Alaska

Since the 1890's, the U.S. Geological Survey (USGS) has been mapping, collecting, and interpreting earth-science data in Alaska. This long-term endeavor continues today. The USGS in Alaska (http://www-ak.wr.usgs.gov/), provides information about the State's natural hazards, landscape, natural resources, fish, wildlife, and environment.

Hazards

Volcanoes

One of the most vital roles of the USGS is to define and mitigate the risk of volcanic eruptions. Alaska has more than 40 active volcanoes that collectively have averaged two significant eruptions every year since 1945. Most of Alaska's volcanoes lie along a 1,600-mile arc from the Aleutian Islands, through the Alaskan Peninsula, and into south-central Alaska (fig. 1). Damage from these volcanoes has amounted to more than $400 million in the last decade. Volcanic ash is a severe threat to jet aircraft that fly over the North Pacific Ocean. On an average of 4 days each year, explosive eruptions send potentially lethal clouds of ash directly into international air traffic routes over and near Alaska. Anchorage International Airport is the busiest air cargo hub in the United States. Rapid detection and notification of eruptions beneath Alaskan air routes are increasingly critical.

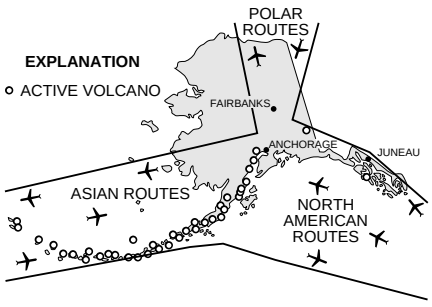

Figure 1. International air traffic corridors and active volcanoes in Alaska.

The Alaska Volcano Observatory (AVO) (http://www.avo.alaska.edu/), is cooperatively operated by the USGS, the University of Alaska Geophysical Institute, and the Alaska Division of Geological and Geophysical Surveys. The AVO monitors volcanoes in real time (fig. 2), issues timely eruption notifications, and assesses and communicates volcanic-hazards information that might assist in mitigating risks.

Earthquakes

Alaska is the most earthquake-prone state in the Nation and one of the most seismically active regions in the world. At least one magnitude-7 or greater earthquake occurs in Alaska every year; a magnitude-8 or greater earthquake occurs about every 14 years. All critical transportation, communication, and oil transfer facilities in Alaska are in regions of high earthquake risk. The USGS, in cooperation with the University of Alaska and other Federal agencies, records earthquake activity in the State and helps to define the seismic hazards. In addition, the USGS is a partner in the Alaska Earthquake Information Center in Fairbanks (http://www-ak.wr.usgs.gov/aeic.html) which performs round-the-clock earthquake recording and analysis, and disseminates information on the State's earthquakes to the public, media, and government agencies.

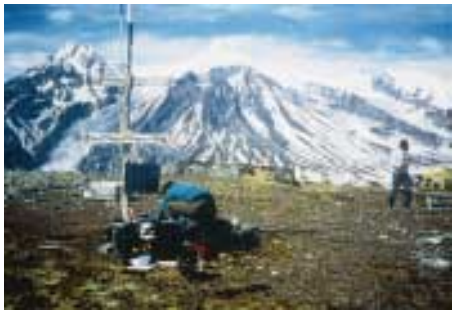

Figure 2. USGS volcano seismologists servicing a seismic station south of Crater Peak, Mt. Spurr volcano.

Floods

Many of Alaska's communities and transportation facilities are located along large rivers and are subject to flooding caused by rainfall, seasonal meltwater, and ice dams. USGS hydrologists (fig. 3) survey flooded areas by collecting and assessing information about water levels, discharge, and damage so that flood frequencies and magnitudes along rivers and streams throughout the State can be predicted. This information (http://ak.water.usgs.gov/Data/swdata.htm) is used by many agencies for flood warning, flood-plain management, and risk assessment.

Unstable channel bottoms and riverbanks, high sediment loads in streams, and streamflow diversion by icing frequently contribute to high maintenance costs for highways, bridges, and culverts throughout the

State. The USGS also is surveying selected bridge sites and is collecting hydraulic data for analysis of bridge-scour processes. This information is used to assess bridges that may be at risk of failure during floods.

Figure 3. USGS hydrologist servicing stream-gaging equipment.

Global Climate Change

As climate changes, the effects are most rapid and most extreme in high-latitude areas, which makes Alaska a premier natural laboratory for the study of climate change in the United States. The USGS brings together numerous areas of research to focus on both present climate change and past changes deduced from the fossil record. Working with eight other nations, the USGS is applying state-of-the art remote sensing and geographic information systems technologies to map the vegetation of the entire Arctic region. When it is completed, the project will provide a comprehensive and consistent map of vegetation with which changes can be compared.

