

Chapter 3

Description of the study area

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The Platte River Basin drainage basin covers approximately one quarter of the state in southeastern and central Wyoming, plus smaller areas of northern Colorado and western Nebraska. The basin comprises approximately 24,106 square miles (15.43 million acres) in Wyoming, 2,074 square miles (1.33 million acres) in Colorado, and 109 square miles (0.07 million acres) in Nebraska. In Wyoming, the Platte River Basin includes all of Albany, Laramie, and Platte counties, parts of Goshen (95.9%), Carbon (70.8%), Natrona (57.2%), Converse (49.9%), and Fremont (18.9%) counties, and small undeveloped parts of southwestern Niobrara, western Sublette, and northern Sweetwater counties. In Colorado, the basin covers all of Jackson County, 16.5 percent of Larimer County and a small area of northern Weld County, and small areas of Scottsbluff and Sioux counties in Nebraska. **Figure 3-1** shows the boundary of the Platte River Basin in relation to state and county borderlines for all three states.

Although, the Platte River Basin encompasses about 25 percent of Wyoming's total surface, it serves as home to approximately 231,000 people or about 41 percent of the state's current population (2010 census). The basin contains the state's three largest incorporated municipalities (Cheyenne, Casper, and Laramie) and several larger towns such as Rawlins, Douglas, and Wheatland as well as numerous smaller towns and a substantial rural population. **Figure 3-1** is an index map that shows townships, major roads and incorporated municipalities within the overall Platte River Basin, and the hydrogeologic sub-regions that were established for this study within the Wyoming area of the basin (**Chapter 2**).

3.1 Physiography, landforms, topography, and surface drainage

The greater Platte River drainage basin is located within areas of the southern Rocky Mountain, Wyoming Basin, and Great Plains Physiographic provinces. The uplifts and basins that constitute the Platte River Basin were introduced in **Chapter 2**. Major drainages, reservoirs, and physiographic features of the Platte River Basin are shown on **Figure 3-2**. A map of the physiographic provinces of Wyoming can

be found on the WSGS website at <http://www.wsgs.uwyo.edu/Research/Geology/images/Final/Elevations.pdf>, and a map of the South Platte River drainage basin can be found at <http://co.water.usgs.gov/nawqa/splt>. The southern Rocky Mountain Province contains the Laramie, Medicine Bow, and Sierra Madre mountain ranges; areas east and northeast of the Laramie Mountains and Casper arch are within the Great Plains Province; and the remainder of the Platte River Basin to the west and northwest of the southern Rocky Mountain Province is within the Wyoming Basin Province.

The overall physiography of the Platte River Basin reflects a deeply eroded geologic foundation of large anticlinal uplifts that have crystalline basement complexes exposed in their cores bordering large-scale synclinal basins filled with varying thicknesses of sedimentary rocks. Concurrent uplift and erosion of the highlands, and downwarping and deposition in the basins during the Laramide orogeny was followed by continued uplift, faulting, erosion, mass wasting, and fluvial processes. This resulted in the current physiography characterized by mountains of variable areal scale and elevation, valleys, rolling plains, plateaus, escarpments, bluffs, hills, drainage ways, and small local basins. Elevations in the Platte River Basin range from 4,025 feet above mean sea level at the North Platte River where it crosses the Wyoming-Nebraska state line, to 12,013 feet at Medicine Bow Peak (Trihydro Corporation and others, 2006a). Detailed discussions of the geography of the seven drainage sub-basins of the Platte River Basin are provided in the 2005 Available Groundwater Determination (Lidstone and Associates, 2005b) and can be accessed online at http://waterplan.state.wy.us/plan/platte/techmemos/TechMemo_3-3_FINAL_lowres.pdf.

Surface drainage in the Platte River Basin is controlled by topography and is essentially equivalent to physiography. Perennial streams receive a large percentage of their source waters from overland flow associated with snowmelt and rainfall that originate in semi-humid and humid mountainous headwater regions and persistent baseflow (Trihydro Corporation and others, 2006a). Most ephemeral flow occurs in response to springtime snowmelt and to intense, short duration

