of the South Fork.

Basin big sagebrush/basin wildrye (*Artemisia tridentata*ssp. *tridentata*/*Elymus/cinereus*) - In good condition, this community has moderate cover of tall sagebrush plants with a nearly complete cover of basin wildrye in the understory. In poor condition the wildrye is replaced by cheatgrass (*Bromus tectorum*). This was also the presettlement vegetation type in hay fields at the 45 Ranch, by far the largest stream terrace along the river. We mapped 46 terraces with this community along the South Fork. Their ecological condition is discussed later. Throughout its range in the Intermountain west, high quality stands of the basin big sagebrush/basin wildrye community type are rare. They occur in landscape settings that have been converted to human uses or have been heavily grazed, hence the high biodiversity conservation rank assigned to this community (Table 2).

On a few terraces, we observed greasewood (*Sarcobatus vermiculatus*) sharing dominance with basin big sagebrush. In two instances (Bull Camp and Coyote Hole), greasewood dominates terraces on sites that I would expect to see basin big sagebrush/basin wildrye. Sandberg bluegrass (*Poa secunda*) dominates an open and depauperate understory. It is unclear to me whether this represents a legacy of past livestock grazing or different site conditions. The successional status of greasewood on these terraces needs further study.

Two upland communities occur in minor amounts on terrace surfaces that are slightly higher than those described above. The basin big sagebrush/needle-and-thread grass (*Stipa comata*) community occurs on a couple of high, sandy terraces. Wyoming big sagebrush/Thurber's needlegrass (*Artemisia tridentata*ssp. *wyomingensis*/*Stipa thurberiana*), a type more common on the plateau and in Spring Creek Basin, occurs on a few very rocky outwash fans at the mouths of side canyons.

Ecological Condition

We mapped 46 terraces along the South Fork that support the basin big sagebrush/basin wildrye community type. We did not map small terraces less than about two acres, which often occur as narrow strips and can support high quality vegetation. The distribution of terraces by ecological rank is as follows:

A Rank	16 (35%)
B Rank	10 (22%)
C Rank	19 (41%)
D Rank	1 (2%)

Total	46 terraces

Only one terrace, the 45 Ranch, lacks both wildrye and sagebrush cover to qualify for a D rank. On all other terraces inventoried, basin big sagebrush was the dominant or codominant plant. On 19 terraces, however, the native perennial species, largely basin wildrye, were replaced by cheatgrass. These C-ranked terraces occur in clusters within the South Fork canyon, probably indicating accessibility to cattle in the past, such as at Bull Camp, Coyote Hole, and the bars for 0.75 mile below the 45 Ranch. The A- and B-ranked terraces are scattered throughout the allotment, but are more common in the relatively inaccessible portions of the canyon, especially in the rugged lower canyon below the Spring Creek confluence. This concentration of A- and B-ranked examples of the basin big sagebrush/basin wildrye community is the greatest of any place we've inventoried in Idaho. Maintenance of these stands should be a conservation objective of 45 Allotment management.

LITTLE OWYHEE RIVER

Physical and Hydrological Setting

The Little Owyhee is an intermittent river throughout its length in Idaho. It is the largest tributary of the South Fork, in terms of land area, draining 916 sq. mile (586,157 acres). It includes portions of Nevada (76%), Oregon (14%), and Idaho (10%; EPA 1999). It's headwaters lie in Nevada, in the eastern foothills of the Santa Rosa Range known as the Calico Hills. According to the Environmental Protection Agency, there is no forested land cover or crop use in the drainage (EPA 1999). Our observations of the watershed bear this out. Most of watershed is covered by sagebrush-steppe vegetation, with lesser amounts of canyonlands and dry lakebeds.

The Little Owyhee flows for 7.8 river miles on the 45 Allotment before reaching its confluence with the South Fork. It flows for a similar distance through Idaho, upstream of the allotment boundary fence. Similar to the South Fork, it flows through a narrow canyon, ranging from 550 to 800 feet deep and varies from 0.4 to 0.7 miles wide. There is only one tributary to the Little Owyhee of any size on the allotment and it is an intermittent wash near the mouth.

The flow of the Little Owyhee is entirely intermittent in Idaho. This also appears to be the case in Nevada and Oregon, although there are probably some perennial springs in the Calico Hills and possibly elsewhere. There are no major snow accumulation zones in the drainage. Discharge patterns for the Little Owyhee drainage are largely unknown, but it is probably a very flashy system, flowing only during spring runoff and summer storm events. The USGS briefly operated a gauging station on the headwaters of Tent Creek in Oregon, which measured discharge from a drainage area of only 15.4 sq. miles. Tent Creek is a major tributary of the Little Owyhee and is confluent with it in Star Valley, Idaho, about 4 miles above the allotment. The station operated during water years 1978 through 1981, and throughout most of its operation the creek had no flow. Below are the dates and discharges for peak flows during the four years of operation (USGS 1999):

1978 (April 27)	25 cfs
1979 (September 1)	21 cfs
1980 (May 7)	114 cfs
1981	0.0 cfs

Throughout its length on the 45 Allotment, the Little Owyhee flows through a narrow valley bottom, confined by steep canyon walls. This is especially true above rm 2.3, where the straight channel flows between cliffs and steep colluvial toe slopes, and is not more than 150 feet wide (Figure 4a). Below rm 2.3 the valley bottom widens to over 200 feet and is similar to the South Fork. It becomes deeply entrenched into the old floodplain and increases in sinuosity somewhat (Figure 4b). The gradient is 0.6%, slightly steeper than the South Fork. Using Rosgen's (1996) classification, the Little Owyhee is also a F stream type, with sand, gravel, and cobble channel substrates, approximately in equal proportion.

Similar to the South Fork, there are riparian plant community types that are restricted to the floodway and others restricted to the river terraces. Because of its intermittent flow, the floodway communities are very different from the South Fork. The river terrace community, however, is the same.

