



# History of the Fort Collins Science Center, U.S. Geological Survey

Compiled by Thomas J. O'Shea



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## Contents

Introduction .....	1
Chronology of Selected Background Events.....	5
A Diversity of Functions from Diverse Lineages .....	10
The U.S. Geological Survey Lineage .....	11
The U.S. Bureau of Land Management Lineage .....	11
The U.S. Bureau of Reclamation Lineage .....	12
The National Park Service Lineage.....	12
The U.S. Fish and Wildlife Service Lineage .....	14
Roots in the Denver Wildlife Research Center Ecology Branch.....	16
Roots in the Western Energy and Land Use Team .....	17
Other Related U.S. Fish and Wildlife Service Programs .....	19
Origins of the Modern Branches of the Fort Collins Science Center.....	19
Policy Analysis and Science Assistance Branch.....	19
Aquatic Systems and Technology Applications Branch .....	20
Ecosystem Dynamics Branch.....	20
Invasive Species Science Branch.....	20
Species and Habitats of Federal Interest Branch .....	21
Acknowledgments.....	21
References Cited .....	21
Appendix .....	25

## Tables

1. Field stations previously administered through science center headquarters in Fort Collins under the National Biological Service .....	3
2. Field stations previously administered through research center headquarters in Fort Collins under the U.S. Fish and Wildlife Service. ....	16

# History of the Fort Collins Science Center, U.S. Geological Survey

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## Introduction

The U.S. Geological Survey's Fort Collins Science Center ("the Center") has been a nucleus of research, technology development, and associated scientific activities within the Department of the Interior for more than 30 years. The Center's historical activities are deeply rooted in federal biological resources research and its supporting disciplines, particularly as they relate to the needs of the U.S. Department of the Interior and its resource management agencies. The organizational framework and activities of the Center have changed and adapted over the years in response to shifts in the scientific issues and challenges facing the U.S. Department of the Interior and with the development of new strategies to meet these challenges. Thus, the history of the Center has been dynamic.

The Center has been nested within the U.S. Geological Survey since 1996. From 1993 to 1996 the Center was a major unit of the National Biological Service (named the National Biological Survey at its inception). This was a period of great organizational flux. During that time the Center comprised multiple field stations and science functions that prior to 1993 had been scattered among the U.S. Bureau of Land Management, the U.S. Bureau of Reclamation, the National Park Service, and the U.S. Fish and Wildlife Service. In 1993, certain biological research components of these agencies were assigned to join with the National Ecology Research Center, formerly one of the major research and development hubs of the U.S. Fish and Wildlife Service. This was the year when biological resources research in the U.S. Department of the Interior was consolidated by the Secretary of the Interior, who in an April 1993 memo explaining his intentions wrote, "Our Department has, without doubt, the best biologists in the world." Soon after formation of the new agency, the Center was re-named the Midcontinent Ecological Science Center, reflecting its geographic location within the new Midcontinent administrative region of the National Biological Service (the other three original administrative regions were the eastern, western, and southern). The change in name to the Fort Collins Science Center took place in 2002, soon after the center moved to new facilities on the Colorado State University Natural Resources Research Campus.

At various times during the period when it was part of the National Biological Service (1993–96), the Center served as the administrative and programmatic home base for a wide number of science activities in numerous Western states (table 1). This reflected the previous fragmentation of biological and related science efforts across resource management agencies in the U.S. Department of the Interior. The organization of the

Center within the National Biological Service was a manifestation of the desire of the Secretary of the Interior to consolidate its biological science activities in administratively independent entities that would ensure that the science retained its objectivity. Congress later recognized the need to maintain a hierarchical independence between biological science and resource management in the Department. However, Congress also saw that the U.S. Geological Survey, with its long history of objective science support to the nation in geology, water resources, geography, and remote sensing, was a suitable alternative home for these biological science functions. Thus, in 1996 Congress transferred the biological resources functions of the National Biological Service to the U.S. Geological Survey. Detailed overviews and opinions about the history and policy issues surrounding the formation and subsequent fate of the National Biological Service can be found elsewhere (for example Cohn, 1993, 2005; Kaufman, 1993; Kreeger, 1994; Pulliam, 1995, 1998a,b; Reichhardt, 1994; Wagner, 1999)

**Table 1.** Field stations previously administered through science center headquarters in Fort Collins under the National Biological Service (forerunners to the Fort Collins Science Center were the Midcontinent Ecological Science Center in the National Biological Service and the National Ecology Research Center under the U.S. Fish and Wildlife Service). [Acronyms: BLM, U.S. Bureau of Land Management; BOR, U.S. Bureau of Reclamation; FORT, Fort Collins Science Center; FWS, U.S. Fish and Wildlife Service; NPS, National Park Service; USGS, U.S. Geological Survey]

<b>Field station or program</b>	<b>Parent agency and location</b>	<b>Current status</b>
Jemez Mountains Field Station	NPS. Bandelier National Monument, Los Alamos, N. Mex.	FORT Field Station, USGS
Canyonlands Field Station	NPS. Canyonlands/Arches National Park, Moab, Utah.	Southwest Science Center Research Station, USGS
Colorado Plateau Research Station	NPS. Northern Arizona University, Flagstaff, Ariz.	Southwest Science Center Research Station, USGS
Glacier Field Station	NPS. Glacier National Park, Mont.	Northern Rocky Mountains Science Center, USGS
Greater Yellowstone Field Station	NPS. Yellowstone National Park, Mont.	Northern Rocky Mountains Science Center, USGS
Bozeman Field Station (Yellowstone grizzly bears)	NPS. Co-located with U.S. Forest Service, Bozeman, Mont.	Northern Rocky Mountains Science Center, USGS
Bozeman Field Office (ungulate ecology, Yellowstone)	NPS. Co-located at Montana State University, Bozeman, Mont.	Northern Rocky Mountains Science Center, USGS
Atmospheric and Ecosystem Monitoring, Fort Collins	BLM. Environmental Science and Technology Center, Fort Collins, Colo.	Organizationally defunct
National Air Quality Monitoring, Lakewood	NPS. Lakewood, Colo.	Administered by NPS
Denver Field Station (limnology, reservoir and riparian ecology and restoration, fishery biology)	BOR. Lakewood, Colo. (Ecological Resources Division)	FORT Field Station
Rocky Mountain Field Station (NPS monitoring and research, plant ecology, ecosystem studies, large mammals)	NPS. Natural Resources Ecology Laboratory, Colorado State University, Fort Collins, Colo.	FORT Headquarters and Colorado State University
Watershed Ecosystem Research Program	NPS. Colorado State University, Fort Collins, Colo.	Incorporated into FORT
Ecosystem Processes Studies Program	NPS. Co-located with U.S. Forest Service Rocky Mountain Experiment and Range Station, Fort	Incorporated into FORT

