

Cover photograph: © Douglas A. Yates

Bonanza Creek Experimental Forest & Caribou-Poker Creeks Research Watershed

Introduction

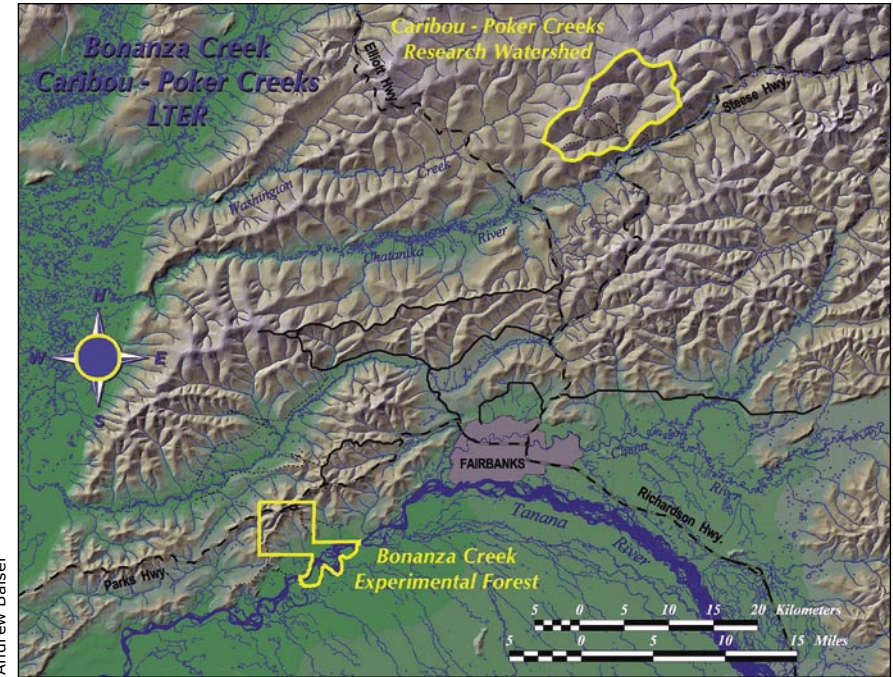
Bonanza Creek Experimental Forest and Caribou-Poker Creeks Research Watershed are located in the boreal forest of interior Alaska. Research focuses on basic ecological processes, hydrology, disturbance regimes, and climate change in the boreal forest region. Interior Alaska lies between the Alaska Range to the south and the Brooks Range to the north and covers an area of 170,000 square miles—more than the states of Oregon and Washington combined.

The 12,486-acre Bonanza Creek Experimental Forest is about 20 miles southwest of Fairbanks. The experimental forest was established in 1963 on land owned and managed by the state of Alaska. The state has given the USDA Forest Service, Pacific Northwest Research Station, a long-term lease on this land for the exclusive purpose of conducting forestry research.

The 25,000-acre Caribou-Poker Creeks Research Watershed is 30 miles north of Fairbanks in the Yukon-Tanana uplands. The Bonanza Creek Long-Term Ecological Research (LTER) program, based at the University of Alaska Fairbanks, manages the research conducted in the state-owned watershed through a cooperative agreement.

Bonanza Creek and Caribou-Poker Creeks are 2 of the 10 experimental areas associated with Pacific Northwest Research Station. These experimental areas—eight forests, a watershed, and a

range—represent important forest and range types and provide opportunities for short- and long-term field studies and demonstrations. Research is the primary purpose, although some forest management activities may occur in some experimental areas, generally as part of scientific studies.