Understanding past climate change is key to understanding climate changes today. The USGS is reconstructing climate and vegetation records for the past 15,000 years. Detailed records of such changes are preserved in deposits of lake sediments and peat in many areas of Alaska. Sediment records show that during the 20th century, forests have expanded northward, westward, and into higher elevations in response to warmer temperatures.

The USGS uses geodetic, photogrammetric, and satellite observations to monitor the size and movement of Alaska's glaciers, which cover about five percent of the State. Analyses of historical responses of glaciers to recorded weather patterns aid in our understanding of the complex responses of glaciers to climate change. For more information, follow the links for "Glaciers and Climate" at http://ak.water.usgs.gov/.

To make data on changing Arctic systems available to researchers and interested parties, the USGS maintains the Arctic Environmental Data Directory (http://www-ak.wr.usgs.gov/aedd/), which contains descriptions of data on global change studies, environmental interactions, and earth sciences.

Biological Resources

The Alaska Biological Science Center (http://www.absc.usgs.gov/) and the Alaska Cooperative Fish and Wildlife Research Unit conduct research on wildlife and their vast habitats in Alaska. USGS scientists provide biological information and research findings to resource managers, policymakers, and the public to support sound management of biological resources and ecosystems in Alaska. Some of the major studies are described as below.

Wolves

Management of wolves and their prey is a major national environmental issue. In Denali National Park, USGS scientists are studying the population dynamics of wolves and their major prey species—caribou and moose.

Brown bears

Katmai National Park is a spectacular subarctic wilderness that supports the highest density of brown bears in the world (fig. 4). USGS scientists and collaborators have teamed up to study the use patterns of people and bears at selected high-use areas. The results

Figure 4. Brown bear at Katmai National Park, site of highest density of brown bears in the world

will help National Park Service managers meet their dual mandate of preserving nature while helping the public enjoy those resources.

Dusky Canada geese

USGS scientists are studying the largest known concentration of breeding dusky Canada geese on the Copper River Delta in Alaska. The population has decreased significantly during the past 20 years as a result of habitat changes caused by earthquake uplift. USGS research will aid managers in conserving these geese.

Eiders

USGS and U.S. Fish and Wildlife Service scientists are investigating the population dynamics and ecology of Steller's and spectacled eiders (northern sea ducks) in Alaska (fig. 5). In recent years, the nesting population of these species has decreased 50 to 97 percent. One

Figure 5. Spectacled eiders (northern sea ducks).

significant discovery is that lead poisoning from spent shotgun pellets in tundra wetlands limits recovery of the eider population. The information gathered during this research will be used to develop recovery plans for these two species under the Endangered Species Act.

Black brant

The USGS Alaska Cooperative Fish and Wildlife Unit investigated the influence of oilfield development on black brant (small geese) on the North Slope of Alaska. The study indicates that oilfield development has had few negative effects on black brant, except for reduced nesting success. The most likely hypothesis for the reduced nesting success is that human sources of food attract and maintain high predator densities in the oilfields.

Oil spill

USGS scientists and collaborators are integrating studies of population demographics, biomarkers, and prey populations to determine the state of recovery of the near-shore ecosystem in Prince William Sound (fig. 6) after the 1989 Exxon Valdez oil spill. Scientists are trying to determine if critical near-shore resources are recovering from the oil spill.

Energy and Mineral Resources

Scientists of the USGS Energy Program recently completed a new quantitative assessment of the oil and gas potential of the Arctic National Wildlife Refuge (ANWR) 1002 Area. This economic analysis estimated in-place, technically recoverable, and economically recoverable oil and gas resources. A summary of that assessment is available at http://energy.usgs.gov/factsheets/ANWR/ANWR.html.

USGS activities also include petroleum geologic studies in the National Petroleum Reserve–Alaska (NPRA), an area of current industry exploration interest; evaluation of the resource potential of frozen natural gases (hydrates) in northern Alaska; evaluation of coalbed methane as a local energy source for some Native villages; and Cook Inlet petroleum reservoir and coal studies. These activities are in cooperation with State agencies.

