Chapter-1

Physical Setting of the Area under Study
Much of Central Asia is either mountainous or desert. These occupy the western part of the Central Asia. From west to east, the terrain ranges are close to sea level. The deserts and steppes of Turkmenia up to the Mongolian plateaus, have an average height about 1,609 km. Between the Caspian Sea and the Amu Darya (Oxus) is a vast area of sandy desert a clay depressions (Takyr) known as Karakum (Black sands). The dry alluvial plain kyzylkum (Red sand) lies between the two well known rivers of Central Asia Amu Darya and Syr darya.

Between the Southern border of the Turanian lowland and the high mountains of Central Asia is zone of loess and covered piedmont plains at a height of 100-250m. This zone includes the slopes of the kopet Dag and also the Fergana Basin.

A high mountain wall, extending from the East coast of the Caspian Sea to the Zaysan Depression, encloses Central Asia on the south and east. In the south, the kopet Dag (Dry Mountain) and associated ranges lie mainly in Iran, where they reach heights above 2,700m. Much of the same applies to the ranges of the Hindu Kush to the east of the Kopet Dag in that they lie almost entirely in Afghanistan.

Snow capped mountains along with deep valleys are found in the south-east. The pamir-Alay Mountains are a series of East-West oriented ranges fanning out from the Pamir Knot (Roof of the world) of Afghanistan and Pakistan. The highest peaks like Mount Communism rises to 7,495 and Mount Lenin to 7,134 m are found in these ranges.

The Tyan Shan (Heavenly Mountains) system is a complex of
ranges, having a height of about 33,00m and infrequent passes. The Fergana Basin (the gem of Central Asia) 15-40 km wide and 160 km long lies in the north of the Trans-Alay Range. The basin containing the Issyk-Kul (hot lake).

1.1 Physiography of Uzbekistan

The Republic of Uzbekistan which is one of the newly independent states of Central Asia lies in the heart of Asia. The Republic of Uzbekistan bordered on west and north by Kazakhstan, Kyrgyzstan on the east, on the south-east by Tajikistan and on the south by Afghanistan and Turkmenistan. The karakalpakstan (Qoraqalpagh Autonomous Republic) occupies 37 percent of Uzbekistan's territory in the western part of the country. The capital city of Uzbekistan, Tashkent which is also the chief industrial and cultural centre, is located in the north-east of Uzbekistan. Uzbeks make up the majority of the Republic's population.

Uzbekistan is a landlocked country that covers an area of about 447,400 Sq.km (172,700 Sq.miles). The Republic of Uzbekistan occupies a large territory with various forms of relief and natural conditions.

On the basis of physical features the country is divided into three zones. These are as under. (Fig1.1)

i) Desert (kyzylkum), steppe and semi-arid regions. Covering 60 percent of the country, mainly the central and western part.

ii) Fertile valleys (including the Ferghana valley, Samarkand Oasis.)

iii) Mountainous areas in the east.

To the west of the mountains, Uzbekistan is generally low in elevation. More than two third of Uzbekistan territory is covered by desert and steppe (semiarid grassy plains). One of the largest desert in the world, the vast barren, Qyzylqum, lies in the north central Uzbekistan, and extends into Kazakhstan. In northeastern Uzbekistan, south west of Tashkent, lies the Mirzachol desert. Across west central Uzbekistan is a vast area of flat plains called the Turan Plains.
The physical setting...

Fig. 1.1

TOPOGRAPHIC MAP

Uzbekistan

Legend:

- Desert, steppe, semi-desert region
- Fertile valleys
- Mountainous areas
- Rivers

Source: GRID - Arendal 2001
additional plains lies south and east of the Qyzylqum. The extreme western portion of the country is occupied by the Usturt Plateau which is an elevated plain.

Uzbekistan generally lies between the two largest rivers of Central Asia, the Amu Darya and Syr Darya. These two roughly parallel rivers both have their headwaters in the mountains, lies in the east of Uzbekistan and flow north westerly direction towards the Aral Sea. Uzbekistan’s largest river is the Amu Darya. This river is formed by the confluence of the Panj and Vakhsh rivers on the extreme southwestern border of Tajikistan near the southeastern tip of Uzbekistan. The Amu Darya traverses a course generally parallel to Uzbekistan’s southern borders with Afghanistan and Turkmenistan, and then turns to north.

