PART III DESCRIPTION OF RIVER BASINS

PICTURE 38
Two different worlds separated by one river: on the right bank of the Murghab River, kuchi nomad tents in Afghanistan; on the left bank, a cooperative in Turkmenistan. Water is largely unused on the Afghan side. Murichak, Bala Murghab, 21 May 2003 (N35.72, E, 63.19, NW)

I. MAPS AND STATISTICS BY RIVER BASIN

Map 8 shows the boundaries of the five river basins delineated for Afghanistan:

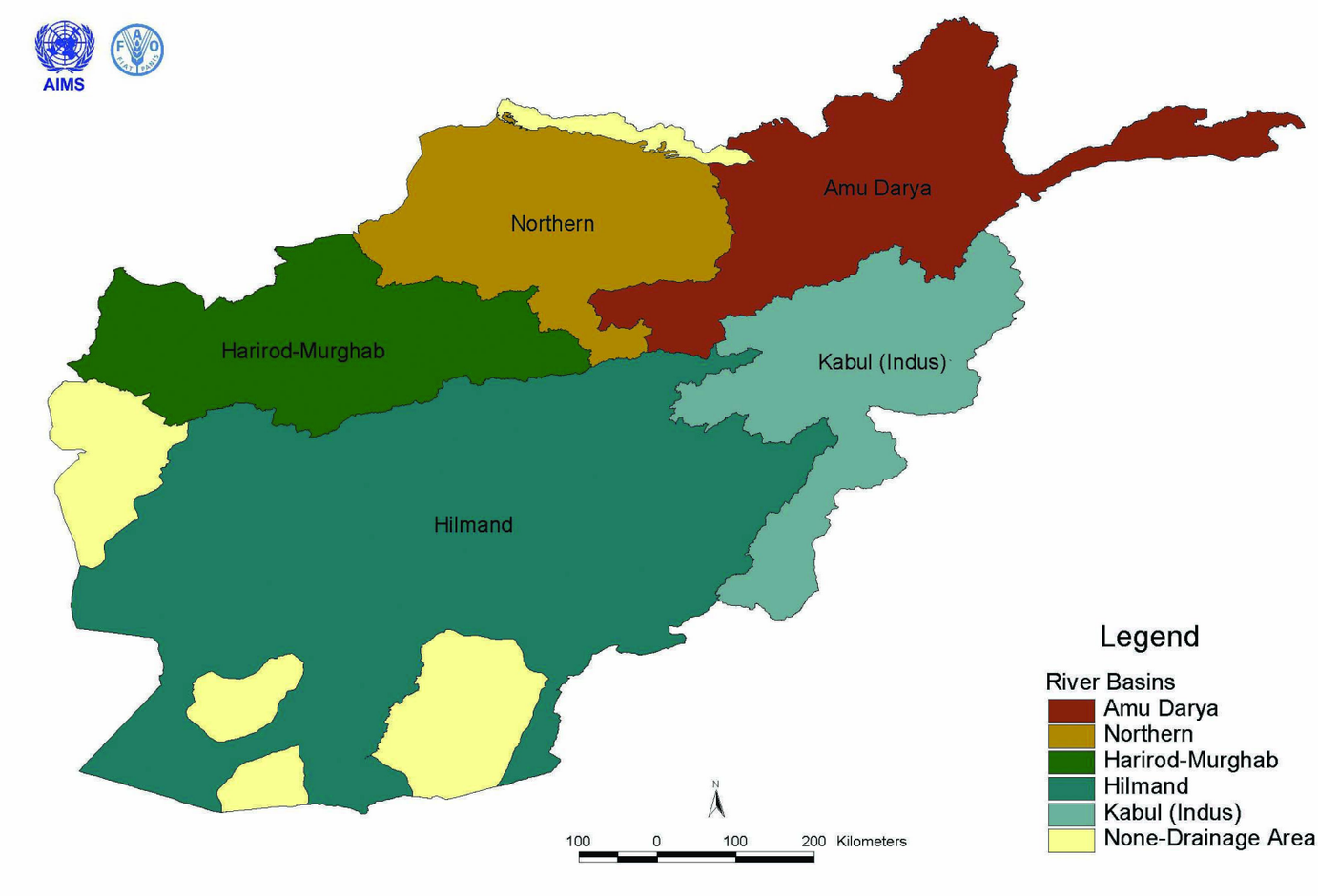
1. The Amu Darya river basin
2. The Northern river basin
3. The Harirod-Murghab river basin
4. The Hilmand river Basin
5. The Kabul (Indus) river basin

For each river basin, source of water, transboundaries riparian issues, natural resources, protected areas, land cover, type of agriculture, hydrological infrastructures (dams) and main historical developments along water sources are summarized and, whenever possible, illustrated with pictures. Tables 8, 9 and 10 present statistics on area, population and the main land cover features by river basin. Graph 8 shows that the largest of these five basins is the Hilmand basin, covering 43 percent of the national territory. The other four basins are of similar sizes and cover 10-14 percent of the country. In additions to these river basins, there are four non-drainage areas: Namaksar, Registan-i Sedi, Registan and Dasth-i Shortepa.

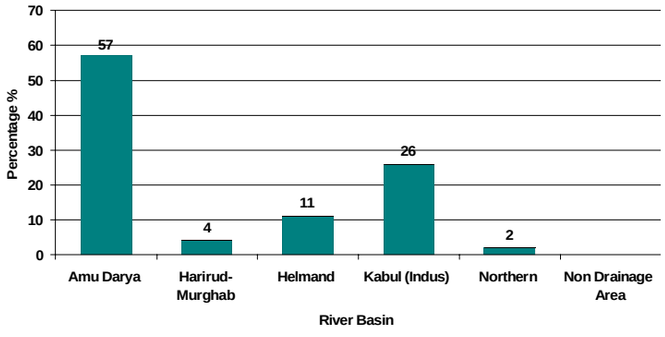
The graph on Map 8 shows that 57 percent of the total river flow in Afghanistan originates from the Amu Darya river basin. The Kabul and Hilmand river basins contribute, respectively, to 26 percent and 11 percent of the total water flow. The Harirod-Murghab and Northern river basins have small contributions of, respectively, two percent and four percent.

Graphs 10, 11 and 12 show that the largest number of settlements are located in the Hilmand river basin; however, the largest settled population density is found in the Kabul river basin, with 93 inhabitants/sq. km. The national average is 32 inhabitants/sq. km (nomadic population not included). Non-drainage areas have the lowest population density, with two inhabitants/sq. km. Pressure on natural resources is likely to be highest in the Kabul river basin.

Graphs 13-20 show different land cover class areas by river basins. The permanent snow cover is most important in the Amu Darya river basin and the Kabul river basin, and close to nil in other river basins. The water bodies and marshlands are chiefly found in the Hilmand river basin (Hamum-i Hilmand). A significant proportion of marshlands are found in the Amu Darya river basin and the non-drainage areas. Forests are chiefly found in the Kabul river basin (pistachio forests are not reflected in Graph 18). Irrigated land is found in a good proportion of all river basins. The Hilmand river basin includes the highest acreage of irrigated land, both intensively and intermittently cultivated, while the lowest is the Harirod-Murghab river basin. The northern rainfed belt lies across the Amu Darya, Northern and Harirod-Murghab river basins, with the highest acreage in the Northern basin. Rangeland is found in all river basins, but primarily in the Hilmand.

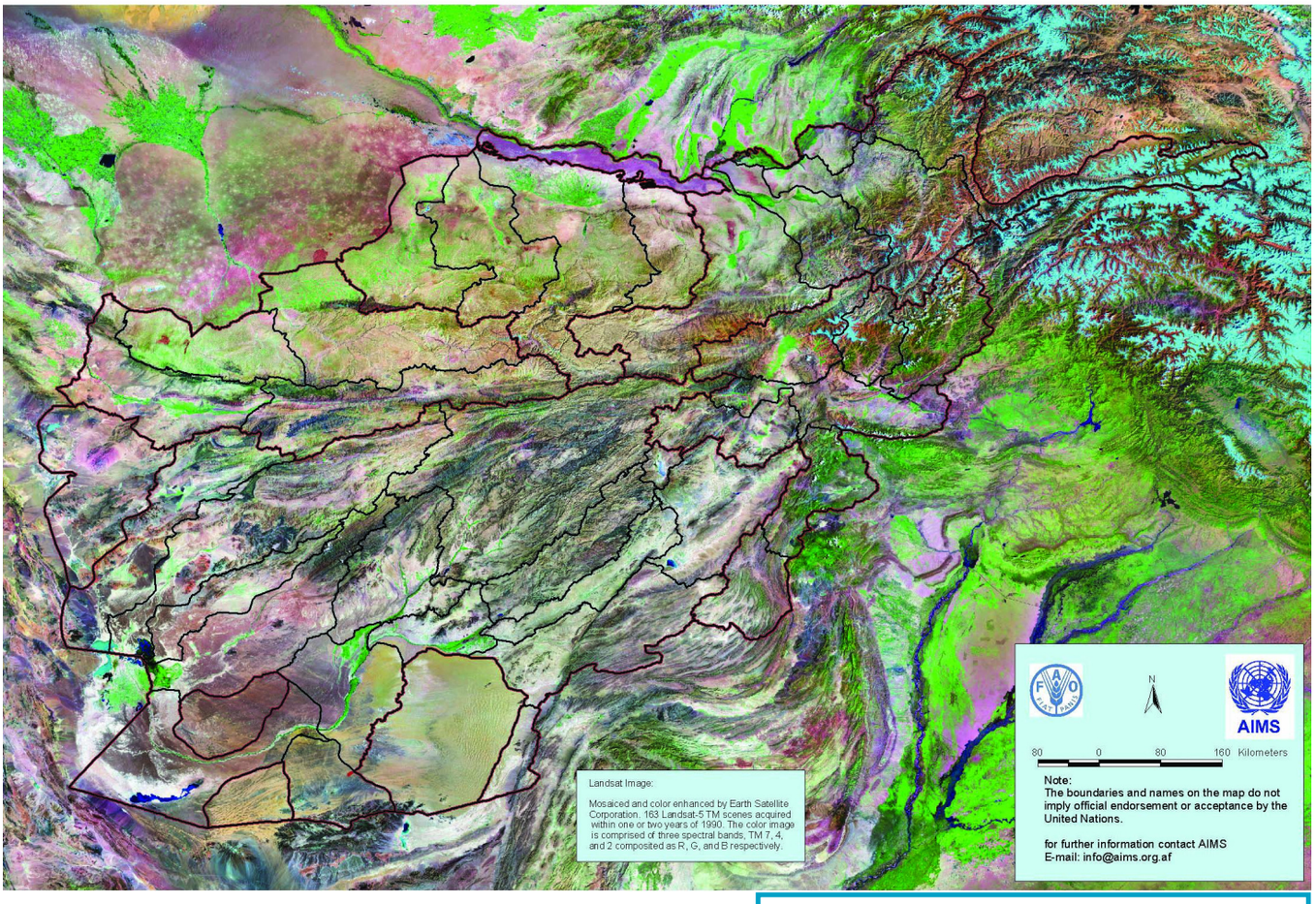


MAP 8
River basin map of Afghanistan



GRAPH 8
Proportion (%) of total river flow by river basin (see hydrological data in table 2, Part I)

River Basins and Watersheds on Landsat Satellite Image



Map 9

River basins and watershed vectors on Landsat Satellite Image.

The satellite image illustrates the features in Afghanistan and its neighbouring countries (light blue on the top left: snow; green: vegetation, mostly irrigated areas along rivers; blue: water bodies).
Note in particular :

1. The end drainage areas of the Hari Rod and Murghab Rivers forming the irrigated oases 'delta' of Tejen and Merv (or Mary) in Turkmenistan (above left).

2. The irrigated oases 'delta' within Afghanistan's boundaries formed by various rivers of the Northern river basin (above centre).

3. The Sistan depression wetlands between Afghanistan and Iran (bottom left)

4. The Indus valley (bottom right)

DIGITALLY COMPRESSED MOSAIC OF AFGHANISTAN/PAKISTAN AND ENVIRONS (MAP 9)

The image with this document is a mosaic of more than 100 Landsat-5 Thematic Mapper scenes acquired within one or two years of 1990 (the original image covers a larger area, with 163 images). The image is digitally compressed by MrSID. The colour image is comprised of three spectral bands, TM 7, 4, and 2 composited as R, G, and B respectively. The mosaic is un-projected (in geodetic latitude and longitude) on the WGS84 datum/spheroid with a pixel size of two arc seconds (approximately 60 m). The image mosaic was spectrally enhanced using EarthSat's LOCAL enhancement technique. This custom approach to contrast adjustment allows the preservation of spatial information across large areas of extreme differences in brightness. Mosaic work and colour enhancement by Earth Satellite Corporation [www.earthsat.com].

River Basins	Area (Ha.)	Area (Km²)	%	Number of Settlements	%	Settled Population*	%	Population Density
Amu Darya	9069189	90692	14.04	4152	13.30	2968122	14.34	33
Harirod-Murghab	7760366	77604	12.02	2959	9.48	1722275	8.32	22
Hilmand	26234136	262341	40.62	14041	44.96	5881571	28.42	22
Kabul	7690829	76908	11.91	7039	22.54	7184974	34.72	93
Northern	7090127	70901	10.98	2969	9.51	2783033	13.45	39
Non-drainage area	6735636	67356	10.43	69	0.22	151629	0.73	2
Total	**64580283**	**645803**	**100.00**	**31229**	**100.00**	**20691604**	**100.00**	**32***

* Based on CSO 2003-04 figures. Nomadic population not included.