River Floodway

Riparian Plant Communities

Riparian plant communities in the floodway of the Little Owyhee are much more diverse than the South Fork. Although the fluvial landforms (i.e., habitats) are the same, the intermittent flow of the Little Owyhee adds hydrologic complexity not found on the South Fork. The interplay of these two factors creates the greater community diversity. An intermittent drainage the size of the Little Owyhee River is very unusual in Idaho, and may be ecologically unique. In my experience, there are only a few others in the Owyhee Uplands. Dickshooter Creek may be the most similar, but its drainage area is relatively small compared to the Little Owyhee.

Figure 4. Valley bottom profiles and distribution of plant communities along the Little Owyhee River, Idaho. 4a. Profile for the narrow, upper canyon at rm 3.3. 3b. Profile for wider, lower canyon at rm 1.2. Plant community abbreviations: Artrt/Elci = basin big sagebrush/basin wildrye; Elpa = creeping spike-rush.

Even though the surface flow of the Little Owyhee is intermittent, there are perennially wet habitats in the floodway. They are maintained by a subsurface flow in the channel sediments. Because of the complex channel geometry, some habitats are left high and dry after surface flows subside, while low points in the channel remain near the water table or even contain pools. These subsurface flows appear to be relatively stable throughout the late summer, maintaining these wetland and open-water oases in an otherwise dry canyon. Below is a brief synopsis of the habitats and riparian plant communities in the Little Owyhee floodway, roughly in order of their occurrence along the hydrologic gradient from wet to dry.

Open water - There are many open-water pools along the river throughout the 45 Allotment. The pools are kept cool by the subsurface flows. Water temperatures averaged around 60° F, nearly 20° cooler than the South Fork. Aquatic macrophytes, such as water buttercup (*Ranunculus aquatilis*) and pondweeds (*Potamogeton* spp.) are common in the pools, as is the rare aquatic plant, fringed waterplantain (*Machaerocarpus californicus*). Green algal mats are also common, but rarely very thick. The larger ponds contain small schools of fish that appeared to be mostly small-mouth bass. We saw no redband trout.

Recent sand, gravel, and cobble deposits - Most of these surfaces were probably scoured by the last flood event or are new deposits. The new gravel and cobble deposits are mostly devoid of plants. The sandy substrates, however, often contain a unique suite of annual plants that can be quite abundant if the deposits remain moist. Species such as *Camissonia tanacetifolium*, *Downingia latea*, *Lilaea scilloides*, and *Limosella aquatica* are restricted or are most common in this habitat. The rare fringed waterplantain is also found on moist sands adjacent to pools.

Graminoid communities - Where the water table is at or near the surface, the channel can be dominated by lush graminoid wetland communities (Figure 4). The creeping spike-rush - palustrine community type (Table 2; Appendix 1) is the most common, followed by a community dominated by a mixture of grass and grass-like species, mostly Baltic rush. Surprisingly, sharp bulrush, which is so abundant on the South Fork, is rare along the Little Owyhee river, occurring in small patches below rm 4.2.

Sandbar willow communities - As on the South Fork, willow-dominated vegetation is represented by the sandbar willow/barren and sandbar willow/mesic graminoid community types, however, they are less common here than on the South Fork. They can occur in the channel or on low bars along its edge. Very few other deciduous shrubs were observed. We saw one plant of arroyo willow (*Salix lasiolepis*) and Wood's rose is locally common in small patches.

Prairie sage community - The prairie sage community type occurs on high cobble bars in the middle of the channel. Plant cover is low, but is clearly dominated by the low-growing, herbaceous plant, prairie sage (*Artemisia ludoviciana*). There can be a high diversity of associated species (Table 2; Appendix 1).

Silver sagebrush community - Although uncommon and occurring in small patches, silver sagebrush (*Artemisia cana*) can dominate small bars on the edge of the dry channel. It is underlain by gravel and cobble alluvium. The understory is open, but dominated by a variety of dry-site grasses, such as bottlebrush squirreltail (*Sitanion hystrix*), Nevada bluegrass (*Poa nevadensis*), and even bluebunch wheatgrass (*Agropyron spicatum*). This community is clearly underwater at high flows, but probably for short duration.

Ecological Condition

As I mentioned in the Methods section, we did not perform a PFC assessment on intermittent drainages, including the Little Owyhee. Similar to the South Fork, however, maintenance and condition of the floodway communities are more affected by the larger fluvial processes of the watershed than by local livestock grazing, which was nonexistent in 1998.

River Terraces

Riparian Plant Communities

River terraces large enough to map on 1:24,000-scale topographic maps are only found below rm 2.3. In nearly all respects they have the same physical characteristics as those along the South Fork, except they are not as high above the channel, generally less than 10 feet. We mapped 12 large terraces along the lower Little Owyhee. All were occupied by the basin big sagebrush/basin wildrye community type, as it was described in the previous section (Figure 4). Greasewood was often prominent on these terraces, along with basin big sagebrush.

Ecological Condition

All terraces along the Little Owyhee were C-ranked, that is, they were all dominated by sagebrush, but the native perennial understory species were uniformly replaced by exotic annuals, mostly cheatgrass and clasping pepperweed (*Lepidium perfoliatum*). This is a legacy of past livestock grazing. The big terraces along the lower Little Owyhee are easily accessible and have been grazed hard since settlement. The intermittent nature of the Little Owyhee probably contributed to the ease of access.

CANYON SPRING SYSTEMS

Small springs emanate from the canyon walls of the 45 allotment in three areas: (1) the north end of the allotment in Juniper Basin and along the East Fork canyon rim; (2) the south end of the allotment in the South Fork canyon above Coyote Hole; and (3) Spring Creek Basin. Springs and associated creeks are quite different in these three areas, in terms of size, riparian plant communities, and grazing impacts. They are discussed separately below. All of these spring systems are small and, except for the ones along the South Fork, are isolated sources of perennial

water and associated riparian habitats. This makes them especially important for wildlife species (e.g., Skagen et al 1998).

North End Springs

Three springs were observed in this area, all are very small and have only local influence in these otherwise dry sites.

“Cabin Spring” - Located in Juniper Basin near an old cabin and corral (T13S R5W S28 SW4 of NE4; indicated on USGS topo map). There is no obvious flow from the spring, it just creates a small (50' x 15'), subirrigated wetland dominated by herbaceous species (creeping spike-rush, sharp bulrush, and cattails). The lower end has been gouged out by heavy equipment. No sign of recent cattle grazing.

