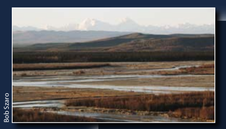
USDA United States Department of Agriculture

Forest Service

Experimental FORESTS AND RANGES



Rob Sparo

Pacific Northwest

BONANZA CREEK

At Bonanza Creek, scientists have correlated global warming trends with melting of the permafrost, which disrupts the boreal ecosystem by releasing carbon into the atmosphere and altering hydrologic cycles.

Frank Valloni

Pacific Northwest

STARKEY

The Starkey Project was designed to measure the responses of cattle, deer, and elk to intensive management of forests and rangelands. Results from the Starkey research have prompted changes in policies, management standards and guidelines, hunting regulations, and timber sale planning throughout western North America.

Frank Valloni

Rocky Mountain

PRIEST RIVER

Nearly 100 years of weather records help scientists and managers understand weather patterns and their relationship to wildfire. These records became the basis for predicting forest fire behavior and establishing the first fire danger rating system. Similar long-term records provide valuable data on streamflow, snowfall, and forest growth.

Northern

MARCELL

The hydrology and ecology of peatlands—moist areas of partially decomposed organic matter—are important research topics at Marcell Experimental Forest, established in 1959. Boreal and subarctic peatlands play a distinctive role in global carbon cycling. Because organic matter accumulates and decomposes very slowly, northern peatlands have been storehouses of carbon for millennia. Rising global temperatures will likely increase decomposition rates in peatlands, thereby releasing more carbon into the atmosphere. A new measurement system at Marcell will help scientists determine whether, and how much, warming peatlands may contribute to rising levels of atmospheric CO_2.

THE LANGUAGE OF THE LAND

The land cannot speak but it can communicate. A change in the flow of a stream, the timing of bud break on a sycamore tree, the rate at which shrubs come in after a wildfire—all these are messages humans can read if they know the language. That language is science. For a century, scientists of the USDA Forest Service have been reading the language of the land on a comprehensive network of experimental forests and ranges. These 80 sites comprise a rich variety of forest and grassland ecosystems across the United States and Puerto Rico. They range from small (the 116-acre Kawishiwi Experimental Forest in Minnesota) to large (the 55,600-acre Desert Experimental Range in Utah). They range from boreal forest (Bonanza Creek Experimental Forest in Alaska) to tropical forest (Luquillo Experimental Forest in Puerto Rico) to peat-bog deciduous forest (Marcell Experimental Forest in Minnesota) to semi-arid chaparral (San Dimas Experimental Forest in California) to dry desert (Desert Experimental Range in Utah).

Studies established decades ago on many of these sites are still going strong. Experimental forests and ranges provide a valuable, long-term stream of information about the land and its resources. Over the years, scientists have built an impressive body of science to support good land management and further our understanding of natural processes. Their research sheds light on such important questions as:

- ***Ecology of old-growth forests in the Pacific Northwest.*** Much of what is known about old-growth structure and function came from studies on the H.J. Andrews Experimental Forest in Oregon. Current research is carrying knowledge of old growth into management of young forests, including plantations.
- ***Mitigating acid rain.*** Research from Hubbard Brook Experimental Forest in New Hampshire sounded an early warning about the effects of acid rain on forest soils, streams, and vegetation. Current research is examining unfolding dimensions of effects of atmospheric chemistry on forests, soils, and streams.
- ***Managing deer, elk, and livestock.*** A 25,000-acre fenced enclosure is helping scientists at Oregon's Starkey Experimental Forest and Range gather the largest, most accurate set of data ever on the habits of wild deer and elk as well as cattle.
- ***Restoring degraded rangelands.*** Early trials to rehabilitate watersheds at Great Basin Experimental Forest in Utah helped pioneer the discipline of range management.
- ***Regenerating forests.*** The Fort Valley Experimental Forest in Arizona was the site of some of the earliest experiments on regeneration of ponderosa pine after extensive logging. Many other experimental forests have contributed to a rich body of knowledge about regenerating forests.
- ***Protecting wildlife habitat.*** The Tallahatchie Experimental Forest in Mississippi has yielded key information on how plants and birds respond to changes in fire regimes.