TABLE 8

Area and population by river basin

River Basins	Area (Km²)	Snow Cover	%	Water Bodies	%	Marshlands*	%
Amu Darya	90692	10385	71.00	62	2.51	678	16.23
Harirod-Murghab	77604	49	0.34	13	0.51	127	3.04
Hilmand	262341	73	0.50	2271	91.48	2284	54.67
Kabul	76908	4074	27.86	25	0.99	264	6.32
Northern	70901	44	0.30	33	1.33	205	4.92
Non-drainage area	67356	0	0.00	79	3.20	619	14.82
Total	**645803**	**14626**	**100.00**	**2483**	**100.02**	**4177**	**100.00**

* Permanently and seasonally inundated

TABLE 9

Snow cover, water bodies and marshlands by river basin

River Basins	Irrigated land*	%	Intermit-tently Cultivated	%	Rainfed Land **	%	Rangeland	%	Forest Cover ***	%
Amu Darya	3540	22.70	481	2.92	13156	29.13	56643	19.41	648	4.96
Harirod-Murghab	1725	11.06	1284	7.79	9371	20.75	52481	17.98	99	0.76
Hilmand	4758	30.50	9002	54.61	2344	5.19	113258	38.81	114	0.87
Kabul	3060	19.62	1781	10.80	1554	3.44	37152	12.73	12141	92.91
Northern	2378	15.25	3870	23.48	18747	41.50	32148	11.02	64	0.49
Non-drainage area	138	0.88	67	0.41	0	0.00	131	0.05	1	0.01
Total	**15598**	**100.00**	**16485**	**100.00**	**45172**	**100.00**	**291813**	**100.00**	**13067**	**100.00**

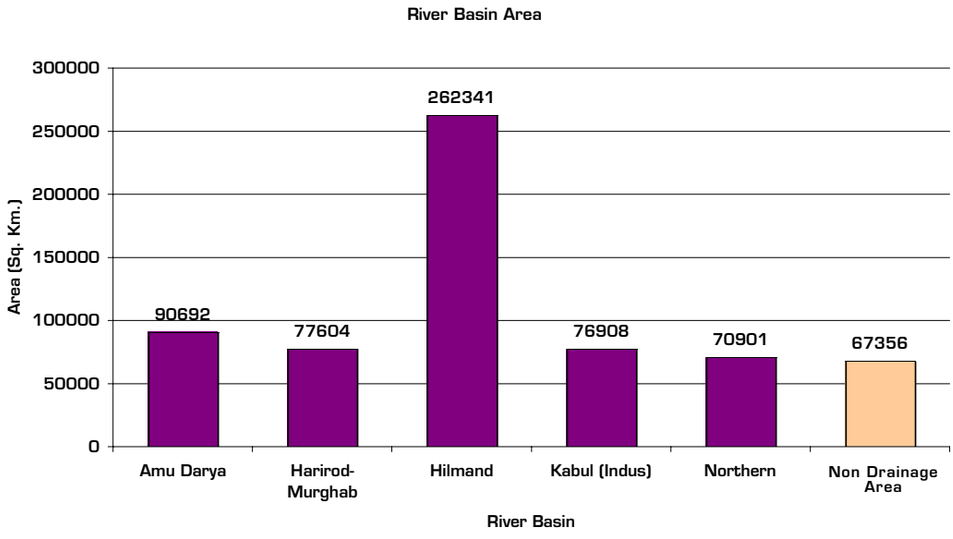
* Intensively cultivated (1 and 2 crops per year)

** Sloping and flat-laying areas

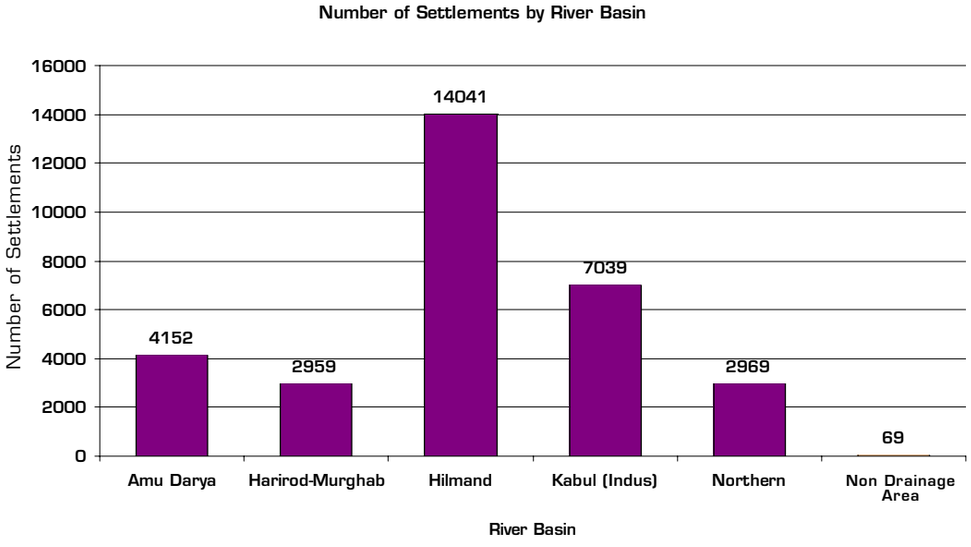
*** Degenerated, open and closed forest cover

TABLE 10

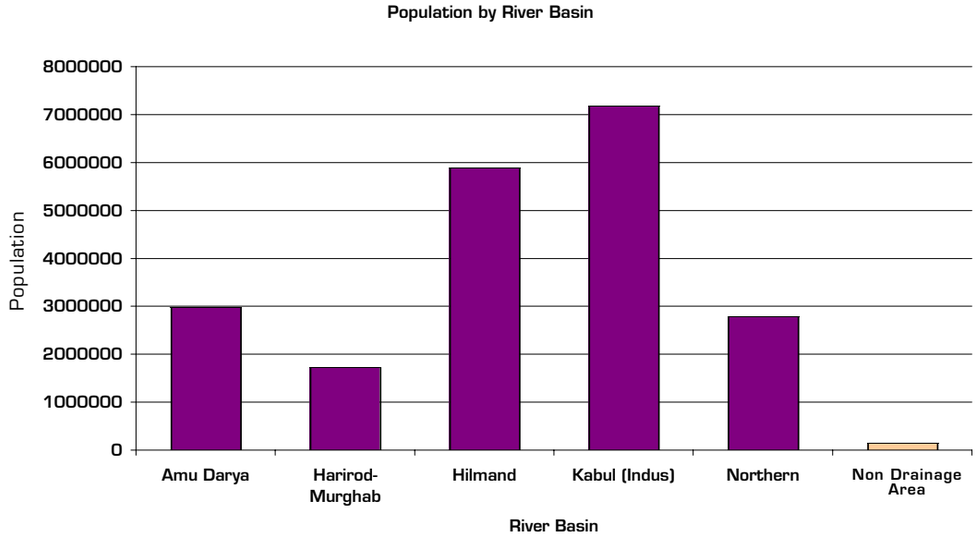
Agriculture land, rangeland and forest cover by river basin



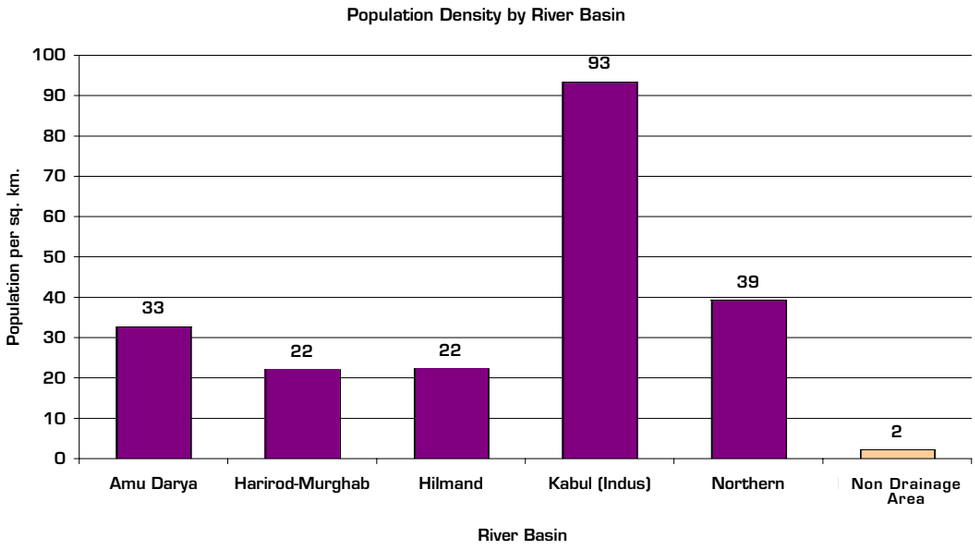
GRAPH 9
Area (sq.km) of each river basin



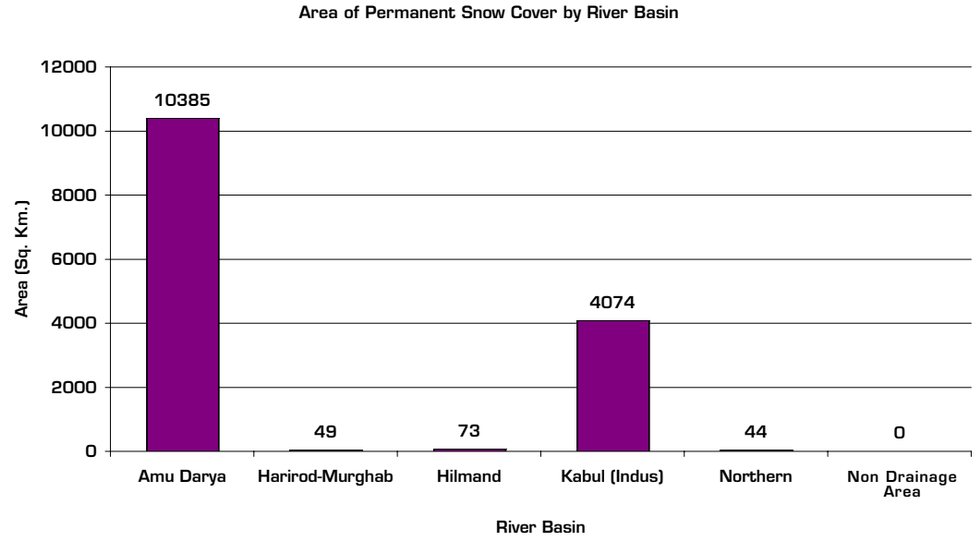
GRAPH 10
Number of settlements by river basin



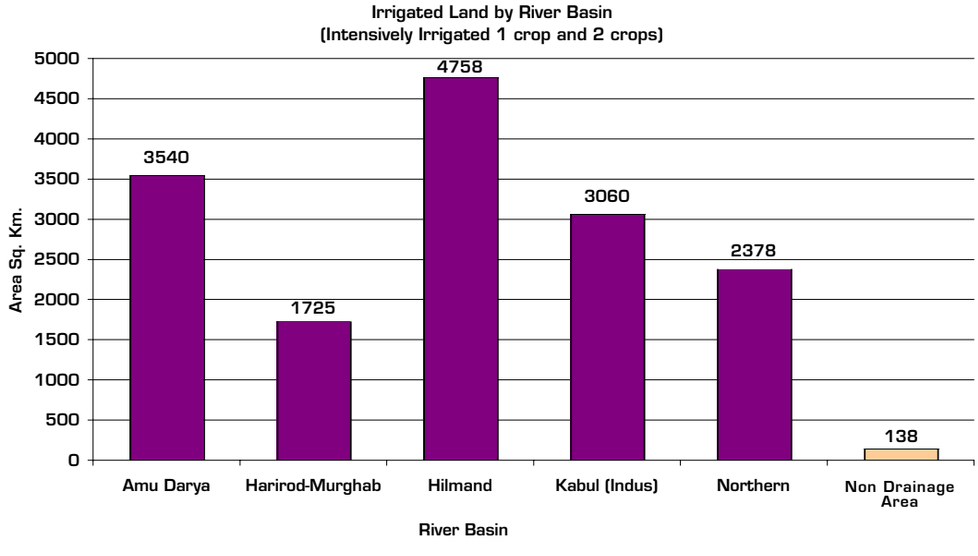
GRAPH 11
Population by river basin



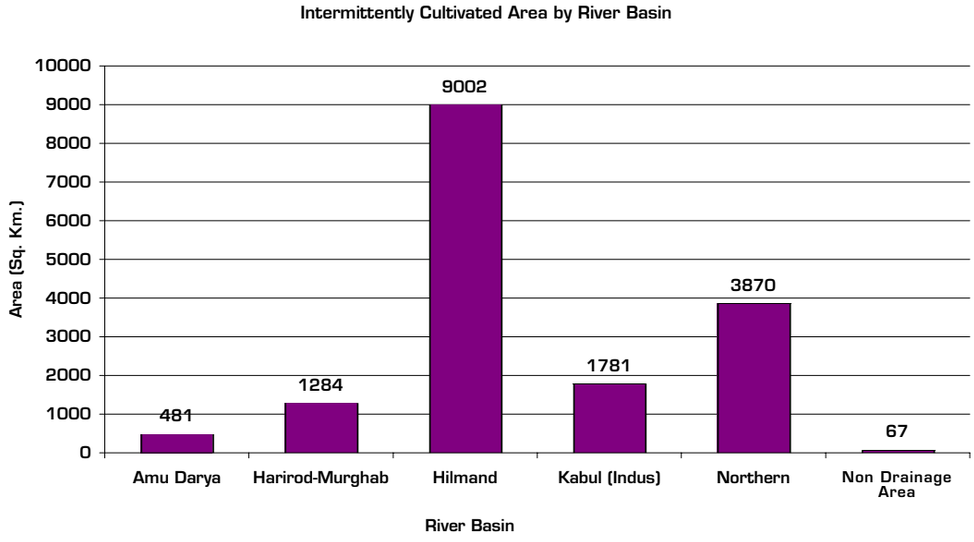
GRAPH 12
Population density by river basin



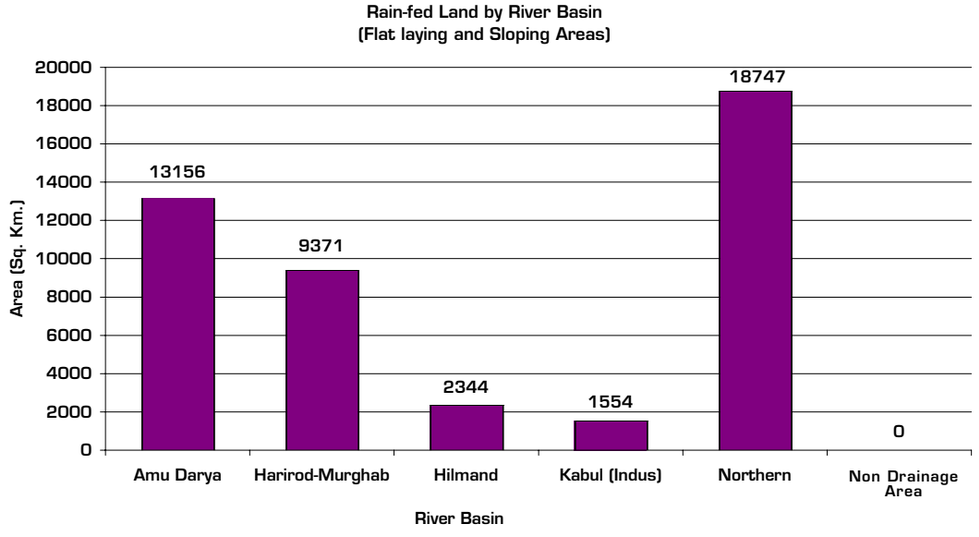
GRAPH 13
Snow cover by river basin



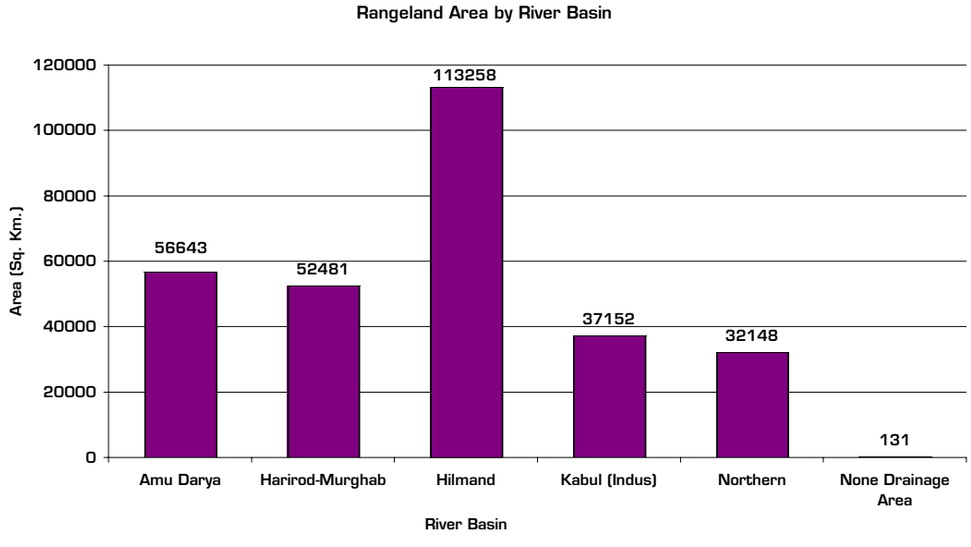
GRAPH 14
Irrigated land (intensively cultivated-one and two crops/year) by river basin



