CHAPTER - III

PHYSICAL SETTING

Although physical factors like topography, climate and soil determine the broad limits of different farming areas and are most important in affecting the type of farming, the special type of farming is modified by many socio-economic factors. Economic factors tend to determine the definite crop and kind of commodity produced within the various choice available as established by the physical factors. Economic factors change from time to time in contrast to the physical factors. Physical factors may vary from region to region and determine the general possibilities of growing a particular type of crop suited to that area. The most important physical factors causing the present pattern of agricultural production in the study area are (i) Geology, structure and relief (ii) drainage and drainage basins (iii) climate and (iv) soil.

(i) Geology, Structure and Relief

As a result of intensive survey carried out for petroleum and other explorations, knowledge of Geology, pattern of structural units and land reform are now better known.
In recent years, the idea of plate tectonics in the West Asia have been developed by various researches very broadly as follows.

In Triassic-Jurassic times (200 million years ago) drifting continental plates had collapsed to form a very large land mass with two major lobes: one in the north termed as Laurasia and the other as Gondwana land in the south. Between these two occurred the extensive Tethys sea, in which great sedimentary deposits were made from the erosion of land plates from the north and the south. As these sediments developed trapping the bodies of sea creatures that eventually gave rise to petroleum.

Spreading action in the north-eastern part of the Gondwana lobe during the cretaceous period produced a number of plate fragments to which the name Proto-Iranian has been given. By the late Mesozoic the Indian plate had moved far away from the main mass of Gondwanaland, and one or more Iranian plates of smaller size were also separated. Around these smaller plates Tethys sediments were later compressed to give the present day local basins or micro plates of Iran viz. the Tabas, Lut, and Helmand basins. In the process a major Arabian plate was detached and continued to move north-eastwards impinging strongly against the Iranian plate and consequently elevating the main Zagros ridges of Iran.

Further south in the Makran the collision has been between
the Iranian plate and the oceanic plates, giving some what less spectacular subduction feature (massive mountain ranges) as compared with the continental - continental collision that characterizes the higher and wider Zagros chains.

Main feature of forming the Zagros is the thrust zone in response to a more unified and consistently impinging of plates over several hundreds of kilometres. Folds are symmetrically parallel. Due to consistent impinging of plates sedimentary layers are locally disturbed, more prominently in the south-west Iran. To the north is a major area of dislocation forming a high plateau of Azerbayejan - Armenia, traversed by fault lines with much differential uplift and downthrow and presence of volcanicity.

Conditions in north Iran are not well studied. Some studies however regard the southern Caspian area as minor continental plate with the Elburz range as a zone of impaction. The narrowness of this range with a great range of strata exposed (Paleozoic to recent) points to major disturbance, though on a restricted scale. Basin structures delineated by encircling high-mountains ranges are the most characteristic land farm in the north and eastern region. There are few large river valleys many of which have no outward drainage. In the middle tertiary period occurrence of fluvial deposits of several hundred metres in thickness
and of alluvial origin are found on the piedmonts of Elburz, Zagros and Makran. These deposits were laid down in various erosion episodes in the middle tertiary period. In the eastern and central part of Iran wind blown deposits, chiefly of loessic origin are found in considerable thickness.

The Elburz consists of relatively narrow series of folds disposed in shallow crescent along the southern border of caspian sea. The fold ridges are extremely steep. Erosion had been very active on the northern slope of Elburz and this region is broken by deep gorges, at the bottom of which great torrents flow directly northwards towards the caspian shore. Further to the south flow a number of longer and better developed rivers such a Shahrud and Safidrud. In the extreme south hill sides are entirely bare. Wherever water is available, many parts of the southern Elburz are extremely fertile, especially the alluvial cones and river terraces, where there is a thick deposit of rich soil. In some places the river bed is too deeply incised to allow the deposition of silt, and such valleys are uninhabited.

On the northern edge of the Elburz range and its western continuation, the Talish hills, lies the coastal plain of the southern capian varying between 15 and 100 kilometres in width. Close to the caspian shore is the zone of sand dunes, behind which lie salt marshes and lagoons.
These are succeeded by slightly higher and firmer ground, most of which was densely covered by the Hyrcanian vegetation (Vegetation developing under condition of abundant rainfall throughout the year with high or moderate temperature).

In the east, the Elburz range is succeeded by a trough. The average height of this trough is about 1500 metres. This low land serves to divide the higher Elburz to the west from the more massive ranges of the east. In the most northerly portion between Kopet Dagh and Kuh-i-Aleh lies a well defined valley, occupied by two rivers, the Atrek flowing northwest to the Caspian, and the Kashuf flowing south-east towards Afghanistan. Most of the high lands are barren and empty and serve as grazing ground, but the ravine lowlands are relatively cultivated. The richest part is upper Kashuf Valley around Mashhad and Nishapur.

In the north-western part of Zagros, Horst blocks and down thrown basins are prominent. At places they have been modified by intense erosion. One of these down thrown basins is the Lake Urmiyeh (50,000 km\(^2\)) and others are in Mughan districts of the lower Aras (Araxes) river and upper reaches of Qara Su(Ardebil region). Numerous deeply incised valleys separate the individual blocks, so that, despite general impression of plateau, relief is extremely varied. Some river valleys are like gorges and some much wider like
Aras Valley and Safidrud (named in its lower course the Qizil-Uzan). Besides much basalt pavement the plateau uplands are stoney and undulating covered by recent lava and offer few inducements to settlement. They are hot and arid in summer and bitterly cold in winter - possibly with the most extreme climate in the world - In the south-west fold are simple anticlines (ridges) and synclines (valleys) Shiraz and Nizir basins are enclosed with arctic drainage, hence have salt marshes and lakes. In other parts streams are broken through the surrounding highland rim, and there is a normal drainage only outwards towards the north-west. Some of these basins are intensively cultivated in the non-saline stretches, away from the lowest parts of these basins i.e. shiraz was the cradle of cultural movement and gave rise to such internationally famous Iranian poets as Hafiz, Saadi and Omar Khayyam.

The western Zagros shows short immature streams that have cut spectacular gorges even across anticlinal ridges and, because of their erosive power, carry increased quantities of silt, the Karun in particular. In its lower reaches even the Karun becomes hurried in its own alluvium with only a seasonal flow reaches the sea.²

The Jaz Murian basin in the south-east is partly filled by a thick layer of silt and wind blown materials deposited in dunes. There is no drainage from the basin
and the centre is occupied by salt lakes, fed by two streams, the Rud Halil and Rud Bampur. Other streams from the surrounding high ground fail to reach the lake and, soon disappear beneath the drift cover. The entire eastern region is markedly barren and unproductive, for besides the difficulties of irregular topography, there is extreme heat and cold, great aridity and violent wind.

In an extensive area of central Iran river flow is only seasonal. Dry ravines fill rapidly after rainfall and rushing torrent carry abundant fine sediments and pebbles and erosion during this time can be very rapid, consequently rapid subsidence and deposition of eroded materials occurs. These materials when dried may be redeposited by wind action. The interior Iran is divided among kavir and endoreic (closed or inland) basins. The main influencing factors of endoreic drainage are low annual rainfall high evaporation, surface porosity and physiography i.e. encircling fold ranges. These closed drainage basins often have an alluvial fan, immediately below the mountain slopes, which are composed of rock debris, gravel and silt. At lower level topography becomes level and plain strewn with finer silt that may be redeposited by aeolian action though there can be some benches or relict shore line that break-up the level surface. At the lowest level there is usually an expanse of water, marsh, or salt desert (Kavir); shallow and
highly variable, often saline. Iran has the greatest extent of inland drainage, since no major river has broken through the encircling fold ranges, and thus the interior is divided among Kavir and endoreic basins. Lake Urmiyeh and Helmand (Hirwan) lake system are the largest of these latter with open water. Only in the extreme north and west are the streams sufficiently developed to have cut back deeply into the mountain chains.

