UNITED STATES SATELLITE VIEW

Prepared by U. S. Geological Survey

Mosaic of sixteen Advanced Very High Resolution Radiometer (AVHRR) images taken May 24, 1984–May 14, 1986 by the National Oceanic and Atmospheric Administration (NOAA)

Albers Equal Area Projection
SCALE 1:7,500,000

The mosaic of the conterminous United States was prepared using 16 images from the Advanced Very High Resolution Radiometer (AVHRR) sensors on the meteorological satellites NOAA–8 and NOAA–9. The images were acquired between May 24, 1984 and May 14, 1986. Standard image processing techniques were used to enhance the detail and the data were resampled to a resolution of 1500 meters (1.5 km) per picture element (pixel). The images were digitally processed to eliminate the individual pixels on the final product.

The satellites launched by the National Oceanic and Atmospheric Administration (NOAA) in Sun-synchronous polar orbits have an orbital period of approximately 102 minutes. The orbital height is 805 km with a swath width of 3000 km at the nadir. The orbital tracks repeat every 8 days, thereby providing more frequent coverage than the Landsat series of satellites.

Two channels of data were used in the mosaic. Channel 1 (0.58–0.68 μm) was used for the blue and green bands, printed in yellow and magenta respectively, and Channel 2 (0.72–1.1 μm) was used for the red band, printed in cyan. Channel 1 is in the red portion of the visible spectrum, which is sensitive to daytime clouds and vegetation. Channel 2 is in the reflected infrared (near-infrared) part of the spectrum and is used for shoreline and vegetation discrimination. This channel is similar to band 7 of the Landsat Multispectral Scanner (MSS).

On false-color infrared mosaics, vegetation appears in various tones of red instead of green. The "redness" indicates vegetation density and type and whether growing on dry land or in a swamp (a mixture of reddish vegetation and dark blue surface water produces dark tones). Grasslands appear light red, deciduous trees and croplands appear red, and coniferous forests appear dark red or maroon. Desert areas appear white and urban areas (pavement and buildings) appear bluish green. Lakes, rivers, and oceans appear in various shades of blue, dark blue for deep water and light blue for shallow or turbid water. Exposed bedrock generally appears as a dark bluish-green or other dark tone.

Further information on the image enhancement techniques and the identification of the specific images used in the mosaic may be obtained from the U. S. Geological Survey, EROS Data Center, Customer Services, Sioux Falls, SD 57198.

NATIONAL ATLAS OF THE UNITED STATES OF AMERICA
DEPARTMENT OF THE INTERIOR, U. S. GEOLOGICAL SURVEY
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NATIONAL ATLAS

U. S. SATELLITE VIEW

1 MOUNT SAINT HELENS AND THE CASCADE RANGE, WASHINGTON

The Cascade Range, whose prominent peaks include Mount Rainier (4392 m), Mount Adams (3742 m), and Mount St. Helens (2550 m), was formed by volcanism caused by the Pacific crustal plate sliding under the North American plate. During the past 13 million years there have been three major periods of volcanic activity, the most recent of which continues into the present. On May 18, 1980, Mount St. Helens erupted explosively causing widespread damage to the surrounding area. The eruption began with a moderate earthquake that triggered a massive landslide, followed by great explosions that sent clouds of steam, ash, and rocks into the air. Trees were flattened up to 19 km away. Mudflows blocked rivers and surged through valleys. Ash falls 1–7 cm thick blanketed parts of central and eastern Washington and Idaho. Although the northern slopes of Mount St. Helens appear to be devoid of vegetation in this mosaic (bluish tone), a renewed plant succession is occurring. Vegetation appears as reddish tones and snowpack and glaciers in the higher elevations of the Cascade Range appear as white areas.

2 CRATERS OF THE MOON, IDAHO

The area including Craters of the Moon National Monument contains some of the youngest basalt flows in the Pacific Northwest. It is located on the north end of the Great Rift, a 1.5 km-wide belt of eruptive fissures, cinder cones, and lava flows that are characteristic of the Snake River Plain. The most recent volcanism (2,000 to 15,000 years ago) produced cinder cones and lava flows that are iridescent blue in rock samples but appear dark in the mosaic; the older, weathered flows appear lighter blue. The basalt flows have very sparse vegetation, and streams disappear rapidly into cracks and numerous caves within the porous lava fields. Except for irrigated fields, the area is relatively dry, with limited vegetation (pink tones). Higher elevations support trees (dark red tone) because of more rainfall. Snowpack at the mountain crests appears white.