“South Juniper Spring” - Located in Juniper Basin south of Cabin Spring (T13S R5W S34 NW4 of NW4; indicated on USGS quadrangle). Similar to Cabin Spring, there is no obvious flow from this hillside spring. It creates a small (30' x 12'), subirrigated wetland dominated by herbaceous species (creeping spike-rush and cattails). It has been gouged out by heavy equipment. No sign of recent cattle grazing.

“North Canyon Spring” - Located below the canyon rim in an intermittent drainage that flows north from Spring Butte (T13S R6W S13 SW4 of NW4; not indicated on USGS quadrangle map). This small wet area occurs in a plunge pool at the base of a 15-foot, intermittent waterfall. Creeping spike-rush, mat muhly (*Muhlenbergia richardsoni*), and meadow barley (*Hordeum barchyantherum*) are the dominant species. Rim rock surrounds the spring, excluding livestock grazing.

South Fork Canyon Springs

Between Coyote Hole and the Nevada border, there are 13 springs that surface on the lower slopes of the canyon walls. Discharge from these springs is small and the associated creeks flowing into the South Fork are short, generally ranging from about 20 feet long to about 300 feet. One spring creek in Coyote Hole is about 1000 feet long. Six springs are concentrated in Coyote Hole (rm 19.6) and three are concentrated near the allotment boundary (ca. rm 29.3). The remaining four are scattered between Coyote Hole and Bull Camp (river miles 21.9, 24.4, 24.7, and 25.1).

The location of the springs appears to be geologically controlled. The upper cluster of three springs surface at the base of large landslide debris that straddles the Nevada - Idaho border. Most, however, emanate at the base of a mapping unit called Interbedded Sediments, at the contact with a rock unit known as the Tuff of Swisher Mountain (Ekren et al. 1981). Surface water probably percolates through the sediments and runs along the impermeable tuff before surfacing. Below Coyote Hole, down to the Ranch, Tuff of Swisher Mountain comprises the

entire canyon wall and no springs occur. Surprisingly, there are no springs in the canyon below the 45 Ranch. The prominent “inner” gorge below the ranch is tuff, while the gentler upper canyon slopes are sediments.

Most of the riparian plant communities associated with spring systems on the 45 Allotment are unique to these geohydrologic settings in the South Fork canyon and in Spring Creek Basin. They don’t occur along the hydrologically dynamic rivers. In the South Fork canyon, two of the three communities are restricted to springs. Communities are discussed below. These springs are also habitat for two rare plant species, Nevada angelica (*Angelica kingii*) and giant hellebore (*Epipactis gigantea*). The former occurs at one spring in Coyote Hole (and another in Spring Creek Basin) and the latter at the upper-most spring on the allotment at rm 29.3.

Threesquare bulrush (*Scirpus americanus*) - This is a rare plant community type in Idaho and elsewhere (Table 2). We found one occurrence on the 45 Allotment, a high quality stand at a spring on a river terrace at rm 24.4. Threesquare bulrush forms a tall (6'), dense monoculture.

Wandering spike-rush (*Eleocharis rostellata*) - This community type is restricted to springs along the South Fork and in Spring Creek Basin. It is a moderately rare community type in Idaho and throughout its range. Wandering spike-rush is a distinctive, low-growing graminoid that forms near monocultures along moderate- to steeply-sloping spring creek channels. Along the South Fork, examples occur at several springs in Coyote Hole, with the threesquare bulrush community at rm 24.4, and two of the three springs near the allotment boundary.

Common reed - This community was described earlier as occurring on a few river bars above the 45 Ranch. It is also prominent around the spring heads at several sites along the South Fork, especially in Coyote Hole. Similar to the river stands, common reed forms tall, dense stands. The diversity of understory species is greater at the springs, however, where it is the primary habitat for the rare Nevada angelica. Stands of mixed riparian shrubs can occur on some steep spring channels below the common reed-dominated spring heads. Shrubs include sandbar willow, yellow willow, Wood’s rose, and golden currant.

All spring areas along the South Fork have been grazed in the past, but we observed no recent evidence. The riparian communities appeared to be in high ecological condition.

Spring Creek Basin

Only portions of two tributaries of Spring Creek are perennial, both having their source at springs that surface in sediments below the canyon rim. The remaining drainages in Spring Creek Basin are intermittent. These two tributaries, which we’ve called “Main Fork” and “North Fork,” are small and high gradient, but both have well-developed riparian vegetation. Riparian communities and their ecological condition is described for each fork.

Main Fork

This is the drainage labeled Spring Creek on the USGS quadrangle and the two spring sources are identified on the map. The total length of the channel supporting riparian vegetation below the springs is about 1.4 miles, however, only 1.2 miles has surface flows. The remaining 0.2 mile is subirrigated by the water table. Below this the channel is dry.

The source springs and most of the riparian vegetation is upstream from the allotment boundary fence, with only 0.4 mile occurring on the 45 Allotment. Vegetation types below the boundary fence are as follows:

Nebraska sedge (*Carex nebrascensis*) - The Nebraska sedge community is restricted to that portion of the drainage with surface flows, which is only 0.1 mile on the 45 Allotment. It is much more common above the boundary fence. Dense stands of this strongly rhizomatous sedge dominate the streambanks.

Cut-leaved water-parsnip (*Berula erecta*) - Cut-leaved water-parsnip is an aquatic plant that grows directly in the channel. It dominates the community and provides nearly complete cover to the creek. This and the Nebraska sedge community described above form a mosaic along the creek.

Baltic rush (*Juncus balticus*) - The remaining 0.3 mile of the riparian zone is subirrigated and has no perennial surface water. Baltic rush dominates this stretch.

The composition and structure of the vegetation, as well as stream and hydrologic characteristics all indicate that this short segment is in Proper Functioning Condition (Appendix 2).

North Fork

This fork starts at the springs on the state section and parallels the jeep road through Spring Creek Basin. There are 1.1 miles of riparian vegetation from the springs to the confluence with the Main Fork; the channel is intermittent below the confluence. About 250 feet of the creek below the spring were excluded from cattle grazing in 1997. Vegetation patterns along the North Fork are similar to the Main Fork.