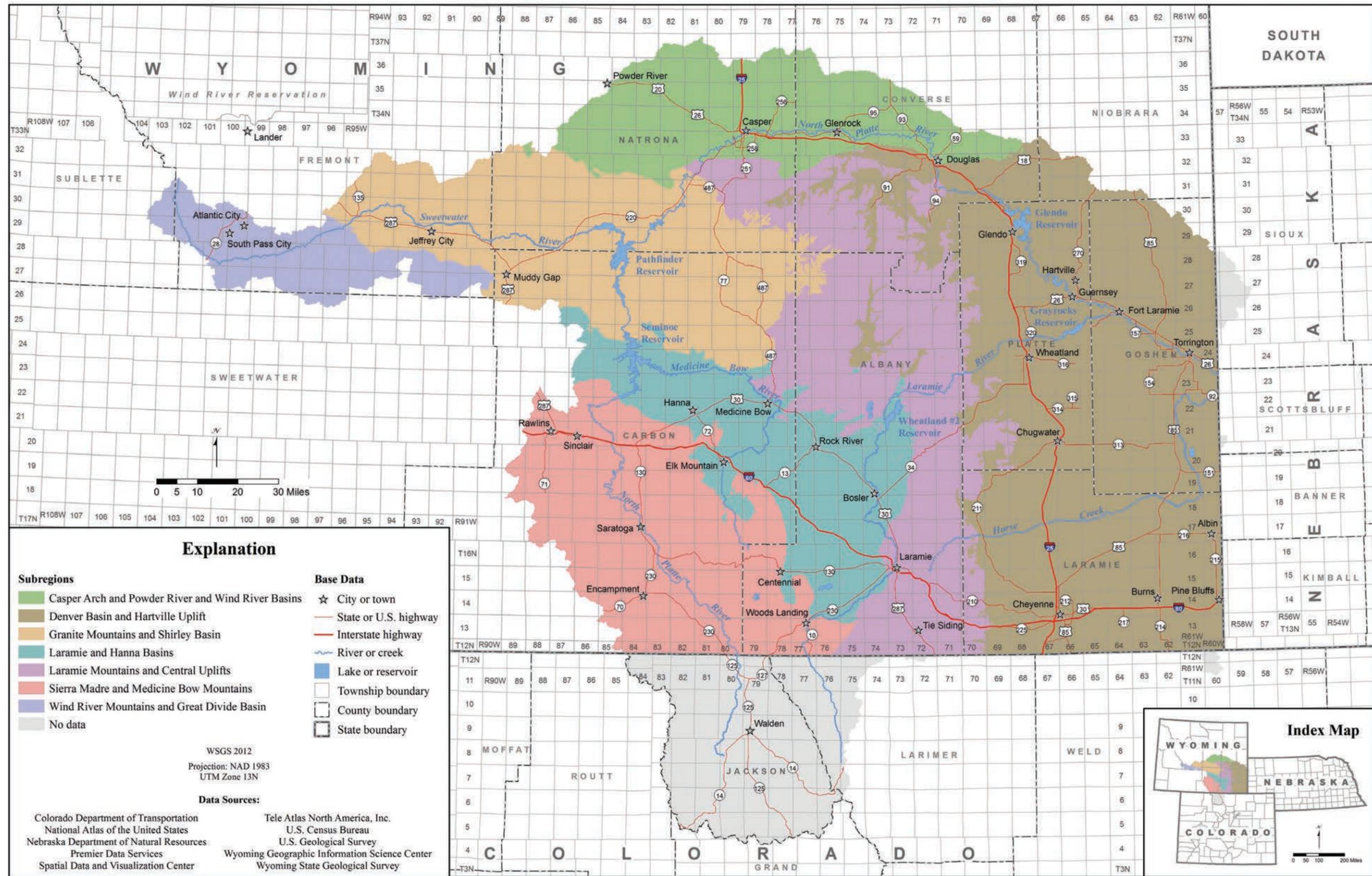


Figure 3-1. Subregion, township, and range index map, Platte River Basin.

rainfall events characteristic of transient convective thunderstorms. Streamflows are also affected by vegetation, temperature, manmade diversions, and complex interconnections with groundwater. Precipitation and natural streamflow vary by elevation. Annual precipitation increases with surface elevation and can exceed 60 inches a year in the high mountain headwater areas of the Platte River Basin. Most of the basin receives from 9 to 20 inches of precipitation annually (**Figure 3-3**).

Major drainages, reservoirs, and physiographic features of the Platte River Basin are shown on **Figure 3-2**. The basin encompasses the North Platte River and its headwater drainage system, and the northern part of the headwater drainage of the South Platte River (however, the South Platte River does not flow through Wyoming). The Platte River is the major tributary to the Missouri-Mississippi River Basin. Primary tributaries to the North Platte River include the Laramie, Medicine Bow, and Sweetwater rivers. Crow Creek and Lodgepole Creek are Wyoming headwater tributaries to the South Platte River. The distal divides of these drainages define the limits of the Platte River Basin study area. Maps of the surface drainages within the seven drainage sub-basins described in the previous Platte River Basin Water Plan (Trihydro Corporation and others, 2006a) are provided in the Platte River Basin Water Plan, Section 3.2 – Water Atlas (Trihydro Corporation, 2005i) online at <http://waterplan.state.wy.us/plan/platte/atlas/index.htm>. A map of the South Platte River drainage basin is available at <http://co.water.usgs.gov/nawqa/splt>.

