Plant Communities, Ethnoecology, and Flora of the Idaho National Engineering Laboratory

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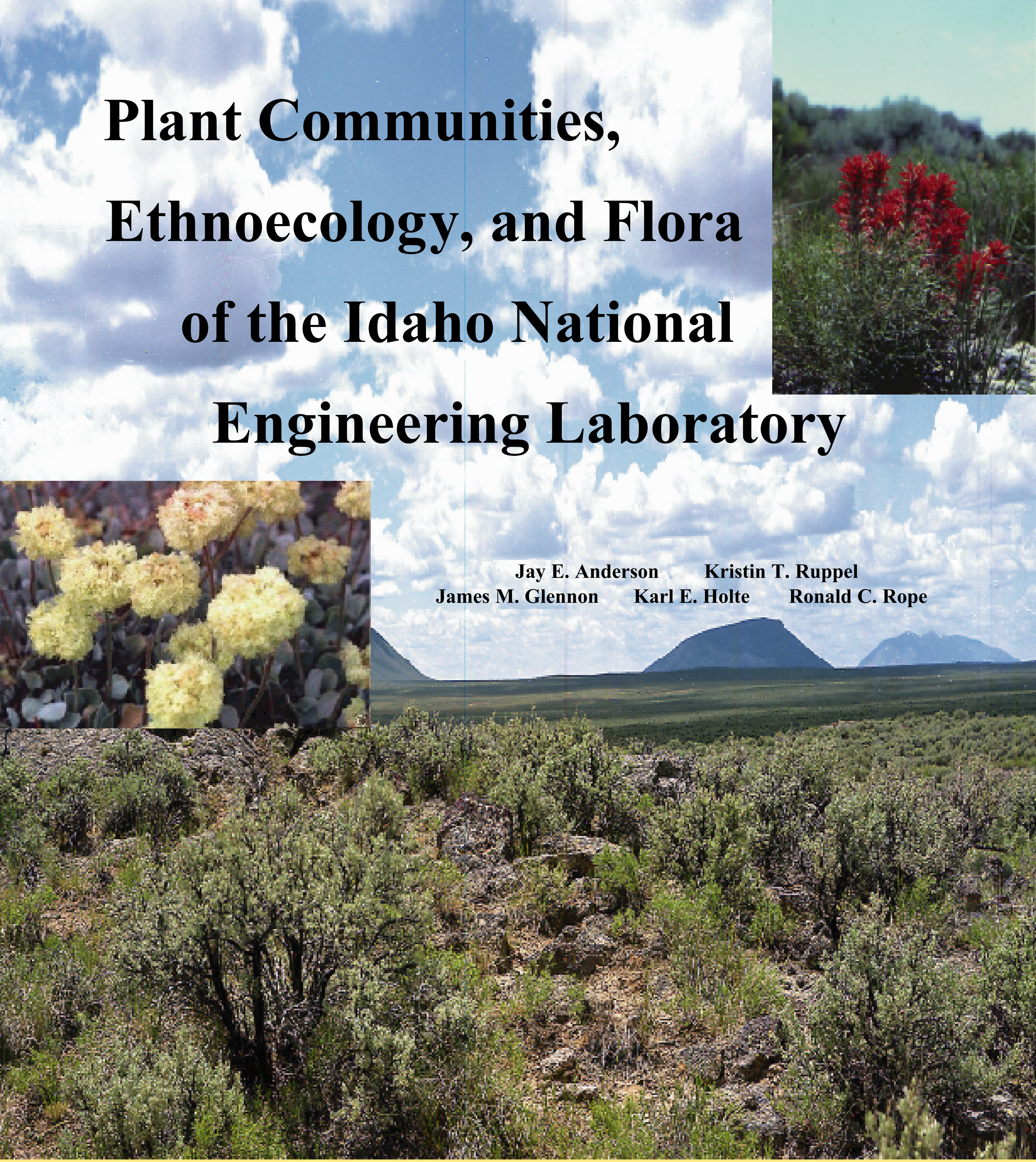

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PLANT COMMUNITIES, ETHNOECOLOGY, AND FLORA OF THE IDAHO NATIONAL ENGINEERING LABORATORY

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Cover Photographs

Upper right: Desert paintbrush (*Castilleja angustifolia*)

Upper left: Cushion buckwheat (*Eriogonum ovalifolium*)

Center: Sagebrush steppe of the Idaho National Engineering Laboratory

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ACKNOWLEDGMENTS

The Department of Energy and its predecessors have supported ecological research at the Idaho National Engineering Laboratory since 1950 when D.L. Goodwin and colleagues established the permanent vegetation transects. Additional plots were established in 1957. These early efforts established the baseline for future floristic and vegetation studies. Roy Harniss and Neil West reexamined the permanent plots in 1965 and contributed two publications, including the first vegetation map of the area. The first comprehensive floristic survey of the area was published in 1970 by Duane Atwood. Richard Jeppson sampled the permanent vegetation plots in 1975 and established the INEL Herbarium in 1976. He collected and prepared the vast majority of the specimens in that herbarium. Ray McBride, Norm French, A.H. Dahl, and Jack Detmer produced a map of vegetation types and a description of soils in 1978. Their map has been used by many investigators over the past two and a half decades. Anita Cholewa and Douglass Henderson assessed the status of rare vascular plants at the INEL in 1984. We have drawn from the knowledge and insights of these and numerous recent investigators (see Appendix 1) and gratefully acknowledge their contributions.

We thank the following individuals who reviewed portions or all of the manuscript; their comments, corrections, and suggestions resulted in many significant improvements: Roger Blew, Eddie Chew, Rick Holmer, Doyle Markham, Randy Morris, Gail Olson, Lorenz Pearson, Teresa Ratzlaff, Dick Smith, and Julie Tullis. Tracy Bowlin, Randy Lee, and Randy Stamm provided technical support. We are also indebted to Drusilla Gould, Shoshone linguistic specialist, and Ramona Wahlema, Bannock ethnobotanist, for many contributions to the ethnoecology section. Teresa Ratzlaff prepared Appendix 1. Financial support was provided by the Environmental Science and Research Foundation, by the Department of Energy, and by Idaho State University. We especially want to thank Doyle Markham who encouraged and enthusiastically supported the project.

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SUMMARY

The Idaho National Engineering Laboratory (INEL) occupies 2,300 km^2 of sagebrush steppe on the eastern Snake River Plain and is the largest of the few protected reserves of this extensive vegetation type. This publication documents the floristic diversity of the area, describes its abiotic environment and common plant communities, and summarizes our expanding knowledge of its ethnoecology.

The INEL lies in the rainshadow of mountain ranges immediately to the west. Mean annual precipitation is about 220 mm, and the scarcity of water coupled with cold winters and hot, dry summers places severe constraints on plant growth. Nevertheless, the INEL proper is home to some 400 species of vascular plants. Compared with areas that have a long history of livestock grazing, the INEL supports a rich diversity of native forbs. Eighty-five percent of the species are natives, and three-fourths of those are forbs.

The natural vegetation of the INEL typically consists of an overstory of shrubs and an understory of grasses and forbs. Big sagebrush (*Artemisia tridentata*) is by far the most common shrub, but 43 other species of shrubs have been recorded on the INEL and the adjacent Big Southern Butte. Perennial grasses are the most abundant understory plants in shrub-dominated communities and are the dominant plants in grassland communities where shrubs are scarce. Ten vegetation/cover classes are described and depicted on the enclosed vegetation map.

Prior to irrigation development in adjacent valleys, the area now within the INEL boundaries was the final destination of three important perennial streams, the Big Lost River, the Little Lost River, and Birch Creek. These streams emptied into playas and sinks on the floor of the 90 km^2 area occupied during the Pleistocene by Lake Terreton. Although difficult to imagine given the current flows in the Big Lost River, landform remnants of a Pleistocene flood through Box Canyon on the INEL's west side implicate that flood as the third most powerful known.

Humans arrived on the eastern Snake River Plain about 11,000 years ago. Over 850 archaeological sites at the INEL indicated a slow but steady increase in the use of the area over that period. The eastern Snake River Plain's original inhabitants likely were ancestors of the Plateau or Plains cultures who migrated to the north or northeast during the Altithermal, a period of gradual warming and drying during the early to mid Holocene. The ancestors of the present-day Shoshone and Bannock migrated north from the Great Basin proper as conditions became cooler and wetter some 4,500 years B.P. Archaeological sites in the region document continuity of the Shoshonean culture from 4,000 years until historic times. These native peoples primarily were hunters of large game, so the major role of plants was to furnish habitat and food for the animals that attracted the hunters to the area. Direct use of plants by the aboriginal inhabitants is only infrequently indicated by the archeological record, but the artifacts found at one INEL site, Aviator Cave, suggest a variety of uses including foods, fiber, and fuel. Information on known and potential uses of the region's plants by Native Americans is included in a summary table.

The fur trade, the Oregon Trail (including Goodale's Cutoff which crossed the southwest corner of what is now the INEL), and the establishment of Fort Hall all impacted the natural ecosystems and aboriginal culture of the eastern Snake River Plain in the early to mid 1800's. Bison were still numerous in the area in 1834, but numbers declined rapidly thereafter. The late 1800's witnessed severe overgrazing by domestic cattle and sheep throughout the Intermountain West, but the extent to which native plant communities on the area now occupied by the INEL were impacted is unknown. Remnants of trails and wagon roads that were used, at least in part, for cattle and sheep drives indicate that the area was grazed, but it may have been used primarily as winter range. Federal legislation around the turn of the century resulted in the construction of hundreds of kilometers of canals in an effort to "reclaim" the desert, but most of these were abandoned because they wouldn't carry water. During World War II, the U.S. Navy used several hundred square kilometers of the present INEL as gunnery and bombing ranges. In 1949, those ranges were coupled with a large parcel of land withdrawn from the public domain to form the National Reactor Testing Station. In 1974, the name was changed to the INEL, and in recognition of its importance as a field laboratory for ecological research, the INEL was designated as a National Environmental Research Park in 1975. It is an important reservoir of the biodiversity of sagebrush steppe ecosystems.

"In all the miles of stage travel which our pioneering covered, there was none more uncomfortable and disagreeable than through the desert lands and lava beds of southern Idaho . . .. The alkali poured into the nostrils and throat with every breath; it made the skin sore and rough, the eyes sore, and even irritated the disposition."

From the journal of Carrie Strahorn (Strahorn 1911:174-175)

INTRODUCTION

Establishment of the National Reactor Testing Station on the sagebrush desert of the upper Snake River Plain in 1949 had an unforeseen public benefit: the protection of a rich natural flora and fauna, a reservoir of the genetic diversity of sagebrush steppe ecosystems. About 40% of the 2,300 km^2 area that is now known as the Idaho National Engineering Laboratory (INEL) has not been grazed by livestock for the past 45 years. This is the largest of the few protected reserves within the sagebrush steppe, which is the most extensive semidesert vegetation type of the Intermountain West, covering some 450,000 km^2 (West 1988). Recognition of the importance of the INEL as a field laboratory for ecological research resulted in its designation in 1975 as a National Environmental Research Park. The purpose of this publication is to document the floristic diversity of the INEL, describe its abiotic environment and most common plant communities, and discuss the ethnoecology of the area.

Physiographic Setting

Situated along the northwestern edge of the eastern Snake River Plain at an average elevation of about 1,500 m, the INEL is bounded on the west and northwest by the Lost River and Lemhi Ranges and the mouths of the Big Lost River and Little Lost River Valleys and on the north by the mouth of the Birch Creek Valley and the southern tip of the Beaverhead Mountains of the Bitterroot Range (Figure 1). Saddle Mountain, on the southern end of the Lemhi Range, rises over 1,500 m above the Plain to an elevation of 3,147 m. The eastern and southern edges of the INEL are continuous with the sagebrush rangelands of the Snake River Plain, but are punctuated by the Plain's predominant topographic features, Big Southern, Middle, and East Buttes. The latter two, also referred to as the Twin Buttes, are within the INEL boundary; Big Southern Butte, elevation 2,300 m, is within 4 km of the southern boundary.

These buttes are the most conspicuous among the many reminders of the volcanic origin of the Snake River Plain. Many smaller buttes and cinder cones dot the landscape, and lava outcrops and lava tubes are common features of the rolling and broken terrain of the southern two-thirds of the INEL. The Plain is thought to have been formed by the southwestward migration of the North American tectonic plate over a stationary "hot spot" or plume in the earth's mantle. This migration has formed a linear volcanic province extending from southwestern Idaho to Yellowstone National Park over the past 17 million years (Pierce and Morgan 1992). Explosive volcanic activity in the area encompassing the INEL occurred between 4 and 7 million years ago (Pierce and Morgan 1992), resulting in silicic lava flows and pyroclastic deposits that are at least 2,500 m thick (Hackett and Smith 1992). These rhyolite rocks underlie the more recent "fractured and rubbly basalt lava flows," which are interbedded with sediments forming a highly permeable aquifer (Link and Phoenix 1994). Depths up to 1,100 m for these interbedded basalt flows have been documented at the INEL (Hackett and Smith 1992). The most recent basalt flow at the INEL, the Cerro Grande flow, occurred about 13,000 years ago (Kuntz et al. 1994). It extends only for a few km north of the southern boundary and can be readily identified on the Landsat image on the back cover. The Hell's Half Acre flow to the east of INEL is 5,200 years old (Kuntz et al. 1994). At nearby Craters of the Moon National Monument, basalt was extruded as recently as 2,100 years ago. The extensive basalt plains of the southern two-thirds of the INEL (Figure 1) are between 200,000 and 730,000 years old (Hackett and Smith 1992). Basalts on the northern part of the INEL attain ages of a million years or more.

The three prominent buttes are also relatively young. All are extruded rhyolite domes formed by the squeezing up of viscous rhyolite through layers of basalt (Link and Phoenix 1994). Big Southern Butte is about 300,000 years old, and the age of East Butte is roughly 600,000 years. It has not been possible to date Middle Butte because the rhyolitic core did not break through the basalt cap. Its distinct profile results from exposure of only tilted basalt, whereas the more readily weathered rhyolite is exposed on Big Southern and East Buttes (Link and Phoenix 1994).

Climate

This is cold desert country, characterized by large daily and seasonal temperature fluctuations. The average annual temperature is 5.6^{o}C, and the frost-free period is about 90 days. Mean air temperatures during the 2 to 3 months of winter are below freezing (Figure 2), and topsoils usually remain frozen from mid to late November through February or early March. Snow cover typically persists for at least 2 to 3 months. During summer, low humidity and clear skies result in relatively high maximum temperatures (30 - 35^{o}C) and high evaporative demand during the day; at night, radiative cooling often drops temperatures to below 10^{o}C. Thus, diurnal temperature fluctuations often exceed 20 ^{o}C.

By the time air masses moving inland from the Pacific Ocean reach the eastern Snake River Plain, they have lost much of their moisture to the many intervening mountain ranges of Oregon and central Idaho. Consequently, mean annual precipitation at the INEL is only about 220 mm. Approximately 36% of that falls during April, May, and June (Figure 2; note strong precipitation peak in the spring). On average, precipitation exceeds potential evapotranspiration from October through May, and potential evaportranspiration exceeds precipitation through the summer months (Figure 2). Melting snow and spring rains typically account for most of the annual recharge of soil moisture (Anderson et al. 1987).

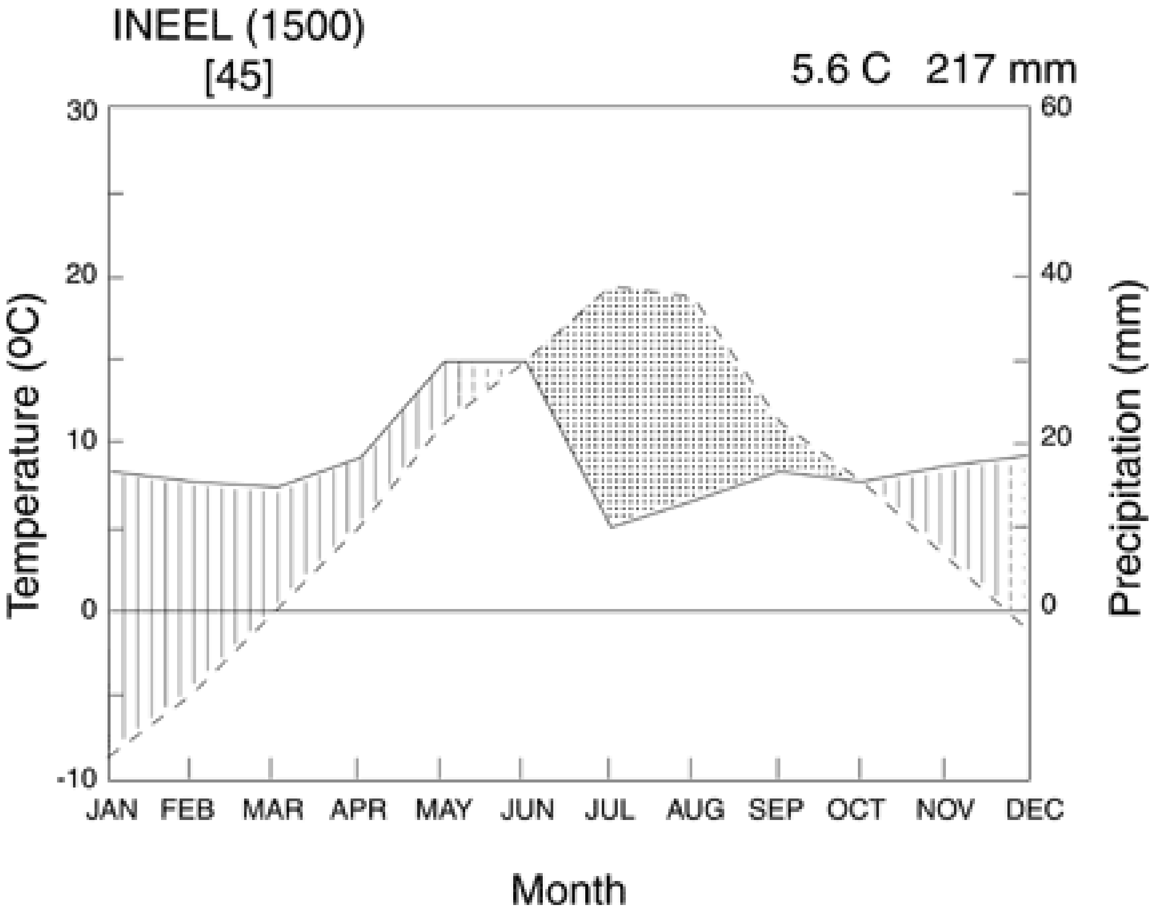

*Figure 2. Climate diagram (*sensu *Walter et al. 1975) for the Idaho National Engineering Laboratory (INEL) based on data for 45 years from the Central Facilities Area (NOAA, 1950-1994, unpublished data). Solid line depicts mean monthly precipitation; dashed line shows mean monthly temperatures. Vertical hatching indicates periods when precipitation generally exceeds potential evapotranspiration. Stippled area indicates the period when potential evapotranspiration generally exceeds precipitation. Numbers at top of graph are elevation (1500 m), number of years of record, mean annual temperature (5.6^o C), and average annual precipitation (217 mm).*

June, 1995, was the wettest month of record at the INEL, when 118 mm of rainfall were recorded at the Central Facilities Area. The previous record month was 112 mm in May of 1957. The record for a single day is 42 mm, which fell on June 10, 1969. The second highest 24-hour amount (39 mm) fell on June 5, 1995. The 1995 "water year" (October - September) was also the wettest on record, with 360 mm of precipitation.

Hydrography

Big Southern Butte, the Twin Buttes, and numerous small volcanic cones are roughly aligned along a broad volcanic ridge extending from Craters of the Moon, which lies some 20 km southwest of the INEL, toward the Mud Lake basin (Figure 1). North of this ridge is a closed topographic basin that encompasses the mouth of the Big Lost River Valley near Arco and then slopes gently to the north, occupying a substantial portion of the INEL (Nace et al. 1972). Prior to agricultural development in the region, three major perennial streams drained into this basin. The Big Lost River flows through the basin, entering the southwest corner of the INEL and meandering some 48 km before reaching the "sinks" of the contiguous Big Lost River and Birch Creek playas. Former channels are common topographic features along the alluvial plain (Figure 3), and the present channel becomes braided to the north as it approaches the sinks area.

A cataclysmic Pleistocene glacial flood sent an estimated 60,000 $m^3 s^{-1}$ (2 million cfs) of water down the Big Lost River and carried boulders, probably on ice rafts, from Copper Basin to Box Canyon near the INEL's western border (Rathburn 1993). That torrential discharge ranks as the third most powerful flood known, exceeded only by the Lake Missoula and Lake Bonneville floods (ibid.). Rathburn (1993) estimated that water velocity in Box Canyon at peak discharge reached 12 $m s^{-1}$ (27 mph). The flood, thought to have occurred about 20,000 years before present (B.P.), left distinctive fluvial deposits along the length of the river (Hackett and Smith 1992) and created scabland topography, boulder bars, and cataracts comparable to those of the Missoula and Bonneville events (Rathburn 1993).

The other perennial streams that flowed into the closed basin are Birch Creek and the Little Lost River. Birch Creek arises from springs between the Lemhi and Bitterroot Ranges and, prior to its total diversion for irrigation and power production, ran into the Birch Creek playa (Figure 1). The Little Lost River terminated in a separate playa just north of the INEL boundary near Howe.

The Lost River and Birch Creek playas occupy a portion of ancient Lake Terreton, which, under the cooler, wetter conditions of the late Pleistocene, covered approximately 90 km^2 of the northern half of the INEL. Mud Lake is a mere remnant of Lake Terreton, the shoreline of which was roughly coincident with the 4,800-foot (1,463 m) contour (Hackett and Smith 1992). During most of the Holocene, the playas of the Lost Rivers and Birch Creek formed extensive wetland areas that likely would have supported a diversity of plants and animals. Now, as a result of extensive upstream irrigation diversions, which began in the 1880's, water flows into the sinks only during years when precipitation is well above normal. During the wet period of the early 1980's, much of the Big Lost River/Birch Creek wetlands were flooded. Drought followed, and the summer of 1993 was the first time in 7 years that flow from the Big Lost River actually reached the sinks, and then only for a few days (Figure 3). However, during June and July of 1995 water flowed into the sinks for several weeks. As noted earlier, June of 1995 was the wettest month of record at the INEL.

The need for flood control was recognized during the 1950's because of the potential for flood water reaching ICPP and TRA, which had built on the Big Lost River flood plain (see Figure 1). Flooding resulted from ice jams, which caused the river to overflow. Frozen soils prevented infiltration, resulting in overland flow. To address this problem, a small diversion dam and channel were built on the Big Lost River at its southernmost point (see Figure 1) in 1958. During winter, water is diverted from the Big Lost River through the diversion channel into topographic depressions known as Spreading Areas A, B. C. and D. This prevents water from flowing north across the INEL at times when ice jams and frozen soil could cause flooding at facilities on the flood plain.

During the winter of 1983-84, wet conditions coupled with extreme cold (-47°F) resulted in ice jams between Spreading Areas A and B. Water levels rose to within 0.15 m of overtopping the diversion dam, which threatened flooding at the Radioactive Waste Management Complex (RWMC). As a result, the diversion dam and containment dikes were raised several feet and the diversion channel was enlarged to provide additional flood protection.

Figure 3. Big Lost River Sinks

Over much of the INEL, surface runoff drains into small playas or low-lying areas between lava ridges. Some of these local drainage systems are sizable, but they typically flow only during the spring runoff following wet winters. No perennial tributary joins the Big Lost River channel. During the Pleistocene, high discharge seasonal flows from the Lemhi and Big Lost River mountains formed a series of large alluvial fans that slope eastward from the foothills along the western side of the INEL. These are variously dissected and patterned by meandering depositional channels. Smaller alluvial fans occur at the base of Big Southern and Twin Buttes.

Given that surface water at the INEL flows into closed basins, it follows that there are only two pathways for water to leave the INEL: evapotranspiration or deep drainage into the vast Snake River aquifer. The water table at the INEL typically is between 50 and 270 m below the surface (Link and Phoenix 1994). Where soils are sufficiently deep to store all of the water received as rain or snow, that water will be returned to the atmosphere via evapotranspiration during the next growing season (see Anderson et al. 1987). In most years, 1 m of soil would suffice to store the water received, and 1.5 to 2 m would be adequate, even in the wettest years (Anderson et al. 1993). Thus, recharge of ground water that may eventually reach the aquifer is limited to playas or depressions where water accumulates and to areas having shallow soils or basalt outcrops.

Soils

Although the area is underlain by basalt, most INEL soil is derived from older silicic volcanic and paleozoic rocks from the surrounding mountains (McBride et al. 1978). The basaltic uplands of the southern and eastern portions of the area are covered by a thin veneer of eolian sediments. Major episodes of loess deposition apparently occurred between 10,000 and 70,000 years ago and between 140,000 and 200,000 years ago; little loess has accumulated on the most recent flows of the upper Snake River Plain, indicating that there has been no major deposition of loess in the Holocene (Hackett and Smith 1992). Because of the uneven, broken surface of the basalt, depths of the silt loam and sandy loam soils vary from a few centimeters on recent lava flows or exposed ridges of older flows to a couple of meters in lower lying areas. On the lee side of lava ridges, accumulation of sand on the soil surface can improve water infiltration, increasing water storage in the underlying fine-textured soil. A similar phenomenon is observed north of the basalt flows on the east side of the INEL where numerous windrows of drifted sand cap the underlying fine-textured ancient lake sediments. Enhanced rates of infiltration and reduced evaporation on the parallel dunes result in improved moisture availability to plants compared to that of the intervening slacks (Shumar and Anderson 1986). Changes in vegetation and surface albedo make these SW to NE trending dunes readily apparent on the satellite image (back cover) and the vegetation map (Appendix 2).

Figure 4. Sagebrush steppe at the Idaho National Engineering Laboratory.

Alluvial soils are found along the Big Lost River flood plain, on the alluvial fans along the western side of the INEL, and to the north where the alluvial fan of Birch Creek extends onto the INEL. The alluvial fans often are covered with loess, but the alluvial soils of the Big Lost River flood plain are often gravelly on the surface and underlain by sandy loams. The sandy textures of such soils resulted in the failure of a network of irrigation canals established in the early 1900s (see page 26). Most eolian and alluvial soils at the INEL are well drained.

The playas and lakebed sediments of Pleistocene Lake Terreton generally are fine-textured loams or clay loams with a relatively high clay content. However, well-drained lakebed soils derived from eolian and alluvial sands also occur.

A comprehensive survey of the soils at the INEL has not been conducted; however, the information from county surveys and numerous other sources has recently been compiled by Olson et al. (1995). Most INEL soils are *Aridisols*, with Calciorthids being the most common great group; *Entisols*, namely Torriorthents and Torrifluvents, and *Mollisols,* including Calcixerolls and Haploxerolls, also are common.

VEGETATION

In this section, we first provide a general overview of INEL vegetation. This is followed by a brief fire history of the INEL and discussion of the role that fire has played in shaping the current vegetation. Next, we review the history of vegetation studies at the INEL. Finally, we discuss development of the current INEL vegetation map and describe the major vegetation types identified on the map.

INEL Vegetation, An Overview

The natural vegetation at the INEL typically consists of a shrub overstory with an understory of perennial grasses and forbs (Figure 4). The most common shrub is Wyoming big sagebrush (*Artemisia tridentata* subspecies *wyomingensis*[1]). Basin big sagebrush (*Artemisia tridentata* subspecies *tridentata*) may be dominant or co-dominant with Wyoming big sagebrush on sites having deep soils or accumulations of sand on the surface (Shumar and Anderson 1986). Communities dominated by big sagebrush occupy most of the central portions of the INEL. Green rabbitbrush (*Chrysothamnus viscidiflorus*) is the next most abundant shrub in many of these communities. Other common shrubs include gray rabbitbrush (*Chrysothamnus nauseosus*), winterfat (*Krascheninnikovia lanata*, Figure 6), spiny hopsage (*Grayia spinosa,* Figure 7), prickly phlox (*Leptodactylon pungens*), broom snakeweed (*Gutierrezia sarothrae*), and horse-brush (*Tetradymia canescens*). On the lakebed sediments of former Lake Terreton, assemblages occur that are very much akin to the "salt-desert shrub" communities so common in Utah and Nevada. These communities are dominated by shadscale (*Atriplex confertifolia*), Nuttall saltbush (*Atriplex falcata*), or winterfat.

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[1]Nomenclature is based on *The PLANTS Database.* (USDA 1994). Synonyms are cross referenced in the index. Keys used for identification are listed at the beginning of **THE FLORA** (page 47).

Figure 5. Winterfat (Krascheninnikovia lanata).

Figure 7. Perennial grasses and forbs are abundant in many INEL habitats.

Figure 6. Spiny hopsage (Grayia spinosa).

Figure 8. Tapertip hawksbeard (Crepis acuminata).

Utah juniper (*Juniperus osteosperma*), threetip sagebrush (*Artemisia tripartita*), and/or black sagebrush (*Artemisia nova*) often dominate communities on the periphery of the INEL on slopes of the buttes, alluvial fans, and the foothills of adjacent mountains..

The most common native grasses include thickspiked wheatgrass (*Elymus lanceolatus*), bottlebrush squirreltail (*Elymus elymoides*), Indian ricegrass (*Oryzopsis hymenoides*), needle-and-thread grass (*Stipa comata*), and Nevada bluegrass (*Poa secunda*). Patches of creeping wildrye (*Leymus triticoides*) and western wheatgrass (*Pascopyrum smithii*) are locally abundant. Bluebunch wheatgrass (*Pseudoroegneria spicata*) is rare at the lowest elevations but is common at slightly higher elevations to the southwest and along the eastern side of the INEL; it is often the dominant grass on alluvial fans and slopes of the buttes and foothills.

Unlike much sagebrush steppe, which has a long history of grazing, the INEL supports a high diversity of forbs (Figure 7). Common native forbs include tapertip hawksbeard (*Crepis acuminata*, Figure 8), Hood's phlox (*Phlox hoodii*), Hoary false yarrow (*Chaenactis douglasii*), paintbrushes (e.g., *Castilleja angustifolia*., Figure 9), globe-mallow (*Sphaeralcea munroana,* Figure 10), buckwheats (e.g., *Eriogonum mancum*, Figure 11), evening primrose (*Oenothera caespitosa*, Figure 12), lupines (e.g., *Lupinus argenteus*, Figure 13), bastard toadflax (*Comandra umbellata*), milkvetches (*Astragalus* spp.), and mustards (e.g., *Thelepodium laciniatum,* Figure18, *Stanleya viridiflora, Arabis*, spp.).

Figure 9. Paintbrush (Castellija angustifolia).

Figure 10. Globemallow (Sphaeralcea munroana).

Figure 11. Buckwheat (Eriogonum mancum).

Figure 12. Evening primrose (Oenothera caespitosa).

Figure 13. Lupine (Lupinus agrenteus).

Fire History

The cold-desert climate, with its cold, wet winters and springs and dry, hot summers, predisposed many sagebrush steppe communities to an evolutionary history with recurring fire. Estimates of fire return intervals for sagebrush steppe range from ca. 20 to 100 or more years (Houston 1973, Wright et al. 1979, Wright and Bailey 1982). Wright et al. (1979) surmised that the interval between fires must have been sufficiently long for big sagebrush, which does not resprout and must recolonize burned sites from seeds, to regain dominance; otherwise, the extensive areas dominated by sagebrush would have been dominated by root-sprouting shrubs such as horsebrush or rabbitbrush. Nevertheless, it is clear that fire played an important role in the evolution of many plant species that comprise cold desert communities. The vast majority of shrubs and perennial grasses and forbs can survive wildfires, especially fires that occur in late summer or fall when many plants are dormant. Some species respond vigorously to postfire conditions (Wright et al. 1979, Cole 1987, Ratzlaff and Anderson 1995).