Thus Iran's Physical Geography and topography have the greatest impact on climate and in turn both of these affect the agriculture and its activity. It is for this reason that such elements as frequent drought, sudden change in winter and summer temperature, short growing season, wind, hail storm and water shortage are directly responsible for limiting both the maximum area under cultivation and the variety of products produced.

(ii) Drainage and Drainage Basins

In Iran there was an extensive network of rivers in earlier times, but today drainage system formed by rivers and streams is much reduced and, in some places, the rivers are intermittent (Figure 3.1).

The four major drainage basins are the Central Desert, the Caspian Sea in the north-east of Tehran into which river Atrek and Gorgan flows, the Persian Gulf and Gulf of Oman in the south and Lake-Urmiyeh in the
north-west. Because of the mountain drainage structure in the marginal regions, more than half of the surface of the country loses its water in the interior. Scattered sub-basins or low points in the larger inland basins called sumps can be utilized to collect water, naturally or artificially by gravity, in sufficient amount to support habitations.³

The absence of any river with a substantial volume of flow emphasizes the extremely arid and segmented conditions of the terrain. Few rivers drain the interior slopes and then dwindle to brooks or dry up completely during the hot months. Nothing is more misleading than the broad river beds strewn with pebbles and gravels which are inundated for only a few hours at a time after sudden flush flood. The Zayandehrud is an example. Further to the north between Qom and Tehran the Karaj which flows down from the Qazvin mountains have to struggle with all its might to reach the sparkling salt-marshes of the Daryache-ye-Namak leaving almost all their water behind in the sizzling heat of the central plateau.⁴ Other rivers that drain the interior and are purely seasonal and dependent on rainfall are Kalsur in the northeast, Hablehrud, Jajrud, Shur, Saveh (Qareshu) and Golpayegan are other rivers which drain into the central part (Hinterland fields) seasonally. River Halilrud, Bampur, Mashkil and Kor are the other examples of the same category (figure 3.1).
Mountain barriers break the country up and affect the distribution of surface water regionally. In the north, in the Caspian basin where occurrence of rainfall is heaviest and well enough keep the four rivers flow all the year round. Chief among them is the Safidrud fed by its tributary rivers Qezeluzan and Shahrud which waters the region of Rasht. It is the longest river in Iran after river Karun. It flows for three quarter of its course through mountains. As the coastal plain is narrow the other rivers are much shorter. Rivers that drain the Azerbayejan provinces and Khorasan are river Aras in the north-west between the frontiers of Iran and newly independent state of Azerbayejan from former USSR and river Atrek between the province of Khorasan and Turkmanistan (also an independent state from the previous USSR) respectively. River Atrek in the north-east irrigates the northern region of Khorasan and parts of Gorgan plains while the Aras irrigates the northern districts of Azerbayejan (Figure 3.1).

Other main rivers of the caspian sea are Gorgan, Neka, Jajan, Polerud, Qarehsu, Larijan and Shahrud. Rivers rising from Zagros range pour into the Persian Gulf after watering the fertile plains of Khuzestan. The most important among them and only navigable one is the river Karun, the largest river in the country. It rises in the mids of the Central Zagros Highlands and flows
north-west through mountains for about 400 km in length, when it turns and winds generally in a south-west direction. In its upper reach often it is called Kurang river. After its junction with the Dez about 160 km north-east of Ahwaz it becomes a wide deep stream that joins the Tigris and Euphrates near Khorram-Shahr and Abadan to become the Shatal-Arab, the single channel through which all these rivers enter the Persian Gulf (Figure 3.1).

Besides these some small and non-perennial rivers that flow in the area and ultimately enter the Persian Gulf are the river Jarahi, Zohreh, Dalaki, Mand, Mehran, Shur, Minab, Jagin, Gabrik, Sadij, Nikshahr, Bahukalat, Karkeh and Dez.

As shown in Figure 3.1, rivers* flowing into the Lake Urmiyeh are Ajichay, Zarrinehrud, Siinehrud and Mahabad.

In the eastern part of Sistan and Baluchistan Province a series of large sumps collect water from Iranian and Afghan rivers. Most of the water comes from Afghanistan, and the largest single source is the river Helmand - which the Afghan can control by Dams nears its fountain head - Fertility of the surrounding land support crops, and here water is available for most years; hence the inhabitants are farmers. In some years, however, drought destroys crops and pasturelands, and a severe economic depression occurs in the region.

* River is rendered into Persian Language as 'Rud'.
In Iran water has been a great problem. Less than 14 per cent of the land receives more than 50 per cent of
the precipitation. In some areas precipitation is lacking
for long period of time. Sometimes storm with heavy rains
may provide the entire annual rainfall. Beyond the local
damage these storms may bring about, the rapid runoff
precludes the use of precipitation for irrigation.

Where precipitation are insufficient the solution is
to store water for irrigation. If these measures fail or
are insufficient, the food production is severely affected.
Where rainfall is inadequate supplementary sources of wells,
qanats or springs must be available.

In Iran surface water accounts for only a small
portion of the total rain and snowfall. A high proportion
is lost through evaporation (about 60 per cent). In addition
infiltration takes away another 15 per cent. So only 25 per
cent is left as surface water and this is very little indeed
for good crop cultivation of such a vast country.

**Lakes of Iran**

Caspian Sea with an area of 424,200 km\(^2\) is the
world's largest lake situated in the north of Iran, and
links the country with Europe via the water ways of Russia.
Most of the Iranian Lakes are of the salt-water type and the
largest ones are Lake-Urmiyeh (4868 km\(^2\)), Lake Daryache-ye-
Namak (1806 km\(^2\)), Lake Daryache-ye-Neyriz, Lake Daryache-ye-
Bakhtegan (750 km$^2$) and Lake Daryache-ye-Sistan. Lakes of Iran, especially Urmiyeh, are so salty that no irrigation is possible from these lakes.$^6$

(iii) Climate

Iran possesses a diverse climate ranging from subtropical to subpolar. In winter a persistent high pressure system in Central Asia centred in Siberia brings the country under the influence of Siberian anti-cyclone creating northerly and north-easterly winds in the northern part of the country.$^7$ In the southern half there is a shift towards a westerly component, most pronounced in the Persian Gulf. Low pressure develops over the warm waters of the Caspian, the Persian Gulf and the Mediterranean.$^5$ In summer, dry continental air associated with the peripheral circulation of the low pressure area centred over northwest India, Pakistan and Persian Gulf covers most of Iran, and gives temperature comparable with those of the Thar Desert.

Steady summer winds constitute a climatic feature in many parts of the country. Winds prevailing in summer are from the north-west and are known as shimal.$^9$ They vary in velocity and direction in different localities, they increase in velocity at noon and diminish in the evening. In the narrow mountain valleys, the wind blows in two opposite directions during a twenty-four hour period. During the day they blow up the valley but, as the air cools, in
the evening they blow down the valley. There is a diurnal change of direction on the coastal areas, with usually an onshore breeze during the day and an offshore breeze at night.