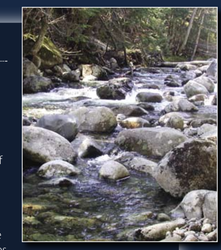
Like the land itself, scientific capacity is a resource that needs stewardship. Over the past century, the Forest Service's experimental forest and range network has developed the capacity to deepen understanding of the problems confronting society and the natural world: global climate change, species extinction, water quality and quantity, ecosystem degradation, invasive plants and animals.

To be good stewards of the land, we need to understand the language of the land. With continued stewardship, the experimental forest and range network will continue its good work into its second century. ■

Northern

HUBBARD BROOK

In 1963, scientists at Hubbard Brook partnered with others from Dartmouth College to study nutrient cycling. In measuring the chemistry of rainwater, they noted that its pH was quite low. They had detected acid rain—the first documented in North America. Acid rain is a problem in areas of heavy industrialization, where emissions of sulfur and nitrogen oxides are high. Subsequent long-term monitoring at Hubbard Brook revealed that chronic acid precipitation harms trees in several ways, including injuring leaves and stunting growth. Hubbard Brook joined the LTER network in 1987, and research conducted there provided scientific basis for amendments to the Clean Air Act in 1990.



Pacific Northwest

H.J. ANDREWS

Much of what we know about Pacific Northwest forests and watersheds comes from early studies at the H.J. Andrews, established in 1948. Work at the H.J. Andrews, one of the first to join the Long-Term Ecological Research (LTER) network, has revealed the complexity of old-growth forest structure and its importance in sustaining biodiversity, as well as the role of forests in sequestering atmospheric carbon. The H.J Andrews has a six-decade storehouse of hydrologic data.

Tom Iraci

Larry Ridenhour

Gary Monroe

Rocky Mountain

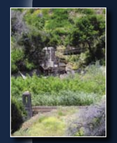
GREAT BASIN

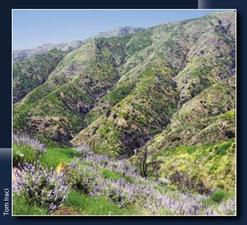
Studies carried out for more than 90 years have provided much of the information and technology used to restore wildlands damaged by severe flooding and overgrazing by domesticated animals.

Pacific Southwest

SAN DIMAS

San Dimas Experimental Forest was established in 1933 to study the water cycle in semi-arid mountains adjacent to Los Angeles. The initial goal was to find ways to increase availability of water for agriculture and domestic consumption. Scientists began by developing rainfall and streamflow gauges specifically for mountainous terrain. Then they tested different types of ground cover as alternatives to the native chaparral. Some of these plantings did yield more water, but increased erosion. These studies have revealed tradeoffs between increasing water yield and maintaining stability of the land. They have also led to techniques for restoring land after wildfire.





Tom Iraci

Rocky Mountain

FRASER

Fraser Experimental Forest, established in 1937, has yielded key information about the effects of timber management on water quantity and quality in alpine and subalpine forests. Studies at Fraser have helped scientists and managers understand the water-yield tradeoffs among different types of forest management, helping them better forecast water supply and maintain water quality. An LTER water-quality environmental monitoring system was installed at Fraser in 2001.

Southern

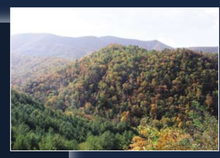
CROSSETT

After decades of overcutting had eliminated the virgin forests of loblolly and shortleaf pine in the South, Crossett Experimental Forest was established in 1934 to study methods for rehabilitating the land and managing second-growth timber.

Southern

COWEETA

Research at Coweeta Experimental Forest, established in 1934, focuses on fundamental relationships among vegetation, climate, soils, and streamflow in mountain watersheds. Coweeta's long-term data have helped managers predict how major disturbances like storms, floods, landslides, and fire affect water quality and availability. It also has deepened basic understanding about the important role forested watersheds play in securing clean and dependable drinking water supplies, especially in areas with mixed land use. Coweeta is a charter member of LTER.