The Syr Darya is formed in the fertile Fergana valley by the convergence of two rivers flowing from the east, the Naryn and Qaradarya. The Syr Darya then flows westwards through this valley and northern Tajikistan, turn north to cut through Uzbekistan and enters Kazakhstan, eventually reaching the northern section of the Aral Sea.

Another important river is the Zeravshan which flows westwards from the mountains of Tajikistan through east central Uzbekistan. The Zeravshan was the Amu Darya’s largest tributary, now it dissipates in the kzyllkum desert near the city of Bukhara-Uzbekistan has thousands of small streams that expire in the desert, many having been emptied by irrigation:

Extensive canal system such as the Amu Bukhara Canal and many others built during the Soviet period, have greatly altered water flow pattern. Artificial lakes and reservoirs have been created, many of which are fed by irrigation runoff. The largest fresh water lake is Lake Aydarkul. This lies in the northeastern of Uzbekistan.

1.2 Climate and Agro-Ecological Zones

Climate refers to the sum total of weather conditions and variations over a large area for a long period of time (more than thirty
The elements of weather and climate are same that is temperature, atmospheric pressure, wind, humidity and precipitation. It is often observed that weather conditions fluctuate very often even within a day. But there is some common pattern over few weeks or months, e.g., days are cool or hot, windy or calm, cloudy or bright and wet or dry. On the basis of the generalized monthly atmospheric conditions, the year is divided into seasons and world is divided into number of climatic zones.7

The climate of Uzbekistan is described as of continental type over 60 percent of the territory. This type of climate is found in the countries lying between Tropic of Cancer 23½° North and Tropic of Capricorn 23½° south.

Uzbekistan lies in the heart of Central Asia, far from oceans. Uzbekistan has a harsh continental climate that is dry, hot summers, cool and wet autumn and cold winter.8 Climate of Uzbekistan is extreme continental, arid and noted for abundance of solar radiation, small cloudiness and poor atmospheric precipitation. Thermal regime in winter period is formed under the influence of dry, cold, Arctic and Siberian air masses of the north and tropical air from the south. In summer the territory is under the influence of local tropical air. The mountainous relief greatly effects on climate formation. The continentality of climate can be really seen in the considerable and sudden changes of meteorological elements during the year and a variation by year etc. The peculiarity of the climate is also shown by the contrast when one season changes to another. In the cold six months the air masses of temperate latitudes prevail, while in summer period there is a dominance of warm continental tropical air. (Fig1.2)

In January temperature varies from -8° c to 2° c and 3° c, being reduced in the most severe winter up to -30° c in the north and to -22° c and -25° c in the south. During the hottest month (July) the average monthly temperature reaches 31°c, 32° c with an absolute maximum in a long term aspect 50° (Ternez).9

Mean annual amount of precipitation in flat part ranges from 100- 150mm (desert) to 200- 400 mm (foothills). The greatest amount
of precipitation drops out in winter and spring months (60-70 percent). Autumn precipitation is much less and absolutely insignificant precipitation is observed in summer months. The drought period in deserts lasts 6 to 7 months (since May till November). In foothills it is reduced to 4 to 5 months and more. Distribution of precipitation in mountains depends on height above the sea level, forms of relief and exposure of slopes.

Deficiency of moisture in the southern part of Uzbekistan from April-September reaches about 1300 to 1600 mm.\(^{10}\)

The plains are bounded by mountains spreading in a latitudinal direction and gradually declining from east to west. The territory of Uzbekistan is divided into plains, foothill and mountain zones. The last being subdivided into foothills plains, foot hills, average high mountains and high mountains. In local language the plain belt is called “Chul”, foothills are called “Adyr”, average high mountains are called “Tau”, and while as high mountains are named as “yaylau”.\(^{11}\)
Fig 1.2
Annual Range of Temperature in Uzbekistan
1. **Plain Belt (Desert) "Chul"**

This is a belt of irrigation farming and karakul sheep. The annual precipitation of this belt ranges from 100 to 250mm. The annual temperature is about 15°C. The main vegetation types of this belt are desert, psammophytic shrubs, and ephemeral, semi-shrubs. The different soil types found in this zone are brown-brown, takir, meadow-takir, and desert sandy soils.