In the south-east a wind called the wind of "120 days summer wind" blows incessantly from May to September which sometimes reaches a velocity of 100 kilometres per hour in the Sistan region near the Pakistan frontier. This wind at its worst, has a tremendous destructive force and drives dust and gravel before it, giving great inconvenience to men and animals. Its scouring effect causes serious erosion on structures and terrain, but it drives away insects and pests that otherwise thrive in the summer season and become a nuisance to the standing crops.¹⁰

Maritime influences are excluded by the high mountain walls, most fully developed on the west and south, so that milder, damp air from the Mediterranean, the Caspian Sea and the Persian Gulf affect only the outer regions of Iran. In winter most of the rainfall of Iran is associated with eastward moving depressions that originate over or near the Mediterranean sea. In summer the outflowing air from Siberian anticyclone is dry and rainfall does not occur, so do the masses of summer, which with a long land tract round the summer monsoonal low, have little moisture on passing over Iran. Hence summer is completely dry, except the
shores of the Caspian. Rainfall at other seasons depends on the arrival of maritime air masses from the west. As most of the precipitation occurs over Asia Minor and the Levant in its moving tract, depression in this maritime air stream is, however, highly weakened while reaching Iran. Remaining moisture is precipitated during the crossing over the Zagros and there is little rainfall over the central plateau. When Mediterranean depression follows the land locked track quantity of rainfall occurring in Iran is very meagre, but when the track is followed via the Aegean and Black Sea it gives the heaviest rainfall, while those moving due east across Syria and Iraq are almost dry, a partial regeneration of these exhausted depressions may occur over the swamps of lower Iraq and Persian Gulf.  

Iran's natural climate may be characterized as semiarid punctuated with marked contrast such as the rainy mountain fringes of the north and west and, the arid lands of the interior and the south. These may be sub-divided into five climatic regions.

(i) The coastal land of the Caspian sea
(ii) The Elburz mountains region
(iii) The Zagros mountains region
(iv) The Basins and ranges of interior Iran
(v) The low land of the Persian Gulf
(i) The Coastal Land of the Caspian Sea

The caspian littoral is characterized by warm humid winter and hot but humid summer. It may be seen from Figure 3.2 that mean monthly temperature at Babolsar ranges between 5°C and 28°C in the months of February and July respectively. Lowest averages are in the months of January 8°C and February 5°C. While the maximum mean monthly occurs in the months of July and August, July maximum being 28°C and August 25°C respectively. It may also be seen from Figure 3.3 that at the same station at occasions absolute minimum drops to 0°C in the month of January and a further decrease up to -4°C is noticed in the month of February. Whereas absolute maximum for the same months registered a temperature between 12°C and 18°C. So the months of December, January and February are the coldest and June, July and August with maximum temperature between 32°C and 36°C and minimum temperature between 17°C and 19°C are the hottest. Figure 3.4 shows that temperature on an average at Rasht near Babolsar remains below zero for about 15 to 18 days in winter season and occurrence of frost is directly related to the drop of temperature. The number of frosty days are more than the number of the days when temperature remains below freezing point. Relative humidity during the months of June, July and August remain low. In the month of June it is 48 per cent, July 45 per cent and August 46 per
IRAN: MEAN MONTHLY TEMPERATURE
1983

BABOLSAR

AHWAZ

KERMAN

MASHHAD

SOURCE: Data Based on Statistical Centre of Iran, 1984

FIG. 3-2
IRAN: MAXIMUM & MINIMUM TEMPERATURE

MAX. —△—△—
MIN. —●●●—

BABOLSAR

AHWAZ

JFMAMJJASOND

C

50

10

-20

JFMAMJJASOND

C

50

10

-20

JFMAMJJASOND

C

50

10

-20

JFMAMJJASOND

C

50

10

-20

SOURCE: Data Based on Statistical Centre of Iran, 1984

FIG. 3.3
IRAN: AVERAGE NUMBER OF FROSTY DAYS & TEMPERATURE BELOW FREEZING POINT AT DIFFERENT STATIONS
1961-83

SOURCE: Data Based on Statistical Centre of Iran, 1984 & 1987

FIG. 3-4
cent respectively. In the month of December, January and February it remains between 79 per cent and 83 per cent. In the month of September and October it tends to increase and reaches its peak in the month of January and February. The highest precipitation is recorded at Bandar-Anzali followed by Rasht and Babolsar (Table 3.1 and Figure 3.5). Rainfall at these stations varies between 763 mm at Babolsar to 1666 mm at Bandar-Anzali per annum. Sometimes annual total occurs between 1000-1700 mm at Rasht (in Gilan). The lowest rainfall at this station occurred in 1979, about 1000 mm and the highest about 1700 mm took place in 1975. Rainfall in this region decreases east-ward being 700-1300 mm at Babolsar (in Mazandaran). At Babolsar minimum rainfall of about 700 mm was recorded in 1980 and maximum of 1350 mm was recorded in 1981 (Figure 3.5).

Onset of Mediterranean depressions begin in the month of September and becomes vigorous in December. From October to February there is fairly good rain. In the month of April rain normally begins to recede and rainless intervals become longer.

Table 3.1 shows that Rasht, Bandar-Anzali and Babolsar receive 67 per cent, 58 per cent and 64 per cent rainfall respectively in five months, during October to February, while from March to May these stations get 10 to 15 per cent rain and 16 to 30 per cent between June and September.
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the State</th>
<th>Annual rainfall</th>
<th>Rainfall October-November</th>
<th>Rainfall December-February</th>
<th>Rainfall March - May</th>
<th>Rainfall June - September</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mehr to Aban % of the Total</td>
<td>Azer to Bohman % of the Total</td>
<td>Esfand to Ordebehesh</td>
<td>Khordad to Shahrivar % of the total</td>
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<td>1.</td>
<td>Tehran</td>
<td>213.90</td>
<td>37.25 17.41</td>
<td>120.30 56.24</td>
<td>50.05 23.40</td>
<td>6.30 2.95</td>
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<td>Rasht</td>
<td>1278.35</td>
<td>325.55 25.47</td>
<td>543.45 42.51</td>
<td>200.20 15.66</td>
<td>209.15 16.36</td>
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<td>3.</td>
<td>Bandar Anzali</td>
<td>1666.20</td>
<td>382.80 22.98</td>
<td>585.70 35.15</td>
<td>186.60 11.20</td>
<td>511.10 30.67</td>
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<tr>
<td>4.</td>
<td>Babolsar</td>
<td>763.60</td>
<td>231.30 30.29</td>
<td>260.30 34.09</td>
<td>78.80 10.32</td>
<td>193.20 25.30</td>
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<td>5.</td>
<td>Tabriz</td>
<td>256.80</td>
<td>59.25 23.07</td>
<td>64.85 25.25</td>
<td>109.90 42.80</td>
<td>22.80 8.88</td>
</tr>
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<td>6.</td>
<td>Urmieh</td>
<td>282.85</td>
<td>55.00 19.45</td>
<td>78.25 27.66</td>
<td>127.45 45.06</td>
<td>22.15 7.83</td>
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<td>7.</td>
<td>Bakhtaran</td>
<td>396.65</td>
<td>95.05 23.96</td>
<td>169.45 42.72</td>
<td>132.15 33.32</td>
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<td>8.</td>
<td>Ahwaz</td>
<td>160.50</td>
<td>53.90 33.58</td>
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<td>37.35 23.27</td>
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<td>91.34 53.36</td>
<td>75.00 43.98</td>
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<td>1.25 1.13</td>
<td>66.10 59.66</td>
<td>43.45 39.21</td>
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<td>Mashhad</td>
<td>202.55</td>
<td>11.00 5.43</td>
<td>60.55 29.89</td>
<td>129.35 63.86</td>
<td>1.65 -</td>
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<td>Esfahan</td>
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<td>0.00</td>
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<td>19.40 30.70</td>
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<td>517.80</td>
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<td>264.65</td>
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<td>83.10 18.93</td>
<td>181.15 41.28</td>
<td>174.65 39.79</td>
<td>0.00 -</td>
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<td>6.85 4.80</td>
<td>114.25 80.18</td>
<td>21.4 15.02</td>
<td>0.00 -</td>
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<td>273.80</td>
<td>41.25 15.07</td>
<td>98.05 35.80</td>
<td>128.05 46.77</td>
<td>6.45 2.36</td>
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<td>Semnan</td>
<td>121.50</td>
<td>10.45 8.60</td>
<td>54.75 45.06</td>
<td>48.25 39.71</td>
<td>8.05 6.63</td>
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<td>Yazd</td>
<td>75.50</td>
<td>0.00</td>
<td>33.75 44.70</td>
<td>41.75 55.30</td>
<td>0.00 -</td>
</tr>
<tr>
<td>21.</td>
<td>Bandar-e-Abbas</td>
<td>86.55</td>
<td>0.00</td>
<td>39.50 45.64</td>
<td>34.55 39.92</td>
<td>12.50 14.44</td>
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<tr>
<td>22.</td>
<td>Central</td>
<td>154.10</td>
<td>22.60 14.67</td>
<td>76.90 49.90</td>
<td>52.30 33.94</td>
<td>2.30 1.49</td>
</tr>
</tbody>
</table>