	Collins, Colo.	
Aquatic Toxicology	NPS. Colorado State University, Fort Collins, Colo.	Incorporated into FORT
Riverside, Calif. (Desert Tortoise)	BLM. Riverside, Calif.	Box Springs Field Station , Western Ecological Research Center, USGS
Palm Springs, Calif. (Desert Tortoise)	BLM. Palm Springs, Calif.	Incorporated into Western Ecological Research Center
St. George, Utah (Desert Tortoise)	BLM. Bureau of Land Management, St. George Utah	Las Vegas Field Station, Western Ecological Research Center, USGS
Las Vegas, Nev. (Desert Tortoise)	BLM. Bureau of Land Management, Las Vegas, Nev.	Las Vegas Field Station, Western Ecological Research Center, USGS
San Marcos, Tex.	FWS. San Marcos Fish Technology Center, San Marcos, Texas	San Marcos National Fish Hatchery & Technology Center, San Marcos, Texas, FWS
Fort Collins (endangered species; ferret research)	FWS.	Incorporated into FORT
Fort Collins (landscape and habitat analysis, social economic, instream flow)	FWS.	Incorporated into FORT
Water Resources, Fort Collins	NPS. Water Resources Division, Washington Office	FORT Headquarters
Technical services section	FWS.	Incorporated into FORT
Southeastern Stream Ecology Project, Auburn, Ala.	FWS.	Organizationally defunct
Vertebrate Ecology Section	FWS.	Incorporated into FORT
Arid Lands Field Station, Albuquerque, N. Mex.	FWS. National Ecology Research Center, Fort Collins, Colo.	FORT (Arid Lands Field Station)

## **Chronology of Selected Background Events**

Because of its origin in multiple agencies and mandates, the Fort Collins Science Center can trace its history through a complex chronology of events. These are outlined below. This chronology is intended to provide a historical perspective on important legislation and federal government reorganizations that were the foundation of mandates guiding many of the Center's activities over the years. Additional details directly pertinent to the U.S. Department of the Interior agency lineages leading to the present-day Center are then provided in a subsequent section of this document.

*1812.*—Congress created the General Land Office to handle the opening of frontier lands for sale to the public. The General Land Office, a forerunner to the modern U.S. Bureau of Land Management, was transferred from the U.S. Department of the Treasury to the U.S. Department of the Interior with the creation of the latter in 1849. Certain U.S. Bureau of Land Management research functions were transferred to the Center with creation of the National Biological Survey in 1993.

*1849.*—The 30th Congress created the U.S. Department of the Interior to take charge of the Nation's internal affairs (Utley and Mackintosh, 1989).

*1871.*—An independent Bureau of Fisheries was established, later assigned to the U.S. Department of Commerce (Madison, 2005).

*1879.*—The U.S. Geological Survey was formed by act of Congress, with Clarence King appointed as first Director. The Survey was charged with responsibility for "classification of the public lands, and examination of the geological structure, mineral resources, and products of the national domain" (Rabbit, 1989). The Survey became the Nation's principal source of scientific information about its land, minerals, and water.

*1881.*—Major John Wesley Powell, civil war veteran, geologist, and explorer of the American Southwest, became the second Director of the U.S. Geological Survey and served in this capacity until 1894 (Rabbitt, 1989).

*1885.*—The Economic Ornithology Branch was established in the Division of Entomology of the U.S. Department of Agriculture. This branch was expanded to the Division of Economic Ornithology and Mammalogy in 1886, and to the Division of Biological Survey in 1896. These were the forerunners to the Bureau of Biological Survey within the U.S. Department of Agriculture (Cameron, 1929). Dr. C. Hart Merriam was the first head of the Economic Ornithology Branch and served as head of the Bureau of Biological Survey until 1910 (Sterling, 1974). Merriam's lineage extends to some current-day activities of the U.S. Geological Survey (Fisher, 2003), formerly administered through the Center in Fort Collins in the 1980s and 1990s.

*1902.*—The Reclamation Act of 1902 (also called the Newlands Act) provided for the construction of dams, reservoirs, and aqueducts to provide water to arid and semiarid lands in the West, later to emerge as the chief function of the U.S. Bureau of Reclamation. In July 1902 the Reclamation Service was organized within the U.S.

Geological Survey to aid in carrying out mandates of the Reclamation Act (Rabbit, 1989; U.S. Bureau of Reclamation, 2002).

*1905.*—The Bureau of Biological Survey was formed in the U.S. Department of Agriculture as an expansion of activities first initiated in 1885 with the establishment of the Economic Ornithology Branch (Cameron, 1929).

*1916.*—President Wilson signed legislation creating the National Park Service (Mackintosh, 1999, 2004). The function of the agency was to oversee administration and management of the 14 National Parks and 21 National Monuments that had been created up through that time, the largest being Yellowstone National Park, founded in 1872. Direction was given to the Park Service “to conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.” Many scientists at the Fort Collins Science Center have backgrounds that include service in the National Park Service.

*1918.*—The Migratory Bird Treaty Act was passed. This legislation provided the authority for the Center’s avian research.

*1923.*—The Bureau of Reclamation became a separate bureau in the U.S. Department of the Interior, drawn from the former Reclamation Service within the U.S. Geological Survey (Rabbitt, 1989; U.S. Bureau of Reclamation, 2002). The Fort Collins Science Center group currently stationed in Lakewood, Colo., at the U.S. Bureau of Reclamation building extends from this lineage, and the Center continues to work with the U.S. Bureau of Reclamation on water and biological resource problems.

*1931.*—The Bureau of Biological Survey (U.S. Department of Agriculture) established the Food Habits Laboratory in Denver, Colo., to study the economic impact of predators, other mammals, and birds in the Western United States. This was a forerunner to the Denver Wildlife Research Center, which through various reorganizations now has lineages within the Fort Collins Science Center of the U.S. Geological Survey, and within the National Wildlife Research Center (also located in Fort Collins) of the U.S. Department of Agriculture’s Animal and Plant Health Inspection Service (U.S. Department of Agriculture, 2005). A small collection of reference specimens of vertebrates was started in connection with food habits studies.

*1934.*—Congress passed the Fish and Wildlife Coordination Act, with provisions that included determining effects of pollutants and water projects on fish and wildlife, and conducting wildlife surveys on the public lands. (This Act had subsequent amendments in 1946, 1958, 1978, and 1995.) In September, J.N. "Ding" Darling consolidated functions within the Bureau of Biological Survey of the U.S. Department of Agriculture to form a Division of Wildlife Research (Madison, 2005).

*1939.*—The U.S. Department of the Interior became home to two bureaus transferred from two other cabinet-level Departments: the Bureau of Biological Survey, transferred from the U.S. Department of Agriculture, and the Bureau of Fisheries,

transferred from the U.S. Department of Commerce (Guinan and Curtis, 1971; Madison, 2005).

*1940.*—The Wildlife Division of the National Park Service was transferred to the Bureau of Biological Survey on January 1. The Bureau of Biological Survey and the Bureau of Fisheries were consolidated on June 30 as the U.S. Fish and Wildlife Service (Guinan and Curtis, 1971). Former National Park Service Wildlife Division activities continued under the U.S. Fish and Wildlife Service as the Office of National Park Wildlife (Sumner, 1983). The Denver Wildlife Research Laboratory was formed under the new U.S. Fish and Wildlife Service from the Control Methods Research and Food Habits Laboratories, former components of the Bureau of Biological Survey (U.S. Department of Agriculture, 2005).

*1946.*—The U.S. Bureau of Land Management was formed by a merger of the General Land Office and the Grazing Service (formed in 1941 from the Division of Grazing, created under the Taylor Grazing Act of 1934) within the U.S. Department of the Interior (Muhn and Stuart, 1988). (Several research functions that developed within the U.S. Bureau of Land Management found a home in the forerunner to the Fort Collins Science Center during the 1993–96 National Biological Service.) Also in 1946, the U.S. Fish and Wildlife Service established a River Basin Studies program in response to amendments to the Fish and Wildlife Coordination Act of 1934 (Madison, 2005). The purpose of the River Basin Studies program was to help minimize impacts to fish and wildlife resources from water projects undertaken under federal permits. This program was a forerunner leading to the formation of the U.S. Fish and Wildlife Service's Ecological Services Program and the river-related studies led by the Office of Biological Service's Western Energy and Land Use Team in Fort Collins.

