Encyclopædia Iranica

AFGHANISTAN I. GEOGRAPHY
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Published: December 15, 1983
Last Updated: June 1, 2018

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i. Geography

Natural regions. Afghanistan is a fan-shaped country extending from the Wāḵān "handle" in the northeast at about 70° east longitude, out through the highlands to the southwest desert border with Iran at about 61° 3l' east longitude. From north to south the country extends from about 38° 30' north latitude in the northeast to about 29° 30' north latitude in the southwest. With a 650,000 sq. km area, Afghanistan is much the same size as California and Nevada and similar in climate and landforms. The country is bordered on the extreme northeast tip of the Wāḵān by the People's Republic of China, on the north by the Soviet Union, on the west by Iran, and on the south and east by Pakistan. Afghanistan has been divided into a variety of natural regions by different researchers (Humlum 1959, Cressey 1960, and others), but Dupree's work (1973) is probably the most useful. He recognizes eleven primary zones, which are basically either a part of the Hindu Kush mountain system or of the peripheral plains and deserts.

Wāḵān corridor and Pamir knot: This Afghanistan "panhandle" is a long narrow border construct brought into existence by late 19th century political necessity and designed as a buffer zone between Czarist Russia and British India. More than three-quarters of the area is above 3,000 m in altitude, and numerous peaks rise above 6,000 m. Snowfields and glaciers are common in the area. Several wide, flat valleys between the mountains provide limited

access and sites for human habitation.

Badaḵšān: This high rugged portion of northeastern Afghanistan is characterized by spectacular peaks, gorges, and alpine scenery. The highest peaks are over 6,000 m, but most are around 4,000-5,000 m. Glaciers occur in both the north and south and lakes, mostly of glacial origin, abound.

Central mountains: The main axis of the Hindu Kush spreads out in the center of the country in a broad, fan-shaped arrangement from northeast to southwest. Numerous near-parallel valleys also fan outwards from this massif. Two main passes in the central part allow north-south access; the Šebar to the west and the Sālang to the east. The highest peaks range between 4,000 and 5,000 m.

Eastern mountains: These mountains are another topographically complex area of high-altitude peaks (about 6,000 m) and large valleys. Four main valley systems occur here: (1) the large, open Kabul valley with its thick, alluvial fill and high, surrounding mountains (Paḡmān range, Sefīd Kūh, and Kūh-e Bābā); (2) the linear Kūhestān-Panǰšīr valley, which bears to the northeast from the open basin of Kūh-e Damān around Čārīkār, north of Kabul; (3) the Ḡōrband valley, which bears to the west from Čārīkār to the Šebar pass, and (4) the Nūrestān valley complex, which consists of five major north-south valleys and about thirty east-west lateral valleys. Many of these valley systems contain thick, late Cenozoic sedimentary valley-fill sequences and are much like those in Nevada or western Montana. The Rīg-e Ravān is an anomalous area of sand dunes south of Čārīkār.

Southern mountains and foothills: Many low (about 2,500-3,000 m), northeast-southwest trending mountain ranges occur here. Extensive valley fills and broad alluvial plains extend between the ranges, and ephemeral stream channels are ubiquitous. Some alluvial fans and basins of interior drainage occur, together with a few minor areas of sand dunes.

Northern mountains and foothills: This is a broad zone of mountain plateaus and foothills, with some peaks over 3,000 m. The Band-e Torkestān range, the Paropamisus (not to be confused with the ancient Paropamisus), Kūh-e Čangar, and Fīrūzkūh are the chief ranges. The main valleys from west to east are the Morḡāb, Band-e Amīr (Balḵāb), Andarāb-Sayḡān-Sorḵāb system, and the Kondūz group.

Turkestan plains: The northern foothills decrease in altitude and pass into stony plains of 300-400 m. Sand drifts and dunes abound; loess deposits (wind-blown dust) and salt pans occur. This dry desertic area is commonly separated by marshy, alluvial terraces from the level floodplain of the Āmū Daryā river, which forms the northern border.

Herat-Farāh lowlands: This area is a relatively low-lying complex of broad arid alluvial plains, playa basins, and low hills and mountain ranges. Numerous alluvial fans and dry desert washes occur. The general elevation is about 1,000 m, and the regional slope is to the west and southwest.

Helmand valley-Sīstān basin: The Helmand river system, which rises in the central mountains section, passes through the center of this area. It empties into the endorheic Sīstān basin through the Hāmūn-e Helmand system, a series of marshes and connecting lakes. In exceptionally wet years, it empties into the Gowd-e Zereh, which is an ephemeral brackish lake. The area as a whole is an alluvial plain of about 500-600 m altitude and is characterized by surrounding sandy and rocky desert.