**Source:**
FIG. 3.5

IRAN: ANNUAL RAINFALL
1961 TO 1983

RASHT

BABOLSAR

URMIYEH

Khorramabad

AHWAZ

MASHHAD

ESFAHAN

KERMAN

SOURCE: Data Based on Statistical Centre of Iran, 1984
Total monthly rainfall at Rasht during October to February almost varies between 140 mm to 250 mm. Total rainfall received in the month of December amounts for about 250 mm (Figure 3.6). These are the rainiest months of the year as they receive almost 60 per cent of the total annual rainfall. The number of rainy days on an average is 15 in a month. The number of rainy days increases from east to north-west.

The Caspian region of Iran has a special climatic regime. Owing to the presence of Elburz ranges and proximity to two expanses of sea which form a 'Storm track' for depressions, rainfall in this part is very high. Low altitude of the coastal plain keeps temperature in consonance with the latitudes. Cloud cover during summer helps to reduce insolation, so the high temperature characteristic of the rest of Iran are not found here. It is seldom that the temperature reaches $37^\circ$C and the July mean is only $24-27^\circ$C. Summer is mildly hot and winter mildly cold than in the adjacent areas. Rainfall is ubiquitous and abundant throughout the year except in summer when it is received on a reduced scale. It is for this reason that Caspian provinces stand in contrast from the rest of the country with conditions resembling to those of the humid tropics.
IRAN: AVERAGE MONTHLY RAINFALL, 1982-83 TO 1983-84

SOURCE: Data Based on Statistical Centre of Iran, 1984.

FIG. 3-6
(ii) The Elburz Mountains Region

The Elburz Mountains form the greatest divide in the country. To the north lies the green landscape of the Caspian land; to the south are the barren lands of the arid plateau. Just as striking is the contrast between the two flanks of the Elburz: that at Rasht in the north on the Caspian 1300 mm of rainfall occurs every year but in Tehran only 120 km south, the annual rainfall is only 215 mm.

It will be seen from Figure 3.2 that mean monthly temperature at Mashhad (altitude 985 metres) ranges between $-2^\circ C$ and $28^\circ C$. The lowest temperatures observed are in the months of January $2^\circ C$, February $-2^\circ C$ and December $3^\circ C$, while the mean monthly maximum varies between $23^\circ C$ and $28^\circ C$. The month of July records the highest temperature of $28^\circ C$ while the months of June and August, $23^\circ C$ and $25^\circ C$ respectively. Figure 3.3 shows that absolute minimum sometimes drops to below zero even in the month of October and November and continues till March. Absolute minimum and maximum sometimes occurs in the month of January ranging between $-10^\circ C$ and $12^\circ C$. In the month of February absolute minimum further drops to $-18^\circ C$ and maximum remains at $15^\circ C$. In the months of November and December absolute minimum remains below zero and the maximum temperature in the month of November rises to $20^\circ C$ and in the month of December to $25^\circ C$. At Mashhad the range of temperature is very high.
In July the absolute maximum reaches 42°C and the minimum plummets to 12°C, June, July and August are the hottest months at Mashhad. Temperature for about 100 days remains below zero at Mashhad. Frosty conditions are experienced throughout the winter season, from November to February. However, in Tehran mercury remains below zero for about 35 days and frosty conditions linger for 45 days (Figure 3.4). Relative humidity at Mashhad remains low in the months of June, July and August, being lowest in the month of July, 45 per cent, and in August 46 per cent. Higher relative humidity is found in the months of November, 76 per cent in December, 79 per cent in January and February, 83 per cent and March 77 per cent. It reaches its climax in the months of January and February.

In Tehran, altitude 1750 metres, temperature remains a bit low in the respective months compared to Mashhad. Relative humidity at Mashhad between October to May remains higher than in Tehran. Rainfall at both places are almost equal. Figure 3.5 indicates that average annual rainfall between 1961-70 at Mashhad remained 220 mm while at Tehran during the same period it was almost 210 mm. Perusal of these figures show that total annual rainfall in all those years shown in Figure 3.5 did not exceed 300 mm at both the places except at Mashhad in 1981 when it was exceptionally high as 470 mm. In majority of the years rainfall was about 210 mm or below this amount at Tehran and 270 mm at Mashhad.
It will be seen from Table 3.1 that Mashhad gets the highest rainfall of 64 per cent during spring season, 30 per cent during winter, 5 per cent between October to November and none from June to September whereas in Tehran heaviest rainfall of 56 per cent occurs in winter, 23 per cent in spring season, 17 per cent between October and November and only 3 per cent from June to September in summer. At Mashhad April is the rainiest month with 55 mm rainfall followed by May with 35 mm, the month of March gets the same amount of rainfall as that in May (Figure 3.6). Total number of rainy days are 23 per annum, March and April having 5 days each in the whole month.

(iii) The Zagros Mountains Region:

Zagros mountains along their length of 1300 km maintain an altitude of over 1800 metres, at many places this height exceeds 3600 metres. In winter temperature drops by 4°C with ascent above 2100 metres in south and by 4°C it drop above 900 metres in north. North west is the coldest part of Iran and here the lowest temperature has been recorded as -36°C. The coldest spots in the country all the year round are usually found in the western part ie Hamadan (altitude 1747 metres) and Kordestan (altitude 1373 metres).

Perusal of Figure 3.2 shows that mean monthly temperature at Ahwaz (altitude 18 metres) in south-western part
ranges between 12°C and 38°C. The lowest mean monthly takes place in the month of December and January at about 10°C to 12°C and highest in the month of July at about 38°C. While at Kerman, (Lut region) in the central and eastern part monthly mean temperature varies between 5°C to 27°C, 5°C in December and 27°C in June and July.

