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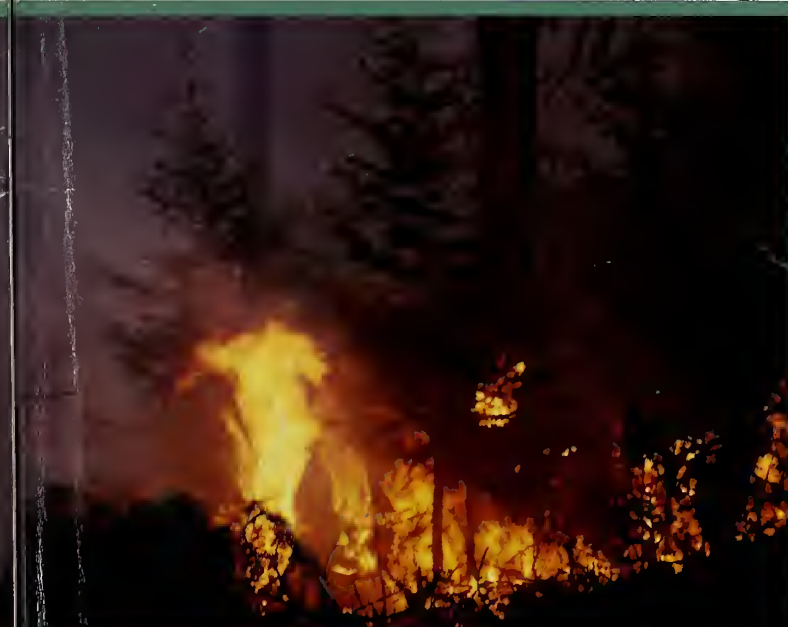
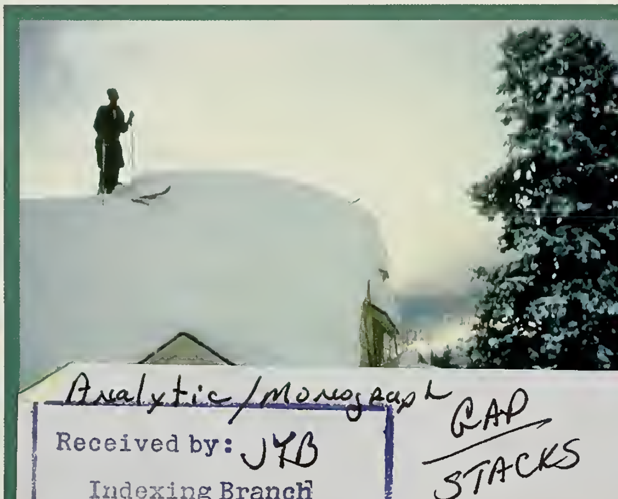
Experimental Forests, Ranges, and Watersheds in the Northern Rocky Mountains:

A Compendium of Outdoor Laboratories in Utah, Idaho, and Montana





The Compilers

Wyman C. Schmidt is Scientist Emeritus with Intermountain Research Station's Research Work Unit on Ecology and Management of Northern Rocky Mountain Forests at the Forestry Sciences Laboratory, Bozeman, MT. Dr. Schmidt's research has focused on the ecology, regeneration processes, stand development, and related cultural practices in coniferous forests of the Mountain West. Much of his research has centered on the relationships of timber, water, animal, and other resources as well as the interaction of cultural practices with insect pests such as western spruce budworm. Dr. Schmidt has also been heavily involved in the international aspects of forest science, particularly the exchange of scientific information for the world's larch and stone pine ecosystems.

Judy L. Friede is Office Automation Clerk and handles administrative details for Intermountain Research Station's Research Work Unit on Ecology and Management of Northern Rocky Mountain Forests at the Forestry Sciences Laboratory, Bozeman, MT. Ms. Friede holds a B.A. degree in English from Montana State University and is currently completing requirements for a masters degree in adult, community, and higher education. Much of her training has focused on writing, both teaching and editing. She provides professional tutoring services for Montana State University's Writing Center and some editing of manuscripts for Intermountain Research Station.

Experimental Forests, Ranges, and Watersheds in the Northern Rocky Mountains: A Compendium of Outdoor Laboratories in Utah, Idaho, and Montana

Compilers
Wyman C. Schmidt
Judy L. Friede

Preface

In 1992, the Northern Alliance was created by leaders from Utah State University, University of Idaho, University of Montana, and the U.S. Forest Service's Intermountain and Northern Regions and Intermountain Research Station. The charter of the Northen Alliance states that its purpose is:

> ...to expand cooperation, improve coordination, and further interdisciplinary participation of natural resource scientists, educators, and managers working in partnership to address changes in natural resource priorities. The Alliance will address natural resource situations in the northern Rocky Mountains to identify potential and appropriate management strategies and will develop coordinated research and education programs to support these strategies. A variety of cooperative ventures are anticipated to result from the additional and more intensive cooperation under the Alliance partnership.

This compendium—one of the cooperative ventures—responds to information needs expressed by these educators, researchers, and natural resource managers. The increasing emphasis on holistic management of the complex ecosystems in the Northern Rocky Mountains makes it imperative that information developed on the various experimental areas be made readily available. The compendium provides an overview of areas with a rich array of research results and key contacts for ecosystem management learning experiences.

The Alliance recognized that no one person or organization has the breadth and depth to provide all the answers for managing these complex and widely diversified ecosystems. The Alliance also recognized that there is a wealth of scientific data and management experience that is too often unknown or not fully recognized for its importance. The most obvious sources of information are the formally established experimental forests, ranges, and watersheds. Information has accumulated from these U.S. Forest Service and university-sponsored experimental areas for much of this century and is available through publications, on-the-ground demonstrations, and other sources such as displays, brochures, videos, and computer programs.

Unfortunately, the who, what, when, and where for these experimental areas are not always well known to many who could use the information in their resource management planning, their search for scientific information, their educational pursuits, and their need for "just show me what happens." The Northern Alliance realized this and saw this compendium as a valuable tool in the development of the Learning Center concept. Learning Centers are an evolving concept in cooperatively gathering and synthesizing information needed for implementing ecosystem management. Long-term ecological research is key to the development of this concept. Experimental areas provide just such needed basic biological and physical science information. Interpretation of this research in the context of current social and economic concerns will establish a scientific focal point of Learning Centers.

To get this process under way, the Northern Alliance requested that we solicit and publish basic information that describes the formally established experimental and demonstration areas in the Northern Rocky Mountains. This publication is the product of many authors—usually the experimental area managers—who are most intimately acquainted with the past and present activities on these areas. We especially acknowledge Louise Kingsbury and Joyce Stoddard of the Intermountain Research Station for their editorial and graphic design suggestions, Jim Vernon of Montana State University for the map graphics, and we thank all who played a role in this publication, particularly the following authors:

Utah

Norbert V. DeByle, Plant Ecologist (Retired). Intermountain Research Station, Logan, Utah

Stanley G. Kitchen, Botanist, E. Durant McArthur, Project Leader, and Stephen B. Monsen, Botanist. Intermountain Research Station, Provo, Utah

James N. Long, Forest Resources Department. Utah State University, Logan, Utah

Idaho

Theresa B. Jain, Forester, and Russell T. Graham, Research Forester. Intermountain Research Station, Moscow, Idaho

Harold L. Osborne, Experimental Forest Manager, and Ross Appelgren, Assistant Experimental Forest Manager. University of Idaho, Moscow, Idaho

John Sloan, Research Forester, and Robert Steele, Research Forester (Retired). Intermountain Research Station, Boise, Idaho

Montana

Clinton E. Carlson, Project Leader, and Raymond C. Shearer, Research Forester. Intermountain Research Station, Missoula, Montana

Rick F. Floch, Resource Forester. Bitterroot National Forest, Darby, Montana

Henry Goetz, Director of Field Stations. Bandy Experimental Ranch and Lubrecht Experimental Forest. Montana Forest and Conservation Experiment Station, University of Montana, Missoula, Montana

Ward W. McCaughey, Research Forester. Intermountain Research Station, Bozeman, Montana

R. Steven Wirt, Assistant Fire Manager Officer. Flathead National Forest, Hungry Horse, Montana

WYMAN C. SCHMIDT
Scientist Emeritus
Intermountain Research Station

JUDY L. FRIEDE
Office Automation Clerk
Intermountain Research Station

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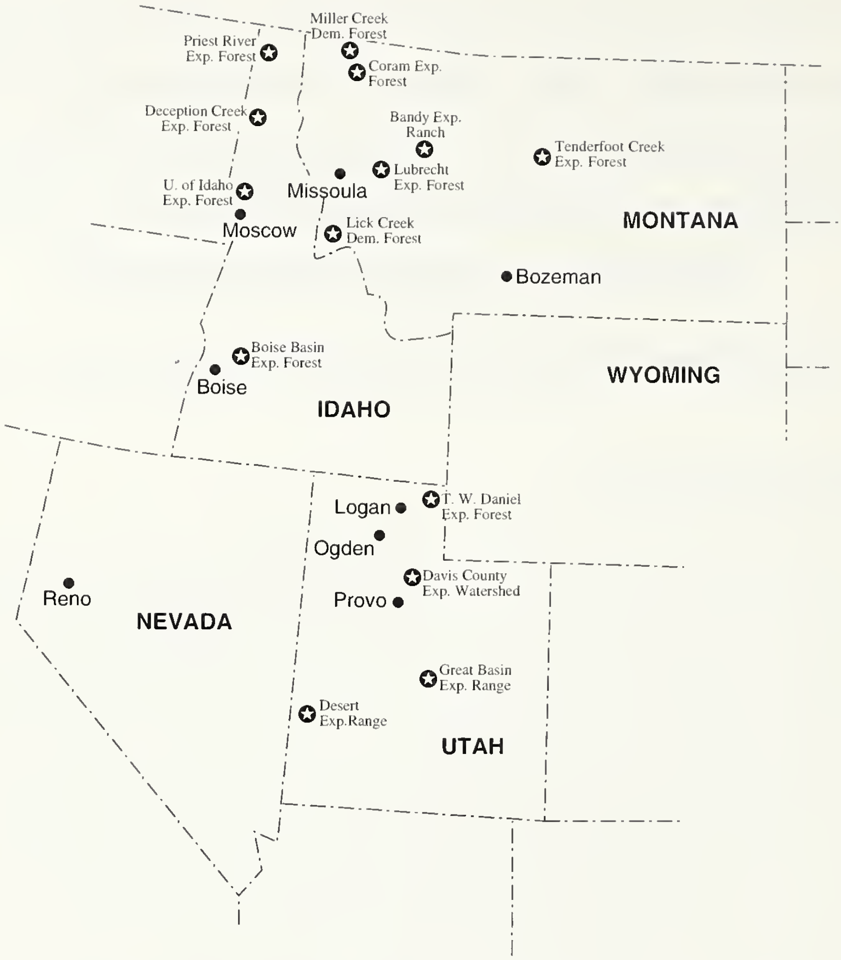
Introduction

Experimental and demonstration areas—dedicated to research in the ecology and management of a wide spectrum of ecosystems in the Northern Rocky Mountains—are the subject of this publication. Fourteen of these outdoor laboratories range from the deserts of southern Utah, the semimaritime forests of northern Idaho, and the subalpine forests of northern Montana. These outdoor laboratories provide basic information about how these ecosystems function. They also demonstrate the effects of various management treatments. These experimental and demonstration areas were formally established by the Forest Service of the U.S. Department of Agriculture, and the three university members of the Northern Alliance on Federal and State lands in Utah, Idaho, and Montana. Two were established early in this century, eight in the 1930's, one in the early 1960's, and three in the late 1980's and early 1990's. All offer unique and comprehensive education opportunities for short- and long-term research, and continuity needed for long-term studies and demonstrations.

Ecosystems represented in these experimental and demonstration areas vary widely both geographically and ecologically. As a result, research emphases have also varied spatially and temporally, often in response to urgent needs concerning watershed management, forest management, range management, wildlife habitat management, and numerous combinations of these with other resource values. All of these areas are open to visitors and offer opportunities for collaborative research and demonstration.

Although this publication focuses on 14 formally established experimental and demonstration areas in Utah, Idaho, and Montana, we emphasize that many other such areas beyond the boundaries of these areas function as satellites. They embrace a wide variety of ecological conditions and provide opportunities for more extensive experiments not always possible on the more limited experimental areas described here. In addition to the experimental areas of the Northern Alliance members, the Agricultural Research Service has three formally established experimental areas in Montana and Idaho where domestic livestock, range, and watershed interactions are researched and demonstrated. These areas



Distribution of experimental and demonstration forests, ranges, and watersheds in Utah, Idaho, and Montana.

near Miles City, Montana, and Dubois and Boise, Idaho, are described briefly in this publication.

All of the experimental areas included in this paper are widely recognized regionally and nationally, and two—Coram Experimental Forest and Desert Experimental Range—are Biosphere Reserves. Biosphere Reserves are an international network of experimental areas representing major ecosystems on Earth. They are assigned special international recognition by the United Nations Educational, Scientific, and Cultural Organization (UNESCO), under the Man and the Biosphere Reserve (MAB) program.

Seven of the experimental areas have portions reserved as Research Natural Areas where natural processes in the absence of intentional manipulations can be observed and studied over long periods. Research Natural Areas are not restricted to those formally established on experimental areas. Instead, they are systematically being established throughout the Northern Rockies in a coordinated effort by public agencies such as the U.S. Forest Service, universities, Bureau of Land Management, and private organizations such as the

Nature Conservancy within each of the three states of Utah, Idaho, and Montana. Cooperation between these organizations has been the key to establishing or proposing about 250 Research Natural Areas within these three states. Sources of information about Research Natural Areas are listed at the end of this compendium.

Experimental and demonstration areas established by private organizations and state agencies are not included in this directory. Examples include the Theodore Roosevelt Memorial Ranch established by the Boone and Crockett Club in northern Montana, numerous wildlife and waterfowl management areas, and state experimental areas. They were beyond the scope of this effort but would be useful contributions to future informational publications, perhaps on a state-by-state basis.

In these changing times, new demands and priorities for management are key issues facing most people involved with natural resources. These issues include landscape management, fragmentation, biodiversity, and sustainable ecological systems. Information is often available but is sometimes difficult to find or access. Therefore, this publication, in an effort to help meet these challenges, seeks to provide a useful summary of field locations, key learning opportunities, and contact persons for the experimental areas in the Northern Rocky Mountains.

We intend that this publication will further improve the communication between scientists, educators, managers, and the public, and provide part of the framework for developing Ecosystem Management Learning Centers in the Northern Rockies. This information will help build a common understanding of ecosystem management principles, promote ecological awareness based on sound scientific knowledge, and present readers with new information, techniques, and strategies to adapt research results to management, consistent with the new resource demands and priorities.

A summary of experimental areas in Utah, Idaho, and Montana.

Location and name	Year established	Management	Major flora
Utah			
Davis County Experimental Watershed	1933	U.S. Forest Service	Sagebrush, Gambel oak, Bigtooth maple, Mountain mahogany, Subalpine fir, Engelmann spruce, Aspen
Desert Experimental Range	1912	U.S. Forest Service	Shadscale, Winterfat, Budsage, Low rabbitbrush, Ricegrass, Gooseberry, Globemallow, Sagebrush, Juniper
Great Basin Experimental Range	1933	U.S. Forest Service	Herbland, Oakbrush, Pinyon-juniper, Aspen, Engelmann spruce, Subalpine fir, White fir

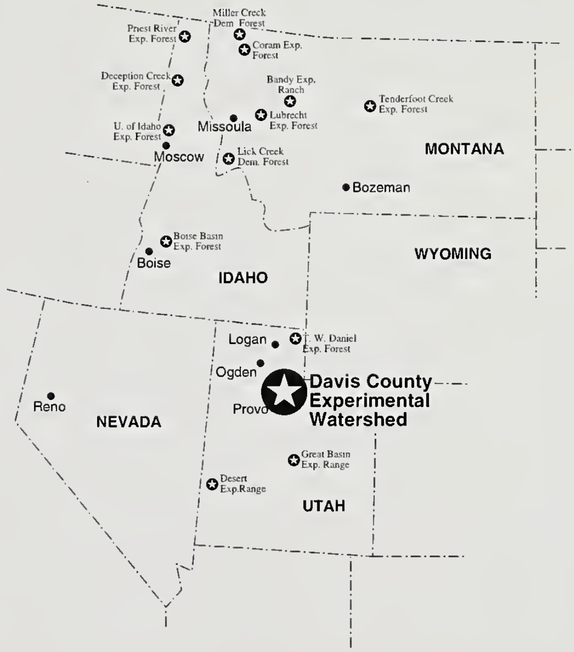
(con.)

Location and name	Year established	Management	Major flora
T. W. Daniel Experimental Forest	1936	Utah State University	Engelmann spruce, Douglas-fir, Lodgepole pine, Aspen, Limber pine, Subalpine fir
Idaho			
Boise Basin Experimental Forest	1933	U.S. Forest Service	Ponderosa pine, Douglas-fir, Aspen, Mountain shrubs
Deception Creek Experimental Forest	1932	U.S. Forest Service	Western hemlock, Grand fir, Western redcedar, Douglas-fir, Western larch, Western white pine
Priest River Experimental Forest	1911	U.S. Forest Service	Western white pine, Grand fir, Subalpine fir, Douglas-fir, Western hemlock, Western redcedar
University of Idaho Experimental Forest	1933	University of Idaho	Grand fir, Douglas-fir, Western redcedar, Subalpine fir, Ponderosa pine
Reynolds Creek Experimental Watershed	1960	U.S. Agricultural Research Service	Sagebrush spp., Subalpine fir, Douglas-fir, Aspen
U.S. Sheep Experiment Station	1915	U.S. Agricultural Research Service	Sagebrush spp., Bluebunch wheatgrass, Idaho fescue, Mountain bromegrass
Montana			
Bandy Experimental Ranch	1989	University of Montana	Douglas-fir, Western larch, Ponderosa pine, Aspen, Lodgepole pine, Riparian wetland communities, Fescue—wheatgrass grasslands
Coram Experimental Forest	1933	U.S. Forest Service	Western larch, Douglas-fir, Engelmann spruce, Subalpine fir, Lodgepole pine, Paper birch
Lick Creek Ecosystem Management/Research Demonstration Area	1991	U.S. Forest Service	Ponderosa pine, Douglas-fir, Grand fir, Lodgepole pine, Subalpine fir, Willow, Aspen
Lubrecht Experimental Forest	1937	University of Montana	Ponderosa pine, Douglas-fir, Western larch, Lodgepole pine, Engelmann spruce, Subalpine fir
Miller Creek Demonstration Forest	1989	U.S. Forest Service	Western larch, Engelmann spruce, Douglas-fir, Subalpine fir, Western redcedar, Lodgepole pine
Tenderfoot Creek Experimental Forest	1961	U.S. Forest Service	Lodgepole pine, Subalpine fir, Engelmann spruce, Whitebark pine
Fort Keogh Livestock and Range Research Laboratory	1924	U.S. Agricultural Research Service	Native grass, forb, and shrublands typical of the Northern Great Plains

Utah

Davis County Experimental Watershed

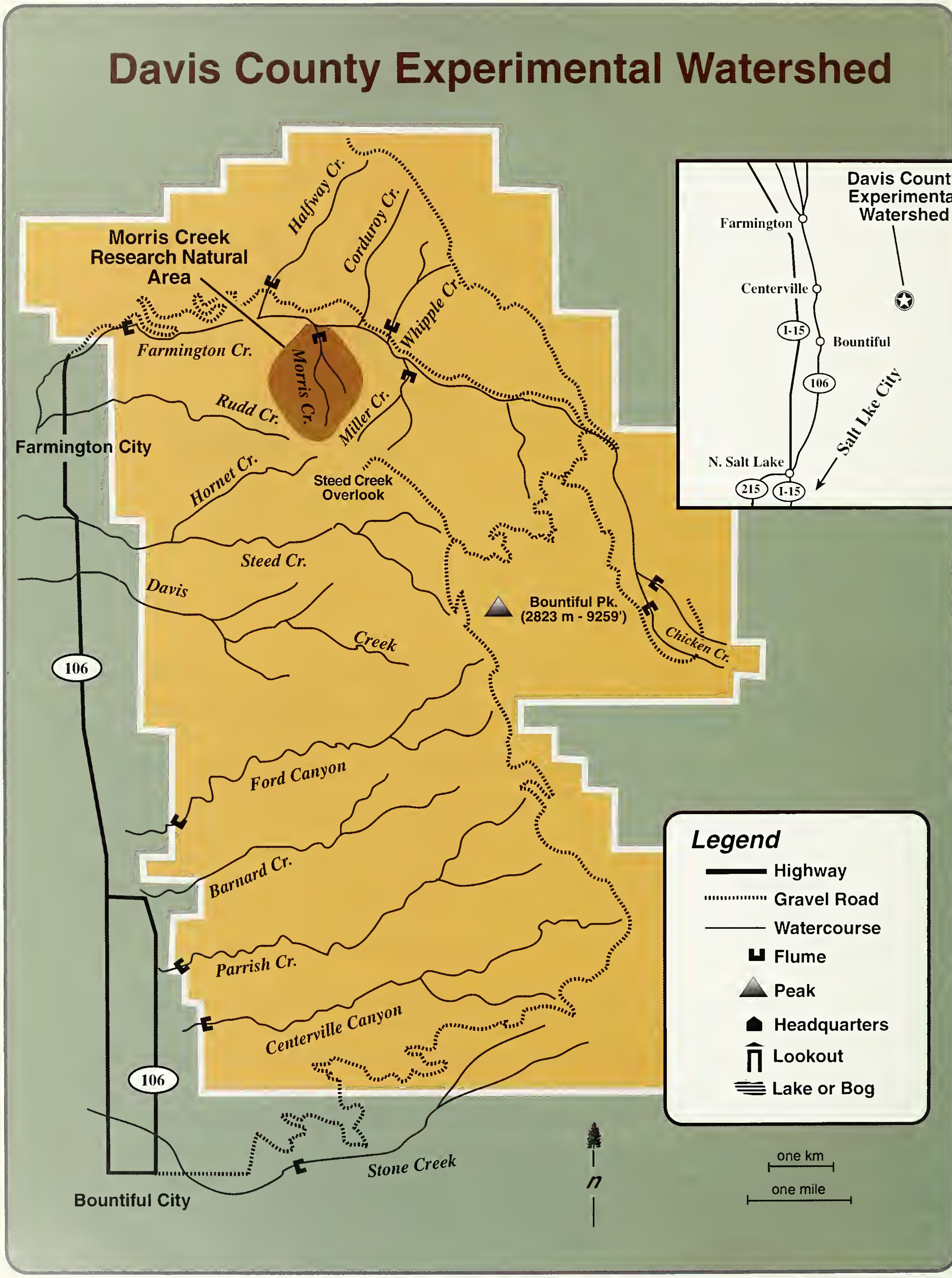
Norbert V. DeByle



The Davis County Experimental Watershed came into existence in 1933 as part of the Wasatch National Forest, 20 years before its formal designation in April 1953. Watershed and related research was conducted here from 1933 through 1981. All research was done or sponsored by the U.S. Forest Service, through what is now the Intermountain Research Station.

From 1847 to 1930, mismanagement of watershed lands in Utah, especially in this section of the Wasatch Mountains, caused serious problems with floods of mud, rock, and water from intense summer rainstorms. Fire, logging, and severe overgrazing had denuded the land of its protective vegetal cover. For the first time since Lake Bonneville receded some 10,000 years ago, these watersheds could no longer absorb intense rainfall. Increasingly severe flooding was destroying developed property in the growing communities at the mouths of most perennial streams. After the causes were recognized, land managers began a watershed restoration program that consisted of increased fire protection, greatly restricted grazing, contour trenching, and reseeding. Researchers set out to determine the most effective rehabilitation methods. Contour trenching and reseeding especially required research, testing, and evaluating before their later widespread application on flood-source areas in the Intermountain West. The Davis County site was the area chosen for this and related watershed protection research.

Locally, the boundaries of the Wasatch National Forest expanded through purchase of privately owned mountain lands. The Forest Service eliminated grazing of domestic livestock on the west-facing drainages of this portion of the Wasatch Mountains. On approximately 526 ha (1,300 acres) of flood-source land, crews contour-trenched and seeded between 1933 and 1939. They established stream gauging stations in Ricks, Parrish, Centerville, and Farmington Creeks, and on most perennial tributaries of Farmington Creek. Researchers established a network of climatic stations and snow courses and installed a group of runoff-erosion plots at the head of Parrish Canyon. Data were gathered


Davis County Experimental Watershed
Morris Creek Research Natural Area
Halfway Cr.
Corduroy Cr.
Whipple Cr.
Farmington Cr.
Morris Cr.
Rudd Cr.
Miller Cr.
Farmington City
Hornet Cr.
Steed Creek Overlook
Steed Cr.
Davis
Creek
Bountiful Pk. (2823 m - 9259')
Chicken Cr.
106
Ford Canyon
Barnard Cr.
Parrish Cr.
Centerville Canyon
106
Stone Creek
Bountiful City
Davis County Experimental Watershed
Farmington
Centerville
I-15
Bountiful
106
Salt Lke City
N. Salt Lake
215
I-15
Legend
Highway
Gravel Road
Watercourse
Flume
Peak
Headquarters
Lookout
Lake or Bog
one km
one mile
n

from many of these installations until the 1960's. Extensive data on watershed cover also were accumulated.

The success of the watershed rehabilitation program and accompanying research is self-evident: no floods have emanated from the treated areas since restoration even though intense summer storms continue to occur on what once were flood-source areas. Land treatments restored watershed stability and flood control. This program was documented in 48 publications, all of which are annotated by DeByle and Hookano (1973).

Later research on the Davis County Experimental Watershed had a different objective. Beginning in 1960, major emphasis shifted to water yields in this semiarid region. Research on practices that might increase yields without adversely affecting water quality was conducted here during the following two decades. This change in research emphasis, and the closure of the Farmington Research Center, forced termination of data gathering on a long-term basis from most of the earlier network of stream gauges, weather stations, and runoff plots. Money and effort were diverted to water yield research.

Crews contour-trenched the top of Halfway Creek in 1964, gauged the Chicken Creek watersheds in 1965, and established other weather stations. A few selected gauges, stations, and plots on the old network continued to be used for water yield research, now being conducted out of the Forestry Sciences Laboratory in Logan, Utah, some 97 km (60 miles) away.

This water yield research included evaluations of the effects of contour trenches on streamflow, of aspen harvesting on water quality and yields, and of water consumption by a variety of vegetation types. This new research program resulted in at least 46 publications by 1984.

For 40 years, several hundred scientists, wildland managers, and members of the public were informed of the history of the Davis County Experimental Watershed, its rehabilitation, and the success of the research programs through many personal contacts, technical and popular publications, and numerous tours. Summer field trips were conducted almost weekly for one group or another until the mid-1970's. There were many foreign visitors; the Davis County Experimental Watershed had become internationally known as an example of successful rehabilitation of abused land.

Water quality and yield research was terminated in 1976, but some data continued to be gathered until 1981. Then the Davis County Experimental Watershed fell into an inactive status. The area is managed today by the Salt Lake Ranger District of the Wasatch-Cache National Forest, primarily as a protected watershed with limited recreational opportunities.

Climate

The climate is continental. Summer and early autumn are warm and dry. Summer precipitation occurs from local thunderstorms, which are more common at high elevations. These storms can be intense; for example, one storm, a Utah record for many years, delivered 18 mm (0.7 inch) of rain in 5 minutes on the Davis County Experimental Watershed in 1947. Late autumn, winter, and spring seasons are usually cool and moist. The bulk of the annual precipitation falls during these seasons as snow or gentle rain. Snowpacks holding 760 mm (30 inches) or more of water commonly accumulate at the higher elevations.

Because this is a west-facing mountain slope, elevation has a marked effect on precipitation here. About 64 km (40 miles) west, in the valley of Great Salt Lake, only 100 or 127 mm (4 or 5 inches) of precipitation falls annually. Farmington, at the base of these mountains, receives about 500 mm (20 inches); whereas 1,270 mm (50 inches) or more of precipitation falls at the highest elevations of the Davis County Experimental Watershed.