Numerous fire scars are apparent in satellite images of the INEL and vicinity (see back cover). These abrupt linear features generally trend along the prevailing wind directions from southwest to northeast. They mark abrupt changes in albedo that result from differences in soil surfaces and vegetative cover. The scars of 10 fires that are known to have burned during this century have been mapped from satellite imagery or aerial surveys. These range in size from a few to over 6,900 ha (17,000 acres). Wildfires have been aggressively controlled at the INEL since 1950, which may have decreased the area that otherwise would have burned. Nevertheless, the two largest known fires at the INEL occurred in the last two years. The largest, ignited by burning rubber from a flat tire on a horse trailer, occurred in early July of 1994; it started near the junction of Highways 20 and 22 on the western boundary of the INEL and burned to the northeast across "Deadman Flats," traversing some 25 km just inside the INEL's western border. The conditions for a large fire likely were established by a very wet growing season in 1993, which resulted in the accumulation of abundant fine dry fuels that persisted through the summer of 1994. The second of these recent fires burned some 2,500 ha (6,000 acres) near the Argonne National Laboratory West facility in August of 1995. It was ignited by a cigarette dropped from a vehicle on Highway 20.

The next largest fire burned approximately 1,400 ha in the Tractor Flat area on the east side of the INEL. This fire is thought to have occurred in 1910, which is likely because the summer of 1910 was one of the most severe fire seasons in the recorded history of the region. It has been estimated that 2,500 fires were burning simultaneously in central and northern Idaho and western Montana during that year and that about 1.2 million ha (3 million acres) of forests were burned. Vestiges of the Tractor Flat fire scar can be distinguished on the satellite image (back cover). The scar of another large fire, which burned about 1,200 ha in 1949, is readily identified on the satellite image. It lies just north of Highway 20 near the junction of Highways 20 and 26. The bright triangular feature at the junction is an area that was plowed and seeded to crested wheatgrass in the late 1950's.

The Principal Lineament. A distinct linear feature, which became known as the principal lineament, was conspicuous on the earliest aerial photographs of the INEL. This feature is discernible on the satellite image (back cover) as a dark line extending north and south from the corner of the INEL boundary just northeast of East Butte; it lies along the eastern edge of a large area of relatively high albedo that extends to the northeast from Middle Butte. Most early investigators assumed that this feature was of geologic origin (see Morin-Jansen 1987 for a review of hypotheses). One hypothesis was that a lateral blast from Middle Butte deposited a layer of ash that radiated to the northeast. Walker (1964) described the principal lineament as "a prominent and continuous rift which can be traced for 12 miles." Bonilla and Chase (1967 as cited by Malde 1971) noted that the lineament extended for about 17 miles northward from East Butte and argued that it was not caused by a fault but was a surface feature that probably formed during volcanic episodes. Malde (1971) determined that the lineament was not a result of basalt emplacement or of a fault. He concluded that the feature consisted of an anomalous strip of sand on the surface that increased infiltration and storage of water. The improved water availability resulted in a corresponding strip of lush vegetation. Connelly et al. (1984 as cited by Morin-Jansen 1987) postulated that the lineament was the remnant of a cattle trail. They found little difference in the plant communities on either side of the lineament, but reported that sagebrush cover was about 25% lower to the west than in the areas to the east. Downs (1984 as cited by Morin-Jansen 1987) suggested that the principal lineament controlled the eastern edge of a fire. Downs thought that higher water content of the vegetation growing over a perched water table along the lineament may have stopped the fire.

The principal lineament is indeed a surface feature that can be readily distinguished from surrounding vegetation. Its main features were summarized by Morin-Jansen (1987) as follows: It is characterized by accumulations of sand on the surface, by stands of Great Basin wildrye in topographic depressions and by vigorous stands of big sagebrush on higher ground. Its location is independent of topography; it crosses depressions, volcanic vents, lava lobes, lava channels, and pressure ridges along its 27.8 km course. The lineament is somewhat sinuous, varying in width from 20 to 125 m. Its western boundary is distinct, but the eastern edge is diffuse and scalloped, consisting of northeast-trending sand lobes that have been deposited by wind.

The most reasonable hypothesis to account for the principal lineament is that it represents the eastern edge of a fire scar where wind-blown sediments accumulated. The higher albedo to the west of the lineament is likely a consequence of lower sagebrush cover and, perhaps, postfire erosion of sandy sediments from the soil surface. The extent of this area is clearly visible on aerial photographs and satellite images (see back cover). Assuming that this hypothesis is correct, this would have been a fire of similar magnitude to that of the 1994 Deadman Flats fire. It appears that the fire burned in a more northerly direction than the prevailing southwest to northeast wind direction; thus, the stage was set for substantial accumulations of wind-blown sediments, which, in turn, resulted in higher infiltration of moisture and higher availability of water for plant growth. Similar accumulations of sand to depths of 30 to 50 cm were observed in August of 1994 along the eastern side of the Deadman Flats burn.

When did the fire that formed the principal lineament occur? The fact that no charcoal has been found on the putative fire scar, the observation that sagebrush plants on both sides of the lineament are the same age (Morin-Jansen 1987), and the fact that no written record of a large fire in that area has been found suggest that it occurred prior to settlement of the region. It seems likely that it burned sometime during the 1800's, assuming that differences in vegetation and soil reflectance would gradually disappear. One thing is clear, assuming that the fire hypothesis is correct: disturbances due to wildfire can have effects that persist for a very long time in cold-desert communities.

Vegetation Studies

Vegetation studies were initiated at the INEL in 1950 with the establishment of 99 permanent sample plots at 1.6-km intervals along two perpendicular lines that transect the area from southwest to northeast and from southeast to northwest. Seven plots were destroyed by farming or range seeding prior to 1957; data from the remaining plots were collected in 1957, 1965, 1975, 1985, and 1995. Data from a 35-plot subsample were collected in 1978, 1983, and 1990. Data from these permanent transect plots form the basis for numerous publications and reports (Appendix 1).

In 1957, several clusters of additional permanent plots were established in some community types that inadvertently had been missed by the original transects (see Harniss 1968). These plots have not been examined on a regular basis. Between 1955 and 1959, 16 25-m^2 permanent quadrats were established to evaluate effects of periodic radioactive contamination on natural vegetation (McBride et al. 1978). Eleven of these quadrats were re-examined in 1976 by French and Mitchell (1983). Earlier maps depicting major vegetation types at the INEL were prepared by Harniss and West (1973) and McBride et al. (1978). Over the past two decades, numerous vegetation studies have been conducted at the Idaho National Environmental Research Park (Appendix 1).

The data from the permanent transects and from other studies (e.g. Floyd 1982) show that plant communities at the INEL form continuously varying, complex patterns. This complexity is readily apparent in the vegetation map (Appendix 2). The species composition and structure of individual assemblages depends on local soils and topography, availability of propagules, disturbance history, herbivore impacts, and outbreaks of insects or pathogens. Coupled with this spatial heterogeneity is temporal variability in climate, which, over periods of years to decades, can cause significant change within a local patch of vegetation. Data from the permanent plots show that cover of shrubs and perennial grasses may fluctuate by as much as 100% and 500%, respectively, over the span of a few decades in the absence of any major disturbance (Anderson and Inouye 1988). Average species richness per plot has increased over the past 45 years, as has the variability in species composition among plots that were very similar in 1950. The increase in richness reflects an increase in the size and distribution of populations, especially perennial grasses, that were depleted in 1950 as a result of extended drought in the 1930's and 1940's (ibid.).

Classification of Plant Communities and the INEL Vegetation Map

> *Numerous plant species, with population centres scattered along environmental gradients, each with binomial distributions broadly overlapping those of other species, freely and variously combine into communities which predominantly intergrade with one another, forming a complex and potentially continuous but variously interrupted population pattern.*
>
> Robert H. Whittaker (1967)

As the quotation from Whittaker emphasizes, the vegetation of an area seldom consists of a mosaic of discrete types having unique species assemblages distinct from other types. For the most part, plant species are distributed individualistically, each according to its own requirements, characteristics, and interactions with other species in a particular locale (Gleason 1926). As a consequence, vegetation is a continuously varying phenomenon that depends on the distributions and proportional abundances of individual species. No two patches of vegetation are identical in the combinations and proportions of species present (Miles 1979). Even replicate samples from a small, relatively homogeneous patch of vegetation typically have average percent similarity values of only 50 to 90% (Gauch 1982). Such "noise" among samples, which results from "chance distribution and establishment of individuals, animal activity, local disturbances, and environmental heterogeneity at scales below that of the sample area" (ibid.), limits the precision to which one can estimate the abundance of species present (see Floyd and Anderson [1987] in relation to INEL vegetation). It is also unlikely that any two patches will follow highly similar trajectories through time. Despite this variability, different patches existing under similar environmental conditions in a region tend to have similar assemblages of species, making it possible to recognize "types." Whittaker (1975) likened the recognition of community types to our recognition of colors within the continuous spectrum of wavelengths of light. Some rather distinct community types will be readily apparent, whereas recognition of other types necessarily will be quite arbitrary. It is important to bear in mind that community type designations are ultimately arbitrary, abstract, *ad hoc* divisions. They reduce the inherent complexity of vegetation to something manageable; they are necessary to facilitate communication and management.

Community types typically are distinguished by the dominant growth forms and the visual aspect created by the dominant species. We assume that such types reflect interpretable differences in environment, but disturbance history of a site may be equally important, as is clearly shown by the numerous fire scars that are readily identified in aerial photographs or satellite images of the INEL (see **Fire History,** page 8).

Development of the Vegetation Map. The use of satellite imagery to map vegetation is based on the assumption that there will be a close correspondence between the properties of the vegetation and the spectral properties of the site. In arid regions where vegetation is sparse, however, the spectral signature of an area may depend largely on spectral characteristics of the soil surface and/or the shadows cast by individual trees or shrubs (Tueller 1987, Smith et al. 1990). To the extent that soil spectral properties and vegetation are not related, we can expect limits on the ability to accurately map vegetation from satellite imagery. Furthermore, as we have explained above, the continuously varying nature of vegetation places constraints on the precision and accuracy of any classification scheme. Because of the inherent variability in vegetation, precision (prediction of species composition) and accuracy (correct identification of a "type" at a particular location) of a vegetation map tend to be inversely related. Broad vegetation classes (e.g., sagebrush/grassland) may be very accurate but not provide sufficient precision to be useful for environmental assessment or management. On the other hand, precise predictions may be possible with narrow classes, but if accuracy is low, those predictions will be erroneous and misleading.

The vegetation map of the INEL (Appendix 2) was developed from Landsat satellite images (Kramber, et al. 1992). Two Landsat scenes were selected to provide contrasting vegetation conditions; one was from May 8, 1987, during the spring growth period, and the other was from August 17, 1989, when most herbaceous plants were senescent. Spectral data from the two scenes were combined, and a preliminary classification was developed consisting of 27 cover classes that potentially represented vegetation types. This classification was accomplished by a remote sensing analyst (William Kramber, Idaho

Department of Water Resources) working with three of the authors (Rope, Anderson, and Glennon) and was based on known or inferred vegetation patterns from our field experience. Aerial photography from 1976 was used to help identify patterns in some areas. Thirty-two 1:24,000 scale maps, corresponding to USGS 7.5' quads, were produced to facilitate field sampling for refining this initial classification.

We sampled vegetation, soils, and other parameters at plots representing all 27 classes of the preliminary classification in July and August, 1990. Sixty-six plots were sampled. At each plot, abundance of each vascular plant species occurring on the site was ranked using a four-point scale (see Appendix 2). Slope, aspect, and soil surface characteristics also were recorded. Comparable data were collected from 35 plots on the permanent vegetation transects.

The vegetation data were used to develop an error matrix highlighting discrepancies between the draft land cover classes and actual vegetation. This provided a framework for reclassifying the 200 spectral classes. The process used was one of successive refinements based on the plot data, field notes, and our field experience at the INEL. Ordinations and cluster analyses were used to classify the vegetation samples and identify assemblages of species that corresponded to the cover classes on the map (Anderson 1991). These results were used to make further refinements of the map cover classes. Several spectral classes were associated with areas dominated by perennial grasses, but the individual classes did not consistently have the same species composition. For example, it was clear that we would be unable to distinguish between areas that had been seeded to crested wheatgrasses (*Agropyron desertorum* or *Agropyron cristatum*) from native grasslands (the crested wheatgrasses are perennial bunchgrasses that are native to the steppes of Asia). We therefore combined several spectral classes into one "grasslands" class. Spectral classes associated with various disturbances and bare soil were also combined. Eleven vegetation classes are recognized on the INEL Vegetation Map (Appendix 2). Some of these classes are quite distinct in species composition, whereas others are much more heterogeneous. A description of each of the vegetation classes is given in the next section.

Vegetation integrates climate, soils, aspect, evolution, site history, species interactions, and chance into a single expression. (JEA)

Vegetation Classes and Plant Communities

The sub-headings of this section are the names of vegetation classes corresponding to those of the vegetation map (Appendix 2). These broad classes do not represent homogeneous community types. Each consists of a variety of intergrading communities that share some dominant species and have similar physiognomies; they tend to be more similar to each other than to communities represented by other vegetation classes. The map provides a realistic impression of this continuously varying mosaic. The vegetation map also includes a matrix showing the distributions and relative abundances of the more common plant species across the vegetation classes.

Juniper Woodlands. These communities are characterized by the presence of Utah juniper which may be the dominant species or a co-dominant with Wyoming big sagebrush or black sagebrush (Figure 14). Other common shrubs include threetip sagebrush, green rabbitbrush, and shrubby buckwheat (*Eriogonum microthecum)*. Perennial grasses, including Indian ricegrass, needle-and-thread, and bluebunch wheatgrass typically are abundant. Common forbs include arrowleaf balsamroot (*Balsamorhiza sagitata*, Figure 15), tapertip hawksbeard, Hood's phlox, false yarrow, and ballhead gilia (*Ipomopsis congesta*).

Grasslands. INEL's grasslands are quite variable, but they share one common characteristic: dominance by perennial grasses (Figure 16). Nearly pure stands of the robust bunchgrass Great Basin wildrye (*Leymus cinereus,* Figure 17) occur in low lying areas between lava ridges where deep soils accumulate. Scattered individuals of green or gray rabbitbrush and big sagebrush typically are present in these stands.

Some INEL grasslands are dominated by rhizomatous species such as thick-spiked wheatgrass, western wheatgrass, creeping wildrye, or Douglas' sedge (*Carex douglasii*), while in others, the dominants are bunchgrasses such as Indian ricegrass (Figure 16), bottlebrush squirreltail, needle-and-thread grass, Nevada bluegrass, and bluebunch wheatgrass. Many INEL grasslands are a mosaic of the two growth forms; patches of rhizomatous grasses are interspersed with areas dominated by bunchgrasses, and shrubs including black sagebrush, big sagebrush, green rabbitbrush, and prickly phlox are locally abundant. Prickly-pear cactus (*Opuntia*

Figure 14. Juniper woodland.

Figure 15. Arrowleaf balsamroot (Balsamhoriza sagitata).

polyacantha) is abundant in many of these mixed grassland communities. Common forbs include Hood's phlox, globe-mallow, false yarrow, and the native annuals small-flowered mentzelia (*Mentzelia albicaulis*), western tansy-mustard (*Descurainia pinnata*), and western stickseed (*Lappula occidentalis*). A number of alien species are common and sometimes very abundant. These include Jim Hill mustard (*Sisymbrium altissimum*), desert alyssum (*Alyssum desertorum*), salsify (*Tragopogon dubius*), and cheatgrass (*Bromus tectorum*). These communities usually have high species richness.

Included in the grassland classification are some areas that have been seeded to the introduced crested wheatgrasses. In 1958 and 1959, some 2,650 ha (6,400 acres) were plowed and seeded in an effort to control the spread of halogeton (*Halogeton glomeratus*), an aggressive annual weed that was introduced to North America from Asia. Smaller areas that have been disturbed during facilities development, power line installation, or road construction have been seeded over the intervening years. Crested wheatgrass establishes well at the INEL, and the resulting stands are quite stable, effectively resisting invasion by native species (Marlette and Anderson 1986). A large seeding can be distinguished on the Landsat image (back cover) at the intersection of US Highways 20 and 26 near the main entrance to the INEL; another is on the southern border, south of

Figure 16. Grassland dominated by Indian ricegrass (Oryzopsis hymenoides).

Figure 17. Great Basin wildrye (Leymus cinereus).

EBR 1. Large areas were also seeded on the southern end of Tractor Flat, which lies on the east side of the INEL.

Sagebrush Steppe. Two sagebrush steppe classes are distinguished on the vegetation map: Sagebrush Steppe on Lava and Sagebrush Steppe off Lava. The distinction is largely a consequence of differences in soil reflectance rather than vegetation. Soils overlying the basaltic uplands of the southern two-thirds of the INEL tend to be darker than those of sagebrush-dominated communities off lava because of the presence of dark-colored pebbles or sand on the surface or because small patches of bare lava are exposed. On the broken, irregular basalt topography, the soil surface often is sandy and friable and less likely to form the platy vesicular crusts that characterize many areas off the basalt flows. This may influence species composition. For example, cheatgrass has invaded many of the communities on the basalt flows, but is rare or absent from some of the sagebrush dominated areas off the flows. Soils in areas where cheatgrass is absent tend to be slightly saline and to form thick surface crusts. Distinguishing between these two classes of sagebrush steppe also makes it easy to identify the extent of upland areas where shallow soils overlay relatively recent basalt flows. One must keep in mind, however, that the classification is not completely accurate; some sagebrush communities on the basalt flows may be classified as "off lava" and vice versa.

Figure 18. Thelypody (Thelepodium laciniatum) *in sagebrush steppe.*

Sagebrush steppe may be dominated by either Wyoming big sagebrush or basin big sagebrush, or by both. The differential distributions of the two subspecies are related to gradients of soil texture (Shumar and Anderson 1986). Basin big sagebrush occurs on sandy soils that are usually deep and well drained, whereas Wyoming big sagebrush tends to occur on fine-textured, shallow soils having limited depths of water infiltration. Wyoming big sagebrush is the most abundant sagebrush at the INEL, but extensive patches of basin big sagebrush occur on the eastern basalt uplands (Shumar 1983). Pockets of basin big sagebrush within areas generally dominated by Wyoming big sagebrush occur on the lee sides of lava ridges where sand accumulates, within former channels of the Big Lost River, and on the linear sand dunes near the Mud Lake basin. The influence of these linear dunes is readily apparent on the vegetation map (Appendix 2).

Figure 19. Low shrubs on lava.

Figure 20. Columbia goldenweed (Happlopappus acaulis).

Some areas of sagebrush steppe are dominated by one of the species of "low sage," black sagebrush (*Artemisia nova*) or *Artemisia arbuscula*. Black sagebrush typically occurs on shallow, stony, calcareous or limestone-derived soils (Shultz 1983, Hironaka 1979), although it also occurs on dry, windswept ridges and on shallow soils overlying basalt. *A. arbuscula* also occurs on shallow soils, but it is more of an upland species, often found on foothill slopes.

Aside from the dominance of sagebrush, the sagebrush steppe communities do not have a unique species composition. However, most sagebrush steppe has an abundance of perennial grasses, and the combined cover of perennial grasses can approach that of the sagebrush. These are the same grasses that occur in the grasslands described earlier. In fact, the only apparent difference between many areas classified as sagebrush steppe and others classified as grasslands is the density of sagebrush. In some areas, this reflects fire history. Sagebrush is killed by fire and must recolonize burned sites from seed. Most perennial grasses and forbs resprout following fire from roots or other organs that are protected below ground. Therefore, these herbaceous species can become the dominants following fire and it may be decades before sagebrush again reaches a high density. Such areas likely will be classified as grasslands.

Shrubs other than sagebrush occur in most of these steppes. Green rabbitbrush is essentially ubiquitous; other common shrubs include winterfat, prickly phlox, and spiny hopsage.

Low Shrubs on Lava. These communities occur on basalt ridges and other areas where shallow soils overlay basalt (Figure 19). Black sagebrush is often present, but usually not dominant. Green rabbitbrush and broom snakeweed are common. Wyoming big sagebrush and winterfat occur in some areas. Native bunchgrasses and forbs typically are abundant. Columbia goldenweed (*Haplopappus acaulis*), a suffrutescent shrub, is found on patches of exposed lava (Figures 19 and 20).

Sagebrush-Rabbitbrush. Communities in this class are characterized by an abundance of green rabbitbrush, which may be the dominant shrub or a co-dominant with Wyoming big sagebrush or, occasionally, black sagebrush. Communities in this class fall both on and off the basalt flows. Many of these communities have a rich understory of perennial grasses and forbs. Cheatgrass is present and sometimes very abundant where these communities occur on coarse-textured soils. These communities variously intergrade with big sagebrush steppe.

Green rabbitbrush often is characterized in the literature as an "early successional" species. However, it is the only shrub that consistently increased in abundance between 1950 and 1985 on the INEL permanent vegetation plots (Anderson and Inouye 1988). That this occurred in the absence of any major disturbances such as fire or livestock grazing indicates the "early seral" characterization is inappropriate. It may well be an opportunistic species that can take advantage of disturbances, but the data from the INEL does not support the view that it will be displaced by other species in later stages of vegetation development. Green rabbitbrush can sprout vigorously following fire, so its abundance on some sites may be a consequence of fire history.

Sagebrush-Winterfat. Communities in this class typically are dominated by Wyoming big sagebrush, but winterfat is typically abundant and may be dominant or co-dominant. Green rabbitbrush is common, as are members of the suite of perennial grasses, especially Indian ricegrass. This class occurs on soils derived primarily from lacustrine deposits of ancient Lake Terreton. Cheatgrass seldom is found in these communities. Our vegetation data suggests that these communities are intermediate between the Sagebrush/Green Rabbitbrush communities and Salt Desert Shrub communities. This may reflect a gradient from upland loess soils to the more halomorphic lacustrine soil of the Lake Terreton basin.

Salt Desert Shrub. Salt desert shrub communities are found on the Big Lost River and Birch Creek playas and on other playas within the Lake Terreton basin. All are dominated by members of the chenopod family, but their composition varies considerably. Our samples indicated the occurrence of three relatively distinct community types. The first is dominated by suffrutescent shrubs. Nuttall saltbush is the dominant species. Shrubby buckwheat is a co-dominant in some areas and winterfat is often present. The second type is dominated by shadscale. Winterfat and green rabbitbrush are common in these communities, and Nuttall saltbush may be present. The third type is dominated by winterfat, but fourwing saltbush (*Atriplex canescens*) is abundant.

The spectral complexity of the northern portions of the INEL, particularly within the area formerly occupied by Lake Terreton, is apparent on the vegetation map. This complexity is a consequence, at least in part, of differential deposition of alluvial and lacustrine sediments and wind-blown sands, which affects spectral properties of the soil surface as well as vegetation development. The salt desert shrub and other communities that occupy the Lake Terreton basin often have a high percentage of bare ground, which may dominate the spectral signature of a satellite image. Thus, classification errors can be quite common because there is not a close correlation between vegetation characteristics and spectral properties of the area.

Wetlands. Wetlands are identified on the vegetation map in the vicinity of the Big Lost River sinks. These areas are periodically flooded during years of high precipitation (see **Hydrography,** page 3). Part of this area was a cattail (*Typha latifolia*) marsh in the early to mid 1980's. The dominant species over much of the area is common spike-rush (*Eleocharis palustris*). Western wheatgrass becomes more common toward the margins as the wetlands grade into grasslands. Species diversity of these wetlands is very low.

Playas, Bare Ground, Disturbed Areas. These areas typically have a high proportion of exposed soil as a consequence of past disturbance or periodic flooding. Some are dominated by the exotic annual summer cypress (*Kochia scoparia*); poverty-weed (*Iva axillaris*), Russian thistle (*Salsola kali*) and verbena (*Verbena bracteata*) are common. Perennial plants are virtually absent from these communities.

Russian thistle dominates other areas within this class. Summer cypress and poverty-weed are common, as is the native shrub, four-wing saltbush. Thick-spiked wheatgrass usually is present. Some areas south of the Radioactive Waste Management Complex are dominated by foxtail (*Hordeum jubatum*).

This class also includes gravel/borrow pits and gravel covered areas associated with roads and facilities.

Lava. The spectral signature of this class is dominated by exposed lava. The most extensive areas in the class are the recent lava flow south of the INEL Main Gate and on the slopes of Middle Butte. Smaller patches are found throughout the large area generally classified as "Sagebrush Steppe on Lava." Vascular plants are sparse on these areas. The most common species are basin big sagebrush, gray rabbitbrush, and fern-bush (*Chamaebatiaria millefolia*). An individual Utah juniper or Rocky Mountain juniper (*Juniperus scopulorum*) occurs on some outcrops.

RARE VASCULAR PLANTS

The first comprehensive survey of rare vascular plants at the INEL was conducted by Cholewa and Henderson (1984). They reported one species on the "federal watch list" and eight species on the "state watch list." Four of those species are no longer listed (see below) as a result of new information on their distribution and abundance in Idaho. More recent surveys were conducted by James Glennon in 1990 in conjunction with sampling for refining the classification of the vegetation map and by Karl Holte and James Glennon in 1993. Holte and Glennon made extensive searches of the INEL and immediate vicinity during the exceptionally wet 1993 growing season. During this survey, three additional species were found that are on State or Federal lists. At present, seven "sensitive" plants are known to occur at the INEL, and one Federal Candidate occurs on Big Southern Butte. The status of each, as well as that of the species originally listed by Cholewa and Henderson (1984), is shown in Table 1. Representative specimens were deposited in the Ray J. Davis Herbarium at the Idaho Museum of Natural History at Idaho State University and at the INEL Herbarium.

Phacelia inconspicua (Reprinted by permission from Cronquist et al. 1984, page 183; Copyright 1984, The New York Botanical Garden).

Table 1. Status of rare vascular plants of the Idaho National Engineering Laboratory and vicinity.

Species	Family	Distribution	Status[1]
Astragalus aquilonius[2]	Fabaceae	Uncommon, western foothills	d
Astragalus ceramicus var. *apus*	Fabaceae	Common, north end of INEL	f
Astragalus gilviflorus	Fabaceae	Uncommon, Reno Point	b
Astragalus kentrophyta	Fabaceae	Northwest portion of INEL	f
Camissonia pterosperma	Onagraceae	Rare, northwest foothills	d
Escobaria missouriensis (Coryphantha missouriensis)	Cactaceae	Common, Reno Point	e
Gymnosteris nudicaulis	Polemoniaceae	Scattered, southern INEL	f
Halimolobos perplexa var. *perplexa*	Brassicaceae	Rare, on buttes	e
Ipomopsis polycladon	Polemoniaceae	Common, western foothills	c
Lesquerella kingii var. *cobrensis*	Brassicaceae	Common, east side of East Butte	f
Oxytheca dendroidea	Polygonaceae	Uncommon, throughout INEL	d
Phacelia inconspicua	Hydrophyllaceae	Big Southern Butte	a

[1]Federal and State status categories, or prior status:

a. Federal Candidate List

b. State Priority 1: A taxon in danger of becoming extinct or extirpated from Idaho in the foreseeable future if identifiable factors contributing to its decline continue to operate; these are taxa whose populations are present only at critically low levels or whose habitats have been degraded or depleted to a significant degree.

c. State Priority 2: A taxon likely to be classified as Priority 1 within the foreseeable future in Idaho, if factors contributing to its populations decline or habitat degradation or loss continue.

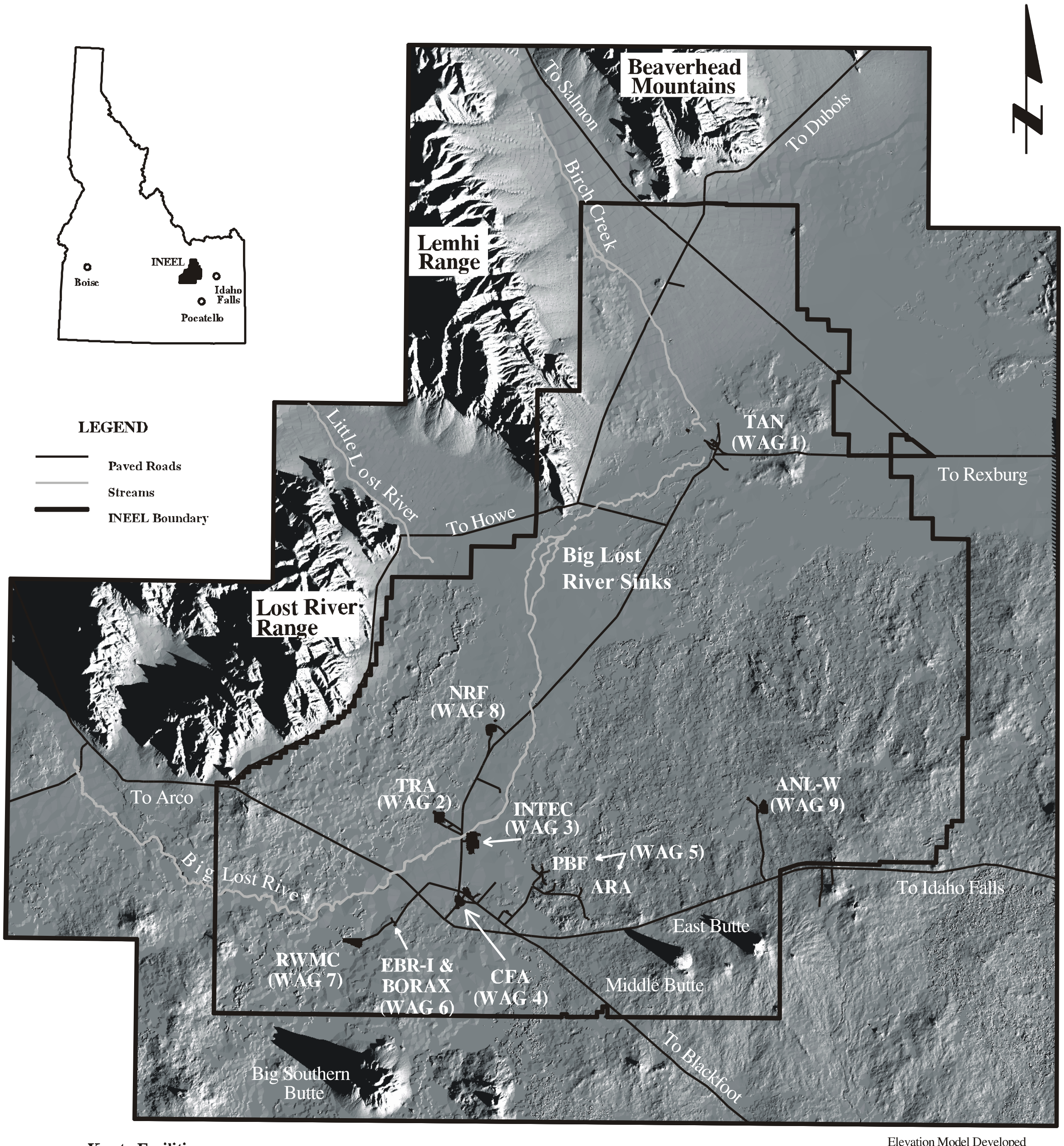
d. State Sensitive: A taxon with small populations or localized distributions within Idaho that presently do not meet the criteria for classification as Priority 1 or 2, but whose populations and habitats may be jeopardized without active management or removal of threats.

e. State Monitor: Taxa that are common within a limited range or taxa that are uncommon, but have no identifiable threats.

f. Listed by Cholewa and Henderson (1984), but subsequently removed from State or Federal Lists.