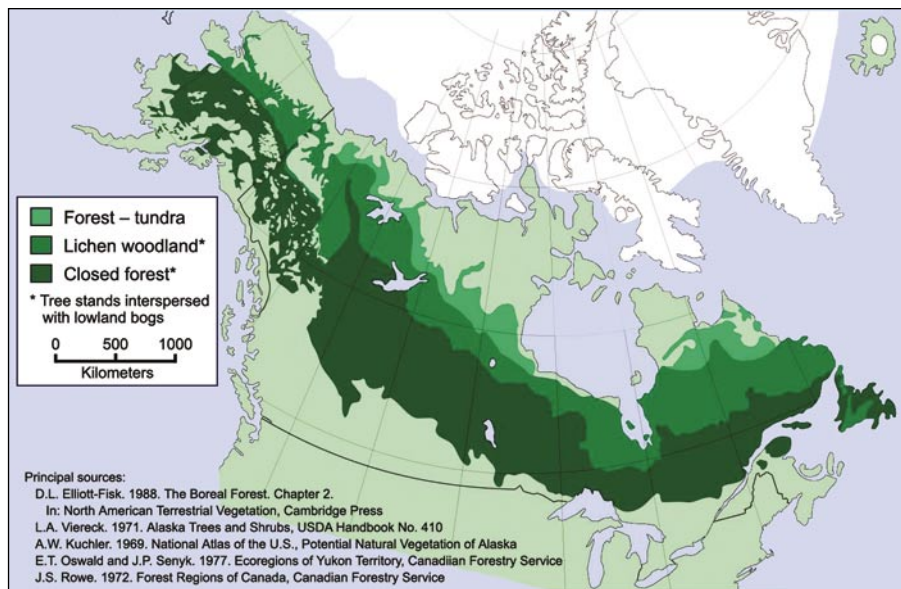


Locations of the Bonanza Creek Experimental Forest and the Caribou-Poker Creeks Research Watershed.



The Tanana River has many braided channels and islands, silt bars along channel bends, and oxbow lakes and wetlands in old channels.

U.S. Geological Survey



Boreal forest extends in a wide band across Alaska and Canada.

Environment

Boreal forest is the second most extensive terrestrial biome on earth, covering millions of acres in a circum-polar band across North America, Asia, and Europe. Boreal forest is also a young biome, existing in its current location only since the end of the last ice age, about 10,000 to 15,000 years.

Boreal forest may be particularly sensitive to climate change. Over the past 25 years, a warming climate trend has been associated with a gradual warming and melting of permafrost in the boreal forest zone, changes in the growth rates of primary tree species, increased acreage burned in wildfires, and changes in animal and insect populations. In fact, boreal forest appears to be changing the most rapidly of any terrestrial biome.

Interior Alaska has a climate of long winters, short summers, and extreme temperature fluctuations. The sun stays above the horizon for nearly 22 hours on June 21, the summer solstice, but for less than 4 hours on December 21, the winter solstice. The highest temperature ever recorded in Fairbanks, located between

Glenn P. Juday

the two research areas, was 100 °F in June 1915, and the record low was -66 °F in January 1989. Average annual precipitation is only 11 inches, but the snow that does fall persists, with snow cover in Fairbanks averaging 214 days every year. Permafrost, or perennially frozen ground, is typically found on north-facing slopes and valley bottoms or river flood plains.

The Tanana River runs through Bonanza Creek Experimental Forest (see cover photo). Elevations range from about 394 feet on the river flood plain to 1,542 feet

on uplands within the forest.

Subsistence activities take place in the forest, making it unusual among USDA Forest Service research areas. Moose are important in the lifestyles and economy of both Native and non-Native Alaskans; a successful fall moose hunt makes a major contribution to the annual food supply for many families. Fish wheels and gill nets are used to harvest some of the Tanana River's abundant salmon as well. Trapping for marten, lynx, beaver, and wolves is done both in the uplands and on the flood plain.

In the area that is now Bonanza Creek Experimental Forest, the most active period of timber harvesting was nearly a century ago.

Logging along the river supplied fuel for the boilers of stern-wheeled riverboats, and lumber and fuel for gold mines and the newly established town of Fairbanks. A small amount of logging continues to this day

Caribou-Poker Creeks Research Watershed encompasses several small headwater stream basins in the Yukon-Tanana uplands. Elevations range from 689 feet at Poker Creek near its confluence with the Chatanika River to 2,710 feet on a ridgetop near the watershed's northern end. Slopes are gentle within the watersheds.