*1956.*—The Fish and Wildlife Act reorganized the U.S. Fish and Wildlife Service into two bureaus: the Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife (Madison 2005). Most of the functions of the Bureau of Commercial Fisheries were later (1970) transferred to the National Oceanic and Atmospheric Administration in the U.S. Department of Commerce under a proposal by President Nixon, and are currently carried out by the National Marine Fisheries Service (Guinan and Curtis, 1971).

*1958.*—The Bird and Mammal Laboratories (headquartered at the National Museum of Natural History) were formed from reorganization of sections within the Division of Wildlife, Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service. These sections were rooted directly within the old Bureau of Biological Survey and its forerunners. In particular, these involved the old bureau's Division of Wildlife Research and subsequently renamed administrative units during its history with the U.S. Fish and Wildlife Service (Section of Wildlife Surveys, Section of Biological Surveys, Section of Distribution of Birds and Mammals; Fisher, 2003).

*1959.*—The Denver Wildlife Research Laboratory expanded its research to include wildlife on public lands and impacts of pesticides on wildlife and was renamed the Denver Wildlife Research Center (U.S. Department of Agriculture, 2005).

1963.—A commission appointed by U.S. Secretary of the Interior Udall issued the Leopold report "Wildlife Management in the National Parks", which stressed the need for expanded scientific research in the National Park Service and noted that "...management without knowledge would be a dangerous policy indeed" (Leopold and others, 1963)

1969.—The National Environmental Policy Act of 1969 was passed. The purpose was "...to declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation". These functions resulted in development of standards and scientific procedures for evaluating impacts of federal projects by many of the agencies in the U.S. Department of the Interior and other branches of government.

1972.—The U.S. Marine Mammal Protection Act of 1972 was passed, mandating research and management on sirenians, sea otters, polar bears, and walrus to the U.S. Department of Interior.

1973.—The U.S. Endangered Species Act of 1973 was enacted by Congress. The Bird and Mammal Laboratories within the U.S. Fish and Wildlife Service were renamed the National Fish and Wildlife Laboratory (Fisher, 2003) and given expanded responsibilities that included research on marine mammals, endangered species, and public lands. By the late 1970s the Laboratory was organized into three sections (the Ecology, Museum, and Marine Mammal Sections) and had field stations at Fort Collins Colo. (established about 1974), Gainesville, Fla. (about 1974), Albuquerque, N. Mex. (about 1974), Santa Cruz, Calif. (about 1976), San Simeon, Calif. (about 1976), and New Orleans, La. (about 1977–84). The collection of vertebrates from the early Food Habits Laboratory in Denver was moved to Fort Collins. Some personnel of the National Fish and Wildlife Laboratory shared space in Fort Collins with staff of the Denver Wildlife Research Center.

1974.—The U.S. Fish and Wildlife Service initiated its Biological Services Program in the autumn of 1974, based on new initiatives from Congress and transfers of funds from other agencies, including the U.S. Geological Survey, U.S. Bureau of Mines, U.S. Environmental Protection Agency, U.S. Bureau of Land Management, and the Water Resources Council (U.S. Fish and Wildlife Service, 1976). The mission of the Biological Services Program was to supply scientific information and methodologies on key environmental issues that impact fish and wildlife resources and their supporting ecosystems.

1975.—The U.S. Fish and Wildlife Service Office of Biological Services established the Western Energy and Land Use Team in Fort Collins. This was one of four national teams started by the Office of Biological Services of the U.S. Fish and Wildlife Service to support implementation of U.S. Department of the Interior resource development programs requiring ecological input and to fulfill the Service's analytical responsibilities for environmental impact assessments. A major focus involved assessing impacts of western oil shale development.

*1980.*—The National Fish and Wildlife Laboratory merged with the Denver Wildlife Research Center; the Laboratory's sections and field stations were added to those already existing within the Denver Center (U.S. Department of Agriculture, 2005).

*1985.*—Congress transferred the U.S. Fish and Wildlife Service's animal damage control programs, including major segments of the Denver Wildlife Research Center, to the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (U.S. Department of Agriculture, 2005). Remaining field stations not transferred included many of the components from the former National Fish and Wildlife Laboratory and the Section of Wildlife Ecology on the Public Lands of the Denver Wildlife Research Center. These stations and their programs were eventually merged with the Western Energy and Land Use Team of the U.S. Fish and Wildlife Service's Office of Biological Services in Fort Collins. The new center was named the National Ecology Center, subsequently re-named as the National Ecology Research Center.

*1990.*—The Non-Indigenous Aquatic Nuisance Prevention and Control Act of 1990 was enacted, with provisions including a focus on the brown tree snake problem.

*1992.*—The National Academy of Sciences delivered a report ("Science and the National Parks") calling for establishment of a true mandate for science in the National Park Service with enhanced credibility and quality (National Research Council, 1992).

*1993.*—The National Ecology Research Center opened a new field station in Corvallis, Oreg., with responsibilities in amphibians, reptiles, endangered species, and marine mammals. The collection of vertebrates was moved from Fort Collins to the Museum of Southwestern Biology on the campus of the University of New Mexico (Finley and Bogan, 1992). In February the U.S. Secretary of the Interior informally proposed to establish a National Biological Survey drawn from elements of eight U.S. Department of the Interior bureaus, intended to be the start of an independent biological resources science agency for the Department. The action was recommended in a National Academy of Sciences Report (National Research Council, 1993) and in an internal advocate position paper developed by Dr. Ted LaRoe of the U.S. Fish and Wildlife Service. The proposal became formal on March 17 with a memorandum from the Secretary to other Cabinet heads. On April 22 Congressman Studts introduced HR 1845, the "Biological Survey Act of 1993," with similar legislation introduced in the Senate, but organic legislation was stalled. Secretarial Order No. 3165 was issued on May 17, titled "Organizational Preparations for the Creation of the National Biological Survey." The Fiscal Year 1994 Interior appropriations bill passed the House on July 15, 1993, and included budgets transferred from other bureaus and newly authorized funding to help achieve the Secretary's goals. The U.S. Fish and Wildlife Service hosted a meeting of Center Directors in Leetown, W. Va., August 11–13, during which assignments and realignments of U.S. Department of the Interior biological resources functions were announced. The National Ecology Research Center headquartered in Fort Collins was slated to have the greatest number of staff and field stations and the largest budget. An internal transfer became imminent with the September 29 Secretarial Order No. 3173, "Establishment of the National Biological Survey." The National Biological Survey became operational on November 11, 1993, when Congress passed and President Clinton signed into law the Fiscal Year 1994 Interior Appropriations Act.

*1995.*—On January 5 the name of the National Biological Survey was changed to the National Biological Service to better reflect the agency's mission. Congress' intentions to eliminate the National Biological Service, reorganize its functions, and markedly reduce its budget became clear during 1995. A House subcommittee markup on the Fiscal Year 1996 appropriations bill tentatively named the remaining functions the Life Sciences Research Service; this was then tentatively renamed the Natural Resources Research agency in development of the Congressional conference report on the Interior and Related Agencies Appropriations Act of 1996. The directive to prepare to assign the biological resources research to the U.S. Geological Survey was made in the Oct 31 conference report (104-\300) on the Fiscal Year 1996 appropriations bill.

*1996.*—Plans to restructure and merge the operations of the National Biological Service with the U.S. Geological Survey were firmed by Congress and became effective on October 1 (the beginning of Fiscal Year 1997). Most of the activities of the National Biological Service that were retained in this transfer fell under the umbrella of the newly formed Biological Resources Division of the U.S. Geological Survey.