[2]Common names are listed in THE FLORA (see page 47).

Idaho National Engineering and Environmental Laboratory



Key to Facilities

ANL-W	-	Argonne National Laboratory-West
ARA	-	Auxiliary Reactor Area
BORAX	-	Boiling Water Reactor Experiment
CFA	-	Central Facilities Area
EBR-I	-	Experimental Breeder Reactor-I
INTEC	-	Idaho Nuclear Technology & Engineering Center
NRF	-	Naval Reactor Facility
PBF	-	Power Burst Facility
RWMC	-	Radioactive Waste Management Complex
TAN	-	Test Area North
TRA	-	Test Reactor Area

0 5 10 15 Miles

0 10 20 30 Kilometers

Elevation Model Developed
From USGS 1:24,000 Scale
Digital Line Graphs

COORDINATE SYSTEM: Stateplane
PROJECTION: Transverse
DATUM: NAD27
ZONE: 3701
UNITS: Feet

Date Drawn: November 12, 1999

(/gis/d08/tindemo: shade-wags)

ETHNOECOLOGY OF THE INEL

AND THE EASTERN SNAKE RIVER PLAIN

The eastern Snake River Plain is a region of cultural and natural edges. Ethnographically, it forms the northeastern fringe of the Great Basin[2], but its aboriginal inhabitants were in many ways distinct from their cousins in the Great Basin proper, at least during the past 4,500 years. The Plain is adjacent to the northern Plateau area of deeply incised mountain ranges and relatively more abundant water (Figure 21). The Rocky Mountains to the east formed a psychological barrier, if not a physical one, between the Basin-Plateau and the Plains cultures.

The flora of the INEL and immediate vicinity includes much of the diversity of plant species adapted to the environmental extremes found within the region. Nearly 500 plant species have been identified on the INEL itself, one-third of which have potential uses for humankind. Many more are relied upon by over 200 seasonal and resident species of vertebrates (Ringe 1995) and hundreds of hundreds of insect species (Stafford et al. 1986, Stafford 1987, Youtie et al. 1987). Information on known and potential uses of some of the region's ethnobotanically or ethnoecologically important plants (those that have features or inhabit places that are especially attractive to humans) can be found in tabular form at the end of this section. The remainder of this section will be devoted to assessing the ecological and environmental determinants of human occupation or use of the eastern Snake River Plain through a brief summary of the region's prehistory and history. The INEL itself is central to the area of study and is representative of many, though not all, aspects of the region's ecology as it pertains to human use.

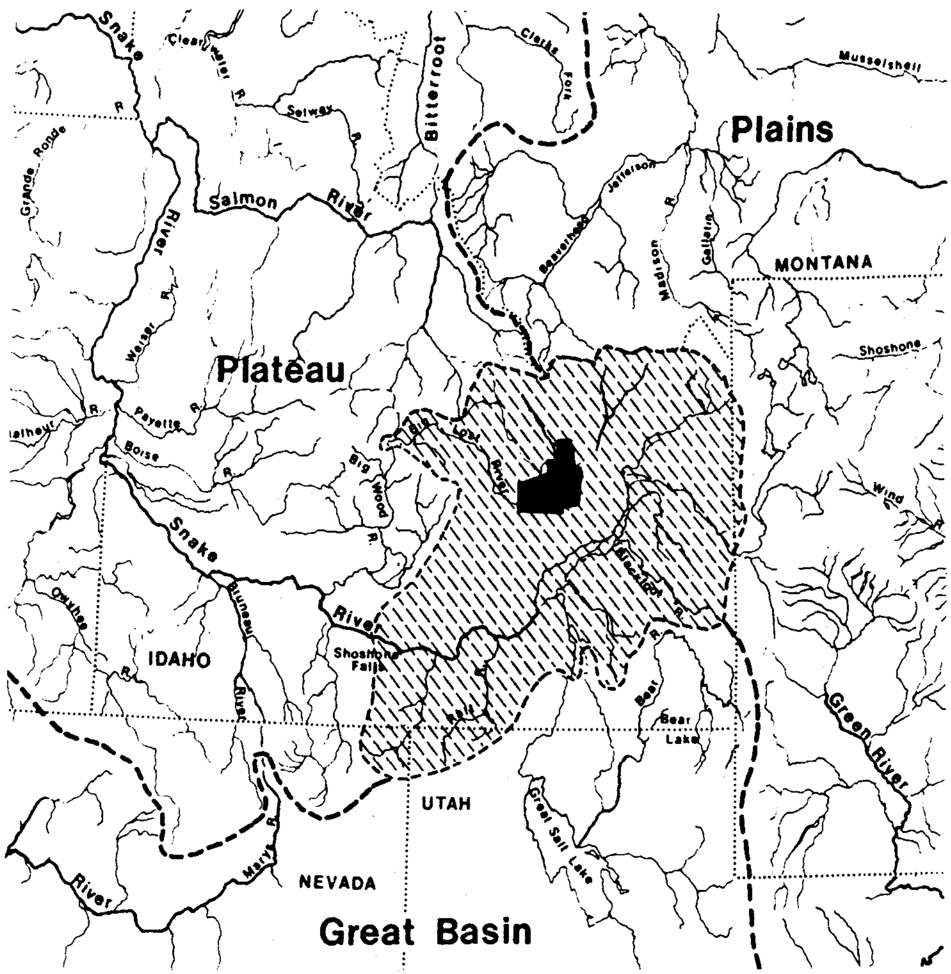


Figure 21. Cultural areas adjacent to the eastern Snake River Plain (hatched area) (from Reed et al. 1987).

[2] In *The Desert's Past*, archaeologist Donald Grayson (1993) refers to four separate definitions of the Great Basin: the hydrographic, the physiographic, the flo-ristic, and the ethnographic. The floristic and ethnographic Great Basins include all of the Snake River Plain. The hydrographic and physiographic Great Basins only flank the southeastern edge of this region along the Idaho-Utah and Idaho-Nevada borders.

Prehistoric Human Occupation

The first human beings to tap the resources of what we now call the Snake River Plain likely were descendants of people who crossed the Bering Strait land bridge; they arrived here some 11,000 B.P. That date was obtained from cultural deposits in Owl Cave (Wasden Site) just east of the INEL (Figure 22). A date of 14,500 B.P. was obtained three decades ago during the infancy of radiocarbon dating from deposits in Wilson Butte Cave (Figure 22), 200 km southwest of the INEL (Gruhn 1965); however, newer dating techniques applied to the same deposits provided dates younger than 11,000 years B.P. (Meatte 1989). Other archaeological sites on the Plain, in caves and lava tubes, along the shorelines of rivers and lakes, and in the foothills, have established that humans have occupied the Snake River Plain and its edges more or less continuously ever since. Over 850 archaeological sites at the INEL indicate a slow, steady increase in use of the area during that period (R. Holmer, personal communication; Figure 23). Palynological and archeological studies show that plant species composition on the Snake River Plain has changed little during the Holocene (the past 10,000 years) (Davis and Bright 1983, Davis et. al. 1986, Steadman et al. 1994), but the altitudinal distributions and relative abundances of individual species likely were different during the Altithermal, a period of gradual warming and drying during the early to mid Holocene. Studies in the area indicate a peak in xeric conditions between 8,200 and 6,700 B.P. (Beiswenger 1991); however, warm and dry conditions apparently persisted on the eastern Snake River Plain at least until 5,500 B.P. (Davis 1981). A change in projectile point morphology around 7,500 B.P. suggests a shift in hunting technology (Figure 23). Another shift around 4,500 B.P. may have corresponded with occupation of the area by migrants from the south following the close of the Altithermal. The widespread climatic shift to more arid conditions during the early Holocene may have caused the earliest human inhabitants of the Plain to follow the moist conditions to which they were accustomed to higher latitudes, thus opening a niche on or around the Plain for people migrating north from the comparatively more aird conditions in the south. According to this hypothesis, the Plain's original inhabitants were ancestors of the Plateau or Plains cultures to the north, while some-time during or toward the close of the Altithermal, ancestors of the present day Northern Shoshone and Bannock (Northern Paiute) emigrated north from the Great Basin and took up residence on the Snake River Plain (Holmer 1994). Until the last decade this hypothesis had little support from the archaeological record, but data from two recently discovered sites are consistent with it. A camp site at Dagger Falls on the Middle Fork of the Salmon River shows Shoshonean cultural continuity from 4,000 B.P. to historic times, and the sacred Wahmuza site on the Fort Hall bottoms shows similar continuity from 2,000 B.P. (Torgler 1995, Holmer 1994). The temporal, contextual, and artifactual overlap between these two sites seems to confirm continuous Shoshonean presence in southern Idaho since the close of the Altithermal.

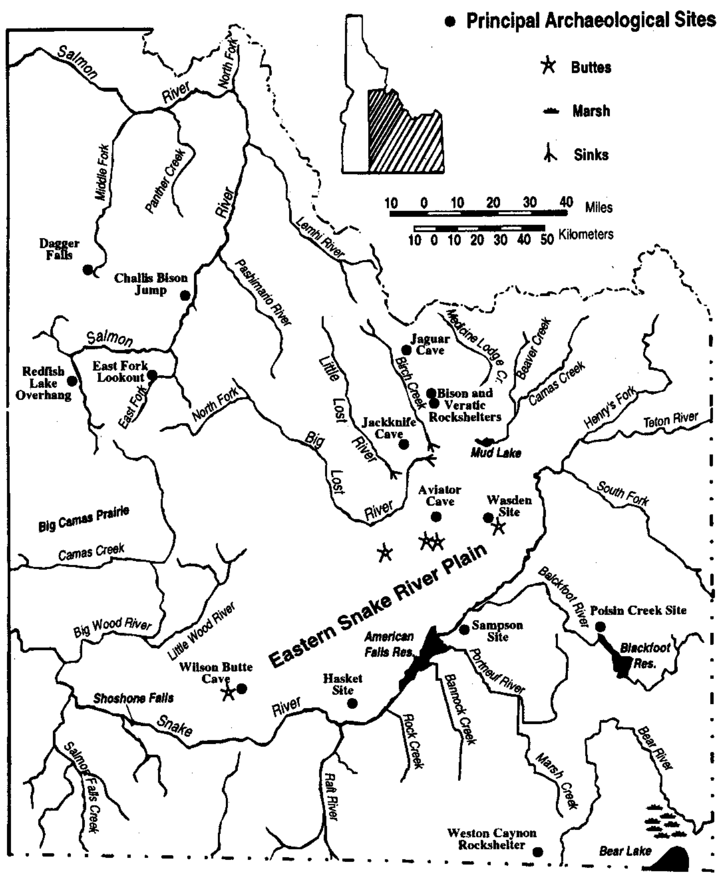


Figure 22. Important archaeological sites of the eastern Snake River Plain and nearby areas (redrawn from Reed et al. 1987).

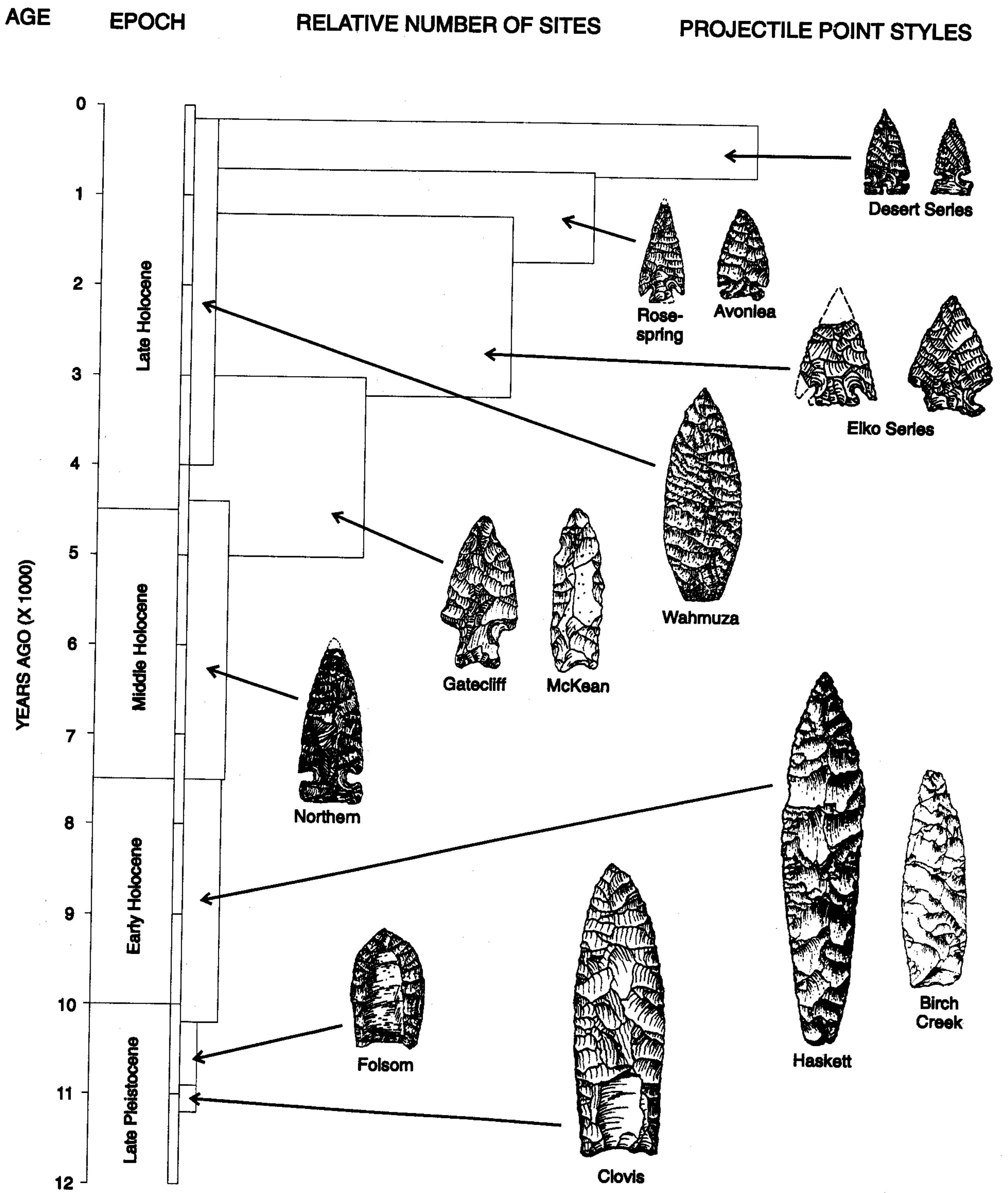


Figure 23. Cultural chronology of the eastern Snake River Plain. Width of bars in graph indicates temporal duration of projectile point styles; length of bars indicates relative number of sites associated with each style (from Holmer 1995).

The Nature of Prehistoric Evidence and the Hunter vs. Gatherer Debate

By its nature, archaeology is concerned with those materials from the past that persist. To become an artifact useful to archeologists, a thing must either be made of material that does not decompose or disintegrate, or it must be fossilized or otherwise preserved from the mechanical and chemical processes of wind and water. Cultural chronologies of prehistoric people (e.g., Figure 23) are based largely on inorganic material made of stone or clay (projectile points, grinding implements, pottery) and bone because those are the remnants of a people's material culture that survive to the present. Use of organic elements, such as plants, can usually only be inferred by assuming some measure of cultural continuity between the historic and the prehistoric. Such assumptions must then be examined in view of new information that may become available.

It is quite certain that from the earliest stages of human occupation on the Snake River Plain, people here were hunters of large game. Lithic tools from the earliest strata of cultural deposition include large spear points that are often associated with the bones of now extinct mammoth, caribou, bison, and horse (Reed et al. 1987:82-108). Grinding implements and pottery, which might indicate the use of plants, are almost entirely absent. The archaeological record indicates a gradual reduction in projectile point size that corresponds roughly with the local or complete extinction of large, relatively slow moving mammals, and their replacement by the swifter-footed, smaller mammals that exist on or about the INEL today: mountain sheep, deer, elk, and pronghorn. The smaller projectile points are accompanied first by evidence of spear-throwing technology (i.e. the atlatl), and later by evidence of the bow and arrow, both of which seem to be adaptations to the hunting of smaller, faster animals (Ringe 1995).

Use of plants by prehistoric people is only infrequently indicated by the archaeological record. Seeds may be found charred in a hearth or adhering to the inside walls of a cooking pot. They may also be found preserved as they were cached in a sealed container buried for future use. Coprolites, or human feces, are one of the most valuable sources of information about the prehistoric human diet, as indigestible parts of both plant and animal food may be preserved there. Remnants of wood and brush shelters may be found preserved in very dry climates, or roof support post holes may be discerned from a subsurface change in soil structure and the presence of molds (from decomposing posts) in the soil. The problem for archaeologists on the Snake River Plain is that such examples of preserved organic materials are seldom found in this part of the world. Here, the combination of semi-arid (as opposed to arid) conditions with semi- to fully-nomadic cultures produced an archaeological record that is heavily biased toward the more recalcitrant artifacts: lithic tools and evidence of their manufacture, and the bones of animals brought down by their use. This evidence alone would lead one to believe that the Plain's prehistoric inhabitants were subsisting chiefly on flesh.

However, one of the INEL's best preserved sites, Aviator Cave (Figure 22) presents a limited cultural assemblage that provides evidence to the contrary. It includes charred cactus seeds and spines, twined plant fiber, both matted and charred sagebrush, a bunchgrass torn up by the roots and apparently used as a makeshift broom (the stems are evenly worn), and a few fragments of Subalpine Fir needles that must have been transported to the site (perhaps stuck in sap carried as travel food). This site dates to between 1500-300 B.P. (Lohse 1990), and its cultural assemblage can be readily interpreted despite sketchy ethnographic information: cactus stems and fruits were eaten, often after being roasted in a fire; sagebrush was often used for fuel, insulation, or bedding; various kinds of sap were collected and eaten, or carried about as travel food (Steward 1938). Unfortunately, this is one of only a handful of sites on the eastern Snake River Plain containing any ethnobotanical information at all. Consequently, most of what we can say about prehistoric plant use in this region is conjecture based on ethnographic information, on assumptions of prehistoric-historic cultural continuity, and on models of human nutrition. However, studies of successful hunter/gatherers worldwide suggest that the common pattern is one of primary reliance on plant resources as *the* dependable source of calories (Lee 1968, Simms 1984).

Ethnoecology of the Plain

It is generally agreed that the aboriginal culture areas of the Great Basin were defined by the ranges of two plants: greasewood in the south and sagebrush in the north. That observation underlines the ecological nature of ethnobotanical lore but fails to illuminate the diversity of environments available to the region's indigenous people. That Shoshone/Bannock ethnoecology emphasizes riparian communities is indicated by prehistoric evidence and historic accounts of long-term camp sites along rivers, as well as by the relatively large body of customary knowledge concerning water-related resources (Lowie 1908, Steward 1938, Clark 1986). However, indigenous ecological knowledge is by no means limited to riparian ecosystems any more than it is to sagebrush-dominated plant communities. The semi-nomadic nature of Shoshone/Bannock subsistence in the past, and the practice among some members of the present day Reservation population of gathering seasonally available resources from far afield (e.g. pinyon nuts and bitterroot, neither of which grows on or near the Fort Hall Reservation) imply a breadth of Shoshone/Bannock ecological knowledge that is in keeping with the region's environmental diversity.

Ethnography as well as archaeological evidence has revealed that the prehistoric populations using resources on the INEL were nearly as transitory as the populations active there in recorded history. The few sites with any cultural stratigraphy (most sites are surface scatters of lithic debitage), such as Aviator Cave, are interpreted as short-term camp sites used successively over perhaps a number of years (Lohse 1990, Henrickson 1991). However, recent studies of site distribution on the INEL (Ringe 1995, Reed et al. 1987) imply that prehistoric population movements were aimed at landforms that were indicative of certain resource communities. One such study associates prehistoric evidence of human activity on the INEL with specific topography, such as buttes, craters, caves, the Big Lost River, Birch Creek, the Lemhi mountains, edges of lava flows, and the Lake Terreton basin (Ringe 1995). The Lost River Sinks are also considered areas of high site potential, although relatively few archaeological sites have been recorded there. This dearth of recorded sites may be due to the small number of archaeological surveys performed there and to lacustrine and alluvial soil deposition that may have rapidly covered any sites that did exist (Ringe 1995). Such sites may have been preserved, however, and further survey of the Sinks area may reveal areas where wetland plant species such as cattail were processed.

Reed et al. (1987:111-114) list five landscape types postulated by archaeologists to have affected the movements and ecology of early human populations: the Great Rift, which may have served to divert human transit around recent lava flows (there are high site concentrations along lava flow margins); buttes, which served as vantage points and held lithic resources (e.g., ignimbrite), wood, and, on some, permanent water; dunes, which offered wind protection and soft bedding (most archaeological sites associated with dunes are located in the lee of pressure ridges); lava tubes, which offered shelter and water both historically and in prehistory; riparian areas such as those mentioned above; and playas offering seasonal water-related resources.

Historic Human Occupation: Linking the Past with the Present

Resources of the eastern Snake River Plain were relatively abundant by western Plain and Great Basin standards. Early explorers interpreted the state of the Great Basin's native human population as one of abject poverty. Writing from Fort Hall to Henry Schoolcraft at the Office of Indian Affairs on April 3, 1848, Wyeth recounts,

> *...the few whites in the region called the more miserable bands Diggers, or Shoshonees [sic]. They differ from the other Snakes [the English term for Shoshones] somewhat chiefly in language; their condition is much poorer, having no horses and living chiefly on fish and roots from the brooks with what small game that region affords* (Schoolcraft 1851:206).

It was not until the printing of anthropologist Julian Steward's (1938) landmark work, *Basin-Plateau Aboriginal Sociopolitical Groups*, that more detailed ethnographic information came to light. Except for the records of Lewis and Clark and of anthropologist Robert Lowie (1909), interpretations of subsistence and social activities of the region's aboriginal inhabitants are largely inaccurate, confusing, exaggerated, or made in passing since most Euroamerican visitors to the Snake River Plain during the early historic period were intent only on reaching Oregon and the coast. As Steward lamented,

> *Despite the large number of travelers, which included many ambitious chroniclers, records of the Indians continue to be disappointing. The natives between the Rocky Mountains and the Sierra Nevada Mountains were generally dismissed with the remark that they were only miserable "Diggers"* (Steward 1938:6).

However, Steward's ethnography includes and either corrects or augments the observations of many early travelers, well-known and obscure alike. His lengthy ethnographic descriptions were obtained from some of the last Shoshone and Bannock whose memories included pre-reservation life. He made significant contributions to Basin-Plateau ethnology by paying special attention to the intense interplay between culture and environment. This he defined not as "environmental determinism" which "postulates some kind of automatic and inevitable effect of environment upon culture" but as "human ecology or the modes of behavior by which human beings adapt themselves to their environment" (Steward 1938:2).

Steward's ethnographic work has not gone unchallenged, but it is still considered the baseline for most anthropological research in the Great Basin-Plateau region. Most of what is known of Snake River Plain ethnology stems from Steward's work, but it is continually supplemented by more recent findings of archaeology.

Steward's Interpretation of Shoshone/Bannock Subsistence

Although the eastern Snake River Plain was not considered a place of abode except along major waterways, it was flanked by people who made good use of its resources. The Lemhi and Tukaduka (mountain sheep eater) Shoshone lived in and around the Lemhi Valley, and the Fort Hall Shoshone and Bannock[3] , though more nomadic than the Lemhi groups, wintered along the Fort Hall bottoms on the Snake River. In spring and summer, both groups are said to have broken into small, socially fluid groups composed of a few to several related families (smaller groups could more easily feed themselves while moving from resource to resource). Every year, a group's composition might change, and families often alternated between various yearly subsistence activities: one summer might be spent collecting roots and trading with the Nez Perce, Flathead, and other Shoshone on the Camas Prairie of the western Snake River Plain; the next summer might be spent to the east, collecting berries, nuts and roots on the way to and from bison hunts in Yellowstone or on the northern plains. Salmon could be obtained to the west on the Snake River below Shoshone Falls. Berries and game were plentiful to the south around Bear River (Figure 24). Steward recounted:

> *Whether they went east for buffalo, south...for berries and for hunting, or west for salmon, camass [sic], and trading depended upon individual circumstances. Also, whether they joined other groups depended upon where and when they traveled and whether they had horses* (Steward 1938:203).

Very little is known about the culture and subsistence of pre-horse aboriginal groups in this area. Steward (1938) and others have surmised that the Northern Shoshone culture of the pre-horse era (most of their history) would have been similar to, though more nomadic than, that of the Western Shoshone of the western Snake River Plain and eastern Oregon in the historic era, for these people remained unmounted even after their eastern relatives chose the equestrian lifestyle. Bannock and Northern Shoshone groups (including both Lemhi and Fort Hall Shoshone) had horses by the early 1700's (Murphy and Murphy 1960). It is not clear whether acquisition of the horse radically changed subsistence activities, but it seems that it significantly altered social structures especially among those groups that traveled east for bison. Whereas the family and small group were the most efficient economic units throughout the Great Basin, larger group solidarity and cooperation were necessary features of a successful bison hunt, and were in turn made possible by the increased wealth (measured chiefly in horses and bison robes) and the ensuing need to protect that wealth from enemy groups.

Shoshone cultural distinctiveness at the east and west ends of the Snake River Plain, especially in terms of subsistence strategies, was the result of environmental differences. The Snake River Plain becomes less and less arid as one travels west to east. Prior to 1840, bison were found chiefly in the northeastern portion of the Plain and hardly at all toward the west, owing primarily to a lack of feed (Steward 1938). Likewise, horses that were acquired by those

[3]The Shoshone and Bannock of the Fort Hall area, historically and to some extent prehistorically, wintered together in the vicinity of Fort Hall. They often joined forces with each other and with other Shoshone in hunting, gathering, trading, and defending themselves against the Blackfoot and Crow. Although they were socio-politically similar, they were and are linguistically distinct groups: the Shoshone language is more closely related to Ute and Gosiute; Bannock stems from Northern Paiute. However, both are Numic languages, whose stock was originally found in southern California and subsequently spread east and north in a much debated phenomenon known among anthropologists as the "Numic Expansion."

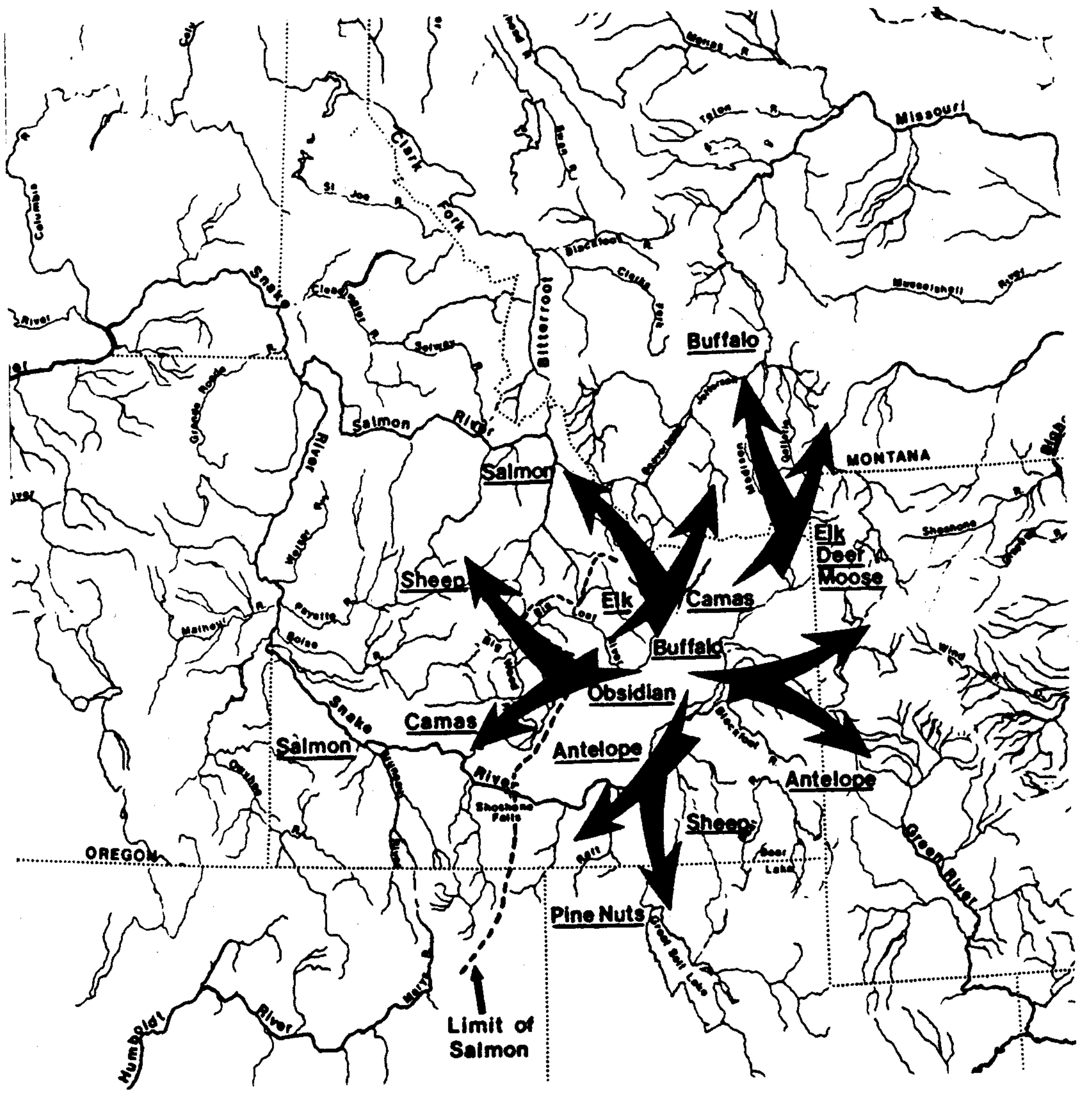


Figure 24. Subsistence resources of the eastern Snake River Plain (from Reed et al. 1987).

living on the western Plain tended to eat “the very plants upon which people depended” and so were usually eaten themselves rather than used in further quests for food (Steward 1938). In contrast, the horse must have fit easily into the already nomadic lifestyle of the Northern Shoshone, whose access to bison was only limited by speed and the element of surprise. Here, the horse provided a mode by which human beings could better adapt themselves to their environment, thus increasing their ability to exploit its myriad resources. In the Lemhi Valley, on the northeastern Snake River Plain, on the Fort Hall bottoms, and all along the upper Snake River, there was plenty of grass to support an expanding equestrian lifestyle.. On the eastern Plain, human and horse ecologies were compatible, whereas on the western Plain, they were not (Steward 1938:230-237).