Nebraska sedge - This is the main riparian community along this fork. It begins below the small, constructed pond near the headwaters and continues downstream along both banks nearly to the confluence. Soils are perennially saturated, often with standing water.

Cut-leaved water-parsnip - This aquatic plant grows in the spring channel and provides nearly complete cover to the creek when not grazed too heavily. A population of Nevada angelica (*Angelica kingii*) occurs in this community above the enclosure fence.

Baltic rush - This community occurs occasionally along this fork, generally where the riparian zone widens and soil moisture is less saturated than that of the Nebraska sedge community.

Wandering spike-rush - This community is rare here, sampled in one small stand near the confluence. Another, larger stand occurs below one of the headwater springs on the Main Fork.

The riparian zone along the North Fork is grazed much more intensively than the Main Fork. The Nebraska sedge community was grazed to a low stubble height prior to our inventory in August, so it was difficult to identify all the species. However, Nebraska sedge clearly formed a thick, continuous stand along the entire creek bank. What is troubling about this fork is the condition of the cut-leaved water-parsnip community in the creek channel. In both the North Fork above the enclosure fence and the upper Main Fork, water-parsnip has nearly 100% cover over the channel and reaches a height of about 10 inches. Below the enclosure fence on the North Fork, it has very low cover and is only about 2 inches tall, a condition clearly attributable to cattle use. On the upside, however, we only saw banks being affected by trampling in a couple of small areas. We did not see any active bank or head cutting and other stream and hydrologic attributes appeared stable (Appendix 2). The saving grace here is that this is a constant-flow, spring-fed creek. If there was a variable hydrograph, with runoff peaks in the spring or during flash floods, I believe this creek would begin to unravel.

Below the enclosure fence, we rated the North Fork as being Functional At-Risk, with the trend not apparent to us. The 250 feet above the enclosure fence are in PFC (Appendix 2). Given the quick recovery of the riparian zone above the new enclosure fence, there is reason to be optimistic about the recovery and maintenance of a functional riparian zone along the remainder of this creek.

INTERMITTENT LAKES AND CREEKS

Intermittent creeks and natural lakes and pools are widespread on the plateau and in the canyons of the 45 Allotment. They have water in them only part of the year and sometimes not every year, depending on climatic patterns. Vegetation associated with these habitats is different than surrounding uplands, clearly showing the influence of high water tables and/or flowing water. Because they are intermittently wet, however, they do not remain green season-long and do not attract livestock like perennially wet areas. For this reason, livestock management does not become a high-priority issue in these habitats. Also, because these features tend to be small and local, they are often ignored when considering management of the surrounding uplands. Nevertheless communities supported by these geohydrological conditions are often unique and represent important biodiversity elements on the 45 Allotment. We sampled 20 stands of eight community types in the study area. Little is known about the succession, disturbance, and management of these communities (they are also ignored by most riparian inventories and classifications!), so I will only document their occurrence on the allotment. Ecological characterizations of these communities can be found in Moseley (1998; 1999).

Intermittent streams (and lakes) are defined as flowing “only at certain times of the year when they receive water from springs or from some surface source such as melting snow in mountainous areas.” In contrast, ephemeral streams flow “only in direct response to precipitation, and whose channel is at all times above the water table” (Prichard 1998). In the context of the 45 Allotment, these definitions probably represent the extremes of what is actually a continuum of hydrology. In some cases, creeks may be both intermittent and ephemeral, depending on the year. I have chosen to call them all intermittent for convenience.

There are two major types of intermittent features on the 45 Allotment. There are internally-drained basins on the plateau that often have a lake or small pool at the lowest point. All creeks on the plateau and most in the canyon are also intermittent. Community types occurring in these two features are different from each other and are discussed below. The Little Owyhee River is intermittent and is a special case because of its size, but it shares some of the same communities with intermittent creeks.

Intermittent Lakes and Pools

Throughout the world these wetlands are usually referred to as vernal pools (Keeley and Zedler 1998), although in Idaho they are often called playas. In this report I refer to them as intermittent or vernal. They occur on the gently rolling volcanic plains of the Owyhee Uplands where there is no external drainage. The basin areas can range in size from a few acres to several hundred acres. In one case on the 45 Allotment (the upper Spring Creek drainage), a creek actually traverses the basin, but has a gradient of only 10 feet over a distance of 4+ miles. This essentially creates a hydrologic condition more similar to an internal drainage; plant communities reflect this regime. Below are the three community types documented from intermittent lakes and pools on the 45 Allotment (see also Table 2 and Appendix 1).

Silver sagebrush/mat muhly (*Artemisia cana/Muhlenbergia richardsoni*) - This occurs on the three lakes at the northwest corner of the allotment, Bull Lake, Oregon Lake, and an unnamed lake near the canyon rim. It also occurs in the large basin at the head of Spring Creek, straddling the allotment boundary. Outside the allotment, it occurs in a basin northeast of 45 Hill on the Star Valley Allotment and in at least one of the lakes at the north end of the YP Desert (Moseley 1998).

Creeping spike-rush - vernal pool (*Eleocharis palustris*) - We separated this community from one dominated by the same species along creeks, because of obvious ecological and hydrological characteristics, such as associated species. It occurs at the three northwestern lakes mentioned above, as well as one of the YP Desert lakes.

Davis peppergrass vernal pool (*Lepidium davisii*) - Davis peppergrass is often the only plant occurring in these small pools. On the 45 Allotment, we documented 19 Davis peppergrass pools, one above Spring Creek Basin and the rest occurring on the southern unit of the allotment between the Little Owyhee and South Fork. Many other Davis peppergrass pools

are known from either side the allotment on both the Star Valley and YP allotments.

Intermittent Creeks

As mentioned in previous sections, very few tributaries of the South Fork are perennial. Most are intermittent and many originate on the plateau and traverse the canyon slopes on their way to the river. A few originated entirely within the two mid-canyon basins, Spring Creek Basin and Juniper Basin. We documented five community types, as follows (see also Table 2 and Appendix 1).

Western juniper/California oatgrass (*Juniperus occidentalis/Danthonia californica*) - Western juniper is rare on the 45 Allotment and this community type was only found at the north end. One site was on the intermittent drainage below Cabin Spring in Juniper Basin and the other was in a draw below the north canyon rim.