Western stony deserts: These are waterless, barren, alluvial wastes north of the great arc of the Helmand as it swings from south to north. The Dašt-e Ḵaš and Dašt-e Mārgō deserts are characterized by a desert pavement of stones left where finer sediments were blown away by wind. The altitudes average about 700 m.

Southwestern sandy deserts: This area (Rēgestān, Dašt-e Pōḡdar, Dašt-e Arbū) is similar to the above but has many more fixed and mobile sand dunes with some moist, sandy, clay, interdune (pat) areas similar to playas. Much of the sand was probably derived from deflation in the Helmand-Sīstān depression and the western stony desert section.

Drainage. Water is the life blood of an arid country such as Afghanistan, and the main sources are the melting glaciers and higher precipitation zones of the mountains. In general the rivers of Afghanistan reflect three major drainage controls: (a) the north and northwestward flow into the Central Asian depressions of the U.S.S.R.; (b) the strong west and southwestward flow, largely structurally controlled, into other basins, particularly the Sīstān depression; and (c) the southeastward flow into the Indus system. Most of the drainage rises in the higher and wetter eastern half of the country. Many of the rivers have steep gradients and run through slender and commonly

precipitous valleys in the higher elevations. They carry large silt loads, particularly during peak runoff in the spring and early summer storm-and-melt season, when many disastrous floods occur. About 10 river systems or major subsystems exist (Westfall and Latkovich, 1966, pp. 11-13), although it is difficult to group together many of these arheic and endorheic water courses, which disappear into deserts or swampy areas. Furthermore, nomenclature is as yet not standardized, differing between ethnic and political groups, a fact which makes understanding doubly difficult.

Āmū Daryā (Oxus) system: This river of classical fame rises in the high mountain area of the Wāḵān corridor-Pamir knot as the Āb-e Pāmīr and the Āb-e Wāḵān, which flow together to form the Āb-e Panǰa. This river, joining with the Kūkča and Kondūz downstream (together with the Waḵš from the U.S.S.R.), form the main Āmū Daryā. Farther downstream the Tāškorgān (Ḵolm), Balḵāb, Sar-e Pol, and Āb-e Qayṣar-Šīrīn Tagāo are also tributary to the Āmū Daryā during great floods, but most of their water is generally removed for irrigation. After forming the northern border of Afghanistan and the U.S.S.R. for about 1,100 km, the Āmū Daryā ultimately swings away to the north and empties into the Aral Sea.

Helmand-Arḡandāb system: The Helmand is about 1,300 km long and drains about 40 percent of Afghanistan's land are. Classical and modern irrigation works along it and its tributaries attest to its importance in agriculture. The river flows generally southwesterly until it empties into the marshes of the Sīstān basin on the Iranian border, where it is lost to evaporation. Overflow from it and other related rivers, together with the drying up of Pleistocene lakes (Smith 1974), has produced numerous salt flats such as Gowd-e Zereh. Several tributaries join the Helmand, e.g., the Kaǰ Rūd, Terīn, and Rūd-e Mūsā Qaḷʿa; but the Arḡandāb (560 km long) and its tributaries are the most important. The chief among these are the Arḡastān, Dōrī, and Tarnak.

Kabul river system: This is the only prime river system in Afghanistan with an outlet to the sea; it flows about 350 km east to join the Indus in Pakistan. The Lōgar and Panǰšīr rivers contribute the bulk of the water in the upper reaches; the Laḡmān and Konaṛ are the most important in the lower part.

Harī Rūd system: This river flows about 650 km west through Afghanistan out of the central highlands. It eventually turns north and forms the Afghan-Iranian border before becoming the Iranian-Soviet border and finally passing into the deserts of the U.S.S.R. The Harī Rūd has a single major tributary, the

Kāō Rūd (Kowgōn), which it parallels for a considerable distance.

Minor systems: The Morḡāb river in the northwest has a fairly large drainage area with several important tributaries. It flows north into the U.S.S.R. The Adraskand and Farāh rivers in the west empty into the marshes of the Sīstān basin, together with the Helmand. Finally, there are a number of tributaries along the southeastern Afghan-Pakistan border which empty into the Indus. Chief among these are the Gumal and Matun.

