3.2.4 Vegetation

The results of field survey, and analysis of existing data and information indicate that the most dominant tree in the Study Area is Quercus (oak), the most dominant shrub is Astragalus(milkvetch), and the most prevailing grasses are Bromus (Bromegrass) and Agropyron (wheatgrass). Among the forbs, Gundelia (artichoke) is the most dominant. In an average, the natural vegetation of the Study Area have poor condition, decreasing trend, and a carrying capacity of 155 AUM/km^2. This disappointing situation can be attributed to over exploitation and unwise utilization of the resources. The status and distribution of natural vegetation in the Study Area, along with definition for the important terms are given in Table 3-2-4-1 and Table 3-2-4-2, respectively. Brief description for each vegetation species is given as follows;

(1) Astragalus species

This species is commonly called as milkvetch, and belongs to Leguminosae family. The plant is a short thorny shrub growing at altitude between 2000 and 2700 meters. Due to presence of thorn animals graze on its leaves only. In dry year, the local people cut its branches, soften them in water, then feed them to animals. With its wide canopy, the plant highly contribute in soil conservation. Based on its vegetative condition, trend and carrying capacity, which differ according to soil condition and grazing pressure, it is divided into three different categories.

a) ASI; moderate condition, increasing trend, carrying capacity 200 AUM/km^2.
The increasing trend indicates that the grazing pressure has reduced, and soil condition has become more favorable for growth. This group covers 554 km^2, or 2.1 % of the Study Area.

b) ASD; poor condition, decreasing trend, carrying capacity 148 AUM/km^2.
This group covers 8,348 km^2, or 31.1 % of the Study Area.

c) ASC; moderate condition, constant trend, carrying capacity 230 AUM/km^2.
This group covers 632 km^2, or 2.4 % of the Study Area.

(2) Bromus species

This species is commonly known as Bromegrass, and belongs to Graminaceae family. This grass usually grows at altitude between 800 and 2000 meters. It reaches its maximum growth in a spring season. Based on condition of growing place and grazing pressure, the vegetation is divided into two different categories.

a) BRMD; moderate condition, decreasing trend, carrying capacity 280 AUM/km^2.

This group covers only 33 km^2, or 0.1 % of the Study Area.

b) BRMP; poor condition, decreasing trend, carrying capacity 152 AUM/km^2.
This group covers 346 km^2, or 13 % of the Study Area.

(3) Agropyron species

This is a grass commonly known as wheatgrass, and belongs to Graminaceae family. It is a cold resistance plant with about 40 cm height. Although it has low feed value, in pastureland it contributes in soil conservation by its deep root. This vegetation has poor condition, constant trend, and a carrying capacity of 163 AUM/km^2. It covers 500 km^2, or 1.9 % of the Study Area.

(4) Psathyronstachys species

This is a grass commonly called as Wildrye, and belongs to Graminaceae family. It is a cold resistance plant with medium pasturage value. This vegetation has poor condition, decreasing trend, and a carrying capacity of 188 AUM/km^2. It covers only 116 km^2, or 0.4 % of mountainous parts of the Study Area.

(5) Glycyrrhiza species

This is a grass commonly known as Liquorice, and belongs to Papilionaceae family. It grows at altitude between 2100 and 2500 meters. The grass has medicinal and industrial value. It is not a wide spread vegetation, rather has established itself in abandoned rainfed cultivated lands. It has low pasturage value, but contribute in soil conservation by its root system. This vegetation has very poor condition, constant trend, and a carrying capacity of 144 AUM/km^2. The constant trend can partly be attributed to its glandular root, which helps in regrowth. Since it is collected by man, as well as grazed by animal it is in very poor condition. This vegetation covers only 13 km^2, or 0.1% of mountainous parts of the Study Area.

(6) Gundelia species

This is a forb commonly known as Artichoke, and belongs to Compositeae family. The vegetation has wide leaves which are edible. It also has medicinal and industrial value. It is a plant with low pasturage value, scattered in mountainous parts of the Study Area. This vegetation has poor condition, decreasing trend, and a carrying capacity of 93 AUM/km^2. It covers only 17 km^2, or 0.1 % of mountainous parts of the Study Area.