2. **Foot Hill Belt ("adyr")**

This is the zone of rain-fed land and annual precipitation is very low. In this belt there are huge rain fed areas and it is a zone of better irrigation farming. The Tashkent, Golodensteppe (Golodneya steppe), karshi, oasis and others. The annual temperature of this belt varies from 13°C in the south and goes up to 14°C to 16°C.

This zone receives an average precipitation of about 200 to 545 mm. The prevailing soil type is light and typical sierozems soil type prevails to a wide extent.

3. **Average High Mountain Belt ("Tau")**

This is a rainfed region with normal precipitation and mostly covers Tashkent, Samarkand and Surkhandarya regions. This belt of Uzbekistan receives an average annual temperature of about 8 to 11°C. The annual precipitation of this belt is over 400mm. Prevailing soil types are dark sierozems, brown soils, with steppe, forest steppe and forest vegetation formation. This belt is favorable for Orchards and Vineyards.

4. **High Mountain belt ("yaylau")**

This belt of Uzbekistan is characterized by light brown soils and meadow steppe vegetation. It is the zone of summer pastures, although vertical belts differ greatly in
natural features, agriculturally, they complement each other (irrigated farming, rain-fed farming, forest-orchard zone, ranges of different seasonality) and is the area of good base for specialization of agricultural zones in the frame work of a single agricultural complex.

1.3 Agro-Ecological Zones

Agro-ecological zoning (A.E.Z) refers to the division of an area of land into smaller units which have similar characteristics related to land stability, potential production and environmental impact. So an agro-ecological zone is land resource mapping unit, defined in terms of climate, landform and soils and/or land cover and having a specific range of potential and constraints for land use. As for as agro-ecological zones are concerned the Republic of Uzbekistan is divided into three agro ecological regions. These are Northern, Central and Southern zones (Fig.1.3).

i) The Northern zone

This zone comprises of karakalpakstan, the khorezem region and the foothill districts of Tashkent and Samarkan. This zone has the shortest vegetative growth period, just about 180 to 200 days that means hardly 5 or 6 months. The temperature during growing season is very low. The temperature rise above 10°C during this period. Cotton, rice, melon, vegetables and different fruit trees are grown in this belt. The summer temperature ranges form 35°C to 42°C during the day (which is favorable for rice, cotton, vegetables, fruits etc) and 20°C to 28°C at night. The North zone is divided into two sub zones. The first zone includes Karakalpakstan and khorezm. The soils of this zone are old irrigated, hard and loamy. The average water penetration is low and the water is highly saline.

The second sub zone (includes foothill areas of Tashkent and Samarkan) has sierozems and sierozem meadow soils with a low salt content. The growing season
Fig. 1.3

Source: State committee for forestry 2001

LEGEND

NORTH ZONE

CENTRAL ZONE

SOUTHERN ZONE
The physical Setting

for vegetation of this zone is about 5 to 6 months. The temperature of this zone always remains low. The amount of rainfall of this zone is about 360 to 400 mm a year, falling mostly in the winter and early spring.

ii) The Central Zone

This zone includes the Fergana Valley, Tashkent and Samarkand. The growth period for vegetation in this zone is of about 200 to 220 days i.e. about 6 to 7 months. The sum of temperature is about 40° C to 42° C. The evaporation is higher than rainfall; Cotton, wheat, barley, grapes, tobacco, potatoes, tomatoes, and other vegetables and fruit crops are grown in this zone.

This is also divided into three sub zones. The first sub zone includes the Fergana valley, Tashkent, Syr Darya and Samarkand regions. The soils of this region are gleysols and meadow soils, with low salinity, and good hydro-physical properties. The period for the growth of vegetation is about 190 to 200 days. This region receives rainfall of about 320 to 380 mm a year, and receives rainfall mainly during winter and spring season.

The second sub zone includes Syrdarya, Djizak, and Samakand regions. About 190 to 200 days are the growing period for vegetation in this zone. This zone receives rainfall of about 240 to 270 mm. per year. The soils of this zone are typical gleysols, non-saline, gleysol-meadow soil and meadow soils.