3 THE BLACK HILLS AND THE BADLANDS, SOUTH DAKOTA

The Black Hills lie between the Belle Fourche and Cheyenne Rivers and rise over 600 m above the surrounding plains. The highest point is Harney Peak (2207 m). The Black Hills consist of a series of ridges and valleys, apparently related to faulting deep in the Earth, that surround a central dome. Pine-covered crystalline rocks and resistant ridges appear as dark red areas in the mosaic. One of the world's largest active gold mines is located in the northern Black Hills at Lead, South Dakota.

The light area slightly southeast of the Black Hills is the Badlands, an area about 193 km long and 50–80 km wide. "Badlands" has become the generic term for this type of topography: an arid plateau of ridges and mesas cut by erosion, with sparse vegetation. Badlands National Park was created to preserve the landscape, wildlife, and many prehistoric fossils found in the area.

4 MINNESOTA RIVER AND MORAINE AREA, MINNESOTA

The Minnesota River begins at Big Stone Lake on the Minnesota-South Dakota border and eventually drains into the Mississippi River south of St. Paul. The river follows the valley of prehistoric River Warren, which was the southern outlet of Lake Agassiz during the Pleistocene Epoch (Ice Age). Many recessional moraines (deposits of sand, gravel, and pulverized rocks dropped by retreating glaciers) are evidence of glacial activity in the area. The topography varies from nearly level to gently rolling plains covered by soils developed on glacially-deposited materials and wind-blown silt (loess). The loess provides fertile soils that, in combination with a favorable climate, create one of the best grain-producing areas of the world. Soybeans, corn, alfalfa, and oats are the dominant crops. The reddish-brown strips in the mosaic running through the farmlands (dark, mottled areas) are bands of deciduous trees along the Minnesota River and its tributaries.

5 CHICAGO, ILLINOIS

Chicago is a major transportation hub and an important port for Great Lakes shipping. Today, Chicago is the center of a large industrial and agricultural area with iron and steel mills, stockyards, and meat-packing plants. The original settlement developed where the Chicago River empties into Lake Michigan. Its proximity to the Des Plaines River provided easy portage for people traveling west to the Central Plains. The urban area appears blue because of the high proportion of paved streets and building roofs. The surrounding agricultural area appears red because of growing vegetation.

6 FINGER LAKES REGION, NEW YORK

The Finger Lakes region contains a series of elongate lakes formed where water is impounded by terminal moraines deposited by the retreating Laurentide ice sheet during the Pleistocene Epoch (Ice Age). The long, narrow blue-black lakes fill north-south trending valleys which were formed by the erosional action of ice streams within the ice sheet. The glacial deposits support an agricultural economy that produces vegetables, grapes, wine, apples, and wheat. The topography and numerous lakes have made the region a favorite resort and recreation area.

7 ADIRONDACK MOUNTAINS, NEW YORK

The Adirondack Mountains are a nearly circular region of uplifted Precambrian rocks characterized by gently rolling upland in the northwest and rugged mountain masses in the southeast. Mount Marcy is the highest peak at 1629 m. The area is covered with hardwood forests (dark red tone) interspersed with isolated farms. Adirondack Park, covering about two-thirds of upstate New York, is the Nation's largest State preserve. Important products from the area include lumber and pulpwood, in addition to maple syrup and Christmas trees. During World War II, the area was mined for iron, tin, zinc, and titanium. Lake Champlain (dark blue), on the New York-Vermont border, formed along a fault system on the eastern edge of the region. Both Lake Champlain and the Saint Lawrence River to the north are used extensively for transportation and recreation. Light pink tones represent agricultural areas that surround the Adirondack Mountains.

8 NORTHEASTERN CONIFEROUS FORESTS, MAINE

Northern hardwoods such as maple, birch, and beech mixed with softwoods such as spruce and fir cover 80–90 percent of the area outlined. The forests provide lumber and pulpwood for the building and paper industries and are also used extensively for hunting and recreation. Most areas of forested land in Maine are owned by large paper-product companies. Some farming is done on a part-time basis, but many farms are used only as rural residences. Abundant rainfall, perennial streams, many natural lakes such as Moosehead Lake (dark blue), and ponds supply water. The coniferous forests appear dark brown in the mosaic because the trees have small leaves (needles) which reflect less near-infrared radiation than do the broad leaves of deciduous trees. The area also includes the granite monadnock, Mount Katahdin, the highest peak in Maine (1606 m).