(7) Hordeum species

Is a grass commonly known as Wildbarley, and belongs to Graminaceae family. It is a cold resistance plant, growing at altitude between 2100 and 2700 meters. It has high pasturage value, and greatly contributes in soil conservation. The vegetation has moderate condition, increasing trend, and a

carrying capacity of 137 AUM/km^2. The increasing trend can partly be attributed to improvement in soil condition, and reduction in grazing pressure. This vegetation covers 71 km^2, or 0.3% of mountainous parts of the Study Area.

(8) Quercus species

This is a tree commonly known as Oak, and belongs to Fagaceae family. The tree is about 25 meters in height, with a canopy width of about 18 meters. It grows well in altitude between 2000 to 2700 meters. The plant can be considered as the most valuable vegetation in the Study Area. The reasons are as follows;

- Its fruits are edible
- It has medicinal value
- Its wood is used for industrial purposes
- The animals graze on it leaves
- Due to its deep root and wide canopy it largely contribute in soil conservation.

The vegetation has poor condition, constant trend, and a carrying capacity of 617 AUM/km^2. It covers 3,501km^2, or 13 % of the Study Area.

(9) Weed

This vegetation is comprised of various unwanted plants which are widely seen in abandoned rainfed cultivated lands. Weeds quickly invade the areas where the native vegetation has been destroyed, since they face no competition in such circumstance. The weeds are distributed in most part of the study area and sometimes grazed by some animals. Usually presence of weed indicates the decline in soil fertility and land quality. This vegetation has very poor condition, decreasing trend and a carrying capacity of 66 AUM/km^2. It covers 1,970 km^2, or 7.4 % of the Study Area.

(10) Non-vegetated Localities

Some localities have no natural vegetation, and are occupied by rocks, residential areas and some other physical objects. These cover 6,779 km^2, or 25.3 % of the Study Area.

(11) Water Bodies

The water bodies refer to the lakes, farm ponds and dam reservoirs occurring in the Study Area. These cover only 29 km^2, or 0.1 % of the Study Area.

Table 3-2-4-1 Status of Dominant Natural Vegetation in the Study Area

Code	Family	Species	Common Name	Condition	Trend	C. C.	Life Form
ASI	Leguminosae	Astragalus	Milkvetch	Moderate	Increasing	200	Shrub
ASD		Astragalus	Milkvetch	Poor	Decreasing	148	Shrub
ASC		Astragalus	Milkvetch	Moderate	Constant	230	Shrub
BRMD	Gramiuaceae	Bromus	Bromegrass	Moderate	Decreasing	280	Grass
BRMP		Bromus	Bromegrass	Poor	Decreasing	152	Grass
ASSP	Graminaceae	Agropyron	Wheatgrass	Poor	Constant	163	Grass
PSFR	Graminaceae	Psathyronstachys	Wildrye	Poor	Decreasing	188	Grass
GLCY	Papilionaceae	Glycyrrhiza	Liquorice	Very poor	Constant	114	Grass
GUAS	Compositeae	Gundelia	Artichoke	Poor	Decreasing	93	Forb
HOBU	Graminaceae	Hordeum	Wildbarley	Moderate	Increasing	137	Grass
QDP	Fagaceae	Quercus	Oak	Poor	Constant	617	Tree
WEED		Weeds	Unwanted plant	Very poor	Decreasing	66	Grass/Forb
NNV	No Natural Vegetation. (Rocks, Residential areas).						
WET	Water Bodies. (Lakes, Farm ponds).						

C. C.; Carrying Capacity in Animal Unit Month per square kilometer. (AUM/km^2).

Definitions

a) Animal Unit (AU); in Iran an adult female goat weighing 40 kg is equivalent to an animal unit.

On this basis the AU for other animals are decided.

A normal cow is equivalent to 5 AU. A baby goat is equivalent to 0.6 AU.

b) Animal Unit Month (AUM); is the forage requirement of an AU in one month.

It is equivalent to 60 kg of forage on dry matter basis.

c) Life Form; in Iranian scientific literatures it refers to living form of vegetation.

In this context the terms Grass, Forb, Shrub and Tree are commonly used.