International Institute of Tropical Forestry

LUQUILLO

Encompassing almost 28,000 acres and four major forest types—including hardwoods and palm trees—Luquillo Experimental Forest, a member of the LTER network, is one of the world's most intensively studied tropical forests. Research focuses on the effects of large-scale disturbances such as hurricanes, landslides, climate change, and deforestation on tropical ecosystems. Test plantings of more than 400 tree species and data sets going back more than 100 years yield a wealth of information on regenerating forests following severe disturbances. Such knowledge prepares managers to respond to the more-intense tropical storms expected with rising global temperatures.

Puerto Rico 79

80 U.S. Virgin Islands

Hawaii 23

Key to Sites

1 Bonanza Creek/ Poker Creek
2 Young Bay
3 Maybeso
4 Entiat
5 Wind River
6 Cascade Head
7 H.J. Andrews
8 Starkey
9 South Umpqua
10 Pringle Falls
11 Redwood
12 Caspar Creek
13 Blacks Mountain
14 Swain Mountain
15 Challenge
16 Onion Creek
17 Sagehen
18 Stanislaus-Tuolumne
19 San Joaquin
20 Teakettle
21 San Dimas
22 North Mountain
23 Hawaii
24 Priest River
25 Deception Creek
26 Boise Basin
27 Coram
28 Tenderfoot Creek
29 Desert
30 Great Basin
31 Fort Valley
32 Long Valley
33 Sierra Ancha
34 Black Hills
35 Glacier Lakes
36 Fraser
37 Manitou
38 Big Falls
39 Kawishiwi
40 Cut Foot Sioux
41 Pike Bay
42 Marcell
43 McCormick
44 Dukes (Upper Peninsula)
45 Argonne
46 Coulee
47 Udell
48 Lower Peninsula
49 Kane
50 Penobscot
51 Bartlett
52 Hubbard Brook
53 Massabesic
54 Sinkin
55 Kaskaskia
56 Paoli
57 Vinton Furnace
58 Fernow
59 Silas Little
60 Koen
61 Sylamore
62 Alum Creek
63 Crossett
64 Stephen F. Austin
65 Palustris
66 Delta
67 Tallahatchie
68 Harrison
69 Escambia
70 Bent Creek
71 Coweeta
72 Blue Valley
73 Calhoun
74 Santee
75 Scull Shoals
76 Hitchiti
77 Chipola
78 Olustee
79 Luquillo
80 Estate Thomas

Experimental
FORESTS AND RANGES

Experimental Forests Inform Management Decisions

Over their century-long history, experimental forests and ranges have contributed policy and practical guidance to natural-resource policymakers and managers. The Calhoun Experimental Forest in South Carolina was started in the 1930s on land that was worn out and eroded after decades of heavy cotton and tobacco farming. The site was chosen because it represented "the worst of the worst"—an environmental problem that cried out for practical, focused research on soil improvements.

A few other examples:

- Native longleaf pine in the South anchors an ecosystem that has long been threatened by land-clearing for agriculture and plantation forestry. A method for regenerating longleaf pine through shelterwood cutting, now widely used throughout the South, was developed at the Escambia Experimental Forest in Alabama.
- Reforestation of extensively logged and burned lands was an urgent problem in western Douglas-fir forests in the first half of the 20th century. Studies of Douglas-fir regeneration at the Wind River Experimental Forest in Washington, covering thinning, pruning, spacing, and nursery production of seedlings, led to silvicultural systems by which millions of acres of Douglas-fir forests were successfully regenerated.
- Early grazing studies at the Great Basin Experimental Range in Utah on effects of cattle grazing on various plant species led to methods to restore rangeland vegetation, improve habitat, and mitigate effects on streams. These rangeland restoration methods are widely used today in the arid intermountain West.