*1997.*—Effective April 1, the Biological Resources Division of the U.S. Geological Survey implemented conformance to common agency regional boundaries. All field stations of the Midcontinent Ecological Science Center in Arizona, Utah, Nevada, Oregon, and California were re-aligned with Western Region Science Centers. The wolf and deer projects in Minnesota were aligned with the Center at this time but re-assigned to the Northern Prairie Wildlife Research Center in 1998.

*1999.*—Field stations in Bozeman, Missoula, Glacier National Park, and Yellowstone National Park were reassigned from the Midcontinent Ecological Science Center to the newly created Northern Rocky Mountain Science Center.

*2000.*—Based on Biological Resources Discipline guidance, the Center held a Core Capabilities Retreat at Estes Park, Colo., on May 22–24 to develop a vision for major areas of future activities. These areas later become the basis for reorganization into the current branch structure of the Center.

*2002.*—The Center moved to its new location on the federal Natural Resources Research Campus of Colorado State University. The name of the Center was changed from the Midcontinent Ecological Science Center to the Fort Collins Science Center.

*2004.*—The Brown Tree Snake Control and Eradication Act of 2004 spelled out the Center's role in scientific research on this invasive species problem.

## **A Diversity of Functions from Diverse Lineages**

The unification of former scientific research arms of various U.S. Department of the Interior agencies within the Center has resulted in many of the Center's diverse functions. The diversity of these functions provides the Center with strength, helps to maintain flexibility in its capacity for future activities, and sets the stage for additional

integration of other U.S. Geological Survey disciplines into the Center. However, much of the expertise at the Center has roots that can be traced to the distinct lineages of the earlier science subunits of the parent agencies that coalesced in 1993. Although much of the work of the Center has moved on to new and exciting objectives since then, it is important to recognize the more recent lineages that led to much of the current staffing and operations of the Center. This heritage has provided a strong foundation to build on and can provide a sense of continuity to new staff, clients, and science managers as the Center moves forward to the future. Additional detailed synopses of the past scientific lineages that have evolved into the existing capabilities of the Center are provided below.

## **The U.S. Geological Survey Lineage**

The U.S. Geological Survey was created by an Act of Congress in 1879 on the basis of recommendations of a committee of the National Academy of Sciences commissioned by Congress to suggest a plan for surveying and mapping the Territories of the United States (similarly, a National Academy of Sciences report in 1993 recommended the formation of the National Biological Survey, which was later incorporated into a major biological science discipline within the U.S. Geological Survey). The 1879 legislation charged the U.S. Geological Survey with the mission of "classification of the public lands, and examination of the geological structure, mineral resources, and products of the national domain." The establishment of the U.S. Geological Survey was an extension of a developing policy by which Congress first created the Department of the Interior in 1849 to assist in management and exploration of the public lands and its resources. In 1867 Congress first authorized western explorations in which scientific investigations were the principal objective: the study of the geology and natural resources along the fortieth parallel (route of the transcontinental railroad), under the Corps of Engineers, and a geological survey of the natural resources of the new State of Nebraska (Rabbitt, 1989). This increased recognition of the need to apply science to the exploration and management of the nation's resources led to the creation of the Geological Survey just 12 years later. In 1996 Congress merged the former National Biological Service with the U.S. Geological Survey. The science programs that transferred became the Biological Resources Division of the U.S. Geological Survey, renamed as the Biological Resources Discipline in 1999 as part of Director Groat's Strategic Change planning.

## **The U.S. Bureau of Land Management Lineage**

The U.S. Bureau of Land Management actively promoted a scientific basis for conservation and use of lands under its jurisdiction. This Bureau did not have a long history of in-house biological science activity: it did not hire its first wildlife biologist until 1961, and it first entered into research agreements with other agencies in the 1960s (Muhn and Stuart, 1988). However, by 1980 the U.S. Bureau of Land Management had 360 wildlife biologists, and the number of biological science programs in this agency continued to grow with increasing responsibilities under subsequent legislation. During the period when the Center was part of the National Biological Service, there were two principal activities that were transferred from the U.S. Bureau of Land Management.

These were (1) research in deserts related primarily to the threatened desert tortoise and its associated habitats and (2) an ecosystem monitoring and research program with emphasis on air quality in wilderness areas. The former activities involved staff at field stations in Nevada, California, and Utah (table 1), now part of the Western Ecological Research Center. The ecosystem monitoring program was headquartered in Fort Collins but is no longer an intact function. However, the U.S. Bureau of Land management continues to be an important client agency. A number of current projects within the Center are based on requests and agreements with this agency.

## **The U.S. Bureau of Reclamation Lineage**

The U.S. Bureau of Reclamation has its roots in the 1902 Reclamation Act. This legislation provided for the construction of dams, reservoirs, aqueducts, and canals to irrigate arid and semiarid lands for agricultural endeavors in the West. This new program, aimed at bolstering the Nation's infrastructure, was first implemented by the formation of the U.S. Reclamation Service within the U.S. Geological Survey. The Secretary of the Interior proclaimed the U.S. Reclamation Service a separate Interior bureau in 1907. The Service was retitled the U.S. Bureau of Reclamation in 1923. The U.S. Bureau of Reclamation now operates about 180 projects in the 17 Western States, providing agricultural, household, and industrial water to about one-third of the population of the American West, as well as generating significant amounts of electrical power. With the completion of its infrastructure projects, the emphasis of the agency has shifted to its current mission to "manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public" (U.S. Bureau of Reclamation, 2002, p. 1). During the reorganization of U.S. Department of the Interior research in the 1990s, the Center became home to biological science research and engineering staff located at the U.S. Bureau of Reclamation's Research and Laboratory Services Division, Applied Sciences Branch, Environmental Sciences Section. This Center group stationed in Denver continues its work with an aim towards U.S. Bureau of Reclamation science needs in aquatic resources, fisheries biology, and riparian ecosystems affected by management of water resources.

## **The National Park Service Lineage**

Contributed by Robert Stottlemeyer

The authority to carry out research in the National Park Service was contained within the 1916 National Park Service Organic Act and within the legislation establishing individual parks such as Cape Hatteras and the Noatak National Preserve. The need for a research function was included in the 1872 legislation establishing Yellowstone National Park, primarily because there was no ecological research to guide policy for the first national park. However, balancing the demands for visitor use and enjoyment with

resource protection, as emphasized within the 1916 Organic Act, has proven difficult for the National Park Service to achieve (Leopold and others, 1963).

Many of the 19th- and early 20th- century national parks were established out of concern for the preservation of certain plants and animals. Without ecological guidance, widespread practices such as fire suppression and predator control took place in the national parks, preserves, and national forests. The fallacy of such policies was scientifically evident by the 1920s and early 1930s (Adams, 1925; Wright and others, 1933). Management of fauna had a high public profile and led shortly to establishing the Division of Wildlife within the National Park Service, headed by George M. Wright. Wright's untimely death in 1936 and the onset of World War II halted effective scientific research in the National Park Service for more than two decades (Reid, 1976). (The Division of Wildlife was transferred out of the National Park Service to the Bureau of Biological Survey in 1940.) The continuing need to develop a strong biological research program within the National Park Service was recommended several times during the course of its history (for example, Leopold and others, 1963; National Research Council, 1992).