Scientists of the USGS Mineral Resources Program, (http://www-mrs-ak.wr.usgs.gov:80/wrmrsAK/) in cooperation with State and Federal agencies (Bureau of Land Management, U.S. Forest Service), are investigating mineral potential in the Wrangell area of southeast Alaska and in the Sleetmute area in southwest Alaska. USGS scientists are evaluating the effects of naturally occurring minerals (such as mercury and arsenic) and mining activities on

Figure 6. Sea otter in oil-spill affected Prince William Sound.

the environment in southwest and east-central Alaska. Scientists (fig. 7) are establishing the baseline and background geologic, geochemical, and biogeochemical framework for the lower Fortymile River area in east-central Alaska.

Historical datasets critical to understanding the mineral and energy resources of the State are being transferred to more accessible digital formats. One focus is the data generated during two government oil and gas exploration programs in the NPRA from the 1940's to the 1980's.

Figure 7. USGS geologists sampling minerals in Alaska.

The USGS is working with Federal, State, and local agencies to update bibliographic, mineral occurrence, geochemical, and geologic databases and to make them accessible on the internet. Parts of these databases are already accessible at http://imcg.wr.usgs.gov/.

Water Resources

In 1997, the USGS began a 10-year study of the Cook Inlet Basin as part of the National Water-Quality Assessment (NAWQA) Program. Water-quality issues in the Cook Inlet Basin are related primarily to salmon spawning and to documenting the conditions in relatively undeveloped environments (fig. 8). Streams draining into Cook Inlet produce world-renowned salmon runs. The

Figure 8. USGS hydrologists collecting fish for tissue sampling for the NAWQA program .

Cook Inlet Basin NAWQA activities (http://ak.water.usgs.gov/Projects/nawqa.htm) will focus on describing water quality in areas of residential development, intense recreational use, and timber harvesting. Cook Inlet has abundant natural resources, and the development of these resources could adversely affect water quality and, possibly, salmon populations. In addition, an opportunity exists to characterize water quality in undeveloped areas of the Cook Inlet Basin. The availability of predevelopment data would offer resource managers a basis for evaluating any future water-quality changes.

In 1999, USGS hydrologists are collecting water discharge measurements at 80 streamflow-gaging stations, peak-flow data at 45 crest-stage stations, and water levels at more than 30 observation wells. The surface-water database includes data from more than 2,600 sites (http://ak.water.usgs.gov/Data/wtrindex.htm).

Mapping

The USGS has undertaken a program to complete a digitally based mapping program at 1:63,360 scale for the entire State of Alaska. This program will provide comprehensive statewide coverage for hydrography (lakes, rivers, shorelines) and terrain (digital elevation models), as well as a computer-scanned image of each USGS paper map product that exists for the State. Transportation (roads, pipelines, railroads), and aerial photography (digital orthophoto quads) also will be available as digital files for most map quadrangles.

The Alaska mapping and resource management community is heavily invested in computer-based mapping and geographic information systems (GIS) technology. In direct support of computer mapping and GIS technology, the USGS operates a geo-processing computer laboratory in Anchorage, the only one of its kind in the Nation. This facility provides government agencies with access to data from Earth-orbiting satellites, digital image processing systems, and GIS software to address a broad range of natural resource issues.

The Alaska Geographic Data Committee (AGDC) is a consortium of Federal, State, local government, university, and private agencies that has been working together since 1993 to build geographic information partnerships (http://agdc.usgs.gov/). Its purpose is to provide a forum for the coordination of spatial-data development projects, to foster the development of coordinated methods for implementing standards and policies, and to review and respond to Federal initiatives that affect Alaska. Through the concerted efforts of its joint membership, the AGDC has brought several nationally funded mapping programs to Alaska, resulting in the development of comprehensive statewide baseline digital databases.

The USGS Earth Science Information Center in Anchorage and a State-affiliate office at the Geophysical Institute in Fairbanks provide information on topics such as cartography, geography, biology, digital data, remote sensing, geology, geophysics, geochemistry, hydrology, geohydrology, aerial photography (fig. 9), and land use. These offices provide reference materials, technical assistance, training and outreach activities, and access to USGS data bases.

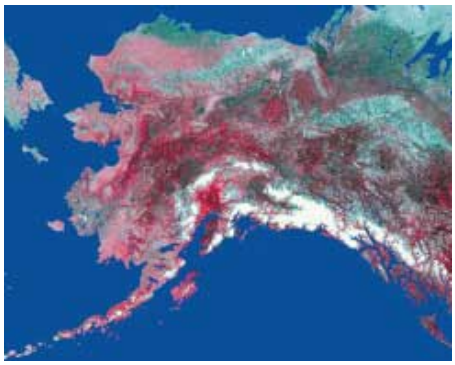

Figure 9. An Advanced Very High Resolution Radiometer satellite image of Alaska.

USGS office locations

The USGS has 251 employees in Alaska

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