In the past few decades, scientists have come to a better understanding of the ecosystem context of environmental problems. Accordingly, the research focus at experimental forests and ranges has shifted from local, narrow, applied topics to a wider range of topics with broader relevance—global climate change, watershed function, invasive plants, recovery after natural disturbances, and others. ■

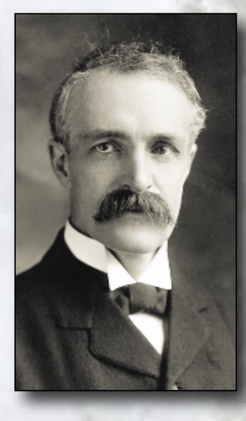
Established Experimental Forests and Ranges

International Institute of Tropical Forestry		North Central*		Northeastern*		Pacific Northwest		Pacific Southwest		Rocky Mountain		Southern	
1964	Estate Thomas	1947	Argonne	1932	Bartlett	1964	Bonanza Creek/Poker Creek	1934	Blacks Mountain	1961	Black Hills	1959	Alum Creek
1956	Luquillo	1961	Big Falls	1934	Fernow	1934	Cascade Head	1962	Caspar Creek	1933	Boise Basin	1925	Bent Creek
		1961	Coulee	1955	Hubbard Brook	2008	Echo Cove (proposed)	1942	Challenge	1933	Coram	1964	Blue Valley
		1932	Cutfoot Sioux	1932	Kane	1957	Entiat	2007	Hawaii	1933	Deception Creek	1947	Calhoun
		1926	Dukes (Upper Peninsula)	1961	Massabesic	1948	H.J. Andrews	1964	North Mountain	1964	Desert	1952	Chipola
		1942	Kaskaskia	1961	Penobscot	1956	Maybeso	1958	Onion Creek	1931	Fort Valley	1934	Coweeta
		1931	Kawishiwi	1933	Silas Little	1931	Pringle Falls	1940	Redwood	1937	Fraser	1934	Crossett
		1954	Lower Peninsula	1961	Vinton Furnace	1951	South Umpqua	2005	Sagehen	1987	Glacier Lakes	1945	Delta
		1960	Marcell			1940	Starkey	1933	San Dimas	1912	Great Basin	1947	Escambia
		1970	McCormick			1932	Wind River	1934	San Joaquin	1936	Long Valley	1939	Harrison
		1963	Paoli			1959	Young Bay	1943	Stanislaus-Tuolumne	1936	Manitou	1946	Hitchiti
		1932	Pike Bay					1932	Swain Mountain	1911	Priest River	1951	Koen
		1951	Sinkin					1938	Teakettle	1938	Sierra Ancha	1931	Olustee
		1961	Udell							1961	Tenderfoot Creek	1935	Palustris
												1937	Santee
												1959	Scull Shoals
												1945	Steven F. Austin
												1934	Sylamore
												1950	Tallahatchie

* In 2006, the North Central and Northeastern Research Stations merged to form the Northern Research Station.

Profiles in Forest Service Research

Gifford Pinchot
(1865–1946)

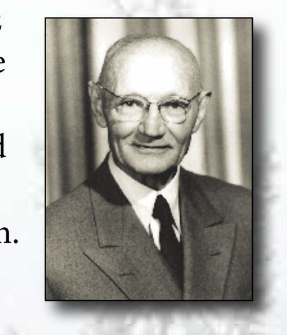


Pinchot's vision for science-based forest management blended his European forestry education with realities of America's political climate and physical landscape. As the first chief of the Forest Service, Pinchot advocated the notion of "wise use" and saw scientific research as playing a key role in managing forest resources productively over the long term.

Raphael Zon
(1874–1956)

As Forest Service chief of silvics in 1906, Zon designed the system of experiment stations on national forests. In August of 1908 he planted a ceremonial tree at the first experiment station, Fort Valley in Arizona, saying the words, "Here we shall plant the tree of research." Zon was the first director of the Lake States Forest Experiment Station from 1923 until he retired in 1944. His ashes were spread over the "Avenue of Pines" in the Chippewa National Forest.

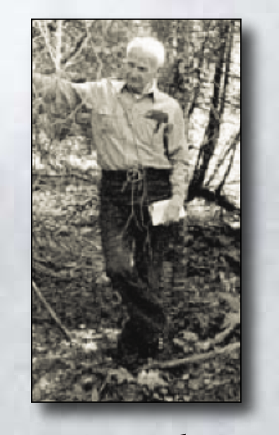
Arthur W. Sampson
(1884–1967)



Sampson was the first director of the Utah Experiment Station, later called the Great Basin Experiment Station. Known as "the father of range management," he invented the discipline of range ecology in the United States and wrote the first college textbook on range management, which is still in use today.