3.2 Climate, precipitation, and vegetation

Climate within the Platte River Basin is primarily a function of altitude and, to a lesser degree, latitude and topography. Climate types range from semi-arid continental within the basin interiors to humid-alpine in the bordering mountain ranges. The mountain ranges capture much of the atmospheric moisture through orographic uplift that results in increased annual precipitation in the mountainous regions while substantially decreasing precipitation in the basin interiors. Temperature varies by season from well below 0° F in the winter to

more than 100° F in the summer. Most precipitation within the basin occurs as snowfall during the winter and early spring and as convective thunderstorms during late spring and summer months (Libra and others, 1981). Average annual precipitation ranges from 9 to 15 inches in the interior basin areas and plains east of the Laramie Mountains; 16 to 30 inches along the foothills adjacent to the mountains, over the lower uplifts, and the high plains around Horse Creek; and 31 to 60 inches in the higher mountain ranges (**Figure 3-3**).

The distribution of the diverse vegetation within the Platte River Basin is strongly influenced by elevation, soil type, exposure, and precipitation. Approximately half of the basin is rangeland (Kuhn and others, 1983) where the dominant vegetation consists of mixed prairie grasses and shrubs (primarily sagebrush). Cottonwood and Russian olive trees are found along rangeland drainages where elevated soil moisture levels are maintained by perennial or frequent ephemeral streamflows. Fertile bottomlands along the perennial streams have been converted to irrigated cropland. Major crop producing areas are located east of the Laramie Mountains, in the Saratoga valley, west of Laramie, and in the Kendrick Irrigation Project west of Casper. The abundance of grasses, shrubs, and a variety of woodland trees (primarily conifers) and other species generally increases with altitude and increased annual precipitation up to timberline above which vegetation is alpine tundra species of lichens, low shrubs, and grasses. A map illustrating the distribution of the broad categories of vegetation types in the Platte River Basin is provided online in the Platte River Basin Water Atlas (Trihydro Corporation, 2005i) at http://waterplan.state.wy.us/plan/platte/atlas/overview/_general/veg.pdf.

3.3 Population distribution, land use, and land ownership

U.S. Census Bureau data does not provide high resolution population numbers by river basin. A highly accurate population count would prove even more difficult in the Platte River Basin as delineated for this study. Reasonable estimates can be made; however, by processing the most recent census data (U.S. Census Bureau, 2010