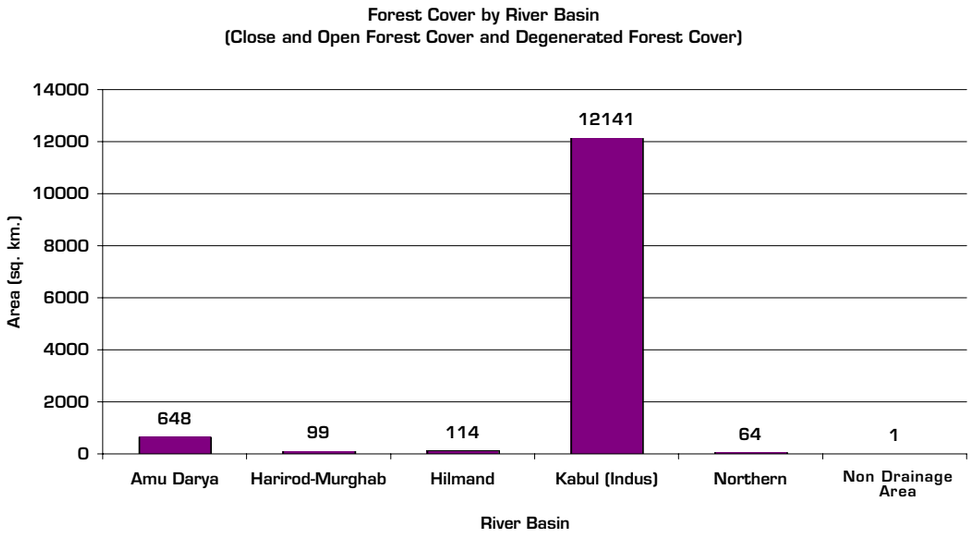
GRAPH 15
Irrigated - intermittently cultivated land by river basin



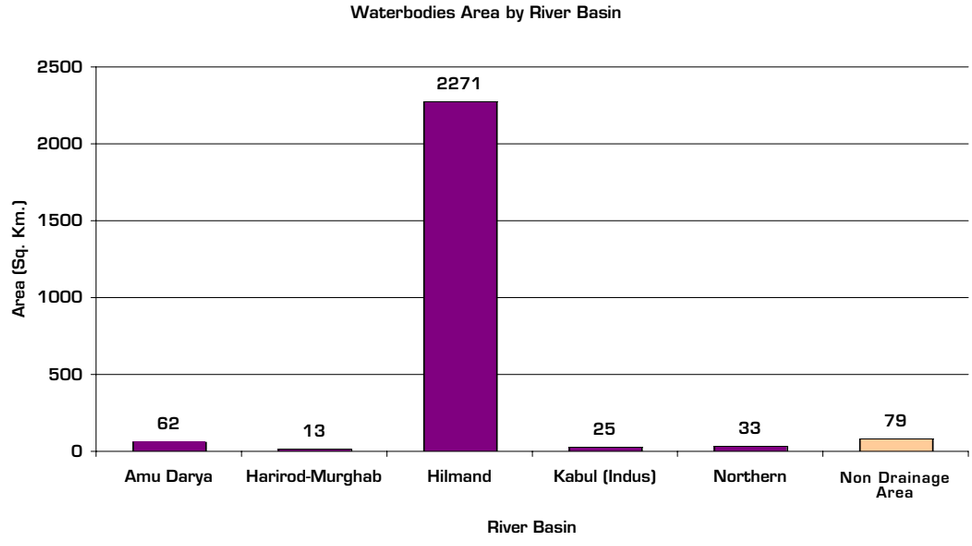
GRAPH 16
Rainfed (sloping and flat-lying areas) by river basin



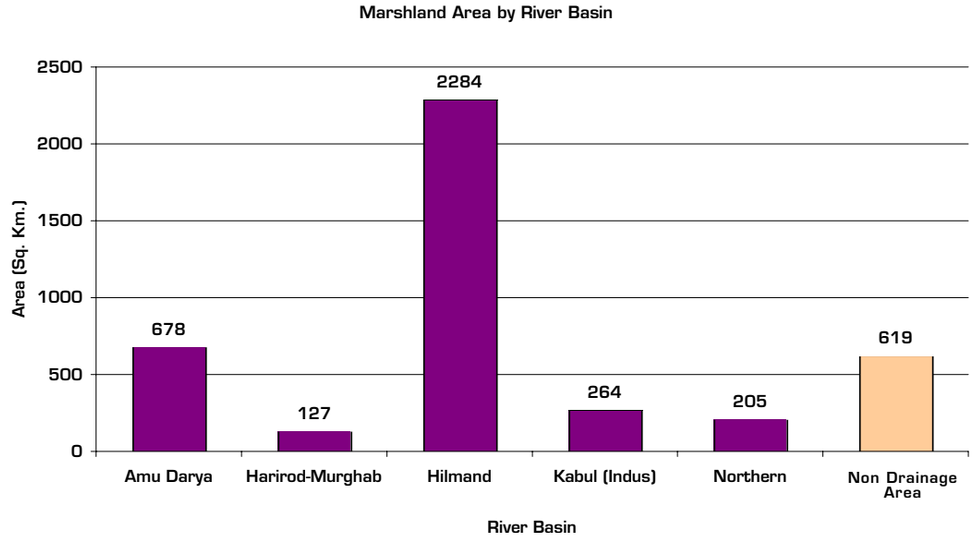
GRAPH 17
Rangeland by river basin



GRAPH 18
Forest cover (closed, open and degenerated classes) by river basin



GRAPH 19
Water bodies area by river basin



GRAPH 20
Marshland (permanently and seasonally inundated) by river basin

II. NOTE ON TRANSBOUNDARIES RIPARIAN ISSUES

Most rivers in Afghanistan – and almost the entire supply of the country's water for irrigation, drinking and maintenance of wetland ecosystems – are derived from precipitation falling within the country's own borders, and the seasonal melting of snow and glaciers in mountainous areas. All the important rivers in Afghanistan originate in the central highlands region or the northeastern mountains. The only notable exception is the Kunar River, which takes its source in the Karakoram Mountains across the border in Pakistan.

Most rivers, however, are shared with Afghanistan's neighbouring countries, with the exception of the Northern river basin[1]. Therefore, the use of water from rivers taking their source in Afghanistan has a regional dimension. Table 11 presents the riparian countries and existing treaties for the river basins of Afghanistan based on the FAO/UNEP & OSU Atlas of International Freshwater Agreements[2] and related publications. Most Afghan rivers drain into inland lakes or dry up in sandy deserts or irrigation canals. The only exception is the Kabul river basin, which flows into the Indian Ocean. Natural wetlands and lakes with high environmental importance exist in Afghanistan. Therefore, water use for irrigation has a direct impact on the maintenance of the wetlands.

The Landsat satellite image (Map 9) illustrates - among other features - vegetation, lakes and snow cover in Afghanistan and surrounding countries. The river basin boundaries (red lines) have been overlaid on the satellite image. The image illustrates the regional dimension of rivers taking their source in Afghanistan.

[1] The issue of transboundaries aquifers is not addressed in this section.
[2] FAO/UNEP and OSU, "*The Atlas of International Freshwater Agreements*", 2003. http://www.transboundarywaters.orst.edu/publications/atlas/

RIVER BASINS	RIPARIAN COUNTRIES	Area '000 (sq km)	TREATIES with AFGHANISTAN	COMMENTS
Aral Sea	Kazakhstan	424	Frontier Agreement between Afghanistan and the USSR, 13 June 1946.Treaty concerning the regime to the Soviet-Afghan frontier, 18 January 1958. Protocol between the USSR and Afghanistan concerning the joint execution of works for the integrated utilization of the water resources in the frontier section of the Amu Darya, 25 June 1958	Countries : Afghanistan, Iran
(includes both Amu Darya and Northern river basins)	Uzbekistan	383		The 1946 Agreement subjects all matters associated with water use to specific agreements between the two countries and provides for the establishment of a joint commission. Under it, Afghanistan is entitled to use up to 9 km^3 of water from the Pyandj River. Under the Treaty of 18 January 1958, the two countries commit themselves to take joint measures to prevent changes in the course of frontier rivers, streams or canals and to correct the effects of such changes and sha re the costs equally. Furthermore, they commit themselves to prevent water pollution, to exchange regular information on the level and volume of water and meteorological data and to adopt a flood warning system. Finally, the 1958 Protocol envisages the joint integrated utilization of the frontier sections of the Amu Darya [3].
	Tajikistan	136		
	Kyrgyzstan	112		
	Afghanistan	105		
	Turkmenistan	70		
	China	2		
	Pakistan	(0.2)		
Hilmand	Afghanistan	288	Terms of reference of the Hilmand River Delt a Commission and an interpretive statement relative thereto, agreed by Afghanistan and Iran, 7 September 1950	Countries : Iran, Afghanistan
	Iran	55		Principal issue : Water Quantity
	Pakistan	10		The Hilmand River Delta Commission was created and given the task to measure and divide the river flows between the two signatories .
Indus (Kabul river basin)	Pakistan	598	Treaty between the government of Afghanistan and His Britannic Majesty's Government for the establishment of neighbouring relations, 22 November 1921.	Countries: Afghanistan, Great Britain
	India	382		Principal issue : Water Quantity
	China	76		Allocation : None
	Afghanistan	72		Britain agreed to permit Afghanistan to draw water from a pipe for use of the residents of Tor Kham. Afghan istan agreed to permit British officers and tribesmen on British side of boundary to use Kabul River for navigation and to maintain existing rights of irrigation.
	Chinese control*	10		
	Indian control**	2		
	Nepal	(0.01)		
Harirod wa Murghab	Afghanistan		No	Some treaties on the Amu Darya basin may cover the Harirod-Murghab basin.
	Turkmenistan			
	Iran			
Namaksar	Afghanistan		No	Non-drainage area. Salt lake in the border area between Afghanistan and Iran.
	Iran			

* Claimed by India ** Claimed by China

TABLE 11
River basins and treaties in Afghanistan. The acreage for each river basin presented here originates from the *International River Basins of Asia*[4]. Therefore, they may slightly differ from the river basin data computed for the Atlas, due to finer boundary delineation and the recognition of non-drainage areas in the classification of water catchments.

[3] Votrin, Valery "*Transboundary Water Disputes in Central Asia: Using Indicators of Water Conflict in Identifying Water Conflict Potential*", Master's thesis Vrije Universiteit Brussel, Faculty of Medicine and Pharmacy, Master program in Human Ecology, Academic year 2002-2003. http://www.transboundarywaters.orst.edu/publications/related_research/votrin/votrin_thesis.html

[4] FAO/UNEP and OSU,, *Ibid*, 2002.

III. DESCRIPTION OF THE FIVE RIVER BASINS OF AFGHANISTAN

1. Amu Darya river basin

1.1 General

The Amu Darya basin has its headwater in the High Pamir Mountains of Afghanistan and Tajikistan. The northern branch of the Amu Darya, the Ab-i Pamir River, has its source in Zor Kul Lake, which is shared between Tajikistan and Afghanistan. The southern branch, the Wakhan River, flows out of Chakmatin Lake. The Amu Darya River (the classical Oxus River) runs for 2,400 km and receives a large number of tributaries in Central Asia, but dries up in the Turan lowlands in Turkmenistan and Uzbekistan. The main reason for this is the excessive use of the water by irrigation for cotton production. Less than 20 years ago, the river ran as far as the Aral Sea. Today's lack of inflow has been a major factor for the dramatic reduction in the surface area and volume of the Aral Sea. Huge international efforts are presently being made by the UN, the World Bank and other donors to try to halt or improve the situation on the Aral Sea. The Ministry of Water and Power (MWP) notes that "upstream activities that might counteract these efforts will most likely not be well received in the international community"[5].

The Amu Darya basin covers 14 percent of the national territory, but alone it drains more than half (57 percent) of the total annual water flow of Afghanistan. Therefore, the basin has great hydropower potential that is largely unused.
The basin comprises five watersheds:

1. Panj watershed
2. Kokcha watershed
3. Ab-i Rustaq watershed
4. Khanabad watershed
5. Kunduz watershed

1.2 Transboundaries riparian issues

The environmental problems of the Aral Sea basin are among the worst in the world. Water diversions, farming methods and industrial waste have resulted in a disappearing sea, salinization and organic and inorganic pollution. The problems of the Aral, which previously had been an internal issue of the Soviet Union, became internationalized after its collapse in 1991. On 18 February 1992, five major riparian countries - Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan - signed an agreement to coordinate policies on their transboundary waters and established the Interstate Commission for Water Management Coordination to manage, monitor and facilitate the agreement. Due to conflicts, Afghanistan, a critical partner to any future transboundary water management agreement, has so far not yet participated in any of the discussions.

Table 11 presents the diverse agreements with the Afghan Government on the Amu Darya river basin. Nanni (1996) and Vinogradov and Langford (2001)[6] note that since 'localisable' international agreements (i.e. those relating to identifiable parts of the territory of states) are subject to state succession under international law, these agreements remain in force for the newly independent Central Asian states.

According to Valery Votrin[7], until now, Afghanistan has used only about 2 km^3 of the 9 km^3 of water it is entitled to use under the treaties. Meanwhile, the Pyandj River has an annual flow of 19 km^3, and Afghanistan's fresh involvement in the process of water use would radically change the Amu Darya flow if the new Afghan government decides to develop agriculture in the north. Votrin further notes, "Given that Afghanistan's rehabilitation is unlikely without increasing its intake from the Amu Darya, Afghanistan's water demands will have to be taken into consideration when negotiating the water situation in the basin." Votrin recommends that "interstate legislative coordination for the Amu Darya water resources should be tailored to fit sustainable development of the Amu Darya Basin before proceeding with reconstruction assistance in Afghanistan." Fuchinoue, Tsukatani and Toderich recommend that a major role should be played by international donor agencies in promoting principles of regional cooperation. Uzbekistan and Turkmenistan must be convinced that Afghanistan's demands will have to be taken into account when negotiating the water situation in the basin[8].

[5] Ministry of Water and Power, "*Power Sector Master Plan Update, Draft Final Report*", report prepared by Norconsult-Norplan for MWP, October 2003.
[6] Nanni Marcella. 1996. "*The Aral Sea Basin: Legal and Institutional Issues*". Review of European Community and International Environmental Law, 5(2): 130-137 and Langford P.E., Vinogradov Sergei and Vance P.E. Langford. 2001. Managing Transboundary Resources in the Aral Sea Basin: In Search of a Solution. International Journal of Global Environmental Issues 1(3/4). In : Valery Votrin, "*Transboundary Water Disputes in Central Asia*: *Using Indicators of Water Conflict in Identifying Water Conflict Potential*", Master's thesis Vrije Universiteit Brussel, Faculty of Medicine and Pharmacy, Master program in Human Ecology, Academic year 2002-2003.
http://www.transboundarywaters.orst.edu/publications/related_research/votrin/votrin_thesis.html

[7] Votrin, Valery, *Ibid*., 2003.
http://www.transboundarywaters.orst.edu/publications/related_research/votrin/votrin_thesis.html
[8] Fuchinoue, H., T. Tsukatani, and K.N. Toderich. 2002. "*Afghanistan Revival : Irrigation on the Right and Left Banks of Amu Darya, Discussion Paper No. 554*". Institute of Economic Research, Kyoto University, Kyoto:
http://www.kier.kyoto-u.ac.jp/DPindex.html
[9] Petocz G. Ronald, Habibi Khushal., Jamil Abdul, Wassey Abdul, "*Report on the Afghan Pamir. Part 11. Biology of Marco Polo Sheep* (*Ovis ammon poli*)", FAO and Ministry of Agriculture, 1978.

1.3 Environment highlights

PAMIR-I BUZURG

More than 700 years ago, one of the world's most renowned explorers wrote of a spectacular species of wild sheep that inhabited the mountains of the 'Roof of the World.' The now-famous Marco Polo sheep (*Ovis ammon poli*) are still followed by the legendary aura of their namesake. In Afghanistan, interest in these sheep began when the former king, Mohammad Zahir Shah, visited the *Pamir-i Buzurg*, or Big Pamir, and successfully hunted a trophy ram. By royal prerogative, the king ordered that the wild sheep be protected in a single large valley of the Wakhan Corridor[9]. The Big Pamir was designated a wildlife reserve in 1978.