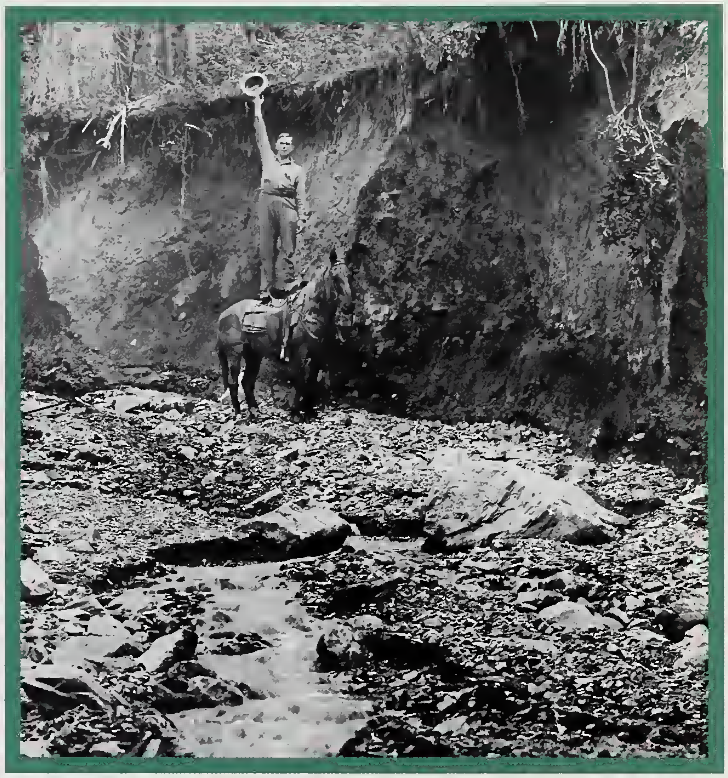
Soils and Geology

Near the west boundary of the Davis County Experimental Watershed, sediments from Lake Bonneville and alluvium from the streams dominate the landscape below and to the west of the upper shorelines (terraces) of this extinct Pleistocene lake. Pre-Cambrian era rocks are exposed above these terraces. Most are metamorphic gneisses and schists. Many pegmatite and granite dikes have intruded into this metamorphic rock complex.

On the eastern portion of the watershed, in the Chicken Creek area, much younger (Eocene epoch) sedimentary rocks, including reddish conglomerates, sandstone, and shales, lie atop the old rocks on the back of a westward tilted fault block.

Folding, faulting, and thousands of feet of uplift have given rise to these Wasatch Mountains. Most of this occurred between late Eocene and Quaternary time, both before and after deposition of the reddish sedimentary rocks mentioned above. Many of the faults are still active, as evidenced by frequent earthquakes along the Wasatch Front.

Most of the soils on the Davis County Experimental Watershed have developed in place from the rocks now underlying them. Soils derived from the metamorphic rocks are medium to relatively fine textured. Those developed from the reddish sedimentary rocks are fine textured. Stream valleys and the area below the Lake Bonneville terraces are covered with transported and water-sorted soils materials of varying properties. Depth of soil varies from virtually nothing on exposed ridges and outcrops to deep mantles with excellent moisture-holding capacities in the valleys.



Early range and watershed construction foreman, Harry Pledger, standing atop his horse, demonstrated the depth of damage from a 1936 flood on Whipple Creek in Farmington Canyon on the Wasatch National Forest in Utah. All along the Wasatch Front, floods for several decades destroyed hundreds of buildings below the foothills. To hold back both water and destructive mud and rock slides, crews dug miles of trenches in the Davis County Experimental Watershed. Today those trenches are still functional and visible—like festoons across the mountainside.

Main Communities

Grasses and scattered sagebrush (*Artemisia*) occupy the lower, west-facing, very dry sites below the Lake Bonneville terraces. Above the terraces, a mountain brush type predominates. This type, made up of Gambel oak (*Quercus gambelii*), bigtooth maple (*Acer grandidentatum*), mountain-mahogany (*Cercocarpus ledifolius*), and others, occupies approximately a 600 m (2,000 ft) elevational band. The mountain brush type extends to nearly the top of south-facing slopes, but stops below about 1,800 m (6,000 ft) elevation on north- and east-facing slopes. Above this, on all but the harshest sites, are conifers, dominated with subalpine fir (*Abies lasiocarpa*) and some Engelmann spruce (*Picea engelmannii*). There are also extensive areas of the aspen (*Populus tremuloides*) type in this forested zone. On harsh, high-elevation, wind-swept sites the mountain brush and the forested types grade into a subalpine community of dwarf shrubs, forbs, and grasses.

Data Bases

In 1986, the many years of streamflow and climatic data, photographs, and other ancillary records from the Davis County Experimental Watershed files were archived in the Merrill Library at Utah State University in Logan, Utah. Also in those archives is one copy each of all the available publications derived from work done on the watershed.

Examples of Research

- Control of erosion and overland flow through watershed rehabilitation
- Contour trenches:
  - Design criteria
  - Their effects on overland flow and erosion
  - Their effects on soil water contents, snowpacks, and streamflow
- Analyses and descriptions of mud-rock flows from Wasatch Mountain watersheds
- Runoff and erosion from small plots within the flood-source area
- Infiltration and erosion as influenced by vegetation
- Soil moisture depletion and evapotranspiration on mountain watersheds
- Effects of vegetation removal or conversion on evapotranspiration
- Aspen clearcutting—effects on:
  - Evapotranspiration and streamflow (yield and quality)
  - Breeding bird populations
  - Elk and snowshoe hare use of the habitat
  - Forage production and aspen regeneration

More than three decades of data from snow sampling enabled scientists and land managers to rehabilitate Davis County watersheds and to predict spring and summer water yields—important for the towns and large populations of this semiarid region.

Facilities

All climatic stations, runoff plots, and stream gauging stations that were installed through the years have been closed, the instrumentation removed, and, to the extent possible, these sites have been returned to an undisturbed condition. However, the flumes and stilling wells at stream gauging stations have been left intact, thus permitting possible reactivation of these stations at minimal cost.

The headquarters buildings (formerly the Wasatch Research Center) in Farmington were transferred to the Wasatch-Cache National Forest. They now serve as a work station for the Salt Lake Ranger District.

A road network permits access to much of the Davis County Experimental Watershed (see map). A portion of Farmington Canyon and northward is open year-round. The rest is blocked with snow from November through June.

Location

The Davis County Experimental Watershed consists of approximately 7,280 ha (18,000 acres) in the Wasatch Mountains immediately east of Farmington and Bountiful in northern Utah. It is in Townships 2 and 3 North, Range 1 East of the Salt Lake meridian.

All of the Davis County Experimental Watershed drains westward to the Salt Lake valley, from elevations near 2,800 m (9,200 ft) to the valley floor near 1,370 m (4,500 ft). This is steep, mountainous land with stream gradients up to 42 percent. It is dissected with eight major drainages (Farmington, Rudd, Steed, Davis, Ricks, Barnard, Parrish, and Centerville Creeks). Farmington is the largest with 2,590 ha (6,400 acres) and is fed with many permanent tributaries, 12 of which have been gauged.

Suggested Reading

Anonymous (by N.V. DeByle). 1970. Your tour of Davis County Experimental Watershed. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. Brochure.

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Johnston, Robert S. 1984. Effect of small aspen clearcuts on water yield and water quality. Res. Pap. INT-333. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 9 p.

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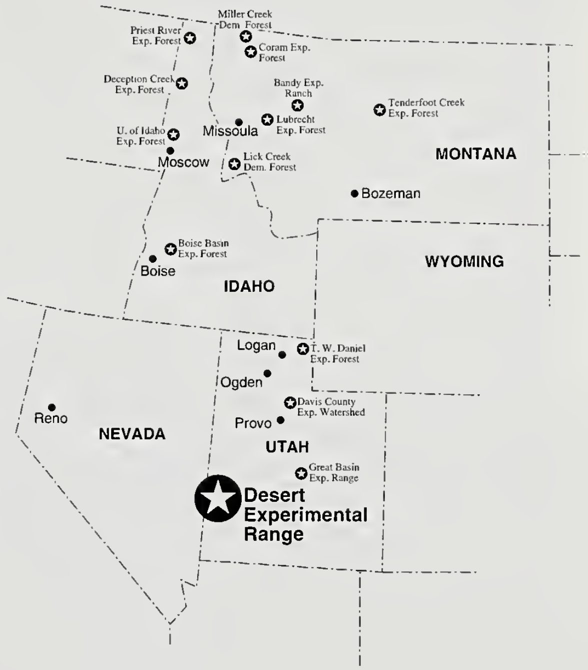
Contact Address

Director
Intermountain Research Station
324 25th Street
Ogden, Utah 84401
Tel: (801) 625-5407
FAX: (801) 625-5129

Desert Experimental Range

Stanley G. Kitchen and E. Durant McArthur



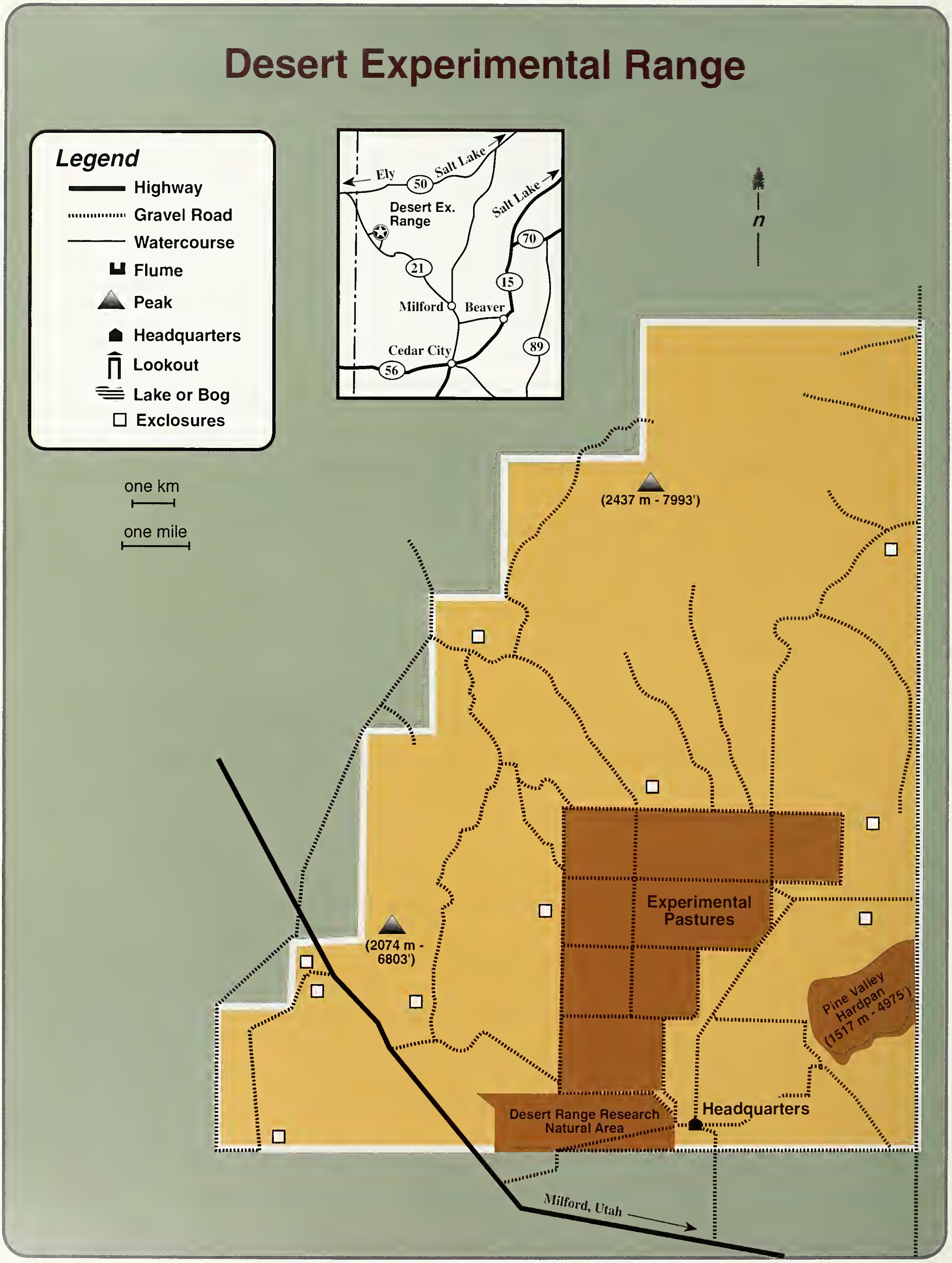
The Desert Experimental Range is geologically and floristically representative of approximately 200,000 km^2 (77,220 miles^2) of the Great Basin, an arid region of the Western United States comprising a series of north- and south-aligned ranges and closed basins. It was established in 1933 when President Herbert Hoover withdrew 225 km^2 (87 mile^2 sections) from the public domain "as an agricultural range experiment station." Construction of an office, living quarters, support buildings, well, tennis court, major roads, and over 190 km (118 miles) of fence were completed before 1935 by a large camp of the Civilian Conservation Corps.

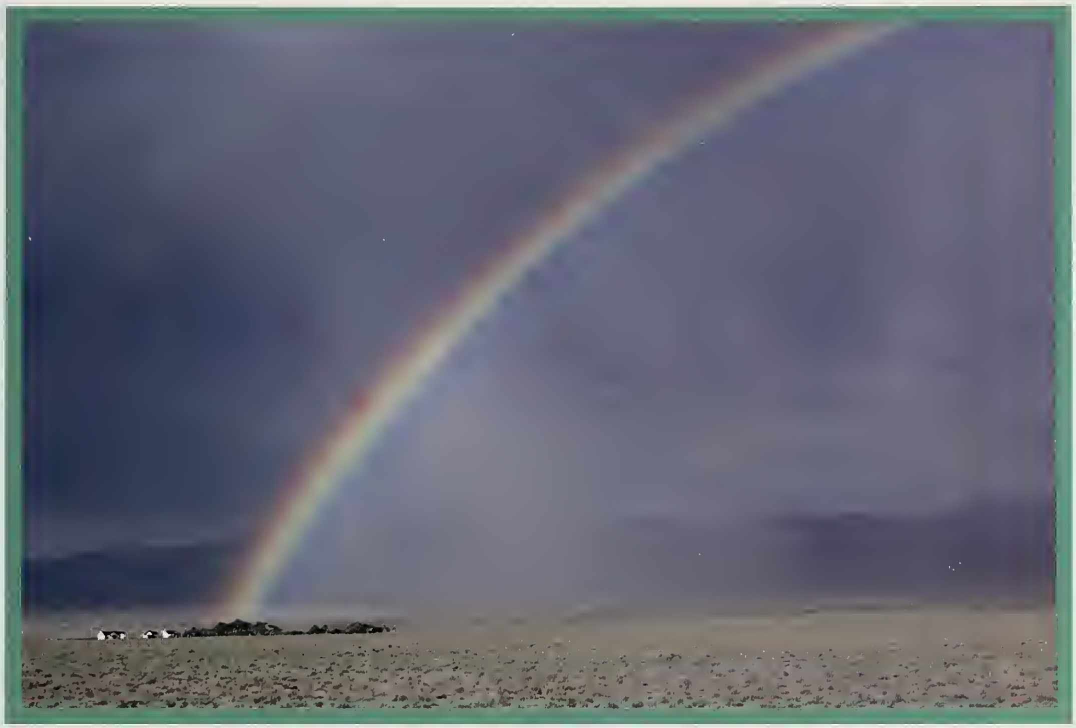
These facilities have allowed the Desert Experimental Range to serve not only as a year-round research center at a remote location, but also as a range ecology educational facility of international significance. Appropriately, in 1976 the Desert Experimental Range was designated a Biosphere Reserve by the United Nations Educational, Scientific, and Culture Organization (UNESCO) under the Man and the Biosphere (MAB) program. Currently, it participates as one of a handful of Biosphere Reserves representative of cold-desert biomes worldwide and is unique in this respect in the Western Hemisphere.

Sheep grazing studies began in the winter of 1934/1935 to study the economic and ecological impacts of grazing at different intensities, seasons, and frequencies. The core of those grazing treatments has been maintained each winter for 59 years. Cattle grazing was added later. Several permanent exclosures ranging in size from 0.4 to 740 ha (1.0 to 1,828 acres) are scattered throughout the Desert Experimental Range on all plant community types permitting direct examination of the effects of grazing and nonuse.

As time passed, research at the range broadened to include work with insects, birds, rodents, pronghorn, soil crusts, soils, and weather.

Desert Experimental Range





The Desert Experimental Range headquarters complex sits as a "pot of gold" at the end of a rainbow, a product of a brief summer storm.

Climate

The climate is cold desert, with cold winters and warm summers. Mean January temperature is –3.5 °C (26 °F), and for July, 23.3 °C (74 °F). Mean daily range in temperature is 18 °C (32 °F), though daily swings of 28 °C (50 °F) are not unusual in the summer. The average frost-free period is from about mid-May to late-September (125 days).

Mean annual precipitation at valley sites is 157 mm (6.2 inches), about half of which falls from May to September. Generally, this warm season precipitation does not reach the root zone (deeper than 8 cm, 3.1 inches) of most species, and quickly evaporates, providing little value for plant growth. Cool-season precipitation generally reaches to depths of 15 to 70 cm (6 to 28 inches). Most of this moisture is available to plants during the growing season. Precipitation on surrounding hills can be as much as 50 percent higher than valley locations.

Soils

The mountain ranges surrounding the Desert Experimental Range are composed primarily of sedimentary rock of Paleozoic origin. Dolomite, limestone, and quartzite are the primary parent materials of soil formation. Some Early Tertiary igneous extrusions are also present. Soils are Aridisols (calciothids and camborthids) and Entisols (torrifluvents and torripsamments). They are mostly gravelly loams, sandy loams, and loamy sands with low

Sheep thrive during winter months at the Desert Experimental Range but can have long-term impacts on desert communities.

clay content except for the playa in the valley bottom. Soil pH averages around 8.0 and salt concentrations are low in the upper 30 to 40 cm (12 to 16 inches). Carbonate concentration is relatively high in most series.

Soil disturbance is important on local and landscape scales. For example, rodents occupy and continually disturb 3 to 12 m (10 to 40 ft) diameter patches. This modifies soil horizon development and thus alters vegetative composition. These patches create a distinctly spotted appearance on aerial photographs (1:30,000). On a larger scale, a small Pleistocene lake filled the lower regions of Pine Valley and left still recognizable shorelines and the barren hardpan. Infrequent but intense summer storms scour ephemeral washes moving sediments down the long alluvial fans that skirt the rocky peaks.

Main Communities

Native vegetation for the alluvial slopes and valley bottom that make up about 75 percent of the Desert Experimental Range comprises a relatively few number of perennial shrubs, grasses, and forbs, commonly referred to as the salt-desert shrub vegetative community. Dominant shrub species are short, approximately 25 cm (10 inches), and include shadscale (*Atriplex confertifolia*), winterfat (*Ceratoides lanata*), budsage (*Artemisia spinescens*), and low rabbitbrush (*Chrysothamnus greenei*). Primary grasses include Indian ricegrass (*Oryzopsis hymenoides*) and bottlebrush squirreltail (*Sitanion hystrix*), both cool-season bunchgrasses, and the warm-season grasses of galleta grass (*Hilaria jamesii*), sand dropseed (*Sporobolus cryptandrus*), three-awn (*Aristida purpurea*), and blue grama (*Bouteloua gracilis*). Gooseberryleaf globemallow (*Sphaeralcea grossulariifolia*) is the most widespread perennial forb. Important annuals include cheatgrass (*Bromus tectorum*), halogeton (*Halogeton glomeratus*), and Russian thistle (*Salsola iberica*), all Old World introductions. Numerous distinct combinations of two to eight dominant species and near monocultures are common.

On the shallow soils of foothills and mountain slopes, black sagebrush (*Artemisia nova*), Utah juniper (*Juniperus osteosperma*), singleleaf pinyon pine (*Pinus monophylla*), and littleleaf cercocarpus (*Cercocarpus intricatus*) are important and often dominate. Numerous species of shrubs, grasses, and forbs result in communities with considerably greater floristic and structural diversity than those in valley locations.

Changes in grazed and ungrazed communities have been monitored since 1935 providing researchers with the data needed to test theories of community dynamics.

Data Bases

Climate

Daily precipitation and daily temperatures (minimum and maximum) are available from 1934 to 1981. Collection of hourly data on precipitation, air and soil temperatures, soil moisture, solar radiation, and wind speed and direction began in 1993.

Vegetation

Field drawn vegetation maps were completed in 1934 and 1974. Community composition data of paired grazed and exclosed units were taken periodically from 1934 to 1980. Biomass production data are also available.

Maps and Photographs

Maps reveal grazing treatments, roads, vegetative communities, and fences. Aerial photographs were taken in 1953 (1:60,000), 1970 (1:30,000), and 1973 (color 1:15,000). A soils map is available.

Publications

A master file of publications resides at the contact address. Publications cover such topics as vegetation sampling techniques, plant ecology and taxonomy, wildlife ecology, and range management.

Examples of Research

- Disturbance and successional processes in North American cold desert plant communities
- Desertification
- Winter sheep management on the cold desert
- Rodent ecology
- Pronghorn biology and management
- Cryptobiotic soil crust ecology
- Avian and mammalian population dynamics

Facilities

Three dwellings with running water, electricity, telephone, and oil furnaces are maintained at the Desert Experimental Range. Support structures include power house, garages, shops, horse barn, and well house. Potable water is pumped from a 150 m (500 ft) deep well and stored in a 120,000 liter (32,000 gal) storage tank. No lab facilities are presently available. Trailer pads with sewer and water hookups are available. An automated weather station is maintained at the headquarters. Use of the facilities must be scheduled in advance.

Location

The Desert Experimental Range is in Pine Valley approximately 70 km (43 miles) west of Milford, Utah, on State Road 21 (lat. 38°40′ N., long. 113°45′ W.). Elevation ranges from 1,547 to 2,565 m (5,074 to 8,413 ft). The headquarters complex is approximately 4 km (2.5 miles) north of Highway 21 on an improved gravel road accessible by ordinary vehicles year round. Travel time to the Desert Experimental Range is approximately 4 hours from Provo, Utah, and 2 hours from Cedar City, Utah.

Suggested Reading

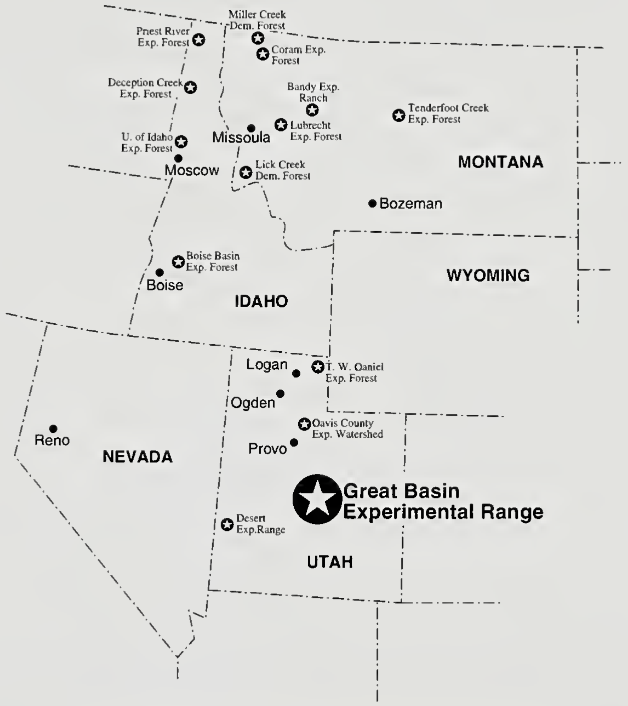
Blaisdell, James P.; Holmgren, Ralph C. 1984. Managing Intermountain rangelands: salt-desert shrub ranges. Gen. Tech. Rep. INT-163. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 52 p.

Contact Address

Project Leader or Site Manager
Shrub Sciences Laboratory
735 North 500 East
Provo, Utah 84606
Tel: (801) 377-5717
FAX: (801) 375-6968

Great Basin Experimental Range

E. Durant McArthur and Stephen B. Monsen

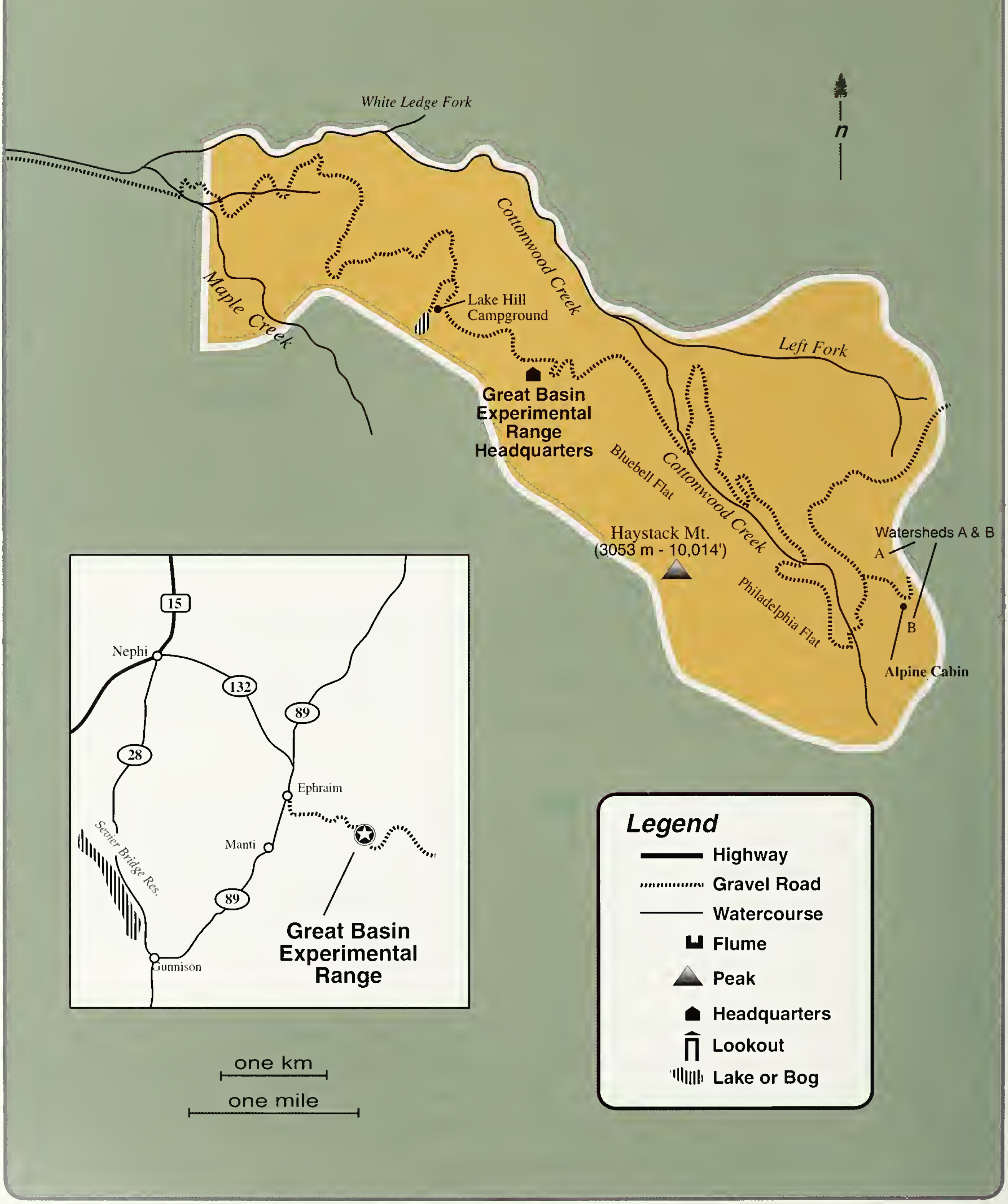


The Great Basin Experimental Range has been a focal point for research on the ecology and management of watersheds and rangelands as well as on silvicultural problems since it was established as the Utah Experiment Station in 1912. Subsequent names for this research area have been Great Basin Experiment Station (1918-1930), Great Basin Branch Experiment Station (1930-1947), Great Basin Research Center (1947-1970), and Great Basin Experimental Range (1970-present). Until it was formally established as the Great Basin Experimental Range in 1970 under the authority of the Secretary of Agriculture, it enjoyed the status as an experimental area under the Secretary of Agriculture's Regulation U-4. It was one of the key elements that coalesced into the Intermountain Forest and Range Experiment Station (now Intermountain Research Station) when the nationwide network of geographical Forest Service Research Stations was established in 1930.