9 RIDGE AND VALLEY PROVINCE, PENNSYLVANIA

The Appalachian Mountains (Ridge and Valley Province) are a classic example of folded and faulted mountains. In several places rivers, such as the Susquehanna in the center of the outlined area, cut across the ridge-forming strata, creating wind and water gaps. The forested ridges appear darker red than the valley floors that support agriculture. The ridges are composed of resistant sandstones and conglomerates that rise 60–150 m above broad lowlands, which are underlain by weaker shales and limestones. The pressure and heat associated with the folding of the rocks compressed the shales into slates of commercial value and created deposits of anthracite and bituminous coal throughout Pennsylvania, Virginia, West Virginia, and Kentucky. Folding and faulting of the rock strata also created favorable structures for the accumulation of oil and/or natural gas in the western parts of Pennsylvania, West Virginia, and Virginia, and in Ohio and Kentucky.

10 EASTERN DECIDUOUS FORESTS, WEST VIRGINIA

Most of the area is covered by forests of mixed hardwoods and pine. Farming in the area is primarily crops that support beef and dairy cattle production. Large areas have been strip mined for bituminous coal. The topography consists of long steep-sided slopes between narrow ridges and narrow stream valleys and flood plains.

The deciduous forests appear red in the mosaic because during the growing season the chlorophyll in the broad-leafed trees is highly reflective in the near-infrared part of the spectrum. Foresters use variations in the red color to distinguish between different species and between healthy and diseased stands of trees.

11 OUTER BANKS AND DISMAL SWAMP, NORTH CAROLINA AND VIRGINIA

The Outer Banks of North Carolina are part of a series of sand bars and spits and barrier islands extending from New York to Florida. On these sandy coasts, waves, storms, and variations in sea level continuously alter the shoreline through erosion and deposition of sediments. In North Carolina the barrier island system fronts a large shallow sound (Pamlico Sound); offshore are complex, ever-changing submerged sand bars and dangerous cross currents. The North Carolina barrier island system is built partly on and partly against an older system deposited during a period of higher sea levels associated with the last interglacial interval during the Pleistocene Epoch.

The Dismal Swamp (bright red) with Lake Drummond (black) in the center is a tree covered swampland consisting of peat bogs, vines and briar thickets, pines and hardwoods, cedars and cypress. Lake Drummond is used to supplement the water level of the canals in the Swamp. The canal locks provide stability to the Swamp's water level, thus preventing the complete drying out of the Swamp resulting in habitat loss and encroachment of undesirable vegetation species.

12 FALL LINE/SAVANNAH RIVER PLANT, SOUTH CAROLINA AND GEORGIA

The Fall Line marks the inland limit of the Coastal Plain that begins at the eastern end of Long Island, widens rapidly to the south, and extends along the entire Atlantic and Gulf coasts. Inland of the Fall Line lies a plateau of resistant crystalline rocks. The rapid descent of rivers from the plateau to the softer sediments of the Coastal Plain results in waterfalls, which mark the head of navigation on the rivers. As a barrier to waterborne commerce and as a source of power, the Fall Line was a determining factor in the location of many cities such as Augusta, Georgia, and Columbia, South Carolina, which appear light blue in the mosaic.

The roughly circular area of dark tones in the mosaic delineates the densely wooded Savannah River Plant, a nuclear research and development facility. Lying on the South Carolina-Georgia border, it is surrounded by farmland (lighter tones).

13 LAKE PLAINS AND BARRIER SYSTEMS, FLORIDA

The Lake Plains are a sandy area in central Florida characterized by frequent collapse of surface materials into sinkholes in the underlying limestone, resulting in a pockmarked appearance from the numerous circular lakes (dark blue) that fill in the sinkholes. Phosphate mines, light colored in the mosaic, are a prominent feature in this area. This area is also the major citrus-producing region of Florida, as well as a thriving tourist center. Vegetation appears as red tones.

Fossil shorelines visible to the east are composed of detrital sand ridges or weakly cemented sand and limestone ridges that are resistant to erosion. The oldest fossil shorelines may date from 3 to 3 million years ago. In the past 5,000 to 6,000 years, the rise in sea level has allowed new barrier island systems to be developed on top of the old shorelines. Merritt Island and Cape Canaveral (site of the Kennedy Space Center) are well-known examples of these ancient shorelines and modern barrier island systems.

14 EVERGLADES AND FLORIDA KEYS, FLORIDA

The Everglades is a swampy, subtropical area of sawgrass, savannahs, and hammocks (island-like clusters of trees in the water). The area (dark blue and red on the mosaic) extends approximately 160 by 80–120 km from the Big Cypress Swamp on the west, to the light-colored, developed coastal strip on the east, and to the swamps of Florida Bay and the Gulf of Mexico on the south. The area is situated on a gently sloping limestone plateau. Canals and ditches drain over 4 million acres of land around the Everglades. Overdrainage of the area has left dry, flammable muck and peat at the surface, resulting in periodic extensive fires. The southern part, included in Everglades National Park, has sawgrass and water prairies, fringing mangrove forests, sandy beaches, and unique flora and fauna.