Low land zone of Iran lying within the Mesopotamian valley can develop extremely high temperature - south east inner basins and parts of Khuzestan show occasional summer day maximum of 50°C whilst the highest recorded temperature in Iran is 53°C - in Khuzestan which also, at Shustar, has the highest July mean maximum of 47.3°C. Figure 3.2 shows that absolute maximum temperature at Ahwaz in 1983 rose abnormally high to 60°C in the month of August. Absolute minimum for the same month was only 20°C. Absolute maximum in the month of December and January rises to about 25°C and minimum drops around 2°C to 3°C. However, at Kerman (altitude 1749 metre) absolute maximum goes upto 40°C in the month of June and absolute minimum in the same month comes down to 10°C while in the winter season from October to February and March temperature remains below zero at night. Absolute minimum temperature between December and February plummets down between -10°C to -15°C and maximum rises 20°C to 25°C in these months. At Ahwaz temperature does not go below zero in winter season and frosty
conditions are not found there while in Kerman absolute minimum goes down below freezing point for about 120 days and frosty conditions persist for about 100 days in a year (Figure 3.4). It may be seen from Figure 3.4 that in Iran, except at Ahwaz, altitude 18 metre, (Khuzestan), Yasuj, altitude 1760 metre, (Kohgilueh and Boyer Ahnad), Bushehr, altitude 14 metre, and Bandar Abbas, altitude 10 metre, (Hormozgan), temperature drops below freezing point throughout Iran in winter season, ranging between 15 to 140 days in a year and frosty conditions occur during the corresponding periods varying between 25 days in Rasht to 130 days in Hamadan per annum. Places where frosty conditions persist for more than 80 to 90 days are Arak (Central), Tabriz, altitude 1312 metre, (East Azerbayejan), Urmieh, altitude 1360 metre (West Azerbayejan), Bakhtaran, altitude 1322 metre, (Bakhtaran), Kerman altitude 1749 metre (Kerman), Mashhad, altitude 905 metre, (Khorasan), Sanandaj, altitude 1373 metre, (Kordestan), Hamadan, altitude 1747 metre, (Hamadan), Shahr-e-Kord, altitude 2078 metre, (Chahar Mahal and Bakhtiyari), Zanjan, altitude 1663 metre, (Zanjan. Except Rasht in Mazandaran all other places shown in Figure 3.4 experience frosty weather for more than 40 days in a year. In Rasht too this condition lingers for about 25 days. Tabriz, Urmieh, Sanandaj, Hamadan, Zanjan and Bakhtaran, all situated in north or north-western part.
Mashhad in north-eastern part and Kerman in the south-east have both early and late frost as well as mid winter frost, all other places mostly experience mid winter frost. In the north-west highest humidity occurs in spring season while in the south-west highest humidity is found in the month of December and in the south humidity is highest in summer.

It may be seen from Table 3.1 and Figure 3.6 that in the north-western part of Zagros mountains comprising the states of West Azerbayejan, East Azerbayejan, Kordestan, Hamadan and Zanjan, higher percentage of rainfall, over 42 per cent occurs in spring season while in the central part of Zagros highest occurs in winter season. States where winter rainfall of about 41 to 80 per cent is prevalent are Bakhtaran, Hamadan, Lorestan, Chahar Mahal and Bakhtiyari, Kohgilueh and Boyer Ahmad, Khuzestan, Fars, Bushehr and Hormozgan. In the south-east Zagros, Kerman and Sistan Baluchistan 56 to 60 per cent rainfall occurs in winter season. Figure 3.6 shows that in the northern part at Urmiyeh, most of the rainfall occur in winter and spring season from November to May between 25 and 60 mm. Whereas in the south at Ahwaz in Khuzestan 15 mm to 50 mm rainfall takes place between November and January, the highest being in the month of November.

Figure 3.5 indicates that average annual rainfall at Urmiyeh in the north was 375 mm between 1961-70 and
fluctuated considerably from 1971 to 1983. The lowest annual rainfall was registered in 1983 and the highest in 1975 ranging between 225 mm and 450 mm. In the south-west, Ahwaz receives lesser annual rainfall than Khorramabad located some distance away in the north. Annual average rainfall varied between 200 mm at Ahwaz to 500 mm at Khorramabad during 1961-70. Annual fluctuation at Ahwaz is higher than at Khorramabad. Annual rainfall ranged from 125 mm in 1973 to 350 mm in 1979 at Ahwaz and at Khorramabad it ranged from 400 mm in 1983 to 700 mm in 1975. Rainfall in the whole of Iran alternates with rainy years to moderates rains and drought conditions. As a whole rainfall, except Caspian Coast, is Capricious, varying greatly in amount from year to year (Figure 3.5) and even in regions where annual rainfall is below 250 mm, rainfall of 50 mm in 24 hours have been recorded and years may pass without any precipitation.

(iv) The Basins and Ranges of Interior Iran:

The basins and ranges of the interior are distinguished climatically by aridity and extremes of temperature.

It will be seen from Figure 3.2 that mean monthly temperature at Kerman varies between 5°C to 28°C. The lowest mean monthly temperature is recorded in the months of December, January and February and the highest in the months of June, July and August. Figure 3.3 shows that highest
absolute maximum temperature at the same station rises to 40°C and ranges between 38 to 40°C in the months of June, July and August while absolute minimum temperature plum­mets down to -15°C and varies between -10 to -15°C in the months of December, January and February. Here temperature for about 100 days remains below freezing point and frosty days are recorded for about 3 months and odd. Relative humidity remains very low at Kerman. Figure 3.5 indicates that annual rainfall at Kerman ranges between 80 mm to 200 mm. Average annual rainfall between 1961-70 remained only 150 mm. Highest shower of about 200 mm took place in the year 1974 and lowest of about 80 mm in 1979. December and January are the wettest months of the year receiving almost 25 to 50 mm rains (Figure 3.6). December, January and February altogether receive 60 per cent of rainfall of the year and the months of March, April and May experience 39 per cent as a whole while the remaining months hardly receive any rain. The same condition prevails in the whole of interior Iran with a little plus or minus difference.

(v) The Low Land of the Persian Gulf:

On the Persian Gulf Coast humidity is high throughout the year coupled with extreme heat and oppressive conditions. Where sea breeze carries in moisture from sea to land, as at jask, summer humidity is very high. At Abadan the opposite occurs and with the prevailing wind from
the northwest (land mass) humidity is low. This difference in humidity is all the more striking in view of the complete absence of summer rainfall at both the places.

Mean monthly temperature differs between $15^\circ C$ to $33^\circ C$ at Bushehr. The lowest being recorded in the months of December, January and February and highest in the months of June, July and August. At Bandar-Abbas the difference between mean monthly lowest and the highest temperature is recorded between $17.7^\circ C$ and $34^\circ C$. The lowest temperature occurs in the months of December, January and February and highest takes place in the months of June, July and August. At Bushehr absolute maximum temperature in the months of June, July and August remains at about $40^\circ C$, $48^\circ C$ and $41^\circ C$ respectively whereas at Bandar-Abbas absolute maximum of about $43^\circ C$, $48^\circ C$ and $41^\circ C$ occurs also in the months of June, July and August. Temperature at these places never goes below freezing point and consequently there does not occur any frosty condition over the area. Average annual rainfall at Bushehr is 200 mm and at Bandar-Abbas it is only 114 mm. Of the total rainfall about 85 to 90 per cent occurs between December and April (Table 3.1).
Rainfall Variability

It is supposed that places showing rainfall variability* of 12 per cent or more are susceptible to famine. In Iran most of the areas with the exception of caspian littoral States and Zanjan and to some extent Lorestan and East Azerbayejan, the whole of Iran are liable to the occurrence of famine. Table 3.2 shows that annual variability of rainfall in Iran ranges from 8.5 per cent at Zanjan to 50 per cent at Bandar-e-Abbas. Figure 3.7 showing mean annual variability indicates that barring the states adjacent to Caspian littoral states where rainfall is higher, all other states where rainfall is less have comparatively higher tendency of variability in the rainfall.