Lakes: Few large lakes exist in Afghanistan because of the general aridity and lack of suitable depressions. Profuse small glacial lakes do occur, however, high in the mountains of the northeast. Sar-e Kōl and Čaqmaqtīn Kōl are two of the large glacial lakes in the Wāḵān corridor-Pamir knot region. Kōl-e Šīva in eastern Badaḵšān is one of the largest in the northeast. In the central mountains the famous five lakes of Band-e Amīr are self-damming in that calcium carbonate is precipitated in the agitated water of the outflow, thus producing a natural rock rim much like that around hot springs. The endorheic Dašt-e Nāwor basin receives water from the surrounding area and exists as a central, mineral-rich lake with surrounding playa flats (Förstner 1973). The Āb-e Īstāda in the southern mountains and foothills between Ḡaznī and Qandahār occurs as a depression into which the ephemeral Ḡaznī river flows. This lake is also much like the Nāwor with mineral-rich water and surrounding playa flats, a reflection of the high evaporation of the area and lack of outflow. At one time this lake flowed to the southwest through the Lora river system and into the Arḡandāb. The numerous marshes, lakes and playas of the Sīstān basin are collectively endorheic and are shrunken remnants of a much larger (65,000 sq. km) Pleistocene lake (Smith 1974). Within the Afghanistan part of the basin, the reed-filled marshes and lakes of the Hāmūn-e Ṣāberī and the Hāmūn-e Pūzak receive much of their water from the Helmand system. During very wet years, the water flows out of these depressions into the Gowd-e Zereh, which is otherwise a playa depression of deflation origin (Smith 1974, p. 50). Kōl-e Namaksār, on the border with Iran west of Herat, is a salt-crusted playa which dries up annually, although old beaches attest to its former greater size (Smith 1973). Numerous other playas occur along the border here; Daḡ-e Namadī (Daḡ-e Tondī) west of Farāh is one of the largest. Several other closed depressions with salt lakes occur on the Turkestan plains in the north (Smith 1973). These are Namaksār Andḵūy (Ḵᵛāǰa Mod) in the west and Namaksār Tāškorgān (Sar-e Namak) in the central part of the plains.

Geology. The geology of Afghanistan largely controls the topography. The fan-shaped, central highlands are comprised of old, resistant bedrock; and the younger, soft, and erodable sediments of Cenozoic age (Paleogene, Neogene, Quaternary) wrap around the edges, starting in the northern Turkestan plains, proceeding through the western Herat-Farāh lowlands and the Sīstān basin to the southeastern mountains and foothills. The highest, northeastern part of the country is characterized mainly by Prepaleozoic and Paleozoic metamorphosed sediments and granitic intrusions. About 150 km west of Kabul this group divides into two zones, the widest band of which strikes southwest toward Qandahār with the narrow zone heading towards Herat. To the north, Cretaceous and Paleocene limestones and red sandstones dominate; to the south are older Jurassic to Cretaceous limestones and sandstones. Tertiary (Paleogene, Neogene) sedimentary rocks are especially dominant along the border with Pakistan between Jalālābād and Qandahār.

The present topography and geology of this part of Asia can be best understood by reference to the predominant, new theory of plate tectonics. According to it, the Indian subcontinent broke its attachment to Africa about 75 million years ago and moved slowly northeastward across what is now the Indian Ocean. Beginning about 45 million years ago, the leading edge of this plate began to collide with the continental shell that bordered the then southern edge of Asia. The result was a vast folding and fracturing, melting and intrusion of rock, earthquakes, and uplift of the entire Hindu Kush-Pamir-Himalaya mountain chain. The ever-present earthquakes of this unstable region testify to the continuation of this colossal collision (Heuckroth and Karim, 1970).

Geologic wealth may be measured not only in terms of minerals but also in terms of deposits capable of producing good soils for agriculture. The vast plains and valley fills along all but the northeastern borders of the country are predominantly composed of Cenozoic alluvium and wind-blown dust (loess) and sand (dunes). Where adequately watered, some of these materials have good agricultural potential. Some, however, contain excess salts and are agriculturally sterile. A few lakes and playas in these areas may be potential sources of valuable evaporites (Smith 1973). Sweetwood (1968) has listed 24 types of actually or potentially important mineral occurrences: asbestos, barite, beryl, celestite, chromite, coal, copper, dolomite, fuller's earth, gold, iron, lapis lazuli, lead-zinc, limestone, magnesite, manganese, marble, mica, ruby, salt, silica sand, sulfur, talc, and natural gas.

Climate. Afghanistan has an extreme continental, arid climate which is characterized by desert, steppe, and highland temperature and precipitation regimes. The climate is also characterized by strong radiation, copious sunshine (more than 3,000 hours annually in many places), low relative humidity, and high evaporation.