The Contact Period

By the time Euroamericans started keeping historical accounts of the aboriginal ways of life they were displacing, those lifestyles had been adapting to the stresses placed on them by populations to the east for decades. For millennia, a very low population density and a nomadic lifestyle had allowed the Northern Shoshone and Bannock of the Snake River Plain to exist in relative harmony with neighboring Basin and Plateau cultures. The Great Plains cultures to the east posed periodic threats as Blackfeet and (less commonly) Crow bands came west of the Rockies to steal horses. But the more significant threat came when, sometime around 1750, the Blackfeet acquired firearms from the Europeans. When Lewis and Clark arrived in the Lemhi Valley in 1805, the Shoshone of that area had already been driven back from their earlier expansion into the northern Great Plains by a combination of mounted, well-armed Blackfeet, and the ravages of smallpox (Murphy and Murphy 1960:295), in other words, by the ripple effects that preceded Euroamerican expansion. By the time Lewis and Clark reached them, the Northern Shoshone had possessed horses for over a century, but they had ceased making forays into the northern Great Plains for bison except when joined by Flathead, Bannock and other Shoshone to increase their own defenses. The bison they had hunted even on the Snake River Plain were infrequently pursued anymore for fear of raiding, well-armed Blackfeet (Lewis and Clark in Steward 1938:192). Although bison were still numerous on the Snake River Plain in 1834 when Nathaniel Wyeth built the original Fort Hall, they began to decline soon after that, hastened by the increasing numbers of Euroamerican trappers and explorers entering and exploiting the lands west of the Rockies. Wyeth noted in a letter to Schoolcraft, "Near Fort Hall, in 1834, there were plenty of buffalo, but soon after the Fort was established they disappeared from its neighborhood. The beaver disappeared next" (Schoolcraft 1851:217).

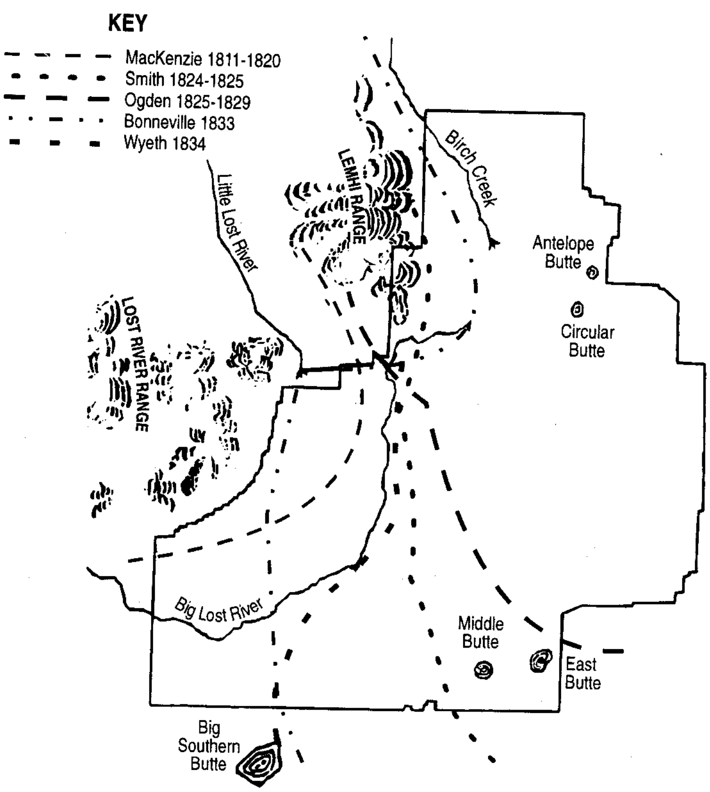


Figure 25. Approximate routes of trappers and explorers across the Idaho National Engineering Laboratory (redrawn from Reed et al. 1987).

With the opening of the American Frontier came forces that would utterly disrupt the human ecology that had been developing along the Snake River Plain for thousands of years. The fur trade began in about 1810. By 1840 it had essentially come to an end, but the intervening years had seen a steady decline in game (including small mammals and birds) traditionally hunted by native human populations (Steward 1938). The Oregon Trail was well established by the 1840's, enabling the passage through southern Idaho of an estimated 240,000 emigrants and their 1.5 million grazing animals by the year 1857 (Madsen 1980). Native plant communities suffered massive overgrazing and trampling as a result, further depleting the resources on which Northern Shoshones, Bannocks and their livestock traditionally depended. By 1868, treaties had been signed forcing the native populations onto the reservation at Fort Hall; for a time, a reservation in the Lemhi Valley was established, but that group too was moved to Fort Hall, in 1907. By the 1870's, miners had entered the Salmon River country, providing the impetus for farmers, ranchers, and others to follow. And even though treaty provisions allowed for seasonal subsistence rights to traditional resource areas, such as the Camas Prairie, "native plants had been so reduced by cattle grazing and native animals by hunting that complete reliance on them was no longer possible" (Steward 1938:249).

The eastern Snake River plain contained enough resources, if one knew where to find them, to allow passage across it, and it offered seasonal usage of some choice areas (e.g. the Sinks and the buttes). Prehistoric and early historic humans were attracted to it for a wide variety of reasons ranging from bison to obsidian. In contrast, the first Europeans were largely repelled by what appeared to their agriculture-accustomed eyes to be a wasteland: "[These lands] are unfeasible for any kind of cultivation . . . from the extreme coldness of the nights . . . superadded to extreme dryness and poverty of soil" (Wyeth in Schoolcraft 1847:210). Or, they were simply in search of something besides what the desert had to offer. Trappers and fur traders were some of the first to make their way across the Plain, probably following trails blazed and long-used by the Shoshone and Bannock. Figure 25 shows the probable routes they followed, cutting directly across the INEL and sticking close to sources of water wherever possible. Emigrants employed the part-Indian Tim Goodale and other guides to usher them across the Plain on an offshoot of the Oregon Trail that came to be known as Goodale's Cutoff (Figure 26). The only travelers that settled prior to the 1860's were Mormon farmers sent by Brigham Young to colonize the region. In 1855, they were digging irrigation canals and successfully homesteading to the northeast of the INEL (Clements n.d.). Meanwhile, stockmen made mad dashes across the Plain and wrote about their desert crossings in nightmarish terms:

> *Few of us will forget the torture of those two days and nights from Lost River to Blackfoot. It was through lava-ash and lava-dust country, covered mostly with sagebrush, where the lava was not on the surface to prevent brush from growing. It was by far the hottest weather we had experienced, and a blistering, dry, scorching wind blew out of the southeast . . . There were a few small depressions where a little brackish rain water had collected, but this was only an aggravation to our suffering animals. Every steer's tongue hung out, and there was a hopeless expression in their faces . . .* (Rollinson 1948:96-97).

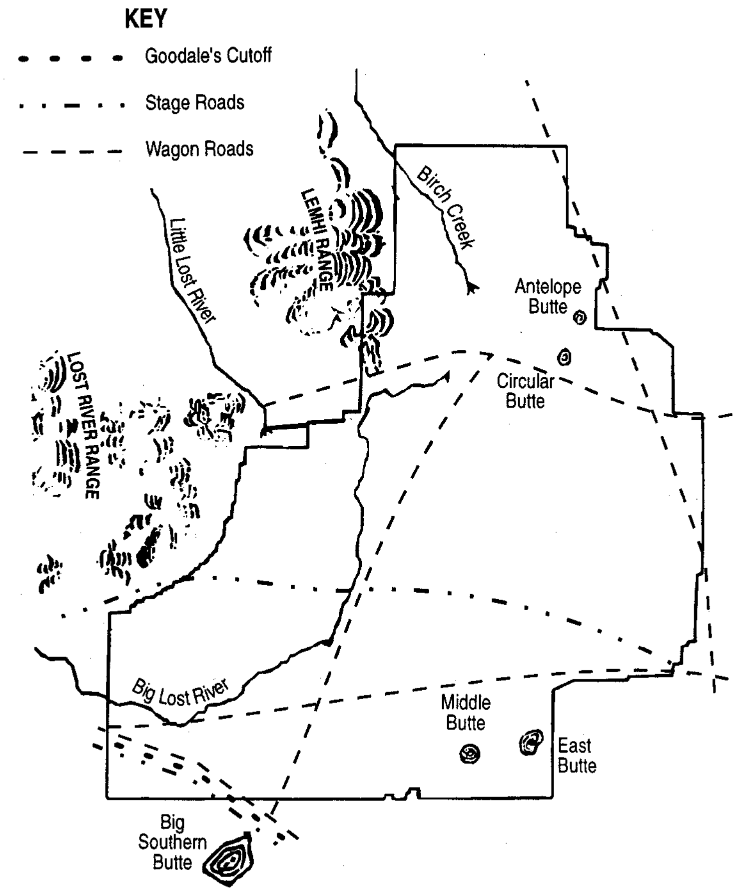


Figure 26. Emigrant, stage, and wagon roads at the Idaho National Engineering Laboratory in the mid 1800's (redrawn from Reed et al. 1987).

Archaeological remains of historic livestock drives are embodied in the numerous roads and trails still evident on the INEL (Figures 26 and 27), and in the occasional basalt structures typical of early sheepherders. Livestock production was a commercial industry along the Snake River Plain by the late 1860's, but its purpose remained a transient one as cattle and sheep were trailed between the coastal states and the grasslands east of the Rockies. It was not until the 1880's that the livestock industry took root in the area (Wentworth 1948). Homesteads sprang up along the Lost Rivers and Birch Creek. The Wood Livestock Company in the Pahsimeroi Valley and the Hawley brothers in the Little Lost Valley were two of the first to successfully import cattle and sheep. These were sold first to local miners and later to markets in Wyoming and Montana (Reed et al. 1987, Wentworth 1948). Commercial hunters also sold their goods to miners, but, by the early 1900's, were finding themselves beat out by the livestock industry. Market hunter James Beard remembered, in 1903 or 1904, seeing the Little Lost after many thousand head of sheep had been driven up the valley to feed in the high country. After the sheep went through, there was no feed left to speak of for any other animal, wild or domestic (Robert Sherwood, Nevada BLM, personal communication, 1994). Domestic animals were usually wintered on the open range of the Plain, where snows were not so deep; then sheep were trailed into the valleys, and cattle into the foothills, following the receding snow

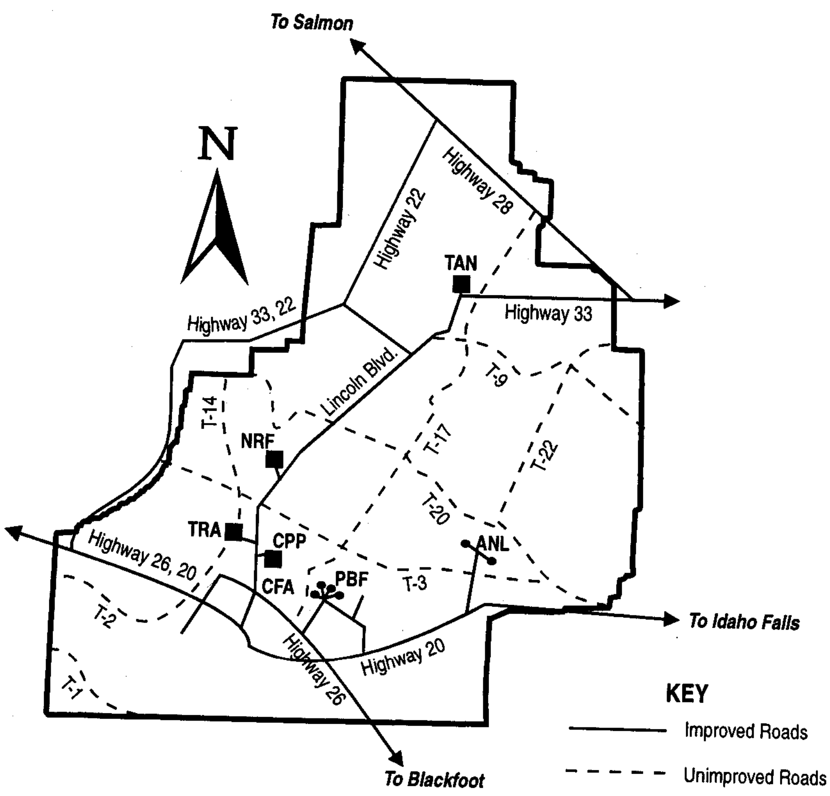


Figure 27. Unimproved roads currently designated as "t-roads" at the Idaho National Engineering Laboratory that were used for cattle and sheep drives or for stage and wagon travel (redrawn from Reed et al. 1987).

line through the warmer months. Wild horses also grazed on the Plain and in the Lost River and Birch Creek Valleys, their populations numbering between seven and nine thousand in the early 1900's (Oberg 1970:134).

Real incentive to attempt settlement on the eastern Snake River Plain came with Federal Legislation. The Homestead Act of 1862 gave 160 acres to settlers willing to cultivate and reside on their newly acquired property for five consecutive years. The Desert Claim Act of 1877 provided 640 acres to settlers able to irrigate that land. In the Carey Act of 1894, Idaho obtained one million acres of Federal land for homesteading, with the proviso that the state would supervise its irrigation. And in 1902, Idaho received funding through the Reclamation Act to build diversionary canals in an attempt to "reclaim arid lands" (Reed et al. 1987). Of the hundreds of kilometers of major canals and distribution laterals that were dug within the first three decades of the century, only one system, the Owsley Canal (part of the Mud Lake project) in the INEL's northeast corner, was successful, but only partially so (Figure 28).

Among the other attempts at making the desert bloom, the Carey Act's Powell reclamation project was notable and notorious. During the first decade of the project, a diversionary dam on the Big Lost River and nearly 160 km of canals and laterals were constructed by Powell Tract settlers to supply water from a proposed reservoir above Mackay[4], in the Lost River Valley, to the proposed village of Powell (also known as Pioneer) in what is now the INEL's southwest corner. The next decade and a half were spent revamping the project until its final demise in 1927. The canals, the larger of which were "70 feet wide at the top, 40 feet wide at the bottom and 8 feet deep", never held water (Reed et al. 1987, Schmalz 1963, Arco Advertiser 9/10/1909). A similar project with the same fate was attempted on the Little Lost River, with portions of canals extending across the INEL's northwest boundary (Idaho State Journal 5/15/1989). The ruins of homesteads along the Big Lost River and foundations near abandoned canals are all that remain of these strenuous efforts to "reclaim" the desert.

During the Second World War, the Navy and the Army Air Corps used several hundred square kilometers of the eastern Snake River Plain as a gunnery range (Figure 29). In 1949, the Federal government coupled these ranges with a large parcel of land withdrawn from the public domain and some purchased private lands to form what was called the National Reactor Testing Station. Livestock grazing on the newly established "Site" (as it has come to be known by modern residents of the area) was disallowed until drought forced the issue in the 1950's (Robert Sherwood, Nevada BLM, personal communication, 1994). Now, domestic grazing is allowed on about 60% of the INEL, including much of the

[4] The dam above the present town of Mackay was finally completed in 1919.

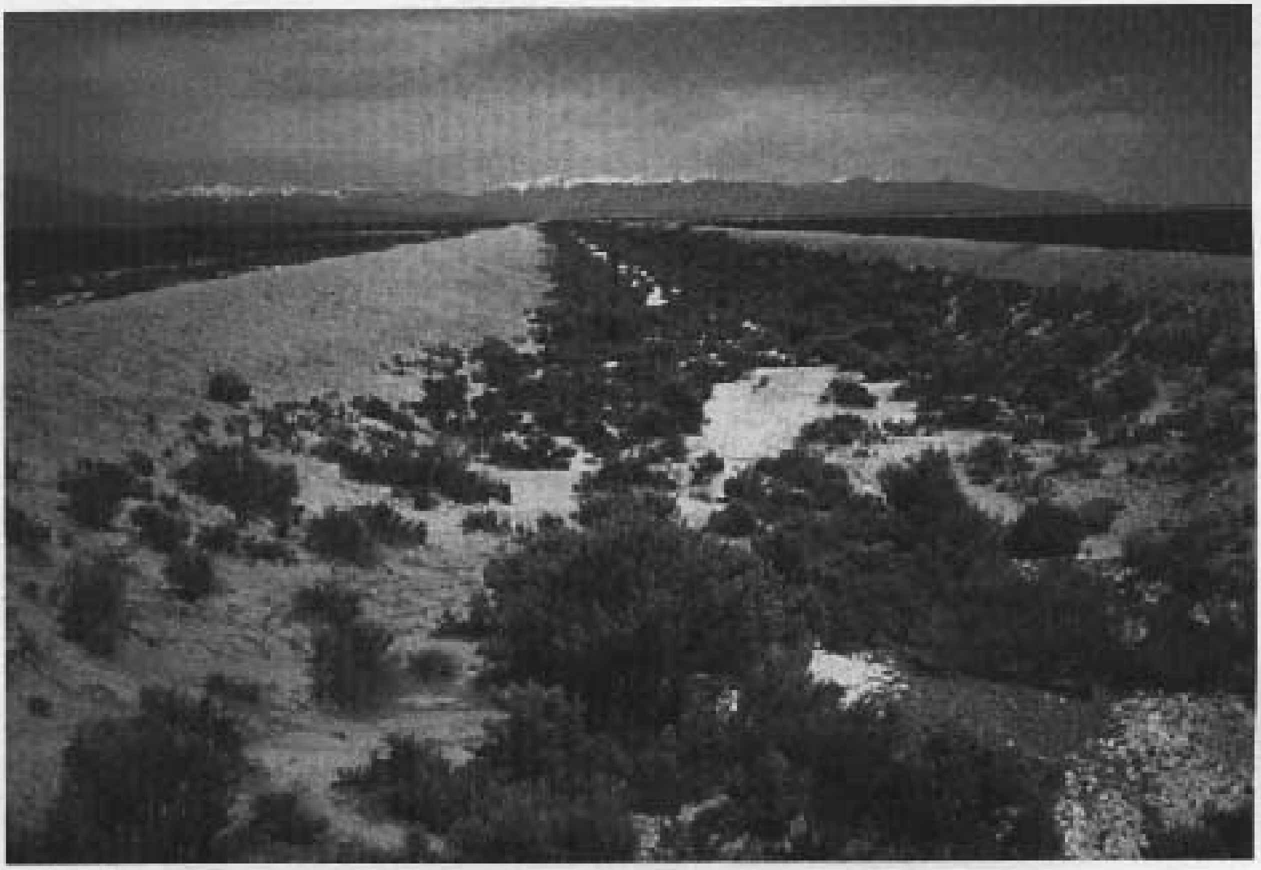


Figure 28. An abandoned portion of the Owsley Canal near Road T-9 (*see Figure 27*) *on the eastern side of the Idaho National Engineering Laboratory. Remnants of the abandoned sections of this canal system are visible on the satellite image (back cover) superimposed over the linear sand dunes on the northeastern side of the INEL.*

area north of Highway 33 and elsewhere along the periphery.

Disruption of natural water flows[5] and introduction of exotic plant species in those areas most heavily grazed (e.g. the Sinks) has severely degraded their historic plant diversity; for example, some of the wetlands communities that once thrived in the vicinity of the Sinks have been invaded and largely replaced by stands of Russian thistle *(Salsola kali)* and fanweed *(Thlaspi arvense)*. In other areas, cheatgrass *(Bromus tectorum)* is the primary invader and, once established, becomes a perennial problem for both agriculturalists and for those interested in preserving the integrity of the Plain's most nearly natural habitat. Otherwise, large portions of natural sagebrush cold desert remain untouched by the surrounding drive for development. Herds of elk and pronghorn find refuge there, and it is one of the few areas left on the Snake River Plain that has not been wholly plowed under. In 1974, the Site was given its current name, the Idaho National Engineering Laboratory, to emphasize that its mission has changed over the years to include aspects of scientific inquiry besides nuclear research and testing. Designation of the INEL as a National Environmental Research Park in 1975 emphasized its importance as a field laboratory for ecological research and for studying the environmental impacts of energy development. Except for domestic grazing and the ongoing degradation of ground and surface water sources, much of the INEL is a microcosm of the eastern Snake River Plain that existed up until 150 years ago. It represents a unique opportunity for long-term scientific inquiry and preservation.

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[5] By the 1800's, settlers had begun diverting water from the Lost Rivers and Birch Creek for irrigation. This lowered water levels in the Sinks, but the more drastic downstream effects of irrigation were not fully realized until sprinkling was instituted. The first "wheellines" in the Big Lost River Valley north of Arco appeared only within the last 12-15 years (H. Dorst, Mackay resident, personal communication, 1992). The ability to irrigate more acreage more effectively increased the amount of water taken from the river and from the underlying aquifer as more and more wells were drilled.

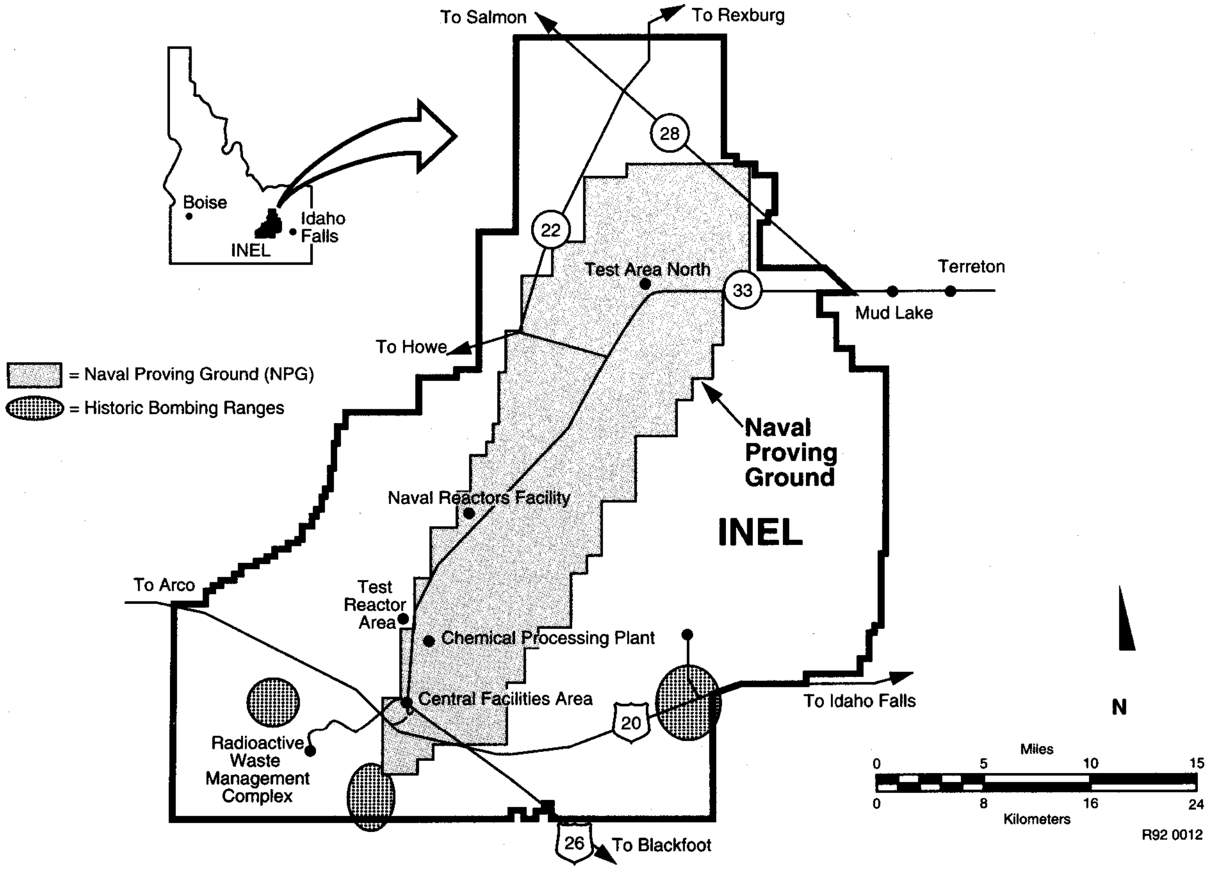

Figure 29. Locations of the U.S. Navy's artillery range and bombing ranges used during World War II at the Idaho National Engineering Laboratory (from Update Fact Sheet, INEL Environmental Restoration Program, March 1995.)

ETHNOBOTANY

The current status of documented ethnobotanical knowledge pertaining to plants found at the INEL is tabulated on the following pages. We endeavored to distinguish between generalized ethnobotanical information - that attributed to "the Indians," as if all indigenous groups could be represented by one cultural milieu - and specific ethnobotanical repertoire included in Shoshone/Bannock cultural ecology. The task of documenting a Shoshone/Bannock ethnobotany is ongoing and is largely a matter of reconstructing past behavior from lingering linguistic evidence and reporting present day practices from ethnographic research. The table shows the native Shoshone/Bannock term for the plant or plant parts, if it is known, and a symbol referring to the documented status concerning use of the plant by the area's native aboriginal population (see key below). These symbols do not represent Shoshone/Bannock use or non-use of a plant; instead, they represent the state of documentation concerning a plant's use. This distinction is meant to establish a baseline from which further research, more in the vein of reconstructive ethnography, might stem. It should also be noted that many of the "food plants" listed in the table are exotic species that were introduced to the area after European settlement. These would have come into use by local Native Americans during the last two centuries.

Key to Symbols in Table

+ = documented use among indigenous groups of the eastern Snake River Plain

? = use inferred from documented use among neighboring groups

- = potential for use, but no documentation found

[1]denotes introduced species

Intitials "DG" and "RW" refer to key Shoshone and Bannock informants.

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Aceraceae - Maple Family *Acer glabrum* Torr. Rocky Mountain maple	medicine (seed, bark) food (young shoot, cambium)	-	ravines on buttes	common in scattered patches	{Bauer, 6; Harrington, 344}
Acer negundo L. Box elder	food (sap) medicine (smoke) fuel (wood)	+ do'yas'hi[S] {DG}	near cultivated areas	not common	{Harrington, 344; Hart, 4}
Alismataceae - Water Plantain Family *Alisma gramineum* Gmel. Water plantain	food (root)	-	recorded from sinks area	not seen in recent years	Related genus (*Sagittaria*) has species with large, starchy, edible tubers called "wapato" by "the Indians". This genus, however, has fibrous roots. {Hitchcock & Cronquist, 558}
Amaranthaceae - Amaranth Family *Amaranthus* spp. Redroot, Amaranths, Pigweeds	food (leaf, seed)	-	disturbed areas throughout INEL	common, abundant	Some species were actually cultivated among Nevada Northern Paiute. {Fowler, 69; Harrington, 55; Steward, 21}
Anacardiaceae - Sumac Family *Rhus trilobata* Nutt. Squawbush, Skunkbush	food (berry) medicine (leaf, root?, flower, bark) manufacture (bark)	-	on buttes and along Big Lost River	scattered but common	{Fowler, 70; Harrington, 260; Hart, 55 (*R. glabra*); Vogel, 362}
Apiaceae - Parsley Family *Cymopterus* spp. Biscuit-root, Cymopterus	food (root, stem, leaf)	-	throughout INEL	common	{Fowler, 70; Harrington, 171}
Lomatium spp. Desert-parsley, Lomatium	medicine (root, leaf?) food (root)	+ (do tsa[S&B])	scattered over site	common	Native term refers to *L. dissectum*, Fern-leaved desert-parsley. *L. cous* root (called *xawsh* by natives) was a documented and important food among N. Shoshone and neighbors (traded it with Lewis and Clark) but it is not found on the INEL. Another important food species included in this family but not found on the INEL is *Perideridia gairdneri* ("yampa"). Root of *L. foeniculaceum* and *L. triternatum* used; root of *L. dissectum* is edible but bitter) {Craighead 127; Fowler, 70; Hart, 26; Moore 1993: 167}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Osmorhiza spp. Sweet-cicely	food (seed, root) medicine (root, leaf, seed)	-	Webb Springs	common in patches	{Harrington, 363; Moore 1993: 236; Vogel, 129,193}
Apocynaceae - Dogbane Family *Apocynum cannabinum* L. Indian hemp, Dogbane	cordage (stem) medicine (root, milky juice, leaf for smoking)	+ (tsitogi[S])? {DG}	Big Lost River diversion dam	one large patch	{Harrington, 16; Hart, 12; Moore 1993: 292; Steward, 313; Vogel, 305}
Asclepiadaceae - Milkweed Family *Asclepias speciosa* Torr. Showy milkweed	food (young seed pod) manufacture (outer stem)	+ (pe ze beh eh[B])	along roadsides	scattered, not common	{Harrington, 113; Hart, 66; Steward, 310; Vogel, 322}
Asteraceae - Sunflower Family *Achillea millefolium* L. Common yarrow	medicine (leaf, flower)	-	disturbed areas, roadsides	common	{Moore 1993: 272; Steward, 310; Vogel, 383}
Agoseris glauca (Pursh) Raf. False dandelion	food (leaf) medicine (milky juice)	-	scattered throughout INEL	common	*A. aurantiaca* and *A. retrorsa* {Fowler, 71}
Ambrosia acanthicarpa Hook. Ragweed	medicine (leaf)	-	Big Lost River, Spreading area	patchy but common	{Moore 1993: 291; Vogel, 190}
Antennaria spp. Pussy-toes	medicine (stem, leaf)	-	throughout INEL	abundant	{Craighead, 189; Moore 1993: 197}
[I]*Arctium minus* (Hill) Bernh. Common burdock	medicine (leaf, flower) food (young leaf, stem, root)	?	disturbed areas, Big Southern Butte	not common	Was probably intentionally introduced with Euroamerican immigration into the area (by ca. 1900). Modern usage common. {Craighead, 190; Harrington, 156; Mack, 203; Moore 1993: 43; Vogel, 272}
Arnica cordifolia Hook. Heart-leaved arnica	medicine (leaf, root, flower)	-	buttes and surrounding foothills	common where found	{Craighead, 191; Moore 1993: 46; Vogel, 261}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Artemisia spp. Sagebrush, Sage	medicine (leaf) cordage (bark) clothing (bark, leaf) shelter (plant) fuel (trunk) dye (leaf) food (seed)	+ (bohoo'bi[S]) {DG} (sawah'be[B])	throughout INEL	common, abundant	Native names seem to refer to *A. tridentata* only, which was and is extensively used in medicine and manufacture (not for food, according to Steward). {Craighead, 193; Fowler, 71; Hart, 44; Moore 1993: 162; Steward, 21-2, 310, 312; Vogel, 383}
Aster spp. Aster	medicine (root) food(?) (seed)	-	Big Lost River and edges of INEL	common, scattered	{Steward, 22, 310}
Balsamorhiza spp. Balsamroot	food (seed, stem, root) medicine (leaf, root)	+ (ak'eh[S&B])	around buttes	common where found	Native term was also used for sunflowers (or sunflower seeds) in general. Medicinal applications complementary to those of *Lomatium*. {Craighead, 196; Hart, 20; Moore 1993: 55; Steward, 22}
Bidens cernua L. Nodding beggar-ticks	medicine (leaf, flower)	-	spreading area, Big Lost River	not common	{Craighead, 196; Moore 1993: 68}
Chaenactis douglasii (Hook) H & A Hoary false-yarrow	medicine (leaf, root)	?	throughout INEL	common, abundant	Documented use among Great Basin groups. {Chamberlin, 365; Steward, 310}
Chrysothamnus spp. Rabbit-brush	medicine plant, root) gum (bark of lower stem, root)	+ (pasawi tumb['S]) (donoobi[S]) {DG}	throughout INEL	common, abundant	Term collected by Steward from Nevada Shoshones, apparently refers to species in general. He also collected several other terms from other groups, referring to particular species not found here. {Steward, 23, 311}
Cirsium spp. Thistle	food (stem, root)	+ (tsin', tsinambo go[S])	scattered throughout INEL	relatively common, scattered	Term collected by Steward from Lemhi Shoshone for some thistles whose roots they baked overnight for drying or storing. {Craighead, 201; Fowler, 71; Harrington, 166; Hart, 13; Steward, 22}
Crepis spp. Hawksbeard	food (leaf)	-	throughout INEL	common, abundant	{Fowler, 71; Steward, 24}