The Great Basin Experimental Range consists of approximately 1,861 ha (4,597 acres). It ranges in elevation from 2,070 to 2,710 m (6,790 to 8,889 ft). The range is about 8 km (5 miles) long and varies in width from about 1.5 to 4 km (1 to 2.5 miles). The buildings at the headquarters complex sit on a 32 ha (79 acres) compound. The headquarters complex is currently (since 1992) managed by Snow College under a special use permit, and the area is now known as the Great Basin Environmental Education Center.

The Great Basin Experimental Range lies on the west face of the Wasatch Plateau wholly within the Sanpete Ranger District of the Manti-LaSal National Forest. A network of research sites, including long-term exclosures and the Elk Knoll Research Natural Area, extend out from the Great Basin Experimental Range into other Forest Service lands on both the Sanpete and Ferron Ranger Districts.

Great Basin Experimental Range



Headquarters complex of Great Basin Experimental Range at the time of dedication of Great Basin Environmental Education Center in 1993.

A leading cause for the establishment of the Great Basin Experimental Range was a host of requests to the Secretary of Agriculture during the last part of the 19th century and early part of the 20th century. The local populace wanted scientific study of summertime floods that originated on mountain watersheds and were seriously damaging farms and rural communities in the West. These floods, usually including mud and rocks, were especially severe in the Sanpete and Emery County communities below the Wasatch Plateau.

The Great Basin Experimental Range may be regarded as one of the few pioneering sites that led to the establishment of the discipline of range management. Several young researchers and technicians began and developed their careers here prior to achieving prominence as rangeland or forestry researchers, managers, and academicians. Their featured research includes: (1) watershed stability and rehabilitation, including the oldest continuously monitored paired watersheds in the world; (2) rangeland studies, including impacts of relative levels of grazing pressure on ecosystems and individual plants, and rangeland restoration, including development and evaluation of plant materials and of plant establishment techniques; (3) basic studies on plant physiology and nutrition, climate, silviculture, and plant/rodent interactions; and (4) wildlife habitat restoration, including selection and development of woody and herbaceous plant species and techniques to culture and plant these species.

Climate

The climate of the Great Basin Experimental Range varies as would be expected for a site that changes in elevation by some 700 m (2,300 ft) in the space of 8 km (5 miles). The average annual precipitation ranges from about 300 mm (11.8 inches) at the lowest elevation (west end) to more than 750 mm (29.5 inches) at the upper elevations (east end). At lower elevations, about half of the precipitation falls as snow during the November 1 to May 1 winter season with that figure increasing over three-fourths at the high elevations. June and September are the driest months. Summer thunder storms are common during July and early August. Temperatures range from –36 to 37 °C (–33 to 99 °F). Mean January temperature across the experimental range is –8 °C (18 °F); mean July temperature is 13 °C (55 °F). Maximum and minimum temperature differences within the experimental range usually vary from 3 to 10 °C (5 to 18 °F) on any one day depending on elevation and site.

Deep snow at headquarters of Great Basin Experimental Range, winter 1951 to 1952.

Visiting scientists from Russia with Forest Service researchers overlooking a watershed at Great Basin Experimental Range, 1979.

Soils

Soils at the lower elevations of the Great Basin Experimental Range are commonly derived from the North Horn formation and vary from silt loam and loam at the surface to clay loam in the subsoils. At the upper part of the range, soils are derived mainly from Flagstaff limestone and are mostly clay loam in texture. In general, the soils are productive, have good water-holding qualities, and are only moderately erodible.

Main Communities

The 1970 establishment report of the Great Basin Experimental Range listed the following major plant communities:

Plant community	Hectares	(acres)	Percent of area
Barren and waste	17	(42)	01
Herbland	717	(1,771)	39
Oakbrush and pinyon-juniper (*Quercus* and *Pinus-juniperus*)	280	(692)	15
Aspen (*Populus tremuloides*)	251	(620)	13
Engelmann spruce (*Picea engelmannii*)	287	(709)	15
Subalpine fir (*Abies lasiocarpa*)	102	(252)	05
White fir (*Abies concolor*)	207	(511)	11

Alpine cabin and outbuilding at Great Basin Experimental Range in 1981.

Because of this variety of plant communities, the Great Basin Experimental Range provides examples of most of the ecological situations representative of the general area.

Data Bases

Permanent plots and exclosures were established in the various vegetation communities of the Great Basin Experimental Range with additional permanent plots and exclosures in the general area on the Manti-LaSal National Forest but outside the range. Long-term climatic records (temperature and precipitation) from a range of elevations have been kept since 1925 with some records going back to 1901.

Streamflow data were collected from the 1920's until the 1950's. Long-term records of restoration plantings throughout different vegetative communities are available to compare with natural recovery processes.

Examples of Research

- Plant adaptation
- Plant succession
- Nutrient cycling
- Revegetation
- Restoration ecology
- Game habitat improvement

Facilities

The headquarters complex, now known as the Great Basin Environmental Education Center and currently managed by Snow College, includes a museum, amphitheater, offices, and lodging, cooking, and camping facilities. Running water, plumbing, electricity, and telephones are present. The eight principal buildings were constructed during two primary periods, 1912 to 1913 and 1934 to 1936. All buildings were recently renovated and brought up to modern safety and health standards (1992 to 1994). There is also a small cabin, the Alpine Cabin, located adjacent to Experimental Watersheds A and B. This cabin does not have electricity or indoor plumbing. The 24 ha (59 acre) Lake Hill Campground lies within the Great Basin Experimental Range and includes about two dozen developed camping sites. See the map for location of the facilities. Commercial accommodations are available at Ephraim and Manti, Utah, some 8 and 19 km (5 and 12 miles) distance, respectively, from the west (lower) boundary of the Great Basin Experimental Range.

Location

The Great Basin Experimental Range is on the south portion of the Ephraim or Cottonwood Creek drainage on the west front of the Wasatch Plateau about 8 km (5 miles) east of Ephraim, on the Manti-LaSal National Forest (see map). Access is from a Sanpete County road known as the Ephraim Canyon or Ephraim-Orangeville Road (lat. 39°19′ N., long. 111°30′ W.). Elevations range from 2,070 to 2,710 m (6,790 to 8,889 ft). Except for the lower hard-surfaced 2 km (1.2 miles), this is a gravel road. The road is well maintained except in the winter when it is closed due to deep snow. This county road runs through the length of the Great Basin Experimental Range. It turns into State Road 29 on the east slope of the Wasatch Plateau at the Emery County line. At the eastern boundary of the range on the top of the Wasatch Plateau, the Ephraim-Orangeville Road is bisected by the graveled Skyline Road, a county road that extends some 80 km (50 miles) along the crest of the Wasatch Plateau.

Suggested Reading

Keck, Wendell M. 1972. Great Basin Station—sixty years of progress in range and watershed research. Res. Pap. INT-118. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 48 p.

Stevens, Richard; McArthur, E. Durant; Davis, James N. 1992. Re-evaluation of vegetative cover changes, erosion, and sedimentation on two watersheds—1912-1983. In: Clary, Warren P.; McArthur, E. Durant; Bedunah, Don; Wambolt, Carl L., comps. Proceedings—Symposium on ecology and management of riparian shrub communities; 1991 May 29-31. Sun Valley, ID. Gen. Tech. Rep. INT-289. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 123-128.

Tippets, David; Anderson, Val Jo. 1991. Partnership preserves historic range research sites. Rangelands. 13: 121-124.

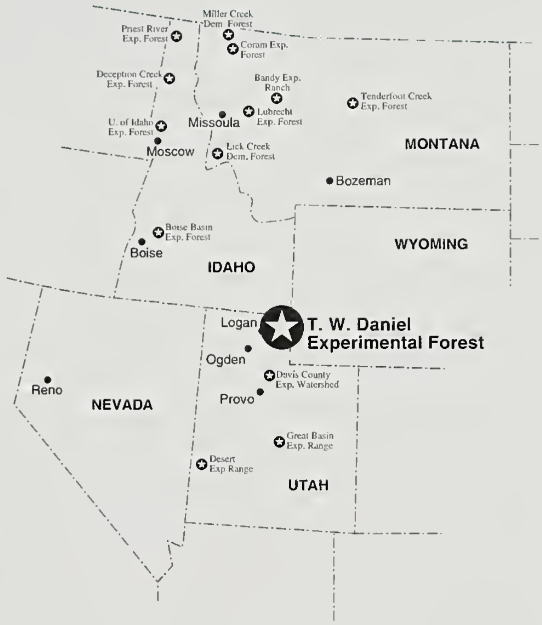
Contact Address

Project Leader
Shrubland Biology and Restoration
Shrub Sciences Laboratory
Intermountain Research Station
735 North 500 East
Provo, Utah 84606
Tel: (801) 377-5717
FAX: (801) 375-6968

T. W. Daniel Experimental Forest

James N. Long

The T. W. Daniel Experimental Forest, maintained by Utah State University, is in the Wasatch Mountains of northern Utah about 15 km (9 miles) south of the Utah-Idaho border. The forest was established in 1936 as a part of the newly created School of Forestry. The university purchased a section of land from the State Land Board and was granted a special use permit from the Forest Service, U.S. Department of Agriculture, on three contiguous sections (now part of the Logan Ranger District, Wasatch-Cache National Forest). These four sections, totaling 1,036 ha (2,560 acres), form the forest, which was originally called the Utah State University Experimental Forest.



The forest is intensively used for teaching and demonstration and has been the site of extensive research for the past 50 years. Early research efforts in forest ecology and hydrology led to major National Science Foundation-sponsored ecosystem-level research projects in the 1970's. This research provides an excellent background for current and anticipated basic and applied research in the areas of forest ecology, silviculture, disturbance ecology, and ecosystem management. The area also has a long history of timber harvest, livestock grazing, and dispersed recreation. Stand ages range from recently regenerated to old growth, such as spruce-fir (*Picea-Abies*) stands greater than 250 years old. However, the predominant stand ages range from 80 to 120 years.

Climate

The climate is typical of high elevations in the central Rocky Mountains, with mean January and August temperatures of –11 and 17 °C (12 and 63 °F), respectively. Average annual precipitation is 1,040 mm (41 inches). Most precipitation comes in the winter as snow, and maximum snow depths may range from 1 to 3 m (3 to 10 ft). Photo periods

T.W. Daniel Experimental Forest
89
Cabin
Sinks Road
Cabin
n
(2690 m - 8823')
Legend
Highway
Gravel Road
Watercourse
Flume
Peak
Lookout
Headquarters
Lake or Bog
Elevation
one km
one mile
Preston
Idaho
Utah
Pocatello
Twin Falls
91
15
2
Bear Lake
Garden City
Riverside
89
30
84
Logan
89
91
T.W. Daniel Experimental Forest
15
Brigham City
Salt Lake
Forestry Field Station

A characteristic mosaic of subalpine meadow, spruce-fir, and aspen types on T. W. Daniel Experimental Forest.

range from 15 hours 2 minutes on June 1 to 13 hours 9 minutes on September 1, with 15 hours 15 minutes maximum at the solstice. Daily solar radiation totals as high as 768 calcm^{-2} have been measured. Frost may occur in any month.

Soils

Soils throughout the T. W. Daniel Experimental Forest are derived from the Knight formation of the Wasatch group, a Tertiary red conglomerate of quartzite, sandstone, and shale. Most soils are deep, loamy-skeletal, mixed Cryic Paleboralls. These soils have the organic matter and base rich surface soil or mollic epipedon characteristic of "prairie soils." This trait is likely due to the base rich subsoil, slow decomposition rate, good distribution of fine roots in the upper 50 cm (20 inches) of soil, and the high degree of mixing by orthopods and mammals such as pocket gophers. Site index for lodgepole pine (*Pinus contorta*) varies between 24.4 and 27.4 m (80 and 90 ft) at base age 100.

Main Communities

The principal vegetation types are spruce-fir, Douglas-fir (*Pseudotsuga menziesii*), lodgepole pine, aspen (*Populus tremuloides*), and limber pine (*Pinus flexilis*) forests, with interspersed meadows and shrub-forb-grass uplands. Most forest sites have been classified as representing the *Abies lasiocarpa/Pedicularis racemosa* habitat type. Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) are the dominant late successional species throughout most of the forest. The major early successional tree species include lodgepole pine and aspen with Douglas-fir on south-facing ridges and at lower elevations.

Studies of production ecology of subalpine forests center on a series of permanent plots throughout the experimental forest.

The experimental forest is used extensively as a teaching laboratory for natural resources for students of Utah State University.

Data Bases

A master list is maintained of publications resulting from work done on the T. W. Daniel Experimental Forest. This list includes over 70 published reports and 40 masters degree theses and Ph.D. degree dissertations. Cone crops on the forest have been estimated annually since 1947. Standard map coverage includes roads, topography, and fire history. Digital map coverage includes vegetation (generated from satellite data), elevation, and drainage lines. Currently most data bases reside in files associated with individual research projects.

Examples of Research

- Fire history
- Conifer stand development and production ecology
- Changes in ecosystem properties during succession
- Lodgepole pine/mountain pine beetle interactions

Facilities

Two rustic cabins are on the forest. Temporary office, bunk, and storage space may be available at the T. W. Daniel Forestry Field Station (see map), which includes a mess hall, dormitory, and administration building. Complete services are available in Logan, Utah, about 65 km (40 miles) west of the forest.

Location

The T. W. Daniel Experimental Forest (lat. 42° N., long. 111° W.) comprises four sections (sec. 15, 16, 21, and 22, Township 13 North, Range 4 East, Salt Lake Meridian), a total of 1,036 ha (2,560 acres). Elevations range from about 2,400 m (7,800 ft) to 2,650 m (8,700 ft), and topography is gentle. Access to within 8 km (5 miles) of the experimental forest is via Highway 89. Access to the boundary and within the forest is on unpaved but excellent forest road that bisects the forest north to south; the remainder of the forest is accessed via primitive roads and trails. Winter access is limited to skis or snow machines.

Suggested Reading

Long, J.N., Compiler. 1995. Research publications on the T. W. Daniel Experimental Forest, Utah. 1958-1994. Department of Forest Resources, Utah State University. Logan, UT 84322-5215. 9 p.

Roberts, S.D.; Long, J.N. 1991. Effects of storage, planting date, and shelter on Engelmann spruce containerized seedlings in the Central Rockies. Western Journal of Applied Forestry. 6: 36-38.

Schimpf, D.J.; Henderson, J.A.; MacMahon, J.A. 1980. Some aspects of succession in the spruce-fir forest zone of northern Utah. Great Basin Naturalist. 40: 1-26.

Wadleigh-Anhold, Linda L. 1988. Fire frequency and the vegetal mosaic of the Utah State University Experimental Forest. Masters thesis. 54 p.

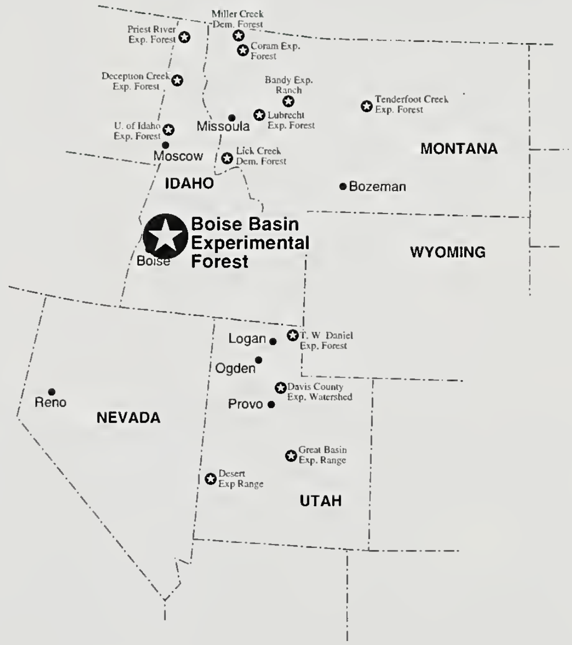
Contact Address

Chair, Department of Forest Resources
College of Natural Resources
Utah State University
Logan, Utah 84322-5215
Tel: (801) 750-3219
FAX: (801) 755-3563

Idaho

Boise Basin Experimental Forest

John Sloan and Robert Steele

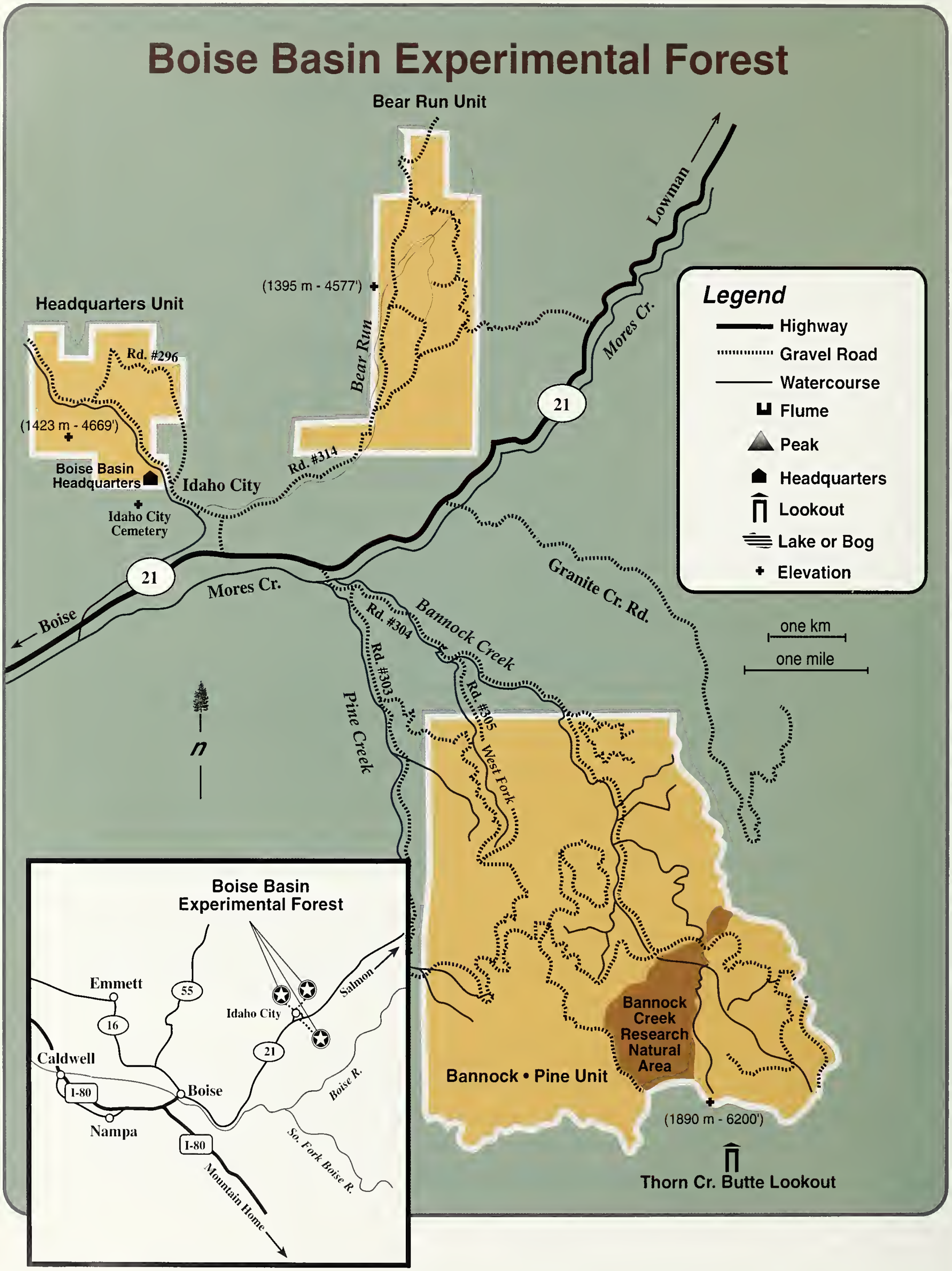


The Boise Basin Experimental Forest was established in 1933 to study management of ponderosa pine (*Pinus ponderosa*). It consists of 3,540 ha (8,740 acres) and is divided into three units that occur near the historic town of Idaho City, Idaho. A research natural area that has never been logged is included in the largest unit.

The earliest studies, beginning in 1933, evaluated different methods of selecting mature trees for harvest and the effects of remaining tree patterns on tree growth, reproduction, and undergrowth vegetation. Crews installed permanent transects for monitoring tree reproduction and undergrowth vegetation. Subsequent studies evaluated factors affecting germination, survival, and growth of young ponderosa pine and the phenology of trees and undergrowth vegetation in ponderosa pine forests. Competition factors for planted and natural pine seedlings were investigated in 1937, followed by two studies of seed storage, viability, and germination of ponderosa pine and Douglas-fir. Subsequent studies dealt with such varied components of stand management as root systems of trees and seedlings, porcupine feeding relationships with ponderosa pine, and thinning and pruning methods.

Later studies compared timber production under individual tree versus group selection methods of harvest, the viability of seeds stored in the soil, site preparation methods for tree planting, tree seed dispersal, application of plant hormones, and conversion of old growth stands to second growth.

Current activities include studies of how various shade densities affect planted tree seedlings on harsh sites, the historical changes in stand composition and density, continued monitoring of the 1933 transects, and demonstration areas relating to ecosystem management and forest health. In recent years, many field tours of the demonstration areas have been given to various interest groups. Other activities by the public include hunting, hiking, skiing, and snowmobiling.



Boise Basin Experimental Forest
Bear Run Unit
Headquarters Unit
Rd. #296
(1423 m - 4669')
Boise Basin Headquarters
Idaho City
Idaho City Cemetery
(1395 m - 4577')
Bear Run
Rd. #314
Lowman
Mores Cr.
21
Boise
Mores Cr.
Granite Cr. Rd.
Bannock Creek
Rd. #304
Rd. #303
Rd. #305
Pine Creek
West Fork
Legend
Highway
Gravel Road
Watercourse
Flume
Peak
Headquarters
Lookout
Lake or Bog
Elevation
one km
one mile
n
Bannock Creek Research Natural Area
Bannock • Pine Unit
(1890 m - 6200')
Thorn Cr. Butte Lookout
Boise Basin Experimental Forest
Emmett
55
16
Idaho City
Salmon
Caldwell
21
I-80
Boise
Boise R.
Nampa
I-80
So. Fork Boise R.
Mountain Home

Climate

The climate is characterized by warm, dry summers and cool, wet winters. Annual precipitation at Idaho City averages about 635 mm (25 inches) delivered mostly by cyclonic maritime storms from October to June. From July through September, storms are less frequent but are more convectional and can deliver brief downpours and severe lightning. Temperatures range from an average low of –4 °C (24 °F) in winter to an average high of 19 °C (66 °F) in summer.

Soils

Soils are derived from granitic rocks of the Idaho Batholith. The rocks are mostly quartz monzonite with some porphyritic and aplitic dikes. Remnants of Miocene lakebed sediments also occur here. The soils are generally deep except on extremely steep slopes and ridges and are mostly coarse to moderately coarse in texture. Representative soils are mostly typic or lithic Xeropsamments, Cryumbrepts, Cryoboralls, Cryorthents, and Cryocrepts. Soil pH ranges from 5.5 to 7.0 but is mostly about 6.0. The 50-year site index modified from Lynch (1958) ranges from about 16 to 20 m (53 to 66 ft).

A crew plants 6,000 ponderosa pine and Douglas-fir seedlings on the Boise Basin Experimental Forest. The planting is part of a study to determine the effects of shade and competition from overstory tree on tree seedlings.

Main Communities

Interior ponderosa pine is the predominant forest cover type on the experimental forest. Prior to fire control, frequent underburns maintained this type as nearly pure ponderosa pine with some patches of quaking aspen (*Populus tremuloides*). Presently, much of this type contains an undergrowth of Douglas-fir (*Pseudotsuga menziesii*) in response to 100 years without fire. In some areas, the interior Douglas-fir type now occupies the cooler aspects. Mountain shrub communities occupy the most shallow soils of upper slopes and ridges.

Data Bases

Road and topographic maps are available. A soil survey was conducted in 1965 and a map prepared. The largest unit of the experimental forest including the natural area was mapped to habitat type and is on file at the Intermountain Research Station, Boise, Idaho. A baseline inventory of vegetation, small mammal, avian, and aquatic components was established in 1982 in the natural area. Vegetation transects established in 1933 were remeasured in 1934, 1938, 1978, and 1988. Maps of these transects are available at the Intermountain Research Station in Boise. A record of historical fire return intervals has been completed, and a study of historical stand development in the natural area is near completion.

The Bear Run Unit of the Boise Basin Experimental Forest was established in 1953 to study second-growth ponderosa pine. This unit now supports 90-year-old even-age stands of almost pure ponderosa pine.

The Bannock-Pine Unit of the Boise Basin Experimental Forest was established in 1933 to conduct research on management of old growth ponderosa pine. Today the forest is dominated by a combination of ponderosa pine and Douglas-fir.

Examples of Research

- Regeneration of ponderosa pine under various silvicultural methods
- Growth response of ponderosa pine to various residual basal areas
- Management of the ponderosa pine type using thinning and underburning

Facilities

The Boise Basin Experimental Forest has no facilities. Temporary space for storage and house trailer setup may be available at the Idaho City Ranger Station. Food, fuel, general merchandise, and some lodging are available in Idaho City. A full range of amenities are provided in Boise, Idaho, 60 km (37 miles) to the southwest.

Location

The three units of the Boise Basin Experimental Forest (see map) lie on the outskirts of the small town of Idaho City, Idaho, (T. 6 N., R. 5 E., section 26, Boise principal meridian, or lat. 43°49′ N., long. 115°50′ W.). Idaho City can be reached via State Highway 21. Inquiries as to accessibility of the experimental forest can be made at the Idaho City Ranger Station. Most roads on the experimental forest receive minimal maintenance. Generally, high-clearance vehicles are needed in the summer months, and snowmobiles are recommended in winter. Elevation ranges from about 1,220 to 1,920 m (4,000 to 6,300 ft).

Suggested Reading

Garton, E.O.; Pregitzer, K.; Rabe, F.W. 1983. Baseline inventory of the terrestrial and aquatic resources of the Bannock Creek Natural Area. Unpublished report on file: Intermountain Research Station, Boise, ID. 101+ p.

Lynch, D.W. 1958. Effects of stocking on site measurement and yield of seed-growth ponderosa pine in the Inland Empire. Res. Pap. INT-56. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 36 p.

Olson, O.C. 1965. A soil survey report of the Boise Basin Experimental Forest. Unpublished report on file: Intermountain Research Station, Boise, ID. 31 p., map.

Steele, R.; Arno, S.F.; Geier-Hayes, K. 1986. Wildfire patterns change in central Idaho's ponserosa pine - Douglas-fir forest. Western Journal of Applied Forestry. 1(1): 16-18.

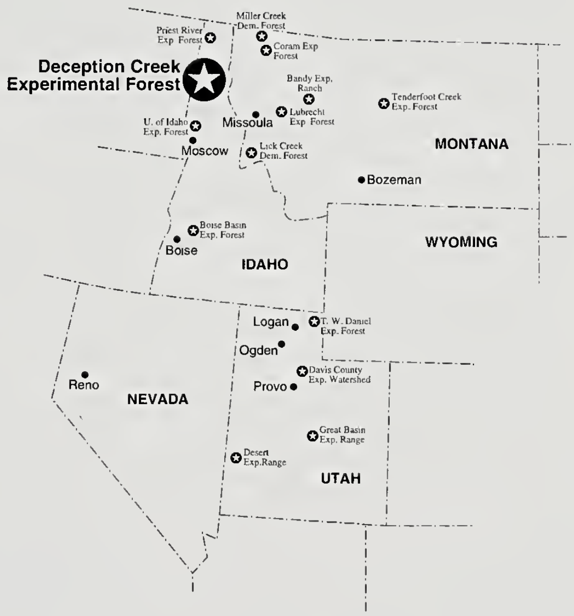
Contact Address

Project Leader
Conifer Ecology and Regeneration Research Work Unit
Intermountain Research Station
316 E. Myrtle Street
Boise, Idaho 83702
Tel: (208) 364-4342
FAX: (208) 364-4346

Deception Creek Experimental Forest

Theresa B. Jain and Russell T. Graham

Deception Creek Experimental Forest is in one of the most productive forests in the Rocky Mountains. When the forest was established in 1933, large, old-age western white pine (*Pinus monticola*) were important for producing lumber products. The forest, located in the Coeur d'Alene Mountains, is in the heart of the western white pine forest type. Therefore , research at Deception Creek Experimental Forest focused on the ecology and silviculture of western white pine and its associated species.