A recent UNEP report[10] notes that the Wakhan Corridor contains healthy populations of endangered snow leopards and other mammals, including Marco Polo sheep. However, active hunting is occurring in many regions of the country, either for sport, for meat, or in order to supply furs for sale to foreigners in Kabul. Sadly, snow leopard furs are sold openly in Kabul's main tourist shops along the famous Chicken Street.

PICTURE 39
Wall painting of a Marco Polo Sheep in Khandud. Wakhan, 2 September 2003 (N36.95, E72.32, N)

AJAR VALLEY

The Ajar Canyon, deep in Afghanistan's Hindu Kush range, was once the hunting estate of former King Mohammed Zahir. The area was declared a national wildlife reserve in 1977. The canyon is exquisite: the river has eroded its way through colourful limestone strata and formed a narrow, twined canyon one kilometre high. Part of the Ajar River, in Dara-i Jawzari, where Zahir Shah built a hunting lodge, is subterranean. The royal hunting lodge lies in ruins. The site was an important grazing area for ibex (*Capra ibex*), wild goat (*Capra aegagrus*) and urial sheep (*Ovis orientalis*). Bactrian deer (*Cervus elaphus bactrianus*) and feral yaks (*Bos grunniens*) are also present. The main carnivores are the snow leopard (*Panthera uncia*), leopard (*Panthera pardus*), lynx (*Felis lynx*), wolf (*Canis lupus*) and jackal (*Canis aureus*)[11].

TUGAI FORESTS

Tugai is an important and characteristic wetland ecosystem in the dry lands of Central Asia. The wetlands along the Amu Darya River consist of networks of braided river channels and creeks with numerous large and small islands, vast tracts of reeds (*Phragmites*) interspersed with thickets of *Tamarix* and *Salix trees*, and large stands of *Elaeagnus woodland*[12]. The main Tugai forests in Afghanistan are riparian, primarily found along the Amu Darya River in Imam Sahib in Kunduz province and Yangi Qala/Darqad district in Takhar province. Because of the rarity of this ecosystem within Afghanistan, two island chains with Tugai forests, Imam Sahib and Darqad, were proposed for protected area status in 1981 (UNEP, 2002). An important Tugai forest is also found along the Kokcha River in the Kuran wa Munjan district of Badakhshan province. These sites have significant eco-tourism potential.

PICTURE 40
Koh-i Sunduq Mountain (2,500 m) in Doab, at the doorstep of the Ajar Valley wildlife reserve. Note the red conglomerate (Devonian period); it is in these sediments that iron ore are found in Afghanistan. Kahmard district, Baghlan, 15 September 2003 (N35.26, E67.99, NW)

[10] UNEP, "*Afghanistan. Post-Conflict Environment Assessment*", 2002. www.unep.org.
[11] International Center for Mountains Development, "*Protected Areas in Afghanistan*", http://www.icimod.org.np/focus/biodiversity/afg_prot.htm
[12] D. A. Scott, "*A Directory of Wetlands in the Middle East*", Wetlands International Publication, 1995. http://www.wetlands.org/inventory&/MiddleEastDir/AFGHANISTAN.htm

1.4. Agriculture highlights

The Amu Darya basin is one of the main production areas of Afghanistan. From an agro-ecological point of view, the Amu Darya basin is divided into three major zones:

1. The irrigated valley floor in mountainous areas
2. The intensively irrigated areas of the Qataghan zone (Baghlan-Kunduz-Khanabad)
3. The northeastern rainfed area

VALLEY FLOOR IRRIGATION IN MOUNTAINOUS AREAS

Most of the Amu Darya basin is mountainous with snow/glacier-fed rivers flowing down steep gradients. A valley floor irrigation system has developed in narrow valleys, often between high cliffs with dramatic scenery (Picture 41). In low-elevation valleys, input-intensive double crop growing is practiced, while in the higher elevations, less-intensive spring crops are cultivated. The rangeland on the mountain side is grazed by farm animals and nomads during the warm summer months.

INTENSIVELY IRRIGATED AREA

The intensively irrigated land of the Qataghan zone is a major production area in Afghanistan. Two main rivers feed the area: the Kunduz and Khanabad Rivers (Picture 42), which take their sources from among the highest mountains in Afghanistan. These mountains are generally covered by snow until late summer, allowing for second crops in the lowlands (paddy, mung beans or maize) after the June wheat harvest.

NORTHEASTERN RAINFED AREA

Rainfed farming is annually practiced in the Amu Darya basin (see Picture 43) up to an approximate elevation of 2,500 m. Compared to the north and west of Afghanistan, rainfed areas in the Amu Darya basin benefit from a higher level of rainfall (see description of rainfed farming in the Northern river basin section below).

PICTURE 41
Irrigated valley floor farming near Bamyan centre. 4 June 2003 (N34.82, E67.95, SW)

PICTURE 42
View of the intensively irrigated plain planted with rice in Takhar province, near Taluqan. 6 September 2003 (N36.74, E69.34, N)

1.5 Historical highlights

The abundance of water and fertile land gave rise to early rural and urban settlements with extremely rich historical developments. In the western upper part of the river basin lies the superb large valley of Bamyan, where Buddhist devotees created, in the 3rd and 4th century AD, spectacular images of the Buddha. The name of its ancient capital, *Shar-i Gholghola* – 'City of Noise' - refers to the tumult of the massacre by Genghis Khan's army in the valley in the 13th century. The colossal Buddhas survived and continued to tower from their red pastel cliff over the exquisite valley of Bamyan until their destruction by the Taliban in March 2001.

Further downstream, Surkh Kotal, near Pul-i Khumri (Baghlan province) is the site of a great religious temple founded by Kanishka, Great King of the Kushan, where early Greco-Buddhist art developed in Afghanistan. Baghlan – 'sanctuary' - takes its name from Kanishka's temple, which flourished in the 2nd century AD.

In the lowlands, Kunduz, which lies at the centre of an intensively irrigated area in the north, is associated with two local adages reflecting its historical past and present. The first is "If you want to get rich, go to Kunduz." The soils of the irrigated area of the Qataghan province (today Baghlan, Kunduz and Takhar provinces) have a rare fertility that gave rise to dense populations before the total devastation of Ghengis Khan in 1220. The region never recovered, and when in the 19th century Murad Beg, an Uzbeg Amir in Kunduz, depopulated the mountains of Badakhshan to colonize the fertile plains, most of the population was decimated by malaria. Malaria is still endemic in these plains, giving rise to the second adage: "If you want to die, go to Kunduz."

At the turn of the last century, the 'Iron Amir' of Afghanistan, Abdur Rahman, transmigrated the Pashtuns from the south of the Hindu Kush in order to colonize the fertile, but hostile, plains in the north. In the north the Pashtuns initiated some irrigation work. However, it was later, in the 1930s, when irrigation canals started to be built in the Khanabad region, up to Pul-i Khumri. Land was available at very low prices, and resulted in two major movements of population, one from the southern part of the Hindu Kush (mostly Jalalabad and Kandahar) and another from the north, as the population fled the Russian Revolution. This resulted in rapid economic development; this region today is one of the most populated, ethnically complex and intensively cultivated areas of Afghanistan[13], perpetuating the promise of riches in Kunduz.

Because of it abundance of water and apocalyptic historical events, archaeologists believe that the vestiges of several large, ancient cities in the area remain to be found. The Greek city of *Ai Khanum* – 'Moon Lady'[14] - was discovered in 1965 by French archaeologists[15] in the northern lowlands of the Amu Darya river basin. Ai Khanum is located at the confluence of the Amu Darya and the Kokcha Rivers in Khwaja Ghar district (Dasht-i Qala) of Takhar.

PICTURE 43
Rainfed wheat fields (above the settlement) not harvested in September 2003 due to low wheat prices in the market, after a record harvest, and high labour wages. Paddy rice fields can be seen on the plain. Takhar province, 6 September 2003 (N36.74, E69.36, S)

[13] The survey of the Société Grenobloise d'Etudes et d'Applications Hydroliques (SOGREAH) in 1965-66 showed a population density of 300 to 400 inhabitant/km^2 in the Kunduz-Khanabad region!
[14] Ai Khanum was established by a Greek kingdom -perhaps ordered by Alexander the Great himself - in Bactria and its real name has yet to be revealed. The site was studied by the French Archaeological delegation as from 1964.
[15] Etienne, G., *Ibid.*, 1972

2. Northern river basin

2.1 General

The northern basin has the smallest annual flow contribution in Afghanistan, with only 2 percent of the total, but all of the water is used within the national boundaries of the country. The basin is composed of watersheds of short perimeters that take their sources in the high mountains of the central highlands (Picture 44). The rivers dry up in irrigation canals or desert sands long before reaching the Afghan border and the Amu Darya River. It should be noted that in the event of exceptional floods, the Balkhab River may at times drain water into the Turkmenistan lowlands just on the other side of the border. Historically, in the northern Turkistan plain, the river deltas were close to the Amu Darya, but with the development of traditional irrigation schemes centuries ago, these rivers no longer contribute to this river, drying up in canals 50-100 km short[16]. Therefore, a non-drainage area exists between the Northern river basin (Shirin Tagab, Sare Pul, Balkhab and Tashkurghan Rivers) and the Amu Darya River.

The Northern river basin in the north is comprised of four watersheds:

1. Khulm watershed
2. Balkhab watershed
3. Sari Pul watershed
4. Shirin Tagab watershed

2.2 Transboundaries riparian issues

Not applicable, as rivers remain within the national boundaries.

2.3 Environmental highlights

BAND-I AMIR LAKES

The Band-i Amir Lakes in the upper part (approximately 2,900 m elevation) of the Northern river basin comprise one of the world's uniquely beautiful natural landscapes. Band-i Amir consists of a chain of six 'lapis lazuli' lakes nestled between 300 m-high magenta rock walls (Picture 46). From west to east, these are: Band-i Gholaman ('Dam of the Slave'), Band-i Qambar ('The Groom's Dam'), Band-i Haibat ('Dam of Awe', Picture 45), Band-i Panir ('Dam of Cheese'), Band-i Pudina ('The Mint Dam') and Band-i Zulfiqar ('Dam of the Sword of Ali'). The two largest lakes, Haibat and Zulfiqar, cover 490 ha and 90 ha, respectively. Panir Lake, only 100 m in diameter, is the smallest. The white travertine dams (about 10 m high and 3 m thick) that separate the lakes are formed when gaseous carbon dioxide from calcium-rich spring water is driven out by bacterial or algal activity, forming the mineral deposits that create the dams. The waters of the lakes are oligotrophic and calcareous, with a pH of 7.8[17]. Their stunning deep blue colour is a result of the water's purity and high lime content. Surface water temperature reaches 14-17 °C during summer. In winter, the lakes freeze over. The site became Afghanistan's first national park in 1973. UNEP reports that Band-i Amir National Park is in good hydrological condition and has remained generally unchanged since studies conducted in 1977 by FAO and UNDP, despite the recent drought. This natural treasure has all of the characteristics of a World Heritage Site, and could become an important destination for eco-tourism if given proper management and community support[18].

PICTURE 44
Chaman Valley near the Yakaolang district centre, with a view of the Koh-i Baba Mountains in the background. Bamyan province, 3 June 2003 (N34.74, E67.00, W)

[16] J. Humlum, *Ibid.*, 1959.

[17] D. A. Scott, *Ibid.*, 1995.
[18] UNEP, *Ibid.*, 2002..

PICTURE 45
Band-i Haibat, the westernmost lake, with impressive travertine. Bamyan province, 3 June 2003 (N34.82, E67.19, W)

PICTURE 46
Band-i Haibat, Band-i Panir, Band-i Pudina and Band-i Zulfiqar. Bamyan province, 3 June 2003 (N34.84, E67.21, S)

PISTACHIO WOODLANDS

The UNEP reports that pistachio woodlands in the provinces of northern Afghanistan have been highly degraded, with 50-70 percent of the forest cover lost over the past three decades. With the loss of forests and vegetation, overgrazing and rainfed cultivation (Picture 47), soils are being exposed to serious erosion from wind and rain. Traditionally, the forests were managed locally, and pistachios used to provide a significant income to local people. As early as the 17th century, Mountstuart Elphinstone wrote about traditional communal pistachio forest management and observed that pistachio was one of the main exports of Afghanistan[19].

PASTURELAND

Numerous grazing lands exist between irrigated oases and on the foothills of the northern plains, including the Dasth-i Laili pasture (Picture 48). These lowland pastures are essential to the northern livestock economy, as they provide grasses in winter and spring when there is little animal feed available. A case study[20] showed that Dasht-i Laili pastureland is being extensively encroached upon for rainfed wheat cultivation. This reduces grazing areas for livestock and increases water and wind erosion (Picture 49). In the area of Dasht-i Laili, grazing land encroachment is endangering the quality of Ankhoi salt lakes.

According to a Russian schematic map[21] of underground water composition for northern Afghanistan, underground water in the northern Turkistan plain is saline and cannot be used for irrigation purposes. Indeed, in most of the plain, salinity varies between 3 and 35 g/litre. However, along and near the main river beds, the salinity is lower, varying between 1 and 3 g/litre.

PICTURE 47
Encroachment of rainfed farming in pistachio forest has taken place for several decades. Ab-Kamari district, Badghis, 22 may 2003 (N34.94, E62.81, SW).

[19] Elphinstone, Montstuart, "*An Account of the Kingdom of Caubul*" Indus. Publ., Karachi, first public. 1815, reprint 1992.

[20] Raphy Favre, "*Grazing Land Encroachment. Joint Helicopter Mission to Dasth-i Laili. 25-27 March 2003*", Kabul 23 July 2003.

[21] Anonyme,"*Underground Water Composition in Northern Afghanistan*", (in Russian), 1968.

PICTURE 48
View of pastureland in Dasht-i Laili. Jawzjan, 25 March 2003 (N36.46, E65.21, SW)

PICTURE 49
Aerial view of pastureland encroached by rainfed cultivation in Dasth-i Laili. Note the sand dunes created by wind erosions, which are the first signs of desertification of the northern pasturelands. After ploughing, the denuded sandy/loamy soils of Dasht-i Laili are exposed to wind erosion. 25 March 2003 (N36.53, E65.54, N)

2.4 Agriculture highlights

From an agro-ecological point of view, the northern basin is divided into two major zones:

1. The northern rainfed area
2. The northern irrigated oases

NORTHERN RAINFED AREA

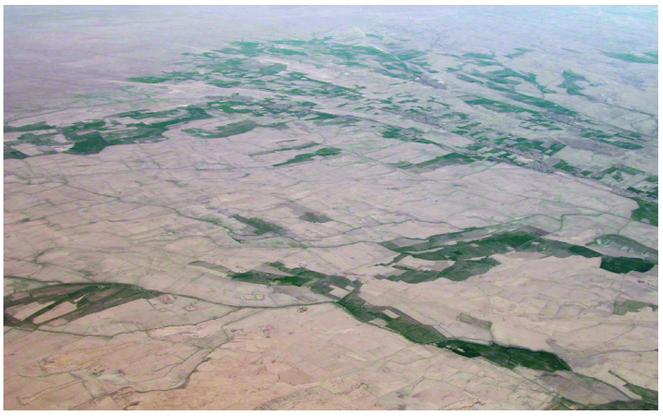
Much of the rainfed land is located in the Northern river basin. A vast area of rolling hills carries huge layers of Quaternary loess deposited along the entire northern mountain slopes, from the Hari Rod River in the northwest corner of Afghanistan (western basin) to the foothills of Badakhshan (Amu Darya basin). The loess are fine soil particles that are transported every year during the summer period by the northern wind (*Shamal*) from the Central Asian plains and placed at the foot of the mountains, where wind speed is frustrated by the relief (Pictures 50 and 51). The abrasion of the wind and its deposits shape the relief into smooth undulating hills, on which even rain cannot manage to cut sharp edges.