Charles Wellner
(1911–2001)

A tireless advocate for experimental forests, Wellner once refused to carry out an order to close down the Priest River Experimental Forest in Idaho. Priest River is still going strong today. After he retired in 1973, he worked to establish research natural areas, which today number more than 150. Wellner directed that his ashes be scattered over the Priest River Experimental Forest "so I can keep an eye on things."



Experimental Forests as the Backbone of a Nationwide Research Network

Although most of the Forest Service's experimental forests and ranges were not started with collaborative research specifically in mind, they have become meeting grounds for powerful scientific collaborations.

They are part of a nationwide research network that includes such programs as the

- Long-Term Ecological Research (LTER) program, sponsored by the National Science Foundation,
- United Nations' Man and the Biosphere (MAB) program, and
- National Aeronautic and Space Administration's Moderate Resolution Imaging Spectroradiometer (MRIS) program.

Of LTER's 26 field research sites, 5 are located at experimental forests and ranges: H.J. Andrews in Oregon, Bonanza Creek/Caribou-Poker Creeks Watershed in Alaska, Coweeta in North Carolina, Hubbard Brook in New Hampshire, and Luquillo in Puerto Rico.

Other collaborative endeavors include:

- Environmental-monitoring programs such as the National Atmospheric Deposition Program, which is supported by a consortium of public and private agencies, and AmeriFlux;
- Stream-monitoring studies by scientists of the U.S. Geological Survey;
- A newly established collaboration of environmental observatories known as the National Ecological Observatory Network; and
- Future hydrological monitoring through the Consortium of Universities for the Advancement of Hydrologic Science, Inc.

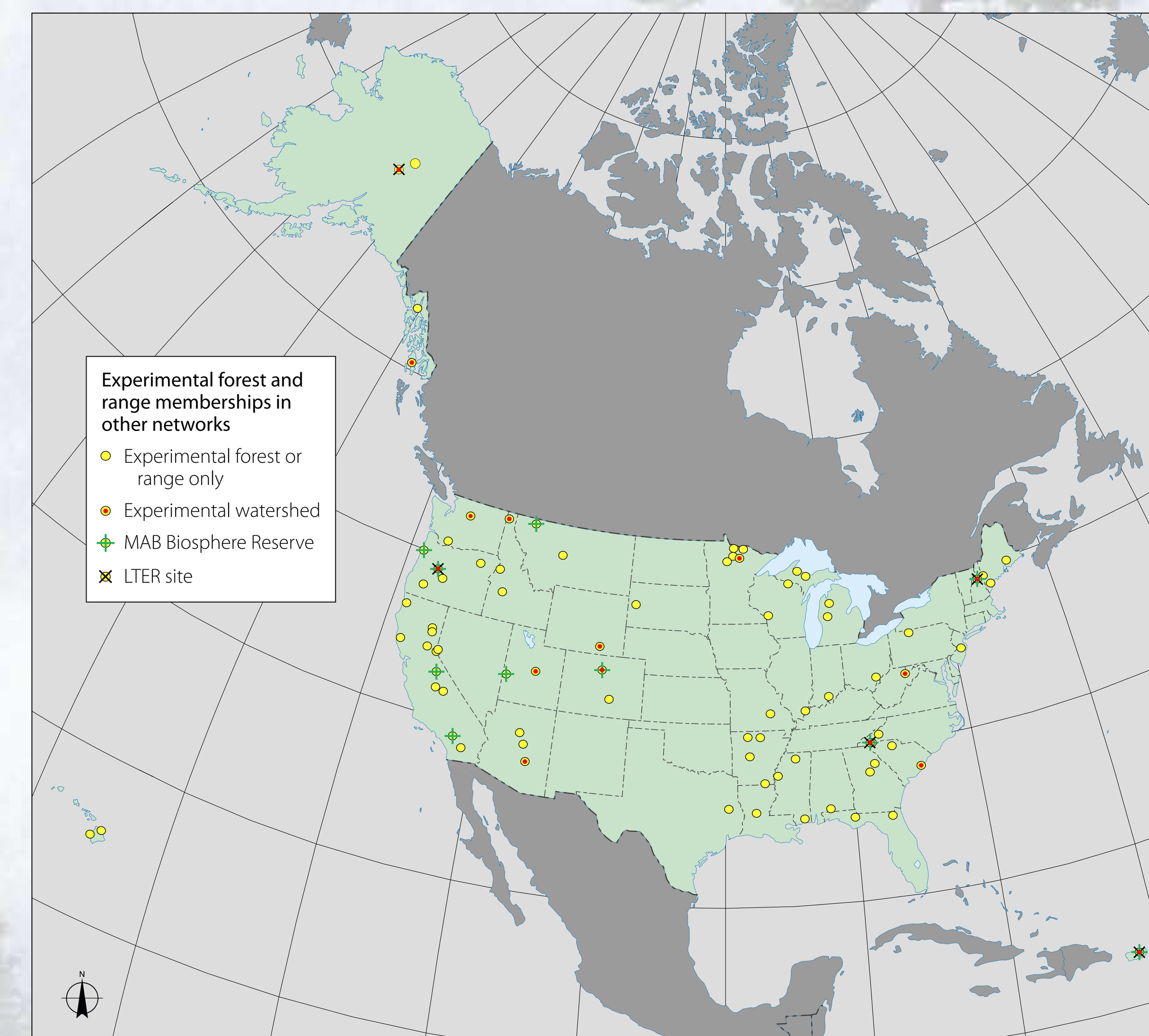
Experimental forests and ranges are vital to these shared efforts. They provide long-term data on a wide variety of ecosystems. This information feeds into broader research on forest growth, global climate change, stream dynamics, restoration of degraded forests and rangelands, economic and social dimensions of land use, and many other important environmental issues.