The third zone comprises of Djizak, Samarkend, and parts of kashkadarya. The soils of this zone are of typical gleysols and meadow soils, non saline or of low salinity. This zone has an average temperature of about 16° C to 20° C during the growing period of vegetation. This zone receives rainfall from 220 to 240 mm: annually. Out of this 75 percent falling outside the vegetative period.
The physical Setting

iii) The Southern Zone

This zone includes Bukhara and Surkhandarya regions. The period for the growth of vegetation in this zone is long as compared to Northern Zone and Central Zone i.e. 240 to 270 days (i.e. 8 to 9 months in a year). This zone has very hot summer. The day temperature ranges from 46°C to 50°C.

The zone is known for sub tropical crops like melon, fine fiber, cotton and various vegetables and fruit crops are grown in this zone.

The Southern Zone is also divided into sub zones. The first sub zone of Southern zone comprises of Kashkadarya region and southern districts of Bukhara. In this zone typical Gleysols light Gleysols and desert soil are well developed. The zone has a long vegetative growing period of about 230 to 270 days in a year. This zone receives good amount of rainfall as compared to other sub zones, (about 140 to 180 mm per year). The maximum temperature reaches about 46°C to 50°C in this zone. And because of the high temperature, this zone experiences high rate of evaporation.

The second sub zone comprises of southern parts of Bukhara and northern parts of Qarshi. The soils of this zone are meadow gley sols, old irrigated land, lightly alkaline. The climate is severely continental. The vegetative growing period ranges from 250 to 260 days. This zone receives rainfall of about 80 to 120 mm annually. The third sub zone includes Southern part of Qarshi and Surkhondarya.

In this zone sub tropical crops and late ripening varieties of fine fiber cotton are grown on irrigated land. The vegetative period is about 250 to 260 days (out of 365 days). This sub zone receives insufficient rainfall of about 70 to 100 mm per year.

1.4 Soils

The term soil has many definitions, depending upon the person
who is using the term, for example to engineers "soil" is unconsolidated surficial material. Where as to many soil scientists, it is mainly the medium for plant growth. Generally "soils" are the top covering of the mantle, made up of very small particles and have been formed by the wear and tear of rocks. Soils also contain humus.

The territory of Uzbekistan has several distinct zones, determined by the different natural conditions like a warm subtropical belt with desert, semi-desert in the foothill and bushy steppes, diversity of soil forming rocks, ecological regimes, vegetation, extreme continental climate and vastness of the territory contribute to great diversity and complexity of soil cover in the Republic. In the most plains of Uzbekistan with continental climate, a desert type of soil is common, while on contemporary river plains with their favourable soil.\(^{14}\)

The soil cover of foothills and mountainous regions are slightly different from that of plains. About 69 percent of the irrigated lands are located in the desert and semi-desert zones. In Uzbekistan natural pasture dominates the desert zone. The main features of the different types of soils found in Uzbekistan are (Fig. 1.4).\(^{14}\)

i) Desert brown Soils

Desert soils are found on the Ustyart Plateau, residual low mountains, the kizilkum plains, the karnabchul and Malikchul foothill plains, pebbled adyrs, vertical belts above the desert zone at 1500-2000 meters with typical zonal soils, sierozems, and vegetation of ephemeral - ephemeraloid grass, of the western Fergana and low mountains of the Surkhandarya region. Brown-brown soils are the most widespread type of soils in the desert zone of Uzbekistan. The main characteristic of the brown-brown soil is that its upper part is less compressed and lighter in colour and the lower part is lighter and bedded soil intensely coloured in brown or orange. The humus content in the upper soil horizon is about 0.4 to 0.6 percent while at a depth of 50 cm it is about 0.2 to 0.3 per cent.

Another main characteristic of desert brown soil is the
Fig. 1.4

UZBEKISTAN
MAIN SOIL TYPES

Source: DSMW - FAO
presence of a porous crust 2 to 4 cm thick on the surface.

ii) Desert sandy Soils

These spread in the kizilkum desert, on the Amu Darya, ancient delta plains and in low mountains of the surkhandarya basin. They contain very low humus content (about 0.5 percent) and have no salinization.

iii) Taryr Soil

These soils are well developed in the ancient deltas of Amu Darya, the kashkadarya, the surkhandarya and in the central part of the Fergana valley.  