Temperature: High annual fluctuations amounting to 25°-28° C are dominant, with a sudden transition from summer to winter and vice versa (Fischer 1968, p. 73). The map of January isotherms (Sahab 1974, p. 21) shows temperatures greater than 6° C for the Jalālābād basin and the two other small low-lying areas along the southeast border of the country. The same temperature regime encompasses most of the southwestern part of the country up to about a line connecting Farāh and Qandahār. The Turkestan plains average between 0°-3° C; and elsewhere temperatures decrease regularly with altitude, so that a minimum of less than -15° C is attained in the central high mountain areas, the glacierized northeast, and in the Wāḵān corridor-Pamir knot area.

The July isotherms show similar distribution patterns (Sahab 1974, p. 22) with a high of about 35° C or greater in the Sīstān depression in the extreme southwest. The Jalālābād basin, the lowest part of the Turkestan plains along the Āmū Daryā, and most of the southwestern part of the country average between 32°-35° C. Qandahār, Farāh, Herat, and much of the Turkestan plains average between 29°-32° C; and elsewhere temperatures decrease regularly with altitude down to a minimum of less than 10° C.

Winds: The general circulation patterns for Afghanistan are (a) a limited southerly monsoonal effect in the southeast which is largely responsible for higher summer precipitation in that area; (b) a persistently northerly effect of the outflow of dry, subsiding, continental air from the high pressure zone of interior Asia; and (c) winter mid-latitude cyclones originating in the Mediterranean basin. During the summer months the strong thermal and pressure differences between the northern plains and southern lowland deserts create the seasonal hot and dusty “wind of 120 days” in the west of the country (Dupree 1973, p. 28). Northwesterly katabatic winds stir up much dust in Kabul during summer (Fischer 1968, p. 74).

Precipitation: Afghanistan is mostly arid with an extreme minimum of about 0-5 cm in the Sīstān depression, 5-10 cm in the Wāḵān corridor, and subsidiary minima of 10-20 cm in the Jalālābād basin and the northernmost Turkestan plains. Elsewhere precipitation increases with altitude to maximums of more

than 40 cm in the central highlands, the mountains north and south of Jalālābād (which receive the limited monsoonal effects from the Indian Ocean), and the extreme north of Badaḵšān (Sahab 1974, p. 20). The highly variable summer precipitation tends to be convectional everywhere except in the southeast, monsoonal, orographic zones. Winter precipitation tends to be largely cyclonic throughout the country and is also highly variable. Blizzards are common in the highlands.

Climate type: The climate of Afghanistan is newly mapped according to a modified Köppen system using the latest available weather statistics (R. Bifaro, personal communication). The dry climates are divided into four subgroups, warm and cold deserts (BWh, BWk) and warm and cold semiarid steppes (BSh, BSk). The warm deserts occur around Jalālābād and in the southwest. The cold deserts occur on the Turkestan plains along the Āmū Daryā and possibly along the higher edge of the warm deserts of the southwest (these could be warm steppes also). The warm steppes definitely occur at slightly higher elevations around the Jalālābād basin. The cold steppes occur as a wide loop around the central highlands, extending from Kabul to Ḡaznī, through Herat, and back around through Mazār-e Šarīf and Kondūz. They probably also occur in the Wāḵān corridor. The humid mesothermal climates (Cs), characterized by relatively warm temperature regimes, occur at isolated stations at higher more humid elevations with a winter precipitation maximum. Several stations in Badaḵšān and one north of Kabul and between Herat and Mazār-e Šarīf report such climate statistics. The humid microthermal D climates of the central highlands are also a reflection of lower temperatures and higher precipitation. They grade progressively upward into even colder and wetter boreal climate (E) zones and ultimately into alpine tundra (Ft) and glacier ice (Fi) zones where appropriate.

Soils. Soils in Afghanistan clearly show the impact of centuries of overuse and neglect (Hildreth 1957, p. 9). Descriptions herein are based primarily on the preliminary reconnaissance of Salem and Hole (1969) using classic terminology.

Soils of alluvial plains: Because of leaching or precipitation of minerals, most of these soils lack normal horizonation; some may have it as a result of repeated floodplain sediment deposition. Some reflect strong aridity and have altered upper horizons or slight hardpans. These soils occur in lower reaches of most river valleys.

Saline, alkalai, and salt marsh soils: These halomorphic soils occur in poorly drained areas where soluble salts of sodium, calcium, and magnesium become concentrated through high evaporation. They are most common in the low-lying Sīstān depression, the Herat-Farāh lowlands, and the Turkestan plains.