The National Park Service Office of Natural Science Studies was established in the mid-1960s in Washington, D.C. It was shortly thereafter renamed the Office of the Chief Scientist. By 1968 more than 760 natural and social science studies were coordinated from this office (National Park Service, 1968). Almost all studies were conducted by university scientists, many with long-term relationships with the National Park Service and cooperating with National Park Service researchers. At the time, much National Park Service research was conducted by Park Naturalists who also had academic standing and published in the peer-reviewed journals. The Office of Sociological Studies was established in 1968 with initial emphasis on rural sociology. Longer term studies were in place concerning hydrologic regulation, reintroduction of fire into park ecosystems, control of exotic herbivores, and the elimination of beach erosion control in the coastal barrier island national parks. These topics were major National Park Service issues in need of fundamental policy change.

By the early 1970s rapid change in research within the National Park Service was underway, driven in large part by the public interest in environmental matters, the spirit and letter of the National Environmental Policy Act of 1969, and the Administrative Procedures Act of 1967. In 1971, the National Park Service began hiring a significant number of doctoral-level scientists and researchers and established a network of Cooperative Park Studies Units at about 25 universities. Most National Park Service researchers were attached or administered through these units. The units were established along scientific discipline lines, and the model was the precursor to the present but multi-discipline Cooperative Ecosystem Studies Units. The National Park Service adopted the Research Grade Evaluation peer review process for its research scientists in 1972, modeled after that employed by the U.S. Department of Agriculture's Forest Service and Agricultural Research Service. There was a formal agreement with the Nature Conservancy throughout the 1970s for cooperative studies (Jenkins and Bedford, 1973). By 1973, applied technology became a significant component of National Park Service natural science studies and park planning. Satellite and digitized U-2 color infrared imagery and geographic information system overlays were used to

generate Resource Basic Inventories for natural and cultural national parks. With the establishment of the urban national parks, including the “Gateways” in New York City and San Francisco, urban sociology became a major component of the Sociological Studies Program.

By 1980, National Park Service research became less mission-oriented and more focused on short-term issues of site-specific value. The research program was largely administered through a group of Regional Chief Scientists and Park Superintendents. The situation led to numerous national meetings and symposia organized by outside scientific groups and professional organizations to evaluate what could be done to improve the situation (National Research Council, 1992). Obstacles preventing park-based scientists from conducting objective, peer-reviewed research were among the specific reasons given by Secretary Babbitt in support of a National Biological Survey in 1993. During this period, mission-oriented studies were largely funded by the Acid Precipitation Assessment Program, National Global Climate Change Program, National Park Service funding for wildlife studies or basic inventory work, and external funds through universities.

The National Park Service was intent on making such improvements at the time it contributed components to the Center with the establishment of the National Biological Survey in 1993. However, research within the National Park Service had been organized at several somewhat independent levels. Some units had research scientists on staff within parks. Other research functions were carried out directly through the Washington Office, and yet other researchers were assigned to university campuses. The current staffing of the Center includes scientists with backgrounds in all three contexts. The Jemez Mountains Field Station conducts ecological research from facilities at Bandelier National Monument. Research that originally stemmed from the national-level Watershed Ecosystems Program and Water Resources Program continue but to a reduced degree, and former Park Service scientists stationed at Colorado State University and headquarters are actively involved with research endeavors in ecosystem monitoring, large mammal ecology, invasive species, hydrology, biodiversity, and biogeochemical cycling. Much of this work continues to serve interests of the National Park Service. Numerous other elements of National Park Service research were transferred to the Center with the formation of the National Biological Survey, including scientists stationed at, or assigned to, research at parks in Montana, Wyoming, Colorado, Utah, New Mexico, and Arizona (table 1). Several researchers also conducted studies at parks in other locations throughout the Nation. Many of these scientists were attached to other Research and Science Centers within the U.S. Geological Survey soon after the reassignment from the National Biological Service to conform to the U.S. Geological Survey's administrative boundaries.

### **The U.S. Fish and Wildlife Service Lineage**

The current operations in every branch of today's Center involve areas of scientific work that can trace their beginnings through the U.S. Fish and Wildlife Service. Fiscal Year 1975 marked the establishment of the Fish and Wildlife Service's Office of Biological Services and the Biological Services Program, including new activities headquartered in Fort Collins. The Biological Services Program was created on the basis

of Congressional budget enhancements and transfers of funds from other agencies (the U.S. Geological Survey, U.S. Bureau of Mines, U.S. Bureau of Land Management, U.S. Environmental Protection Agency, and Water Resources Council). The intent of the program was to provide a bridge between U.S. Fish and Wildlife Service activities at the research level and those at the field operations or management level. The program synthesized scientific research data into operationally useful guidelines and manuals, and it provided technical assistance on environmental problems directly to U.S. Fish and Wildlife Service regional offices (U.S. Fish and Wildlife Service, 1976). This included defining baseline characteristics of ecosystems, describing impacts on fish and wildlife resources, improving methods and tools for evaluating habitats and assessing environmental impacts, developing information systems and management strategies, and coordinating effective agency participation in decision making (U.S. Fish and Wildlife Service, 1976; Reed and Drabelle, 1984). This focus on applied science was a mission of the Biological Services Program's Western Energy and Land Use Team and other U.S. Fish and Wildlife Service groups established in Fort Collins at about the same time. These groups' efforts included then ground-breaking approaches in remote sensing, geographic information systems, habitat assessment methods, habitat suitability models, modeling workshops, database development, and decision-support software. Many of these kinds of activities have been adopted and enhanced over the years by private industry, other government agencies, and academia, and have entered the mainstream of modern applied ecology.

While these new developments were taking place in the U.S. Fish and Wildlife Service during the mid-1970s, several more traditional fish and wildlife research activities also were being carried out in Fort Collins under field stations of the National Fish and Wildlife Laboratory and the Denver Wildlife Research Center. Then in the mid-1980s, many Office of Biological Services activities were reorganized nationally and administratively combined with the traditional research centers and laboratories into a national Research and Development Program, formally designated as Region 8 within the U.S. Fish and Wildlife Service (Reed and Drabelle, 1984). Part of this administrative reorganization included formation of the National Ecology Research Center in Fort Collins as a model of combined research and development functions. Formation of the U.S. Fish and Wildlife Service's National Ecology Research Center is thus a convenient recent nexus of events for a more detailed account of the beginnings of the Fort Collins Science Center.

The National Ecology Research Center (called the National Ecology Center in 1986–87) was formed as a recombination of subdivisions of the Denver Wildlife Research Center within that Center's Ecology Branch and the Western Energy and Land Use Team of the U.S. Fish and Wildlife Service's Office of Biological Services, each with offices in Fort Collins. These two entities were brought together by a further internal U.S. Fish and Wildlife Service reorganization precipitated by the transfer of the wildlife damage control research activities of the Denver Wildlife Research Center to the U.S. Department of Agriculture by Congress in 1985, but with the Ecology Branch of the Denver Wildlife Research Center retained in the U.S. Fish and Wildlife Service.