The Florida Keys are thin coral fringes and islands (white tones) built on eroded limestone formations that were deposited during the last interglacial period of the Pleistocene Epoch. The submerged coral reefs appear light blue in the shallow water. Today the Keys are popular for commercial fishing and vacationing.

15 MISSISSIPPI RIVER DELTA, LOUISIANA

The Mississippi River drains most of the interior of the country between the Appalachian Mountains and the Rocky Mountains. The delta at the mouth of the river is formed by the deposition of river-borne sediment. The fingers of land spreading out into the Gulf of Mexico give the name "bird's foot" to this type of delta. Wave action, surface subsidence, a rising sea level, and manmade alterations to the land have caused salt water intrusion leading to a significant and continuing loss of productive agricultural land on the Delta. The erosion and subsidence of older deltas have left an offshore barrier island chain still visible today, especially the arc-shaped Chandeleur Islands to the east.

South of Lake Pontchartrain (dark blue) is New Orleans, Louisiana (white in the mosaic), a major U.S. port situated 160 km upstream from the mouth of the river. Offshore, in the Gulf of Mexico, is an area of active oil exploration and drilling. Vegetation appears in various tones of red or nearly black, depending on its type and concentration and on the amount of surface water.

16 MISSISSIPPI VALLEY MISSISSIPPI-ARKANSAS

In this area, the Mississippi River (dark blue) wanders in a broad flood plain that is 65–115 km wide. Cutoffs and oxbow lakes are created as the river changes course. During the normal spring runoff, the river deposits large amounts of sediment in the flood plain, providing fertile soil for farming and cattle raising. In many areas elevated levees along the banks allow the flood waters to rise above the surrounding countryside. In times of high water, there is great danger of the levees being breached, causing extensive flooding of adjacent fields and homes. The density of vegetation is related to the intensity of the red tone; fallow fields or areas of low vegetation density appear nearly white.

17 OZARK PLATEAU, ARKANSAS-MISSOURI

The Ozark Plateau is an area of limestone ridges and remnant plateaus. The limestone was deposited 440–625 million years ago. Many of the ridges have steep sides, and the narrow valleys have steep gradients. Forested lands (deep red tones in the mosaic) are used for recreation and timber production. Mixed-use areas (light red) for growing corn, feed grains and hay for livestock, orchards, vineyards, and truck gardens are an important part of the agricultural economy. Tobacco is a major cash crop. Small farms are characteristic of much of the area; larger dairy and livestock farms are found in areas with deep fertile soil. Most farms have shallow wells or small ponds for domestic and livestock use. Several large reservoirs (blue) have been created for flood control and recreational use by damming rivers along the Missouri-Arkansas border.

18 WICHITA, KANSAS

Wichita, Kansas, was established at the mouth of the Little Arkansas River as a trading post on the Chisholm Trail in 1864. The city developed because of the Texas cattle trade along the Chisholm Trail and the spread of agriculture that followed the construction of the railroad. With the advent of the railroad in 1872, Wichita became a major cattle shipping center. As farmers fenced in the open range, grain became the more important commodity. Today, Wichita is still a center for grain processing and storage and livestock marketing, as well as for oil refining and aircraft construction. The city appears blue in the mosaic in sharp contrast to the red of the vegetation of the surrounding farmland. Scattered reservoirs appear either black or blue depending on depth and sediment content.

19 DENVER AND THE FRONT RANGE, COLORADO

Denver, appearing as a light blue area surrounded by grasslands (light red tone) at the east edge of the example, is situated in the broad valley of the South Platte River. The snowcapped Front Range to the west of Denver was created by vertical uplift caused by the intrusion of granites into the metamorphic rocks of this part of the Rocky Mountains. Rich gold-bearing veins were discovered at Central City and Idaho Springs west of Denver in 1859. During the 1870's and 1880's, mining was a major activity in the area. By the 1890's, Denver had become a center of an important agricultural and livestock region. Today, grazing is the most important land use, with some lumbering in the mountains. Winter sports are popular in the mountains west of Denver, whose crests are snow-covered (white). The coniferous forests of the uplands appear very dark red in the mosaic.