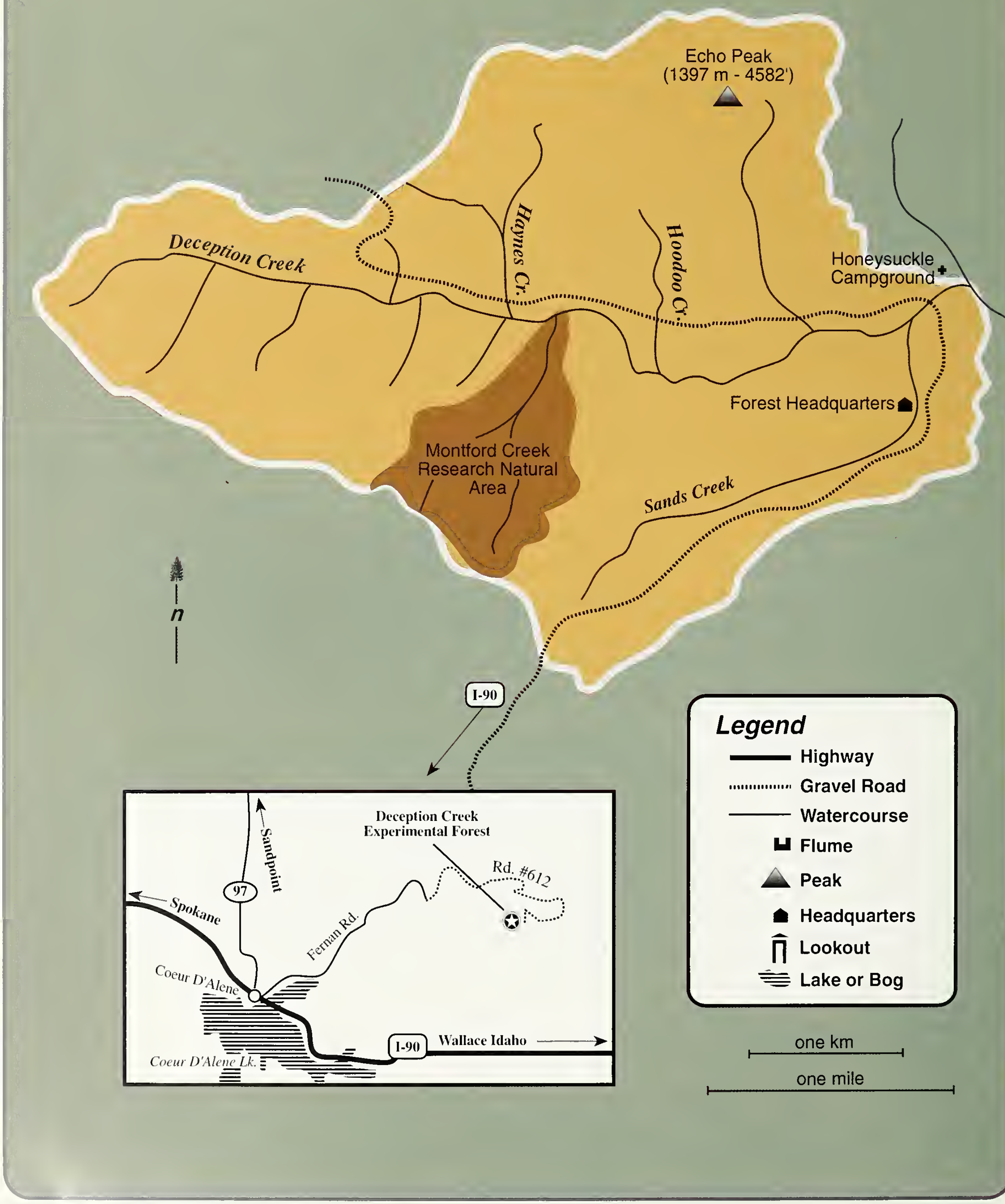
Since the 1940's western white pine on the forest has decreased due to white pine blister rust (*Cronartium ribicola*). However, regeneration, vigor, growth, and genetic studies on western white pine and other species have continued. Research has also included site preparation, fire effects, insects and disease, and watershed studies. The legacy of past research and high forest productivity has created a diverse and lush forest, making Deception Creek Experimental Forest an ideal location for conducting research.

The forest includes the entire Deception Creek drainage, a tributary of the North Fork of the Coeur d'Alene River in northern Idaho. Deception Creek Experimental Forest is located approximately 32 km (20 miles) northeast of Coeur d'Alene, Idaho, on the Fernan Ranger District of the Idaho Panhandle National Forests. The area encompasses 1,425 ha (3,520 acres) with elevations ranging from 840 to 1,400 m (2,800 to 4,600 ft). Deception Creek and many other small drainages influence the forest's topography by creating predominantly north- and south-facing slopes with slope angles ranging from 35 to 80 percent.

Climate

Weather at Deception Creek Experimental Forest is influenced by the maritime climate of the Pacific Coast. Summers are short, autumns and winters are cloudy. The precipitation is enhanced by the mountainous topography and the forced uplift of moist air that contributes to the average annual precipitation of 1,397 mm (55 inches). The high precipitation is

Deception Creek Experimental Forest



Headquarters compound for Deception Creek Experimental Forest in the 1940's.

greater than the average precipitation of 660 to 1,067 mm (26 to 42 inches) in other northern Idaho locations. Annual snow fall averages 4,064 mm (160 inches) accounting for 25 percent of the total precipitation. The average mean annual temperature is 6 °C (42 °F).

Soils

The rich and productive soils at Deception Creek Experimental Forest are primarily Typic Vitrandepts, which are volcanic ash above beltian metasediments. The depth of the volcanic ash varies depending on aspect and slope. For example, the ash cap may be up to 1.5 m (5 ft) deep on gentle north-facing slopes, while the ash cap may only be 0.1 to 0.3 m (0.6 to 1.0 ft) on steep southwest-facing slopes.

Main Communities

Two major habitat types occur on Deception Creek Experimental Forest. Most of the forest (80 percent) is a western hemlock/queencup beadlilly (*Tsuga heterophylla/Clintonia uniflora*) habitat type. The other major habitat type is grand fir (*Abies grandis*)/queencup beadlilly. In addition, there are small areas of western redcedar/devil's club (*Thuja plicata/Oplopanax horridum*), and grand fir/beargrass (*Xerophyllum tenax*). Major tree species include grand fir, western hemlock, Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), and western white pine. There is also a minor component of Engelmann spruce (*Picea engelmanii*), lodgepole pine (*Pinus contorta*), western redcedar, and ponderosa pine (*Pinus ponderosa*). The majority (60 percent) of Deception Creek Experimental

Forest is old-age forest with dense canopies and sparse understories, 20 percent mid-age forest, and 20 percent young-age forest with a high shrub component of alder, ceanothus, and willow species (*Alnus*, *Ceanothus*, and *Salix* species).

The different aged forests (10 to over 200 years), vegetative structures, soils, climate, and past studies at Deception Creek Experimental Forest make it an ideal location for conducting research. Undisturbed areas include the Montford Creek Research Natural Area, which is 118 ha (292 acres) and has western white pine and western hemlock 200 years and older. Deception Creek Experimental Forest is close to Coeur d'Alene and has an extensive road system making most sites accessible.

Examples of Research

Deception Creek Experimental Forest was originally established as a center for conducting silviculture research. Therefore, research on the forest concentrated on applying both uneven-age and even-age silviculture systems for managing this forest type. Studies emphasized regeneration methods and subsequent effects on establishment, composition, and growth of natural and artificial regeneration. These studies not only observed western white pine but included the many other species found in this forest type.

Deception Creek Experimental Forest also has a wealth of insect and disease, long-term soil productivity, and fire research. Growth and yield plots on the forest monitor forest

Silvicultural treatments, which include individual tree selection for uneven-age management, have been tested on Deception Creek Experimental Forest.

Healthy, blister rust-free western white pine, like this one, produce many sought-after cones for genetics studies in the research effort to re-invigorate thousands of acres of diseased forests in the West.

productivity and changes in species composition. Genetic studies of rust-resistant western white pine started in the mid-1950's and continues today. However, vegetation is not the only forest component studied at Deception Creek Experimental Forest. For example, small mammal populations were studied within the Montford Creek Natural Area and adjacent disturbed sites.

Currently, research on Deception Creek Experimental Forest involves studies on how forest management affects ecosystem structures and functions. Clearcuts will probably be used much less in future forest management. Therefore, variations in both even-age and uneven-age silviculture systems are being studied. Other studies on the forest include fire effects on sedimentation and soil nutrients, management effects on overstory and understory species composition, growth and yield, forest genetics, and root disease.

The accessibility of the forest and proximity to Coeur d'Alene makes Deception Creek Experimental Forest an ideal demonstration site for showing forest managers, educators, and students a wide variety of forest structures and ages caused by a variety of silviculture treatments. Different silviculture studies show visitors what alternatives and options are available for forest management. In addition, these studies have shown what important ecological aspects should be considered if society chooses to maintain these ecosystems.

Facilities and Administration

The research headquarters is located along Sands Creek. Currently a bunkhouse and trailer pads are on the forest. Water is presently hauled to the compound, and electricity is supplied by generators. Most of the research conducted at Deception Creek Experimental Forest occurs during the summer.

The Fernan Ranger District of the Idaho Panhandle National Forests is responsible for fire control, road maintenance, and timber sale preparation and administration. A research forester on the Silviculture and Genetics Research Work Unit manages the forest. Funding for operating Deception Creek Experimental Forest is provided by that work unit.

Location

Deception Creek Experimental Forest is approximately 35 km (22 miles) northeast of Coeur d'Alene, Idaho. Take the Fernan Road from I-90 to Forest Road #612 to the Sands Creek drainage.

Suggested Reading

Boyd, R.J. 1969. Some case histories of natural regeneration in the western white pine type. Res. Pap. INT-63. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 24 p.

Finklin, A.I.; Fischer, W.C. 1987. Climate of Deception Creek Experimental Forest, northern Idaho. Gen. Tech. Rep. INT-226. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 73 p.

Graham, R.T. 1988. Influence of stand density on western white pine, redcedar, hemlock, and grand fir in the Rocky Mountains. In: Schmidt, W., ed. Proceedings—Future forests of the Mountain West: a stand culture symposium. Gen. Tech. Rep. INT-243. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 175-184.

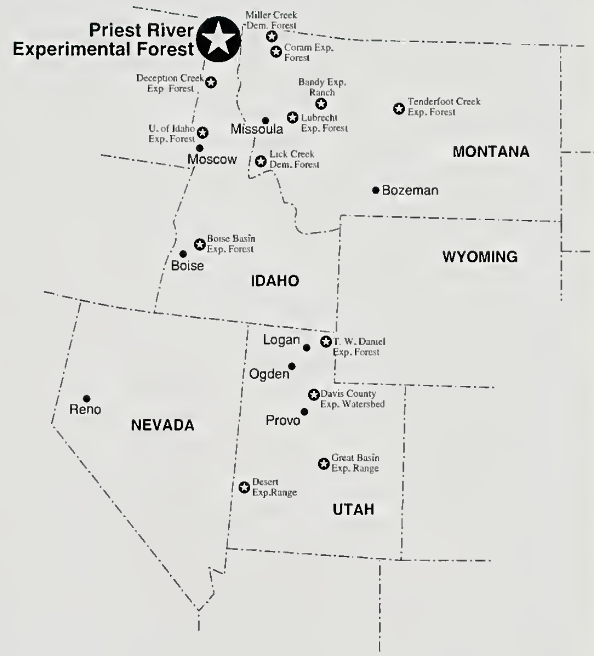
Wellner, C.A.; Foiles, M.W. 1951. What to see and where to find it on the Deception Creek Experimental Forest: a field research center of the Northern Rocky Mountain Forest and Range Experiment Station. Misc. Pub. No. 2. Missoula, MT: U.S. Department of Agriculture, Forest Service, Northern Rocky Mountain Forest and Range Experiment Station. 74 p.

Contact Address

Scientist-in-Charge
Deception Creek Experimental Forest
Intermountain Research Station
1221 S. Main Street
Moscow, Idaho 83843
Tel: (208) 882-3557
FAX: (208) 883-2318

Priest River Experimental Forest

Theresa B. Jain and Russell T. Graham



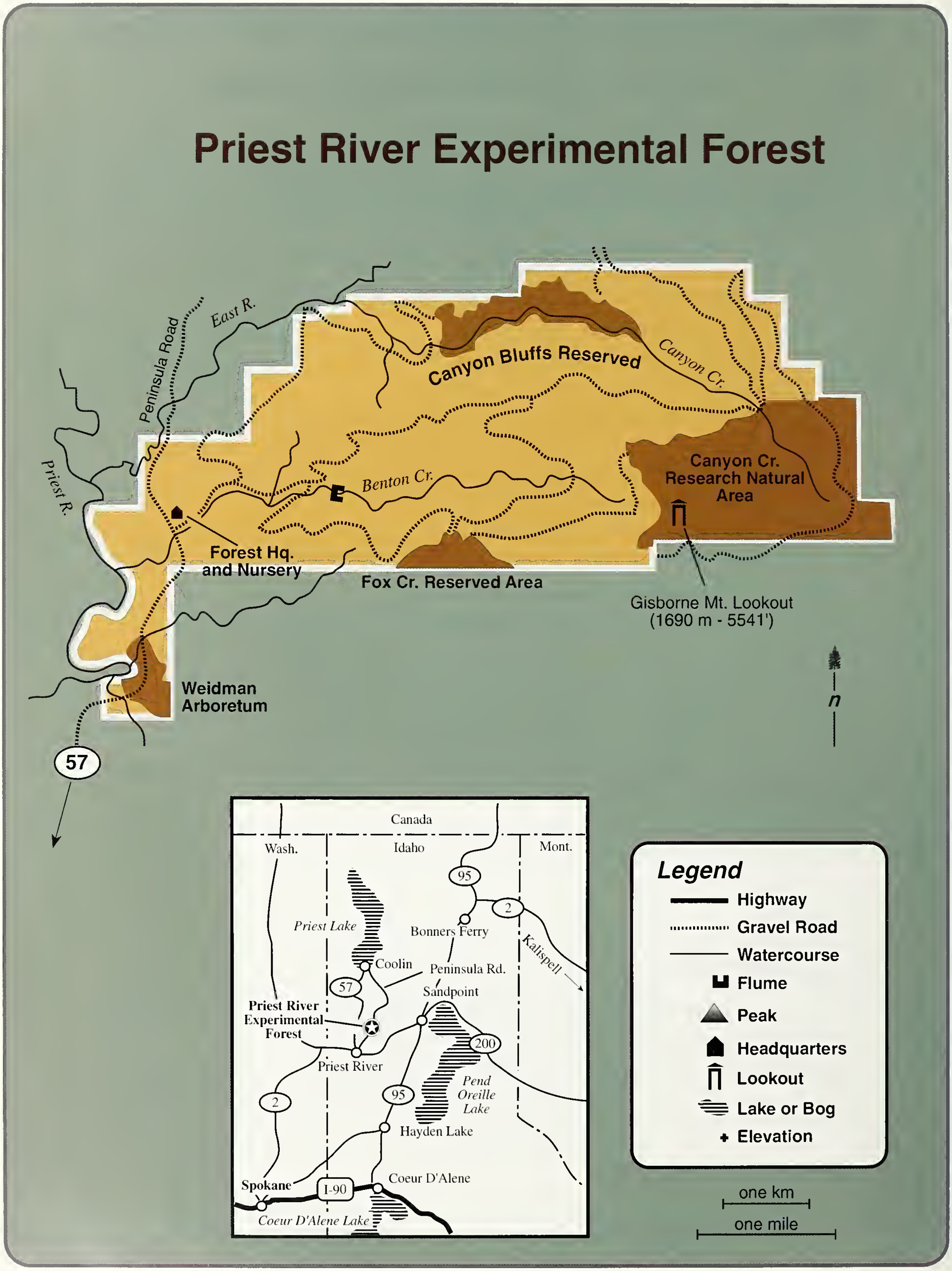
Priest River Experimental Forest was among the first experimental forests set aside as a forestry research center in September 1911. The forest served as the headquarters for the Priest River Forest Experiment Station until 1930 when the forest was incorporated into the Northern Rocky Mountain Forest and Range Experiment Station. The forest is currently administered by the Intermountain Research Station.

Since Priest River Experimental Forest's establishment, numerous educators, Forest Service researchers, and state and private forestry personnel have used the forest. Research conducted by Bob Marshall, Harry Gisborne, Ken Davis, Charles Wellner, and Irvine Haig provided information on basic forestry principles still used today for managing Rocky Mountain forests. These people and other researchers throughout the Forest's history have made it a key location for conducting forestry research.

The forest encompasses 2,600 ha (6,400 acres) with elevations ranging from 680 to 1,800 m (2,230 to 5,900 ft) above sea level. It exists primarily on slopes ranging from 20 to 60 percent. Two major drainages, Benton and Canyon Creek, flow east to west bisecting the forest, resulting in predominantly north- to northwest- and south- to southwest-facing slopes.

Climate

The climate of Priest River Experimental Forest is influenced by the Pacific Ocean, which causes a modified maritime climate. Precipitation averages 817 mm (32 inches) with most of the moisture falling as snow and occurring between November and January. Summers are usually sunny and dry in July and August with intermittent rain in the early spring and fall. The average mean annual temperature is 7 °C (44 °F).


Priest River Experimental Forest
East R.
Peninsula Road
Priest R.
Canyon Bluffs Reserved
Canyon Cr.
Benton Cr.
Canyon Cr. Research Natural Area
Forest Hq. and Nursery
Fox Cr. Reserved Area
Gisborne Mt. Lookout (1690 m - 5541')
Weidman Arboretum
57
n
Canada
Wash.
Idaho
Mont.
95
2
Priest Lake
Bonners Ferry
Kalispell
Coolin
Peninsula Rd.
57
Sandpoint
Priest River Experimental Forest
200
Priest River
Pend Oreille Lake
95
2
Hayden Lake
Spokane
I-90
Coeur D'Alene
Coeur D'Alene Lake
Legend
Highway
Gravel Road
Watercourse
Flume
Peak
Headquarters
Lookout
Lake or Bog
Elevation
one km
one mile

Soils

The soils are categorized within the Typic Vitrandepts soil complex. These soils have a thick mantle of volcanic ash-influenced loess from Cascade volcanoes overlaying belt series parent material. Variations within this major soil complex are dependent on elevation, slope, aspect, and topographic position.

Main Communities

The wide range of elevation and aspects on Priest River Experimental Forest support several mixed conifer vegetation types also found throughout the Northern Rocky Mountains. The five major forest types include subalpine fir (*Abies lasiocarpa*), grand fir (*Abies grandis*), Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and western redcedar (*Thuja plicata*). Western hemlock is the dominant forest type (52 percent) with equal distribution among the other forest types. Greater than 60 percent of the area is approaching mid to late seral successional stages with tree ages between 80 and 160 years old. Only a small portion of the forest is in early successional stages (less than 30 years). This mixture of forest types and understory vegetation enables the forest to provide a wide range of forest sites for conducting different types of research. The major drainages, Benton Creek, Canyon Creek, and the Wild and Scenic Priest River, also provide a wide variety of forest conditions and riparian areas that contribute to the research and aesthetic value of the forest.

Headquarters building at Priest River Experimental Forest.

Data Bases

Information on climate can be obtained from the weather data that has been recorded at Priest River Experimental Forest. For example, a weather station has recorded air temperature, relative humidity, and precipitation since 1911. Daily precipitation and maximum and minimum temperatures are filed with the National Weather Service. A gauging dam established in 1937 records flow rates from the 386 ha (960 acres) Benton Creek drainage. In addition, since the 1940's snow accumulation and water content are recorded through the winter months from low—725 m (2,380 ft)—and high—1,455 m (4,755 ft)—elevation snow courses in cooperation with the Soil Conservation Service.

Several areas on Priest River Experimental Forest are set aside to protect the forest's natural diversity. The Canyon Creek Research Natural Area is 393 ha (982 acres) and was set aside in 1937 to preserve undisturbed conditions of the forest. This research natural area provides undisturbed baseline information often used in conjunction with other study sites on the forest. Two other unusual areas are reserved on Priest River Experimental Forest and

A field tour for forest ecology and silviculture instructors on Priest River Experimental Forest.

treated as potential research natural areas. One area on the south central section of the forest is a Douglas-fir/ninebark (*Physocarpus malvaceus*) habitat type on a south-facing slope. The other area is along the lower stretches of Canyon Creek, containing ponderosa pine (*Pinus ponderosa*) and Douglas-fir forest types, cliffs, and a scenic stretch of rapids and falls.

Other permanent special research areas include an arboretum and two nurseries. The 40 ha (100 acres) Weidmann Arboretum was set aside in 1929 for native and exotic tree species. The arboretum provides demonstration plots for researchers to conduct genetic tests on adaptability of various tree species to different climates. Benton Flats Nursery is 6 ha (15 acres) and is used for genetic, silviculture, and soil biology research. A second, smaller (0.20 ha) high-elevation (1,570 m; 5,150 ft) nursery is used for genetics research.

Examples of Research

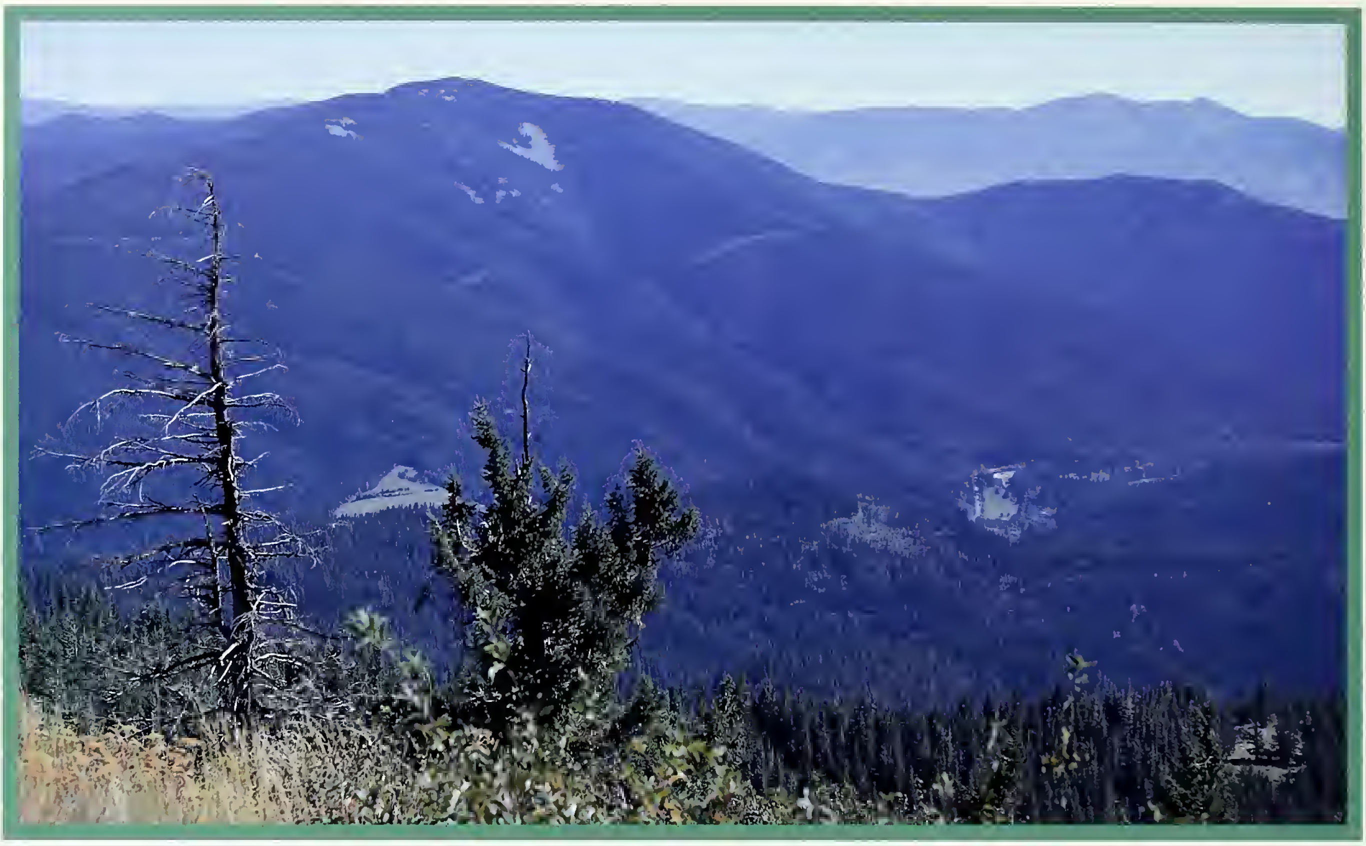
Past Research

Silviculture research conducted at Priest River Experimental Forest provided information for managing forest vegetation to meet a wide variety of objectives for application throughout the Northern Rocky Mountains. Regeneration studies using shelterwood, seed tree, and clearcut methods have provided recommendations for regenerating mixed conifer forest types. Site preparation, planting, cleaning, weeding, and thinning studies provided information on how to regenerate and maintain forest stand composition and growth. Researchers have also studied the effects of these disturbances on wildlife, soils, and water quality.

Forest genetic research conducted at Priest River Experimental Forest has supplied a wealth of information to managers. A racial variation test was established in 1911 to study the performance of ponderosa pine from 22 locations. This study provided valuable information on the genetic variation among different seed sources within a tree species. Other studies included tests to determine growth characteristics of disease resistant western white pine (*Pinus monticola*) and the use of short-term (3 to 4 years) common gardens to determine the geographic and ecologic variation among tree species.

Fire research began at Priest River Experimental Forest with Harry T. Gisborne developing the first Fire-Danger Rating System. This was the foundation for current fire danger systems now used throughout the United States and Canada. Fire behavior, fuel flammability, and fire effects research all had their beginnings at Priest River Experimental Forest.

Forest growth and yield research for the Northern Rocky Mountain mixed conifer forest type has been conducted since 1912. Several permanent plots on the forest are remeasured at regular intervals. Information from these plots and other locations throughout the Northern Rocky Mountains is used to verify and develop growth and yield models.



An overview of the forest on Priest River Experimental Forest.

Other studies conducted at Priest River Experimental Forest have included watershed, disease, soils, and forest succession research, and development of management strategies for improving water quality and quantity. Studies have included effects of prescribed burning on water quality, transpiration and water loss from forest soils, and snow interception and evaporation losses in pure and mixed conifer stands.

Current Research

Current research at Priest River Experimental Forest is concentrating on ecosystem processes and functions. Studies include the effects of management practices on long-term soil productivity, quantifying forest health, observing changes in photosynthetic rates and atmospheric carbon dioxide levels caused by elevational and climatic differences, locating carbon reserves and determining where carbon is stored in forest ecosystems, and testing alternate silviculture systems that can be used without depleting wildlife, soil productivity, and water quality. Fire research continues on the forest, with studies observing successional and vegetation differences in relation to different burn severities. Current watershed research includes monitoring water quality changes due to soil erosion and runoff.

The facilities and surrounding forest are important for technology transfer. They provide visitors an opportunity to meet researchers and discuss management concerns while in a forest setting. Priest River Experimental Forest is also a superb area for training individuals on how to conduct research and establish experiments. For example, the variety of vegetation types provides an ideal location for plant identification training within a short distance from the living facilities.

Facilities and Administration

Priest River Experimental Forest has well-established living quarters, offices, conference room, shop, and laboratory facilities. These facilities are currently nominated for the State and National Historical Register. Laboratory, conference, and shop facilities are available from April 1 through November 1. Living facilities, however, are available throughout the year. Priest River Experimental Forest can provide sleeping accommodations for 30 people comfortably but can accommodate up to 40 people for short periods.

The forest is within the Priest Lake Ranger District of Idaho Panhandle National Forests. Priest Lake Ranger District personnel provide all road maintenance, fire protection, and timber sale preparation and administration. A research scientist in the Silviculture and Genetics Work Unit in Moscow, Idaho, manages Priest River Experimental Forest. There is also a full-time superintendent on the forest throughout the year.