Silver sagebrush/dry graminoid - Only one stand was found on the plateau near Bull Lake. It also occurs along the Little Owyhee River.

Owyhee sagebrush (*Artemisia papposa*) - This distinctive and rare sagebrush, nearly endemic to the Owyhee Uplands, dominates small stands along intermittent drainages on the plateau. Only two stands were found on the 45 Allotment, both at the north end in adjacent drainages near Long Pull Reservoir.

California oatgrass - A common community type along intermittent drainages of the Owyhee Uplands, we only sampled two stands near the north end. It probably occurs elsewhere.

Prairie sage (*Artemisia ludoviciana*) - This community type is common in intermittent drainages in Spring Creek Basin and along the Little Owyhee.

RIPARIAN FLORA

Checklist

We observed 275 vascular plant species in the riparian zones of the 45 Allotment. They are listed in Appendix 3, arranged by life-form (trees, shrubs, perennial forbs, etc.), and with their distribution within major habitat groups (perennial streams, intermittent streams, river terraces, and intermittent lakes). This list will be expanded in 1999 to include all the flora observed on the 45 Allotment during the project. Next year's summary report will contain another list with the common names of the plants. For now refer to Moseley (1998), which has a list containing common names for most of the plants in Appendix 3.

Rare Species

Several rare plant species had been reported from the 45 Allotment prior to our work. Many of these were encountered in 1998 and several new discoveries were made, including two species that may be new to the state (*Nevada angelica* and *downingia*). I will only describe the seven rare riparian species here (Table 3). Rare plants from upland habitats will be summarized next year.

Table 3. Distribution and habitats of rare riparian species on the 45 Allotment.

COMMON NAME	SCIENTIFIC NAME	RANK	OCC. #	DISTRIBUTION AND HABITAT
Owyhee sagebrush	<i>Artemisia papposa</i>	G4/S4	N/A	Intermittent creeks; dominates community; 2 creeks at N end
Howell's goldenweed	<i>Haplopappus uniflorus</i> var. <i>howellii</i>	G5T?/S1	002	Intermittent creeks; Owyhee sagebrush and California oatgrass communities; 2 creeks at N end.
Davis peppergrass	<i>Lepidium davisii</i>	G3/S3	096, 097, 098, 102, 103, 171	Intermittent pools; dominates community; 19 pools on S end of allotment
giant helleborine	<i>Epipactis gigantea</i>	G4/S3	060	Small spring rivulet at southern boundary along South Fork.
fringed waterplantain	<i>Machaerocarpus californicus</i>	G4/S2	014	Pools and moist sands in Little Owyhee river bed.
Nevada angelica	<i>Angelica kingii</i>	G?/S1	N/A	Springs in Spring Creek Basin and Coyote Hole; wandering spike-rush, common reed, and cut-leaved water-parsnip communities.
downingia	<i>Downingia insignis</i>	G?/S1	N/A	Drying mud near 2 reservoirs: W of Juniper Basin and W of Little Owyhee Canyon (Star Valley Allotment).

First, I need to correct a mistake I made during my brief inventory of the 45 Ranch in 1997. I reported the occurrence of the rare American wood sage (*Teucrium canadense*) from along the South Fork (Moseley 1998). We were unable to locate this population in 1998, but did locate a

population of marsh betony (*Stachys palustris*) more or less in the same area. Marsh betony is a similar-looking mint; I must have been afflicted with floristic delirium during the 1997 visit.

Below I briefly describe the distribution and management implications for the six riparian species. For some species, numerous references exist that can be consulted for further information. I forego citing them all here, but they are available on request.

Owyhee sagebrush - Owyhee sagebrush dominates low bars along intermittent drainages on the volcanic plains and is now treated as a riparian community type in Idaho (as you've read about previously in this report and in Moseley 1998; 1999). It used to be treated as a rare plant in Idaho due to its limited distribution. It was found to be locally common, however, on the western side of the Owyhee Uplands and in the Bennett Hills-Wood River area north of the Snake River Plains. It remains a unique floristic element and should be of special interest on the 45 Allotment.

We found stands of Owyhee sagebrush only in two drainages on the north side of Spring Butte. The largest occurs in the creek immediately east of Bull Lake. A portion of this population was destroyed by construction of a reservoir. A much smaller population occurs in the draw one mile north of Long Pull Reservoir, near the canyon rim. There is little forage in this community and it dries out early, limiting grazing impacts. Some stands are impacted by trampling due their proximity to the reservoir.

Howell's goldenweed - As further evidence of my floristic delirium in 1997, I reported a population of Howell's goldenweed from the intermittent bed of the Little Owyhee, near its mouth (Moseley 1998). We discovered that this was a misidentification of another goldenweed, *Haplopappus hirtus*. However, I later discovered the real Howell's goldenweed in the same intermittent drainages with Owyhee sagebrush, mentioned above. The two species have nearly identical distributions on the 45 Allotment. This variety is endemic to extreme southwestern Idaho and adjacent portions of Oregon, Nevada, and northeastern California. Habitats are only lightly grazed, probably because the very rocky substrate limits trailing through the populations.

Davis peppergrass (*Lepidium davisii*) - Similar to Owyhee sagebrush, this rare plant dominates its habitat and is also considered a community type. Unlike Owyhee sagebrush, however, Davis peppergrass is considered rare throughout its range and of conservation concern. As mentioned previously, we have found 19 intermittent pools on the 45 Allotment containing this species. Grazing impacts are minimal to nonexistent.

Giant helleborine - In Idaho, this orchid is restricted to springs, either hot springs in the mountains or cold springs in the desert areas. The tiny spring on the 45 Allotment had a small clone or a few stems and is isolated from any grazing impacts.

Fringed waterplantain - This species is at the northeastern corner of its range in Idaho, being more common in Oregon, Nevada, and California. It occurs around vernal pools and along the margins of intermittent streams. On the 45 Allotment, it occurs in the riverbed of the Little Owyhee, where it gets flooded every year. No grazing impacts were observed in 1998.