20 THE GREAT SALT LAKE AND SALT FLATS, UTAH

The Great Salt Lake (dark blue) is a remnant of Lake Bonneville, which covered much of western Utah and parts of Idaho and Nevada during the Pleistocene Epoch. During the warmer and drier period after the last Ice Age, Lake Bonneville receded leaving the Great Salt Lake. Runoff from rivers in the area and precipitation are the water sources for the lake. Water loss is from natural evaporation and pumping into evaporation ponds for salt recovery. Varying amounts of runoff, precipitation, and evaporation cause the lake level to fluctuate. Historic high water levels occurred in June 1873 and again in June 1986 and March and April 1987. The difference in image tone of the lake is due to a railroad causeway that crosses the lake and restricts water flow, causing the level in the south part to be over .5 m higher than in the north.

Early settlers used the Great Salt Lake for recreation and its islands for grazing. The Bonneville Salt Flats to the west (whitish tones) are the site of the Bonneville land speed-record course. Vegetation is sparse (light red), except for forested uplands (dark red).

21 GRAND CANYON AND THE COCONINO PLATEAU, ARIZONA

The Grand Canyon is a gorge 350 km long, 6–27 km wide, and 1.6 km deep. The Colorado River has cut through younger sedimentary rocks of the Coconino Plateau down to Precambrian metamorphic rocks over 570 million years old). The rim of the canyon is composed of limestone that was deposited 220–270 million years ago. The river falls more than 700 m vertically at the western end, mostly through a series of rapids. The constricted water flow and adjacent deeper pools downstream produce erosion and deposition effects enjoyed by river rafters.

The Coconino Plateau is characterized by laccolithic mountains and volcanic fields. The mountains are caused by intruding magma (molten rock) bulging overlying rock layers. In some areas, subsequent erosion has stripped away the overlying sedimentary layers, leaving buttes, dikes, and other associated volcanic remnants exposed. The San Francisco volcanic field near Flagstaff, Arizona, at the southeastern edge of the example, has cinder cones and flows ranging from under 1000 years to over 1 million years old. Coniferous forestlands in the higher elevations, where more precipitation falls, are dark red.

22 BASIN AND RANGE PROVINCE, NEVADA

The Basin and Range Province is a distinctive region of high, north-south trending mountain ranges interspersed with dry, alluvium-filled, flat-floored valleys. In the mosaic, the forest-covered mountains (dark red) resemble caterpillars lying between the light-colored valleys that have sparse shrub and grass cover. Lying in the rain-shadow of the Sierra Nevada to the west, the region receives only 7–30 cm of rain annually. Most of the region's drainage is internal with short streams that end in salt flats or dry lake beds (playas). During the Pleistocene Epoch, large pluvial lakes filled many of the basins. Subsequent tectonic (mountain building) activity has accentuated the elevation extremes, resulting in elevation differences of 2000 m between adjacent valleys and ranges.

23 SAN ANDREAS, GARLOCK, AND BIG PINE FAULTS, CALIFORNIA

The San Andreas fault system lies along the boundary of the Pacific plate and the North American plate. The fault can be traced for about 1400 km, stretching from the Gulf of California in the south to Cape Mendocino, north of San Francisco. Numerous side faults intersect the San Andreas system. The outlined area shows the intersection of the San Andreas (northwest trending) and the Garlock/Big Pine (northeast trending) faults. The offset between the Garlock (on the east) and the Big Pine (on the west) faults is about 8 km. The San Andreas fault is older and more active than the Garlock or Big Pine faults as evidenced by its greater offset (about 480 km). Forested uplands appear dark red in contrast to the white tone of the sparsely vegetated Mojave Desert on the east. To the north, the red tones represent irrigated agricultural fields in the San Joaquin Valley.

24 SAN FRANCISCO BAY AND CENTRAL VALLEY, CALIFORNIA

San Francisco Bay (dark blue), entered from the Pacific Ocean through the Golden Gate, is part of a large depression running parallel to the coast. The bay is one of the world's best sheltered harbors with depths of up to 30 m. San Francisco was founded as a Spanish mission in 1776, and taken by the United States in 1846 during the Mexican War. The city was the chief gateway to the California gold fields in the 1850's. The area is now a cosmopolitan seaport and a commercial and distribution center for inland California.

The Central Valley, lying between the forests (dark red areas in the mosaic) of the Coast Ranges and the Sierra Nevada, is a huge trough that was filled with sediment, uplifted, and then subsided. Sediment deposited in the valley during the Pleistocene Epoch provides good soil for agriculture. Some of California's many wineries are located in the Central Valley. Sparsely vegetated aras appear light red or white.