Location

Priest River Experimental Forest is in the Priest River Drainage on the toe slope of the Selkirk Mountains. It is 13 km (8 miles) north of Priest River, Idaho. Latitude is 48°21′ N. and longitude is 116°51′ W. Main access is on Peninsula Road off State Highway 57.

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Haig, I.T.; Davis, K.P.; Weidmann, R.H. 1941. Natural regeneration in the western white pine type. Tech. Bull. No. 767. Washington, DC: U.S. Department of Agriculture. 99 p.

Leaphart, Charles D.; Stage, Albert R. 1955. Climate: a factor in the origin of the pole blight disease of *Pinus monticola* Dougl. Ecology. 52(2): 229-239.

Wellner, Charles A. 1977. Frontiers of forestry research: Priest River Experimental Forest, 1911-1976. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station.

Contact Addresses

Scientist-in-Charge
Priest River Experimental Forest
Intermountain Research Station
1221 South Main
Moscow, Idaho 83843
Tel: (208) 882-3557
FAX: (208) 883-2318
and
Superintendent
Priest River Experimental Forest
Route 6 Box 41
Priest River, Idaho 83856-9509
Tel: (208) 448-1793

University of Idaho Experimental Forest

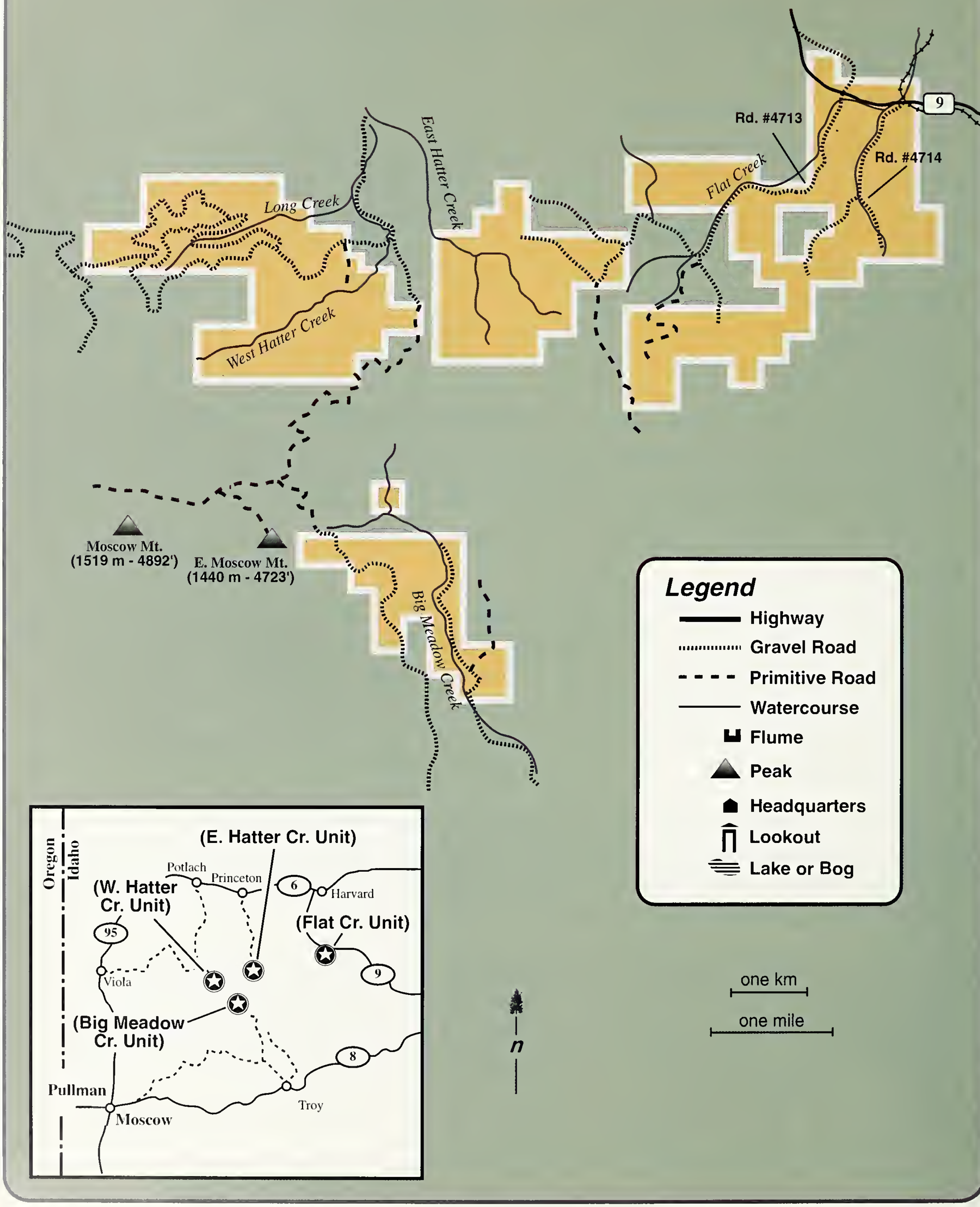
Harold L. Osborne and Ross Appelgren

The College of Forestry, Wildlife, and Range Sciences was established in 1917 as the School of Forestry at the University of Idaho. In 1932 the Forest Development Company (now Potlatch Corporation) of Lewistown, Idaho, made the first of several donations of land that would eventually total over 2,600 ha (6,500 acres). A combination of other donations, exchanges, and purchases has brought the acreage to its present 2,955 ha (7,300 acres). The forest comprises four larger units ranging from 1,100 to 340 ha (2,765 to 840 acres) and three smaller units of 65, 32, and 19 ha (160, 80, and 48 acres). The forest is within 45 minutes drive from campus. This proximity facilitates the multiple-use management applied to the experimental forest as operations are designed to promote teaching, research, and demonstration for all disciplines within the college, which includes forest resources, forest products, range resources, wildlife resources, and recreation and tourism.

Timber provides much of the income for the experimental forest whether it is harvested by the student logging crew or sold as stumpage. This income supports employees, development projects, research, teaching, interpretive trail development, recreation, equipment, seedlings, and fire protection.

Hands-on training and real-world teaching are a major focus of the experimental forest. This is accomplished through hiring College of Forestry wildlife and range sciences students as temporary employees throughout the year or as employees on the summer student logging crew and by encouraging college faculty and staff to facilitate teaching on the experimental forest.

University of Idaho Experimental Forest



Climate

A maritime climate moderates the extremes in temperatures that are often associated with the Northern Rocky Mountains. Just out of the rain shadow of the Cascades, the summers begin moist and gradually turn dry by mid-July and continue mostly without appreciable rain through mid-September. October has an increasing chance of rainfall. As autumn progresses into winter, the precipitation increases dramatically falling as either snow or rain, but generally snow, at the experimental forest elevation range of 850 to 1,160 m (2,800 to 3,800 ft).

In winter the average temperature is 0 °C (32 °F), and the average daily minimum temperature is –4 °C (25 °F). In summer the average temperature is 17 °C (63 °F), and the average daily maximum temperature is 27 °C (80 °F).

The total annual precipitation is 595 mm (23.4 inches). Of this, 203 mm (8 inches), or 35 percent, usually falls in April through September. Average seasonal snowfall is 122 cm (48 inches).

Soils

All soils are very deep to deep at 1.5 m (60 inches), well drained to moderately well drained and formed in volcanic ash, in loess, and in granitic residuum. The predominant series classifications are Santa, Uvi, and Vassar. Santa soils are coarse-silty, mixed, frigid Typic Fragixeralfs. Uvi soils are fine-loamy, mixed, frigid Dystric Xerochrepts. Vassar series soils are medial over loamy, mixed Entic Cryandepts.

All series are poor for road fill material and highly erosive if the organic layer is removed. The volcanic ash top soil (ash cap) present in some Vassar series soils is important in capturing and holding moisture, acting much like a sponge. When in place, it is resistant to erosion.

Main Plant Communities

Potential climax communities are varied. The transition of true prairie to forest (6 miles west) has a great influence on vegetation even within the experimental forest's narrow elevation range of 305 m (1,000 ft). *Abies grandis/Clintonia uniflora* is the predominant habitat type followed by *Pseudotsuga menziesii/Physocarpus malvaceus, Thuja plicata/Clintonia uniflora, Abies lasiocarpa/Clintonia uniflora,* and *Pinus ponderosa/Symphoricarpos albus.*

A student field tour in a ponderosa pine plantation on the University of Idaho Experimental Forest.

Data Bases

Records of annual volume removed are complete since 1972 when a program of annual timber harvesting began. This program was also the beginning of comprehensive forest management of the experimental forest. Since that time, numerous data bases have been established and, where appropriate, are entered into the Geographic Information System (GIS) (ARC-INFO, PC based). Some of the data bases are as follows:

1. Timber volume harvested
2. Complete timber inventory
3. Continuous forest inventory plots established (not complete, GIS)
4. Vegetation cover, delineated and classified from 1:15840 aerial photos (ground truthing not complete, GIS)*
5. Stream side degradation level classification keyed to bank vegetation (in progress, GIS)
6. Forest road locations and type (in progress, GIS)*
7. 10 m (33 ft) contours (completed, GIS)
8. Property ownership mosaic (completed, GIS)*
9. Updated soil survey of the experimental forest (complete, GIS)

* These data bases are presently being established over approximately 16,195 ha, or 40,000 acres, surrounding the experimental forest and entered into the GIS with attributes assigned.

Examples of Research

- Chunk wood at 15.2 cm by 15.2 cm (6 inch by 6 inch)—a commercial fuel alternative
- Small harvesting equipment—an untapped alternative
- Adaptive forestry—silvicultural applications to meet changing needs
- Adaptive forestry—harvesting feasibility and natural resources impacts when the operating standard is changed
- Sheep—reducing vegetation competition in a plantation setting
- Measurements—animal weight change, diet content, conifer damage, conifer growth

Facilities

Visitor accommodations are limited to one small cabin with wood heat and no water. Shop facilities are minimal at Princeton, Idaho, 6 miles from the experimental forest.

Winter timber harvesting demonstration on University of Idaho Experimental Forest.

Summer timber harvesting demonstration on University of Idaho Experimental Forest.

Location

Located entirely in the county of Latah in north-central Idaho, the experimental forest lies primarily on the northeast side of Moscow Mountain. Moscow Mountain is surrounded by Federal Highway 95 and State Highways 6, 8, and 9, with many access roads including those of the experimental forest. Access by vehicle to Moscow Mountain and the experimental forest in winter is limited mostly to those roads kept open for timber removal. The approximate legal land description is portions of T. 40 N., R. 3 W. and R. 4 W., T. 41 N., R. 3 W., and R. 4 W. at and near their juncture. Latitude range is 46°47′ N. to 52′ N. and longitude is 116°43′ W. to 52′ W.

Suggested Reading

Osborne, Harold L. 1995. Report of research, education and operational activities for the University of Idaho Experimental Forest, 1978-1995. Internal report. College of Forestry, Wildlife and Range Sciences, University of Idaho, Moscow, Idaho.

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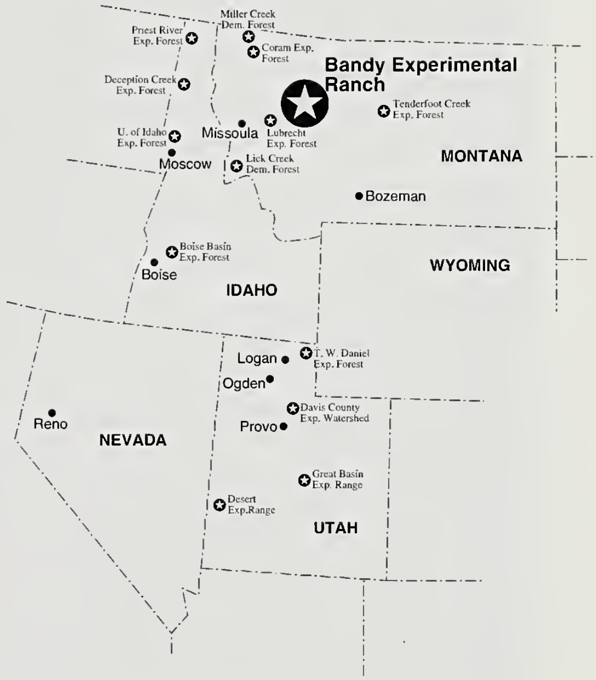
Contact Address

Manager, Experimental Forest
Department of Forest Resources
University of Idaho
Moscow, Idaho 83844-1133
Tel: (208) 885-7016
FAX: (208) 885-6564

Montana

Bandy Experimental Ranch

Henry Goetz

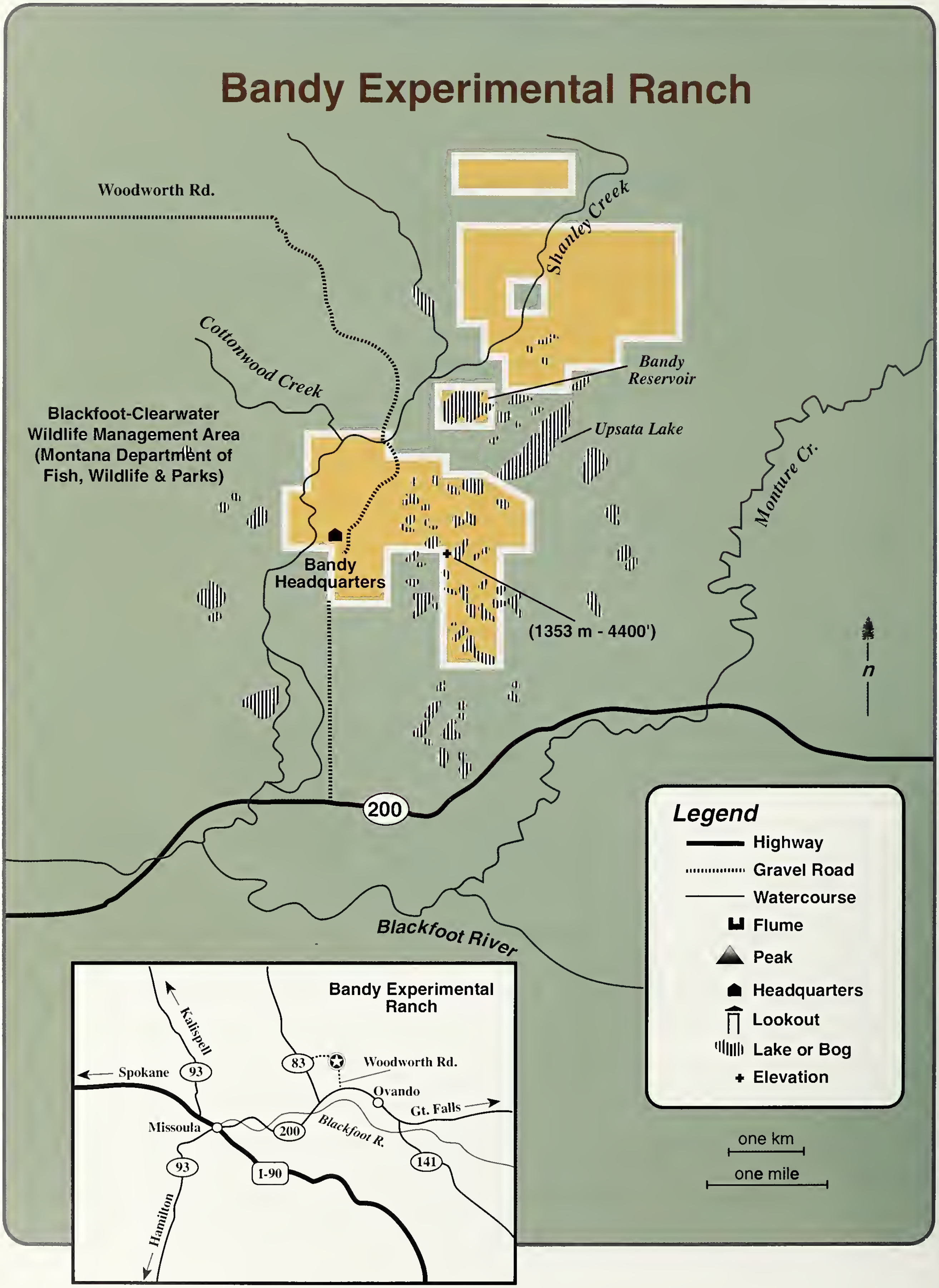


The Bandy Experimental Ranch is a 1,391 ha (3,437 acre) operating cattle ranch in the Blackfoot River drainage, 80 km (50 miles) northeast of Missoula, Montana. In 1989, Edward Bandy, Jr., a long-time Ovando Valley resident, bequeathed his ranch to the Montana Forest and Conservation Experiment Station of the University of Montana. The bequest was given with the stipulation that the property be used "...for the purpose of conducting and supporting agricultural research and management, rangeland research and management, and timberland research and management."

In 1993, the experiment station entered into an agreement with the Agricultural Experiment Station at Montana State University, Bozeman, for joint operations and cooperative research on the facility. The stations intend to operate the ranch as a self-sufficient agricultural unit with primary research emphasis on the interactions between wildlife and ranching operations.

The property is bordered on the west by the Blackfoot-Clearwater Wildlife Management Area (administered by the Montana Department of Fish, Wildlife, and Parks), on the north by Plum Creek Timber, and on the east and south by private ranches. The ranch has 740 ha (1,827 acres) of timberland, 155 ha (384 acres) of tillable irrigated hay land, and 496 ha (1,226 acres) of native pasture and water, including a 20 ha (50 acre) reservoir. The entire ranch is glacial moraine containing over 140 potholes and two major creeks. The excellent water resources help explain the ranch's considerable biological diversity.

The ranch consists of four parcels, two large and two small. The southern parcel contains the ranch buildings, the hay land, and native prairie range. About 0.5 km (0.25 mile) to the northeast is a 49 ha (120 acre) parcel of range and timberland that contains the reservoir. The Heart Bar Heart Ranch owns the land surrounding the reservoir property. The largest timbered land tract (671 ha; 1,667 acres) is situated another 0.5 km northeast. Separated by Plum Creek Timber property, an east-west strip of four 16 ha (40 acre) parcels lies 0.5 km north of the large timbered tract.



Bandy Experimental Ranch
Woodworth Rd.
Shanley Creek
Cottonwood Creek
Bandy Reservoir
Upsata Lake
Blackfoot-Clearwater Wildlife Management Area (Montana Department of Fish, Wildlife & Parks)
Monture Cr.
Bandy Headquarters
(1353 m - 4400')
n
200
Blackfoot River
Legend
Highway
Gravel Road
Watercourse
Flume
Peak
Headquarters
Lookout
Lake or Bog
Elevation
one km
one mile
Bandy Experimental Ranch
Kalispell
Spokane
93
83
Woodworth Rd.
Ovando
Gt. Falls
Missoula
200
Blackfoot R.
141
93
I-90
Hamilton

Climate

The Bandy Ranch has a temperate continental climate tempered by Pacific Maritime influences, similar to the Lubrecht Experimental Forest, northeast of Missoula, Montana. The nearest weather station is 6.4 km (4 miles) southwest of the ranch (elevation 1,253 km; 4,110 ft), relatively close to its prairie/pothole area. Data from this station indicate that the mean annual precipitation in the lower, grassland portion of the ranch is about 400 mm (16 inches), while 460 mm (18 inches) may be the average for the upper, forested portion. The wettest months are May and June, and January is the month of greatest snowfall. The annual average air temperature ranges from –8 °C (18 °F) in January to 17 °C (62 °F) in July. The temperatures are generally low and the growing season short.

Soils

The Bandy Ranch is mantled with Pleistocene materials (till from three separate glacial advances) and Miocene and Oligocene (Tertiary) lake deposits. The soils on the ranch have been mapped by the Soil Conservation Service as part of the soil survey of Powell County, Montana. Mollisols are the dominant order in the southern prairie tract. Alfisols and, to a lesser extent, Inceptisols are dominant in the northern forested tract. Soils in the riparian zones were mapped as inclusions because the map scale did not permit their delineation. However, typical, poorly drained soils of riparian zones have organic horizons, thick A horizons, G horizons, and mottles somewhere in the solum.

Bandy Experimental Ranch includes a wide variety of mountain and grassland conditions including grass, shrub, and forest habitats found on Cottonwood Creek.

Ponderosa pine forests add diversity to the Bandy Experimental Ranch resources.

Main Communities

Excluding the cultivated hay land, the three vegetative zones on the Bandy Ranch are a forest zone in the northern, higher part, a grassland zone in the southern, lower parcel, and riparian zones in the wet sites throughout the property. The ranch straddles a forest-prairie ecotone that is approximately on the north boundary of the southern parcel. The northern forested zone is primarily of the Douglas-fir (*Pseudotsuga menziesii*) habitat series. The dominant tree species are Douglas-fir, western larch (*Larix occidentalis*), lodgepole pine (*Pinus contorta*), and Engelmann spruce (*Picea engelmannii*). The wooded areas south of the line are mostly isolated, pure stands of ponderosa pine (*Pinus ponderosa*) on well-drained, north-facing sites, with quaking aspen (*Populus tremuloides*) and cottonwood (*Populus trichocarpa*) on riparian sites.

The native vegetation in the grassland zone on well-drained sites is dominated by rough fescue (*Festuca scabrella*), and much of the area is a complex of the *Festuca scabrella/Agropyron spicatum* and *Festuca scabrella/Festuca idahoensis* habitat types. The former type occurs on southern aspects and the latter on northern aspects.

The four types of riparian sites on the ranch are creekside, reservoir, beaver dam complex, and potholes. Representative vegetation on creekside and beaver dam sites include Geyer willow (*Salix geyeriana*), mountain alder (*Alnus incana*), and beaked sedge (*Carex rostrata*). On reservoir sites, representative vegetation includes quaking aspen, Bebb willow (*Salix bebbiana*), and Nebraska sedge (*Carex nebraskensis*). On pothole sites, common cattail (*Typha latifolia*), common spikesedge (*Eleocharis palustris*), and Nebraska sedge are representative. These four areas are important because of the diverse wildlife habitat that each area creates.

Data Bases

The Bandy Ranch has 16 levels of information on PAMAP, a PC-based Geographic Information System. In addition to the usual map data, the system contains information on geology and soils, glacial movement, vegetation on the Blackfoot-Clearwater Wildlife Management Area, fences, and management units. Seasonal habitat data for wildlife will be added as it becomes available. An order 3 soil survey is also available from the Natural Resources Conservation Service.

Pothole prairie conditions, used for summer pasture, are a prominent feature on Bandy Experimental Ranch.

Examples of Research

- Riparian-wetland vegetation analysis
- The effects of wildlife and livestock grazing on riparian biotic communities
- The effects of early spring elk use on summer livestock pastures
- "Wildlife friendly" fencing techniques for livestock

Facilities

The Bandy Ranch has all the normal buildings, machinery, and equipment necessary to support a 200-pair cow/calf operation. The cow herd is a typical commercial herd consisting of Herefords, Black Angus, and black-white faces. Some 65 ha (160 acres) of hayfield are irrigated with power roll sprinklers, and the balance is flood irrigated. Hay is harvested in large round bales and stored in covered, fenced sheds. The Lubrecht Experimental Forest, 32 km (20 miles) from the ranch, provides accommodations for research personnel.

Location

The Bandy Experimental Ranch is at latitude 47°12′ N., longitude 113°15′ E. Elevations range from 1,232 m (4,040 ft) above mean sea level on the southwestern corner of the property to 1,444 m (4,740 ft) on the northeastern corner. The ranch headquarters is on Woodworth Road, approximately 4 km (2.5 miles) north of its intersection with Montana Highway 200. The Woodworth Road turnoff is about 0.2 km (0.1 mile) west of mile marker 38.

Suggested Reading

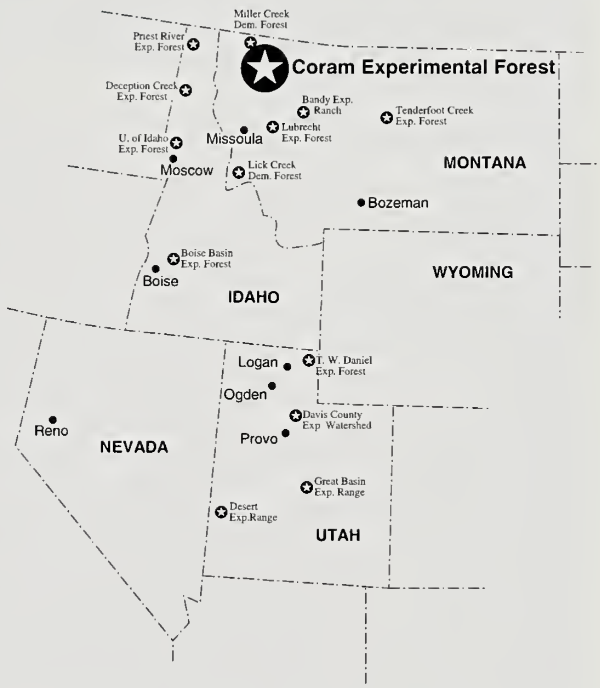
Nimlos, Thomas J. 1992. The Bandy Ranch. Montana Forest and Conservation Experiment Station. School of Forestry, University of Montana, Missoula. 11 p.

Contact Address

Ranch Manager
Bandy Experimental Ranch
235 Woodworth Road
Ovando, Montana 59854
Tel: (406) 793-5581

Coram Experimental Forest

Raymond C. Shearer

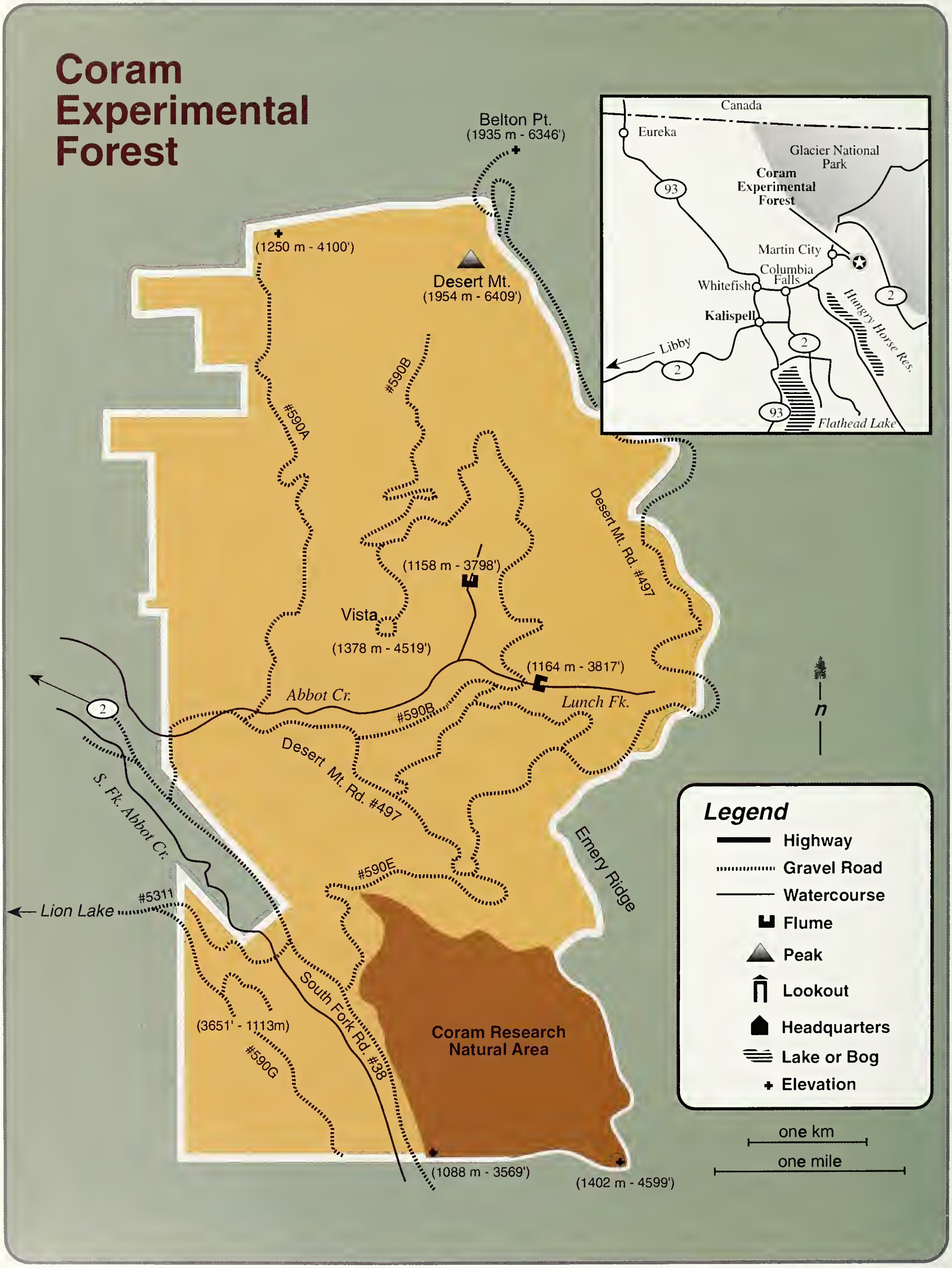


The Coram Experimental Forest is an outdoor laboratory dedicated to providing basic information needed to manage western larch (*Larix occidentalis*) forests. The Coram Experimental Forest was established in 1933 on the Flathead National Forest on 3,019 ha (7,460 acres). Western larch and Douglas-fir (*Pseudotsuga menziesii*) are the most common of 10 conifer species. The dominant, co-dominant, and many of the understory trees average over 300 years old. A few larch are over 500 years, survivors of a stand-replacing fire 300 years ago. Second-growth trees range in age from 5 to over 50 years.