Highest rainfall variability is found in the coastal states of Persian Gulf. At Bandar-e-Abbas it is about 50 per cent, Bushehr 35 per cent and Ahwaz 20 per cent. Almost half of the southern and south-eastern part of Iran

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* The annual variability has been calculated by the writer on the basis of method evolved by P.R. Crow. The rainfall data for fifteen years (1970-71 to 1984-85) obtained, from the records of statistical centre of Iran 1984 and Ministry of Agriculture - Tehran - 1985, were arranged in ascending order for separate stations. Upper quartile, Median and lower quartile were marked in the series and the variability of rainfall in interquartile range as percentage to the median was calculated. Method would be read as follows:

\[
\text{Upper quartile - Lower quartile} \times \frac{100}{\text{Median} \times 2}
\]

### TABLE - 3.2

Per cent mean annual rainfall variability:

1970-71 to 1984-85

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of the Station</th>
<th>Variability %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tehran</td>
<td>16.40</td>
</tr>
<tr>
<td>2.</td>
<td>Rasht</td>
<td>11.83</td>
</tr>
<tr>
<td>3.</td>
<td>Bandar Anzali</td>
<td>11.06</td>
</tr>
<tr>
<td>4.</td>
<td>Babolsar</td>
<td>9.54</td>
</tr>
<tr>
<td>5.</td>
<td>Tabriz</td>
<td>13.22</td>
</tr>
<tr>
<td>6.</td>
<td>Urmiyeh</td>
<td>17.29</td>
</tr>
<tr>
<td>7.</td>
<td>Bakhtaran</td>
<td>16.94</td>
</tr>
<tr>
<td>8.</td>
<td>Ahwaz</td>
<td>20.42</td>
</tr>
<tr>
<td>9.</td>
<td>Sheeraz</td>
<td>28.17</td>
</tr>
<tr>
<td>10.</td>
<td>Kerman</td>
<td>25.00</td>
</tr>
<tr>
<td>11.</td>
<td>Mashhad</td>
<td>19.93</td>
</tr>
<tr>
<td>12.</td>
<td>Esfahan</td>
<td>23.60</td>
</tr>
<tr>
<td>13.</td>
<td>Zahedan</td>
<td>37.68</td>
</tr>
<tr>
<td>14.</td>
<td>Hamadan</td>
<td>19.87</td>
</tr>
<tr>
<td>15.</td>
<td>Khorramabad</td>
<td>12.93</td>
</tr>
<tr>
<td>16.</td>
<td>Bushehr</td>
<td>34.82</td>
</tr>
<tr>
<td>17.</td>
<td>Zanjan</td>
<td>8.50</td>
</tr>
<tr>
<td>18.</td>
<td>Semnon</td>
<td>18.79</td>
</tr>
<tr>
<td>19.</td>
<td>Yazd</td>
<td>40.14</td>
</tr>
<tr>
<td>20.</td>
<td>Bandar-e-Abbas</td>
<td>49.69</td>
</tr>
</tbody>
</table>

N.B.: Computed on the basis of the data received from the sources given in Table 3.1.
MEAN ANNUAL RAIN FALL VARIABILITY (PERCENT)  
1970-71 TO 84-85

FIG. 3.7
comprising six states, viz Sistan and Baluchistan, Hormozgon, Kerman, Bushehr, Fars, Yazd and Southern half of Khorasan and eastern half of Esfahan has the highest rainfall variability between 25 and 50 per cent. Near about another half of the northern and north-western part of the country comprising 12 states and northern half of Khorasan and western half of Esfahan has the variability between 10 and 25 per cent. Only some parts of Gilan, Zanjan and Mazandaran around Caspian sea have the variability below 10 per cent. The extent of variability to which these areas are subjected to is given in Table 3.2 and shown in Figure 3.7.

The season of greatest rainfall fluctuates to some degree over the country. In the northern part (barring Caspian provinces) the maximum takes place in spring with March as the wettest month. Whereas in the south-west the maximum occurs earlier, at Ahwaz and Khorramabad in the month of December and in the south at Jask in January. Further, as is usual under Middle Eastern conditions, rainfall is capricious, varying highly in amount and incidence from year to year. Even in regions where annual rainfall is below 250 mm rainfall of 50 mm in 24 hours are known and some years may pass with little or no precipitation at all. Monthly distribution of rainfall is quite irregular whereas for good agricultural practices light and regular showers are more important. When the incidence of
rainfall is delayed, the whole agricultural planning of the farmers goes haywire. When rainfall is regular and well distributed, the outturn of crops is quite good and agricultural practices are effective with timely onset and evenly distributed rainfall. In the north, the distribution of rainfall is more regular and well distributed compared to the southern part of the country. Since the prevailing winds blow from the north, these winds come mostly from land, they are relatively dry and affect the crops to a large extent.

Rainfall takes place mainly during the winter months from western depressions. These depressions originate in the Mediterranean and sometimes as distant as the Atlantic sea and move in the direction of westerlies. The area to the south and east of the Elburz and Zagros mountains lies in their rain shadows and thus suffers from the lack of rainfall and covers more than two thirds of the country.

Taking 250 mm of rain as the lower limit of dry-farming agriculture, it is obvious that dry farming (rain-fed agriculture) is possible only in certain regions of the country, mainly in north-west and the Caspian littoral (Figure 3.8). In the greater part of Iran agriculture is wholly dependent on the supply of irrigation water. In most part of the country the availability and quality of irrigation water are the main factors determining land use.
IRAN: ANNUAL RAINFALL (in m.m)

FIG. 3.8

and level of agricultural productivity. In most parts of the country rainfall does not occur during the growing period of crops, but surface runoff is supplied by the melting snow of highlands from March to early June. Most water, however, either rain or melted snow, drains into the porous sedimentary rocks and colluvial debris at the foot of the mountains and is then tapped in the form of springs, wells or qanats.

In Iran agricultural operations and the pattern of crops are severely affected by extremes of temperature. Temperature well below freezing point have been recorded at many places. Even at Shat-al-Arab — at sea level — occasional ice formation has been seen. North-west is the coldest part of Iran and here temperature at \(-36^\circ\text{C}\) have been recorded at a number of places. Mean January temperature at Tabriz is \(-1^\circ\text{C}\). In this part sowing as well as germination of crops is delayed. For example wheat on high plateaus is sown in the early winter months but seeds lie in dormant stage till March when thawing begins and sprouting takes place in the month of March. During summer, most of Iran is extremely hot and some of the highest temperature in the world approaching or even exceeding \(55^\circ\text{C}\) may occur in the southern region of the inner plateau. Even low lying zones can develop extremely high temperature. Both the south-east inner basins and part of Khuzestan record occasional summe-
day maximum of 50°C whilst the highest recorded temperature in Iran is 60°C. In these hot months growth of plants is hampered, plants wither away by heat. Evaporation of irrigation water is high and very fast and plants due to scarcity of water and intense heat are wilted.

Frost is normal in large parts of Iran during winter. The risk of frost limits the range of growing of variety of crops that can otherwise be grown. It also determines the timing of cultivation. Certain crops like pigeon-pea, gram and peas are highly susceptible to its adverse influences.

Climatic factors that influence agricultural pattern of the region include rainfall, temperature, amount of sunshine, frost, frequency of storm and similar agents. Among these rainfall and temperature are the most important factors which determine the type of farming.

(iv) Soil

Soil is an important natural resource for any kind of agricultural activity.

Soil classification especially determines the agricultural land use for good farming practices and productivity.