More importantly, such partnerships give Forest Service scientists opportunities to share data and insights with colleagues at universities and other research organizations. Collaboration strengthens and enriches science and helps society solve its most urgent environmental problems. ■

United States Department of Agriculture

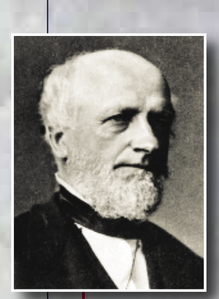
Forest Service

Published by the **Pacific Northwest Research Station**, January 2008.



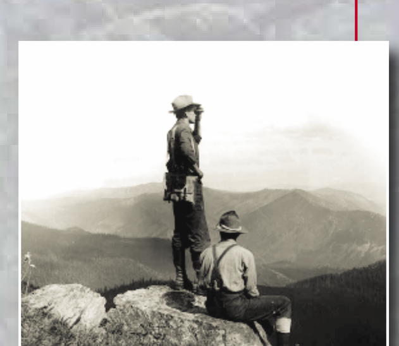
EXPERIMENTAL FORESTS: LEGACY ACROSS TIME

1880s



1881
Franklin Hough becomes the first chief of the temporary Division of Forestry. His reports to Congress are the first to document the status of the Nation's forests and timber resources.

1890s



1891
The Forest Reserve Act authorizes the President to establish forest reserves. The first, comprising 1.8 million acres, is established east of the sparsely timbered 1.9-million-acre Yellowstone National Park.

1897
The Organic Act provides for forest reserves for watershed and forest protection and for "preserving a perpetual supply of timber for home industries." These reserves would become national forests a decade later.

1900s

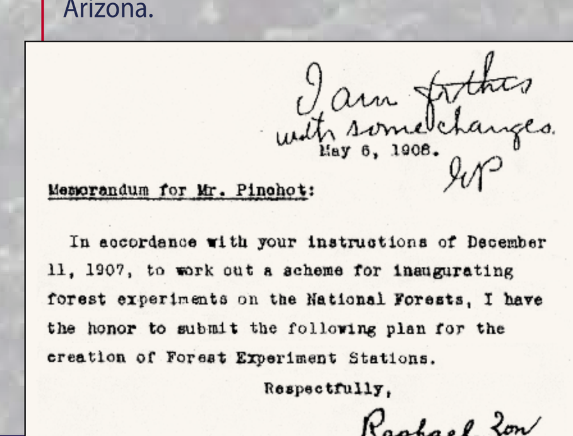
1903
President Theodore Roosevelt designates the Luquillo Forest Reserve, later to become the Luquillo Experimental Forest. It is named for the mountains rising behind Puerto Rico's coastal plain.