## Roots in the Denver Wildlife Research Center Ecology Branch

The Ecology Branch of the Denver Wildlife Research Center comprised research activities of units in Fort Collins, New Mexico (stationed at the University of New Mexico in Albuquerque), Washington, D.C. (stationed at the National Museum of Natural History), Florida (Gainesville), California (San Simeon and Santa Cruz), and Alaska (Anchorage, Fairbanks, and Kodiak; research on seabirds, waterfowl, caribou, and marine mammals, were incorporated into the current-day Alaska Science Center in 1986 when the U.S. Fish and Wildlife Service formed the Alaska Fish and Wildlife Research Center). These activities were administered through three sections within the Ecology Branch. The Museum, Ecology, and Marine Mammal Sections of the former Denver Wildlife Research Center had resulted from a merger with the National Fish and Wildlife Laboratory in 1980. These roots extended back through time: ecological research headquartered in Colorado was an outgrowth of the old Food Habits Laboratory of the Bureau of Biological Survey, represented by more modern missions (the Denver Wildlife Research Center's Section of Wildlife Ecology on the Public Lands), whereas the museum functions in the National Fish and Wildlife Laboratory had their origins in the first activities of the Bureau of Biological Survey under C. Hart Merriam in the late 1800s (see "Chronology" and table 2). Research on marine mammals was in direct response to legislative mandates of the 1970s, including the U.S. Marine Mammal Protection Act of 1972 and the U.S. Endangered Species Act of 1973. Some of the Center's current activities that have roots in the Ecology Branch of the National Ecology Research Center include museum functions and wildlife inventories at the Aridlands Field Station in Albuquerque, and mammal, bird, reptile and amphibian studies headquartered in Fort Collins.

**Table 2.** Field stations previously administered through research center headquarters in Fort Collins under the U.S. Fish and Wildlife Service (forerunners to FORT were named the National Ecology Center and the National Ecology Research Center) and their current status.

Field station	Location	Current status
Santa Cruz, Calif. (sea otters, marine ecology)	University of California at Santa Cruz	Western Ecological Research Center, USGS
San Simeon, Calif. (marine mammals, terrestrial species at risk)	San Simeon, Calif.	Western Ecological Research Center, USGS
Biological Survey Project (vertebrate ecology, surveys, systematics, and museum curation)	National Museum of Natural History, Washington, D.C.	Patuxent Wildlife Research Center, USGS Fort Collins Science Center, USGS (brown tree snakes)
Arid Lands Field Station (vertebrate ecology)	University of New Mexico, Albuquerque	Fort Collins Science Center, USGS
Southeastern Stream Ecology Project	Auburn University, Ala.	Defunct
Gainesville, Fla. (vertebrate ecology, marine mammals)	Gainesville, Fla	Florida Integrated Science Center, USGS

## Roots in the Western Energy and Land Use Team

Contributed by B. Lee Lamb, Robert G. Streeter, Ronald G. Osborn, and Ken D. Bovee

The U.S. Fish and Wildlife Service's Biological Services Program, implemented through the Office of Biological Services, came into being in 1974 (Atchison and others, 1973). The basic objective of the Biological Services Program was to provide a focused ecological capability within the Fish and Wildlife Service to support implementation of U.S. Department of the Interior resource development programs requiring ecological input and to provide more analytical and effective fulfillment of the Service's responsibilities for environmental impact assessments.

The Western Energy and Land Use Team was established early in 1975 in Fort Collins as a part of a National Teams concept (also established were the Coastal Ecosystems Team, Slidell, La., the forerunner to the present National Wetlands Research Center of the U.S. Geological Survey; the Power Plant Team, Ann Arbor, Mich.; and the Eastern Energy and Land Use Team, Harpers Ferry, W. Va. The Western Energy and Land Use Team included four initial subprograms: Coal, Geothermal Energy, Oil Shale, and Western Water. The Team's function was to (1) identify and define problems concerning impacts on fish and wildlife resources resulting from energy development and water utilization, (2) formulate solutions to these problems on the basis of extant factual information and newly designed research projects, (3) incorporate these solutions into standards and technology for use by resource managers; and (4) assist resource managers in implementing the standards and technology. The initial staffing for the Western Energy and Land Use Team in 1975 included a team leader, coal research manager, geothermal energy research manager, oil shale research manager, and Western water research manager. The scientific support staff included experts in biometrics, economics, fishery biology, information transfer, plant ecology, remote sensing, water quality, wildlife ecology, and systems modeling. In the following years, other scientific and technical staff joined the Western Energy and Land Use Team as habitat assessment, instream flow, ecological research, and policy and planning units were established or transferred to the team.

One of the development missions of the Western Energy and Land Use Team in the late 1970s was to apply innovative methodologies and technologies to environmental issues and energy policy analysis. One outcome was the development of geographic information systems (for example, the Wetland Analytic Mapping System, the Map Overlay Statistical System, and the Systems Applications Group Information Systems). A Systems Application Group was established in 1976 to provide regional assessments and national policy decision support. Staff developed and applied geographic information systems, database management systems, simulation and decision modeling tools while participating in exercises to assess possible outcomes from legislation (for example, the Alaska Native Claims Settlement Act, the Alaska National Interest Lands Conservation Act, and unsuitability criteria for the Surface Mining Control and Reclamation Act).

Later analyses and decision support efforts involved assessment of proposed winter navigation on the Great Lakes and integration with strategic planning and budgeting processes within the U.S. Fish and Wildlife Service formally known as “Important Resource Problems” and “Regional Resource Plans.” Much of the early adoption of geographic information systems technology by resource agencies had roots in early technology transfer efforts of the Western Energy and Land Use Team.

The Cooperative Instream Flow Service Group was formed in 1976 under the sponsorship of the U.S. Fish and Wildlife Service with primary funding provided by the U.S. Environmental Protection Agency. The group initially operated as a satellite of the Western Energy and Land Use Team but in 1980 was integrated into the Western Energy and Land Use Team. The purpose of the group was to develop models, methods, and analytical tools to assist fish and wildlife managers in negotiations with the water development and management community. Major technical accomplishments by the group included the synthesis of hydraulic modeling with habitat quantification, integration of temperature and water quality models with microhabitat, development of the habitat time series concept, and the integration of all these components into a decision-support tool (the Instream Flow Incremental Methodology). One of the more innovative aspects of this interdisciplinary group was the inclusion of a political scientist with expertise in water law and instream flow policy. By 1979, instream flow issues had expanded beyond legal questions to a broader context of using technical information effectively in the decision-making process. The effects of this contextual expansion were three-fold. First, it emphasized the importance of understanding the nature of each particular decision-making environment. Second, it enforced the necessity of developing technical tools that provided reliable, understandable, and relevant information to decision-makers. Third, it revealed the need for effective training and communication skills in subjects ranging from study planning and data collection to negotiating instream flow issues using technical information generated throughout the process. As a consequence, the Instream Flow Group developed a sequence of training courses that included (1) problem identification and study planning, (2) data collection for various analytical models, (3) data preparation, (4) calibration and simulation of models, (5) preparation of information for decision-making, (6) conflict resolution and negotiation of instream flow issues. These courses were offered (at minimal or no cost) as a standard curriculum from 1982 until the early 1990s.

In the early 1990s, the Instream Flow Group was reconfigured as the Aquatic Systems Branch of the National Ecology Research Center. The new configuration split instream flow issues into three interacting units, the operations of which remain essentially intact today. The Wetlands and Riparian Ecology Group consisted of wetlands scientists, engineers, botanists, hydrologists, and geomorphologists, with a primary orientation of investigating relations between stream flows (particularly flood events) and sustainability of riparian and wetland communities. The Aquatic Systems and Technology Group (operated under several names since 1990) was primarily responsible for the development and verification of methods relating stream flow to habitat and biological functions. Major advancements have included the adaptation of spatially explicit hydraulic and habitat modeling, quantification of relations between habitat dynamics and fish populations, development of hydroecological assessment procedures and decision support systems. The Management Analysis and Science Support Group

expanded its expertise to include social psychology and economics, adding social scientists and biologists to analyze interdisciplinary policy, social values, and economics as they relate to water resources management.