A detailed soil map of Iran on a scale of 1:2,500,000 has been prepared jointly by the Iranian Ministry of Agriculture and F.A.O. For convenience it was grouped into four
physiographic units viz (1) soil of the plains and valleys (ii) soil of the plateaus (iii) soil of the Caspian Piedmont and (iv) soil of the dissected slopes and mountains.

(i) Soils of the Plains and Valleys

The soils found in the plains and valleys are fine and medium to coarse textured which has been deposited mainly either by water or wind. These soils are alluvial in nature and composed of the sediments of terraces and flood plains. Coarse grained alluvial soils are associated with alluvial fans along foothill regions. Sand dunes are commonly found in low land basins in Iran. Irrigated agriculture is concentrated particularly in the fine textured alluvial soil, which covers 23 per cent of total cultivated area.

The most important soil group under which a variety of crops are produced in the area is alluvial soil.

Fine alluvials are sandy to clay-loams derived from mixed parent materials, dominantly limestone in origin. These are fertile soils, lending themselves to production of most crops. Since they have slow internal drainage, proper irrigation and control of the water-table are of greater importance. Normally their pH is around 7.5 to 8.0 with 30 to 40 per cent free calcium carbonate and high level of potassium. They generally have a low content of available phosphorus, nitrogen and organic matters.
In parts of East-Azerbaijan, West-Azerbaijan, Khorasan, Southern Sistan and Baluchistan Provinces and Bakhtaran, Khuzestan, and Esfahan provinces there are areas of rich black-soil, particularly in the alluvial mountain valleys. Southern Sistan and Baluchistan area has not been cultivated for thousands of years because of the lack of water, but with irrigation it could be a centre of large scale grain and fruit production. Hydrororphic soils (alluvial soils) dark in colour and high in humus content, are well developed in the paddy lands of the Caspian lowlands and support a rich agriculture.

Some of the gentle slopes in the central plateau near the Persian Gulf have fine soils but lack good drainage. In parts capillary action has lifted and accumulated salts at the surface to an excess; where this whitens the ground the flat is known as a "kavir". Solonchak and Solonetz are saline and alkali soils in the drier areas of the country. They are either poorly drained or have developed under impeded drainage conditions, containing large quantities of soluble salts and are low in organic matters. Solonetz soils are formed by the partial leaching of Solonchak soils when irrigation is done without proper drainage. They have a light coloured surface layer over a heavy dark coloured sub-soil they are also associated with salt marsh soil. Both soil types are commonly found in the basins of central Iran.
(ii) Soils of the Plateaus:

Brown, chestnut, desert and sierozem soils are the other major soil associations on which cropping is done. These are next to alluvial soil in superiority and most productive. They are of great importance in dry farming belts. Wheat is the main crop suited to this soil group.

These soils are medium deep to very deep and moderately permeable. They require a minimum of 200 to 300 mm rainfall for successful cultivation. They are similar in their chemical composition to alluvial soils. These soils contain excessive amount of calcium, 30 to 50 per cent. They contain very little phosphorus and organic matters but usually high in exchangeable potassium. These soils have been formed under modified continental climatic conditions with marked aridity at heights of about 1000 metre. Grey Desert and Red Desert soils are common in this region. Surface layer of sierozem soils is powdery and humus is minimal. Such soils are common in desert steppe areas and are alkaline in nature. Closely related to Sierozem soil are the Brown steppe soils, which are probably the most widely spread soils in Iran.

(iii) Soils of the Caspian Piedmont:

These are formed in cool humid climate under coniferous forests. These soils are formed under condition where precipitation takes place throughout the year and an
almost subtropical temperature regime and where vegetation is abundant and chemical weathering of the outcropping Mesozoic sediments are intense. They include Brown Forest, Red-Yellow Podsolic, Grey-Brown Podsolic and Red-Brown Mediterranean soils. — In the Caspian littoral, 55 per cent of the total cropped soil are fine textured alluvial soils and 21 per cent are brown forest soils in the Caspian piedmont — Total area of these soils, however, is only 0.2 per cent of the country.

(iv) Soils of the Dissected Slopes and Mountains:

These are a shallow stony azonal (with lack of profile development) soils consisting chiefly of unweathered or partly weathered rock fragments e.g. scree. Little soil development took place there and organic matter accumulated in the soil horizon giving it a dark appearance. These soils occupy almost half the area of the country.

From the agricultural point of view, the main limitations of the Iranian soils, in order of importance, are salinity, alkalinity, waterlogging, steepness of the slopes and high altitudes (which prevent cultivation of cold sensitive crops). Salinity, alkalinity and waterlogging are the major causes of the deterioration of the irrigated lands. Parent materials are often rich in salts and low rainfall prevents these salts from being leached out of the soil. Since irrigation water is scarce and farmers normally
leave half of its fields fallow every year. In areas with high groundwater table, the capillary rise of the groundwater with its dissolved salt often affects the soil to the extent that no crop can endure the salinity level. During scarcity of water, inadequate irrigation sometimes produces similar result.

It has been estimated that as much as 50 per cent of the present irrigated land is affected to some extent by amalgamation of salt and waterlogging, which are a major cause of the low production in many areas. Reclaimed land are also usually saline, therefore in those areas where new lands are brought under cultivation proper irrigation simultaneously is necessary. Some desert soils have been made productive by flushing out excess soluble salt and by adding up organic matter.

Soil erosion is a serious problem in Iran. It has already ruined a large area formerly under cultivation and has made other areas submarginal. During the period of heavy rains both run-off and erosion are severe. In some areas destruction of the protective vegetation has resulted in wind erosion and moving sand dunes which often threaten irrigation works and other structures. Some 12 per cent area in Iran is covered with sand dunes or is affected by them. On the southern and southeastern borders of the central desert there is some encroachment of the desert on
the surrounding areas. Soil erosion is widespread. Its prime causes are climatic but uncontrolled grazing by goats and the destruction of forest and bushes for fuel have much accentuated the problem. Steep slopes have been denuded of soil cover which they once had. Only few parts of Iran have enough natural cover of vegetation to build up organic content in the soil.

Based on topography, climate, soil and accessibility, the country could be divided into four geographical units and three sub-units which have discernible natural unity.  

(V) PHYSICAL DIVISION

Geographical units and sub-units are shown in Figure 3.9 and discussed as follows:

(I) The Zagros folds: Extending in an area from Armenia to Baluchistan, displaying a series of arcs.

(II) The northern highlands and associated lowlands: A narrow but well-defined series of folds that run between the caucasus mountains of south Russia and the Hindukush of Afghanistan including the coastal zone of Caspian Sea.

(III) The eastern uplands: A more varied, broken region.

(IV) The Central Plateau

(I) The Zagros Folds: This can be sub-divided into three clearly defined zones.

(a) The north-west, dying between the 35°N and about 39°N latitudes.
IRAN : PHYSICAL DIVISION

N.W. ZAGROS
CENTRAL ZAGROS
S.E. ZAGROS (MAKRAN)
NORTHERN HIGH LANDS & ASSOCIATED LOW LANDS
EASTERN UPLANDS
CENTRAL PLATEAU
LOW LAND BELOW 200 METRES


FIG. 3.9
(b) The central part, extending from latitude 35°N to about 27°N.

(c) The south-east portion (Makran) between the strait of Hormuz and Baluchistan.

I(a) This is the first part of the Zagros having its origin in the Armenian Knot. Down thrown Horst blocks and down thrown basins such as Lake Urmiyeh also known as Lake Rezaiyeh (which is 145 km long and 5 km wide covering an area of 50,000 km²); Khoi low lands, separated through the narrow ridge of Mashu Dagh from Lake Rezaiyeh; the Moghan district of the lower Aras river and the upper reaches of the QaraSu (Ardebil region) are the result of differential tectonic movements along the well-marked faults.