1905
Administration of forest reserves is transferred from the Department of the Interior to the Department of Agriculture (USDA), and the Bureau of Forestry becomes the Forest Service. President Theodore Roosevelt selects Gifford Pinchot to serve as the new agency's first chief.

1907
The Santa Rita Experimental Forest is established. After its 1988 transfer to the state of Arizona, research continues on grazing and the effects of climate variability, led by the University of Arizona.

1908
Raphael Zon submits a plan to Gifford Pinchot for the creation of forest experiment stations.

That year, the Forest Service's first experiment station is established at Fort Valley, Arizona.



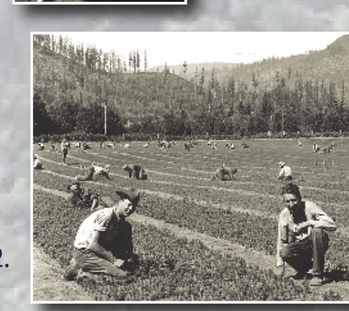
I am for this
with some changes.
May 6, 1908.
GP

Memorandum for Mr. Pinchot:

In accordance with your instructions of December 11, 1907, to work out a scheme for inaugurating forest experiments on the National Forests, I have the honor to submit the following plan for the creation of Forest Experiment Stations.

Respectfully,

Raphael Zon



1909
Thornton T. Munger, first director of the Pacific Northwest Research Station, establishes a tree nursery and research plots near the Wind River in Washington, setting the stage for the establishment of Wind River Experimental Forest in 1932.

1910s

1911
Priest River Experimental Forest is one of the first areas to be set aside as a forestry research center.

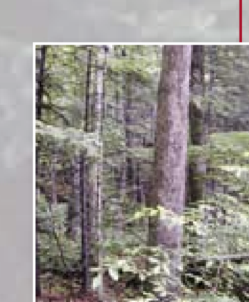
1915
The second Chief of the Forest Service, Henry S. Graves, strengthens and consolidates various research projects around the country under a central research branch.

1920s

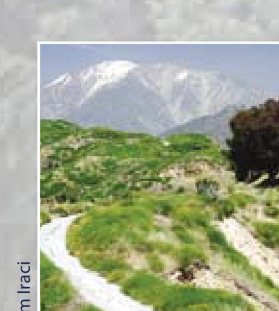
1923
Utah Experiment Station Director Arthur W. Sampson publishes the world's first college textbook on the subject of range management.

1928
The McSweeney-McNary Act, authorizing funding for a federal forestry research program, passes Congress with broad bipartisan and public support. It is a major boost to forestry research.

1930s



1932
Research at the Bartlett Experimental Forest in New Hampshire begins in timber management of northern hardwood forests, from which it has expanded to encompass their ecological structure, function, and processes.



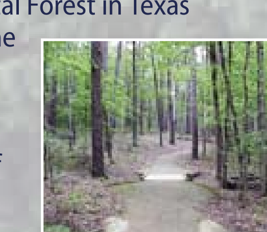
Tom Iraci

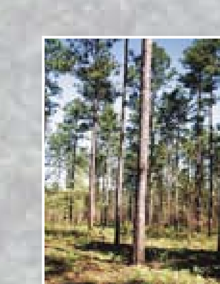
1933
San Dimas Experimental Forest is established at the request of the city of Los Angeles. Associated work leads to the development of the Incident Command system used in fighting fires and later called upon to respond in New York City on September 11, 2001.

1937
Monitoring begins in watersheds of the Fraser Experimental Forest on streamflow, climate, and snow hydrology as part of research essential to maintaining the water supply of the nearby Denver area.