Nevada angelica - Our discovery of this species on the 45 Allotment is believed to be the first documented for Idaho. It is commonly found in the mountains of Nevada. We discovered 63 individuals of this large, herbaceous plant at the head of the “North Fork” of Spring Creek. It grows in the creek channel near the springs, only on the 250 feet of creek above the new enclosure fence. We couldn’t find any plants below the fence. This is a robust, obvious plant and, even with the riparian zone below the fence being as heavily grazed as it was in 1998, we should have been able to see it. It may be purely coincidental that it occurs only above the fence, which was constructed in 1997. In late August, we discovered another population at one of the six springs in Coyote Hole.

Downingia - This also appears to be a new discovery for Idaho. It is more common to the west and south. Downingias are small annual plants that occur around vernal pools. The two sites we found were both in drying mud around two reservoirs, one near Juniper Basin and the other in a gouged out hole on the floor of an internally-drained basin on the Start Valley Allotment, near the Little Owyhee canyon. Because our 1998 survey was late in the season, and these two sites represented some of the only water left on the plateau, we believe that there may be more populations occurring on the plateau that had dried out. Surveys during 1999 may reveal a larger distribution on the allotment.

Weeds

Seventeen percent of the riparian flora (48 species) consists of non-native plants (Appendix 3). We found only four species, however, that should be of concern:

Canada thistle (*Cirsium arvense*) - This has a spotty distribution on river terraces throughout the length of the South Fork, mostly as small patches.

White-top (*Cardaria draba*) - White-top is widespread and more or less continuous along the entire length of the South Fork on the allotment. It consistently has low cover in the mesic transition zone between the wetter riparian communities in the floodway and the drier terrace communities. It is usually in dense rhizomatous grass cover, either reed canarygrass or smooth brome, on the upper edge of river banks.

Tamarisk (*Tamarix* sp.) - Five tamarisk plants were mapped along the South Fork floodway. All were isolated, mature individuals, occurring at river miles 2.9, 19.4 (giant), 20.8, 21.4, and 28.8. We did not see any young recruitment.

Scotch thistle (*Onopordum acanthium*) - Uncommon in widely scattered clumps of a few individuals on terraces along the South Fork. The largest clump was on a terrace at rm 2.2.

CONCLUSIONS AND RECOMMENDATIONS

Below are the important conclusions of our riparian inventory and ecological assessment of the 45 Allotment:

- < Rare Plant Species - We discovered seven rare plant species in riparian habitats on the 45 Allotment, found in river floodways, spring creeks, intermittent creeks, and intermittent pools (Table 3). Of these, Davis peppergrass is the species of greatest conservation concern because of its narrow range and unique habitat. This species is also a community dominant in some intermittent pools. The remaining species are all rare in Idaho, but more common elsewhere in their range. Nevada angelica, however, may be a good indicator of good-condition riparian habitats along the North Fork Spring Creek.
- < Rare Riparian Plant Communities - There are six riparian communities on the 45 Allotment that are considered rare throughout their range (conservation rank of G1 or G2; Table 2): silver sagebrush/mat muhly, Owyhee sagebrush, basin big sagebrush/basin wildrye, wandering spike-rush, threesquare bulrush, and the Davis peppergrass community. They are located along intermittent creeks, river terraces, spring creeks, and intermittent pools.
- < Ecological Condition of the South Fork - We consider the floodway of the South Fork to be in Proper Functioning Condition throughout its run through the 45 Allotment. We mapped 46 river terraces along the South Fork, dominated almost entirely by the rare basin big sagebrush/basin wildrye community type. Ecological condition of these terraces varied, depending on accessibility to cattle. Fifty-seven percent of the terraces, however, were in good to excellent condition. This concentration of high quality examples of the basin big sagebrush/basin wildrye community is the greatest of anywhere in Idaho. The poor condition of the water quality in the South Fork results from upstream land use on ranches in Nevada.
- < Ecological Condition of the Little Owyhee - The Little Owyhee is an intermittent river that is unique in Idaho. It's difficult to assess the condition of the floodway without running water, but it is probably in Proper Functioning Condition. The intermittent channel of the Little Owyhee contains the most extensive stands of graminoid wetland vegetation on the allotment. The 12 river terraces along the Little Owyhee are all in fair condition, with a good cover of sagebrush, but an understory of cheatgrass.
- < Ecological Condition of Canyon Spring Systems - All except one of the spring creek segments were in Proper Functioning Condition. The exception is a 1.1-mile segment of the North Fork Spring Creek, which we rated as Functional-At Risk. This is the only perennial stream segment on the 45 Allotment that is of concern because of livestock grazing impacts.

- < Ecological Condition of Intermittent Lakes and Creeks - Forage is often limited in these settings, so most livestock grazing impacts are the result of trampling or trailing. Two rare communities occur here, the silver sagebrush/mat muhly and Owyhee sagebrush types. The only area of possible concern is in the vicinity of Bull Lake and the adjacent intermittent creek that drains the north side of Spring Butte, which I've called "North Canyon Draw" in Appendix 1. This is the largest intermittent creek on the allotment and it and Bull Lake have a high diversity of community types, including the rare ones. Salt grounds on the Bull Lake lakebed and elsewhere in the area, as well as the reservoir on the creek, combine to concentrate cattle in the area. We noted some impacts during a brief visit on an absolutely torrid afternoon, but more investigation is needed.

Given these conclusions, here are some recommendations relative to allotment management and monitoring. These should be integrated with recommendations resulting from the upland assessment next year to design an efficient monitoring program for the 45 Allotment.