These loess soils have an excellent permeability and can absorb large quantities of water. The water absorbed is slowly released to feed the rivers and to gently irrigate the fields below. In addition, the huge layers of loess (several dozens of metres thick in places) store water and make the growing of plants with deep root systems possible. Pistachio (*Pistacia vera*) forests grow in these hills and are situated in elevations between 600 and 1400 m. They once covered almost all of the entire lower hills. In higher elevations, juniper (*Juniperus seravtschanica*) trees are replacing the pistachio. Wild almonds (*Amygdalus communis*) are also growing at various elevations in similar areas. Figure 9 shows the distribution of pistachio and juniper growing on loess soils in northern Afghanistan. Rainfed crops (particularly wheat, barley, flax, sesame, cumin and the renowned Afghan melon *kharbuza* and watermelon *tarbuza*) are widely cultivated on these hills.

PICTURES 50 AND 51
On the left, loess soil profile. The frame on the left of the picture is one metre high. The first layer, richer in organic matter, constitutes of approximately 60-70 cm (dotted line). Then, the profile is homogenous down to deep layers of the soil (several metres). This type of soil profile is consistent throughout the northern loess hills in Afghanistan. Kushk-i Kuna district, Badghis province, 23 May 2003 (N34.88, E62.48, S). On the right, view of rainfed wheat (below) and land ploughed for melon/watermelon intercropped with sesame planting in early summer (above). Sholgara district, Balkh province, 14 May 2003

NORTHERN IRRIGATED OASES

The rivers (Khulm, Balkh-Ab, Ab-i Safid and Shirin Tagab) that take their source from northern Afghanistan above the loess hills are short in distance. Their flows follow seasonal patterns. When these rivers reach the open lowland of the Turkistan plain (which is a prolongation of the Central Asian plain south of the Amu Darya), they form a delta and end their course in irrigation canals or desert sands (Picture 54). These rivers end long before reaching the Afghan border or the Amu Darya River (see Picture 52). In the oasis system, a mechanism of land rotation has developed in the past to take advantage of the availability of land and to maintain its fertility. The land in rotation is called *zamin-i paikaly*. Today, with the use of fertilizers (which allow yearly cultivation of the same soil) and the whims of local commanders who control water distribution, zamin-i paikaly exists solely at the tail end of the irrigation canals, when and if water is available (see Picture 53)[22]. The 'intermittently irrigated land' of the FAO Landcover Atlas (1993) corresponds to the traditional irrigated zamin-i paikaly.



PICTURE 53
View of the lowest section of the Khulm irrigation delta, where land is intermittently cultivated. Different sections of the land will be irrigated in the following year (2004). Khulm district, Balkh province, 25 March 2003 (N36.75, E67.67, NE)

PICTURE 52
Aerial view of Khulm oasis. The river opens into the Turkistan desert and forms an irrigated delta. The upper part is irrigated every year and a large variety of fruits are planted (particularly pomegranate, almond, apricot and fig trees) while in the lowest part, mainly cereal is cultivated and land is rotated ('*zamin-i paikali*'). Khulm district, Balkh province, 25 March 2003 (N36.63, E67.71, N)

[22] On the issue of irrigation water access in northern Afghanistan, see Hector Maletta and Raphy Favre, "*Agriculture and Food Production in Post-war Afghanistan. A Report of the Winter Agriculture Survey* 2002-2003", FAO, Kabul, August 2003.

PICTURE 54
In Sheberghan, the irrigated land borders the sand dunes of the Turkistan desert. Note the Khwaja Du Koh water channel bordering the sand dunes. Part of Sheberghan town is visible on the right side of the picture. Jawzjan province, 3 March 2003 (N36.65, E65.70, N)

PICTURE 55
With the collapse of traditional water management regulation during the past 25 years of war, farmers at the end of the irrigation structures face insecurity over water. The land is used as pastureland for small stocks. As a result, large tracks of the Turkistan plain are no longer cultivated. Note the mound in the background of the picture (see Historical highlights section). Dawlatabad district, Balkh province, 13 May 2003 (N36.97, E66.76, N)

PICTURES 56 AND 57
In locations far from the water source of the Turkistan desert, farmers have developed practices aimed at storing water whenever the river flow is sufficient to reach the far location in the desert. This normally occurs at the peak of the river flow in April-June, as snow is fast melting in high elevations and rainfalls are more common. On the left, farmers are digging ditches to store water for melon and watermelon cultivation. Jawzjan, Khwaja Du Koh district, 14 May 2003 (N36.83, E65.65, E). On the right, an almond orchard planted in deep trenches in Dawlatabad district. Balkh province, 13 May 2003 (N36.90, E66.77, NE)

2.5 Historical highlights

South of the Amu Darya, extremely rich concentrations of Mesolithic and Neolithic settlements dating as far back as 10,000 BC have been found. Travelling in the Turkistan plain, one notes mounds that seem artificial and alien to the surrounding flat area. Neolithic men built monumental palaces and complex circular temples. The Neolithic revolution took place in northern Afghanistan about 9,000 years ago, which indicates that northern Afghanistan may indeed have been one of the earliest centres for the domestication of plants and animals[23].

Prosperity continued throughout the centuries, and Balkh in particular is a town of prodigious antiquity. Here Zoroaster preached sometime between 1,000 and 600 BC and Alexander the Great chose it as his base between 329 and 327 BC, after which the city remained the capital of the Greco-Bactrian kingdoms. The French archaeology mission in Afghanistan (DAFA[24]) which worked in northern Afghanistan as early as the 1920s, had searched in vain for the foundation of the city captured and enlarged by Alexander the Great. Despairing of hope, the site was thought to be a mythical city. Then, in May 2002, a French archaeologist by chance made an important discovery. The foundation of a legendary city was found in a nearby village[25]. Buddhism flourished under the Kushan dynasty in the early centuries AD. The Arabs, the bearers of Islam, called Balkh 'The Mother of Towns', so impressed were they by its importance and magnificence. The finest Islamic art and poetry flourished in Balkh before its glory period closed in 1220, when the fearsome Genghis Khan and his army rode through and left the plain utterly desolated. It recovered slightly during the Teimorid period, but never to its former glory.

The small oases of the Turkistan plain - irrigated by several short parallel rivers and separated by large stretches of deserts - have hosted the development of fiercely independent Uzbeq Khanates. Maimana, Gurziwan, Andkhoi, Shiberghan, Saripul, Aqcha, Balkh and Khulm were the main Khanates of the Turkistan plain. These Khanates varied in size and form from year to year and from ruler to ruler, mirroring the personal charisma of each Khan and competing for supremacy. Maimana, the last of the Uzbeq Khanates of Afghan Turkistan, submitted to the Afghan King Abder Rahman in April 1884.

[23] Nancy Hatch Dupree,"*An Historical Guide to Afghanistan*", Afghan Air Authority and Tourist Organization, Kabul, 1977.
[24] Délégation Archéologique Française en Afghanistan.
[25] Afghanistan Info, "*Importantes découvertes Archéologiques*", No 51, Sept. 2002.

3. Harirod-Murghab river basin

3.1 General

The Harirod-Murghab river basin contributes to a tiny 4 percent of the total annual flow in Afghanistan. The main rivers are the Hari Rod, which takes its source from the western slope of the Koh-i Baba Mountains in the central highlands, and the Murghab, which comes from the Tir Band-i Mountains in Turkistan. However, only part of the water from both rivers remains within the national boundaries of the country. Indeed, the Hari Rod and Murghab dry up in the irrigation canals of the Mary[26] and Tejen oases of the Garagum desert in Turkmenistan. A water channel, the Garagum channel, linking the oases to the Amu Darya River, was constructed across more than a thousand kilometres of desert in Turkmenistan to add water in the Mery and Tejen oases (from the Amu Darya River)[27].

Along the Hari Rod River, a 547 million m^3-capacity dam, the Bandi Salma, was planned near Cheshti Sharif district centre in Herat province. The project was designed by the Indian group WAPCOS, and construction at the dam site began in 1980 to supply both a further 25,500 hectares of land from the Hari Rod River as well as hydropower. However, the construction of the Bandi Salma dam was interrupted at its initial stage. Excavation of the dam foundation had reached a relatively advanced stage, but foundation cleaning was not completed. The diversion tunnel was completed (Picture 58) and a trench excavated at approximately mid-dam height, seemingly intended for intake and draw-off structures (Picture 59)

The Harirod-Murghab basin includes four main watersheds:

1. Bala Murghab watershed
2. Kushk wa Kashan Rod watershed
3. Upper Hari Rod watershed
4. Lower Hari Rod watershed

3.2 Transboundaries riparian issues

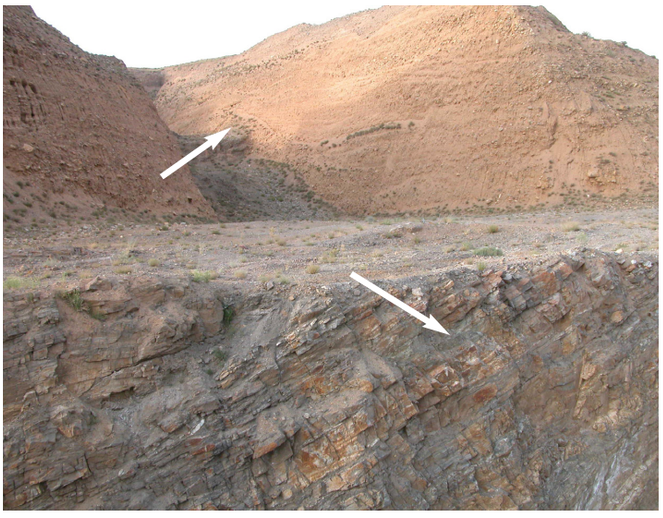
No treaties have been signed on the Harirod and Murghab watersheds[28]. However, some treaties on the Amu Darya basin may cover the Harirod-Murghab basin.

3.3 Environmental highlights

PISTACHIO AND JUNIPER FORESTS

The northern part of the river basin is a main centre of biodiversity for pistachio trees. See description under the Northern river basin section.

Juniper (*Juniperus seravtschanica*) forests once grew in the northern belt above the pistachio woods, as illustrated in Figure 9. Now only pockets of isolated trees remain, as juniper wood is highly valued as fuel. In Kotal-i Sabzac pass, which links Badghis province to Herat, a beautiful juniper forest remains and can be seen along the road (Picture 61).



PICTURES 58 AND 58bis
Diversion tunnel (right) and excavation on Salma dam (arrows) near Cheshti Sharif. Herat, 31 May 2003. (Picture 55: N34.36, E64.11, NW; Picture 56: N34.36, E64.11, NE)

[26] Historically called Merv.
[27] An estimated 1 million ha are irrigated from the canal.
[28] FAO/UNEP and OSU,, *Ibid*, 2002.
[29] J. Humlum, "*La géographie de l'Afghanistan*", 1959.

PICTURE 59
View of Sat-i Dosti dam or "friendship dam" between Iran and Turkmenistan currently under construction on the Hari Rod River nea the iranian city of Sarakhs. Khorassan, Iran, 2004.

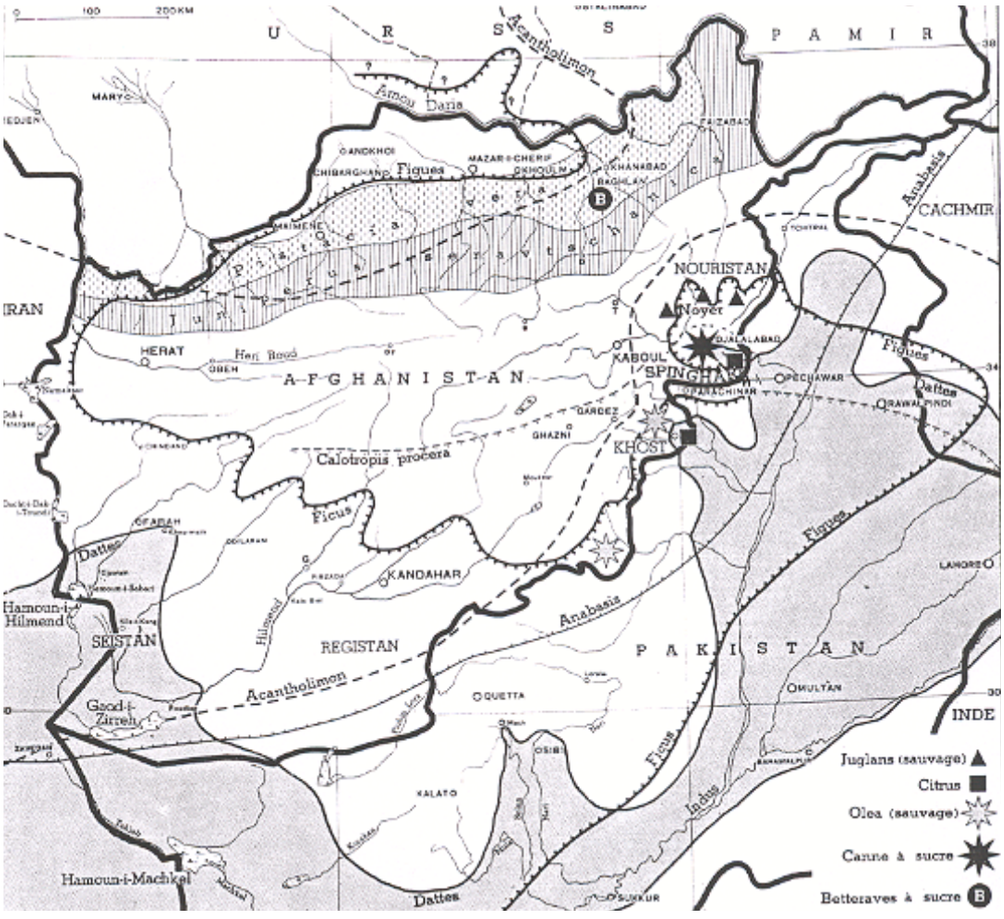


FIGURE 9
Map on vegetation in Afghanistan [29]. Note the pistachio (*Pista vera*) and Juniper (*Juniperus seravtschanica*) belt in northern Afghanistan.

PICTURE 60
View of rainfed cultivated hills in Badghis. According to local authorities, these hills were covered with pistachio trees decades ago. Ab-Kamari district, Badghis province, 22 May 2003 (N34.91; E62.71, NE)

3.4 Agriculture highlights

From an agro-ecological point of view the western basin is divided into three major zones:

1. The intensively irrigated area of Herat lowland
2. The irrigated valley floor in mountainous areas
3. The western rainfed area

INTENSIVELY IRRIGATED AREA OF HERAT LOWLANDS

Irrigated production in the Harirod-Murghab basin is concentrated along the Hari Rod River in Herat (Picture 62). The traditional irrigation management systems along the Hari Rod River in Herat, which are still effective today, were codified during the Teimourid period of the 15th century. The irrigated perimeter of Herat allows one crop per year; however, a second crop (mainly mung beans, maize and paddy rice) may be cultivated at the head of irrigation structures, depending on water availability in early summer. In Herat, most of the paddy rice is sown directly, as opposed to the Qataghan zone (in the northeast) where it is transplanted, which results in a lower average yield (Picture 114)[30].

VALLEY FLOOR IRRIGATION IN MOUNTAINOUS AREAS

Most of the western basin is mountainous, with rain/snow-fed rivers flowing in narrow valleys. Valley floor irrigation systems of various intensities have developed mostly along the Murghab (Picture 107), Ghormach, Hari Rod and Kawgan Rod Rivers. In Ghor, a number of valley systems in high elevations (above 2,600 m) are not cultivated, but kept as summer pastureland for the Aimaq semi-nomadic camps. Simple canals have been built for the water to irrigate the pasture for the whole valleys. However, there is an increased pressure for this land to be transformed into irrigated fields for cereal production (Picture 63). Crop planting in the central highlands is usually later than in other regions due to higher elevations. Up to an elevation of approximately 2,500 m, winter cereal is mostly cultivated. Spring cereals dominate above this height.