1940s

1945
The Stephen F. Austin Experimental Forest in Texas becomes the only such area to be established by an act of Congress.



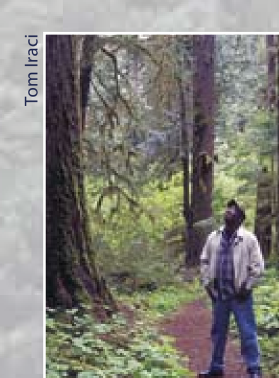


1947
Escambia Experimental Forest is established in Alabama to study problems associated with the ecology and management of longleaf pine forests.

1950s

1955
Hubbard Brook Experimental Forest is established in New Hampshire. It marks the site where acid rain is detected for the first time in North America, from which subsequent research is applied to amend the Clean Air Act in 1990.

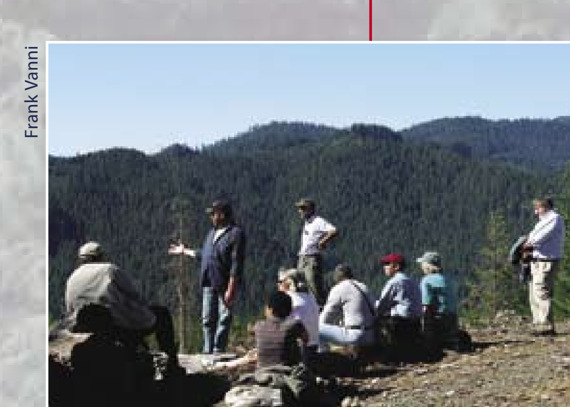
1960s



Tom Iraci

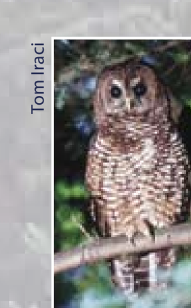
1960
The Multiple Use–Sustained Yield Act directs the Forest Service to give equal consideration to outdoor recreation, range, timber, water, and fish and wildlife on national forests. The range of research topics within the Forest Service expands to meet the growing mandate.

1970s



Frank Vanni

1970s
The International Biological Programme advances intensive ecosystem-scale research in major biomes across the nation, including studies at Coweeta and H.J. Andrews Experimental Forests.



Tom Iraci

1973
The Endangered Species Act provides for federal agencies to take steps to protect and enhance recovery of plant and animal species threatened with extinction.

1976
The National Forest Management Act sets forth a comprehensive blueprint for managing national forests, including managing for viable populations of wildlife. Long-term ecological studies at experimental forests contribute valuable science to managers and policymakers. The law also requires the Forest Service to include research natural areas in their plans.

1980s

LTER

1980
The National Science Foundation initiates the Long-Term Ecological Research (LTER) network. Five of LTER's 26 field research sites are located at experimental forests and ranges.

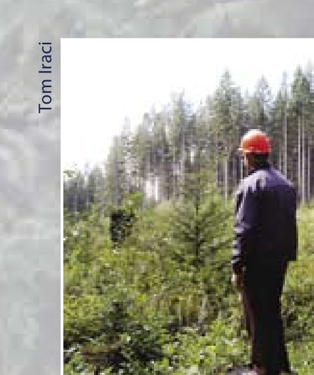
U.S. Geological Survey

1982
Congress designates the Mount St. Helens National Volcanic Monument, dedicated to research, recreation, and education.

1990s

1994
The Northwest Forest Plan becomes the guiding management document for federal forests in the Pacific Northwest, and is based in part on findings from studies of old-growth forests and associated species at H.J. Andrews Experimental Forest.

2000s



Tom Iraci

2003
The Healthy Forests Restoration Act streamlines environmental-assessment and appeals processes for fuels-reduction projects on federal forests, with contributions from research conducted at Blacks Mountain Experimental Forest.

2005
The Forest Service celebrates its centennial, beginning with a Centennial Congress in Washington, DC, in January 2005.

CARING FOR OUR NATURAL LEGACY 1905-2005

2007
The Hawaii Experimental Tropical Forest is established on the Big Island of Hawaii to serve as a center for long-term research on tropical forests.