1. Maintaining the condition of high quality basin big sagebrush/basin wildrye terraces should be a priority in allotment management. This will probably be accomplished through the exclusion or only limited use by livestock. I believe that moving C-ranked (Fair condition) terraces to a higher quality will be problematic. Cheatgrass thoroughly dominates the understory and, on many terraces, there is lack of a basin wildrye seed source. This cannot be overcome without an active restoration effort and cattle exclusion. A combination of photopoints and permanent transects that measure herbaceous (mostly grass) cover can be used to monitor management objectives and/or restoration efforts.
2. The two spring creeks in Spring Creek Basin are of greatest concern, especially the "North Fork" Spring Creek. Permanent photopoints and transects can be used to monitor management. The portion of the Main Fork Spring Creek above the allotment fence (on the Star Valley Allotment) does not appear to be grazed very frequently and might serve as a useful reference area for setting riparian management goals in the rest of Spring Creek Basin. Comparisons of riparian community composition and structure between reference stands above the fence and along the North Fork would be useful.
3. The condition of riparian communities occurring in the intermittent creeks and lakebeds in the northwestern corner of the allotment needs further investigation. This area contains a concentration of interesting and rare community types. Monitoring and management objectives are probably more appropriately integrated with surrounding upland vegetation.
4. The intermittent channel of the Little Owyhee contains the most extensive stands of wetland meadows on the allotment. They occur interruptedly along the channel, but serve as important oases for wildlife in this arid canyon. Rimrock prevents cattle from accessing the canyon throughout its length on the allotment and drift fences manage access at the upstream and downstream ends. It is important to maintain these two drift fences to eliminate unwanted cattle drift into this canyon.

5. Davis peppergrass vernal pools are priority habitats on the allotment, however, they are all in good condition. Due to lack of forage, most livestock impacts to these communities result from trampling, especially in the spring when they are wet or contain water. Most pools are isolated from cattle, with the exception of the pools on Halogeton Flat and possibly along the South Fork canyon rim north of Bull Camp Reservoir. Permanent photopoints on selected pools are probably the appropriate level of monitoring needed to document conditions. Methodologies for more detailed population monitoring area available (Bernatas et al. 1995).
6. Outside of the ranch headquarters area, we found two, relatively minor weed problems that need to be taken care of as soon as possible: (1) the five tamarisk trees should be eradicated, and (2) the scotch thistle infestation on the terrace at rm 2.2 should be controlled.

REFERENCES

- Bernatas, S., R.K. Moseley, and K. Strickler. 1995. Population monitoring of *Lepidium davisii* (Davis' peppergrass), Small Arms Range, Mountain Home Air Force Base: 1991-1995. On file at the Mountain Home Air Force Base, Mountain Home, ID. 31 p., plus appendices.
- BLM - Lower Snake River District. 1996. Draft Owyhee Resource Management Plan and draft Environmental Impact Statement. Volume 1. Lower Snake River District, Bureau of Land Management, Boise, ID.
- Cowardin, L.M, V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. FWS/OBS-79/31. Office of Biological Services, Fish and Wildlife Service, USDI, Washington, D.C. 103 p.
- Dean. M.L. 1960. A taxonomic and ecologic study of the vascular plants of a section of the Owyhee River Canyon in Oregon. Unpublished M.S. Thesis. Oregon State University, Corvallis, OR. 147 p.
- Ekren, E.B., D.H. McIntyre, E.H. Bennett, and H.E. Malde. 1981. Geologic map of Owyhee County, Idaho, west of longitude 116° W. Misc. Investigations Series Map 1-1256. Geological Survey, USDI, Reston, Va.
- Elzinga, C., and R. Rosentreter. 1999. Riparian plant handbook - *Scirpus*. March 1999 Draft. Bureau of Land Management, USDI, Boise, ID.
- Environmental Protection Agency (EPA). 1999. Surf Your Watershed world wide web page: www.epa.gov/surf/hucinfo.

- Hall, J.B., and P.L. Hansen. 1997. A preliminary habitat type classification system for the Bureau of Land Management districts in southern and eastern Idaho. Technical Bulletin No. 97-11. Bureau of Land Management, USDI, Boise, ID. 381 p.
- Hydrology and Hydraulics Committee. 1976. River mile index, Snake River above Weiser, Idaho, Part II. Pacific Northwest River Basins Commission, Portland, OR.
- Jankovsky-Jones, M., S.K. Rust, and R.K. Moseley. 1999. Riparian reference areas in Idaho: a catalog of plant associations and conservation sites. General Technical Report RMRS-GTR-20. Rocky Mountain Research Station, Forest Service, USDA, Ogden, UT. 141 p.
- Keeley, J.E., and P.H. Zedler. 1998. Characterization and global distribution of vernal pools. Pages 1-14 in Ecology, Conservation and Management of Vernal Pool Ecosystems, C.W. Witham, ed., California Native Plant Society, Sacramento, CA.
- Master, L.L. 1991. Assessing threats and setting priorities for conservation. Conservation Biology 5:559-563.
- Moseley, R.K. 1998. Riparian and wetland community inventory of 14 reference areas in southwestern Idaho. Technical Bulletin No. 98-5. Idaho State Office, Bureau of Land Management, Boise, ID. 52 p., plus appendices.
- Moseley, R.K. 1999. Riparian and wetland communities in southwestern Idaho: Second-year inventory results and preliminary catalog of community types. Unpublished report on file at the Conservation Data Center, Idaho Department of Fish and Game, Boise, ID 56 p., plus appendices.
- Natural Resource Conservation Service (NRCS). No date. Wetland plant fact sheet -- common threesquare (*Scirpus pungens*). Plant Materials Center, Natural Resource Conservation Service, USDI, Aberdeen, ID.
- Prichard, D., work group leader. 1995. Riparian area management: Process for assessing proper functioning condition. Technical Reference 1737-9. Bureau of Land Management, USDI, Denver, CO. 51 p.
- Prichard, D., work group leader. 1998. Riparian area management: A users guide to assess proper functioning condition and supporting science for lotic areas. Draft. Technical Reference 1737-15. Bureau of Land Management, USDI, Denver, CO. 130 p.
- Reed, P.B. 1988. National list of plant species that occur in wetlands: Intermountain (Region 8). Biological Report 88(2).8). Fish and Wildlife Service, USDI, Fort Collins, CO. 76 p.
- Rosgen, D. 1996. Applied river morphology. Wildland Hydrology, Pagosa Springs, CO. 352 p.

Skagen, S.K., C.P. Melcher, W.H. Howe, and F.L. Knopf. 1998. Comparative use of riparian corridors and oases by migrating birds in southeast Arizona. *Conservation Biology* 12:896-909.

The Nature Conservancy. In preparation. Biodiversity conservation plan for the Columbia Plateau ecoregion. Draft. Oregon Field Office, The Nature Conservancy, Portland, OR.