PICTURE 62
Intensively irrigated plain in the district of Pashtun Zargun. Note the meandering Hari Rod River below. Herat province, 31 May 2003 (N34.31, E62.63, SW)

PICTURE 63
Valley floor grassland in Ghor province. In the foreground, part of the grassland is being cultivated for cereal production. Shaharak, Ghor, 2 June 2003 (N34.27, E64.39, S)

[30] Raphy Favre, "*MAAH/FAO National Crop Output Assessment - Second Phase. Second Crops in Lowlands and First Crop in Highlands. 27th August to 26th September* ", FAO, Kabul, 23 October, 2003.

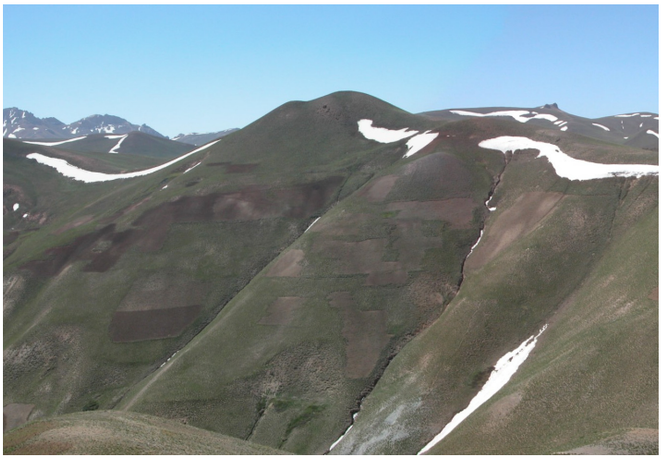
WESTERN RAINFED AREA

Rainfed farming is practiced in the western basin up to an approximate elevation of 3,200 m. In Herat province in particular, mechanized rainfed cultivation has encroached on fragile, low-slope-gradient pastureland primarily for black cumin (*zira*), wheat and melon crops (Picture 64).

In high elevations, rainfed farming production is very low and depends on late rainfalls, in good years, in the central highlands in late spring and early summer (Picture 65).

Rainfed alfalfa is cultivated in the Lal district of Ghor province. Thanks to its deep rooting system, rainfed alfalfa is more productive than indigenous annual rangeland grass species, as it reportedly produces two cuts in a normal year (see Pictures 27 and 28). Alfalfa remains established in the land for a minimum of 15-20 years. Fresh leaves are reportedly consumed in soup or salads in the spring.

PICTURE 64
Strip ploughing (tractor) for melon/watermelon cultivation in Kushk-i Kuna district, Herat province, 24 May 2003 (N34.89, E62.16, W)



PICTURE 65
Rainfed farming on steep slopes in high elevations. Here, at 3,200 m at Kotal-i Sat bark on the border between Bamyan and Ghor provinces. Lal wa Sarjangal district, 3 June 2003 (N34.52, E66.71, SW)

3.5 Historical highlights

The city of Herat, supported by its fertile irrigated plains, is one of the richest cultural centres in the region, reflecting the cultures of Iran, Central Asia and Afghanistan. Herat contains vestiges of a brilliant past, when kings and queens entertained other sovereigns from China's border to the Tigris River, and attention was lavished on the city. Much of the evidence of this period can still be seen today.

In the high mountains east of Herat, the Ghorid dynasty (1148-1202) emerged from local chieftains. The location of Firuzkoh, the great capital of the Ghorid Dynasty, which once ruled from India to Iraq and from Kashgar in China to the Persian Gulf, still remains an enigma. One clan of the local Aimaq population still bears the name of Firuzkohi. The astonishing discovery of the fantastic Minar-i Jam monument was first announced in 1943 by the governor of Herat. The purpose of this 65 m-high minaret is still unknown, but it was built in a gorge at the confluence of the powerful Hari Rod and its tributary, the Jam River (Picture 66). For some 800 years it has defied the powerful forces of hydrology. We learn from that period that the area was covered with timber, which was used to fuel the prized *Ahangaran* (literally, 'blacksmiths') and arms factories, used by the Ghorid warriors [31]. Today the whole region is barren.

PICTURE 66
Minar-i Jam, Ghor province. Note the Jam and Hari Rod Rivers meeting at the feet of the Minar. 1 June 2003 (N34.39, E64.52, N)

[31] Nancy Hatch Dupree, *Ibid.*, 2002

4. Hilmand river basin

4.1 General

The Hilmand basin – Hilmand means 'abundant water' in old Persian - is the largest in Afghanistan, covering almost half (43 percent) of the national territory. Despite its name, it drains comparatively a smaller proportion of the total annual flow, with an 11 percent contribution. The Hilmand basin covers the southern half of the country, draining water from the Sia Koh Mountains in Herat province to the eastern mountains in Gardez province and the Parwan Mountains northwest of Kabul, and finally to the unique Sistan depression between Iran and Afghanistan. The Sistan depression is a large complex of shallow wetlands, lakes and lagoons that are divided into four separate sheets of water. They are locally known as Hamun-i Saberi, the deepest, to the north; Hamun-i Puzak to the northeast and in Afghan territory; Hamun-i Shapour to the south; and a central pool known as Hamun-i Hilmand. These separate sheets of Hamun water become one at flood times and can reach an area of about 3,200 sq. km when the level of the lake rises. The surplus water flows out at the southern end of the lake, through the channel of Shileh Shallaq into the depression of Gaod-i Zirreh inside Afghanistan.

The Sistan-Hilmand basin includes fifteen watersheds

1. Adraskan Rod watershed
2. Farah Rod watershed
3. Khuspas Rod watershed
4. Khash Rod watershed
5. Upper Hilmand watershed (above the Kajaki dam)
6. Middle Hilmand watershed
7. Lower Hilmand watershed (intensively irrigated perimeters below the Kajaki dam)
8. Sistan-Hilmand watershed (below the intensively irrigated perimeter in the Sistan zone)
9. Chagay watershed
10. Upper Arghandab watershed (above the Dahla dam)
11. Lower Arghandab watershed (intensively irrigated perimeter below the Argandab dam)
12. Tarnac Rod watershed
13. Arghistan Rod watershed
14. Sardih wa Ghazni Rod watershed
15. Dasht-i Nawur watershed

4.2 Transboundaries riparian issues

The environmental problems in the Sistan depression wetlands are similar to those of the Aral Sea in the Amu Darya river basin. The water of the Hilmand river basin was the scene of disputes between Afghanistan and Iran over the past century. Piruz (1995)[32] describes in detail the evolution of the water dispute in the Hilmand basin which, according to the author, has yet to be resolved despite several concerted efforts over the past 120 years. One of the more recent episodes occurred in 2001, when Iran wrote to the UN Secretary General, Kofi Annan, alleging that the Taliban had blocked the Hilmand River, causing some 140,000 ha of land in the neighbouring regions of Iran to dry up. However, a UN investigation found drought to be the main cause, as the Hilmand River was flowing at only 2 percent of its annual average.

[32] Pirouz Mojtahed-Zadeh, Ph.D., "*Lake Hamun, a Disaster in the Making. Hydropolitics of Hirmand and Hamun*", University of London, UNEP, March 1995.

According to Piruz (1995), the actual problem began when a British boundary arbitration officer, General F. Goldsmid, decided in 1872 to put the Iran-Afghanistan boundary in Sistan on the main branch of the Hilmand in the delta region, without making any arrangement or recommendation for water division between the two sides. Disputes occurred between the two countries when the river changed its course in the border area in 1896. British arbitration was sought, and Colonel Henry McMahon was assigned in 1903 to demarcate new boundaries. Having already decided to divide the Hilmand water at the border area equally between the two sides in 1903-4, for unknown reasons Colonel McMahon then changed his decision in 1905 and allocated two-thirds of the Hilmand water in the delta to Afghanistan and one-third to the Iranian Sistan, which is much more fertile and a great deal more populous than the corresponding Afghan border district of Nimroz. The Iranians, however, found McMahon's unequal division unacceptable, and refused to ratify it.

In the 1930s, as friendly relations developed between the new and centralized government of Reza Shah Pahlavi in Iran and the independent government of Mohammad Nader Shah in Afghanistan, fresh attempts for the settlement of Hilmand water disputes resulted in the conclusion of the 1939 treaty. However, Afghans could not agree amongst themselves and refused to ratify the treaty, reviving the dispute.

The construction of the Kajaki reservoir and Boghra diversion in Afghanistan in 1949 caused great uproar among Iranians. The two countries eventually sent representatives to Washington in 1959 for negotiation through American mediation. These negotiations failed to yield results, and the disputes continued until 1973, when the two countries prepared a draft agreement regulating their respective water shares of the delta region. Once again the two countries failed to ratify the treaty. According to the abortive 1973 treaty, Iran was to receive 22 m^3/s of Hilmand water in the delta region as its share, and was to purchase an additional 4 m^3/s from the Afghans, summing up to 26 m^3/s. Although this amount per second of Hilmand water for Sistan was even less than the amount of one-third determined by Colonel McMahon's arbitration award of 1905, the Afghans declined to accept it. The quota, nevertheless, became the cornerstone of their argument at any negotiation, and thereafter Iran constructed the Shahname, a 0.7 million m^3 water reservoir. The Iranian monarchy was overthrown by the Islamic Revolution of February 1979. At the same time, the former Soviet Union came to occupy Afghanistan, resulting in civil war and preventing the Afghans from making any fresh efforts for the settlement of Hilmand water disputes.

PICTURE 67
Kajaki dam. Hilmand province. 15 January 2003
(N32.32, E65.12, SE)

4.3 Environmental highlights

SISTAN DEPRESSION WETLANDS

The Sistan depression is important for agricultural production and fishing, but more importantly it is an internationally recognized site for wetland fauna. Iran had it declared a Ramsar site in 1975[33]. It is a centre of migration for Central Asian birds. Hamoun-i-Puzak was one of the most important wetlands in Afghanistan for migrating waterfowl: up to half a million waterfowl were counted in the seventies, representing roughly 150 species of migrating and non-migrating birds. Among them were the Dalmatian pelican (*Pelecanus crispus*) and marbled teal (*Marmaronetta angustirostris*). The diversity of bird life in the wetlands was almost matched by nearly 140 species of fish that supported bird, mammal and human populations[34]. Eight globally threatened waterfowl species spent their winters in the lakes.

Since 1998, the water inflow to Sistan has dramatically reduced, causing desiccation of the wetlands. Maps 3, 4 and 5 illustrate the low level of replenishment of the Sistan depression wetlands despite good rainfall in 2003[35]. Some replenishment is visible following rain and snow fall in early December 2003. However, the wetlands appeared completely dry by the end of September 2003. The wetlands had earlier experienced years of desiccation. UNEP notes that the Boundary Commission found the lakes and the lower Hilmand dry in 1902 and witnessed their refilling in 1903. In the past, it has shown a strong capacity to cope with natural climatic changes, and recovered when the water flow was back to normal. It is an open question, however, whether the additional stress caused by extensive water withdrawals for irrigation, evaporation from reservoirs or manipulation of the seasonal flow regime from irrigation (both in Iran as well as Afghanistan) and hydropower production has now overtopped the recovery capacity of the wetlands. The Post-Conflict Environmental Assessment (UNEP, 2003) underlines the need for an improved water management system to safeguard the protection and sustainable use of the wetlands.

Observers have compared the geographical catastrophe taking place in the Sistan lakes and lagoons as a repetition of the major environmental disaster of the Aral Sea in another corner of Central Asia. Historical documents show that the wetlands once covered a much larger area: the lakes were described at the turn of the twentieth century as covering some 150,000 sq. miles[36].

AB-I ISTADA

Ab-i Istada is a large saline lake located at about 2,000 m elevation in the south corner of Ghazni province (Nawa district). Ab-i Istada drains the water from the Ghazni, Sardeh and Nahara Rod and it overflows into the Arghistan River - itself a tributary of the Arghandab River - in years with good rainfall. The site is remarkable for the migratory greater flamingos arriving at high-water level in spring (late March or April), breeding in summer on the islands and departing when water level is low in September or early October. More than 100 other bird species are also present. The site was once a critical stopover point for the central population of Siberian cranes, which bred in the Russian tundra and wintered in north-central India. The last reliable report of a Siberian crane at Ab-i Istada was of one shot dead by a hunter in 1986. Local residents reported that no flamingos had bred successfully since 1999 [37].

DASHT-I NAWUR

Dasht-i Nawur is an extensive high-altitude plain in southeast Afghanistan (see Picture 127). Some 600 km^2 in area, the plain lies at about 3,350 m elevation, with surrounding peaks, holding ibex and urial, rising to 4,800 m. A narrow brackish lake, more than 10 km long, occurs in the plain. Dasht-i Nawur serves as an important breeding and staging ground for a large number of migratory waterfowl. There are records of breeding populations of avocets (*Recurvirosta avocetta*), redshanks (*Tringa totanus*), greater sandplovers (*Charadrius leschenaultia*), and common terns (*Sterna hirundo*). The area is also a unique, high-elevation breeding ground for greater flamingo. In contrast with Ab-i Istada, the local population in Dasht-i Nawur does not hunt flamingos. Rather, they revere them, as they associate the pink colour of the plumage with the blood of the martyred Imam Hussain. The villagers of Qarya said that they had seen one flamingo in 2002 and eight in 2001, but that no flamingos had successfully bred since then [38].

[33] Ramsar, "*Convention on Wetlands of International Importance Especially as Waterfowl Habitats*", Ramsar List of Wetlands of International Importance, Gland, Switzerland, 2002.
[34] UNEP, *Ibid.*, 2002.
[35] For an overview of the climatic and agriculture situation in 2003, see FAO/WFP, "*Food and Crops Supply Assessment*", 13 August 2003.
[36] Pirouz Mojtahed-Zadeh, Ph.D., "*Lake Hamun, a Disaster in the Making. Hydropolitics of Hirmand and Hamun*", University of London, UNEP, March 1995.
[37] UNEP, *Ibid.*, 2002.
[38] UNEP, *Ibid.*, 2002.

4.4 Agricultural highlights

From an agro-ecological point of view the Sistan-Hilmand basin is divided into five major zones:

1. The intensively irrigated area with water from the large storage dams – formal irrigation
2. The intermittently irrigated land in the Sistan depression (below Khairabad-Reg district)
3. The western irrigated oases
4. The valley floor irrigation in mountainous areas
5. The *karez* - and spring-irrigated area

FORMAL IRRIGATION SCHEMES FROM LARGE STORAGE DAMS

Two major dams were constructed along the Hilmand river basins by the HAVA (Hilmand-Arghandab Valley Authority) program. The Hilmand/Arghadab irrigated zone is the largest formal irrigation scheme in Afghanistan and a major production area. In April 1953, the rock-filled Kajaki Dam (Picture 67), located 70 km above Girishk on the Hilmand River, was inaugurated. Kajaki dam is 91 m high, 270 m long and holds 1,700 million m^3 of water feeding the Hilmand Valley. The rock-filled Band-i Dahla Dam on the Argandab, located 50 km north of the city of Kandahar, was completed in 1952 and is 44 m high, 530 m long and holds up to 470 million feet^3 of water. However, according to the Irrigation Department in Kandahar, 12-15 m are filled with silt, sensibly reducing the retention capacity of the dam.

The HAVA was an 'integrated' development scheme, with education, industry, agriculture, medicine and marketing under a single controlling authority. The HAVA had its base at Lashkar Gah, a modern planned city locally known as the New York of Afghanistan [39].

Figure 10[40] depicts the Hilmand Valley[41] as envisioned in 1956. The Zahir Shah canal cut across the Arghandab River to irrigate regions around Kandahar. The Darweshan and Shamalan canals paralleled the river, watering surrounding areas, while other canals traversed the desert to feed islands of reclaimed land at Marja and Nad-i-Ali.