## **Other Related U.S. Fish and Wildlife Service Programs**

Other noteworthy programs originated from various U.S. Fish and Wildlife Service groups in Fort Collins in the 1970s. The Division of Ecological Services began a Project Impact Evaluation Team in 1977, in response to agency needs dictated by the Fish and Wildlife Coordination Act and the National Environmental Policy Act. This group was designed as a focal point for refinement and implementation of methodologies for assessing project impacts on fish and wildlife, resulting in revision to the agency's Habitat Evaluation Procedures and development of habitat suitability models. This team included an economist and aquatic and terrestrial biologists. It was later merged with the Western Energy and Land Use Team. A simulation modeling program was also developed under the Western Energy and Land Use Team in the 1970s, and it was carried out by the Adaptive Environmental Assessment Group. Developing simulation models and running management scenarios in a workshop format involving principal natural resources stakeholders was a central aspect of this group's work, which was active from 1978 to 1985. Projects dealt with water management issues, environmental contaminants, wildlife population dynamics, and agricultural and industrial interactions with the environment (Auble and others, 1995).

## **Origins of the Modern Branches of the Fort Collins Science Center**

### **Policy Analysis and Science Assistance Branch**

The principal roots of the work of this branch extend to the 1975 creation of the Western Energy and Land Use Team in the U.S. Fish and Wildlife Service and subsequent responsibilities that were added to this group over the years. With the reorganization of the Center under the National Biological Service, in 1994 the Midcontinent Ecological Science Center created a group known as the Social, Economic, and Institutional Analysis Section. That group carried out some of the duties described above, including conflict resolution and informing policy decisions related to water resources management, and also included the work of an economist specializing on terrestrial issues. Over the period of the next two years the section added wildlife biologists with expertise in a field that had become known as the “human dimensions” of wildlife management. The section continued to include biologists and its mission evolved to examine policy-relevant questions in water and land management. An economist position was also added. When this Center was reorganized into the Fort Collins Science Center of the U.S. Geological Survey, the section was converted to the Policy Analysis and Science Assistance Branch with the addition of field biologists working on fire ecology and agricultural practices and policy, particularly as the latter relate to the federal Conservation Reserve Program.

## **Aquatic Systems and Technology Applications Branch**

This branch of the Fort Collins Science Center has roots tracing back to scientific missions that historically served three U.S. Department of the Interior agencies: the U.S. Bureau of Reclamation, the National Park Service, and U.S. Fish and Wildlife Service. Currently, some scientists in this group remain colocated with the U.S. Bureau of Reclamation at the Bureau's headquarters in Denver and carry out research and modeling directly related to operations of that Bureau's major western reservoirs and their associated wetlands and waterways. Aquatic systems modeling, fisheries studies, and hydrologic studies are extensions of missions that began under the U.S. Fish and Wildlife Service's Western Energy and Land Use Team first established in 1975, as well as functions of that agency's Ecological Services Division, Project Impact Evaluation Team. This group also performs hydrologic studies serving National Park Service needs that were originally spelled out in that agency's Water Resources Program, and information management and technology development work in service to missions of both the U.S. Fish and Wildlife Service and National Park Service. Some of the work of this branch had its early origins in the development of geographic information systems and database technology by the Western Energy and Land Use Team, systems and approaches that were adopted globally in the 1970s and early 1980s.

## **Ecosystem Dynamics Branch**

The work of the Center focused within the Ecosystems Dynamics Branch has origins within the National Park Service, the U.S. Bureau of Reclamation, and the U.S. Fish and Wildlife Service. Scientific studies involving riparian ecosystems stem from work that is an outgrowth of U.S. Bureau of Reclamation responsibilities and the U.S. Fish and Wildlife Service's instream flow-related research and modeling started under the Western Energy and Land Use Team and Ecological Services Project Impact Evaluation Team in the 1970s. National Park Service ecosystem studies include place-based research initiated by specific parks and monuments as well as global change studies that were incorporated into the Center with the creation of the National Biological Survey in 1993. The National Park Service also was the origin of the Watershed Ecosystems Program, which was transferred to forerunners of the Center in 1993, and segments of this program continue. Studies of large mammal populations and herbivore impacts on National Park Service lands were also transferred to the Center in 1993, and these missions have grown to encompass such work on topics critical to the U.S. Bureau of Land Management.

## **Invasive Species Science Branch**

The growing impact of invasive species on lands and waters of the United States is a major concern of all the U.S. Department of the Interior agencies. Current studies on the ecology of invasive species and model forecasting of biological invasions are rooted in needs of most of these agencies, including the National Park Service, the

U.S. Bureau of Reclamation, and the U.S. Fish and Wildlife Service. Research on the brown tree snake in Guam began in the U.S. Fish and Wildlife Service's National Fish and Wildlife Laboratory in 1984. This work continued under the mandates of the Non-Indigenous Aquatic Nuisance Prevention and Control Act of 1990, with the Center's science role spelled out most recently by the Brown Tree Snake Control and Eradication Act of 2004.

## **Species and Habitats of Federal Interest Branch**

Missions of this group extend to mandates that originated chiefly with the U.S. Fish and Wildlife Service. Museum studies are direct descendants of the missions of the original Bureau of Biological Survey, first initiated in 1885 and expanded to include a Western vertebrate collection in 1931. Research on species categorized as endangered or threatened falls under the mandate of the U.S. Endangered Species Act of 1973, and avian studies are conducted under the authority of the Migratory Bird Treaty Act of 1918. Many of the researchers in this group were transferred to the National Biological Survey from the U.S. Fish and Wildlife Service in 1993. At that time they carried out work of the National Ecology Research Center in two branches, the Ecology Branch and the Terrestrial Ecosystems Branch. Ecology Branch studies are represented today by wildlife studies on U.S. Fish and Wildlife Service refuges as well as National Park Service and other federal lands, ecological studies of migratory birds and mammals of special concern, and amphibian research and monitoring. The latter efforts stem from a 2000 directive to the U.S. Department of Interior from the President and Congress that has been implemented by the U.S. Geological Survey. Ongoing technological support to marine mammal studies and work on habitat modeling are legacies from the Terrestrial Ecosystems Branch, which had forerunners in the U.S. Fish and Wildlife Service's Ecological Service's Project Impact Evaluation Team and the Office of Biological Service's Western Energy and Land Use Team in the 1970s.

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## Appendix

Past scientists and key administrators headquartered through the Fort Collins Science Center at various stages in its history, 1970–2006 (excluding current employees, technical support staff, temporary employees, and student trainees). The roster includes scientists now active at other Science or Research Centers in the U.S. Geological Survey. Status and current locations are provided in parentheses.