Historical logging along the Tanana River.

John Brooks Collection, 68-32-224, Archives, University of Alaska Fairbanks



Knut Kielland

People harvest abundant salmon from the river, and moose, furs, and cranberries from the forests.



© Douglas A. Yates



Karl Olson



Phyllis Adams

The Tanana River is an important access route. Researchers as well as local people travel by snowmachine in the winter and by boat during the summer.

Some evidence has been found in the watershed of light mining exploration early in the 20th century, and several large gold mines are active nearby.

Forest Types

Boreal forests grow slowly compared to forests in temperate zones. On north-facing slopes and flood-plain terraces, permafrost limits forest growth. Throughout much of Alaska, natural fire and flood cycles still occur. Wildfires exceeding 50,000 acres



P.L. Turner

Mosquitoes are part of the research environment during the short summers of interior Alaska.

are common, in part because the vast majority of the land in interior Alaska receives limited or no fire suppression. The wide glacial rivers deposit silt bars, erode riverbanks, change channels, and create small-scale vegetation mosaics.

On both uplands and flood plains, early forest stages after disturbance are characterized by the rapid growth of shrubs such as willow and alder, followed by aspen, birch, and balsam poplar. White spruce grows slowly and may not dominate the site for 50 to 100 years. Young forests offer prime forage and cover for a variety of wildlife species, including moose, snowshoe hares, and grouse. As the forest grows and creates shade, soil temperatures decline and permafrost gradually enters the soil profile. On some sites, black spruce slowly replaces white spruce as the dominant tree species.

The Bonanza Creek Experimental Forest now has a mosaic of white spruce and black spruce forests, paper birch and

aspen forests, with some balsam poplar, alder, and willows.

In Caribou-Poker Creeks Research Watershed, stands of 60- to 90-year-old birch and aspen dominate the south-facing slopes. Uneven-aged black spruce forests dominate the north-facing slopes, with some trees up to 200 years old.



Trish Wurtz

Boreal forests have evolved with wildfires. The fall after a summer burn, aspen are sprouting on burned forest floor, and foliage on surviving trees turns gold.

Plant and Animal Species

Together, the two research areas support a diverse flora. Lowbush and highbush cranberries, blueberries, cloudberries, nagoonberries, and crowberries are eaten by wildlife and harvested by people. Common wildflowers include fireweed, northern bedstraw, bluebells, cinquefoil, bunchberry, lady's slipper orchids, saxifrage, and anemone. The boreal forest is especially known for its diverse and productive moss and lichen communities.

Moose browse heavily on willows and saplings of birch, poplar, and aspen trees, and use thickets of young trees as cover. Many smaller mammals live in boreal forests, including snowshoe hares, voles, red squirrels, and flying squirrels. A full range of predators thrives in these ecosystems too, including black bears, wolves, lynx, coyotes, marten, and ermine. Grizzly bears are uncommon in the area.

Fish are abundant in the Tanana River. King, chum, and silver salmon run up the Tanana to spawning grounds in sloughs and clearwater tributaries. Other game fish include burbot and Arctic grayling.

The snow goose, trumpeter swan, Arctic tern, spruce grouse, willow ptarmigan, and snowy owl all use the research areas seasonally.



© Patrick J. Endres

Lynx populations are thriving in interior Alaska.



Black spruce forest.

Teresa Hollingsworth

Water

The Tanana River is the dominant feature of Bonanza Creek Experimental Forest. Nearly 512 miles long, the Tanana is the largest tributary of the Yukon River. About 85 percent of the Tanana's water comes from glacier-fed rivers that originate in the Alaska Range and flow north to the Tanana. Typically, the river has long periods of low flow under winter snow and ice cover, when the river ice can freeze 6 feet thick.