Elevation of a series of uplifted horst blocks increases to the north-west, giving the appearance of an intensive irregular plateau tilted towards south-east. The individual blocks are separated by numerous deeply incised vallies. Some of the river valleys look like gorges. Some others are much wider i.e. Aras Valley which is 15-60 km wide and Safidrud (Termed in its lower course the Qizil-Uzan) is 25 km in width, in which town of Mianeh is situated.

A third important topographical feature in the north-west Zagros is the presence of numerous volcanic zones, formed by the rise of magma along the fracture zones.
Besides much basalt pavement, these are imposing peaks i.e. Savalan (4300 metres), Sahand (3650 metres) and Kharazana (3520 metres). These plateau uplands inhibit settlements and are sizzling hot in summer and quite a chilly in winter—possibly with the most extreme climate of any part of the world – permanent settlements are restricted to the vicinity of riverine tracts where irrigation is possible and climatic conditions are a bit clement, here lower slopes can afford only poor grazing. The basins when irrigated however, can support relatively large population.

North-western part of the east and west Azerbayejans though rocky and irregular are used for grazing and because of the fertile soil and predictable precipitation, the valleys are densely populated, and a variety of crops are raised – rice, wheat, barley, cotton, tobacco and vegetables. The Azerbayejan provinces are known as the bread basket of Iran.

The most extensive part of these settlements is situated around Lake-Urmiyeh and extends towards Tabriz. The lake is without outlet and hence extremely saline. Urmiyeh is shallow and fluctuates considerably in area according to season and rainfall. The descending water level in summer (50°C) exposes a black expanse of salty mud, which is excellent for cultivation when irrigated. Because of the two factors: high salinity and seasonal fluctuation in area according to rainfall, settlements occur at a
distance from the shore of the lake on the banks of small streams which can be used for irrigation before the water is contaminated by contact with the lake.

I(b) The second part of Zagros comprises the portion lying between Bandar-e-Abbas and north-west Zagros. Here folding, and not faulting, is the main feature. The ridges are not continuous, but die out at intervals. Folds in the north being broader and higher and in the south smaller and finer form the principal topographical feature in the region. They are geologically young. Extensive dissection by rivers has led to formation of narrow steep-sided valleys, some of which are mere slits or defiles, too recent in formation even for the smallest alluvium-covered terraces to occur. Drainage pattern in this part is extremely intricate. In some areas rivers flow weaving a tortuous transverse (serpentine) course from one syncline or trough to the next. Here mountain ridges are uniform attaining an altitude of 4000 to 5000 metres. Part of the Zagros are vegetation covered, particularly in the north, where rainfall is heavier, but much of the central region consists of bare expanses of rock startlingly coloured in red, yellow, white, grey, green and black. Between some ridges lie vegetation covered deep open valleys, 1200-2500 metres above sea level. Here water is available, cultivation is possible on small fields on terraces cut in the sides of
hills, but for a greater extent the region supports a pastoral population. Condition in spring is sterner due to fall of snow. Another main feature is the occurrence of low land basins such as Shiraz and Niriz enclosed with aretic drainage and intensively cultivated in the non-saline stretches.

I(C) The third-division of Zagros also known as Makran, starts immediately east of Bandar-e-Abbas. Between Bandar-e-Abbas and Jask direction of folding is north-south, east­ward of Jask at first trend is from west-north-west to east­south-east, and later, from west to east. Along the coast of Gulf of Oman and Indian ocean the height of plateau country on an average is 600 to 900 metres, occasionally crossed by 1800-2100 metre hills, between these hills lie numerous river basins in consequent alignment.

Jaz Murian is the lowest basin with an altitude of 300 metres. There is no drainage from this basin and the centre consist of a saline lake fed by two streams, the Rud Halil and Rud Bampur. Other streams fail to reach the lake, and soon disappear beneath the drift cover. In the east of Jaz Murian Kuh-i-Baznan exceeds the 3300 metres height.

Most of the south-east Zagros region presents a vista of bare rocks and sand dunes. Where water is available such as Iran-Shahr, Chah-behar and Bushire patches of cultivation of cereals and cash crops are favoured.
(II) The northern highlands and associated low lands: this part consists of two distinct groups: the Elburz range in the west with outlier, Talish hills, and the more extensive chains of the north east, Kopet Dagh (termed Kuh-e-Hajari Masjid in its South-east portion) succeeded by a second chain Ala Dagh or Kuh-e-Aleh (northern part) and Kuh-e-Binalud (southern part), in between lies a trough in which river Atrek runs. Erosion has been very active on the northern slope of the Elburz — annual rainfall exceeds 2500 mm. The region is broken by deep gorges. Although the broadest part of Elburz is only 100 km wide, the region exhibits marked climatic variation. Its southern flank where rainfall is moderate to scanty river Shahrud and Nur flow. In the north of Tehran Mount Damavand, an volcanic cone, attains a height of 5671 metres. It is snow clad throughout the year and carries a very small glacier.21

Along the northern fringe of the Elburz range and its western prolongation, coastal plain of southern Caspian is situated. The width of this plain varies between 15 to 110 km. Near the Caspian coast lies a band of sand dunes, behind which there are salt-marshes and lagoons succeeded by a stretch of cultivable land (once covered by Hyrcanian vegetation).

The coastal plain is one of the most thickly populated parts in Iran.
Alluvial cones and river terraces, in the extreme south, where water is available are highly fertile.

In the extreme north between Kopet-Dagh and Kuh-e-Aleh, the basins of river Atrek and river Kashuf are relatively densely populated, with numerous cultivated areas, such as upper Kashuf valley round Mashhad and Nishapur.

(III) The eastern Uplands: this term is applied to the region lying between northern highlands and the south-east portion of the Zagros. The whole of the eastern region with irregular topography is barren and unproductive, extremely hot and cold and greatly arid. Regular violent wind blows, sometimes with a ferocity of 120 km to 200 km per hour. Settlement occurs only in shelter gullies. Some agriculture is possible only in the neighbourhood of some rivers, among them river Helmand is most important.

(IV) The central plateau: Within the mountain walls of the great four-sided citadel lies the central plateau amounting to about one half of the total area of the country. It is occupied by a series of closed basins. The lowest elevation of these basins is 300-1000 metres. Average altitude is between 1200-1400 metres. The mountain ring which completely encircles the inner plateau is almost 2500 metres high. It was once under the sea. First it was imprisoned by the great upthrust of the Tertiary and
Quaternary Era, then gradually dried out under the effect of the arid age. As the sea gradually withdrew, it gave way to the desert. It is a mystery that how such an arid area still retains extensive swamp; but possibly the water is a remnant of the old lake supplemented at present by soakage from the mountain crest, aided by presence of magnesium chloride, a strong hygroscopic substance, in the swamp which attracts some moisture from the sub-soil and from the atmosphere.

Dasht-e-Kavir or northern desert covers about one quarter of the total area of the region and Dasht-e-Lut or souther desert, an extensive stretch of sand, east of Kerman falls away into the low plains. The name 'Kavir' is given to the salt marshes of inner Iran. The term 'Dasht' is applied to firm desert or sand dunes (rig). While 'Lut' is a generic term and refers to the arid region in which both dasht and kavir may occur.

Settlement is entirely confined to the flanks of surrounding mountain chains such as Tehran on southern slope of Elburz; Qum, Yazd and Kerman on the eastern foothills of the Zagros. Avoiding the centre of the lut, important routes follow a circuitous path.
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