For nearly 50 years, the Coram Experimental Forest has served as the focal point for much of the research of western larch. Research began in 1948. A wide range of practical studies provides land managers answers to help them effectively manage similar forest lands within the range of western larch in the Inland Mountain West of the United States and southern interior British Columbia. Coram Experimental Forest is a thriving field laboratory for studies on the ecology and silviculture of these forests. Research results point the way to proper application of silvicultural practices to achieve ecosystem management goals and enhance biodiversity of species.

In 1938, a 339 ha (838 acre) block in the southeastern corner of the Coram Experimental Forest was reserved as a natural area. It was officially designated the Coram Research Natural Area in 1988.

Studies in the late 1940's and 1950's determined how to regenerate larch and other conifers naturally using even- and uneven-age methods of harvest cutting coupled with a wide range of site preparation treatments. Research in the 1960's centered on how to regenerate larch using seeding and planting and how young larch forests, grown under a wide range of stand densities, respond with individual tree and stand growth, with understory vegetation development, with water use, and with insect, disease, and animal interactions. Studies in the 1970's and 1980's were designed to determine how to:


Coram Experimental Forest
Belton Pt.
(1935 m - 6346')
(1250 m - 4100')
Desert Mt.
(1954 m - 6409')
#590B
#590A
Desert Mt. Rd. #497
(1158 m - 3798')
Vista
(1378 m - 4519')
(1164 m - 3817')
Abbot Cr.
Lunch Fk.
#590B
2
Desert Mt. Rd. #497
S. Fk. Abbot Cr.
Emery Ridge
#590E
#5311
Lion Lake
South Fork Rd. #38
(3651' - 1113m)
#590G
Coram Research Natural Area
(1088 m - 3569')
(1402 m - 4599')
n
Canada
Eureka
Glacier National Park
Coram Experimental Forest
93
Martin City
Columbia Falls
Whitefish
Kalispell
Hungry Horse Res.
Libby
2
Flathead Lake
Legend
Highway
Gravel Road
Watercourse
Flume
Peak
Lookout
Headquarters
Lake or Bog
Elevation
one km
one mile

- Rapidly establish desired mixtures of regeneration after harvest cuttings that had been designed to utilize varying levels of woody residues
- Determine the effect of stand cultures on the development of the tree and understory vegetation components of these forests
- Reduce insect and disease problems through silvicultural practices
- Enhance watershed, aesthetics, and bird and other wildlife habitat values through silvicultural practices.

In the 1980's, permanent plots were established within the Coram Research Natural Area to monitor long-term succession of all vegetation and birds using this area.

In 1976, the United Nations Educational, Scientific and Cultural Organization designated Coram Experimental Forest and nearby Glacier National Park as Biosphere Reserves under the Man and the Biosphere program. This designation paired a field research site (Coram) with its long history of manipulative research to understand the effects of alternative forest management practices with a large protected area (the National Park) for ecosystem conservation, public education, and baseline monitoring. A 1992 Larix symposium culminated in the establishment of the International Larix Arboretum at Coram Experimental Forest Headquarters. It includes most of the world's Larix species.

Climate

Climate on the Coram Experimental Forest is typical of the Northern Rocky Mountains. Annual precipitation averages about 838 mm (33 inches) at the lowest elevation of 1,006 m (3,300 ft) and about 1,270 mm (50 inches) at Desert Mountain's elevation of 1,942 m (6,370 ft). The May through August mean temperature is about 16 °C (61 °F) with highs on occasion exceeding 38 °C (100 °F). The average winter temperature averages about –7 °C (20 °F) but often drops below –29 °C (–20 °F).

Soils

Soils on the Coram Experimental Forest are typical of those throughout the Northern Rockies. A rock layer primarily comprising argillite and quartzite underlies most of the upper slopes. Glacial outwash and till were deposited on the lower areas. Much of the forest is covered by a thin layer of volcanic ash. Rich loamy soils predominate. Soil depths range from a few centimeters on steep, upper slopes to over 3 m (9 ft) on gentle, lower terrain.

Main Communities

Six forest cover types on the Coram Experimental Forest include a majority of the area in western larch and interior Douglas-fir. Engelmann spruce/subalpine fir (*Picea engelmannii/Abies lasiocarpa*) occupy cooler, moist sites at all but the lowest elevations

Old growth western larch forest in the background with a young larch forest, which became established on a clearcut area, in the foreground.

on the Coram Experimental Forest. Other less frequent forest cover types include western redcedar (*Thuja plicata*) on a lower elevation, moist and sheltered site; western redcedar/ western hemlock (*Tsuga heterophylla*) on occasional lower to mid-elevation moist sites; and whitebark pine (*Pinus albicaulis*) along the high ridge near Desert Mountain (a population in decline because of the influence of white pine blister rust). Other trees are western white pine (*Pinus monticola*), lodgepole pine (*Pinus contorta*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and black cottonwood (*Populus trichocarpa*). Trees that grow only in shrub form on low to mid-elevations on the Coram Experimental Forest are Pacific yew (*Taxus brevifolia*), usually as an understory species on moist soils, and Rocky Mountain juniper (*Juniperus scopulorum*) on drier, more open sites.

The most common forest habitat type on the Coram Experimental Forest is *Abies lasiocarpa/Clintonia uniflora*. Phases of this habitat type include: *Aralia nudicaulis*, *Menziesia ferruginea*, *Clintonia uniflora*, and *Xerophyllum tenax*. It is common throughout this area except on dry southerly and west-facing slopes and at elevations above 1,675 m

(5,494 ft). Another common habitat type is *Pseudotsuga menziesii/Physocarpus malvaceus* found on dry southerly and west-facing slopes below about 1,675 m (5,494 ft). Other habitat types found on the Coram Experimental Forest are *Thuja plicata/Clintonia uniflora* and *Tsuga heterophylla/Clintonia uniflora*, both found in moist bottoms, often close to streams; *Abies lasiocarpa/Xerophyllum tenax* on cold, high elevation sites; and *Abies lasiocarpa/ Menziesia ferruginea* on cold, moist, and high-elevation sites on northerly slopes.

Data Bases

Reports and Publications

A publication list through 1992 of research done on Coram Experimental Forest is available (see Contact Address section).

Completed Studies

- Natural regeneration following methods of site preparation, 1949-1960
- Dispersal of conifer seed, 1949-1956
- Shelterwood and seed tree cutting, site preparation methods, and natural regeneration of conifers, 1950-1984
- Clearcutting, site preparation, seed dispersal, and natural regeneration of conifers, 1952-1964
- Strip clearcutting, site preparation, growth of unmerchantable understory trees, and natural regeneration of conifers, 1954-1974
- Group seed tree cutting, site preparation, and natural regeneration of conifers, 1956-1968
- Direct seeding, germination, and seedling survival of conifers, 1958-1964
- Small mammal relationships in old growth and recently harvested western larch, 1961-1964, 1992

Continuing Studies

- Influence of a wide range of regulated stand densities in young western larch stands on individual tree and stand growth, 1961; on insect, disease, and physical damage, 1961; on water relations and phenology, 1968; on vegetation development, 1970; and on cone production, 1984
- Evaluation of alternative timber harvesting practices—regeneration, vegetation and stand development, soil water use, 1974
- Effects of wide tree spacing and site on flowering response of larch to stem injection of $GA_{4/7}$, 1991
- Weather data, 1958

A series of studies on Coram Experimental Forest are used to evaluate long-term effects of silvicultural treatments.

Climatic Data

A wide range of data collected at 18 locations for varying periods was summarized in 1984 and is available from the Intermountain Research Station in Missoula, Montana. Seven stations now operate within Coram Experimental Forest (including the Coram Research Natural Area) and measure all or some of the following: air, soil, and water temperatures; wind run and direction; precipitation; streamflow; and relative humidity.

Aerial Photographs

Several sets of aerial photos are available from the early 1950's to the present, including some low-level photographs.

Examples of Research

- Site preparation treatments to enhance natural regeneration
- Even-age harvest cuttings for natural regeneration
- Dispersal of conifer seed into cutover stands

- Natural regeneration of conifers using even-age silvicultural systems
- Conifer seed germination and seedling establishment
- Direct seeding of conifers
- Planting bare root western larch, Douglas-fir, and Engelmann spruce
- Growth of thinned young western larch as influenced by spacing
- Effects of stand density on understory vegetation; water use; insect, bear, and snow damage
- Influence of harvest method and residue treatments on water use, nutrient cycling, microbial processes, vegetation response, forest floor arthropods, insects, disease, fire management, birds, small mammals, and aesthetics
- Influence of cutting practices on bird populations
- Revegetating road cut slopes
- Cone production and seed quality
- Streamflow

Facilities

The field headquarters at Hungry Horse, Montana, just off U.S. Highway 2, has living quarters and limited office space. Coram Experimental Forest has road access throughout much of its area, except within the Coram Research Natural Area. Most roads are gated because of grizzly bear habitat restrictions. A few areas are accessed by trails.

Headquarters buildings of Coram Experimental Forest.

Location

Coram Experimental Forest is on the Flathead National Forest near Glacier National Park. It is 45 km (28 miles) east of Kalispell, Montana. From the Hungry Horse Ranger Station, drive 1 km (0.6 mile) to the Martin City junction, turn right and drive 3 km (1.9 miles) east to the main entrance of the Coram Experimental Forest. Roads to research plots are usually snow free from May through October.

Suggested Reading

Hungerford, Roger D.; Schleiter, Joyce A. 1984. Weather summaries for Coram Experimental Forest, northwestern Montana—an International Biosphere Reserve. Gen. Tech. Rep. INT-160. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 34 p.

Klages, M.G.; McConnell, R.C.; Nielsen, G.A. 1976. Soils of the Coram Experimental Forest. Res. Pap. 91. Bozeman, MT: Montana Agricultural Experiment Station. 43 p.

Schmidt, Wyman C.; Shearer, Raymond C.; Roe, Arthur L. 1976. Ecology and silviculture of western larch forests. Tech. Bull. 1520. Washington, DC: U.S. Department of Agriculture, Forest Service. 96 p.

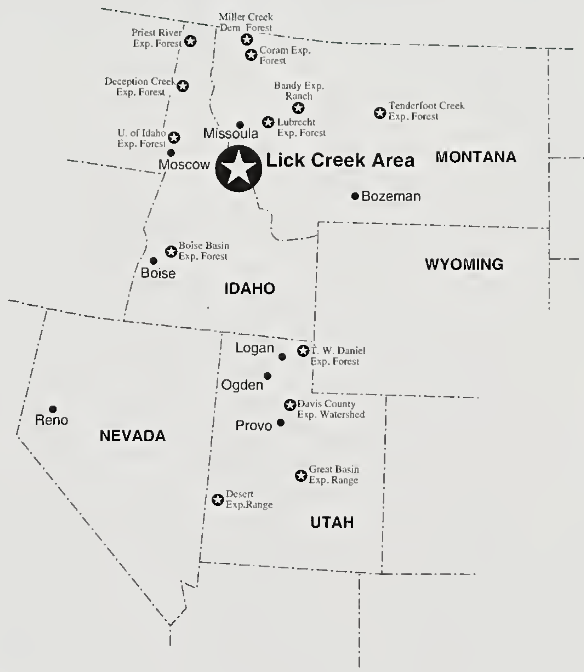
Shearer, Raymond C.; Holgate, Marilyn J. Compilers. 1992. Research publications on the Coram Experimental Forest, Montana, 1948-1992. Missoula, MT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Forestry Sciences Laboratory. 12 p.

Contact Address

Project Leader
Ecology and Management of Northern Rocky Mountain Forests
Intermountain Research Station
Forestry Sciences Laboratory
800 Block East Beckwith
Box 8089
Missoula, Montana 59807
Tel: (406) 721-5694
FAX: (406) 543-2663

Lick Creek Ecosystem Management/ Research Demonstration Area

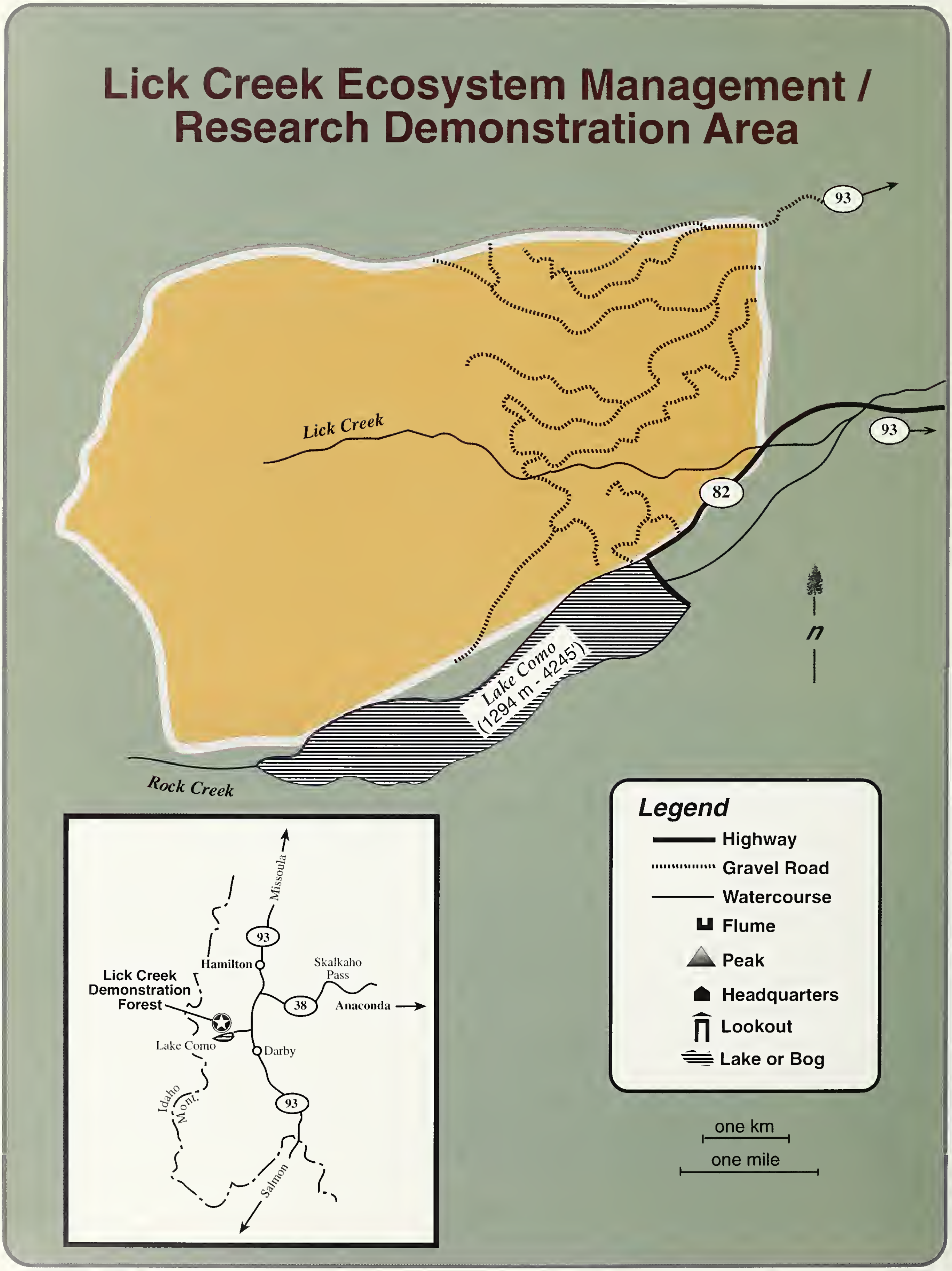
Clinton E. Carlson and Rick F. Floch



The Lick Creek Ecosystem Management/Research Demonstration Area is on the Darby Ranger District of the Bitterroot National Forest in western Montana. Although the area has a long history (since 1906) of management and research activities, it was not officially established until February 1991 when the Intermountain Research Station and the Bitterroot National Forest entered into a formal agreement to cooperate on innovative methods to manage vegetation for varied resource outputs.

Lick Creek is a small watershed of about 1,420 ha (3,500 acres). It is between two major west-to-east drainages of the Bitterroot Mountains—Lost Horse Creek to the north and Rock Creek to the south—and is bordered by the Selway/Bitterroot Wilderness Area on the west. Elevations range from about 1,160 to 2,380 m (3,800 to 7,800 ft) mean sea level. Slopes range from 5 percent at the lower reaches to over 70 percent in the upper portions.

The first timber sale in Lick Creek occurred in 1906. At that time old growth ponderosa pine (*Pinus ponderosa*) was the dominant species over much of the area; Douglas-fir (*Pseudotsuga menziessii*) typically represented less than 10 percent of the stand by volume. Photographs of stand conditions were taken in 1909. Permanent photo points were established in 1938 and included the locations of the 1909 photos. Photo records of conifer succession were made in 1909, 1925, 1927, 1937, 1949, 1958, 1969, 1979, and 1992. The photos and publications illustrating this succession are located at the Intermountain Research Station, Missoula, Montana. Permanent plots to assess effects of residual basal area on stand growth following harvest were installed in the 1940's and monitored periodically. These plots have been maintained and are easily found.


Lick Creek Ecosystem Management / Research Demonstration Area
93
93
82
Lick Creek
Lake Como (1294 m - 4245')
Rock Creek
n
Missoula
93
Hamilton
Skalkaho Pass
Lick Creek Demonstration Forest
38
Anaconda
Lake Como
Darby
Idaho
Mont.
93
Salmon
Legend
Highway
Gravel Road
Watercourse
Flume
Peak
Headquarters
Lookout
Lake or Bog
one km
one mile

In 1991 an interdisciplinary study was installed to determine the influence of prescribed fire on understory development. The three types of harvest used were retention shelterwood, selection, and thinning. Two burn types invoked were dry and wet. The concept is to bring large diameter ponderosa pine back as a primary stand component, similar to the pre-1900 conditions, and maintain that status with periodic prescribed underburning. Treatment effects on wildlife forage, birds, wildlife cover, tree growth, nutrient flux, and other response variables will be assessed through time. Permanent data plots and photo points have been established.

Climate

Summers are generally dry/warm; winters are dry/cold. Annual precipitation at the lower elevations is about 500 mm (20 inches) and increases to about 900 mm (35 inches) at the higher elevations. The high crest of the Bitterroot Range to the west causes a dramatic rain shadow effect on Lick Creek. Snow typically accumulates to less than 0.3 m (1 ft) at the lower areas but reaches 1.0 to 1.2 m (3 to 4 ft) at about 2,100 m (7,000 ft).

Soils and Geology

Bedrock is intrusive granite, part of the Idaho Batholith. The area was heavily glaciated; Lick Creek is bordered north and south by two large lateral moraines. Soils generally are shallow granitic with a poorly developed organic horizon. They are gravelly and cobbley

Lick Creek drainage, with the spectacular Bitterroot Range in the background.

Features at Lick Creek include culture and retention of large diameter ponderosa pine through selection and irregular shelterwood silvicultural systems.

with sandy loam textures and are intermittently shallow and deep. In the lower reaches of the Lick Creek drainage, soils tend to be clayey textured. Soils formed in glacial tills are sandy, with gravels, cobbles, and stones making up 50 percent or more of their mantle. Large surface boulders are plentiful in most areas, reminiscent of glaciation. Soils are nutrient-poor and silica-rich and generally sensitive to surface disruption. The clayey soils along the stream bottom are sensitive to compaction.

Main Communities

Forest climax series include Douglas-fir on the dry aspects and grand fir (*Abies grandis*) on the moist aspects of the lower elevations, and subalpine fir (*Abies lasiocarpa*) at the higher elevations. Ponderosa pine is seral on the Douglas-fir series and is present in varying amounts depending on the incidence of past site disturbance. Ponderosa pine, lodgepole pine (*Pinus contorta*), and Douglas-fir are seral on the grand fir and subalpine fir series. Willow (*Salix* sp.), serviceberry (*Amelanchier alnifolia*), bitterbrush (*Purshia tridentata*), and huckleberry (*Vaccinium* sp.) are common shrubs.

In the absence of disturbance or site preparation over the last 100 years, Douglas-fir has increased to abnormally high numbers on the Douglas-fir series, as have grand fir and subalpine fir on those climax series, generally at the expense of the seral conifers and shrub species. Prior to 1900, fire-free intervals at the lower elevations were only about 7 to 15 years. Since 1900 no significant fire has occurred in the Lick Creek drainage. At the higher elevations, fire-free intervals were 30 to 50 years and were a combination of stand-replacement and underburn fires.

Data Bases

Data from permanent plots have been taken periodically since the 1940's and are available on electronic media. A permanent station to record temperature and rainfall was installed in 1993. A photographic record of succession is available, dating to 1909. New permanent plots will record stand development following harvests and underburning.

Examples of Research

- Effect of residual basal area on stand development
- Effect of residual stand structure on composition and structure of subsequent stand
- Effects of underburning on understory development
- Effects of underburning on nutrient flux
- Conifer regeneration following shelterwood and selection harvest
- Effects of harvest and underburning on bird activity
- Public perceptions of ecosystem management
- Effects of underburning on planted western larch and ponderosa pine

Surface fires, absent for nearly 100 years, have been reintroduced at Lick Creek to reduce stocking of intermediate and small Douglas-fir. Historic fire-free intervals were about 10 years. Removal of fire allowed firs to increase exponentially.

Facilities

Lick Creek has a small cabin that can accommodate small groups for indoor discussion. There are no overnight facilites, except for a National Forest campground at Lake Como, adjacent to Lick Creek. Motels are available in Darby and Hamilton, about 16 and 32 km (10 and 20 miles) distance, respectively.

Location

The Lick Creek Ecosystem Management/Research Demonstration Area is about 16 km (10 miles) northwest of Darby, Montana (lat. 46°5′ N., long. 114°15′ W.). Main access is by paved road from Highway 93 about 6 km (4 miles) north of Darby, then by improved gravel road for about 3 km (2 miles).

Suggested Reading

Carlson, Clinton E.; Floch, Rich; Fiedler, Carl. 1994. Research and demonstration of ecosystem management principles in ponderosa pine/Douglas-fir forests: Lick Creek, Bitterroot National Forest. In: Foley, Louise, compiler. Gen. Tech. Rep. SE-88. Proceedings—silviculture: from the cradle of forestry to ecosystem management. National Silviculture Workshop, Hendersonville, NC; November 1-4, 1993. Ashville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station: 201-206.

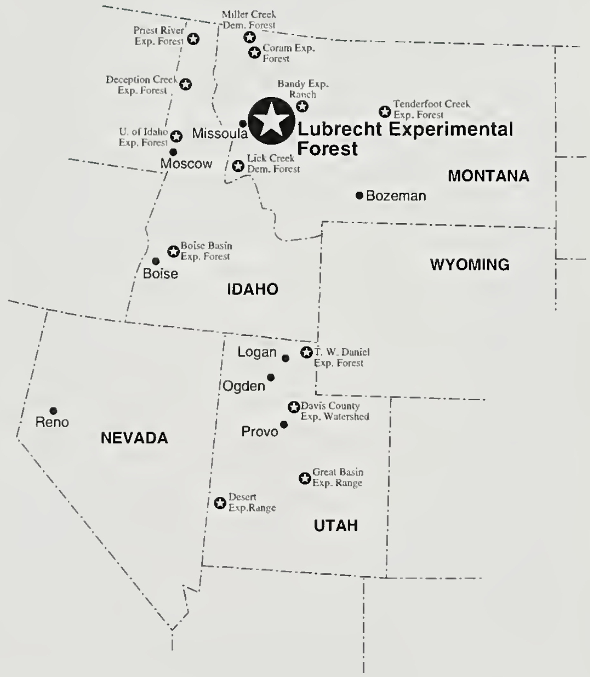
Gruell, George E.; Schmidt, Wyman C.; Arno, Stephen F.; Reich, William. 1982. Seventy years of vegetative change in a managed ponderosa pine forest in western Montana—implications for resource management. Gen. Tech. Rep. INT-130. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 42 p.