The Arghandab irrigated scheme around Kandahar is renowned for its succulent pomegranates and grapes, while in the Hilmand Valley cotton and cereals are produced. The Hilmand/Arghandab irrigated zone is a major poppy production area. A major agricultural problem in the Hilmand and Arghandab irrigated valleys is soil salinity accumulating over the years by both irrigation as well as increased soil capillary action pulling soluble salts and alkalis to the surface. Snowy crusts of salt can be observed in various areas.

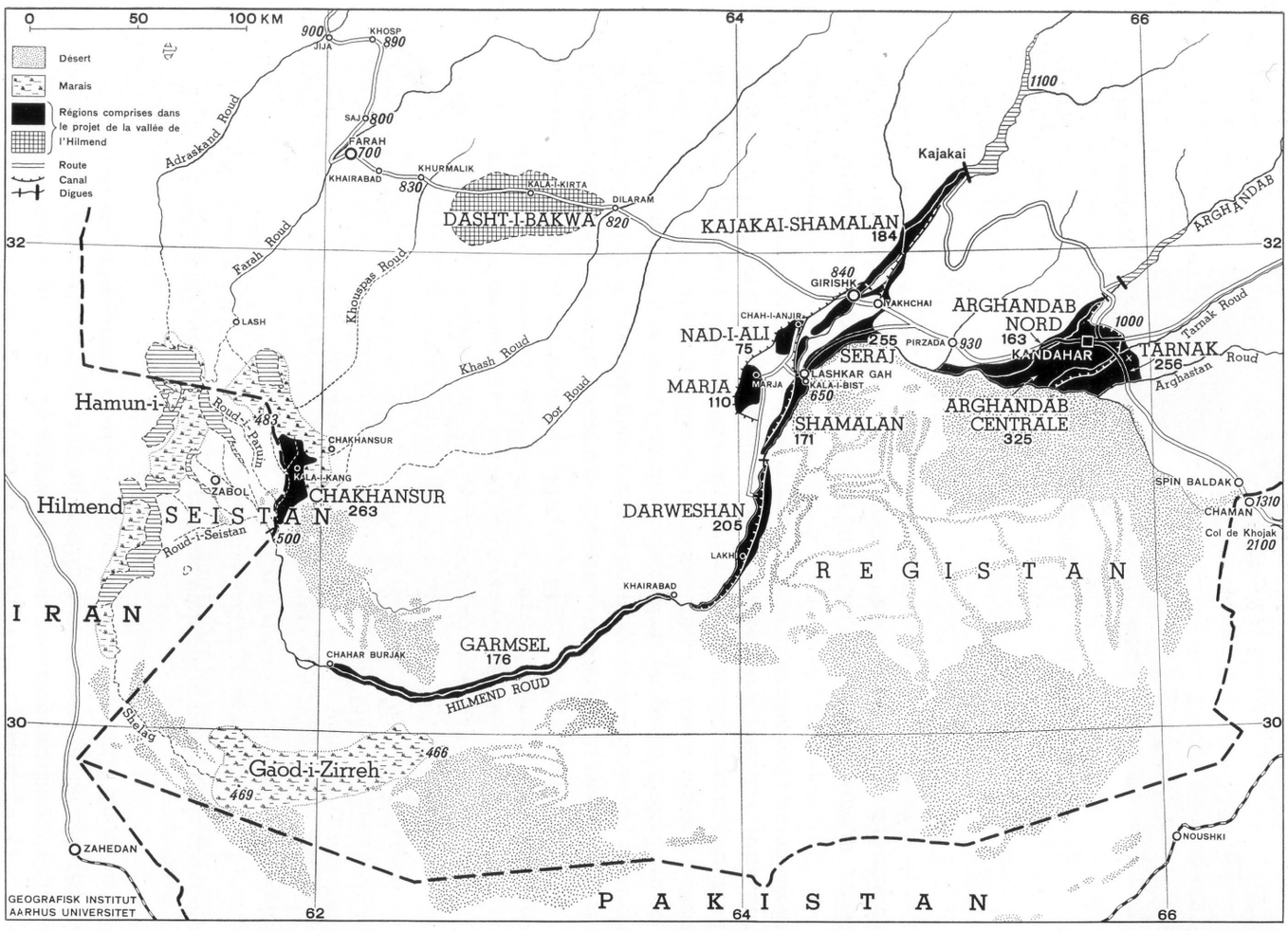


FIGURE 10
Hilmand Valley project as planned in 1956

[39] Cullather, Nick, "*Damming Afghanistan: Modernization in a Buffer State*", The Journal of American History, September 2002.
http://www.indiana.edu/~jah/teaching/404.shtml
[40] From Nick Cullather, Ibid., 2002.
[41] Precursor of the HAVA.

INTERMITTENTLY IRRIGATED LAND IN THE SISTAN DEPRESSION

Works on the lower river, below Khairabad (Reg district), were never completed. Therefore, below Khairabad, a narrow strip of traditional and intermittent irrigation along the banks of the Hilmand river has been maintained. The intermittent irrigation system extends up to the border of Iran in Chahar Burjak district (Nimroz province).

VALLEY FLOOR IRRIGATION IN MOUNTAINOUS AREAS

The provinces of Bamyan, Ghor, Ghazni and Uruzgan high in the Hindu Kush are made up of networks of high valleys and vast pastureland plateaus. The central highland mountains are the source of most of the rivers flowing into the lowland irrigation scheme in the north, west and particularly southwest regions. On the floor of these valley networks, irrigated agriculture is practiced and sustains the livelihoods of the local population (along with rainfed agriculture and animal husbandry in high elevations).

WESTERN IRRIGATED OASES

In the west of Hilmand, short rivers (Adraskan Rod, Farah Rod, Khuspas Rod), which depend mostly on nearby mountains, flow through deserts in the south into the Sistan depression. As in the northern irrigated oases (see section 2.4 above), land availability for irrigation surpasses the water supply capacity from the existing rivers (Picture 69). Therefore, a traditional land rotation system is practiced in order to maintain soil fertility. The land in rotation in these regions is called *zamin-i Bawri*. At the head of the irrigation system (Bala Buluk district along the Farah Rod), soil rotation is little practiced due to good access to irrigation water, but at the middle and the tail end of the irrigation system, such as in the Khaq-i Safid ('White Dust') district of Farah province, soil is rotated on a 12-15-year system.

Close to the wetlands, in the district of Lash wa Joweyn, sand dunes have encroached into irrigated infrastructures during the drought, reducing the possibility of utilizing the water supply for irrigation purposes (Picture 68).

PICTURE 68
Sand dune encroachment in Lash wa Joweyn, Farah province. 27 May 2003 (N31.71, E61.62, S)

PICTURE 69
Irrigated land in the desert. Farah, 25 May 2003

KAREZ AND SPRING-IRRIGATED AREA

Most of the *karezes*[42] in Afghanistan are included in the Hilmand basin. Water from karezes freely flows via underground tunnels from alluvial aquifers for surface irrigation (see Figure 11). Dug by local craftsmen from shafts at close intervals, karezes are usually small in dimension but may be many kilometres in length. Karez water is used both for irrigation purposes (the irrigated areas range from 10 ha to 200 ha) as well as for drinking water supplies. Figure 12 shows the main locations irrigated by karezes in Afghanistan.

Karez - and spring-irrigated areas are similar to oasis farming systems. The possible irrigated perimeters are wide, while the availability of water is limited. Therefore, soil rotation systems were practiced for centuries in order to maintain soil fertility. J. Humlum [43] noted that in the Pirzada oasis, 60 km west of Kandahar, soil is cultivated every third year on average.

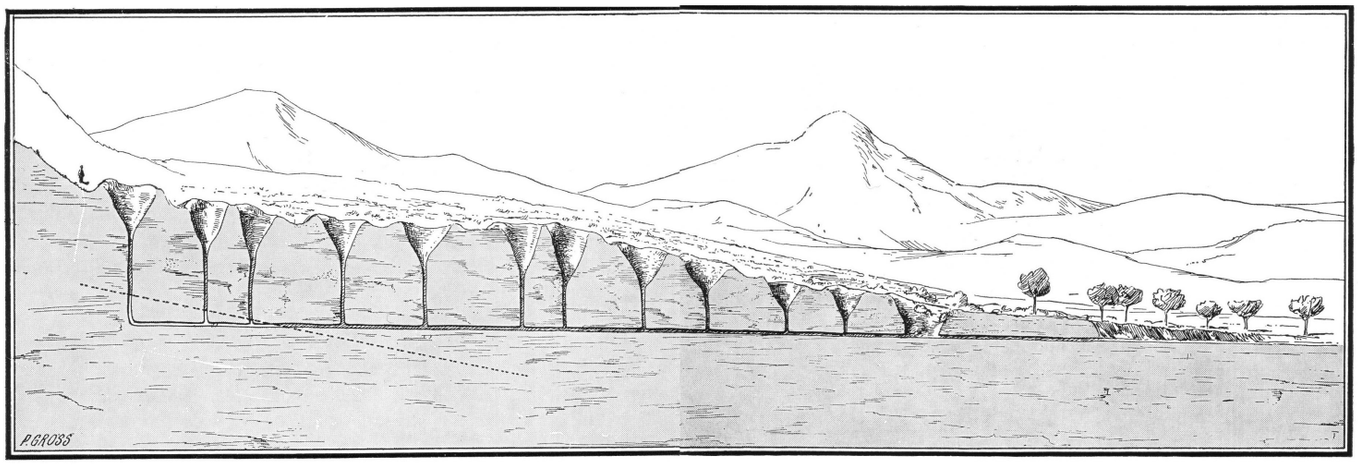


FIGURE 11
Sketches of a karez [44]

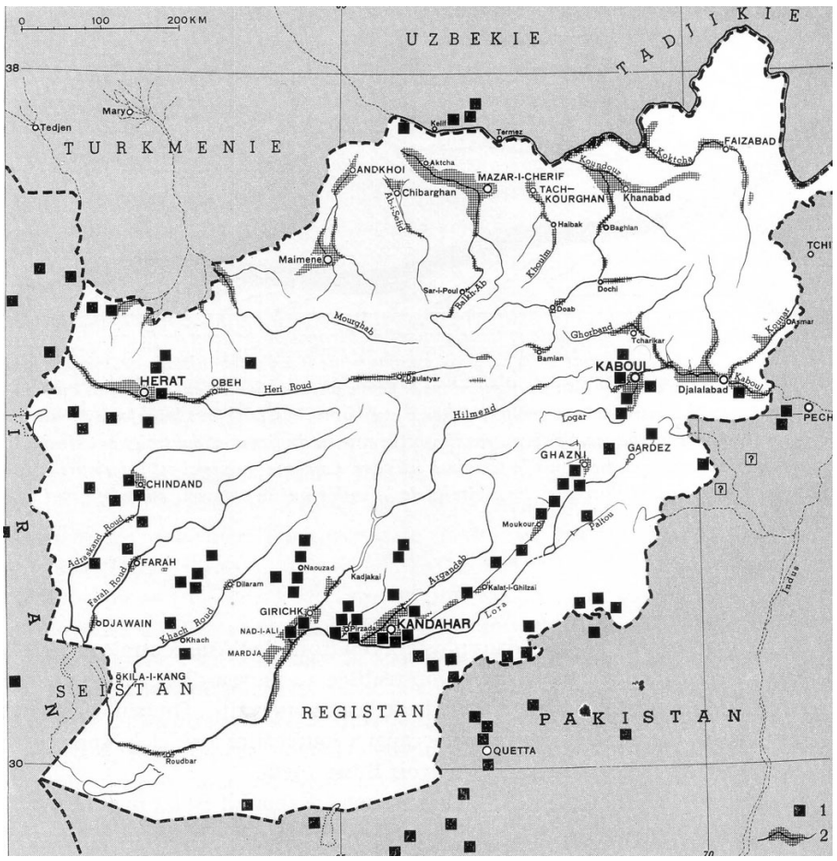


FIGURE 12
Map of the major karez-irrigated areas in Afghanistan [45].
The black squares indicate the main karez-irrigated locations

[42] *Karezes* (called *qanat* in Iran) are gently sloping tunnels dug nearly horizontally into an alluvial fan until the water filters into the channel, runs down its gentle slope, and emerges at the surface as a stream. Water from karez is used for irrigation and household consumption. In excavating these tunnels, diggers must have air and tunnel spoils must be removed, so the tunnels are connected to the surface with a series of vertical shafts spaced every 50 to 150 metres along its course. The top of these shafts are rimmed by piles of excavated dirt to form a "chain of wells" on the surface, a distinctive feature of the arid Afghan landscapes.

The maximum gradient in a short karez is approximately 1:1,000 or 1: 1,500; in a long karez, the canal is almost horizontal. If the gradient is too steep, the tunnel will erode the walls and soon destroy it. See, English, P. W., "*The Origin and Spread of Qanats in the Old World*", Proceedings American Philosophical Society, Vol. 112, No 3, June, 1968. Dug by local craftsmen from shafts at close intervals, they are small in size but may be many kilometres in length. Karezes typically are constructed and maintained by a specialized group of artisans called karezkan. The task is demanding and dangerous, and karezkan are generally well paid by local standards.

Sheladia Associates, Inc. (2003)[46], reports that "the recent drought, along with donor and remittance finance, coupled with a gradual disintegration of communities' shared sense of responsibility, has led some to use groundwater through tube-wells with turbine pumps. There is evidence of groundwater levels dropping in some areas, jeopardizing traditional springs and karez-fed supplies. The apparent overuse of groundwater in the karez belt of the country appears to represent a classic case of the 'tragedy of the commons,' with individuals over-exploiting a commonly owned natural resource".

However, English (1968) notes that although *karezes* provide groundwater without heavy extraction energy requirements, deep wells have several advantages over karezes: "Deep wells are not limited by the slope of soil conditions and can be placed at locations convenient in terms of transportation, markets and other considerations; they draw water from the permanent aquifer, thereby eliminating seasonal variations in flow. Nor is water wasted when demand falls short of supply"[47]. The same author notes that replacing karezes by deep wells requires major adjustments in social patterns, customs and customary laws that have developed around this water-supply system. A conflict is thus developing between these two technologies.

However, these uncontrolled developments of tube-wells in Afghanistan raise a fundamental question of equity and transfer of water from poor to rich[48].

PASTURELAND

The central highlands have numerous pasturelands (Picture 70) that are grazed in summer by both local flocks as well as the herds of nomadic population groups travelling long distances from southern Afghanistan.

4.5 Historical highlights

It is in the Hilmand basin that one of the oldest settlements of agricultural and urban communities was found in Afghanistan. The Bronze Age site of Mundigak in Kandahar province evolved into complex agricultural communities contributing to the prosperity of large cities in the Indus valley such as Mohenjo-daro and Harrapa.

In more recent times along the Hilmand-Argandab Rivers, prosperous civilizations flourished. The Sistan was home of the legendary Rustam, mightiest hero of the "Shahname," the classic story composed by Firdowsi 1,000 years ago. Kandaharis speak with pride of the past prosperity of Sistan: "Once there were so many fine buildings and palaces that one could easily walk from Bost to Zarang on the rooftops without once touching the ground"[49]. Medieval geographers speak of the 'garden of Asia' or 'granary of the East.' The prosperity of the Sistan region was seriously damaged after the invasion of King Timur in the 14th century. However, various authors consider that its decline was a combined effect of sedimentation, salinization and changes in the course of the Hilmand basin's rivers. Today, various parts of the once prosperous Sistan are known by dreadful names such as Dasht-i Margo ('Desert of Death'), Dasht-i Jehanum ('Desert of Hell') and Sar-o Tar ('Desolation and Emptiness'). Sar-o Tar is covered with the fastest moving sand dunes in the world, moving an average of 15 cm/day[50]. From this past prosperity, a rich heritage of fruits - mostly pomegranates and grapes - has managed to survive historical tumults, offering major export potential.

The HAVA (Hilmand-Argandab Valley Authority) program aimed to transform deserts into the irrigated fields they were during the Sistan glory period, before the construction of two major retention dams on the Hilmand and Argandab Rivers. The HAVA built a modern city next to colossal ruins of Qala-i Bost, the summer capital of the Ghaznevid.