Caribou-Poker Creeks Research Watershed includes the streams it is named for, both of which flow into the Chatanika River, and small upland tributaries flowing into the two streams. Watershed hydrology has two distinct flow regimes. Permafrost-free areas produce moderately steady groundwater flows, and areas with permafrost produce highly variable storm runoff from shallow soil layers above the frozen layers. Because of these influences, permafrost has been described as an "ecological adjective" that modifies hydrology and stream ecology.

Geology

The geological material underlying the Yukon-Tanana uplands is sedimentary rock several hundred million years old.

Repeated glaciations and runoff from glacial melting have left thick deposits of sediments in the Tanana Basin, often hundreds of feet thick. The sediments came mainly from glaciers in the Alaska Range. Between glaciations the Tanana River cut through these deposits, creating a complex topography of terraces, flood plains, old river channels, and existing braided channels. Glacial silts deposited in the Yukon and Tanana River valleys were carried to the Caribou-Poker Creeks area by winds and deposited there. Mastodon and woolly mammoth tusks have been

discovered when these thick loess deposits have been disturbed during road or mine construction.

Past Research

In the Bonanza Creek area, research began in 1958 with studies on upland soils, white spruce seed production, and the growth and yield of white spruce, aspen, and birch. Bonanza Creek Experimental Forest was formally established in 1963. Studies began in 1964 on nutrient relationships in birch and black spruce stands on north-facing slopes, later expanded to all slopes.

The first experiments designed to test silvicultural systems for white spruce were established in 1972. Other early research looked at the natural regeneration of white spruce.

Studies of biogeochemistry have been a major focus of ecological research at Bonanza Creek over the last 20 years. These investigations examined nitrogen and phosphorus cycling and soil carbon dynamics across the primary successional plant communities of the flood plain.

Bonanza Creek was designated as a long-term ecological research (LTER) site in 1987. As of early



© Patrick J. Endres

The Tanana Flats area, immediately south of Bonanza Creek, is believed to have the highest moose density of any large area in North America, averaging about 1.5 moose per square mile.

2003, the LTER Program, coordinated by the National Science Foundation, included 24 sites in the United States.

The Caribou-Poker Creeks Research Watershed was established in 1969. Data were collected on climate, hydrology, and ecology. In the early 1970s, scientists could access the research watershed only by foot or helicopter. Large helicopters lifted in two laboratory trailers during the 1970s, and a primitive road and trail system was built in the late 1970s. A rustic field camp and laboratory were created.

In 1993, Caribou-Poker Creeks became a part of the Bonanza Creek LTER site. The U.S. Army installed a Bailey bridge across the Chatanika River in 1995, for the first time enabling easy access to the watershed. In 1998, in just 7 days, the Army repaired or replaced two other bridges in the watershed and rebuilt 3 miles of road.

Current Research in Bonanza Creek Experimental Forest

The majority of research at Bonanza Creek Experimental Forest is done under the auspices of the

LTER program. LTER research is organized around three themes: (1) forest dynamics, (2) the changing boreal carbon cycle, and (3) regional and landscape controls over disturbance regime. Scientists and LTER staff address issues of succession, climate change, disturbance regime, forest sustainability, and ecological resilience through a combination of long-term monitoring of control sites, modeling, geographic information system analysis, and experimental studies.

Timber harvest and silvicultural studies in Alaska boreal forest. In the 1970s and early 1980s, forest managers had problems regenerating white spruce after timber harvest. Studies begun in 1970 and 1980 to develop reliable methods of regenerating white spruce continue to yield valuable data today. One

study compares clearcutting and shelterwood harvesting and examines the effects of scarification on the long-term regeneration dynamics of a productive upland white spruce site. A more expansive project begun in 1980 compares partial overstory retention with clearcutting in white spruce stands on the flood plain.

Moose ecology and management. Scientists are studying the role of mammalian herbivores (primarily moose and snowshoe hares) in primary succession along the Tanana River, through the use of two long-term exclosure studies. Browsing by moose, in particular, can have cascading effects through the ecosystem, affecting plant species composition and soil nutrient dynamics, and ultimately accelerating the rate of successional change.