Contact Address

Project Leader
Ecology and Management of Northern Rocky Mountain Forests
Intermountain Research Station
Forestry Sciences Laboratory
800 Block East Beckwith
Box 8089
Missoula, Montana 59807
Tel: (406) 721-5694
FAX: (406) 543-2663

Lubrecht Experimental Forest

Henry Goetz

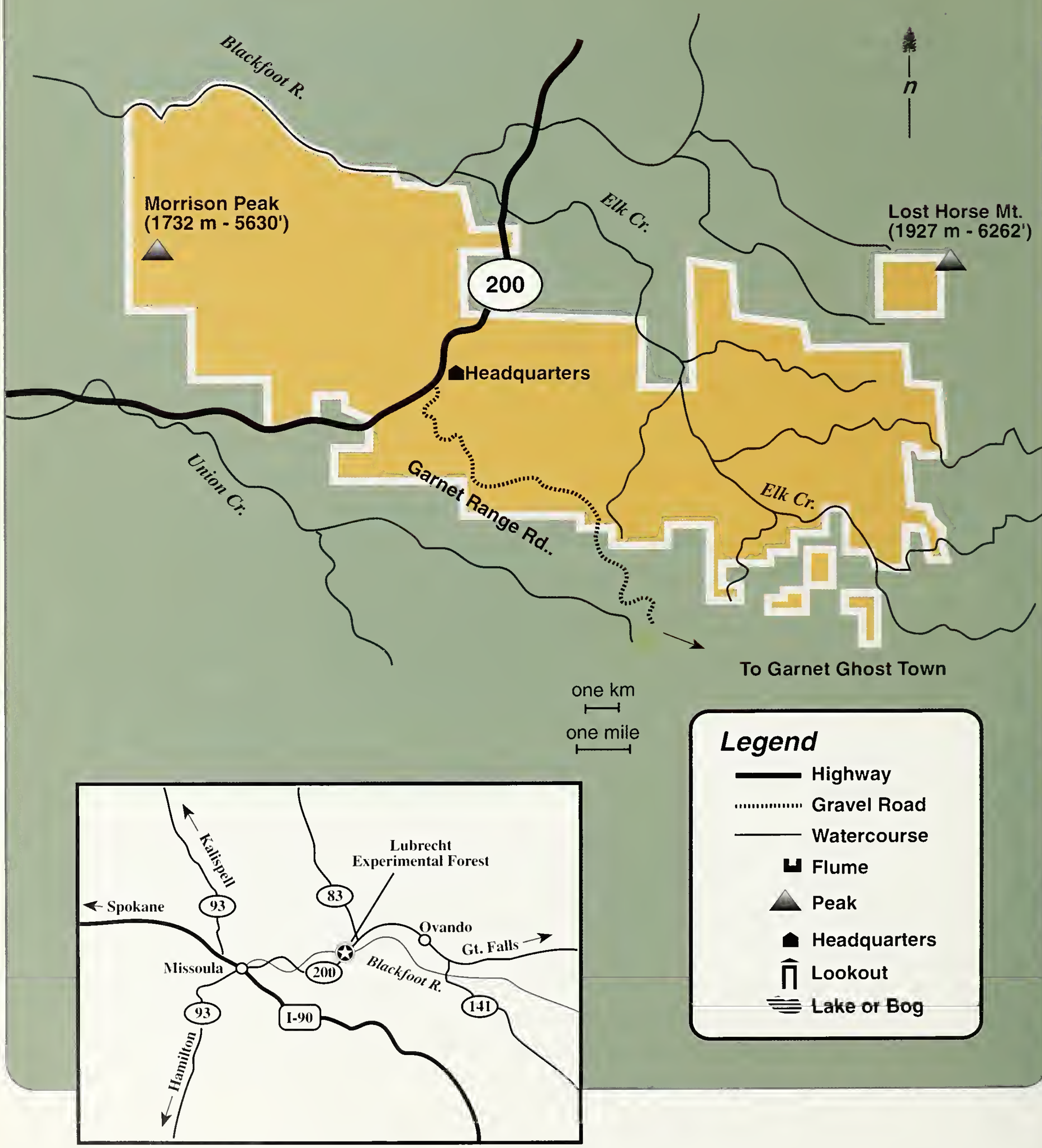


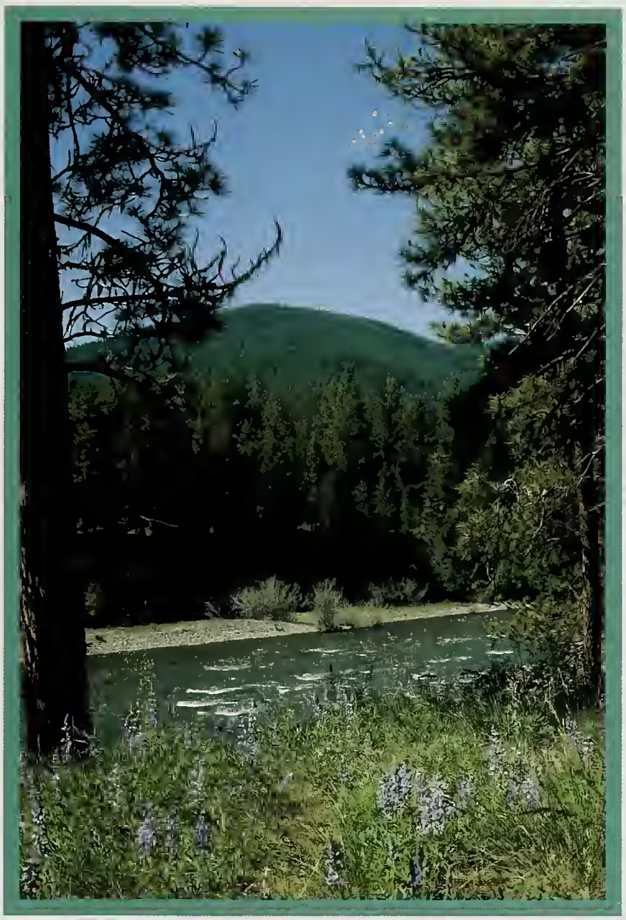
The Lubrecht Experimental Forest is a 11,330 ha (28,000 acre) outdoor laboratory and classroom located 48 km (30 miles) northeast of Missoula, Montana, in the Blackfoot River drainage. The Montana Forest and Conservation Experiment Station of the University of Montana owns and operates 8,500 ha (21,000 acres) of the forest. The remainder is under the jurisdiction of the Montana Department of State Lands and is managed cooperatively with the experiment station. The Lubrecht Forest was created in 1937 when the Anaconda Copper Mining Company donated 4,070 ha (10,058 acres) to the experiment station. Two years later the Northern Pacific Railway Company donated an additional 490 ha (1,210 acres). Over the years smaller tracts have been obtained from private individuals to bring the total acreage to its present figure.

Dedicated to the advancement of natural resource knowledge through research and education, the Lubrecht Forest has been the site of numerous research and demonstration projects since 1950. Long-term demonstration sites include uneven-age management, ponderosa pine plantation techniques, tree thinning responses, and small equipment harvesting techniques. Both undergraduate and graduate students use the forest and camp facilities in their forestry, wildlife, recreation, and range management education.

Lubrecht also supports a full range of operational activities that include timber harvesting, livestock grazing, hunting, and river-related recreation. The station harvests approximately 2,800 m^3 (500 MBF) of timber annually, primarily through commercial thinning and stand improvement cuts. Lubrecht has four active livestock grazing areas that provide 1,500 animal unit months of grazing for three neighboring ranches. Although the entire forest is open for hunting, only nonmotorized access is permitted on two-thirds of the area. Hundreds of people use the 32 km (20 mile) trail system for hiking in the summer and cross-country skiing in the winter.

Lubrecht Experimental Forest





Lubrecht Experimental Forest offers a wide variety of forest habitats and resource values.

Climate

The Lubrecht Forest has a temperate continental climate tempered by Pacific Maritime influences. Weather records have been maintained at the forest since 1956. The average monthly temperature is 4 °C (39 °F) with the lowest in January at –8 °C (17.5 °F) and the highest in July at 16.5 °C (61.7 °F). Daily temperatures in this mountainous terrain have varied from –43 to 40.5 °C (–45 to 105 °F). The average annual precipitation is 455 mm (17.90 inches) with approximately half the total in the form of snow.

Soils

The forest contains sedimentary, igneous, and metamorphic bedrock and a variety of transported materials, including alluvium, lacustrine, and volcanic ash. Because the parent materials vary, soil textures also vary from very fine to sand and stony, depth from shallow to very deep, pH from acid to alkaline, and organic matter contents from low to high. Most soils in the forest are well drained and occur on steep slopes, but some on gentle slopes and flat terrain are poorly drained. Inceptisols with a geologic substrate of belt, granite, and limestone colluvium and alluvium make up 86 percent of the Lubrecht soils.

Demonstrations of various silvicultural practices, such as this study of uneven-age management of ponderosa pine, are key to understanding how these forests function.

Main Communities

The vegetation on Lubrecht follows elevational gradients and exposures typical of this area of western Montana. Stands of ponderosa pine (*Pinus ponderosa*) interspersed with grassy openings dominate the lower elevations and south-facing slopes. As the elevation increases on north and east slopes, the timber type changes to a mixture of Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine. In many instances the Douglas-fir predominates. Almost 80 percent of the forest cover is Douglas-fir and ponderosa pine. Western larch (*Larix occidentalis*) is also mixed with the Douglas-fir on many of the easterly and northerly slopes. Approximately 10 percent of the forest is covered with dense stands of lodgepole pine (*Pinus contorta*) that established following wildfires. Occasional stands of Engelmann spruce (*Picea engelmannii*) and subalpine fir (*Abies lasiocarpa*) occur at the higher elevations and along the moist creek bottoms.

Data Bases

The forest uses PAMAP, a PC-based Geographic Information System, to store and analyze data. The Geographic Information System has over 30 layers of information that includes conventional map data, administrative boundaries, forest stands, soil map, inventory points, timber harvest units, grazing units, elk and deer ranges, and research areas. Global Positioning System data from the Satellite Navigation Field Evaluation Facility on the forest have also been integrated with the Geographic Information System. Climatic data (temperature, precipitation, and humidity) have been collected and summarized on a regular basis since 1956. Six complete sets of aerial photographs were made from flights in 1938, 1953, 1963, 1976, 1981, and 1992. Color photography was obtained on the last three flights.

Examples of Research

- Interaction of climatic and nitrogen fertilization on forest production
- Plant community diversity after herbicide control of spotted knapweed
- Use of a Geographic Information System to characterize rutting, bedding, and feeding site of white-tailed deer on forest winter ranges
- Uneven-age silvicultural prescriptions in ponderosa pine
- Levels of growing stock study in major species on Lubrecht
- Full-tree thinning on gentle and steep terrain

Facilities

Forest headquarters is in the Castles Forestry Research Center, a 465 m^2 (5,000 ft^2) building dedicated in 1983. The center contains administrative offices, two laboratories, a small meeting room, a large classroom that will seat 80 people, a computer room, and record storage area. Across the meadow, the camp facilities consist of a kitchen/dining hall, latrine/shower, sleeping cabins, and shop/maintenance buildings. The camp is rustic and designed to host up to 50 people during April through September. User groups supply their own bedding and have the option of preparing their own meals, hiring a cook, or having catered meal service from Missoula. The center and camp host approximately 2,000 people annually for public and professional natural resource educational activities, university workshops, student training, and community meetings. The facilities are not available for commercial or social functions.

Location

The Lubrecht Experimental Forest (latitude 46°53′ N., longitude 113°27′ E.) is 48 km (30 miles) northeast of Missoula, on Montana Highway 200. The forest headquarters entrance is 0.8 km (0.5 mile) east of mile marker 22.

Castles Forestry Research Center at Lubrecht Experimental Forest is used extensively for natural resource studies, workshops, and student training.

The forest is on a low ridge extending northwesterly from the Garnet Mountain Range. The ridge separates the Ninemile Prairie on the north from the Potomac Valley on the southwest. The Big Blackfoot River borders 8 km (5 miles) of the northwest portion of the forest. Elevations range from 1,091 m (3,580 ft) above mean sea level along a river to 1,975 m (6,480 ft) on the eastern edge of the forest.

Suggested Reading

Durgin, Carolyn; Baker, Nick; Pfister, Robert D. Compilers. 1993-1994 Biennial report for the Montana Forest and Conservation Experiment Station. School of Forestry, University of Montana, Missoula, MT. 82 p.

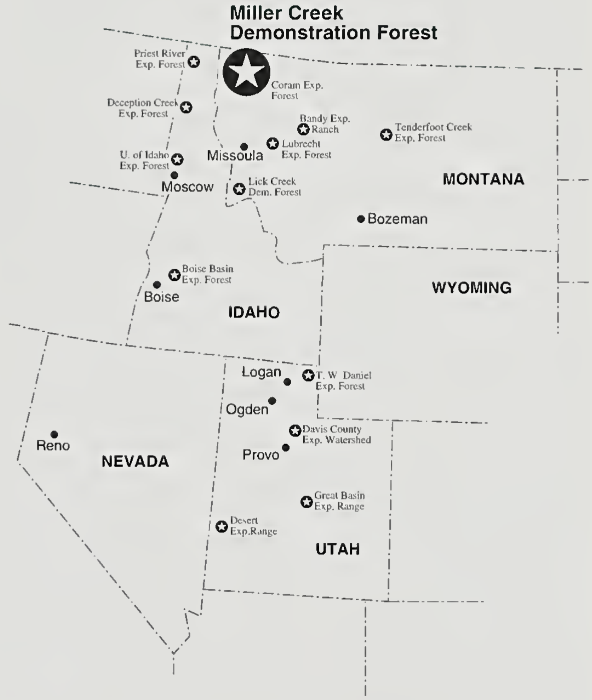
Goetz, Hank. 1994. A review of the legal, administrative, and current management situation of the Lubrecht Experimental Forest. Internal report. School of Forestry, University of Montana, Missoula, MT. 43 p.

Contact Address

Forest Manager
Lubrecht Forest, Box 1
Greenough, Montana 59836
Tel: (406) 244-5524
FAX: (406) 244-5004

Miller Creek Demonstration Forest

Raymond C. Shearer and R. Steven Wirt

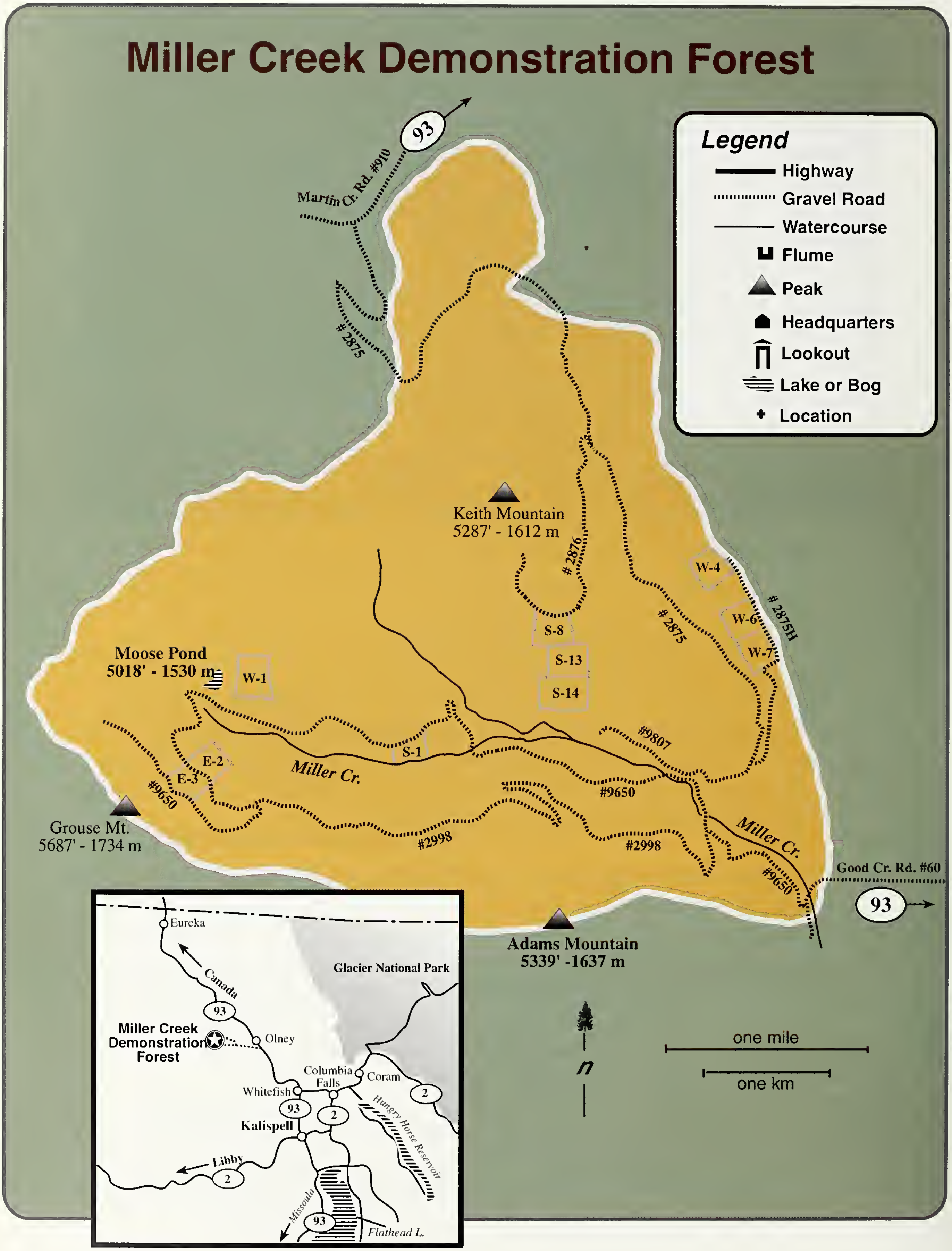


A partnership between land managers and research scientists recognized the need to improve results of prescribed burning in the Northern Rocky Mountains as a method for site preparation and hazard reduction, starting in the western larch forest type. In 1966, forested land totaling 2,234 ha (5,518 acres) on the Tally Lake Ranger District, Flathead National Forest near Whitefish, Montana, was selected as a site for cooperative studies of prescribed broadcast burning.

Sixty 4 ha (10 acre) units (15 each on slopes facing each of the four cardinal directions) were marked for clearcut and broadcast burn treatments; 53 units were within the Miller Creek drainage and seven were within the adjacent Martin Creek drainage. These units were logged from January 1967 through January 1968. Prescribed fire treatments were applied in July, August, and October 1967 and from May through October 1968. A wildfire on August 23, 1967, burned eight clearcut and five uncut units. This wildfire provided a rare opportunity to compare regeneration and plant succession of wildfire and prescribed burned areas with clearcut but unburned units.

A multidisciplinary team of scientists from seven research units worked closely with Forest Service managers through a coordinator on the Ranger District to locate plots and make measurements before, during, and after harvest and prescribed fire treatments. The primary objective for this research was to develop criteria by which prescribed broadcast fires in logging slash could be scheduled to best meet site preparation, hazard reduction, and other management goals. Most original studies concluded by 1974, but conifer regeneration and forest succession studies continued through 1989. A composite study, combining forest succession and tree development, will continue indefinitely.

Excellent cooperation among scientists and land managers enhanced the amount and quality of data collected and improved management practices. The broad base of research provides the opportunity to apply the results to ecosystem management treatments and add to the data base to compare progress over time.



Miller Creek Demonstration Forest
Legend
Highway
Gravel Road
Watercourse
Flume
Peak
Headquarters
Lookout
Lake or Bog
Location
93
Martin Cr. Rd. #910
2875
Keith Mountain
5287' - 1612 m
2876
W-4
2875H
2875
W-6
W-7
S-8
S-13
S-14
Moose Pond
5018' - 1530 m
W-1
#9807
S-1
E-2
E-3
Miller Cr.
#9650
#9650
Grouse Mt.
5687' - 1734 m
#2998
#2998
Miller Cr.
#9650
Good Cr. Rd. #60
93
Adams Mountain
5339' -1637 m
n
one mile
one km
Eureka
Canada
93
Glacier National Park
Miller Creek Demonstration Forest
Olney
Columbia Falls
Coram
2
Whitefish
93
2
Kalispell
Hungry Horse Reservoir
Libby
2
Missoula
93
Flathead L.

Frequent field tours and workshops demonstrate long-term effects of prescribed burning to a wide range of managers, researchers, educators, and the general public.

In 1989, the Flathead National Forest designated this area as the Miller Creek Demonstration Forest and initiated a memorandum of understanding with the Intermountain Research Station to protect existing study areas and promote future research. These Forest Service units will continue this partnership to use the experience and information from the studies to improve management practices.

Climate

The Miller Creek Demonstration Forest has long, cool, wet winters and short, dry summers. Annual precipitation averages 640 mm (25 inches), approximately two-thirds as snow, often from Arctic fronts in November through March. Pacific Maritime frontal systems bring rain in April, May, and June when snowmelt runoff is greatest. Flooding occasionally occurs and is usually associated with rain or snow in the spring rather than from rare high-intensity summer rainfall. The Miller Creek Demonstration Forest watershed yields about 25 cm (9.8 inches) of streamflow annually. Most precipitation contributes to year-long seepage flow or is stored in the soil and reduces water deficits created by evapotranspiration.

Soils

Soils developed in glacial till from argillites and quartzites of the Wallace (Belt) formation. The soils are mantled with a thin layer of loess. They belong to the Sherlock soil series, and most are Andic Cryoboralfs with an unincorporated surface organic horizon from 2 to 8 cm (0.8 to 3.1 inches) thick. The surface 1 to 3 cm (0.4 to 1.2 inches) of mineral soil is silt loam of single-grain structure (30 percent sand, 56 percent silt, 14 percent clay). This layer overlies 30 cm (12 inches) of gravelly loam with a weak blocky structure, beneath which is stony loam for at least 2 m (6.6 ft).

Main Communities

Four Society of American Foresters forest cover types were identified. Over half of the area was classified as western larch (*Larix occidentalis*). Other types were western redcedar (*Thuja plicata*) in stream bottoms; Engelmann spruce (*Picea engelmannii*)—subalpine fir (*Abies lasiocarpa*) on cool, moist sites at higher elevations; and lodgepole pine (*Pinus contorta*) on some south-facing slopes at middle elevations. Timber volume was mostly western larch, 26 percent; Douglas-fir (*Pseudotsuga menziesii*), 31 percent; and Engelmann spruce, 31 percent. Western redcedar, subalpine fir, and lodgepole pine are the other conifers. In 1966, age of these stands ranged from 200 to 250 years.

Because the Miller Creek Demonstration Forest has a relatively uniform, cool, moist environment, the *Abies lasiocarpa/Clintonia uniflora* habitat type predominates. Three phases of this habitat type are represented on the Miller Creek Demonstration Forest: *Menziesia ferruginea* phase on the colder middle and upper north and east slopes; *Xerophyllum tenax* phase on the drier south and west aspects; and the *Clintonia uniflora* phase on the remaining sites. Cool, moist stream bottoms were mapped as *Thuja plicata/Clintonia uniflora* habitat types.

Data Bases

Completed Studies

- Fire behavior and effects, 1967-1968
- Air quality and smoke management, 1967-1968
- Small mammal populations, 1967-1974
- Soil erosion, 1967-1974
- Water quality, 1967-1974
- Conifer regeneration, 1967-1989
- Plant succession, 1966-1992

Prescribed burning techniques and time of the year to burn were the main initial focus of studies at Miller Creek Demonstration Forest.

Continuing Study

Development of conifer regeneration and forest succession began in 1990 and will be remeasured every 5 years.

Climatic Data

Data on daily temperature (minimum and maximum) and daily precipitation for growing season are available from 1967 to present.

Maps

Topographic, habitat type, and plot location maps are available.

Aerial Photographs

Several sets are available from the mid-1960's to present.

Permanent plots are remeasured periodically to evaluate vegetation succession as affected by prescribed and natural burns on Miller Creek Demonstration Forest.

Examples of Research

- Fire behavior and effects of prescribed broadcast fires
- Air quality and smoke management of prescribed broadcast fires
- Small mammal populations in treated and untreated stands
- Soil erosion in treated and untreated stands
- Water quality in treated and untreated stands
- Conifer regeneration on a wide range of treatments
- Plant succession on a wide range of treatments
- Soil moisture
- Stand development following a wide range of treatments

Facilities

No nearby office or laboratory facilities are available. Field research includes a wide range of clearcutting and prescribed broadcast burn (or no burn) treatments on slopes facing the four cardinal directions. Also, some stands of virgin timber were burned by wildfire, and results are contrasted with the planned treatments. Treatments are usually about 4 ha (10 acres) in area.

Location

The Miller Creek Demonstration Forest lies about 99 km (61 miles) east of the Idaho-Montana border and about 53 km (33 miles) south of the Canada-United States border. It is a 1,781 ha (4,400 acres) block that occupies portions of the Miller Creek and Martin Creek drainages 6.5 km (4 miles) east of Olney, Montana (between 48°30′ and 48°33′ N. latitude, 114°39′ and 114°44′ W. longitude; T. 32 N., R. 24 W., S. 8, 9, 16, 17, 19, 20, 29, 30; T. 32 N., R. 25 W., S. 24). Elevations range from 1,280 to 1,527 m (4,200 to 5,000 ft).

From the Tally Lake Ranger Station, just west of Whitefish, Montana, drive about 23 km (14 miles) north on U.S. Highway 93 and turn west, left on the Good Creek Road (Forest Service Road 60). Follow the Good Creek Road for about 11 km (6.8 miles). The first 9 km (5.6 miles) of this road are pavement, and the remaining distance is gravel to Miller Creek Road (Forest Service Road 2875). This junction is the southeast corner of Miller Creek Demonstration Forest. Roads on the forest are usually snowfree from May through October.

Suggested Reading

DeByle, Norbert V. 1981. Clearcutting and fire in the larch/Douglas-fir forests of western Montana: a multifaceted research summary. Gen. Tech. Rep. INT-99. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 73 p.

Shearer, Raymond C.; Stickney, Peter F.; VanDenburg, James H.; Wirt, R. Steven. 1994. A long-term management and research partnership facilitates ecosystem management opportunities in a Montana western larch forest. In: Foley, Louise H., compiler. Proceedings—Silviculture: from the cradle of forestry to ecosystem management. National Silviculture Workshop; 1993 November 1-4. Hendersonville, NC. Gen. Tech. Rep. SE-88. Asheville, NC: U.S. Department of Agriculture, Forest Service, Southeastern Forest Experiment Station: 194-200.

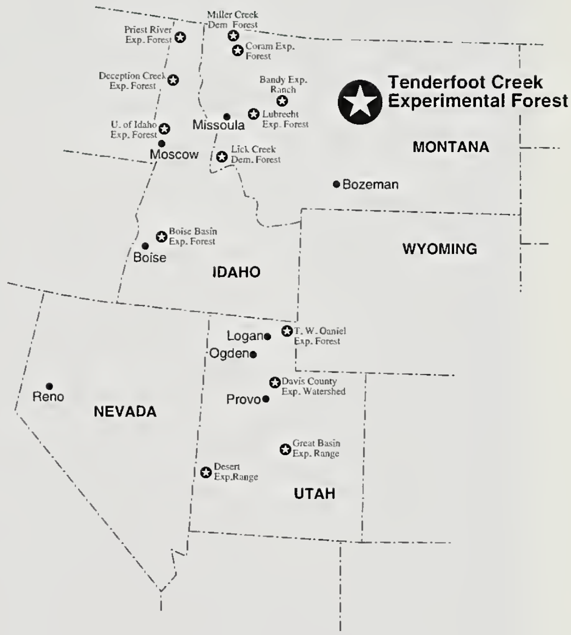
Contact Addresses

District Ranger
Tally Lake Ranger District
1335 Highway 93 West
Whitefish, Montana 59937
Tel: (406) 862-2508

Project Leader
Ecology and Management of Northern Rocky Mountain Forests
Forestry Sciences Laboratory
800 Block East Beckwith
Missoula, Montana 59812
Tel: (406) 329-3485
FAX: (406) 543-2663

Tenderfoot Creek Experimental Forest

Ward W. McCaughey

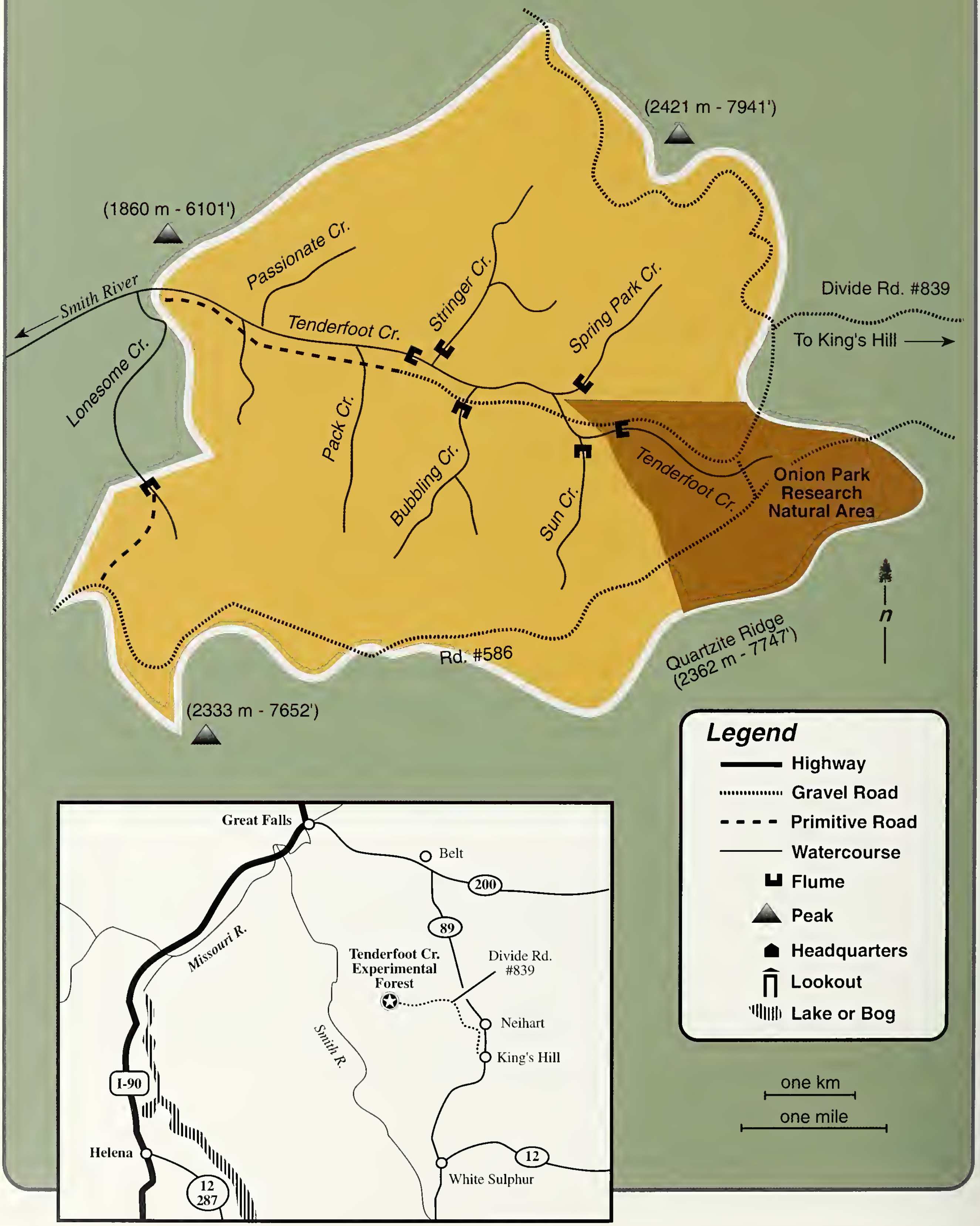


The Tenderfoot Creek Experimental Forest, established in 1961, is representative of the vast expanses of lodgepole pine (*Pinus contorta*) found east of the Continental Divide in Montana, southwest Alberta, and Wyoming. Discrete generations of even-age lodgepole stands form a mosaic typical of the fire-prone forests at moderate to high altitudes in the Northern Rocky Mountains. Spruce (*Picea engelmannii*) grows in the area's sparse but species-rich wetlands, while whitebark pine (*Pinus albicaulis*) and subalpine fir (*Abies lasiocarpa*) grace the higher ridgetops. Native cutthroat trout (*Oncorhynchus clarki*), rainbow trout (*Oncorhynchus mykiss*), cutthroat-rainbow hybrids, and brook trout (*Salvelinus fontinalis*) spawn in the forest's six main drainages.