- A. Kent Andrews* (retired; fisheries ecology)  
*Carl L. Armour* (retired; fisheries biology)  
*Duane A. Asherin* (retired; wildlife biology, geographical information systems)  
*Harold W. Avery* (desert tortoises, ecology)  
*Richard C. Banks* (retired; USGS Patuxent Wildlife Research Center; avian systematics and distribution)  
*Cathy A. Beck* (USGS Florida Integrated Science Center, Gainesville, Fla.; manatee ecology)  
*Jayne Belnap* (USGS Southwest Biological Science Center, Moab, Utah; cryptogamic soils, invasive plants, landscape ecology)  
*Kristin H. Berry* (USGS Western Ecological Research Center, Moreno Valley, Calif.; desert tortoise biology)  
*Bonnie Blanchard* (retired; grizzly bear and ungulate ecology)  
*William I. Boarman* (USGS Western Ecological Research Center, San Diego Calif.; raven ecology and behavior, desert ecosystems)  
*James L. Bodkin* (USGS Alaska Science Center; sea otters, marine ecology)  
*Michael A. Bogan* (retired; University of New Mexico Museum of Southwestern Biology; mammalogy, systematics, biogeography)  
*Robert K. Bonde* (USGS Florida Integrated Science Center, Gainesville, Fla.; manatee ecology)  
*Terrence P. Boyle* (retired; aquatic ecology, ecotoxicology)  
*Robert L. Brownell, Jr.* (National Marine Fisheries Service, Pacific Grove Calif.; marine mammals)  
*Kenneth P. Burnham* (USGS Colorado Cooperative Fish and Wildlife Research Unit, ecology and statistics)  
*R. Bruce Bury* (USGS Forest and Rangeland Ecosystem Science Center, Corvallis, Oreg.; vertebrate ecology, herpetology)  
*Geneva Chong* (USGS Northern Rocky Mountains Science Center, Jackson, Wyo.; landscape ecology, invasive species)  
*P. Stephen Corn* (USGS Northern Rocky Mountains Science Center, Missoula Mont.; vertebrate ecology, herpetology)  
*Harry N. Coulombe* (retired, USGS Patuxent Wildlife Research Center; research administration, quantitative and physiological ecology)  
*Johnie H. Crance* (retired; fisheries biology)  
*Lesley A. DeFalco* (USGS Western Ecological Research Center, Las Vegas, Nev.; desert plant ecology)  
*Elena T. Deshler* (Tucson, Ariz.; ecology)  
*Don G. Despain* (USGS Northern Rocky Mountains Science Center, Bozeman, Mont.; plant ecology, fire ecology)  
*Phil Dittburner* (Retired; plant ecology)  
*C. Kenneth Dodd* (USGS Florida Integrated Science Center, Gainesville, Fla.; vertebrate ecology, herpetology)  
*Harvey Doerksen* (retired, water resources)  
*Charles A. Drost* (USGS Southwest Biological Science Center, Flagstaff Ariz.; zoology)  
*Frank H. Dunkle* (deceased; Center Director, research administration; former Director, U.S. Fish and Wildlife Service)  
*Richard A. Ellison* (retired; adaptive environmental assessment)  
*Todd C. Esque* (USGS Western Ecological Research Center, Las Vegas, Nev.; desert ecology)  
*James A. Estes* (USGS Western Ecological Research Center, Santa Cruz, Calif.; sea otters, marine ecology)  
*Daniel B. Fagre* (USGS Northern Rocky Mountains Science Center, West Glacier, Mont.; ecosystem science, global change)  
*Robert D. Fisher* (USGS Patuxent Wildlife Research Center, Washington D.C.; museum curation)  
*Mercedes S. Foster* (USGS Patuxent Wildlife Research Center, avian studies)

*Mary C. Freeman* (USGS Patuxent Wildlife Research Center, Athens, Ga.; warm water stream and fish ecology)

*Thomas H. Fritts* (retired; vertebrate ecology, herpetology)

*Alfred L. Gardner* (USGS Patuxent Wildlife Research Center, Washington D.C.; mammalian biology, systematics)

*Charles D. Gish* (retired; wildlife and contaminant ecology; computer operations)

*Douglas N. Gladwin* (deceased; wildlife habitat ecology)

*Peter J. P. Gogan* (USGS Northern Rocky Mountains Science Center, Bozeman, Mont.; ungulate ecology)

*Tim B. Graham* (USGS Southwest Biological Science Center, Moab, Utah; community ecology)

*Jack Gross* (retired; wildlife population and systems modeling)

*D. Caldwell Hahn* (USGS Patuxent Wildlife Research Center; avian ecology)

*Wayne Hamilton* (retired; geology)

*Mark Haroldson* (USGS Northern Rocky Mountains Science Center, Bozeman, Mont.; bear ecology)

*Brian B. Hatfield* (USGS Western Ecological Research Center, San Simeon, Calif.; marine mammal ecology)

*Raymond Herrmann* (retired; watershed ecosystem studies)

*Lee S. Ischinger* (retired; water quality, wetland and riparian ecology)

*Ronald J. Jameson* (retired; marine mammal ecology)

*Clyde Jones* (retired, Texas Tech University; former Director, National Fish and Wildlife Laboratory (1969-1980) and Denver Wildlife Research Center (1980-82), mammalian biology, systematics, ecology)

*Richard B. Keigley* (USGS Northern Rocky Mountains Science Center, Bozeman, Mont.; range ecology)

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*Kimberly A. Keating* (USGS Northern Rocky Mountains Science Center, Bozeman, Mont.; large mammal ecology, modeling)

*Carl H. Key* (USGS Northern Rocky Mountains Science Center, Bozeman, Mont.; landscape ecology)

*Bill King* (retired; economist)

*Richard R. Knight* (retired; grizzly bear and ungulate ecology)

*Fritz L. Knopf* (retired; avian ecology, prairie ecosystems, conservation)

*Howard I. Kochman* (USGS Florida Integrated Science Center, Gainesville, Fla.; manatee ecology)

*Catherine A. Langtimm* (USGS, Gainesville, Fla.; vertebrate ecology)

*Murray Laubhan* (USGS Northern Prairie Wildlife Research Center, Jamestown N. Dak.; wetland ecology)

*Lynne W. Lefebvre* (USGS, Gainesville, Fla, marine mammals)

*Davine M. Lieberman* (U.S. Bureau of Reclamation; reservoir ecology)

*Jeffrey E. Lovich* (USGS Southwest Biological Science Center, Flagstaff Ariz.; herpetology, ecology, research management)

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*Leo F. Marnell* (retired; fisheries biology)

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*Henry E. McCutchen* (retired; large mammal ecology, habitat management)

*Roy W. McDiarmid* (USGS Patuxent Wildlife Research Center, herpetology)

*Terry McGowan* (deceased, Team Leader, Western Energy and Land Use Team)

*Thomas E. McMahon* (Montana State University, Professor; fishery biology)

*Mary Meagher* (retired; large mammal ecology)

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*Philip A. Medica* (USGS Western Ecological Research Center, Las Vegas, Nev.; desert tortoise and desert ecology)

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*John Morrison* (retired; wildlife ecology)

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*Edward M. Olexa* (USGS Northern Rocky Mountains Science Center, Bozeman, Mont.; ungulate ecology)

*Rod Olson* (retired; economics)

*Denny Parker* (retired; remote sensing)

*Ed Pash* (retired; Geothermal Energy Research Manager, Western Energy and Land Use Team)

*Douglas R. Posson* (retired; Center Director)

*Raleigh, Bob* (retired; fishery biology)  
*Galen B. Rathbun* (retired, marine mammals, vertebrate ecology)  
*James P. Reid* (USGS Florida Integrated Science Center, Gainesville, Fla.; manatee ecology)  
*Robert P. Reynolds* (USGS Patuxent Wildlife Research Center; herpetology, research administration)  
*Allen R. Ribeiro* (U.S. Forest Service, Washington, D.C.; ecosystem studies)  
*Peter Rowlands* (NPS, Organ Pipe Cactus National Monument; plant ecology)  
*James J. Sartoris* (retired, civil engineering, wetlands management)  
*Norman J. Scott, Jr.* (retired; vertebrate ecology, herpetology)  
*Melvin L. Schamberger* (deceased, wildlife ecology)  
*Charles C. Schwartz* (USGS Northern Rocky Mountains Science Center, Bozeman, Mont.; bear and ungulate ecology)  
*Michael Sestak* (air quality research)  
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*Barbara Wagner* (information transfer)  
*Yvonne B. Weber* (retired; wildlife biology)  
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