### Table 1.2

**Dominant Soil Types in Uzbekistan**

<table>
<thead>
<tr>
<th>Soil</th>
<th>000ha</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light-brown, meadow desert, high mountain</td>
<td>54</td>
<td>1.2</td>
</tr>
<tr>
<td>Brown and dark brown, mountain-woods, middle mountain</td>
<td>166</td>
<td>3.7</td>
</tr>
<tr>
<td>Dark sierozem</td>
<td>105</td>
<td>2.4</td>
</tr>
<tr>
<td>Typical sierozem</td>
<td>305</td>
<td>6.8</td>
</tr>
<tr>
<td>Light sierozem</td>
<td>259</td>
<td>5.8</td>
</tr>
<tr>
<td>Meadow-sierozem and sierozem-meadow</td>
<td>780</td>
<td>1.5</td>
</tr>
<tr>
<td>Meadow-sierozem belt</td>
<td>67</td>
<td>1.5</td>
</tr>
<tr>
<td>Marshy-meadow sierozem</td>
<td>7</td>
<td>0.2</td>
</tr>
<tr>
<td>Sub-total</td>
<td>1041</td>
<td>23.4</td>
</tr>
<tr>
<td>Grey-brown</td>
<td>1103</td>
<td>24.8</td>
</tr>
<tr>
<td>Desert-sandy</td>
<td>137</td>
<td>3.1</td>
</tr>
<tr>
<td>Dry lands</td>
<td>178</td>
<td>4.0</td>
</tr>
<tr>
<td>Meadow and dry-meadow</td>
<td>46</td>
<td>1.0</td>
</tr>
<tr>
<td>Desert zone meadow</td>
<td>179</td>
<td>4.1</td>
</tr>
<tr>
<td>Desert zone marshy meadow</td>
<td>5</td>
<td>0.1</td>
</tr>
<tr>
<td>Saline, alkali soils</td>
<td>127</td>
<td>2.9</td>
</tr>
<tr>
<td>Sand 1210</td>
<td>27.2</td>
<td></td>
</tr>
<tr>
<td>Others land (rocks, wetland etc.)</td>
<td>416</td>
<td>9.4</td>
</tr>
<tr>
<td>Sub-total</td>
<td>3402</td>
<td>76.6</td>
</tr>
<tr>
<td>All land</td>
<td>4442</td>
<td>100</td>
</tr>
</tbody>
</table>

1.5 Natural Vegetation

Natural vegetation means that type of vegetation which grows naturally without any influence of man and includes "wild" or semi-natural vegetation, while as vegetation grown by the influence of man directly or indirectly is called cultural vegetation.

The total forest area of Uzbekistan during 2001 was about 16292 km² which includes both natural forests and plantations. Natural forests include closed forests, where trees cover a high proportion of the ground e.g. broad-leaved forests, coniferous forests and bamboo forests (Fig. 1.5).

Forests are naturally unevenly distributed within the territory of the Republic of Uzbekistan. According to the State Committee of Forestry, natural vegetation and forests currently occupy 85 percent of deserts/steppe areas, 13 percent of mountains, and in the valleys and flood land areas which originally were well covered, (only 2 percent remains.).

Table 1.3
Forest Area of Uzbekistan

<table>
<thead>
<tr>
<th>Forest Area</th>
<th>Hectares</th>
<th>Worlds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Forest Area</td>
<td>1,869</td>
<td>3,869,455</td>
</tr>
<tr>
<td>Natural Forest Area</td>
<td>1,669</td>
<td>3,682,722</td>
</tr>
<tr>
<td>Plantation Area</td>
<td>300</td>
<td>186,733</td>
</tr>
<tr>
<td>Total Dry land Area</td>
<td>44,265</td>
<td>5,059,984</td>
</tr>
</tbody>
</table>

Source: FAO Statistical Service (2005)

Table 1.4
Percentage of Total Land Area Covered By Different Land Divisions (2005)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Land Division</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Forests</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Shrub land, and grass land</td>
<td>47</td>
</tr>
<tr>
<td>3</td>
<td>Crop land and Natural vegetation</td>
<td>27</td>
</tr>
<tr>
<td>4</td>
<td>Urban and built up areas</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Barren vegetation snow and ice</td>
<td>16</td>
</tr>
<tr>
<td>6</td>
<td>Wetland and water bodies</td>
<td>7</td>
</tr>
</tbody>
</table>

Source: FAO Statistical Service (2005)
Fig 1.5

Percentage of Total Land Area Covered by Different Land Divisions

- Forests
- Shrub land, and grass land
- Crop land and Natural vegetation
- Urban and built up areas
- Barren vegetation snow and ice
- Wetland and water bodies

1 27 16 7 2 47
As already mentioned in preceding para that Uzbekistan has total land area of about 44,740 ha, including areas under inland water bodies. Out of this area, forests cover 20 percent, shrubs land, savanna and grass lands cover 47 percent, cropland and natural vegetation occupies about 27 percent, urban and built up areas 1 percent, spare or barren vegetation, snow and ice 16 percent and wetlands and water bodies occupies about 7 percent.