PICTURE 70
Pastureland in Ghor highlands grazed by local stocks and *kuchi* nomads travelling from southern Afghanistan. Ghor, 1 June 2003 (N34.18, E64.82, NE)

[43] J. Humlum, *Ibid.*, 1959.
[44] AFRANE, "*Les karez d'Afghanistan*", 1994.
[45] J. Humlum, *Ibid.*, 1959.
[46] Sheladia Associate Inc., *Ibid.*, 2003.
[47] English, P. W., "*The Origin and Spread of Qanats in the Old World*", Proceedings American Philosophical Society, Vol. 112, No 3, June, 1968.
[48] Thierry Facon, FAO Water Management Officer, Communication Personnelle.
[49] Nancy Hatch Dupree, "*An Historical Guide to Afghanistan*", Afghan Air Authority and Tourist Organization, Kabul, 1977.
[50] In : Nancy Hatch Dupree, "*An Historical Guide to Afghanistan*", Afghan Air Authority and Tourist Organization, Kabul, 1977.

5.Kabul (Indus) river basin

5.1 General

The Kabul (Indus) river basin includes all Afghan rivers that join the Indus River in Pakistan. The Indus empties into the Arabian Sea of the Indian Ocean. The basin drains water from the Kotal-i Shibar Pass to the Kunar Valley in the north and the Paghman Mountains to the Spingar (or Koh-i Safid in Persian) in the south of Jalalabad. In the eastern mountains, rivers take their sources in high mountains covered by snow and glaciers that maintain water flow throughout the summer. The Kabul (Indus) basin also includes the small Pishin Lora River in the southeastern corner of Afghanistan. The eastern part of the Kabul (Indus) basin is under the influence of the monsoon rains reaching the valley systems that face the Indus Valley in the summer.

The Kabul (Indus) basin covers 12 percent of the national territory, but alone it drains one-fourth (26 percent) of the total annual water flow of Afghanistan.

Therefore, the basin has major hydropower potential that is already partly developed:

1. The first hydroelectric station was built in Jabul Seraj between 1911 and 1918 by American engineers (Picture 71). In the absence of a road network, all the heavy equipment was brought from India on the backs of elephants.

2. It was only in 1953 that the second hydropower station was installed in Surobi with German assistance (Picture 72). Norconsult-Norplan notes that the equipment is robust and has been comparatively well maintained with the limited means available. The units can still be operated close to their original output and the station has maintained regular energy production throughout the years..

3. The Mahipar hydroelectric project was completed in 1966 with German assistance (Picture 73). It diverts the Kabul River as it comes off the Kabul plateau, shooting it down a steep tunnel blasted through the heart of the mountain massif and turning the generator located 32 km beyond Surobi. River flow is largest in the winter months, when there is the largest need for energy. However, the river dries for several months in summer. A Norconsult-Norplan consultant notes that the production has dramatically reduced in recent years.

4. The Naghlu hydroelectric plant, a joint Afghan-Soviet project, was completed in 1967 (Picture 74). It is situated at the confluence of the Kabul, Panjshir and Tagao Rivers. Naghlu is the main hydropower project in the Kabul river basin, and the only reservoir project. Norconsult-Norplan note that aging of the equipment combined with lack of maintenance have created a high risk of problems. This may drastically reduce capacity.

5. The Darunta hydropower plant was constructed by the USSR and commissioned in 1967 (Picture 75). The Darunta dam and fish-breeding centre were established in 1965 with the assistance of China.

The existing hydropower plants on the Kabul River form the core of public electricity supply to Kabul city.

The Kabul (Indus) basin is divided into eight main watersheds:

1. Kabul watershed
2. Chak wa Logar Rod watershed
3. Ghorband wa Panjshir watershed
4. Alingar watershed
5. Kunar watershed
6. Shamal watershed
7. Gomal watershed
8. Pishin Lora watershed

5.2 Transboundaries riparian issues

The two main riparian countries on the Indus River are Pakistan and India. However, the Kabul River is a sizeable tributary of the Indus. The riparian issues on the Indus basin are convoluted with the dispute over the border between Afghanistan and Pakistan. The geographical border is a product of British imperial policy drawn up in 1893 and commonly known as the Durand Line. The line was devised by the British to strengthen the status of Afghanistan as a buffer between British India and the Russian Empire.

This border was never ratified by Afghanistan but remains in force today. Review of the border has been under negotiation since 1993 and is becoming an increasing point of tension between the Pakistani and Afghan governments. Pakistan see security of their western frontier as vital to national security, as they also face major problems in the northeast against the Indian government and Kashmiri separatists over the disputed territory of Jammu-Kashmir. The Afghan/Pakistan border area has long been known as a 'lawless frontier' over a thousand miles in length. Religious extremism and civil disorder have built up as a result of two decades of war in Afghanistan, and have now merged with the internal troubles of Pakistan[51].

Norconsult-Norplan notes that the Government of Afghanistan is planning to reinforce irrigation, fishing and hydropower generation along the Kabul River, but, unless an agreement is found, further developments could trigger tensions between Afghanistan and Pakistan.

[51] Ahmad Rashid, "*Taleban. Militant Islam, Oil and Fundamentalism in Central Asia*", Yale University Press, 2000.

PICTURE 71
View of the oldest hydropower equipment brought from India on the back of elephant up to Jabul Seraj in the early 20th century. Parwan, 17 June 2003 (N35.12, E69.24)

PICTURE 72
Bandi Surobi dam, Kabul, 5 December 2003 (N34.59, E69.78, NW)

PICTURE 73
Band-i Mahipar dam, Kabul, 5 December 2003 (N34.56, E69.48, NE)

PICTURE 74
Bandi Naghlu dam, Kabul, 5 December 2003 (N34.64, E69.72, NW)

PICTURE 75
Darunta dam, Nangarhar, 30 December 2003 (N34.48, E70.36, N)

5.3 Environment highlights

EASTERN FORESTS

In eastern Afghanistan oak and coniferous forests grow, dependant on the amount of monsoon rainfall reaching the area from the Indian subcontinent. The lower valleys have walnut (*Juglans regia*) and birch (*Betula kunaresis*, *B. jacquemontii*) forests, thickets and valley meadows. Between 1,500 m and 2,500 m, there is a thick stand of oak forests, dominated by *Quercus baloot* and *Quercus semecarpifolia* on drier slopes and, in more humid places, by *Quercus dilatata*. Above this belt, up to the tree line at 3,300 m, lies a coniferous forest belt (Pictures 75 and 76) with cedar (*Cedrus deodara*), spruce (*Picea smithiana*), fir (*Abies spectabilis*), pine (*Pinus gerardiana, Pinus wallichiana*), juniper (*Juniperus semiglobosa*) and yew (*Taxus wallichiana*). Above the coniferous forests there is an alpine shrubland dominated by rhododendron (*Rhododendron colletianum*), dwarf juniper (*Juniperus nana*), alpine heath and alpine meadowland, which provides excellent summer grazing[52]. These mountains possess rich fauna, including snow leopard, markhor, Asian ibex (*Capra sibirica*), Himalayan black bear (*Ursus thibetanus*) and two species of flying squirrel (*Eoglaucomys fimbriatus* and *Petaurista petaurista*). UNEP's satellite analyses[53] reveal that conifer forests in the provinces of Nangarhar, Kunar and Nuristan have been reduced by an average of 50 percent since 1978. Deodar cedar (*Cedrus deodara*) is a straight-grained, decay-resistant, aromatic wood and the primary conifer species harvested for decades (Picture 20).

KOLE HASHMAT KHAN

Kole Hashmat Khan (also know as Lake Chaman) is a small, shallow, slightly saline, eutrophic and reed-covered wetland situated below Bala Hissar fort at the edge of Kabul city. The lake is the only remaining water body and marsh area of the formerly extensive wetlands on the plain of Kabul. It is fed by a tributary of the Logar River, and has no outlet except when the water level is exceptionally high. The lake is L-shaped, about 2.5 km in length and 0.3-1.0 km in width, and has a maximum depth of 1.5 m[54]. Large areas of former wetland have been converted into agricultural land (Picture 78). The small wetland valley was a worship centre for centuries for followers of Buddhism, Hinduism and Islam. The wetland was long used as a royal hunting area and was declared a waterfowl reserve in the 1930s by King Zahir Shah. The site is important for migrating and wintering water birds. Many settlements are encroaching into the wetland area, and the reeds are cut for sale as roof thatch, destroying the nesting habitat for birds (Picture 79). The site has an important recreational and educational potential for the

PICTURES 76 AND 77
Top, view of a cedar (*Cedrus deodora*) forest in the background. Kamu, Nuristan. Bottom, view of a cedar tree and oak tree forest in the lower background. Barg-i Matal, Nuristan. July 2003

PICTURE 78
Harvesting reeds in Kole Hashmat Khan. Kabul, 10 November 2003 (N34.49, E69.20, N)

[52] D. A. Scott, "*A Directory of Wetlands in the Middle East*", Wetlands International Publication, 1995. http://www.wetlands.org/inventory&/MiddleEastDir/AFGHANISTAN.htm

[53] UNEP, *Ibid.*, 2002.

[54] Derek A. Scott, *Ibid.*, 1995.

PICTURE 79
View of Kole Hashmat Khan. Note the agricultural land encroaching on the wetland (right-hand side of the picture). Kabul, 10 November 2003 (N34.48, E69.20, N)

PICTURE 80
Aerial view of vineyard in part of the Shomali plain destroyed in 1998. Mir Bacha Kot district, Kabul province, 2 April 2003 (N34.70, E69.06, E)

PICTURE 81
Aerial view of the Shomali plain. The Panjshir River is visible on the left, the Ghorband River on the right and the Salang River in the centre. The Panjshir and Ghorband Rivers join in Bagram district of Parwan province. Note the reflection of light from irrigated fields, illustrating an important issue of concern regarding water management in Afghanistan. Due to insecurity of access to irrigation water, farmers tend to inundate their fields when they receive their irrigation turn. 26 March 2003 (N35.15, E69.19, S)

city of Kabul.

5.4 Agriculture highlights

From an agro-ecological point of view, the Kabul (Indus) basin is divided into two major zones:

1. Intensively irrigated area in mid/high elevations
2. Intensively irrigated area in low elevations

INTENSIVELY IRRIGATED AREA IN MID/HIGH ELEVATION

Recent agriculture surveys show that the valley floor irrigated areas surrounding Kabul province are one of the most diverse and intensive agricultural areas in Afghanistan (Pictures 82 and 83)[55]. Kabuli and neighbouring Pakistani markets provide opportunities for specialised production, including apples and potatoes (Wardak), vegetables (Kabul and Parwan) and raisins in the Shomali plain (Kabul, Parwan and Kapisa, Pictures 80 and 81). Irrigated valleys along the Chak wa Logar Rod and the upper part of the Kabul River are famous for apples. Modern apple varieties were first introduced here by an Afghan engineer, Dr. Wakil, whose name is given to some of these varieties. The Shomali plain is particularly famous for quality raisins but also hosts a wide diversity of fruits and nuts growing up into the Ghorband Valley. The southern part of the Shomali plain was entirely destroyed and hundreds of thousands of inhabitants were forced out of the area in 1997-98[56]. Today the valley still bears the deep scars of war (Picture 80).

In the east, mid- and high-elevation agriculture is practiced in Nuristan, where maize and millet are the main crops. South of Jalalabad, a complex of mountain torrents originating from the Spingar range support piedmont agriculture production both in the northeast of the range (Nangarhar) and the southwest toward the Paktiya valleys and the plain of Khost. These streams are seasonal, prone to flash floods and vulnerable to drought, particularly after light snowfall on the Spingar ranges in dry winter.

INTENSIVELY IRRIGATED LAND IN LOW ELEVATION

The lowlands in Nangarhar and lower Kunar Valley benefit from a semi-tropical climate, and have the highest proportion of intensively irrigated, high-yield land in the country. The riverine farms, situated along valley floors of varying widths, produce a range of crops throughout the year. Double cropping is the rule rather than the exception, and triple cropping is noted in areas offering 365 growing days per year. Semi-tropical crops such as citrus, sugar cane and henna are produced around Jalalabad. The Nangarhar Valley Authority, which aims to reclaim desert land, operates four state farms planted primarily with citrus and olive trees.

PICTURES 82 AND 83

Double cropping is practiced in valley floor irrigated land up to an elevation of 2,000-2,200 m in the Kabul basin. Winter wheat is the first crop and is cultivated up to 2,500 m. The second crop is generally maize or pulses. Above, harvesting time in the Panjshir Valley on 18 June 2003.
Below, maize, the second crop in the same location on 27 August 2003. Hisa-i Hawal-i Panjshir district (N35.23, E69.38, E)

[55] Raphy Favre, Anthony Fitzherbert, Javier Escobedo, "*MAAH/MRRD/FAO/WFP National Crop Output Assessment. First Phase. 10th May to 5th June 2003*", FAO, 25th July 2003.
[56] See Ahmad Rashid, *Ibid.*, 2002.

5.5 Historical highlights

G. Etienne[57] notes that the Kabul river basin differs geographically from the northern, eastern and western regions. The Kabul River and its numerous tributaries run in narrow valleys separated by mountainous chains. These rivers do not drain into large open plains as in other parts of the country. These hydro-geographic characteristics have prevented any spatial organisation of the territory as in the Hilmand/Sistan or the Bactrian in the north; local chieftains could not develop large irrigated schemes. The relative simplicity of the irrigation structures contributed to their security and maintenance, and thus successive invasions were absorbed despite temporary destructions. Also, thanks to its rugged terrain and pivotal location in Asia, the Kabul basin had a flourishing international trade. From Jalalabad, the Silk Road led to the Indus Valley through the Khyber Pass. A similar situation exists in the southern part of the Kabul river basin, where the Sulaiman Mounts lie.

Observers noted that although no major known historical centres have flourished along the narrow valleys on the Sulaiman Mounts (in the Khost, Paktia, Paktika and Zabul provinces in Afghanistan), this land has repeatedly influenced the course of regional history. G. Etienne[58] notes that the bellicosity of the eastern Pashtun tribes has no equivalent in the world, and invites readers to remain attentive toward developments on the Sulaiman Mounts for signs of future changes in Afghanistan.

Afghanistan is the land of lost kingdoms and royal gardens enthusiastically described by travellers of the past. While successive invading armies have thrown civilization back into darkness, sometimes for centuries at a time, many rich varieties of royal garden fruits have survived, and today represent a genetic heritage of world significance. Afghanistan is the host of a wide number of apple (*Malus spp*), almond (*Prunus amygdalus*), apricot (*Prunus armenica*) and grape (*Vitis vinifera*) varieties. In addition, Afghanistan is probably the world leader in genetic diversity for mulberry (with eight species, out of which *Morus nigra* and *Morus alba* are the most important) and pomegranate (*Punica granatum*), while it is the centre of origin for walnuts (*Juglans regia*) and pistachio (*Pista vera*)[59]. Part of this significance is found in the Kabul river basin. The first of the great Moghul kings, Babur, described the abundance and variety of Ghorband and Koh-i Daman (Shomali plain) gardens. In the early 19th century, Mountstuart Elphinstone[60] noted that the habile farmers in the Koh-i Daman were exporting fruits up to India.

[57] Gilbert Etienne, "*L'Afghanistan ou les Aléas de la Coopération*", PUF, Paris, 1972.
[58] Gilbert Etienne, "*Imprévisible Afghanistan*", presses de science PO, La bilbio. du citoyen, 2002.
[59] FAO, "*Food Security through Sustainable Crop Production in Afghanistan. An Account of the Achievements of the AFG/96/004 Program 1997-1999 and Opportunities for 2000 and Beyond*", November 1999.
[60] Elphinstone, Mountstuart, "*An Account of the Kingdom of Caubul*", Graz, Akademische Druck u. Verlagsansralt, 1969