The Tenderfoot Creek Experimental Forest is the only experimental forest formally dedicated to research on the east slope of the Northern Rockies. Established originally for watershed research, its scope was recently expanded to include study of fire history, fisheries, composition of vegetation and animal communities, including rare, endangered, and sensitive species, and other physical, biological, and social factors as they relate to landscape-level management.

The Tenderfoot Creek Experimental Forest encompasses 3,591 ha (8,870 acres) in the Little Belt Mountains on the Lewis and Clark National Forest, about 40 air km (25 miles) north of White Sulphur Springs, Montana. Lodgepole pine occupies about 3,412 ha (8,428 acres) of the forest, wet meadows cover 125 ha (309 acres), while grassy slopes make up another 54 ha (133 acres). Elevations in this rugged area range from 1,840 to 2,421 m (6,035 to 7,941 ft). Tenderfoot Creek drains into the Smith River (a tributary of the Missouri River), a well-known blue-ribbon trout stream.

Tenderfoot Creek Experimental Forest

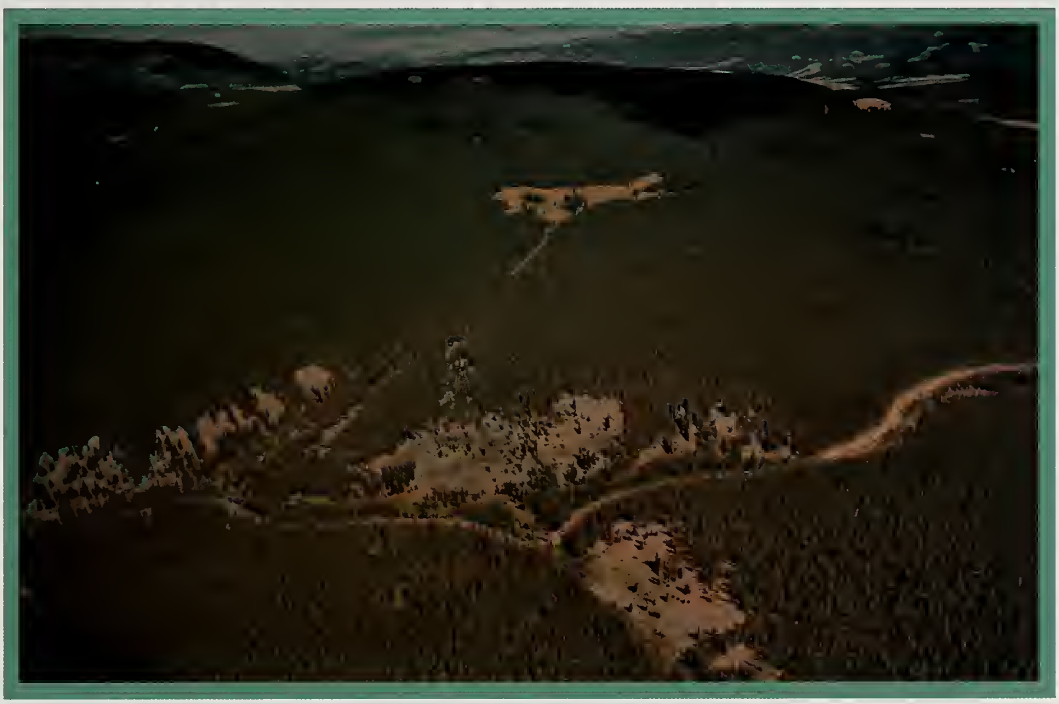


Climate

The climate in the Little Belt Mountains is generally continental with occasional influence of the Pacific maritime climate along the Continental Divide from Marias Pass south. Average annual precipitation ranges between 380 to 510 mm (15 to 20 inches) on the drier foothill regions on the south side of the Little Belts and over 1,020 mm (40 inches) on some of the alpine ridges in the central parts of the range.

Annual precipitation on Tenderfoot Creek Experimental Forest averages 880 mm (35 inches) and ranges from 594 to 1,050 mm (23 to 41 inches) from the lowest to highest elevations. Monthly precipitation generally peaks in December or January at 100 to 125 mm (4 to 5 inches) per month and declines to a late July through October dry period of only 50 to 60 mm (2 to 4 inches) per month. Approximately 70 percent of the annual precipitation falls during November through May, usually in the form of snow. Intense summer thunderstorms are relatively rare, and most overland flow and associated soil erosion are associated with snowmelt. Runoff from the forest is estimated to average about 250 mm (9.8 inches) per year. Peak flow usually occurs in late May or early June and is generated by snowmelt or in combination with rainfall. Lowest flows usually occur from August through winter months.

Mountain soils generally are at field capacity at the beginning of plant growth in early spring. At lower elevations and on dry south-facing slopes, plant soil moisture stress



Aerial view of Tenderfoot Creek Experimental Forest, a typical lodgepole pine ecosystem in the Northern Rockies.

Snow depths and water equivalents are measured periodically at dispersed sites on Tenderfoot Creek Experimental Forest.

stops plant growth for shallow rooted plants by mid-July. At higher elevations growing seasons are shorter, and killing frosts limit growth rather than does moisture stress.

Freezing temperatures and snow can occur every month of the year at Tenderfoot Creek Experimental Forest and throughout the Little Belt range. For hardy native plants, growing seasons average 45 to 75 days decreasing to 30 to 45 days on the higher ridges.

Soils

Tenderfoot Creek, a west-flowing perennial stream, has developed across a gently sloping north-south anticline. The most extensive soil groups are the loamy skeletal, mixed Typic Cryochrepts and clayey, mixed Aquic Cryoboralfs. Rock talus slopes are prominent on the perimeter of the landscape, but rock outcrops are confined chiefly to areas adjacent to the main stream channels. Also prominent in the area are grassland parks chiefly at the head of the drainages. Soils in the parks range from well to poorly drained. Seeps and springs are common over the entire forest.

The geology of Tenderfoot Creek Experimental Forest is characterized by igneous intrusive sills of quartz porphyry, Wolsey shales, Flathead quartzite, and granite gneiss. The northern part of the forest occupies the highest elevations and steepest upland topography and is underlain by igneous intrusive granitic rocks. The arched bedrock in the area was formed from metasediments of Cambrian Age consisting mainly of argillites and quartzites. Glaciation has influenced the landform, producing broad basins in which the streams are beginning to regain a water-carved dendritic pattern. Tenderfoot Creek has carved the deepest pattern and is entrenched in a steep canyon with prominent bedrock cliffs.

Main Communities

According to Pfister's (1977) habitat type classification, four forest habitat types are present on the Tenderfoot Creek Experimental Forest:

- *Abies lasiocarpa/Vaccinium scoparium*
- *Abies lasiocarpa/Vaccinium globulare*
- *Abies lasiocarpa/Calamagrostis canadensis*
- *Abies lasiocarpa-Pinus albicaulis/Vaccinium scoparium*

In addition to these four climax types, a portion of the forest keys to the *Pinus contorta/Vaccinium* community type. In this case, however, the community type is attributable to the *Abies lasiocarpa/Vaccinium scoparium* habitat type because of the extensive and continuous presence of *Abies* regeneration and old growth throughout the forest.

Stream flow is monitored continuously, and water sediment and nutrient/chemical samples are collected periodically at flume sites on Tenderfoot Creek Experimental Forest.

Within each habitat type there are stands of different age classes occurring intermittently throughout the forest. Four other general land descriptions classified for the forest are talus slopes, rock outcrops, grassland parks, and wet meadows.

Data Bases

Among reports on the establishment and early survey work of Tenderfoot Creek Experimental Forest are:

- Establishment report—1961
- Timber inventory—1957-1963
- Soil types and maps—1966
- Fuels analysis—1974
- Ecological habitat type descriptions—1975
- Prospectus of multiresource research program—1975
- Wildlife prescriptions—1977
- Silviculture prescription for timber—1977
- First approximation of integrated treatments for Tenderfoot Creek Experimental Forest—1978
- Hydrologic Instrumentation Plan—1979
- Action Plan for Tenderfoot Creek Experimental Forest—1990

A recent report describes the research activities for the experimental forest since watershed monitoring began in 1991. Reports can be obtained from the Forest Manager (see contact address).

Climatic Data

Weather records dating back to 1967 are available from Snow Survey Telemetry System (SNOTEL) sites near Tenderfoot Creek Experimental Forest. A weather station was installed on the forest in 1993, and eight precipitation and snow course data sites were installed in 1992. Two snow pillows were installed in 1993 and are recording snow water equivalent values for open and closed canopy areas in the upper elevations of the experimental forest. In 1992 snow depth and snow water equivalent monitoring were initiated for evaluating winter precipitation.

Hydrologic Data

Three flumes were installed in 1992, two in 1993, and two in 1994. Stream discharge records are being recorded on continuous strip chart recorders. Sediment and nutrient composition of streams have been monitored since 1992. Automated sediment samplers were installed in 1994, collecting daily sediment production during spring, summer, and fall.

Vegetation Data

Basic forest stand information has been compiled by Lewis and Clark National Forest for all stands identified on Tenderfoot Creek Experimental Forest. Fire history data show fire patterns and current forest stand characteristics. A vegetation mapping study of Onion Park Research Natural Area describes 17 habitat and community types of that portion of Tenderfoot Creek Experimental Forest. A fuels inventory was completed in 1974 for the experimental forest.

Maps and Aerial Photos

Available maps include soils, habitat types, forest stands, geology, fire history, Onion Park Research Natural Area vegetation communities, topographic features, transportation plan, precipitation zones, and watershed boundaries. Aerial photos are available from 1945, 1955, 1960, 1971, 1981, 1988, and 1989 (infrared). Geographical Information Systems layers include forest stands, experimental forest boundaries, roads, streams, watershed boundaries, precipitation zones, data sampling locations, and elevations.

Examples of Research

Research activity on Tenderfoot Creek Experimental Forest is designed to develop and evaluate methods for sustaining the productivity and biodiversity of east-side lodgepole pine communities. Baseline information is being collected in these subject areas:

- Vegetation resources
- Hydrologic inputs and outputs
- Water quality (chemical and sediment)
- Climate
- Wildlife (avian and mammals)
- Fisheries resources (habitat and population surveys)
- Social aspects
- Fire history
- Stream channel characterization

Facilities

The ten permanent structures on Tenderfoot Creek Experimental Forest include seven flumes and three snow pillows. A fully contained travel trailer is parked on or near the experimental forest during summers providing temporary quarters for field crews.

Field research facilities include seven watershed gauging stations, a snow and weather station in Onion Park Research Natural Area, and eight data sites for collection of snow and rainfall data.

Other features include two internal access roads for stream monitoring (Tenderfoot Creek and Lonesome Creek). All other roads are just within, or on the border of, three of the four forest boundaries. The western boundary of the forest is accessed by trails only. Tenderfoot Creek Experimental Forest is open for foot, horse, and motorbike travel in the summer and snowmobile use in the winter. The main road along Tenderfoot Creek is closed to large motorized vehicles except for administrative use.

Location

The 3,591 ha (8,870 acres) Tenderfoot Creek Experimental Forest (lat. 46°55′ N., long.110°52′ W.) is at the headwaters of Tenderfoot Creek on the Lewis and Clark National Forest in Meagher County, Montana. The experimental forest lies within T. 13 N., R. 6, 7 E. and T. 14 N., R. 6, 7 E., MPM.

The forest is approximately a 64 km (40 mile) drive north of White Sulphur Springs, Montana, or a 114 km (71 mile) drive southeast of Great Falls, Montana. The Forest Manager's office is at the Forestry Sciences Laboratory in Bozeman, Montana, approximately 177 km (110 miles) south of the experimental forest.

Suggested Reading

Farnes, Phillip E.; McCaughey, Ward W. 1995. Hydrologic and geologic characterization of Tenderfoot Creek Experimental Forest, Montana. Unpublished Report. Bozeman, MT: Forestry Sciences Laboratory, Montana State University. 200 p.

McCaughey, Ward W.; Farnes, Phillip E. 1994. Tenderfoot Creek Experimental Forest 1992 and 1993 annual report. Unpublished Report. Bozeman, MT: Forestry Sciences Laboratory, Montana State University. 73 p.

Pfister, R.D.; Kovalchick, B.L.; Arno, S.; Presby, R. 1977. Forest habitat types of Montana. Gen. Tech. Rep. INT-34. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 174 p.

Contact Address

Forest Manager
Tenderfoot Creek Experimental Forest
Ecology and Management of Northern Rocky Mountain Forests
Forestry Sciences Laboratory
Montana State University
Bozeman, Montana 59717-0278
Tel: (406) 994-4852
FAX: (406) 994-5916

Agricultural Research Service Experimental Areas

Agricultural Research Service Experimental Areas

Abstracted by Wyman C. Schmidt and Judy L. Friede, from information provided by Rod Heitschmidt, Research Leader, Fort Keogh Livestock and Range Research Laboratory, Miles City, Montana; Charles W. Slaughter, Research Leader, Reynolds Creek Experimental Watershed, Boise, Idaho; and John N. Stellflug, Acting Research Leader, U.S. Sheep Experiment Station, Dubois, Idaho.

Introduction

The Agricultural Research Service has three formally established experimental areas in Montana and Idaho where domestic livestock, range, and watershed interactions are researched and demonstrated. These areas include Fort Keogh Livestock and Range Research Laboratory in Miles City, Montana; Reynolds Creek Experimental Watershed in Boise, Idaho; and the U.S. Sheep Experiment Station in Dubois, Idaho.

Headquarters of the U.S. Sheep Experiment Station, located several miles northeast of Dubois, Idaho. The photo was taken in 1938—23 years after establishment of the station.

Fort Keogh Livestock and Range Research Laboratory

Fort Keogh Livestock and Range Research Laboratory came into being following an Act of Congress that transferred the land from the U.S. Army to the U.S. Department of Agriculture in 1924—land that had originally been set aside as a military fort following the Custer Massacre. This outdoor laboratory is administered by the Agricultural Research Service of the U.S. Department of Agriculture in cooperation with the Montana Agricultural Experiment Station, Montana State University. It encompasses about 22,270 ha (55,000 acres) composed mostly of native grasslands typical of the Northern Great Plains that historically supported vast numbers of buffalo. Of this area, about 2,000 ha (5,000 acres) is used for dryland pasture, irrigated-land, administrative site, and other uses. It is southwest of Miles City, Montana, and ranges in elevation from about 730 to 850 m (2,360 to 2,790 ft) with annual precipitation averaging about 350 mm (14 inches). Early studies here included evaluations of sheep, turkeys, swine, horses, and cattle.

Today the research program focuses on improving efficiencies of cattle production on this type of rangeland, typical of vast areas of ecologically sensitive ecosystems in western North and South Dakota, Wyoming, and eastern Montana. Studies are in genetics, reproductive physiology, nutrition and growth of beef cattle, and in range pasture development, improvement, and management. The rangelands here consist of diverse sites that support cool and warm season grasses, forbs, and shrubs.

For further information, contact:

Research Leader
USDA Agricultural Research Service
Northern Plains Area
Fort Keogh Livestock and Range Laboratory
Route 1, Box 2021
Miles City, Montana 59301
Tel: (406) 232-4970
FAX: (406) 232-8209

Reynolds Creek Experimental Watershed

Reynolds Creek Experimental Watershed was formally established in 1960 to address watershed resource issues on grass and shrub lands typical of semiarid rangelands of the Northwest. A wide range of studies since then have included evaluation of the effects of grazing on soil erosion and productivity, water yields and quality, snow distribution and melt processes, and many other aspects of hydrology. Scientists currently conduct research to quantitatively describe the hydrologic processes and interactive influences of climate, soils, vegetation, topography, and management of rangeland watersheds, and to develop information, simulation models, and expert systems that can be used by action agencies and producers to assist in determining optimum management strategies.

This vast outdoor laboratory is administered by the Northwest Watershed Research Center of the Agricultural Research Service, U.S. Department of Agriculture. Cooperators with the center include the Bureau of Land Management, Natural Resource Conservation Service, Animal and Plant Health Inspection Service, universities, and state and local agencies.

The Reynolds Creek Experimental Watershed encompasses 23,360 ha (57,700 acres) on the north flank of the Owyhee Mountains about 80 km (50 miles) southwest of Boise, Idaho. About 77 percent of the watershed is under Federal or state ownership, with the remainder privately owned. Elevations range from 1,098 to 2,254 m (3,600 to 7,390 ft). Average annual precipitation is 254 mm (10 inches) at lower elevations to 1,016 mm (40 inches) at the highest elevation. Sagebrush (*Artemisia* spp.) dominates most of the landscape, with subalpine fir (*Abies lasiocarpa*), Douglas-fir (*Pseudotsuga menziesii*), and aspen (*Populus tremuloides*) found at the higher elevations.

Detailed surveys of plant communities, soils, and geology have been completed, and meteorological measurements are continuing. Numerous data bases and computer models are available.

For further information, contact:

Research Leader
USDA Agricultural Research Service
Northwest Watershed Research Center
800 Park Blvd., Plaza IV, Suite 105
Boise, Idaho 83712-7716
Tel: (208) 334-1363
FAX: (208) 334-1502

U.S. Sheep Experiment Station

The U.S. Sheep Experiment Station was established in 1915, and the name is appropriate—sheep and rangeland utilization have been the primary focus throughout the long history of the station. At one time, the Intermountain Forest and Range Experiment Station of the U.S. Forest Service managed and conducted research on the area, but in 1977 Sheep Station responsibilities were transferred to the Agricultural Research Service (U.S. Department of Agriculture). Since then, the Agricultural Research Service has managed the Sheep Station in a cooperative arrangement with the University of Idaho. On some of the lands, management is coordinated with the Bureau of Land Management and the U.S. Forest Service. The total experimental area encompasses about 35,254 ha (87,077 acres) with about 11,336 ha (28,000 acres) at the headquarters several miles northeast of Dubois, Idaho, and the remainder dispersed in the Centennial Mountains in Montana and other satellite locations about 56 to 80 km (35 to 50 miles) northeast of Dubois. Although much of the experimental area is in Montana, primary access is from Dubois, Idaho—headquarters for the Sheep Station. Elevations of this experimental area range from about 1,700 m (5,600 ft) at headquarters to 2,990 m (9,800 ft) along the Continental Divide in the Centennials with corresponding differences in precipitation of about 305 mm (12 inches) to 710 mm (28 inches), respectively.

The experimental area represents the major ecosystems of the Intermountain West and includes desert sagebrush (*Artemisia* sp.) and bluebunch wheatgrass (*Agropyron spicatum*), intermediate subalpine sagebrush-grasslands such as Idaho fescue (*Festuca idahoensis*), mountain bromegrass (*Bromus carinatus*), and others on the foothills of the high elevation summer ranges, and subalpine meadows and forests along the Continental Divide that separates Idaho and Montana.

Long-term, season-of-use, grazing trials, initiated in 1922, compare vegetation response on areas with spring grazing only, with fall grazing only, and with no grazing (exclosure). Striking differences in vegetative composition are apparent on these, as well as on several other long-term exclosures on both spring-fall and summer ranges. Current research includes both laboratory and field experiments.

For further information contact:

Research Leader
U.S. Sheep Experiment Station
USDA Agricultural Research Service
Pacific West Area
HC 62, P.O. Box 2010
Dubois, Idaho 83423
Tel: (208) 374-5306
FAX: (208) 374-5582

Information Sources: Research Natural Areas

Information Sources:

Research Natural Areas of the Northern Rocky Mountains, U.S.A.

Information compiled by Wyman C. Schmidt and Judy L. Friede,
with special assistance from Angie Evenden, Research Natural Area Coordinator,
Forestry Sciences Laboratory, Missoula, Montana

Research Natural Areas serve as baseline areas for monitoring long-term change, as research opportunities, and as educational tools. These areas allow natural processes in the absence of intentional manipulations to be observed and studied over extended periods. Although Research Natural Areas are not limited to experimental areas, seven of the 14 experimental areas featured in this publication do have acreage reserved for Research Natural Areas. Today, Research Natural Areas are systematically being established throughout the Northern Rocky Mountains in networks that cover a matrix of habitats and community types in forests, grass and shrub lands, and aquatic ecosystems. The establishment of such areas is a coordinated effort by public agencies such as the U.S. Forest Service, universities, Bureau of Land Management, and private organizations such as the Nature Conservancy. The cooperation among these organizations has been paramount in establishing or proposing approximately 250 Research Natural Areas within Utah, Idaho, and Montana. The following list provides sources of information for these areas:

Program Manager
INT/R1/R4 Natural Areas Program
USDA Forest Service
Intermountain Research Station
Forestry Sciences Laboratory
P.O. Box 8089
Missoula, Montana 59807
Tel: (406) 329-3485

R4 Coordinator
USDA Forest Service
Intermountain Region
324 25th Street
Ogden, Utah 84401
Tel: (801) 625-5596

Utah: Public Land Protection Planner
The Nature Conservancy
559 East South Temple
Salt Lake City, Utah 84102
Tel: (801) 531-0999

Utah Natural Heritage Programs
Natural Areas Database
Utah Division of Wildlife Resources
1596 W. North Temple
Salt Lake City, Utah 84116
Tel: (801) 538-4759

Idaho: Natural Areas Coordinator/Database
Conservation Data Center
Idaho Department of Fish and Game
600 South Walnut, P.O. Box 25
Boise, Idaho 83707
Tel: (208) 334-3402

Montana: Natural Areas Database
Montana Natural Heritage Program
State Library
1515 E. 6th Avenue
Helena, Montana 59620
Tel: (406) 444-3009

Schmidt, Wyman C.; Friede, Judy L., Compilers. 1996. Experimental forests, ranges, watersheds in the Northern Rocky Mountains: a compendium of outdoor laboratories in Utah, Idaho, and Montana. Gen. Tech. Rep. INT-GTR-334. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 117 p.

This is a compendium of experimental forests, ranges, watersheds, and other outdoor laboratories, formally established by the Forest Service and Agricultural Research Service of the U.S. Department of Agriculture, and the universities in Utah, Idaho, and Montana. The purposes, histories, natural resource bases, data bases, past and current studies, locations, and who to contact for information are given for these areas that represent ecosystems ranging from deserts to cold subalpine forests.

Keywords: forest research, range research, watershed research, demonstration forests, Northern Alliance, Northern Rocky Mountains

INTERMOUNTAIN RESEARCH STATION

The Intermountain Research Station provides scientific knowledge and technology to improve management, protection, and use of the forests and rangelands of the Intermountain West. Research is designed to meet the needs of National Forest managers, Federal and State agencies, industry, academic institutions, public and private organizations, and individuals. Results of research are made available through publications, symposia, workshops, training sessions, and personal contacts.

The Intermountain Research Station territory includes Montana, Idaho, Utah, Nevada, and western Wyoming. Eighty-five percent of the lands in the Station area, about 231 million acres, are classified as forest or rangeland. They include grasslands, deserts, shrublands, alpine areas, and forests. They provide fiber for forest industries, minerals and fossil fuels for energy and industrial development, water for domestic and industrial consumption, forage for livestock and wildlife, and recreation opportunities for millions of visitors.

Several Station units conduct research in additional western States, or have missions that are national or international in scope.

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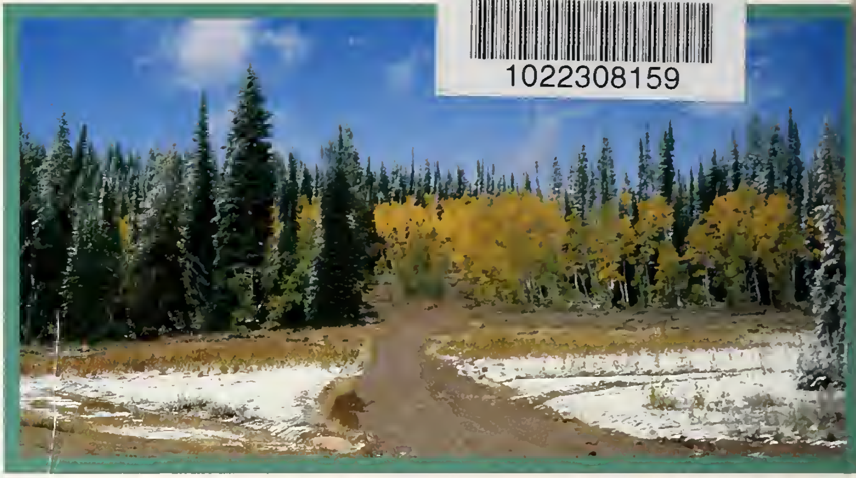

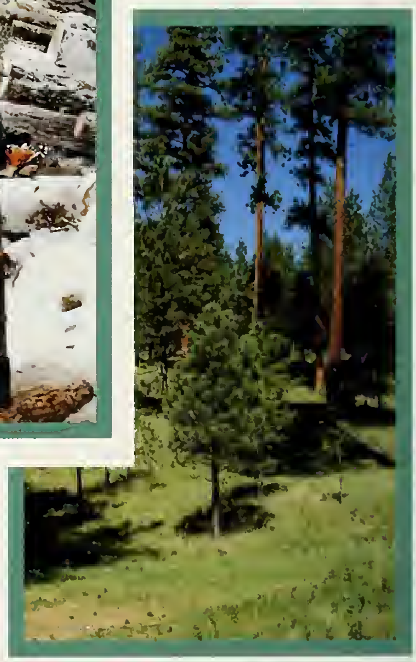

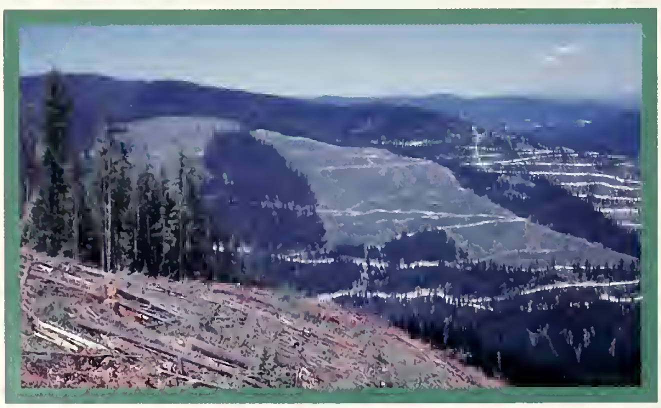

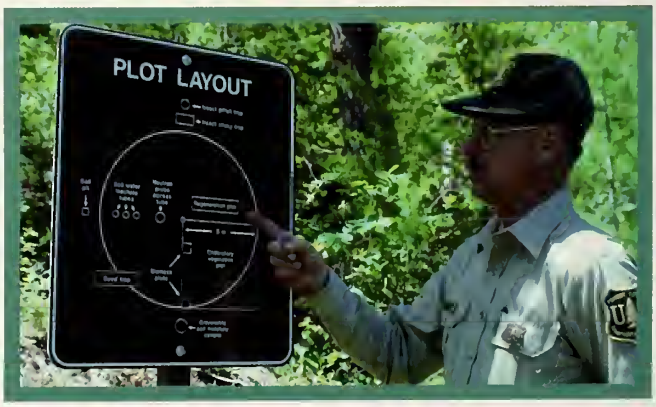
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