Forests and other areas of natural vegetation are areas of economic significance. They have three main values. Firstly, they are important in stabilizing environmental processes (water shed protection, anti desertification and atmospheric etc). Secondly some parts of them can be good pastures, and lastly they are used for collecting timber, fuel woods, nuts, fruits and other usefull products.

Small sectors of riverside forests "Tugia" are still located along big rivers. Until recently, relatively large areas were covered with forests, but as a result of stably (short) riverside forests and river flow control, the area of riverside forests has decreased by more than 10 times.

As far as the mountain regions of the Republic of Uzbekistan are concerned, mountain forests can be found everywhere. Mountain forests improve climate, control water regime, and protect soil from erosion.

Desert shrubs and other vegetation grow mostly on sandy soils. They are very important in protection of sand from blowing away. The largest areas of steppe / desert shrub lands are located in Bukhara province and karakalpakstan. Small areas are also dispersed among surkhandarya, khorezm, and Syr Darya provinces and Fergana valley.

In the past, more than 2 million hectares of forest land were distributed, on temporary basis, to agricultural organizations that have been using these lands as pastures for decades. This has resulted in loss of forestry values in these forest areas. The greatest losses in forestry and natural vegetation occurred between 1930 and 1980, mainly due to the high development in agriculture. After this time the speed of such losses slowed down. However the overall situation
with forestry and natural vegetation cover in Uzbekistan is still unsatisfactory. For example, according to the data of National Centre for Space Environmental Monitoring, total area occupied by trees and shrubs in the kashkadarya river basin has dropped by 12 percent. More than two-fold decrease in number of nut-fruit and fruit shrubs and other valuable species in this region is a sign of real danger.

To overcome this situation, in 1993 the government of Uzbekistan passed a resolution to preserve forests and their resources. In addition, it has been decided to establish commercial plantation of poplars on about 90,000 hectares "elder" pine, on 800 hectares, walnuts on 500 hectares of low productive irrigated lands. Forest policy in Uzbekistan should put a high priority on prevention of further losses in natural vegetation as well as efforts to develop the plantation forestry sector.

1.6 Mineral Resources

The Republic of Uzbekistan is rich in a variety of mineral resources which are unevenly distributed. These minerals as per their composition and economic use are divided into metals and non-metals, power generating resources and raw material for building.

According to the latest economic survey of Uzbekistan, about more than hundred types of minerals are found in Uzbekistan. There are different famous mineral deposits but the very well known minerals deposition of Uzbekistan are copper, silver, gold, lead, zinc, tungsten, natural gas and other resources has made Uzbekistan a
Besides these minerals Uzbekistan has large deposits of salt, raw aluminum, semi-precious, and precious stones, along with some rare metals and raw building materials. Uzbekistan has various famous mineral deposit sites, Gazgen (one of them) which is famous for marble deposits, because its marble is used for buildings and decoration purposes. There are also deposits of feldspar, kaolin, and corundum.

As far as ferrous metals are concerned Uzbekistan has sound iron, manganese and chromium deposits. But as per industrially iron is not significant that is why the Bekabad metallurgical plant the only one of its kind in the country processes primarily scrap metal. The most promising manganese deposits are in Dautash, kizibaiarak and Lakhtakarachin located in the kashkadarya province.

Ferrous metals occupy an important place in mining materials. Hundreds of copper deposits are available in Uzbekistan but only three of them (in the Almalik region and Tashkent province) are currently in operation. The city of Almalim, an important center of non-ferrous metallurgy, found in 1951. There are several other good deposits of copper, that have been discovered in the Kizilkum deserts. Southern Uzbekistan and Karakalpakstan (An Autonomous Republic within Uzbekistan’s border). In addition, deposits of tungsten are currently being exploited in the Samarked (Ingichka) and Dzizak (kotash) provinces.