Desert soils, mostly dunes: Soils in this group have little horizonation and are dominantly sand; they occur in the desert wastes of southwestern Afghanistan and on the Turkestan plains.

Desert soils, with few dunes: As used in this classification, these soils tend to be true desert soils with thin or discontinuous organic layers. They commonly have a calcium-rich lower zone which may be a hard-pan. The upper horizons may be deflated away to leave a truncated soil profile consisting of a lag-gravel concentrate. These soils are most common in the Herat-Farāh lowlands between the low-lying halomorphic soils along the Iranian border and the Sierozemic and brown soils further to the east, towards the mountains. This soil group also occurs along the border with Pakistan.

Sierozem, brown, and mountain soils with lithosols and regosols: The arid-land sierozems have a thin discontinuous gray or brown upper organic layer developed under desert shrubs and a lower carbonate zone. The brown soils tend to have a brown surface zone developed under grass and a more clay-rich subsoil. The regosols are poorly horizonated, sandy deposits; and the lithosols are thin, discontinuous rocky soils. This group of soils occurs as a loop surrounding the central highlands and open to the northeast.

Mountain soils of chestnut, brown forest, and podzolic zones: These soils tend to exist in areas of slightly greater precipitation in the mountains of eastern Afghanistan and possibly in the Paropamisus in the central and western parts. They are transitional between the calcic, arid, and grassland-steppe soils and the soils of the high mountain areas, so they tend to have shrubs and trees and increased leaching of soil materials. The chestnut and brown soils tend to lie between the steppe meadows and the more heavily forested zones, and the scanty precipitation on them restricts organic matter accumulation in the upper horizon. Some may have calcium-rich horizons; others may not, especially as precipitation increases into the podzolic soils. This soil type tends to occur beneath the more heavily watered and forested zones of the higher mountains. They may have a dark, humus-rich layer underlain by a light, leached layer and a lower, clay-rich layer.

Soils of high mountain areas: Alpine tundra and meadow soils commonly have a wet, organic-rich, upper layer, which may overlie gray or mottled yellow or brown subsoils, which may be permanently frozen. Peat accumulations can occur. Lithosols are common wherever rock outcrops predominate and soils are thin. Soil horizonation is limited in these situations and is characterized by profuse rock fragments. Bare bedrock, glacial ice, and snowfields are also included in this group for mapping convenience.

Vegetation. The existing vegetation maps and texts commonly disagree or use different systems of division (Linchevsky and Prozorovsky 1949; Volk 1954; Fischer 1968; Freitag in Kraus 1972; and Sahab 1974). Volk modified the work of Linchevsky and Prozorovsky and divided Afghanistan into five vegetation-group provinces which are essentially geologic-topographic-climatic regions: (a) The Afghan-Turkestan province in the north is thus characterized by poplars, willows, tamarisk trees, and reeds on valley floors and riverbanks; by meadows of annual grasses and geophytes at slightly higher elevations; and a scrub of grasses, small wormwood (*Artemesia*) bushes of the sagebrush type, and scattered pistachio trees at high elevations. Saxaul bushes occur on moist sites and salt-tolerant plants grow on the halomorphic soils. (b) The central highland province, with its high dry climate, has a characteristic *Eurotia-Artemesia* shrub association together with leaf-poor, thorny cushion or mat plants (“hedgehog” steppe or “Igelsteppe”). Dwarf almond (*Amygdalus*) semi-desert occurs together with various grasses at lower elevations, alpine meadow and tundra vegetation at higher altitudes. In addition tragacanth bushes and a few juniper and birch trees occur. (c) The southern, desert province has a hot dry climate and a variety of arid-and salt-tolerant communities such as wormwood, *Calligonum*, *Haloxylon*, *Arthraphaxis*, and *Zygophyllum*. In sandy areas saxaul bushes and *Aristida* occur with salicornian shrubs, tamarisk, and members of the goosefoot family (*Chenopodiaceae*) near high ground water. Dwarf almond, pistachio, and *Prunus* trees occur in some places on the contiguous mountains. (d) The central steppe and semi-desert province is transitional between the latter two provinces and is characterized by wormwood communities with a variety of grasses, geophytes, dwarf almond, and sparse pistachio trees. (e) The east and southeast Afghanistan province has the greatest variety of climates, and hence vegetation. In the warm dry lowlands occurs a largely subtropical scrub with various flowering plants and shrubs. The increased precipitation in the mountains produces an evergreen, hard-leafed (Schlerophyllous) mixed wood with various species of birch, juniper, oak, pistachio, almond, ash, olive, walnut, and alder. At higher

elevations conifers occur, including pines, cedar, fir, larch, and yew.

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