Table 3-2-4-2 Distribution of Natural Vegetation in Secondary Sub-basins of the Study Area [Unit: km^2, (%)]

Vegetation		Secondary Sub-basins								Entire
Code	Species	K1	K2	K3	K4	K5	K6	K7	K8	Study Area
ASI	Astragalus	61.98	0	46.62	50.13	6.56	118.03	11.32	259.38	554.02
		(1.58)	(0)	(1.85)	(1.55)	(1.58)	(0.44)	(0.13)	(7.92)	2.07
ASD	Astragalus	1448.56	584.7	1391.76	1418.41	914.98	656.9	1749.06	183.97	8348.34
		(36.95)	(47.78)	(55.47)	(44.12)	(42.07)	(44.57)	(19.44)	(5.62)	(31.16)
ASC	Astragalus	125.94	70.97	18.17	90.85	308.53	15.66	0.34	1.37	631.83
		(3.21)	(5.81)	(0.72)	(2.83)	(14.19)	(1.06)	(0)	(3.21)	(2.36)
BRMD	Bromus	33.41	0	0	0	0	0	0	0	33.41
		(0.85)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	0.12
BRMP	Bromus	0	0	0	0.20	0	0	345.35	0	345.55
		(0)	(0)	(0)	0.01	(0)	(0)	3.84	(0)	1.29
ASSP	Agropyron	0	0	0	9.72	0	0	490.19	0	499.91
		(0)	(0)	(0)	(0.30)	(0)	(0)	(5.45)	(0)	(1.87)
PSFR	Psathyronstachys	0	0	0	0	0	0	116.25	0	116.25
		(0)	(0)	(0)	(0)	(0)	(0)	(1.29)	(0)	(0.43)
GLCY	Glycyrrhiza	0	0	0	0.05	0	0	13.16	0	13.21
		(0)	(0)	(0)	(0)	(0)	(0)	(0.15)	(0)	(0.05)
GUAS	Gundelia	0	0	0	0	0	0	17.14	0	17.14
		(0)	(0)	(0)	(0)	(0)	(0)	(0.19)	(0)	(0.06)
HOBU	Hordeum	0	0	0	0	0	0	70.63	0	70.63
		(0)	(0)	(0)	(0)	(0)	(0)	(0.78)	(0)	(0.26)
QDP	Quercus	0	0	2.81	0	0.44	0	2455.15	1042.7	3501.08
		(0)	(0)	(0.11)	(0)	(0.02)	(0)	(27.28)	(31.85)	(13.07)
WEED	Weeds	882.61	123.55	147.91	576.74	64.68	170.94	3.15	0.85	1970.43
		(22.51)	(10.10)	(5.89)	(17.94)	(2.98)	(11.60)	(0.04)	(0.03)	(7.36)
NNV	No Vegetation.	1367.72	444.47	898.11	1040.26	858.22	509.39	1474.19	186.40	6778.74
	Rock, Residential	(34.89)	(36.32)	(35.79)	(32.36)	(39.48)	(34.56)	(16.38)	(5.69)	(25.30)
WET	Water Bodies	0	0	0	28.35	0	0	0.11	0	28.45
	Lake, Farm pond	(0)	(0)	(0)	(0.88)	(0)	(0)	(0)	(0)	(0.11)

Note: For some part of K7 and K8 data do not exist.

3.2.5 Right of Common

Historically, the rangeland in Iran has been held in common as grazing land for traditional animal husbandry of the nomadic people and farmers. In the 60's before the Islamic revolution, the rangeland was nationalized. This nationalization was given the difficulties and limits for nomadic social life and behavior because of no provision of alternative grazing land to the nomadic people who is founded on animal husbandry as on the basis of their livelihood. After the revolution, in order to improve the living environment of nomadic people and farmers, the government has provided the land use right, namely the right of common, considering the historical and traditional background of them.

Responsibility on forest and rangeland management in Iran is taken by the Forest and Rangeland Organization of the Ministry of Jihad-e-Sazandegi, under the Forest and Rangeland Law. The main role of the organization is management of forest and rangeland, establishments of reserve rangeland and its management and mini-scale rural development.