Gold is the Uzbekistan's second most important foreign exchange earner, at 22 percent. The main gold mining centre in Uzbekistan is Muruntau, located in the city of Zarafshan because of its significant reserves. There are also gold deposits in Tashkent, Dzizak and the Namangan province Marjanbulak, Zirmitan and chandak.

The above given information highlights that Uzbekistan is very sound in mineral resources. Besides mineral resources, Uzbekistan is very rich in oil and natural gas (fuel and energy resources). Uzbekistan has abundance of natural gas, used both for domestic consumption and export. Main gas producing areas in Uzbekistan are
Fig. 1.6

MINERAL RESOURCES
UZBEKISTAN

LEGEND
▼ MINERAL SALTS  V - CEMENT
▲ IRON  S - SILVER
● OIL  A - ALUMINUM
● ZINC  T - TUNGSTEN
♦ STRONTIUM  ◆ COAL
□ URANIUM  □ NATURAL GAS
▼ MAGNESIUM & TIN  ○ OIL & GAS
○ GOLD  △ PHOSPHORS
□ SILICON METALAS
♦ GRAPHITE & TIELOSPAR
♣ COPPER

Source: Mineral Manual (Asia)
the kashkadarya and Bukhara provinces. The production of gas has been started during 1940 in Andijan province. The production was low with the passage of time, it has shown positive growth, especially from 1959, with the discovery of a large gas deposits in Bukhara province. Now kashkadarya is the leading producer of natural gas in Uzbekistan which produces about 75 percent of all gas in the state.

Uzbekistan also produces large amount of coal. The three deposits of coal have been found in Angren (Tashkent province, Shargun and Baysum Surkhandarya province), very important among them is the Angren deposit of brown coal produced by open mining.

Processing coal into liquid fuel is very important for the efficient use of coal, and Uzbekistan has accumulated extensive experience in this sphere. With a capacity of more than four million cubic meters of gas a year, the “Padzengaz” station in the Angren coal basin of Uzbekistan is unique in the world.

Uzbekistan also produces good quantity of oil which is almost sufficient for domestic needs. This has been estimated that for the future, the kukdumalak oil deposit in the karshi steppe (near the border of the Bukhara province and Turkmenia) can help in solving the main issues of oil in Uzbekistan, because this is the most promising oil deposit in the Uzbekistan.¹⁹

Uzbekistan has large reserves of underground deposits, and their rational use will serve Uzbekistan in boosting the economic independence and a strong foundation for a prosperous state.

1.7 Water Resources

The two main river basins are found in Uzbekistan. These basins form the Aral Sea basin. The Amu-Darya and Syr-darya drainage basins constitute almost the whole region surface water resources.²⁰

The Amu-Darya basin lies in the south, and covers an area of about 86.5 percent of Uzbekistan. The Amu Darya River is divided into three reaches. The upper reach bordering Afghanistan and Tajikistan, and where most of the water flows is generated. The middle reach borders Uzbekistan and Afghanistan and then enters into
The physical Setting

Turkmenistan. The third reach is the lower reach in Uzbekistan, before it discharges into the Aral Sea. The main tributaries of Amu Darya within Uzbekistan are the sherabad, Kashkadarya, Surkhandarya and Zeravshan rivers. The total amount of flow produced by Amu Darya basin is estimated at 78.46 km$^3$ per year.

Because of important losses in the desertic part, and because of major water withdrawal by agriculture, the flow reaching the Aral Sea is limited to a small percentage (less than 10 percent in driest years). About 4.7 km$^3$ per year, or 6 percent of the average total surface water resources of the Amu Darya river basin, are generated with Uzbekistan (Fig. 1.7).

Similarly Syr-Darya lies in the north of Uzbekistan and covers an estimated area of about 13.5 percent of Uzbekistan. The main Syr-Darya is also divided into three reaches, the upper, middle and lower reaches. The upper reach lies in the Kyrgyz Republic, where most of the water flow is used for the generation of hydro-power. The middle reach lies in the Uzbekistan and Tajikistan. The lower reach is found in Kazakhstan. Chirchik and Akhangaran rivers, which rise in Kyrgyzstan and are the main tributaries of Syr Darya within Uzbekistan. The total amount of flow produced in Syr Darya is about 3714 km$^3$ per year; the 5 percent and 95 percent probabilities are estimated at 54.1 and 21.4 km$^3$ per year respectively. Because of important losses in the desertic part, and withdrawal of water for agriculture, the flow reaching Aral Sea, is limited to a small percentage (less than 5 percent the driest years). About 4.48 km$^3$ per year or 13 percent of the average surface water resources of the Syr Darya river basin, are generated within Uzbekistan.