Plant	**Uses (Parts)**	**S/B Use**	**Distribution**	**Status**	**Comments {References}**
Erigeron spp. Fleabane, Daisy	medicine (root, leaf, flower) arrow tip poison (root)	-	throughout INEL	common to abundant	{Chamberlin, 368; Steward, 311; Vogel, 291}
[I]*Grindelia squarrosa* (Pursh) Dunal Gumweed	medicine (flower, leaf)	+ (oakap:[S])	disturbed areas, roadsides	common	Native of the Great Plains, introduced to this region perhaps via trade among Plains, Plateau and Basin tribes. {Hart, 32; Moore 1993: 298; Steward, 311 Vogel, 299}
Gutierrezia sarothrae (Pursh) Britt. and Rusby Matchbrush	medicine (flowering stem)	-	rocky outcrops	common	{Moore 1993: 299}
Haplopappus spp. Goldenweed, Strawflower	food (seed)	-	buttes and surrounding foothills	patchy, common	Fowler documents use of a related species (*H. macronema*) among southern Great Basin groups.{Fowler, 71}
Helenium autumnale L. Sneezeweed	medicine (flower)	-	Big Lost River area	scattered patches	{Moore 1993: 281; Vogel, 223}
[I]*Helianthus* spp. Sunflower	medicine (root) food (seed)	+ (ak'[S&B])	roadsides	common	Lemhi and Snake R. Shoshone distinguished among at least five different species (or types) of sunflower, all of which were referred to by adding a descriptive to "ak'" (i.e. buhak', biak, pa'ak, kusiak). The term ak' was also used to refer to *Balsamorhiza* spp. {Craighead, 216; Fowler,: 71; Harrington, 312; Hart, 30; Steward, 25, 311}
Iva spp. Poverty-weed, Tall marsh elder	food (seed)	-	disturbed areas throughout INEL	common	Seeds of various marsh elder species have been found extensively in archaeological sites from the east and midwest. However, they seem to have been replaced by sunflower, whose seeds are easier to process and procure oil from. {Kindscher, 138}
[I+N]*Lactuca* spp. Prickly lettuce, Blue lettuce	food (leaf) medicine (root, juice, leaf)	-	throughout INEL	common, abundant	{Craighead, 221; Fowler, 71; Harrington, 134; Moore 1993: 300; Vogel, 378}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Lygodesmia spp. Skeleton weed	food (leaf, seed) gum (milky juice)	-	scattered throughout INEL	patchy, common when found	{Craighead, 221; Fowler, 71; Hart, 27}
Microseris spp. False agoseris	food (seed)	-	buttes, surrounding foothills	not common	{Fowler, 71}
Senecio spp. Groundsel, Butterweed	medicine (root) gum (root)	-	throughout INEL	common	{Bauer, 30; Craighead, 223; Moore 1993: 357; Vogel, 361}
Solidago missouriensis Nutt. Goldenrod	medicine (root, plant flower)	-	Big Lost River	scattered, not common	{Craighead, 225; Vogel, 298}
Sonchus asper (L.) Hill Sow thistle	food (leaf, shoot)	-	Webb Springs	not common	{Craighead, 226; Harrington, 149}
[I]*Tanacetum vulgare* L. Common tansy	medicine (flower)	-	Big Lost River	patchy, not common	{Vogel, 367}
[I]*Taraxacum* spp. Dandelion	food (flower, leaf, stem, root) medicine (root)	+	throughout INEL	common	{Craighead, 227; Harrington, 99; Moore 1993: 306; Vogel, 284}
[I]*Tragopogon dubius* Scop. Yellow salsify	medicine (root) food (leaf, root) gum (milky juice)	-	throughout INEL	common	{Craighead, 230; Harrington, 218; Moore 1993: 306}
Xanthium strumarium L. Common cocklebur	food (seed) medicine (entire plant in flower)	-	Big Lost River, sinks, spreading area, Webb Springs	common where found	{Craighead, 235; Moore 1993: 308}
Betulaceae - **Birch Family** *Betula occidentalis* Hook. Western water birch	medicine (leaf, bark) food (sap) whips	+ (daneeteg wai['S]) {DG}	Birch Creek	common along creek	{Moore 1993: 293; Vogel 266}
Boraginaceae - **Borage Family** *Amsinckia* spp. Fiddleneck	food (leaf)	-	hills and buttes	scattered, common where found	{Fowler, 72; Steward, 21}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Lappula spp. Beggar's ticks, Stickseed	food (seed, root)	+ (sohna[S])	disturbed areas throughout INEL	common, abundant	Lemhi Shoshone ate seeds and probably root, according to Steward. {Fowler, 72; Steward, 25}
Lithospermum ruderale Dougl. Gromwell	food (seed) medicine (root)	?	buttes	common where found	Root was used among Nevada Shoshone for contraceptive purposes. Seeds were eaten by Gosiutes. {Craighead, 157; Steward 1938: 26; Vogel, 230}
Brassicaceae - Mustard Family *Arabis* spp. Rockcress	food (seed)	-	throughout INEL	common, abundant	{Fowler, 72}
Brassica spp. Mustard	food (leaf, seed, seed pod) medicine (leaf, seed)	-	Birch Creek, west edge of INEL	not common	{Harrington, 62; Vogel, 328}
Capsella bursa-pastoris (L) Medic Shepherd's purse	medicine (whole herb)	-	Webb Springs, CFA	not common	{Moore 1993: 293}
Descurainia spp. Tansymustard	food (seed) medicine (seed)	+ (aza'boe[B&S?]) (boi'[S])	Disturbed areas	Common	Terms collected among Lemhi Shoshone by Steward. [Also called "pinole" by "the Indians" (Harrington); possibly a generic and widely used term for pudding?] {Fowler, 72; Harrington, 307; Steward, 30}
Draba oligosperma Hook. Whitlow grass	food (seed)	-	foothills west of INEL	not common	Seeds of *D. nemorosa* used by Northern Ute. {Fowler, 72}
Lepidium spp. Peppergrass	food (seed, green pods) medicine (herb)	-	throughout INEL	not common to common, depends on species	{Fowler, 72; Vogel, 207}
Rorippa spp. Yellowcress	food (seed, leaf)	-	Big Lost River, sinks	not common	{Fowler, 72; Harrington, 68, 140}
Sisymbrium spp. Tumblemustard	food (seed, leaf)	-	disturbed areas throughout INEL	common	{Fowler, 72; Harrington, 95; Vogel, 328}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Stanleya viridiflora Nutt. Prince's plume	food (seed, leaf, stem)	-	throughout INEL	common, not abundant	{Fowler, 72}
Thlaspi arvense L. Fanweed	food (young shoot, leaf, seed?)	-	throughout INEL	common, scattered	{Harrington, 103}
Cactaceae - Cactus Family *Opuntia polyacantha* Haw. Prickly pear	food (stem, fruit)	+ (agovi, wogavi [S])	throughout INEL	common, abundant	{Craighead, 69; Fowler, 72; Harrington, 246; Hart, 39; Steward, 26}
Capparidaceae - Caper Family *Cleome lutea* Hook. Yellow bee plant	food (seed, leaf, stem)	-	Big Lost River, NW Foothills	common where found	{Craighead, 69; Fowler, 72; Harrington, 72}
Caprifoliaceae - Honeysuckle Family *Sambucus cerulea* Raf. Elderberry	food (fruit) manufacture (stem, twig)	+ (kunu-gip[S])	Big Southern Butte	common on butte	Used for making flutes (Steward) {Craighead, 181; Fowler, 72; Harrington, 279; Moore 1993: 305; Steward, 29; Vogel, 287}
Symphoricarpos oreophilus Gray. Snowberry	medicine (fruit, plant) manufacture (bark)	? (ija hua, tatsip [S])	buttes and foothills west of INEL	common where found	Berries, bark (for string), and whole plant used among Nevada Shoshone (Steward). {Hart, 59; Steward, 311}
Chenopodiaceae - Goosefoot Family *Atriplex* spp. Saltbush, Shadscale, Spiny hopsage, Red orache	food (seed)	? (sunu[S])	throughout INEL	Red Orache not common, other species common and abundant	Seeds of several different species used among Nevada, Utah, and Wyoming groups. Seeds of *A. argentea* may have been sown broadcast in north central Nevada. Not documented among Snake River Shoshone or Bannock. {Fowler, 72; Harrington, 60; Steward, 22, 313}
[I]*Chenopodium* spp. Goosefoot, Lamb's quarter	food (seed, young plant)	+ (uap'[S])	throughout INEL	common, abundant	Seeds of various species were sown broadcast among north central Nevadan groups. {Harrington, 69, 234; Fowler, 73; Steward, 23}
Monolepis spp. Povertyweed	food (seed, root, stem, leaf)	-	throughout INEL	not common	Gruel from seeds called "pinole" (Harrington)--generic term for pudding? {Harrington, 80}
[I]*Salsola kali* L. Russian thistle	food (young plant)	+ (witah' nomani[B])	disturbed areas throughout INEL	common, abundant	Term means "when the wind blows it rolls" (RW, Bannock informant) {Harrington, 93; Yensen 178}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Sarcobatus vermiculatus (Hook)Torr Black greasewood	food (seed)	-	throughout INEL	common in saline areas	Documented use among Utah Southern Paiute. {Fowler, 73}
Convolvulaceae - Morning Glory Family [I]*Convolvulus arvensis* L. Field morning glory	medicine (root) starvation food (root)	-	roadsides	not common	{Bauer, 34; Craighead, 147; Vogel, 344}
Cornaceae - Dogwood Family *Cornus stolonifera* Michx. Red-osier dogwood	food (fruit) medicine (bark, leaf, root, stem) smoking (leaves, cambium) manufacture (twigs)	+ (ah za qwe she dah nupe[B])	Webb Springs, Birch Creek	common where found	{Harrington, 354; Hart, 21; Steward, 313; Vogel, 285}
Cuppressaceae - Cypress Family *Juniperus* spp. Juniper	medicine (needles) food (cones) manufacture (branches)	+ (wa'pe[S&B]) (nag-wihi[S]) {DG}	throughout INEL	common to abundant	{Fowler, 73; Harrington, 242; Hart, 36; Moore 1993: 300; Steward, 312; Vogel, 315}
Cuscutaceae - Dodder Family *Cuscuta* spp. Dodder	medicine (plant)	-	west edge of INEL	not common	{Moore 1993; 70}
Cyperaceae - Sedge Family *Carex* spp. Sedge	food (shoot, bulb, seed) manufacture (leaf, plant)	+?	Douglas' sedge throughout sagebrush areas, others only on west foothills and at Webb Springs	Douglas' sedge common, others not common	{Craighead, 8; Fowler, 73}
Eleocharis spp. Spike-rush	food (seed, bulb)	?	Webb Springs, sinks	common in small areas where found	Steward says the "Shoshone plant 'mahavit' may be the same" as the *Eleocharis* used among Owens Valley Paiute. {Fowler, 73; Steward, 24}
Scirpus spp. Bulrush	food (seed, pollen, root, stem) manufacture (stem)	?	outflow areas from facilities	not common	{Craighead, 10; Fowler, 73; Harrington, 210; Steward, 29}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Fabaceae - Pea Family *Dalea* spp. Dalea	food (seed)	-	near Big Lost River	not common	One species (not ours) with documented food use among Owens Valley Paiute. {Fowler, 73}
Glycyrrhiza lepidota Pursh. Licorice-root	medicine (root) flavoring (root)	-	Big Lost River, Birch Creek, sinks, spreading area	common	{Craighead, 98; Hart, 35; Moore 1993: 298; Vogel, 308}
Hedysarum boreale Nutt. Northern sweetvetch	flavoring (root)	-? sogobihuda' {DG}	north end of INEL	scattered, common	Root may be used like *Glycyrrhiza*. {Craighead, 98}
[I]*Medicago* spp. Black medic, Alfalfa	medicine (flower)	-	Webb Springs, Birch Creek, along roads	not common	{Moore 1993: 302}
[I]*Melilotus* spp. Sweet clovers	medicine/ tonic (flower, leaf)	-	roadsides	common	{Craighead, 100; Moore 1979: 152}
Thermopsis rhombifolia (Nutt.) Richardson False-lupine	medicine (flower)	-	Birch Creek	not common	Dried flowers were smoked among Plains tribes as a treatment for rheumatism. {Vogel, 197}
[I]*Trifolium* spp. Red clover, Dutch clover	food (seed, leaf, whole plant)	-	Birch Creek, CFA	not common	Used among Owens Valley Paiute. (Attractive forage plant for grouse, Canada geese, deer, elk, bear). {Craighead, 100; Fowler, 74; Moore 1993: 307}
Vicia americana Muhl. American vetch	food (seed, young stem)	-	throughout INEL	common	{Craighead, 104}
Fumariaceae - Fumitory Family *Corydalis aurea* Willd. Ground smoke	medicine (entire plant)	-	Big Southern Butte	not common	{Moore 1979: 65}
Grossulariaceae - Currant/ Gooseberry Family *Ribes* spp. Currant, Gooseberry	food (fruit) medicine? (leaf)	+ (mo goo z'a boe[B&S?]) (ohabogom bi[S]) {DG}	scattered throughout INEL	common	{Craighead, 78; Fowler, 78; Harrington, 262; Steward, 29, 312; Vogel, 198}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Hydrophyllaceae - Waterleaf Family *Phacelia* spp. Phacelia	food (leaf)	-	scattered throughout INEL, (*P. inconspicua* on Big Southern Butte)	most not common, (rare *P. inconspi-cua* on Federal Candi-date List)	Grazed by elk, deer, mountain goat, grizzly. {Craighead, 152; Fowler , 74}
Juncaceae - Rush Family *Juncus* spp. Rush	food (seed) manufacture (stalks)	?	Big Lost River, Webb Springs, Birch Creek	not common	Good forage.{Craighead, 13; Fowler, 74}
Lamiaceae - Mint Family *Agastache* spp. Horsemint, Giant hyssop	food (seed)	-	Big Southern Butte	not common	*A. urticifolia* is considered the west's most important forage plant (for animals) in the mint family. {Craighead, 159; Fowler, 74}
Mentha arvensis L.	medicine (leaf) flavoring (leaf)	+ (bagwana [S&B?])	Big Lost River	not common	{Craighead, 13; Hart, 64; Moore 1979: 130; Steward, 26; Vogel, 323, 326}
Liliaceae - Lily Family *Allium* spp. Wild onion	food (leaf, bulb) medicine flavoring (boiled juice of bulb) dye (bulb skin)	+ (kunk[s]) (ge'nga[S]) {DG}	throughout INEL	common	{Craighead, 15; Fowler, 75; Harrington, 345; Vogel, 292}
Calochortus spp.	food (bulb, seed, plant)	+ (sigo[s]) (sigobi[S]) {DG}	thoughout INEL	common	{Craighead, 18; Fowler, 75; Harrington, 159; Steward, 22}
Fritillaria spp. Leopard lily, Yellow fritillary	food (corm)	? (winigo[s])	buttes	common where found	Steward recorded this term because of its similarity to the Gosiute term (winago) for *F. pudica*. {Craighead, 24; Fowler, 75; Hart, 25; Steward, 25}
Smilacina stellata (L.) Desf. False solomon's seal	food (young leaf and stem) medicine (root)	?	Birch Creek, Webb Springs	not common	{Craighead, 27; Harrington, 125; Moore 1993: 131}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Loasaceae - Blazing Star Family *Mentzelia* spp. Blazing star	food (seed)	?	throughout INEL, disturbed areas	common to abundant	Seeds of related species sometimes broadcast by central Nevada Shoshone (Steward). {Craighead, 117; Fowler, 75; Steward, 26}
Malvaceae - Mallow Family *Sphaeralcea munroana* (Dougl.) Spach. White-stemmed globe-mallow	food (seed, fruit, shoot) medicine (leaf) manufacture (plant)	? (kasone veh[B])	throughout INEL	common, abundant	Related species used among southern Great Basin groups (boiled and mixed with potter's clay) (Steward). {Craighead, 115; Fowler, 75; Moore 1993: 306; Steward, 312}
Nyctaginaceae- Four-o'clock Family *Abronia mellifera* Dougl. Sandverbena	medicine (root?)	-	north end of INEL	not common	Related species used among Ute for stomach and bowel troubles. {Vogel, 191}
Onagraceae - Evening-primrose Family *Epilobium* spp. Fireweed, Willow-herb	food (leaf, young shoot)	+ (temahnike new[B]) (koso-beh[S])	throughout INEL	scattered but common	{Craighead, 120; Harrington, 74}
Oenothera spp. Evening-primrose	food (seed, leaf, young shoot, root) medicine (leaf, root)	?	throughout INEL	common	{Craighead, 121; Fowler, 75; Harrington, 82; Moore 1993: 302; Steward, 26}
Orchidaceae - Orchid Family *Corallorhiza maculata* Raf. Spotted coral-root	medicine (root)	-	Webb Springs	not common	{Craighead, 37; Moore 1993: 295}
Orobanchaceae - Broomrape Family *Orobanche* spp.	medicine (plant) food (plant)	?	throughout INEL	common	Widely used among southern Great Basin groups (Fowler). {Fowler, 76; Moore 1979: 42}
Pinaceae - Pine Family *Pinus* spp. Lodgepole pine, Limber pine	food (seed, sap) manufacture (lodgepoles) medicine (needles)	+ (wongoo' bi[S] = pine tree) (wanda[S] = lodgepole pine) (du'ba[S] = pinenut) (wongoo' bi zizigah nah[S&B?]) {RW}	Big Southern Butte	common on butte	{Fowler, 76; Harrington, 323; Hart, 52; Moore 1993: 303; Vogel, 333}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Pseudotsuga menziesii (Mirbel.) Franco Douglas fir	medicine (needles)	+ (peshaw kokope[B]) (zah kokope[S]) {RW}	Big Southern Butte	common on butte	
Plantaginaceae - Plantain Family *Plantago* spp. Plantain, Indian wheat	medicine (plant) food (leaf, seed)	+ (babashea cah[B] = big leaves) {RW}	throughout INEL	not common	{Harrington, 86; Moore 1993: 303; Vogel, 95, 100, 165}
Poaceae - Grass Family *Agrostis stolonifera* L. Bentgrass	food (seed)	-	Big Lost River, Webb Springs	not common	{Fowler, 76}
Alopecurus aequalis Sobol. Shortawn foxtail	food (seed)	-	Webb Springs	not common	{Fowler, 76}
Bromus spp. Bromegrass	food (seed)	-	throughout INEL	common	Native species used. {Fowler, 76}
[I]*Echinochloa crusgalli* (L.) Beauv. Barnyard grass	food (seed)	-	around CFA and facilities	common where found	{Fowler, 76}
Elymus spp. Wheatgrass	food (seed) medicine (root)	-	throughout INEL	common, abundant	{Fowler, 76; Harrington, 299}
Glyceria grandis Wats. American mannagrass	food (seed)	?	only *G. grandis* on INEL, Big Lost River	not common	*G. borealis, G. aeroides,* and *G. nervata* mentioned in Fowler and Steward. European mannagrass species were particularly popular in Germany and Poland where their seeds (larger than American species) were added to soups or made into gruel (Dayton).{Fowler,76; Dayton, 112; Steward, 25}
Hordeum jubatum L. Foxtail barley	food (seed)	?	disturbed areas, roadsides	common	*H. californicum, H. depressum* and *H. jubatum* used among Great Basin groups. {Fowler, 76}
Leymus spp. Wildrye	food (seed) manufacture (plant)	+ (wadunzip[S]) (wahavi[S] = the seeds)	throughout INEL	common, abundant	*L. cinereus* especially. {Fowler, 76; Steward, 24, 312}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Melica bulbosa Geyer Oniongrass	food (seed)	?	Big Southern Butte	not common	*M. imperfecta* used in the southern Great Basin (Kawaiisu). {Bauer, 48; Fowler, 76}
Oryzopsis hymenoides (R. & S.) Ricker Indian ricegrass	food (seed)	+ (wai[S])	throughout INEL	common, abundant	According to Steward 1938: this term was widely used by Shoshone and N. Paiute of the Great Basin; however, the plant was scarce along the Snake River and unknown to the Lemhi Shoshone. It was, however, collected by N. Shoshone (Fowler). {Harrington, 320; Fowler, 76; Dayton, 148; Steward, 26}
Panicum capillare L. Panicgrass	food (seed)	-	roadsides, CFA	not common	Southern species important food among desert Southwest and southern Great Basin peoples. {Fowler, 76}
Poa spp. Bluegrass	food (seed) medicine (spikelet)	+ (sonip[S])	throughout INEL	common, abundant	{Fowler, 76; Steward, 28}
Sitanion hystrix (Nutt.) J.G. Smith Squirreltail	food (seed)	? (waciup[S])	throughout INEL	common, abundant	Used widely among Nevada Shoshone and N. Paiute, but unknown to Lemhi Shoshone (Steward). {Fowler 1986: 76; Steward 30}
Sporobolus cryptandrus (Torr.) Gray Dropseed	food (seed)	-	scattered over INEL	not common	Several species used among southern Great Basin groups, and widely used by desert Southwest groups. {Fowler, 76}
Stipa spp. Needle-and-thread grass	food (seed)	- (huki[S?])	throughout INEL	common, abundant	Documented uses only in southern Nevada and California. {Fowler, 77; Steward, 30}
[I]*Triticum aestivum* L. Wheat	food (seed)	-	roadsides near agricultural areas	not common	Introduced species here, but used in southern Utah and Nevada. {Fowler, 77}
Polemoniaceae - Phlox Family *Gilia leptomeria* Gray Great Basin gilia	food (seed) medicine (flower, plant)	? (ovu'ha)	throughout INEL	common	Native term collected by Steward among N. Paiute. One of the few members of its genus whose seeds do not become muscilagenous when wet. Other species had medicinal uses, according to Chamberlin. {Chamberlin, 370; Fowler,77; Steward, 25}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Polygonaceae - Buckwheat Family *Eriogonum* spp. Buckwheat	medicine (flower)	? (tawisiwup)	throughout INEL	common	Native term collected by Steward among eastern Nevada/western Utah Shoshone. {Craighead, 40; Fowler, 77; Moore 1993: 93; Steward, 311}
Polygonum spp. Knotweed, Doorweed	food (seed, leaf, stem, root} medicine (root}	-	throughout INEL	common	{Craighead, 42; Fowler, 77; Harrington, 195; Moore 1993: 37; Steward, 28}
Rumex spp. Dock	food (seed, stem, leaf) medicine (leaf, root)	+? (anga [=red] bauwiya[s])	throughout INEL in wet disturbed areas	common	*R. mexicanus* (and other spp.) called this by various Great Basin groups including Snake River (western) Shoshone (Steward). {Craighead, 44; Fowler, 77; Harrington, 90; Moore 1993: 305; Steward, 29, 311; Vogel, 384}
Ranunculaceae - Buttercup Family *Aquilegia formosa* Fisch. Red columbine	food (young plants)	-	Webb Springs	not common	*A. formosa* used among Washoe {Fowler, 78}
Clematis ligusticifolia Nutt. Virgin's bower	medicine (leaf) clothing (seed tails)	-	Big Southern Butte	not common	Leaves chewed by "American Indians" and settlers, to remedy sore throats and colds. Feathery seed tails useful for insulation and are easily ignited. {Craighead, 57; Moore 1993: 58}
Delphinium spp. Larkspur	medicine (seed, flower) dye (flower)	+ (dubu'hi dontsiape[S]) {DG}	throughout INEL	common	{Harrington, 31; Moore 1993: 95}
Ranunculus spp. Buttercup	medicine (plant, root) food (herb)	-	throughout INEL	common	Important forage food for Blue Grouse, ducks and Canada geese. {Craighead, 61; Harrington, 39; Vogel, 283}
Rhamnaceae - Buckthorn Family *Ceanothus velutinus* L. Snowbrush	smoking (leaf) soap (flower) medicine (root)	-	buttes	not common	{Bauer, 79;Craighead, 112; Harrington, 112; Moore 1993: 212; Vogel, 159}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Rosaceae - **Rose Family** *Amelanchier* spp. Serviceberry	food (fruit) manufacture (stem) medicine (stem)	+ (tuemb$^{'s}$) (deambi^{S}) {DG}	buttes	common where found	Native term collected by Steward from Snake River and Lemhi Shoshone.{Bauer, 81; Craighead, 79; Fowler, 78; Harrington, 229; Hart, 9; Steward, 21}
Cercocarpus ledifolius Nutt. Mountain mahogany	manufacture (wood)	? (tunambi^{s})	west foothills	not common	Native term collected by Steward from Nevada Shoshone. {Moore 1979: 111; Steward, 312}
Geum macrophyllum Willd. Large-leaved avens	medicine (root)	-	Big Southern Butte	not common	{Craighead, 83; Moore 1993: 298; Vogel, 374}
Holodiscus dumosus (Hook.) Heller Ocean spray	food (root for tea)	? (bauwun gop$^{'s}$) Collected by Steward from Shoshone of Elko, Nevada area.	Big Southern Butte	not common	{Craighead, 84; Steward, 25, 306}
Potentilla spp. Common silverweed, Cinquefoil	food (root) medicine (leaf)	-	Big Lost River, Webb Springs	not common	{Craighead, 85; Harrington, 201; Moore 1993: 303}
Prunus virginiana L. Common chokecherry	food (fruit; leaf, bark) medicine (bark, seed, cambium, twig) manufacture (twig, branch) dye base (sap) fuel (wood)	+ (doo'nam bi^{s}) {DG}	buttes	common where found	Native term first collected by Steward from Lemhi Shoshone. {Craighead, 89; Fowler, 78; Harrington, 256; Hart, 42; Moore 1993: 303; Steward, 28; Vogel, 375}
Rosa woodsii Lindl. Wood's rose	food (fruit, root, flower, bud, seed) smoking (cambium) medicine (fruit, stem, root bark)	+ (tsiemb) (tsiabe^{S}) {DG}	Big Lost River, Big Southern Butte	common, abundant	First native term collected by Steward from Lemhi Shoshone; refers to this and other species of wild rose. {Craighead, 92; Fowler, 78; Harrington, 269; Hart, 62; Moore 1993: 305; Steward, 29}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Rubus ideaus L. Red raspberry	food (fruit, young shoot, leaf, twig) medicine (fruits, leaf, root, root bark) flavoring (fruit)	+	Big Southern Butte	not common	Chamberlin documented use of *R. leucodermis* among Gosiute, and Steward added that they were "no doubt" used elsewhere (Steward). {Craighead, 93; Fowler, 78; Harrington, 276; Moore 1993: 305; Steward, 29; Vogel, 343}
Rubiaceae - Madder Family *Galium* spp. Bedstraw	medicine (plant) dye (root)	-	Big Southern Butte, foothills	not common	Forage value for ducks, geese, and white-tailed deer (Craighead). {Craighead, 178; Moore 1993: 297; Vogel, 202}
Salicaceae - Willow Family *Populus angustifolia* James Narrow-leaved cottonwood	food (cambium) fuel (upper limbs) manufacture (trunk) dyes (bud, fruits) medicine (bark)	+ (sungavi^{s}) (seho'bi^{S}) {DG}	Big Lost River, Birch Creek	common where found	First native term collected by Steward from central Nevada Shoshone; according to Chamberlin, the Gosiute procured sugar from this species (Steward). {Hart, 68; Steward, 28}
Populus tremuloides Michx. Quaking aspen	medicine (cambium, leaf, bud) manufacture (branch)	+ (senaa'bi^{S}) {DG}	Big Southern Butte	common	{Hart, 67; Moore 1993: 305; Vogel,112}
Salix spp. Willow	medicine (bark, leaf, bud tips)	+ (suhuvi^{s}) (agai [=salmon] suhu^{s})	throughout INEL in moist areas	common	First native term collected by Steward as a general term for *Salix.* Second term collected by Steward from Lemhi Shoshone who burned a species of Salix and applied it to sore eyes {Clark, 51; Hart, 67; Moore 1993: 305; Steward, 311, 312; Vogel, 379}
Saxifragaceae - Saxifrage Family *Heuchera parvifolia* Nutt. Common alumroot	medicine (root)	-	buttes and foothills	not common	Documented usage among the Flathead and Kutenai. {Hart, 31; Moore 1993: 22; Vogel, 256}
Scrophulariaceae - Figwort Family *Castilleja* spp. Paintbrush	medicine (plant) dye (flower)	- (ana [=red] kwiwi'tum and ana bimotoy mup)	throughout INEL	common	Specifically not used but named among southern Nevada and California groups, according to Steward. {Craighead, 166; Steward, 313; Vogel, 231}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
[I]*Linaria* spp. Toadflax, Butter-and-eggs	medicine (plant)	-	Birch Creek	not common	{Moore 1979: 153}
Mimulus spp. Monkey flower	food (leaf, stalk)	-	throughout INEL	not common	Larger species (i.e. *M. guttatus*) eaten by Eastern Shoshone and settlers as greens. {Craighead, 170; Fowler, 78}
Penstemon spp. Penstemon	medicine (leaf)	-	throughout INEL	common	Steward documents use among Shoshone of southern Nevada of *P. palmeri*. {Craighead, 176; Moore 1993: 123; Steward, 311}
[I]*Verbascum thapsus* L. Hairy mullein	medicine (flower, leaf, root) smoking (dried leaf)	-	roadsides	not common	Introduced on the heels of Euroamerican settlers (mid-1800's). Winter survival forage (elk, birds). {Craighead, 177; Moore 1979: 112; Vogel, 327}
Veronica spp. Speedwell	food (herb)	-	Big Lost River	not common	{Harrington, 151}
Solanaceae - Nightshade Family [I]*Hysoscyamus niger* L. Black henbane	medicine (herb)	-	Birch Creek	not common	Introduced intentionally as a medicinal/ornamental plant from Europe. {Craighead, 163; Moore 1993: 299}
Nicotiana attenuata Torr. Coyote tobacco	smoking (leaf) medicine (topical tea)	+ (buhibahu[s]) {DG}(See Steward 1933)	Big Lost River, Webb Springs	not common	{Harrington, 360; Moore 1979: 153; Steward, 313; Vogel, 367}
Solanum spp. Bittersweet	medicine (leaf)	-	Birch Creek, spreading area, foothills	not common	Winter forage for ring-necked pheasants (Craighead). One species (*S. dulcamera*) introduced intentionally by Euroamerican settlers as a medicinal/ornamental. {Craighead, 165; Moore 1993: 72; Vogel, 328}
Typhaceae - Cattail Family *Typha latifolia* L. Common cattail	food (seed, root, young stem) manufacture (leaf) medicine (seed down)	+ (to'i[s])	sinks, outflow from facilities	not common	Native term collected by Steward from Lemhi Shoshone. Seed down mixed with coyote fat and applied as salve to smallpox pustules by Sioux. {Craighead, 1; Fowler, 79; Harrington, 220; Hart, 60; Steward, 30}

Plant	Uses (Parts)	S/B Use	Distribution	Status	Comments {References}
Verbenaceae - Verbena Family *Verbena bracteata* Lag. and Rodr. Bracted verbena	food (seeds) medicine (entire plant)	-	Big Lost River, Birch Creek, spreading area	not common	Seeds collected by Utah S. Paiute (Fowler). {Fowler, 79; Moore 1993: 307; Vogel, 373}
Violaceae - Violet Family *Viola* spp. Violet	food (whole herb, flower) tonic (plant)	-	throughout INEL	scattered, common	{Craighead, 116; Harrington, 152; Moore 1993: 308; Vogel, 373}

THE FLORA OF THE IDAHO NATIONAL ENGINEERING LABORATORY

The area covered by this flora includes all of the INEL, immediately adjacent foothills of the Lost River and Lemhi Ranges, and all of Big Southern Butte. The flora consists of 472 species of vascular plants in 59 families; 409 species occur on the INEL proper. Six subspecies and eight varieties are included herein, bringing the total number of recognized taxa to 486. The largest families are the:

Asteraceae (sunflower family) with 82 species,

Poaceae (grass family) with 49 species,

Brassicaceae (mustard family) with 43 species,

Fabaceae (pea or legume family) with 36 species.