Biodiversity and ecological processes. Because of the abundance of black spruce on the landscape and the key role black spruce communities play in the carbon cycle and fire disturbance, current research specifically addresses the regional variability and biodiversity of black spruce communities.

Scientists at Bonanza Creek Experimental Forest are also looking at insect diversity and disease dynamics after fire; changes in the carbon cycle in different forest successional stages; flood plain soil moisture dynamics; and coarse woody debris budgets. They collaborate extensively with researchers working in other high-latitude ecosystems.

Current Research in Caribou-Poker Creeks Research Watershed

Research in Caribou and Poker Creeks focuses on the influence of discontinuous permafrost on stream hydrology and ecology, the role of fire and browsing in subarctic watersheds, the applicability of stream ecology concepts from other biomes in the subarctic, and improved understanding of boreal forest interactions with global climate patterns.

Fire research. The Frostfire study is a landscape-scale, prescribed research burn conducted in July 1999. It differed from previous experimental fires in the boreal forest because Frostfire was in terrain dominated by permafrost, focused on the large-scale ecological consequences of fire, and took place on an LTER site where long-term studies on fire effects and recovery are possible. Studies on hydrology and climate have quantified the controlling influence of permafrost on



Scientists gather samples for stream chemistry analysis.

Tom Iraci, USDA Forest Service



The Frostfire prescribed research burn is a study of fire effects and recovery in the permafrost zone.

streamflow processes and surface heating and cooling. Field studies have focused on nutrient dynamics, soil carbon dioxide and methane fluxes, watershed-scale carbon balance, and weathering rates.

Travel

Access is restricted to both Bonanza Creek Experimental Forest and Caribou-Poker Creeks Research Watershed. To request permission for access, contact the site manager, Bonanza Creek LTER site, 907-474-5881. Bonanza Creek is near the Parks Highway about 20 miles southwest of Fairbanks; for much of the experimental forest, road access is limited. Many sites along the Tanana River are reached in summer by boat, or via snowmachine in winter. Caribou-Poker Creeks is near the Steese Highway about 30 miles north of Fairbanks. An extensive trail network is accessible by all-terrain vehicle or snowmachine, but road access for passenger vehicles is limited.

Facilities

Rustic camp and laboratory facilities at Caribou-Poker Creeks are available only to scientific researchers.

For Further Reading

Duncan, S.; Miner, C. 2000. Closer to the truth: 75 years of discovery in forest & range research. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 76 p.

Resources on the Web

PNW Research Station. <http://www.fs.fed.us/pnw>. This site lists all publications by Station scientists, including those based on research at Bonanza Creek Experimental Forest and Caribou-Poker Creeks Research Watershed. (15 April 2003).

Bonanza Creek LTER. <http://www.lter.uaf.edu>. This site, maintained by the University of Alaska at Fairbanks, offers information on current research at Bonanza Creek and Caribou-Poker Creeks. (15 April 2003).



Fall harvest: wild cranberries, blueberries, crowberries, and bunchberries.



On winter nights, northern lights fill the sky with rippling banners and curtains of many colors.

For Further Information

Contact the Boreal Ecology Cooperative Research Unit or the Pacific Northwest Research Station (addresses below) for more information about scientific research on the Bonanza Creek Experimental Forest and Caribou-Poker Creeks Research Watershed.

Boreal Ecology Cooperative Research
University of Alaska Fairbanks
P.O. Box 756780
Fairbanks, AK 99775-6780
Phone: 907-474-5435

Pacific Northwest Research Station
333 SW First Avenue
P.O. Box 3890
Portland, OR 97208
Phone: 503-808-2592
Web site: <http://www.fs.fed.us/pnw>



Contact the University of Alaska Fairbanks Museum for more information about the history, people, and geography of the area.

University of Alaska Museum

907 Yukon Drive
P.O. Box 756960
Fairbanks, AK 99775-6960
Phone: 907-474-7505
Web site: <http://www.uaf.edu/museum>

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice or TDD). USDA is an equal opportunity provider and employer.