Ground Water Resources

Ground water is also very important in Uzbekistan. There are about 94 major aquifers in Uzbekistan. This forms a significant part of the water resource in Uzbekistan and plays an important role in providing drinking and agricultural use water including irrigation and pasture watering. So far 357 fresh water aquifers have been
Fig. 1.7

Source: Ministry of Agricultural and water management
Table 1.6
Estimated Average Runoff of Amu Darya and Syr Darya Rivers.

<table>
<thead>
<tr>
<th>River</th>
<th>Annual Flow (km³)</th>
<th>Estimate A</th>
<th>Estimate B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amu Darya River</td>
<td></td>
<td>33.25</td>
<td>34.92</td>
</tr>
<tr>
<td>Pyandj</td>
<td></td>
<td>20.14</td>
<td>20.14</td>
</tr>
<tr>
<td>Vakhsh</td>
<td></td>
<td>22.33</td>
<td>22.09</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>75.72</td>
<td>77.15</td>
</tr>
<tr>
<td>Total Amu Darya</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syr Darya River</td>
<td></td>
<td>13.96</td>
<td>12.53</td>
</tr>
<tr>
<td>Naryn</td>
<td></td>
<td>3.18</td>
<td>3.82</td>
</tr>
<tr>
<td>Kara Darya</td>
<td></td>
<td>7.63</td>
<td>5.65</td>
</tr>
<tr>
<td>Chirchik</td>
<td></td>
<td>2.07</td>
<td>1.69</td>
</tr>
<tr>
<td>Others</td>
<td></td>
<td>34.73</td>
<td>30.63</td>
</tr>
<tr>
<td>Total Syr Darya</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Aral Basin</td>
<td></td>
<td>110.45</td>
<td>107.78</td>
</tr>
</tbody>
</table>


prospected (not including mineral and thermal ones) with capacity totaling 21,480 m³ a day. Of which 10,523 m³ can be used for drinking water. Out of the total numbers of aquifers prospected, only 267 yielding 8,530 m³ a day are used. In others words there is a substantial reserve. Particularly for development of drinking water supply in rural areas.

Lakes and Reservoirs

There are large number of small artificial water bodies and reservoirs created mainly for water management purposes. The collected drainage water flow has led to the creation of artificial lakes in natural depressions. The largest lake are lake Aydarkul storing about 30 km³ of water (1995). The Sarykanish and Sudochie lakes, both located in the Amu Darya basin, the largest being lake parankul storing about 2 km³ of water close to the Zeravshan river.

The only larger natural water body of Uzbekistan is the Aral Sea. Half of the lake lies in Uzbekistan (Karalkalpakistan) and half within Kazakhstan. Aral Sea has been severely affected by irrigated land development and Water Management Polices of the past. Since the 1970's the Aral sea has shrunk to approximately half of its original
In addition to the Aral Sea, there is also a large number of artificial water bodies, as already mentioned. The Aydar - Arnasay lake system located in the north/central part the country within the Duzak and Navoi provinces. This lake system was created in 1969, mainly due to the substantial dumping of up to 25 km$^3$ of Syr-Darya Rivers flown into natural depression (emergency discharge). Its open water area and water volume equals 3,000 km$^2$ and 30 km$^3$ respectively (1989).

In the Amu Darya basin, the largest reservoir is the Tuaymuvun, with a capacity of 7.88 km$^3$ consists of four different reservoirs. It is expected that in the future Kaparas reservoir will be used to provide drinking water for Karakul Pakistan.

At present the drinking water supply for this zone comes from groundwater which is too saline.

In Syr Darya basin, the largest reservoir is the Charvak reservoir, with a capacity of about 7.99 km$^3$ on the Chirchik River near the capital Tashkent and the Andijan reservoir, with a capacity of 1.9 km$^3$ on the karadarya river in the Fergana valley.

References

1. Land and People, Asia, Australia, Newzeland and Oceania, Vol.2, p.327
15. Windows/Desktop/print/ANNEx% 20 soil%20 type’s %20% Uzbek.