The 472 species can be classified according to life history and growth form as follows:

Life History:

320 (67.8%) are perennials

137 (29.0%) are annuals

10 (2.1%) are biennials

5 (1.1%) are variable.

Growth Form:

354 (75.0%) are forbs

58 (12.3%) are graminoids (grasses/grass-like plants)

44 (9.3%) are shrubs

11 (2.3%) are trees

3 (0.6%) are succulents

1 (0.2%) is a climbing vine.

There are 403 (85.4%) native species, while 69 (14.6%) are introduced. Of the 403 native species,

301 (74.7%) are forbs

44 (10.9%) are shrubs

44 (10.9%) are graminoids

10 (2.5%) are trees

3 (0.7%) are succulents

1 (0.2%) is a climbing vine.

Of the 69 introduced species,

31 (44.9%) are annuals

54 (78.3%) are forbs

14 (20.3%) are grasses.

Previous lists of vascular plants at the INEL were prepared by Atwood (1970) and Jeppson and Holte (1978). Herbarium collections of the INEL flora were established in the Ray J. Davis Herbarium, Idaho Museum of Natural History, and at the INEL in 1976. Additional collections were made by Anita Cholewa and Douglass Henderson in 1982, by James Glennon in 1990 and by Karl Holte and James Glennon in 1993. Holte and Glennon made extensive searches of the INEL and immediate vicinity during the exceptionally wet 1993 growing season. Glennon added eight additional species while collecting data from the long-term vegetation plots in 1995. Specimens were identified using *Flora of Idaho* (Davis, 1952), *Flora of the Pacific Northwest* (Hitchcock & Cronquist, 1973), *Vascular Plants of the Pacific Northwest* (Hitchcock, et. al.,1955), *Intermountain Flora* (Cronquist, et. al., 1972, 1977, 1984, 1989, 1994). Nomenclature follows Beetle and Young (1965) for subspecies of *Artemisia tridentata* and Barkworth et al. (1983) for members of the Triticeae. Common names generally are from Hitchcock and Cronquist (1973). Taxonomy was verified by Karl Holte and nomenclature was updated utilizing *The PLANTS database* (USDA, 1995). Voucher specimens for all of the plants listed are in the INEL or Big Southern Butte collections at the Ray J. Davis Herbarium.

Symbols

Each species name in the plant list is preceded by a three or four letter code that indicates the origin, life history, and growth form of that species. The codes for the three columns are as follows:

Origin	**Life History**	**Growth Form**
N = native	A = annual	F = forb
I = introduced	B = biennial	G = graminoid
	P = perennial	S = shrub
	V = variable	Sc = succulent
		Cv = climbing vine
		T = tree

An asterisk (*) indicates that the species is listed as a “sensitive species” (see RARE VASCULAR PLANTS, page 15 and Table 1, page 16).

Aceraceae - Maple Family

NPT *Acer glabrum* Torr. - Rocky Mountain maple
ravines on buttes
IPT *Acer negundo* L. - Box elder
cultivated areas & along Little Lost River

Alismataceae - Water Plantain Family

NPF *Alisma gramineum* Lej. - Water plantain
Big Lost River Sinks

Amaranthaceae - Amaranth Family

NAF *Amaranthus albus* L. - White pigweed
common, widespread in disturbed areas
NAF *Amaranthus blitoides* S. Wats. - Prostrate pigweed
common, widespread in disturbed areas
NAF *Amaranthus californicus* (Moq.) Wats. - California amaranth
Big Southern Butte, disturbed areas around vernal pools, alkaline flats, Spreading Area
NAF *Amaranthus graecizans* L. - Prostrate pigweed, Tumbleweed amaranth
(see *A. blitoides*)
NAF *Amaranthus retroflexus* L. - Redroot
Central Facilities Area, cultivated areas

Anacardiaceae - Sumac Family

NPS *Rhus trilobata* Nutt. - Squawbush, Skunkbush
Big Lost River, buttes

Apiaceae (Umbelliferae) - Parsley Family

NPF *Cymopterus acaulis* (Pursh) Raf. - Biscuit-root
west foothills, northeast sand dunes
NPF *Cymopterus bipinnatus* Wats. - Hayden's cymopterus
(see *C. nivalis*)
NPF *Cymopterus nivalis* S. Wats. - Hayden's cymopterus
west foothills
NPF *Cymopterus terebinthinus* (Hook.) T. & G.
var. *foeniculaceus* (T. & G.) Cronq. - Turpentine cymopterus
(see *Pteryxia terebinthina* var. *foeniculacea*)
NPF *Lomatium dissectum* (Nutt.) Math. and Const.
var. *multifidum* (Nutt.) Math. & Const.- Fern-leaved desert-parsley
scattered throughout site
NPF *Lomatium foeniculaceum* (Nutt.) Coult. & Rose
var. *macdougalii* (Coult. & Rose) Cronq. - Fennel-leaved desert-parsley
buttes and west foothills
NPF *Lomatium triternatum* (Pursh) Coult. and Rose
ssp. *triternatum*
var. *triternatum* - Nine-leaf lomatium
scattered throughout site

NPF *Osmorhiza berteroi* DC. - Sweet-cicely
Webb Springs
NPF *Osmorhiza chilensis* H. & A. - Sweet-cicely
(see *O. berteroi*)
NPF *Osmorhiza occidentalis* (Nutt.) Torr. - Western sweet-cicely
Webb Springs
NPF *Pteryxia terebinthina* (Hook.) Coult. & Rose
var. *foeniculacea* (Nutt.) Mathias - Turpentine cymopterus
buttes, west foothills, grassy areas scattered throughout site

Apocynaceae - Dogbane Family

NPF *Apocynum cannabinum* L.
var. *glaberrimum* DC. - Common dogbane, Hemp dogbane, Indian hemp
(now no varietal status)
Big Lost River diversion dam
NPF *Apocynum cannabinum* L.
var. *suksdorfii*(Greene) Beg.& Bel. - Common dogbane, Indian hemp, Hemp dogbane
(now no varietal status)
Big Lost River diversion dam

Asclepiadaceae - Milkweed Family

NPF *Asclepias speciosa* Torr. - Showy milkweed, Greekweed
scattered along roadsides

Asteraceae (Compositae) - Composite or Sunflower Family

NPF *Achillea millefolium* L.
ssp. *lanulosa* (Nutt.) Piper
var. *lanulosa* - Common yarrow
(see *A. millefolium* var. *occidentalis*)
NPF *Achillea millefolium* L.
var. *occidentalis* DC. - Common yarrow
widespread on disturbed areas, roadsides
IPF *Acroptilon repens* (L.) DC. - Russian knapweed
northern and western edges of the site
NPF *Agoseris glauca* (Pursh) Raf.
var. *laciniata* (D.C. Eat.) Smiley - Pale agoseris, Short-beaked agoseris
on buttes and central area of site
NAF *Ambrosia acanthicarpa* Hook. - Bur ragweed, Annual bursage
Big Lost River and spreading area
NPF *Antennaria dimorpha* - Dwarf pussy-toes, Low pussy-toes
on buttes and foothills
NPF *Antennaria microphylla* Rydb. - Pussy-toes
widespread
NPF *Antennaria rosea* Greene - Rosy pussy-toes
widespread
IPF *Arctium minus* (Hill) Bernh. - Common burdock
occasional on disturbed areas, Webb Springs on Big Southern Butte
NPF *Arnica cordifolia Hook*.
var. *cordifolia* - Heart-leaved arnica
Big Southern Butte and East Butte

NPS *Artemisia arbuscula* Nutt.
ssp. *arbuscula* - Low sagebrush, Dwarf sagebrush
on buttes, northwest foothills, & east of TAN

NBF *Artemisia biennis* Willd. - Biennial wormwood
Birch Creek and Big Lost River, Webb Springs

NPF *Artemisia dracunculus* L. - Dragon sage
roadside by Big Lost River, Webb Springs

NPS *Artemisia frigida* Willd. - Pasture sagebrush, Fringed sagebrush
Birch Creek & spreading area

NPF *Artemisia ludoviciana* Nutt.
var. *incompta* (Nutt.) Cronq. - Silver sagebrush, Prairie sage
Big Lost River, Big Southern Butte, fairly widespread in scattered areas

NPF *Artemisia ludoviciana* Nutt.
var. *ludoviciana* - Silver sagebrush, Prairie sage
Big Lost River, Big Southern Butte, fairly widespread in scattered areas

NPS *Artemisia nova* A. Nels. - Black sagebrush
buttes and west foothills

NPS *Artemisia spinescens* Eat. - Spiny sagebrush, Bud sagebrush
Big Lost River sinks, Birch Creek & north end of site

NPS *Artemisia tridentata* Nutt.
ssp. *tridentata* - Basin big sagebrush
widespread in deeper well drained sandy soils

NPS *Artemisia tridentata* Nutt.
ssp. *wyomingensis* Beetle & Young - Wyoming big sagebrush
most common sagebrush on site, widespread

NPS *Artemisia tripartita* Rydb. - Threetip sagebrush
buttes, spreading area, higher elevations in foothills

NPF *Aster campestris* Nutt.
var. *campestris* - Western meadow aster
west foothills, Big Lost River

NPF *Aster occidentalis* (Nutt.) T. & G.
var. *occidentalis* - Western mountain aster
west foothills, north edge of site

NPF *Aster scopulorum* Gray - Crag aster, Lava aster
(see *Ionactis alpina*)

NPF *Balsamorhiza hookeri* Nutt.
var. *hispidula* (Sharp) Cronq. - Hooker's balsamroot
high on Big Southern Butte & lower on basalt flows east of butte

NPF *Balsamorhiza sagittata* (Pursh) Nutt. - Arrowleaf balsamroot
on buttes and foothills

NAF *Bidens cernua* L. - Nodding beggar-ticks
spreading area & along Big Lost River

IPF *Carduus nutans* L. - Musk thistle, Milk thistle
low on east side of Big Southern Butte, scattered elsewhere

IBF *Centaurea biebersteinii* DC. - Spotted knapweed
Reno Point, gravel pit west foothills, along Highway 22/33

IBF *Centaurea maculosa* Lam. - Spotted knapweed
(see *C. biebersteinii*)

IPF *Centaurea repens* L. - Russian knapweed
(see *Acroptilon repens*)

NBF *Chaenactis douglasii* (Hook.) H. & A.
var. *achilleaefolia* (H. & A.) A. Nels. - Hoary false-yarrow
(see *C. douglasii* var. *douglasii*)

NBF *Chaenactis douglasii* (Hook.) H. & A.
var. *douglasii* - Hoary false-yarrow
widespread throughout sagebrush areas

NPS *Chrysothamnus nauseosus* (Pall.) Britt.
var. *consimilis* (Greene) Hall - Gray rabbit-brush
widespread, common

NPS *Chrysothamnus viscidiflorus* (Hook.) Nutt.
ssp. *lanceolatus* (Nutt.) Hall & Clements - Green rabbit-brush
common with sagebrush, more common than *C. nauseosus*

NPS *Chrysothamnus viscidiflorus* (Hook.) Nutt.
var. *lanceolatus* (Nutt.) Greene - Green rabbit-brush
(see *C. viscidiflorus* ssp. *lanceolatus*)

NPS *Chrysothamnus viscidiflorus* (Hook.) Nutt.
ssp. *viscidiflorus*
var. *stenophyllus* (Gray) Hall - Green rabbit-brush
common with sagebrush, more common than *C. nauseosus*

IPF *Cirsium arvense* (L.) Scop.
var. *horridum* Wimm. & Grab. - Canada thistle, Creeping thistle
around base of Big Southern Butte in disturbed areas

NPF *Cirsium neomexicanum* Gray
var *utahense* (Petrak) Welsh - Utah thistle
Big Southern Butte and Big Lost River Diversion near roads

NPF *Cirsium scariosum* Nutt. - Elk thistle
moist streambank along Birch Creek

NPF *Cirsium subniveum* Rydb. - Jackson's Hole thistle
north of Big Southern Butte on basalt flows

NPF *Cirsium utahense* Petr. - Utah thistle
(see *C. neomexicanum* var. *utahense*)

IPF *Cirsium vulgare* (Savi) Tenore - Bull thistle, Common thistle
disturbed areas in Central Facilities Area

NAF *Conyza canadensis* (L.) Cronq. - Horseweed, Canada fleabane
Webb Springs, Frenchman's Cabin, Big Lost River

NPF *Crepis acuminata* Nutt. - Long-leaved hawksbeard, Tapertip hawksbeard
sagebrush areas throughout site

NPF *Crepis atribarba* Heller
ssp. *atribarba* - Slender hawksbeard
Webb Springs, & east side Big Southern Butte

NPF *Crepis atribarba* Heller
ssp. *originalis* (Babcock & Stebbins) Babcock & Stebbins - Bearded hawksbeard
Big Southern Butte, west foothills

NPF *Crepis barbigera* Leib. - Bearded hawksbeard
(see *C. atribara* ssp. *originalis*)

NPF *Crepis modocensis* Greene
ssp. *modocensis* - Low hawksbeard
Big Southern Butte, west foothills

NPF *Crepis occidentalis* Nutt.
ssp. *occidentalis* - Western hawksbeard
northern end of site

NPS *Ericameria nana* Nutt. - Dwarf goldenweed
west foothills

NPF *Erigeron compositus* Pursh
var. *glabratus* Macoun - Cut-leaved daisy
west foothills

NPF Erigeron corymbosus Nutt. - Long-leaf fleabane
Big Southern Butte in dry areas among sagebrush
NPF *Erigeron filifolius* Nutt.
var. *filifolius* - Thread-leaf daisy
buttes, west foothills
NPF *Erigeron glabellus* Nutt.
var. *glabellus* - Fleabane daisy
Big Lost River
NPF *Erigeron pumilus* Nutt.
ssp. *intermedius* Cronq.
var *gracilior* Cronq. - Shaggy fleabane
common, widespread in sagebrush areas
NPF *Erigeron tweedyi* Canby - Tweedy's daisy
west foothills
NPF *Eriophyllum lanatum* (Pursh) Forbes
var. *integrifolium* (Hook)Smiley - Common eriophyllum, Wooly sunflower
East Butte
NAF *Gnaphalium palustre* Nutt. - Lowland cudweed, Everlasting
Webb Springs
NPF *Grindelia squarrosa* (Pursh) Dunal
var. *quasiperennis* Lunnell - Curly-cup gumweed, Resin-weed
roadside weed throughout site
NPS *Gutierrezia sarothrae* (Pursh) Britt. & Rusby - Matchbrush, Broom snakeweed
buttes, basalt flows throughout site
NPF *Haplopappus acaulis* (Nutt.) Gray
var. *acaulis* - Stemless goldenweed, strawflower
(see *Stenotus acaulis* var. *acaulis*)
NPF *Haplopappus acaulis* (Nutt.) Gray
var. *glabratus* D. C. Eat. - Stemless goldenweed, Strawflower
(see *Stenotus acaulis* var. *glabratus*)
NPS *Haplopappus nanus* (Nutt.) Eat. - Dwarf goldenweed
(see *Ericameria nana*)
NPF *Helenium autumnale* L.
var. *montanum* (Nutt.) Fern. - Sneezeweed
Big Lost River
NAF *Helianthus annuus* L. - Annual sunflower, Common sunflower
widespread roadside weed
IAF *Helianthus petiolaris* Nutt. - Prairie sunflower
roadside along west side of site
NPF *Hymenopappus filifolius* Hook.
var. *idahoensis* Turner - Columbia cut-leaf, hymenopappus
Reno point & west foothills
NPF *Ionactis alpina* (Nutt.) Greene - Crag aster, Lava aster
sagebrush covered basalt and other rock outcrop areas
NPF *Iva axillaris* Pursh - Poverty-weed
disturbed areas scattered throughout site, Big Lost River & sinks
NAF *Iva xanthifolia* Nutt. - Tall marsh elder
spreading area, along Big Lost River, sinks
NPF *Lactuca pulchella* (Pursh) DC. - Blue lettuce
(see *Lactuca tatarica* var. *pulchella*)
IBF *Lactuca serriola* L. - Prickly lettuce, Prickly wild lettuce
disturbed areas throughout site

NPF *Lactuca tatarica* (L.) C.A. Mey.
var. *pulchella* (Pursh) Breitung - Blue lettuce
roadside near Atomic City

NPF *Lygodesmia grandiflora* (Nutt.) T. and G. - Skeletonweed, Rush pink
west foothills, center of site, Big Southern Butte

NPF *Lygodesmia spinosa* Nutt. - Spiny skeletonweed
(see *Stephanomeria spinosa*)

NVF *Machaeranthera canescens* (Pursh) Gray - Hoary aster
common throughout sagebrush areas

NAF *Malacothrix torreyi* Gray - Torrey malacothrix
common in west foothills

IVF *Matricaria perforata* Merat - Scentless may-weed
Big Lost River, Webb Springs, infrequent along roadsides

NPF *Microseris troximoides* Gray - False agoseris
(see *Nothocalais troximoides*)

NPF *Nothocalais troximoides* (Gray) Greene - False agoseris
Big Southern Butte, west foothills

NPF *Senecio canus* Hook. - Wooly groundsel
buttes, spreading area & widespread with sagebrush

NPF *Senecio crassulus* Gray - Thick-leaved groundsel
widespread with sagebrush

NPF *Senecio integerrimus* Nutt.
var. *exaltatus* (Nutt.) Cronq.- Western groundsel, One-stemmed butterweed
widespread with sagebrush

NPF *Senecio serra* Hook. - Tall butterweed
Big Southern Butte

IAF *Senecio vulgaris* L. - Common groundsel
Central Facilities Area in lawns and flower beds

NPF *Solidago missouriensis* Nutt.
var. *fasciculata* Holz. - Missouri goldenrod
Big Lost River

IAF *Sonchus asper* (L.) Hill - Prickly sow thistle
Webb Springs

NPF *Sphaeromeria argentea* Nutt. - Chicken sage
Reno Point, west foothills

NPF *Stenotus acaulis* (Nutt.) Nutt.
var. *acaulis* - Stemless goldenweed, Strawflower
west foothills, and buttes

NPF *Stenotus acaulis* (Nutt.) Nutt.
var. *glabratus* (D.C. Eat.) Kartesz & Gandhi - Stemless goldenweed, Strawflower
west foothills and buttes

NAF *Stephanomeria exigua* Nutt. - Small wirelettuce
west foothills, and scattered throughout site

NPF *Stephanomeria spinosa* (Nutt.) S. Tomb - Spiny skeletonweed
west foothills, and scattered throughout site

NPF *Stephanomeria tenuifolia* (Torr.) Hall
var. *myrioclada* (Eat.) Cronq. - Narrow-leaved skeletonweed, Bush wirelettuce
west foothills and buttes

NPF *Tanacetum nuttallii* T. & G. - Chicken sage
(see *Sphaeromeria argentea*)

IPF *Tanacetum vulgare* L. - Tansy, Common tansy
Big Lost River and roadside highway 20

IPF *Taraxacum officinale* Weber - Common dandelion
scattered throughout site in weedy areas

NPS *Tetradymia canescens* DC. - Gray horsebrush, Spineless horsebrush
widespread but uncommon

NPS *Tetradymia spinosa* H. & A. - Spiny horsebrush, Catclaw horsebrush
scattered but uncommon

NVF *Townsendia florifer* (Hook.) Gray - Showy townsendia
widespread, common

IBF *Tragopogon dubius* Scop. - Goat's beard, Yellow salsify
widespread, common

NAF *Xanthium strumarium* L.
var. *canadense* (Mill.) T. & G. - Common cocklebur
Big Lost River, Webb Springs, spreading area and sinks

Betulaceae - Birch Family

NPT *Betula occidentalis* Hook. - Western water birch
Birch Creek

Boraginaceae - Borage Family

NAF *Amsinckia menziesii* (Lehm.) Nels. and Macbr. - Small-flowered fiddleneck
north of Big Lost River Sinks

NAF *Amsinckia retrorsa* Suksd. - Rigid fiddleneck, Harvest fiddleneck
south side of Big Southern Butte

IAF *Asperugo procumbens* L. - Catchweed, Madwort
north of Big Lost River sinks

NAF *Coldenia nuttallii* Hook. - Nuttall's coldenia
(see *Tiquilia nuttallii*)

NAF *Cryptantha ambigua* (Gray) Greene - Obscure cryptantha
widespread

NAF *Cryptantha circumscissa* (H. and A.) Johnst. - Matted cryptantha
common and widespread in sandy sagebrush areas

NAF *Cryptantha fendleri* (Gray) Greene - Fendler's cryptantha
widespread

NPF *Cryptantha humilis* (Greene) Pays. - White forget-me-not
widespread

NPF *Cryptantha interrupta* (Greene) Pays. - Bristly cryptantha
common and widespread

NAF *Cryptantha kelseyana* Greene - Kelsey's cryptantha
widespread

NAF *Cryptantha scoparia* Nels - Desert cryptantha
common and widespread

NAF *Cryptantha torreyana* (Gray) Greene - Torrey's cryptantha
scattered and widespread

NAF *Cryptantha watsonii* (Gray) Greene - Watson's cryptantha
Big Southern Butte

NPF *Hackelia jessicae* (McGregor) A. Brand - Blue stickseed, Wild forget-me-not
(see *H. micrantha*)

NPF *Hackelia micrantha* (Eastw.) J. L. Gentry - Blue stickseed, Wild forget-me-not
spreading area and on plains, buttes and with native vegetation in hills

NPF *Hackelia patens* (Nutt.) Johnst.
var. *patens* - Spotted forget-me-not
plains and hills throughout site

IAF *Lappula echinata* Gilib. - Stick-tights, Beggar ticks
(see *L. squarrosa*)
NAF *Lappula occidentalis* (S. Wats.) Greene - Western stickseed, Beggar's ticks
common and widespread in disturbed areas
NAF *Lappula redowskii* (Hornem.) Greene
var. *cupulata* (Gray) Jones - Western stickseed, Beggar's ticks
(see *L. occidentalis*)
NAF *Lappula redowskii* (Hornem.) Greene
var. *redowskii* - Western stickseed, Beggar's ticks
(see *L. occidentalis*)
IAF *Lappula squarrosa* (Retz.) Dumort. - Stick-tights, Beggar ticks
common and widespread in disturbed areas, mainly roadsides
NPF *Lithospermum ruderale* Dougl. - Gromwell, Western gromwell, Columbia puccoon
on buttes with sagebrush
NPF *Mertensia oblongifolia* (Nutt.) G. Don - Leafy bluebells
buttes, canyons, west foothills
NAF *Myosotis laxa* Lehm. - Small-flowered forget-me-not
Big Lost River
NAF *Pectocarya linearis* (R. & P.) DC.
var. *penicillata* (H. & A.) M. E. Jones - Winged combseed
(see *P. Penicillata*)
NAF *Pectocarya penicillata* (H. & A.) DC. - Winged combseed
south of Hwy. 26 near T-16
NAF *Plagiobothrys scouleri* (H. & A.) Johnst.
var. *hispidulus* (Greene) Dorn - Meadow plagiobothrys
Big Lost River
NAF *Plagiobothrys scouleri* (H. & A.) Johnst.
var. *penicillatus* (Greene) Cronq. - Meadow plagiobothrys
(see *P. scouleri* var. *hispidulus*)
NAF *Tiquilia nuttallii* (Hook.) A. Richardson - Rosette tiquilia
widespread in sandy areas

Brassicaceae (Cruciferae) - Mustard Family

IAF *Alyssum desertorum* Stapf. - Desert alyssum
disturbed areas throughout site, common
NPF *Anelsonia eurycarpa* (Gray) Macbr. & Pays. - Daggerpod
Big Southern Butte
NPF *Arabis cobrensis* Jones - Cobre rockcress
Big Southern Butte, west foothills
NPF *Arabis holboellii* Hornem.
var. *collinsii* (Fern.) Rollins - Holboell's rockcress
common with sagebrush
NPF *Arabis holboellii* Hornem.
var. *retrofracta* (Grah.) Rydb. - Holboell's rockcress
common with sagebrush
NPF *Arabis lignifera* A. Nels. - Rockcress, Woody-branched rockcress
common with sagebrush
NPF *Arabis microphylla* Nutt. - Littleleaf rockcress
Big Southern Butte
NPF *Arabis nuttallii* Robin - Rockcress, Nuttall's rockcress
west foothills
NPF *Arabis sparsiflora* Nutt. - Elegant rockcress
Big Southern Butte

IAF *Brassica kaber* (DC.) Wheeler - Charlock, Wild mustard
(see *Sinapis arvensis*)

IAF *Brassica nigra* (L.) Koch - Black mustard
west foothills, Birch Creek

IAF *Camelina microcarpa* Andrz. - Littlepod falseflax, Hairy falseflax
roadside south of rest area hwy 26, sinks, spreading area, west edge of site

IAF *Capsella bursa-pastoris* (L.) Medic - Shepherd's-purse
Webb Springs, Central Facilities Area

IPF *Cardaria pubescens* (Meyer) Jarm. Globepodded hoarycress
roadside weed scattered over site

IAF *Chorispora tenella* (Pall.) D. C. - Purple carpet, Purple mustard, Blue mustard
disturbed areas on roadsides and Central Facilities Area

NAF *Descurainia incana* (Bernh.) Dorn - Mountain tansymustard
ssp. *incisa* (Engelm.) Kartesz & Gandhi
uncommon, scattered

NAF *Descurainia pinnata* (Walt.) Britt.
ssp. *nelsonii* (Rydb.) Peck
var. *nelsonii* (Rydb.) Peck - Western tansymustard
widespread, common

NAF *Descurainia richardsonii* (Sweet) Schulz
var. *sonnei* (Robbins.) Hitchc. - Mountain tansymustard
(see *D. incana* ssp. *incisa*)

IAF *Descurainia sophia* (L.) Webb - Tansymustard, Flixweed
widespread, common in disturbed areas

NPF *Draba oligosperma* Hook.
var. *oligosperma* - Few-seeded draba, Few-seeded whitlow-grass
western foothills

NAF *Draba reptans* (Lam.) Fern.
var. *stellifera* (Schulz) Hitchc. - Carolina whitlow-grass
(now no varietal status)
northwest foothills, uncommon

NPF *Erysimum asperum* (Nutt.) DC. - Rough wallflower
(see *E. capitatum* var. *argillosum*)

NPF *Erysimum capitatum* (Dougl.) Greene
var. *argillosum* (Greene) R.J. Davis - Rough wallflower
widespread, uncommon

NPF *Erysimum inconspicuum* (Wats.) MacM. - Smallflowered rocket, Small wallflower
west side along roadsides

NVF***** *Halimolobos perplexa* (Hend.) Rollins
var. *perplexa* - Puzzling halimolobos
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buttes

NAF *Lepidium densiflorum* Schrad.
var. *macrocarpum* Mulligan - Peppergrass, Common peppergrass
scattered with sagebrush

NPF *Lepidium montanum* Nutt.
var. *montanum* - Mountain peppergrass
uncommon, scattered

IAF *Lepidium perfoliatum* L. - Clasping peppergrass
scattered in disturbed areas

NBF *Lepidium ramosissimum* Nels. - Branched peppergrass
Webb Springs

NAF *Lepidium virginicum* L.
var. *pubescens* (Greene) Hitchc. - Peppergrass, Tall peppergrass
sagebrush areas east of Big Southern Butte, west foothills, Birch Creek

NPF *Lesquerella kingii* S. Wats.
ssp. *kingii*
var. *cobrensis* Roll. & Shaw - King's bladderpod
open gravelly areas east side of East Butte

NPF *Lesquerella ludoviciana* (Nutt.) Wats.
var. *ludoviciana* - Silvery bladderpod
(now no varietal status)
with sagebrush at base of Big Southern Butte

IAF *Malcolmia africana* R. Br. - Malcolmia
disturbed areas along west edge

NPF *Phoenicaulis cheiranthoides* Nutt. - Daggerpod
Big Southern Butte, west foothills

NAF *Rorippa islandica* (Oed.) Borbás
var. *glabrata* (Lun.) Butters & Abbe - Marsh yellowcress
(see *R. palustris* ssp. *fernaldiana*)

NAF *Rorippa obtusa* (Nutt.) Britt.
var. *obtusa* - Blunt-leaved yellowcress
(see *R. teres*)

NAF *Rorippa palustris* (L.) Bess.
ssp. fernaldiana (Butters & Abbe) Jonsell - Marsh yellowcress
Big Lost River and spreading area

NPF *Rorippa sinuata* (Nutt.) Hitchc. - Creeping yellowcress, Spreading yellowcress
sinks

NAF *Rorippa teres* (Michx.) R. Stuckey - Blunt-leaved yellowcress
Big Lost River

NPF *Schoenocrambe linifolia* (Nutt.) Greene - Perennial mustard, Flax-leaved plainsmustard
common and widespread

IAF *Sinapis arvensis* L. - Charlock, Wild mustard
roadside near Atomic City

IAF *Sisymbrium altissimum* L. - Jim Hill mustard, Tumbleweed mustard
common and widespread in disturbed areas

IAF *Sisymbrium loeselii* L. - Loesel tumbleweed
northeast corner and along Big Lost River in disturbed areas

NPF *Stanleya viridiflora* Nutt. - Prince's plume, Perennial stanleya
scattered throughout site

NAF *Streptanthella longirostris* (Wats.) Rydb. - Longbeak streptanthella
common in northwest foothills, east and west of Hwy. 22

NPF *Thelypodium integrifolium* (Nutt.) Endl. - Entire-leaved thelypody
Big Lost River

NBF *Thelypodium laciniatum* (Hook.) Endl.
var. *laciniatum* - Thick-leaved thelypody
scattered, most common in west foothills

NBF *Thelypodium laciniatum* (Hook.) Endl.
var. *milleflorum* (Nels.) Pays. - Thick-leaved thelypody
(see *T. milleflorum*)

NBF *Thelypodium milleflorum* A. Nels. - Thick-leaved thelypody
scattered, most common in west foothills

IAF *Thlaspi arvense* L. - Penny-cress, Fanweed
Big Lost River, Birch Creek, spreading area, and scattered throughout site

Cactaceae - Cactus Family

NPSc *Coryphantha missouriensis* (Sweet) Britt. & Rose - Nipple coryphantha
(see *Escobaria missouriensis* var. *missouriensis*)

NPSc* *Escobaria missouriensis* (Sweet) D. R. Hunt
var. *missouriensis* - Nipple coryphantha
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Reno Point

NPSc *Opuntia polyacantha* Haw. - Starvation cactus, Prickly-pear
common & widespread

Capparaceae (Capparidaceae) - Caper Family

NAF *Cleome lutea* Hook. - Yellow bee plant
Big Lost River, west foothills

Caprifoliaceae - Honeysuckle Family

NPS *Sambucus cerulea* Raf. - Elderberry
Big Southern Butte

NPS *Symphoricarpos oreophilus* Gray - Snowberry
Big Southern Butte, west foothills

Caryophyllaceae - Pink Family

NPF *Arenaria aculeata* S. Wats. - Maguire king's sandwort
Big Southern Butte, west foothills

NPF *Arenaria capillaris* Poir.
ssp. *americana* Maguire - Mountain sandwort, Thread-leaved sandwort
west foothills

NPF *Arenaria congesta* Nutt.
var. *congesta* - Capitate sandwort, Ballhead sandwort
common, widespread

NPF *Arenaria franklinii* Dougl.
var. *franklinii* - Franklin's sandwort
Big Southern Butte, common, widepread