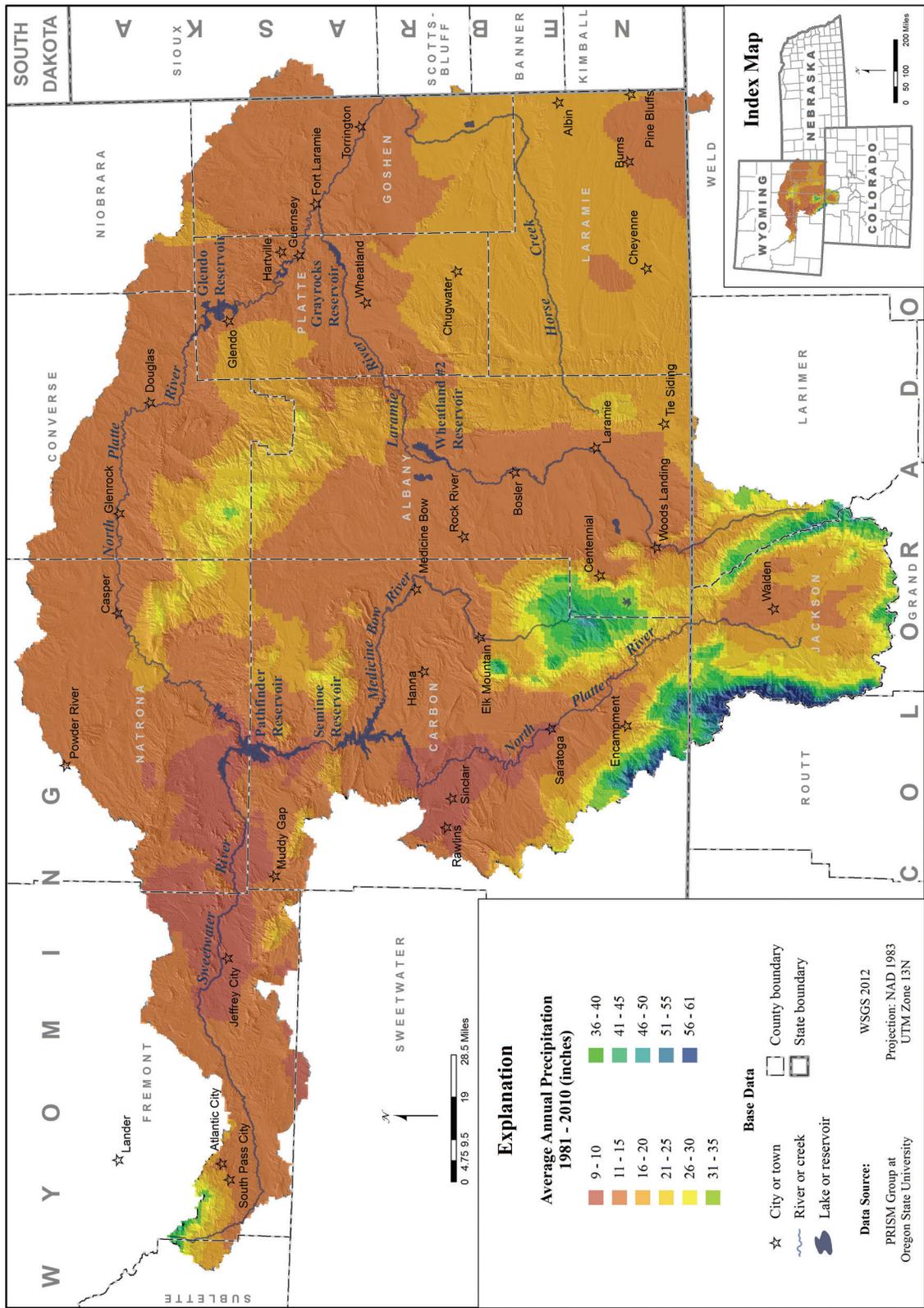


Figure 3-3. Average Annual Precipitation (1981 - 2010), Platte River Basin.

at www.census.gov) for Wyoming counties and municipalities. Using this approach, it is estimated that the 2010 population of the Platte River Basin was approximately 231,000 with about 76 percent residing in cities and towns, and rural populations accounting for the remainder. Except for Cheyenne and Rawlins, which were settled as railroad towns, every large community within the Platte River Basin is located along or within a few miles of a major stream or river. While the planning area encompasses approximately one quarter of the land in Wyoming, in 2010 it contained 41 percent of the state's population and much of its agricultural production (Trihydro Corporation and others, 2006a). Additional detailed information on the demographic conditions of the basin can be found online in the previous 2006 Platte River Basin Final Report at http://waterplan.state.wy.us/plan/platte/finalrept/Final_report.pdf.

Land use in the Platte River Basin is controlled primarily by elevation, climate, the distribution of surface waters, precipitation, the location of mineral resources, and the railroad (in a historical sense). In the high mountain areas above timberline, the alpine lands are generally used only for recreational purposes. At lower elevations, thickly forested areas are utilized for recreation and limited (mostly historic) logging. Grazing is the dominant use on rangelands, foothills, and riparian areas. Agriculture plays a significant role in the basin; approximately 4.1 percent (632,630 acres) of its surface area consists of irrigated cropland (WWC Engineering, Inc. and others, 2007).

Irrigated croplands are located primarily along the rivers and major streams where irrigation with surface water is possible. Most of the basin lowlands are covered sparsely with grasses, sagebrush, and other shrubs and are used for grazing. The locations of active and historic mineral development properties are described in **Section 5.7.2** and shown in figures contained in that section.

Approximately 29 percent of the land area of the Platte River Basin is federally owned. In general, federal land is controlled by the U.S. Bureau of Land Management within the basin lowlands and by the U.S. Forest Service in the forested/mountainous areas. Privately owned

lands, concentrated along rivers and streams, constitute about 61.4 percent of the land in the basin; 8.7 percent is owned by the state of Wyoming; and less than 1 percent is owned by other entities. A map of state, federal, and private land ownership in Wyoming is available online at the Wyoming Water Development Office, 2007 Statewide Water Plan Online Presentation Tool: http://waterplan.wrds.uwyo.edu/fwp/figures/pdf/Fig3-2_3-3.pdf (Wyoming Water Development Office, 2007).