USDA Forest Service. 1996. Status of the interior Columbia basin: summary of scientific findings. General Technical Report PNW-GTR-385. Pacific Northwest Research Station, Forest Service, USDA, Portland, OR. 144 p.

U.S. Geological Survey (USGS). 1999. National Water Information Service world wide web page: waterdata.usgs.gov

Vander Schaaf, D. 1996. A report on the Owyhee Uplands Ecoregion, Oregon, Idaho, Nevada. Unpublished report on file at The Nature Conservancy, Portland, OR. 38 p.

Appendix 1

Riparian and wetland communities of the 45 Allotment, 1997 and 1998 sampling plots

**45 RANCH RIPARIAN AND WETLAND PLOTS
1997 - 1998**

ALLIANCE	COMMUNITY TYPE	LOCATION	PLOT #
Woodlands			
<i>Juniperus occidentalis</i>	<i>Juniperus occidentalis/Danthonia californica</i>	Juniper Basin	98RM077
		“North Canyon Draw”	98RM078
Tall Shrub			
<i>Salix exigua</i>	<i>Salix exigua</i> /Barren	South Fork - rm 4.8	98CM002
		South Fork - rm 10.3	98CM012
		South Fork - rm 11.5	98CM011
	<i>Salix exigua</i> /Mesic graminoid	South Fork - rm 5.8	98RM013
		South Fork - rm 11.5	98CM076
		South Fork - rm 12.0	98RM075
		South Fork - rm 12.2	98RM074
		South Fork - rm 14.2	98RM026
Low Shrub			
<i>Artemisia cana</i>	<i>Artemisia cana</i> /Dry graminoid	“North Canyon Draw”	98RM049
		Little Owyhee - rm 1.3	98RM080
	<i>Artemisia cana</i> /Muhlenbergia richardsonis	basin west of Little Owyhee	98MM001 98RM007
		“N Canyon Rim Lake”	98RM053
		Bull Lake	observ. form
		upper Spring Creek	98RM054
<i>Artemisia papposa</i>	<i>Artemisia papposa</i>	“North Canyon Draw”	98RM051
		“Long Pull Draw”	98RM079
<i>Artemisia tridentata</i> ssp. <i>tridentata</i>	<i>Artemisia tridentata</i> ssp. <i>tridentata</i> / <i>Elymus cinereus</i>	South Fork - rm 5.5	98RM015
		South Fork - rm 8.9	98RM009
		South Fork - rm 11.2	observ. form
	<i>Artemisia tridentata</i> ssp. <i>tridentata</i> / <i>Elymus cinereus</i> - <i>Sarcobatus vermiculatus</i> variant	South Fork - rm 5.8	98CM001
		South Fork - rm 26.7	98RM021

<i>Sarcobatus vermiculatus</i>	<i>Sarcobatus vermiculatus/Poa secunda</i>	South Fork - rm 26.7 (Bull Camp)	98RM022
Graminoid			
<i>Carex nebraskensis</i>	<i>Carex nebraskensis</i>	Spring Creek	98RM056
		“North Fk” Spring Cr	98MM004
<i>Danthonia californica</i>	<i>Danthonia californica</i>	“Vision Quest Gulch”	98RM008
		“North Canyon Draw”	98RM050
<i>Eleocharis palustris</i>	<i>Eleocharis palustris</i> (vernal pool)	“N Canyon Rim Lake”	98RM052
		Oregon Lake	98MM002
		Bull Lake	observ. form
	<i>Eleocharis palustris</i> (palustrine)	Little Owyhee - rm 3.3	98RM048
<i>Eleocharis rostellata</i>	<i>Eleocharis rostellata</i>	South Fork - rm 24.4	98RM024
		South Fork - rm 29.3	98RM020
		Coyote Hole	98RM082
		“North Fk” Spring Cr	98MM003
		Spring Creek	observ. form
<i>Juncus balticus</i>	<i>Juncus balticus</i>	Little Owyhee - rm 7.5	98RM046
		“North Fk” Spring Cr	98RM044
		Spring Creek	98RM047
<i>Phragmites australis</i>	<i>Phragmites australis</i>	South Fork - rm 12.6	98RM028
		Coyote Hole	98RM081
<i>Scirpus americanus</i>	<i>Scirpus americanus</i>	South Fork - rm 24.4	98RM023
<i>Scirpus pungens</i>	<i>Scirpus pungens</i>	South Fork - rm 4.7	98RM016
		South Fork - rm 8.0	98RM012
		South Fork - rm 11.1	97RM023
Forb			
<i>Artemisia ludoviciana</i>	<i>Artemisia ludoviciana</i>	Spring Creek Basin	98RM058
		Little Owyhee - rm 0.1	97RM022
		Little Owyhee - rm 6.4	98RM047
<i>Berula erecta</i>	<i>Berula erecta</i>	“North Fk” Spring Cr	98RM045
		Spring Creek	98RM055

<i>Lepidium davisii</i>	<i>Lepidium davisii</i>	Halogeton Flat	97RM024
		W of L. Owyhee canyon	98RM006

Other Non-riparian River Terrace Communities:

<i>Artemisia tridentata</i> ssp. <i>tridentata</i>	<i>Artemisia tridentata</i> ssp. <i>tridentata</i> / <i>Stipa comata</i> (possibly a mixture of ssp. <i>tridentata</i> and ssp. <i>wyomingensis</i>)	South Fork - rm 8.3	98RM001
		South Fork - rm 5.5	98RM014
<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / <i>Stipa comata</i>	South Fork - rm 2.2	98CM003
		South Fork - rm 8.6	98RM010
	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i> / <i>Stipa thurberuiana</i>	South Fork - rm 12.9	98RM 027

Appendix 2

**Hydrogeomorphic stream data and Proper Functioning Condition checklists
for the South Fork Owyhee River and the forks of Spring Creek**

Appendix 3

Riparian plant species of the 45 Allotment

PERENNIAL = spring or watercourse with year-round water

TERRACE = river terraces along the South Fork and Little Owyhee

INT. CREEK = intermittent creek

INT. LAKE = intermittent lake or vernal pool

= non-native species