NPF *Arenaria kingii* (Wats.) Jones
var. *glabrescens* (Wats.) Maguire - Maguire king's sandwort
(see *A. aculeata*)

NPF *Arenaria nuttallii* Pax
var. *fragilis* (Maguire & Holmgren) Hitchc. - Nuttall's sandwort
(see *Minuartia nuttallii* ssp. *nuttallii*)

NPF *Lychnis drummondii* (Hook.) Wats.- Drummond campion
(see *Silene drummondii* var. *drummondii*)

NPF *Minuartia nuttallii* (Pax) Briq.
ssp. *nuttallii* - Nuttall's sandwort
Big Southern Butte

NPF *Silene douglasii* Hook.
var. *douglasii* - Douglas' silene
East & Big Southern Buttes

NPF *Silene drummondii* Hook.
var. *drummondii* - Drummond campion
Big Southern Butte

NPF *Silene menziesii* Hook.
ssp. *menziesii*
var. *viscosa* (Greene) Hitchc. & Maguire - Menzies' silene
Birch Creek

Chenopodiaceae - Goosefoot Family

NPS *Atriplex canescens* (Pursh) Nutt.
var. *canescens* - Fourwing saltbush, Wingscale
west and north edges
NPS *Atriplex confertifolia* (Torr. & Frem.) Wats. - Shadscale, Spiny Saltbush
widespread
NPS *Atriplex falcata* (M. E. Jones) Standl. - Saltsage, Moundscale, Nuttall saltbush
central and north parts of site
NPS *Atriplex nuttallii* Wats.
var. *falcata* M. E. Jones - Saltsage, Moundscale, Nuttall saltbush
(see *A. falcata*)
IAF *Atriplex rosea* - Red orache
Big Lost River & disturbed areas
NPS *Atriplex spinosa* (Hook.) Collotzi - Spiny hopsage
(see *Grayia spinosa*)
NPS *Ceratoides lanata* (Pursh) J.T. Howell - Winterfat, White sage, Winter sage
(see *Krascheninnikovia lanata*)
IAF *Chenopodium album* L. - White goosefoot, Lamb's quarter, White pigweed
widespread on disturbed areas
NAF *Chenopodium atrovirens* Rydb. - Fremont's goosefoot
widespread on disturbed areas, more common than *C. album*
NAF *Chenopodium fremontii* Wats.
var. *atrovirens* (Rydb.) Fosberg - Fremont's goosefoot
(see *C. atrovirens*)
NAF *Chenopodium fremontii* Wats.
var. *fremontii* - Fremont's goosefoot
widespread on disturbed areas, more common than *C. album*
NAF *Chenopodium fremontii* Wats.
var. *incanum* Wats. - Fremont's goosefoot
(see *C. incanum var. incanum*)
NAF *Chenopodium glaucum* L. - Oakleaf goosefoot, Glaucus goosefoot
(see *C. salinum*)
NAF *Chenopodium hybridum* L. - Maple-leaved goosefoot, Sowbane
(see *C. simplex*)
NAF *Chenopodium incanum* (Wats.) Heller
var. *incanum* - Fremont's goosefoot
widespread on disturbed areas, more common than *C. album*
NAF *Chenopodium leptophyllum* (Moq.) Wats.
var. *leptophyllum* - Slimleaf goosefoot, Lamb's quarter
widespread but not common
NAF *Chenopodium salinum* Standl. - Oakleaf goosefoot, Glaucus goosefoot
Big Lost River
NAF *Chenopodium simplex* (Torr.) Raf. - Maple-leaved goosefoot, Sowbane
west foothills under junipers
NPS *Eurotia lanata* (Pursh) Moq. - Winterfat, White sage, Winter sage
(see *Krascheninnikovia lanata*)
NPS *Grayia spinosa* (Hook.) Moq. - Spiny hopsage
widespread, common

IAF *Halogeton glomeratus* C. A. Meyer - Halogeton
very common on disturbed areas, especially on playas & along roadsides

IAF *Kochia scoparia* (L.) Schrad. - Summer cypress, Red belvedere
widespread on disturbed areas

NPS *Krascheninnikovia lanata* (Pursh) Guldenstaedt - Winterfat, White sage, Winter sage
widespread with sagebrush, salt bushes and in pure stands in some areas

NAF *Monolepis nuttalliana* (Schultes) Greene - Povertyweed, Prostrate monolepis
spreading area, Big Lost River, roadsides & on basalt flows

IAF *Salsola kali* L. - Windwitch, Tumbleweed, Russian thistle
very common, widespread in disturbed areas, sometimes dominant for long stretches

NPS *Sarcobatus vermiculatus* (Hook.) Torr. - Greasewood, Chico
common in saline areas

Compositae - Composite or Sunflower Family
(see Asteraceae)

Convolvulaceae - Morning Glory Family

IPF *Convolvulus arvensis* L. - Field morning glory, Small bindweed
roadside weed

Cornaceae - Dogwood Family

NPS *Cornus sericea* L.
ssp. *sericea* - Red-stemmed dogwood, Red-osier dogwood
Webb Springs, Birch Creek

NPS *Cornus stolonifera* Michx.
var. *stolonifera* - Red-stemmed dogwood, Red-osier dogwood
(see *C. sericea* ssp. *sericea*)

Crassulaceae - Stonecrop Family

NPSc *Sedum lanceolatum* Torr.
var. *lanceolatum* - Lance-leaved stonecrop
west foothills, buttes

Cruciferae - Mustard Family
(see Brassicaceae)

Cupressaceae - Cypress Family

NPT *Juniperus osteosperma* (Torr.) Little - Utah juniper
scattered throughout site

NPT *Juniperus scopulorum* Sarg. - Rocky Mountain juniper
Big Southern Butte

Cuscutaceae - Dodder Family

NPF *Cuscuta indecora* Choisey - Inelegant dodder
west foothills

Cyperaceae - Sedge Family

NPG *Carex aurea* Nutt. - Golden sedge
along Birch Creek at Reno Point

NPG *Carex douglasii* Boott - Douglas' sedge
dry sagebrush areas, scattered throughout site

NPG *Carex filifolia* Nutt. - Thread-leaf sedge
Lemhi foothills

NPG *Carex microptera* Mack. - Small-winged sedge
Webb Springs

NPG *Eleocharis palustris* (L.) R. and S. - Common spike-rush, Creeping spikerns
Webb Springs, sinks

NPG *Scirpus acutus* Muhl. - Hardstem bulrush
outflows and lagoons near facilities

NPG *Scirpus maritimus* L. - Seacoast bulrush
outflows and lagoons near facilities

Dryopteridaceae - Wood Fern Family

NPF *Dryopteris filix-mas* (L.) Schott - Male fern
Moonshiner Cave, lava crevices around buttes

NPF *Woodsia oregana* D. C. Eat. - Woodsia
Webb Springs

Euphorbiaceae - Spurge Family

NAF *Chamaesyce glyptosperma* (Engelm.) Small - Corrugate-seeded spurge
Central Facilities Area, dry stream beds, along roadsides, scattered

NAF *Chamaesyce serpyllifolia* (Pers.) Small - Thyme-leaved spurge
Central Facilities Area, dry stream beds, along roadsides, scattered

IPF *Euphorbia esula* L. - Esula spurge
Big Lost River

NAF *Euphorbia glyptosperma* Engelm. - Corrugate-seeded spurge
(see *Chamaesyce glyptosperma*)

NAF *Euphorbia serpyllifolia* Pers. - Thyme-leaved spurge
(see *Chamaesyce serpyllifolia*)

Fabaceae (Leguminosae) - Pea Family

NPF *Astragalus agrestis* Dougl. - Purple milkvetch, Field milkvetch
Big Southern Butte, Birch Creek

NPF* *Astragalus aquilonius* (Barneby) Barneby - Lemhi milkvetch
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west foothills

NPF *Astragalus calycosus* Torr.
var. *calycosus* - Matted milkvetch, Torrey's milkvetch
common on playas, scattered with sagebrush

NPF *Astragalus canadensis* L.
var. *brevidens* (Gandg.) Barneby - Canada milkvetch
sagebrush along Big Lost River, north end along roadsides

NPF *Astragalus ceramicus* Sheld.
var. *apus* Barneby - Painted milkvetch
north end, common in sandy, sagebrush areas

NPF *Astragalus cibarius* Sheld. - Browse milkvetch
Webb Springs, roadsides along west edge

IPF *Astragalus cicer* L. - Chick-pea milkvetch, Cicer milkvetch
planted along roadsides, Lincoln road

NPF *Astragalus convallarius* Greene
var. *convallarius* - Lesser Rushy milkvetch
Twin Buttes with sagebrush

NPF *Astragalus curvicarpus* (A. Hell.) Macbr.
var. *curvicarpus* - Curvepod milkvetch, Sickle milkvetch
sagebrush near buttes, roadsides north of Central Facilities Area, spreading area

NPF *Astragalus filipes* Torr. - Basalt milkvetch, Threadstock milkvetch
common with sagebrush throughout site

NAF *Astragalus geyeri* Gray
var. *geyeri* - Geyer's milkvetch
scattered north and west edges of site

NPF* *Astragalus gilviflorus* Sheld. - Plains orophaca
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Reno Point

NPF *Astragalus kentrophyta* Gray
var. *jessiae* (Peck) Barneby - Thistle milkvetch
north end of west foothills and adjacent area west of TAN

NPF *Astragalus lentiginosus* Dougl.
var. *salinus* (Howell) Barneby - Freckled milkvetch
common and widespread

NPF *Astragalus miser* Dougl.
var. *tenuifolius* (Nutt.) Barneby - Weedy milkvetch
Big Southern Butte, north and west edges of site

NPF *Astragalus purshii* Dougl.
var. *concinnus* Barneby - Pursh's milkvetch, Wooly-pod milkvetch
scattered on buttes and west foothills

NPF *Astragalus purshii* Dougl.
var. *glareosus* Dougl. Barneby - Pursh's milkvetch, Wooly-pod milkvetch
scattered on buttes and in west foothills

NPF *Astragalus purshii* Dougl.
var. *purshii* - Pursh's milkvetch, Wooly-pod milkvetch
common throughout site

NPF *Astragalus terminales* Wats. - Railhead milkvetch
west foothills

NPF *Dalea ornata* (Dougl.) Eat. & Wright - Handsome prairie-clover
sagebrush areas along Big Lost River

NPF *Glycyrrhiza lepidota* Pursh.
var. *glutinosa* (Nutt.) Wats. - Nuttall's licorice, Licorice-root
(now no varietal status)
Big Lost River, Birch Creek, spreading area and sinks

NPF *Glycyrrhiza lepidota* Pursh.
var. *lepidota* - American licorice, Licorice-root
(now no varietal status)
Big Lost River, Birch Creek, spreading area and sinks

NPF *Hedysarum boreale* Nutt.
ssp. *boreale*
var. *boreale* - Northern sweetvetch
scattered over north end of site

NPF *Lupinus argenteus* Pursh
ssp. *argenteus*
var. *argenteus* - Silvery lupine
Big Southern Butte, sage brush Big Lost River and Spreading Area

NPF *Lupinus argenteus* Pursh
var. *holosericeus* (Nutt.) Barneby - Silvery lupine
(see *L. holosericeus*)

NPF *Lupinus burkei* S. Wats.
ssp. *burkei* - Meadow lupine, Blue pod
Webb Springs, Birch Creek, spreading area

NPF *Lupinus holosericeus* Nutt. - Silvery lupine
scattered and common

NPF *Lupinus polyphyllus* Lindl.
var. *burkei* (Wats.) Hitchc. - Meadow lupine, Blue pod
(see *L. burkei* ssp. *burkei*)

NPF *Lupinus polyphyllus* Lindl.
var. *prunophilus* (Jones) Phillips - Hairy bigleaf lupine
(see *L. prunophilus*)

NPF *Lupinus prunophilus* Jones - Hairy bigleaf lupine
south end of site, uncommon

NAF *Lupinus pusillus* Pursh
ssp. *intermontanus*
var. *intermontanus* (A. A. Heller) C. P. Smith - Small lupine, Tiny peavine
common in sandy areas on north end of site

NPF *Lupinus sericeus* Pursh - Silky lupine
Spreading Area

IAF *Medicago lupulina* L. - Black medic, Hop clover
Webb Springs, Birch Creek

IPF *Medicago sativa* L. - Alfalfa
common along roads

IPF *Melilotus albus* Desr. - White sweet clover
(see *M. officinalis)*

IPF *Melilotus officinalis* (L.) Lam. - Common yellow sweet clover
common on roadsides

NPF *Oxytropis lagopus* Nutt.
var. *lagopus* - Rabbit-foot crazyweed
west foothills

NPF *Oxytropis sericea* Nutt.
var. *sericea* - Silky crazyweed
roadsides by the Twin Buttes

NPF *Petalostemon ornatum* Dougl. - Handsome prairie-clover
(see *Dalea ornata*)

NPF *Psoralea lanceolata* Pursh - Lance-leaved scurf-pea
(see *Psoralidium lanceolatum*)

NPF *Psoralidium lanceolatum* (Pursh.) Rydb. - Lance-leaved scurf-pea
north end of site mostly in sandy areas

NPF *Thermopsis montana* Nutt.
var. *montana* - Mountain thermopsis, False-lupine, Buck-bean
(see *T. rhombifolia* var. *montana*)

NPF *Thermopsis rhombifolia* (Nutt.) Richardson
var. *montana* (Nutt.) Isely - Mountain thermopsis, False-lupine, Buck-bean
Birch Creek

IPF *Trifolium pratense* L.
var. *pratense* - Red clover
along highway near Birch Creek
IPF *Trifolium repens* L. - White clover, Dutch clover
along Birch Creek, lawns in Central Facilities Area
NPF *Vicia americana* Muhl.
ssp. *minor* - American vetch
scattered throughout site

Fumariaceae - Fumitory Family

NAF *Corydalis aurea* Willd. - Golden corydalis, Ground smoke
Big Southern Butte

Geraniaceae - Geranium Family

IAF *Erodium cicutarium* (L.) L'Her - Stork's bill
Throughout Central Facilities Area, near spreading area

Gramineae - Grass Family
(see Poaceae)

Grossulariaceae - Currant or Gooseberry Family

NPS *Ribes aureum* Pursh. - Golden currant
Big Lost River, Webb Springs
NPS *Ribes cereum* Dougl.
var. *cereum* - Squaw currant
Big Southern Butte
NPS *Ribes cereum* Dougl.
var. *inebrians* (Lindl.) Hitchc. - Squaw currant
(see *R. cereum* var *pedicellare*)
NPS *Ribes cereum* Dougl.
var *pedicellare* Brewer & S. Wats. - Squaw currant
Big Southern Butte and west foothills
NPS *Ribes oxyacanthoides* L.
ssp. *setosum* (Lindl.) Sinnott - Gooseberry, Missouri gooseberry
Birch Creek
NPS *Ribes setosum* Lindl. - Gooseberry, Missouri gooseberry
(see *R. oxyacanthoides* ssp. *setosum*)

Hydrophyllaceae - Waterleaf Family

NPF *Hesperochiron pumilus* (Griseb.) Porter - Dwarf hesperochiron
north of Big Southern Butte
NAF *Nama densum* Lemmon
var. *parviflorum* (Greenm.) Hitchc. - Matted nama
west foothills
NAF *Phacelia glandulifera* Piper - Sticky phacelia
(see *P. ivesiana* var. *glandulifera*)
NAF *Phacelia glandulosa* Nutt. - Glandular phacelia
Buttes

NPF *Phacelia hastata* Dougl.
var. *hastata* - Silverleaf phacelia
north of spreading area, buttes
NAF *Phacelia incana* Brand - Hoary phacelia
west foothills
NAF* *Phacelia inconspicua* Greene - Inconspicuous phacelia
FEDERAL CANDIDATE
Big Southern Butte
NAF *Phacelia ivesiana* Torr.
var. *glandulifera* (Piper) Nels.& Macbr. - Sticky phacelia
scattered, not common

Iridaceae - Iris Family

NPF *Sisyrinchium angustifolium* Mill. - Idaho blue-eyed-grass
(see *S. idahoense*)
NPF *Sisyrinchium idahoense* Bickn. - Idaho blue-eyed-grass
Birch Creek

Juncaceae - Rush Family

NPG *Juncus balticus* Willd.
var. *montanus* Engelm. - Balticr rush
Big Lost River, Birch Creek, Webb Spring
NPG *Juncus bufonius* L. - Toad rush
Big Lost River, Webb Springs

Labiatae - Mint Family
(see Lamiaceae)

Lamiaceae (Labiatae) - Mint Family

NPF *Agastache cusickii* (Greenm.) Heller - Horsemint
Big Southern Butte
NPF *Agastache urticifolia* (Benth.) Kuntze
var. *urticifolia* - Giant hyssop
Webb Springs
NPF *Mentha arvensis* L.
var. *canadensis* L. - Field mint
(see *M. canadensis*)
NPF *Mentha canadensis* L. - Field mint
Big Lost River

Leguminosae - Pea Family
(see Fabaceae)

Liliaceae - Lily Family

NPF *Allium acuminatum* Hook. - Hooker's onion
common with sagebrush
NPF *Allium geyeri* Wats.
var. *geyeri* - Geyer's onion
buttes and west foothills
NPF *Allium textile* Nels. and Macbr. - Textile onion

common with sagebrush

NPF *Calochortus bruneaunis* Nels. and Macbr. - Mariposa lily
common and scattered throughout site

NPF *Calochortus macrocarpus* Dougl.
var. *macrocarpus* - Sagebrush mariposa, Green-banded star-tulip
on buttes

NPF *Fritillaria atropurpurea* Nutt. - Leopard lily
buttes

NPF *Fritillaria pudica* (Pursh.) Spreng. - Yellowbell, Fritillary
west foothills, buttes

NPF *Maianthemum stellatum* (L.) Link - False solomon's seal
Birch Creek, Webb Springs

NPF *Smilacina stellata* (L.) Desf. - False solomon's seal
(see *Maianthemum stellatum*)

NPF *Zigadenus paniculatus* (Nutt.) Wats. - Foothills death-camas
Big Southern Butte, scattered with sagebrush in foothills

NPF *Zigadenus venenosus* Wats.
var. *venenosus* - Death-camas, Meadow death-camas
Big Southern Butte

Loasaceae - Blazing-Star Family

NAF *Mentzelia albicaulis* Dougl. - White-stemmed mentzelia, Little blazing-star
common and widespread

NPF *Mentzelia laevicaulis* (Dougl.) T. & G.
var. *laevicaulis* - Blazing-star
west foothills, buttes

Malvaceae - Mallow Family

NPF *Sphaeralcea grossulariifolia* (H. & A.) Rydb. - Gooseberry-leaved globe-mallow
north end of site near Antelope Butte, common where found

NPF *Sphaeralcea munroana* (Dougl.) Spach - White-stemmed globe-mallow
common and widespread

Marsileaceae - Pepperwort Family

NPF *Marsilea vestita* Hook and Grev. - Pepperwort, Clover-fern
formerly abundant in sinks but not recently seen

Nyctaginaceae - Four-o'clock Family

NPF *Abronia mellifera* Dougl. - Sandverbena, White sandverbena
scattered in sandy areas north end of site

Onagraceae - Evening-primrose Family

NAF *Camissonia andina* (Nutt.) Raven - Obscure evening-primrose
base of buttes, spreading area, Big Lost River, western foothills

NAF *Camissonia minor* (A. Nels.) Raven - Small-flowered evening-primrose
scattered throughout site

NAF* *Camissonia pterosperma* (S. Wats.) Raven - Wing-seeded evening-primrose
STATE SENSITIVE
rare in northwest foothills

NAF *Camissonia pubens* (S. Wats.) Raven - Hairy evening-primrose
west foothills, northeast sand dunes

NAF *Camissonia scapoidea* (Nutt.) Raven
ssp. *brachycarpa* (Raven) Raven - Naked-stemmed evening-primrose
north and west portions of site

NPF *Epilobium angustifolium* L. - Fireweed, Blooming sally
Big Southern Butte

NAF *Epilobium brachycarpum* Presl.- Autumn willow-herb, Tall annual willow-herb
west edge of site, Webb Springs, Big Lost River

NPF *Epilobium ciliatum* Raf.
ssp. *ciliatum* - Watson's Willow-herb
Webb Springs, Big Lost River, Birch Creek

NAF *Epilobium minutum* Lindl. - Small-flowered willow-herb
west foothills

NAF *Epilobium paniculatum* Nutt.
var. *paniculatum* - Autumn willow-herb, Tall annual willow-herb
(see *E. brachycarpum*)

NPF *Epilobium watsonii* Barneby
var. *parishii* (Trel.) Hitchc. - Watson's willow-herb
(see *E. ciliatum* ssp. *ciliatum*)

NAF *Gayophytum decipiens* Lewis & Szweyk. - Deceptive groundsmoke
buttes, center of site

NAF *Gayophytum diffusum* T. & G. - Spreading groundsmoke
Big Southern Butte, southwest portion of site, sand dunes in northeast

NAF *Gayophytum racemosum* T. and G. - Racemed groundsmoke
scattered throughout site

NAF *Gayophytum ramosissimum* Nutt. - Hairstem gayophytum
scattered throughout site

NAF *Oenothera andina* Nutt. - Obscure evening-primrose
(see *Camissonia andina*)

NPF *Oenothera caespitosa* Nutt.
ssp. *marginata* (Nutt.) Munz - Desert evening-primrose, Rock-rose
sparsely scattered throughout site

NAF *Oenothera minor* (A. Nels) Munz
var. *minor* - Small-flowered evening-primrose
(see *Camissonia minor*)

NPF *Oenothera pallida* Lindl.
ssp. *pallida* - White-stemmed evening-primrose
sandy areas north end of site

NAF *Oenothera pterosperma* S. Wats. - Wing-seeded evening-primrose
(see *Camissonia pterosperma*)

NAF *Oenothera pubens* (S. Wats.) Munz - Hairy evening-primrose
(see *Camissonia pubens*)

NAF *Oenothera scapoidea* Nutt.
ssp. *brachycarpa* Raven - Naked-stemmed evening-primrose
(see *Camissonia scapoidea* ssp. *brachycarpa*)

NBF *Oenothera strigosa* Mkze. & Bush - Common evening-primrose
(see *O. villosa* ssp. *strigosa*)

NBF *Oenothera villosa* Thunb.
ssp. *strigosa* (Rydb.) W. Dietr. & Raven - Common evening-primrose
west foothills

Orchidaceae - Orchid Family

NPF *Corallorhiza maculata* Raf. - Spotted coral-root
Webb Springs

Orobanchaceae - Broomrape Family

NAF *Orobanche corymbosa* (Rydb.) Ferris - Flat-topped broomrape
west foothills

NPF *Orobanche fasciculata* Nutt. - Clustered broomrape
widely scattered with sagebrush

NPF *Orobanche ludoviciana* Nutt.
ssp. *ludoviciana* - Sand broomrape
infrequent, north edge of Big Lost River Sinks area

Pinaceae - Pine Family

NPT *Pinus contorta* Dougl.
var. *contorta*- Lodgepole pine
Big Southern Butte

NPT *Pinus flexilis* James - Limber pine
Big Southern Butte

NPT *Pseudotsuga menziesii* (Mirbel.) Franco
var. *glauca* (Beissn.) Franco - Rocky Mountain douglas fir
Big Southern Butte

Plantaginaceae - Plantain Family

IPF *Plantago major* L.
var. *major* - CommonpPlantain
Big Lost River

NAF *Plantago patagonica* Jacq.
var. *gnaphalioides* (Nutt.)Gray - Desert plantain, India-wheat
(now no varietal status)
scattered throughout site

Poaceae (Gramineae) - Grass Family

NPG *Agropyron x Elymus* - Wheatgrass/Ryegrass cross
uncommon, scattered

NPG *Agropyron albicans* Scribn. & Smith
var. *albicans* - Wheatgrass
(see *Elymus lanceolatus* ssp. *albicans*)

NPG *Agropyron caninum* (L.) Beauv.
ssp. *majus* (Vasey) Hitchc.
var. *majus* - Slender wheatgrass, Bearded wheatgrass
(see *Elymus trachycaulus* ssp. *trachycaulus*)

NPG *Agropyron caninum* (L.) Beauv.
ssp. *majus* (Vasey) Hitchc.
var. *unilaterale* (Vasey) Hitchc. - Slender wheatgrass, Bearded wheatgrass
(see *Elymus trachycaulus* ssp. *subsecundus*)

IPG *Agropyron cristatum* (L.) Gaertn.
ssp. *pectinatum* (Bieb.) Tzvelev - Crested wheatgrass
commonly planted along roadsides, burns, fields, etc.

NPG *Agropyron dasystachyum* (Hook.) Scribn.
var. *dasystachyum* - Thick-spiked wheatgrass
(see *Elymus lanceolatus* ssp. *lanceolatus*)

NPG *Agropyron dasystachyum* (Hook.) Scribn.
var. *riparium* (Scribn. & Smith) Bowden - Thick-spiked wheatgrass
(see *Elymus lanceolatus* ssp. *lanceolatus*)

IPG *Agropyron desertorum* (Link) Schultes - Desert wheatgrass
commonly planted along roadsides, burns, fields, etc.

IPG *Agropyron pectiniforme* Roemer & Schultes - Crested wheatgrass
(see *Agropyron cristatum* ssp. *pectinatum*)

IPG *Agropyron repens* (L.) Beauv. - Quackgrass
(see *Elytrigia repens* var. *repens*)

IPG *Agropyron sibiricum* Beauv. - Crested wheatgrass
(see *A. cristatum*)

NPG *Agropyron smithii* Rydb.
var. *smithii* - Western wheatgrass
(see *Pascopyrum smithii*)

NPG *Agropyron spicatum* (Pursh) Scribn. and Smith
var. *spicatum* - Bluebunch wheatgrass
(see *Pseudoroegneria spicata* ssp. *spicata*)

NPG *Agropyron trachycaulum* (Link.) Malte
var. *glaucum* (Pease & Moore) Malte - Slender wheatgrass, Bearded wheatgrass
(see *Elymus trachycaulus* ssp. *subsecundus*)

NPG *Agropyron trachycaulum* (Link.) Malte
var. *trachycaulum* - Slender wheatgrass, Bearded wheatgrass
(see *Elymus trachycaulus* ssp. *trachycaulus*)

IPG *Agrostis alba* L.
var. *stolonifera* (L.) Smith - Bentgrass, Redtop
(see *A. stolonifera*)

IPG *Agrostis stolonifera* L.
var. *stolonifera* - Bentgrass, Redtop
(now no varietal status)
Big Lost River, Webb Springs

NPG *Alopecurus aequalis* Sobol. - Shortawn foxtail, Little meadow-foxtail
Webb Springs

NPG *Aristida fendleriana* Steud. - Three-awn
(see *A. purpurea* var. *longiseta*)

NPG *Aristida longiseta* Steud. - Three-awn
(see *A. purpurea* var. *longiseta*)

NPG *Aristida purpurea* Nutt.
var. *longiseta* (Steudel) Vasey - Three-awn
north and northeast parts of site

IAG *Avena fatua* L. - Wild oat
along roadsides, west edge of site

IAG *Avena sativa* L. - Common oat
south of old Dairy Farm, rare on site

NAG *Beckmannia syzigachne* (Steud.) Fern. - Slough grass
Big Lost River, roadside along west boundary

NPG *Bromus carinatus* Hook. & Arn. - California bromegrass
Big Southern Butte
IPG *Bromus inermis* Leys.
var. *inermis* - Smooth bromegrass
along roadsides, scattered
IAG *Bromus japonicus* Thunb. - Japanese brome
west foothills
NPG *Bromus marginatus* Nees. - California bromegrass
East Butte
IAG *Bromus tectorum* L.
var. *glabratus* Spenner - Cheatgrass, Downy chess, June grass
common, widespread over site in disturbed areas
IAG *Bromus tectorum* L.
var. *tectorum* - Cheatgrass, Downy chess, June grass
common, widespread over site in disturbed areas
IPG *Dactylis glomerata* L. - Orchard grass
roadside along west boundary
NPG *Distichlis spicata* (L.) Greene
var. *stricta* (Torr.) Scribn. - Desert saltgrass
saline areas near TAN
NPG *Distichlis stricta* (Torr.) Rydb.
var. *stricta* - Desert saltgrass
(see *D. spicata* var. *stricta*)
NAG *Echinochloa crusgalli* (L.) Beauv. - Barnyard grass
in Central Facilities Area along lawns and edges of lagoons near facilities
NPG *Elymus ambiguus* Vasey and Scribn.
var. *salmonis* Hitchc. - Salmon River wildrye
(see *Leymus salinus* ssp. *salmonis*)
NPG *Elymus cinereus* Scribn. & Merr.
var. *cinereus* - Giant wildrye, Great Basin wildrye
(see *Leymus cinereus*)
NPG *Elymus elymoides* (Raf.) Swezey - Bottlebrush, Squirreltail, Bottlebrush squirreltail
common and widespread with sagebrush
NPG *Elymus flavescens* Scribn. and Smith - Golden wildrye
(see *Leymus flavescens*)
NPG *Elymus lanceolatus* (Scribn. & Smith) Gould
ssp. *albicans* (Scribn. & Smith) Barkworth and Dewey - Wheatgrass
roadside along west boundary
NPG *Elymus lanceolatus* (Scribn. & Smith) Gould
ssp. *lanceolatus* - Thick-spiked wheatgrass
widespread in sagebrush areas
NPG *Elymus trachycaulus* (Link) Gould
ssp. *subsecundus* (Link) A. & D. Love - Slender wheatgrass, Bearded wheatgrass
East Butte
NPG *Elymus trachycaulus* (Link) Gould
ssp. *trachycaulus* - Slender wheatgrass, Bearded wheatgrass
north end, Birch Creek
NPG *Elymus triticoides* Buckl. - Creeping wildrye, Beardless wildrye
(see *Leymus triticoides*)
IPG *Elytrigia repens* (L.) Desv.
var *repens* - Quackgrass
Big Southern Butte

NPG *Festuca idahoensis* Elmer - Idaho fescue
Big Southern Butte
NPG *Festuca kingii* (Wats.) Cassidy - Spike fescue
Big Southern Butte
NAG *Festuca octoflora* Walt. - Six-weeks fescue
(see *Vulpia octoflora* var. *octoflora*)
NPG *Glyceria grandis* Wats. - American mannagrass
Big Lost River
NPG *Hesperochloa kingii* (Wats.) Rydb. - Spike fescue
(see *Festuca kingii*)
NPG *Hordeum jubatum* L. - Foxtail barley, Foxtail
roadsides, disturbed areas throughout site, common
NPG *Koeleria cristata* Pers. - Prairie june grass
(see *K. macrantha*)
NPG *Koeleria macrantha* (Ledeb.) J. A. Schultes - Prairie june grass
Big Southern Butte
NPG *Koeleria nitida* Nutt. - Prairie june grass
(see *K. macrantha*)
NPG *Leucopoa kingii* (Wats.) Weber - Spike fescue
(see *Festuca kingii*)
NPG *Leymus cinereus* (Scribn. & Merr.) A. Love - Giant wildrye, Great Basin wildrye
scattered throughout site
NPG *Leymus flavescens* (Scribn. & Smith) Pilger - Golden wildrye
north end
NPG *Leymus salinus* (Jones) A. Love
ssp. *salmonis* (Hitchc.) Atkins - Salmon River wildrye
west foothills
NPG *Leymus triticoides* (Buckl.) Pilger - Creeping wildrye, Beardless wildrye
Big Southern Butte
NPG *Melica bulbosa* Geyer - Oniongrass
Big Southern Butte
NPG *Oryzopsis hymenoides* (R. & S.) Ricker - Indian ricegrass
common and widespread
NAG *Panicum capillare* L. - Common witchgrass, Panicgrass
roadsides in Central Facilities Area
NPG *Pascopyrum smithii* (Rydb.) A. Love - Western wheatgrass
widespread, patchy
NPG *Phalaris arundinacea* L. - Reed canary grass
Big Lost River
IPG *Phleum pratense* L. - Timothy, Common timothy
along roadsides in north end of site
IPG *Poa bulbosa* L. - Bulbous bluegrass
Big Southern Butte
NPG *Poa cusickii* Vasey - Cusick's bluegrass
(see *P. fendleriana* ssp. *fendleriana*)
NPG *Poa fendleriana* (Steud.) Vasey
ssp. *fendleriana* - Cusick's bluegrass
Big Southern Butte, west foothills
NPG *Poa nervosa* (Hook.) Vasey
var. *wheeleri* (Vasey) Hitchc. - Wheeler bluegrass
Big Southern Butte
NPG *Poa nevadensis* Vasey - Nevada bluegrass
(see *P. secunda*)

IPG *Poa pratensis* L. - Kentucky bluegrass
Big Southern Butte, roadsides by east boundary, lawns in Central Facilities Area
NPG *Poa sandbergii* Vasey - Sandberg's bluegrass
(see *P. secunda*)
NPG *Poa scabrella* (Thurb.) Benth. - Pine bluegrass
(see *P. secunda*)
NPG *Poa secunda* Presl. - Sandberg's bluegrass, Nevada bluegrass, Pine bluegrass
common and widespread in sagebrush areas
NPG *Pseudoroegneria spicata* (Pursh) A. Love
ssp. *spicata* - Bluebunch wheatgrass
patchy throughout sagebrush areas
IAG *Setaria viridis* (L.) Beauv. - Green bristle-grass
Big Southern Butte, roadsides in Central Facilities Area
NPG *Sitanion hystrix* (Nutt.) J. G. Smith - Bottlebrush, Squirreltail, Bottlebrush squirreltail
(see *Elymus elymoides*)
NPG *Sporobolus cryptandrus* (Torr.) Gray - Western dropseed
scattered in sagebrush, lava flow areas, roadsides in Central Facilities Area
NPG *Stipa columbiana* Macoun
var. *nelsonii* (Scribn.) St. John - Columbia needlegrass
(see *S. nelsonii* ssp. *nelsonii* var. *nelsonii*)
NPG *Stipa comata* Trin. and Rupr. - Needle-and-thread grass
common and widespread

NPG *Stipa nelsonii* Scribn.
ssp. *nelsonii*
var. *nelsonii* - Columbia needlegrass
Birch Creek
NPG *Stipa occidentalis* Thurb. - Western needlegrass
Big Southern Butte
NPG *Stipa thurberiana* Piper - Thurber's needlegrass
Webb Springs, lower slopes off Big Southern and East Buttes
IAG *Triticum aestivum* L. - Common wheat
roadsides near cultivated areas in northeast corner of site, Dairy Farm
NAG *Vulpia octoflora* (Walt.) Rydb.
var. *octoflora* - Six-weeks fescue
Big Southern Butte

Polemoniaceae - Phlox Family

NAF *Collomia linearis* Nutt. - Narrow-leaf collomia
Big Southern Butte, west foothills
NAF *Collomia tenella* Gray - Diffuse collomia
Webb Springs
NAF *Eriastrum sparsiflorum* (Eastw.) Mason
var. *wilcoxii* (A. Nels.) Cronq. - Great Basin eriastrum
(see *E. wilcoxii*)
NAF *Eriastrum wilcoxii* (A. Nels.) Mason - Great Basin eriastrum
common and widespread
NVF *Gilia aggregata* (Pursh) Spreng.
var. *attenuata* Gray - Scarlet gilia
(see *Ipomopsis aggregata*)

NPF *Gilia congesta* Hook.
var. *congesta* - Ball-head gilia
(see *Ipomopsis congesta* ssp. *congesta*)

NPF *Gilia congesta* Hook.
var. *palmifrons* (A. Brand) Cronq. - Ball-head gilia
(see *Ipomopsis congesta* ssp. *palmifrons*)

NAF *Gilia inconspicua* (J. E. Smith) Sweet
var. *inconspicua* - Inconspicuous gilia
west foothills

NAF *Gilia inconspicua* (J. E. Smith) Sweet
var. *sinuata* (Dougl.) Gray - Sinuate gilia
(see *G. sinuata*)

NAF *Gilia inconspicua* (J. E. Smith) Sweet
var. *tweedyi* (Rydb.) Cronq. - Tweedy's gilia
(see *G. tweedyi*)

NAF *Gilia leptomeria* Gray
var. *leptomeria* - Sand gilia, Great Basin gilia
common, widespread

NAF *Gilia minutiflora* Benth. - Small flowered gilia
(see *Ipomopsis minutiflora*)

NAF *Gilia polycladon* Torr. - Spreading gilia
(see *Ipomopsis polycladon*)

NAF *Gilia sinuata* Dougl. - Sinuate gilia
west foothills

NAF *Gilia tenerrima* Gray - Delicate gilia
west foothills, Big Southern Butte, scattered elsewhere

NAF *Gilia tweedyi* Rydb. - Tweedy's gilia
scattered throughout site

NAF *Gymnosteris nudicaulis* (H. & A.) Greene - Large flowered gymnosteris
scattered throughout south end of site, Big Southern Butte, west foothills

NVF *Ipomopsis aggregata* (Pursh) V. Grant
ssp. *aggregata* - Scarlet gilia
west foothills

NPF *Ipomopsis congesta* (Hook.) V. Grant
ssp. *congesta* - Ball-head gilia
common and widespread

NPF *Ipomopsis congesta* (Hook.) V. Grant
ssp. *palmifrons* (Brand) Day - Ball-head gilia
common and widespread

NAF *Ipomopsis minutiflora* (Benth.) V. Grant - Small flowered gilia
common, scattered throughout site

NAF* *Ipomopsis polycladon* (Torr.) V. Grant - Spreading gilia
STATE PRIORITY 2
west foothills

NAF *Langloisia punctata* (Cov.) Goodd. - Spotted langloisia
(see *L. setosissima* ssp. *punctata*)

NAF *Langloisia setosissima* (Torr. & Gray) Greene
ssp. *punctata* (Gray) Timbrook - Spotted langloisia
scattered throughout site

NPS *Leptodactylon pungens* (Torr.) Nutt.
var. *pungens* - Prickly phlox
common, widespread with sagebrush

NPS *Leptodactylon watsonii* (Gray) Rydb. - Watson's prickly phlox
west foothills, Big Southern Butte, basalt adjacent to Big Southern Butte

NAF *Linanthus septentrionalis* Mason - Northern linanthus
scattered throughout site

NPF *Phlox aculeata* A. Nels. - Prickly-leaved phlox
west foothills

NPF *Phlox hoodii* Rich.
ssp. *canescens* (T.& G.) Wherry - Hood's phlox, Carpet phlox
very common, widespread throughout site

NPF *Phlox longifolia* Nutt.
ssp. *longifolia* - Longleaf phlox
common, scattered throughout site

Polygonaceae - Buckwheat Family

NAF *Chorizanthe brevicornu* Torr.
var. *spathulata* (Small) Hitchc. - Brittle spine-flower
scattered throughout site

NAF *Chorizanthe watsonii* T. & G. - Watson's spine-flower
scattered throughout site

NPF *Eriogonum caespitosum* Nutt. - Mat buckwheat
buttes and west foothills

NAF *Eriogonum cernuum* Nutt. - Nodding buckwheat
common throughout site

NPF *Eriogonum heracleoides* Nutt.
var. *heracleoides* - Parsnip-flowered buckwheat
buttes

NAF *Eriogonum maculatum* Heller - Spotted buckwheat
Lemhi foothills, center of site, uncommon

NPF *Eriogonum mancum* Rydb. - Imperfect buckwheat
west foothills

NPS *Eriogonum microthecum* Nutt.
var. *laxiflorum* Hook. - Shrubby buckwheat
` common scattered throughout site

NPF *Eriogonum ovalifolium* Nutt.
var. *celsum* Nels. - Cushion buckwheat
(see *E. ovalifolium* var. *purpureum*)

NPF *Eriogonum ovalifolium* Nutt.
var. *ovalifolium* - Cushion buckwheat
scattered throughout site

NPF *Eriogonum ovalifolium* Nutt.
var. *purpureum* (Nutt.) Dur. - Cushion buckwheat
rocky areas on buttes and west foothills

NPF *Eriogonum umbellatum* Torr.
var. *umbellatum* - Sulfurflower buckwheat
buttes

NAF* *Oxytheca dendroidea* Nutt. - Oxytheca
STATE SENSITIVE
uncommon, scattered throughout site in sandy areas

NAF *Polygonum achoreum* Blake - Prostrate knotweed
spreading area

NAF *Polygonum aviculare* L. - Doorweed, Prostrate knotweed
scattered throught site on disturbed areas

NAF *Polygonum lapathifolium* L. - Willow weed, Curl-top ladysthumb
spreading area and Big Lost River

NAF *Polygonum persicaria* L. - Heartweed, Spotted ladysthumb
Big Lost River, highway along west edge

IPF *Rumex crispus* L. - Curly dock
scattered throughout site on temporarily or permanently moist areas

NAF *Rumex maritimus* L. - Seaside dock
Webb Springs, spreading area

NPF *Rumex salicifolius* Weinm.
var. *mexicanus* (Meisn.) Hitchc. - Willow dock, Willow-leaved dock
Webb Springs, spreading area, Big Lost River

NPF *Rumex salicifolius* Weinm.
ssp. *triangulivalvis* Danser
var. *triangulivalvis* - Willow dock, Willow-leaved dock
(see *R. salicifolius* var. *mexicanus*)

NPF *Rumex venosus* - Wild begonia
sandy areas in west foothills and on sand dunes in northeast portion of site

Portulacaceae - Purslane Family

NAF *Calyptridium roseum* Wats. - Rosy pussypaws
(See *Cistanthe rosea*)

NAF *Cistanthe rosea* (Wats.) Hershkovitz - Rosy pussypaws
uncommon, south-central areas near SPERT

NPF *Lewisia rediviva* Pursh- Bitterroot
tip of the Lemhi Range

Ranunculaceae - Buttercup Family

NPF *Aquilegia formosa* Fisch. - Red columbine
Webb Springs

IAF *Ceratocephala testiculata* (Crantz) Roth - Bur buttercup
common in disturbed areas throughout site

NPCv *Clematis ligusticifolia* Nutt. - Virgin's bower
Big Southern Butte

NPF *Delphinium andersonii* Gray - Desert larkspur
Webb Springs, Big Lost River, Middle Butte

NPF *Delphinium nuttallianum* Pritz.
var. *nuttallianum* - Upland larkspur
west foothills

NPF *Ranunculus andersonii* Gray - Anderson buttercup
East Butte

NPF *Ranunculus aquatilis* L.
var. *capillaceus* (Thuil.) DC. - Water crowfoot
(see *R. trichophyllus* var. *trichophyllus*)

NPF *Ranunculus cymbalaria* Pursh - Shore buttercup
Big Lost River

NPF *Ranunculus glaberrimus* Hook.
var. *ellipticus* Greene - Sagebrush buttercup
scattered throughout site with sagebrush

NPF Ranunculus macounii Britt.
var. *macounii* - Macoun's buttercup
Birch Creek
IAF *Ranunculus testiculatus* Crantz. - Bur buttercup
(see *Ceratocephala testiculata*)
NPF *Ranunculus trichophyllus* Chaix
var. *trichophyllus* - Water crowfoot
Big Lost River

Rhamnaceae - Buckthorn Family

NPS *Ceanothus velutinus* Dougl.
ssp. *velutinus*
var. *velutinus* - Snowbrush, Mountain laurel
buttes

Rosaceae - Rose Family

NPS *Amelanchier alnifolia* Nutt.
var. *alnifolia* - Western serviceberry
East Butte
NPS *Amelanchier utahensis* Koehne - Utah serviceberry
Big Southern Butte
NPF *Argentina anserina* (L.) Rydb. - Common silverweed
Big Lost River, spreading area
NPS *Cercocarpus ledifolius* Nutt.
var. *intercedens* Scheid. - Curl-leaf mountain-mahogany
west foothills
NPS *Chamaebatiaria millefolium* (Torr.) Maxim. - Fern-brush, Desert-sweet
crevices in lava south end of site

NPF *Geum macrophyllum* Willd.
var. *perincisum* (Rydb.) Raup - Large-leaved avens
Big Southern Butte
NPS *Holodiscus dumosus* (Hook.) Heller
var. *dumosus* - Ocean spray
Big Southern Butte
NPF *Petrophytum caespitosum* (Nutt.) Rydb. - Rocky Mountain rockmat
west foothills on rocks
NPS *Physocarpus alternans* (M. E. Jones) J. T. Howell - Ninebark
west foothills
NPF *Potentilla anserina* L. - Common silverweed
(see *Argentina anserina*)
NBF *Potentilla biennis* Greene - Biennial cinquefoil
Big Lost River
NPF *Potentilla glandulosa* Lindl.
var. *pseudorupestris* (Rydb.) Breit. - Sticky cinquefoil, Gland cinquefoil
Webb Springs
NPS *Prunus virginiana* L.
var. *melanocarpa* (Nels.) Sarg. - Common chokecherry
buttes
NPS *Purshia tridentata* (Pursh) D. C. - Bitterbrush, Antelope-brush
lava flows southern end of sites, lower portions of buttes

NPS *Rosa woodsii* Lindl.
var. *woodsii* - Wood's rose
Big Lost River, Big Southern Butte, roadside east of hwy 20/26 junction
NPS *Rubus idaeus* L.
ssp. *strigosus* (Michx.) Focke - Red raspberry
Big Southern Butte
NPS *Rubus idaeus* L.
var. *gracilipes* Jones - Red raspberry
(see *R. idaeus* ssp. *strigosus*)

Rubiaceae - Madder Family

NAF *Galium bifolium* Wats. - Thinleaf bedstraw, Low mountain bedstraw
Webb Springs, west foothills
NPF *Galium multiflorum* Kell.
var. *multiflorum* - Shrubby bedstraw
(now no varietal status)
Big Southern Butte

Salicaceae - Willow Family

NPT *Populus angustifolia* James - Narrow-leaved cottonwood
Big Lost River, Birch Creek
NPT *Populus tremuloides* Michx. - Quaking aspen
Big Southern Butte
NPT *Populus trichocarpa* T. & G. - Black cottonwood
Birch Creek
NPS *Salix exigua* Nutt.
ssp. *exigua*
var. *exigua* - Slender willow, Coyote willow
Big Lost River, center of site on moist areas

NPS *Salix exigua* Nutt.
ssp. *exigua*
var. *stenophylla* (Rydb.) Schneid. - Slender-leaf willow
Birch Creek
NPS *Salix lasiandra* Benth. - Whiplash willow
(see *S. lucida* ssp. *lasiandra*)
NPS *Salix lucida* Muhl.
ssp. *lasiandra* (Benth.) E. Murr. - Whiplash willow
Birch Creek
NPS *Salix lutea* Nutt. - Watson willow
Birch Creek, west foothills
NPS *Salix rigida* Muhl.
var. *watsonii* (Bebb) Cronq. - Watson willow
(see *S. lutea* Nutt.)
NPS *Salix scouleriana* Barratt - Scouler's willow
Webb Springs

Santalaceae - Sandalwood Family

NPF *Comandra umbellata* (L.) Nutt.
ssp. *pallida* (DC.) Jones - Pale bastard toad-flax, Bastard toad-flax
scattered throughout site with sage brush

Saxifragaceae - Saxifrage Family

NPF *Heuchera parvifolia* Nutt.
var. *utahensis* (Rydb.) Garrett - Small-leaved alumroot, Common alumroot
buttes and west foothills
NPF *Lithophragma bulbifera* Rydb. - Star flower
(see *L. glabra*)
NPF *Lithophragma glabra* Nutt. - Star flower
Big Southern Butte
NPF *Lithophragma parviflora* (Hook.) Nutt. - Star flower
Big Southern Butte

Scrophulariaceae - Figwort Family

NPF *Castilleja angustifolia* (Nutt.) G. Don.
var. *angustifolia* - Northwest paintbrush, Desert paintbrush
common, scattered throughout site
NPF *Castilleja inverta* (Nels. & Macbr.) Pennell & Ownbey - Pale paintbrush
(see *C. pallescens* var. *inverta*)
NPF *Castilleja miniata* Dougl. - Scarlet paintbrush
Big Soughern Butte
NPF *Castilleja pallescens* (A. Gray) Greenm.
var. *inverta* (Nels. & Macbr.) Edwin - Pale paintbrush
buttes
NAF *Collinsia parviflora* Lindl. - Blue-eyed mary, Small-flowered blue-eyed mary
buttes
NAF *Cordylanthus ramosus* Nutt. - Bushy birdbeak
scattered through site
NAF *Limosella aquatica* L. - Mudwort
Big Lost River

IPF *Linaria dalmatica* (L.) Mill. - Dalmatian toadflax
road near Birch Creek
IPF *Linaria vulgaris* Hill - Butter-and-eggs
road near Birch Creek
NAF *Mimulus breviflorus* Piper - Short-flowered monkey-flower
west foothills, Big Southern Butte
NAF *Mimulus nanus* H. and A.
ssp. *nanus*
var. *nanus* - Purple monkey-flower
uncommon but scattered throughout site
NAF *Mimulus suksdorfii* Gray - Suksdorf's monkey-flower
uncommon, southern area of site near Ryegrass Flat
NPF *Penstemon cyaneus* Pennell - Dark-blue penstemon
west foothills, spreading area and very common on Big Southern Butte
NPF *Penstemon deustus* Dougl.
var. *deustus* - Hot-rock penstemon
Big Southern Butte

NPF *Penstemon eriantherus* Pursh
var. *redactus* Pennell & Keck - Fuzzytongue penstemon
Big Southern Butte, west foothills

NPF *Penstemon humilis* Nutt.
ssp. *humilis*
var. *humilis* - Low penstemon
west foothills, Big Southern Butte

IPF *Penstemon palmeri* Gray - Palmer's penstemon
commonly planted along roadsides, Lincoln road

NPF *Penstemon pumilus* Nutt. - Dwarf penstemon
west foothills, Reno point

NPF *Penstemon radicosus* A. Nels - Matroot penstemon
Big Southern Butte

IPF *Verbascum thapsus* L. - Common mullein, Hairy mullein
scattered along roadsides

NPF *Veronica americana* Schwein. - American brooklime, Speedwell
Webb Springs, Birch Creek, Big Lost River

IPF *Veronica anagallis-aquatica* L. - Water speedwell
Big Lost River

NAF *Veronica peregrina* L.
ssp. *xalapensis* (H. B. K.) St. John & Warren - Purslane speedwell
Big Lost River

Solanaceae - Nightshade Family

IPF *Hyoscyamus niger* L. - Black henbane, Hog's bean, Fetid nightshade, Insane root
Birch Creek

NAF *Nicotiana attenuata* Torr. - Coyote tobacco
Big Lost River, Webb Springs

IPF *Solanum dulcamara* L. - Bittersweet, Climbing nightshade, Poison berry
Birch Creek

NAF *Solanum triflorum* Nutt. Cut-leaved nightshade
west foothills, spreading area

Typhaceae - Cattail Family

NPF *Typha latifolia* L. - Common cattail
Webb Springs, sinks, outflow channels from facilities

Umbelliferae - Parsley Family
(see Apiaceae)

Urticaceae - Nettle Family

NAF *Parietaria pensylvanica* Muhl. - Pellitory
Birch Creek

IPF *Urtica dioica* L.
ssp. *dioica* - Stinging nettle
Birch Creek, Big Lost River, Webb Springs

Verbenaceae - Verbena Family

NPF *Verbena bracteata* Lag. and Rodr. - Bracted verbena
Big Lost River, Birch Creek, spreading area

Violaceae - Violet Family

NPF *Viola nuttallii* Pursh.
var. *vallicola* (Nels.) Hitchc. - Valley yellow violet
(see *V. vallicola* var. *vallicola*)
NPF *Viola purpurea* Kell.
ssp. *venosa* (Wats.) Brain. - Goosefoot violet, Purplish violet
buttes
NPF *Viola vallicola* A. Nels.
var. *vallicola* - Valley yellow violet
Big Southern Butte

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APPENDIX 1: INEL VEGETATION STUDIES

A. Publications and reports based on data from the permanent plots of the long-term vegetation transects at the Idaho National Engineering Laboratory.

Anderson, J.E. 1986. Development and structure of sagebrush steppe plant communities. Pages 10-12 *in* P. J. Joss, P. W. Lynch and O. B. Williams, editors. Rangelands: a resource under siege. Proceedings of the Second International Rangeland Congress. Australian Academy of Science, Canberra.

Thirty-three years of vegetation data on the permanent vegetation plots were examined for trends in species composition. Cover of grasses and shrubs fluctuated, indicating that change was non-directional and stochastic, rather than converging on a climax structure.

Anderson, J.E., and K.E. Holte. 1981. Vegetation development over 25 years without grazing on sagebrush-dominated rangeland in southeastern Idaho. Journal of Range Management 34:25-29.

Data from the permanent vegetation transects were analyzed to determine what changes had taken place in the vegetation complex over the previous 25 years in the absence of livestock grazing. Cover of shrubs and perennial grasses had nearly doubled. No evidence for seral replacement was found.

Anderson, J.E., and R. Inouye. 1988. Long-term dynamics of vegetation in a sagebrush steppe of southeastern Idaho. Final Report, Ecology and Radioecology Program, Idaho Operations Office, U.S. Department of Energy, Idaho Falls, Idaho.

This report describes the dynamics of vegetation over 35 years on a subset of the permanent vegetation plots. The results suggest that shrub cover may fluctuate by as much as 100% and grass cover by as much as 500% within a decade. Changes in the cover of Bromus tectorum *are also described.*

Anderson, J.E., R.J. Jeppson, R.J. Wilkosz, G.M. Marlette, and K.E. Holte. 1978. Trends in vegetation development on the Idaho National Engineering Laboratory Site. Pages 144-166 *in* O.D. Markham, editor. Ecological Studies on the Idaho National Engineering Laboratory Site -- 1978 Progress Report. Radiological and Environmental Sciences Laboratory, U.S. Department of Energy, Idaho Falls, Idaho.

Data collected in 1975 from the permanent vegetation transects were analyzed to determine what changes had occurred in the vegetation complex over the previous 25 years and to compare trends in vegetal composition between grazed and non-grazed areas. This report includes details of the original sampling design.

Harniss, R.O. 1968. Vegetational changes following livestock exclusion on the National Reactor Testing Station, southeastern Idaho. Thesis. Utah State University, Logan, Utah.

Analysis of vegetation change following livestock exclusion in 1950 was the major objective of this study. The author concluded that there was little change that could not be attributed to the influence of precipitation and that "natural revegetation is slow."

Harniss, R.O., and N.E. West. 1973a. Changes in *Artemisia tridentata/Sitanion hystrix* vegetation on the National Reactor Testing Station, southeastern Idaho. 1950 - 1965. Utah Academy Of Sciences, Arts, and Letters Proceedings 50:10-16.

Most of the increase in grass cover at the INEL during the period 1950 - 1965 was due to an increase in the cover of bottlebrush squirreltail (Sitanion hystrix = Elymus elymoides), *which was designated as a climax species for large portions of the INEL.*

Harniss, R.O., and N.E. West. 1973b. Vegetation patterns of the National Reactor Testing Station, southeastern Idaho. Northwest Science 47:30-43.

Twelve vegetation types for the INEL are described and depicted on a map.

B. Other recent vegetation studies at the Idaho National Engineering Laboratory.

Anderson, J.E. 1991. Vegetation studies to support the NPR Environmental Impact Statement. Final Report to EG&G, Idaho, Inc., Idaho Falls, Idaho.

This report describes sampling and analyses associated with development of the INEL vegetation map and classification of plant communities.

Anderson, J.E., and G.M. Marlette. 1986. Probabilities of seedling recruitment and the stability of crested wheatgrass stands. Pages 97-105 *in* K. L. Johnson, editor. Crested wheatgrass: its values, problems, and myths; symposium proceedings. Utah State University, Logan, Utah.

Data on seedling emergence from undisturbed topsoil samples show that there is a paucity of native propagules within crested wheatgrass stands. Recruitment probabilities favor the maintenance of a monoculture rather than its successional replacement.

Anderson, J.E., and M.L. Shumar. 1986. Impacts of back-tailed jackrabbits at peak population densities on sagebrush-steppe vegetation. Journal of Range Management 39:152-156.

Jackrabbit exclosures were constructed in different vegetation types. Plant cover inside and outside the exclosures was estimated in 1979 and 1982. Jackrabbit populations peaked in 1981. Plant cover was significantly reduced outside the exclosures, but relative cover of species was similar. Shrubs were browsed heavily during the winter, but showed compensatory growth in the spring. The results indicated that a peak in jackrabbit populations has little impact on the structure of these plant communities.

Cole, N.K. 1987. The growth and water relations of *Leymus cinereus* following a prescribed burn. M.S. Thesis, Idaho State University, Pocatello, Idaho.

Plant density, basal area, cover and biomass of Leymus cinereus *were measured in burned and unburned stands. Plant phenological parameters and soil water content were also estimated. Although there was some mortality of small individuals, in general* L. cinereus *plants responded vigorously to burning. Tillers emerged earlier and plants were greener and taller on the burned site. Lower soil moisture content on the burn site resulted in significantly lower plant water potentials on the burned site for most of the growing season. Nevertheless, basal cover on the burned site was similar to that of the control site at the end of the first postfire growing season.*

Floyd, D.A. 1982. A comparison of three methods for estimating vegetal cover in sagebrush steppe communities. M.S. Thesis, Idaho State University, Pocatello.

This thesis includes three chapters: 1) pre-burn characterization of vegetation on a prescribed burn site, 2) description of a new point interception frame for estimating vegetal cover, and 3) comparison *of cover estimates, precision, and sampling efforts for line interception, point interception, and cover-class estimation in sagebrush steppe.*

Floyd, D.A., and J.E. Anderson. 1982. A new point interception frame for estimating cover of vegetation. Vegetatio 50:185-186.

This paper describes construction and use of a simple, widely applicable point sighting frame that is used for estimating cover of plants or other entities in a community.

Floyd, D.A., and J.E. Anderson. 1983. Baseline vegetation data for a controlled burn site. Pages 182-197 *in* O.D. Markham, editor. Idaho National Engineering Laboratory Radioecology and Ecology Programs 1983 progress report. DOE/ID-12098. National Technical Information Service, Springfield, Virginia.

An area was selected to study the response of vegetation to a prescribed burn at the INEL. Vegetal cover was estimated by point interception.

Floyd, D.A., and J.E. Anderson. 1987. A comparison of three methods for estimating plant cover. Journal of Ecology 75:221-228.

This study compared cover estimates, precision, and sampling efforts for line interception, point interception, and cover-class estimation in sagebrush steppe.

French, N.R., and J.E. Mitchell. 1983. Long-term vegetation changes in permanent quadrats at the Idaho National Engineering Laboratory Site. Bulletin No. 36, University of Idaho Forest, Wildlife and Range Experimental Station, Moscow, Idaho.

In 1975 and 1976, the authors examined 16 permanent quadrats that had been established between 1955 and 1957. These plots were established to sample some vegetation types not sampled by the two main vegetation transects (see Appendix 1, Part A). The authors concluded that "Vegetation dynamics of shrub-dominated communities of the area are complex events resulting from both long-term successional trends following disturbances . . . and short-term fluctuations due primarily to changing seasonal weather patterns." They also found that "Shrub populations are relatively stable regardless of perturbations caused by climate or livestock grazing. It is the understory herbaceous species which respond most to disturbances, and . . . account for a majority of the vegetation dynamics in succession and fluctuations."

Marlette, G.M. 1982. Stability and succession in crested wheatgrass seedings on the Idaho National Engineering Laboratory Site. M.S. Thesis, Idaho State University, Pocatello.

Study sites were established in crested wheatgrass stands that were more than 20 years old. Analysis of seed reserves and vegetation cover in the crested wheatgrass sites and in adjacent communities of native species showed that vegetal cover of dominant species was positively correlated with their seed reserves. Seed banks in crested wheatgrass stands were heavily dominated by crested wheatgrass seeds.

Marlette, G.M., and J.E. Anderson. 1986. Seed banks and propagule dispersal in crested wheatgrass stands. Journal of Applied Ecology 23:161-175.

Areas sown with crested wheatgrass were compared with adjacent native plant communities for plant cover and seed bank composition. Propagules of native species in the seeded areas were sparse, indicating that stand stability may be a consequence of dominance of the seed bank by crested wheatgrass, rather than direct competition for resources.

Pearson, L.C., and S.K. Rope. 1987 Lichens of the Idaho National Engineering Laboratory. DOE/ID-12110. U.S. Department of Energy, Idaho Operations Office, Idaho Falls, Idaho.

This report lists 111 lichen taxa that occur at the INEL. A key to the lichen species and a general description of the genera are included.

Shumar, M.L. 1983a. Factors affecting the distributions of two subspecies of big sagebrush. Pages 172-181 *in* O.D. Markham, editor. Idaho National Engineering Laboratory Radioecology and Ecology Programs 1983 progress report. DOE/ID-12098. National Technical Information Service, Springfield, Virginia.

The study examined the relationships between distributions and habitat characteristics for two subspecies of Artemisia tridentata*, ssp.* wyomingensis *and ssp.* tridentata*. Distributions of the two subspecies were related to a gradient of soil texture.*

Shumar, M.L. 1983b. Sagebrush distributions on the Idaho National Engineering Laboratory. Pages 157-161 *in* O. D. Markham, editor. Idaho National Engineering Laboratory Radioecology and Ecology Programs 1983 progress report. DOE/ID-12098. National Technical Information Service, Springfield, Virginia.

Sagebrush samples were collected within 25 m of roads and trails on the INEL. Samples were identified to species and subspecies using morphological characteristics and ultraviolet spectrophotometry. Three species of Artemisia *and two subspecies of* A. tridentata *were identified. A map of the distribution of these species and subspecies is included.*

Shumar, M.L., and J.E. Anderson. 1986a. Gradient analysis of vegetation dominated by two subspecies of big sagebrush. Journal of Range Management 39:156-160.

Vegetal cover and soil parameters were analyzed for areas having pure and mixed stands of Artemisia tridentata *ssp.* tridentata *and ssp.* wyomingensis*. Distributions of the subspecies were associated with soil texture.*

Shumar, M.L., and J.E. Anderson. 1986b. Water relations of two subspecies of big sagebrush on sand dunes in southeastern Idaho. Northwest Science 60:179-185.

This study compared plant and soil water potentials among dune tops, dune margins, and areas between dunes. Plant water potentials of Artemisia tridentata *ssp.* tridentata *and ssp.* wyomingensis *were different only when soil water potentials associated with each subspecies were also different.*

Sirotnak, J.M. 1990. Intraspecific and interspecific competition in *Leymus cinereus* and *Chrysothamnus nauseosus* in a cold desert community. M.S. Thesis, Idaho State University, Pocatello, Idaho.

Intraspecific competition in Leymus cinereus *and interspecific competition between* L. cinereus *and* Chrysothamnus nauseosus *in a sagebrush steppe were examined through competitor removal experiments.* L. cinereus *had competitive effects on both conspecifics and* C. nauseosus*, but* C. nauseosus *had little effect on* L. cinereus*.*

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