The provincial forest and rangeland organization decided the rangeland use and migration route for nomadic people after discussion with the provincial office of nomad affair. Based on this decision, the office issues a permit of rangeland use for nomadic people. On the other hand, this provincial organization has carried out the renovation of rangeland, establishments of reserve rangeland and its management and opening of reserve rangeland. When shortage of grass in rangeland occurs by a drought, the reserve rangeland will open for nomadic people.

At village level, territory of village is permitted as common land for grazing. However, animal grazing in wide forest area is prohibited by the reservation of natural environment.

Rangeland and pastures for nomadic people are set up in line with traditional custom. On the rangeland use, the rivalry with farmers is avoided. If the trouble occurs, the provincial forest and rangeland organization will coordinate it.

3.2.6 Nomadism

In the study area, the nomadic society has widely existed since ancient time. Main nomadic tribes forming of the society are Bakhtiyari, Boyerahmad-olia and Ghashghay. The Bakhtiyari tribe is distributed mainly in the Chaharmahal va Bakhtiyari province and Khuzestan province. The Boyerahmad-olia tribe lives in the Kohgiluyeh va Boyerahmad province. Although the Ghashghay tribe lives in the Fars province, they migrate to the Esfahan province in the summer season.

Pastoral nomadic community consists of tribal family who is mainly based on pastoral animal husbandry and rangeland use, having a tribal social structure and traditions. The nomadic migration system is characterized by traditional method of animal husbandry; grazing animal at rangeland in summer season, and raising animal at village in winter season. Annually, there are two nomadic migrations such as from winter settlement (village) in springtime and migration in autumn. Nomadic migration period in spring and autumn is about 15 days respectively, i.e., about one month annually. The grazing period in rangeland of summer time is about five months (May to September). The provincial forest and rangeland office, in line with traditional custom principally permits the grazing place. Traditional custom and rule establish the camping place. Therefore, it cannot see any big change of the camping place.

Nomadic camp organizes from some families as "mal" to ten families and more. Remarkable change in the nomadic migration system is traffic means of nomadic family's migration. It uses a truck. By the drought in recent two years, grass shortage in the migration route is occurred. Consequently, for lack of alternative, some nomads use trucks for migrating animals as their properties.

Until last early century, a head of tribe, called "Khan" had governed the social organization of nomadic tribes. Presently, the tribal social structure was destroyed and only financial force selects social class among people. In general, village elders are elected to member of the pastoral nomadic organization and the Village Islamic committee.

Nomadic social organization is formed by tribe-tribal family-clan-olad-daheyatesh-mal. At present, the mal only remains among nomadic community. Tribal nomadic community is strong by high identification with nomadic people, and it has confederacy and allied relationship among tribes.

In the nomadic life, elders' intention dominates an all-round mode of living and it maintains traditional patterns of behavior. Nomadic family engages handicraft making such as carpet weaving, gelim weaving, jajim weaving, cap making, felt making and giveh making (traditional shoes), except traditional animal husbandry.

The government promotes a construction of settlement (village), provision of living infrastructure as social and welfare support for pastoral nomadic people. However, the permanent settlement throughout year makes slow progress caused by characteristics of a traditional nomadism. Also, they have the lack of farming technology. According to the Socioeconomic Census of Tribal Nomads 1999, there are 7,931 families settled in the sub-basins of K1, K2, K3, K4, K5 and K6. Among them, 82.6% of nomadic families are concentrated to the sub-basin K6 and they settled at mountain area since old time. In the sub-basin K7, the most concentrated place of nomadic people is the Boyerahmad Township, Kohgiluyeh va Boyerahmad province. There are settled 2,400 families. The settlement of

nomadic people in the province makes relatively progress. Other provinces related to the K7 are Esfahan and Fars. There are 12 families in Esfahan and 200 families in Fars. Most of inhabitants in the sub-basin K8 are the Bakhtiyari tribe and they migrate between Chaharmahal va Bakhtiyari province and Khuzestan province seasonally. Settled family in the K8 is 15,269. By the census, in the K8, about 4,000 nomadic populations were moved to other provinces between 1988 and 1998.

The mentioned number of family is based on the residents of winter season. According to the Socioeconomic Census of Tribal Nomads 1999, the settled population of nomads is estimated in two ways, *in summer season and in winter season. There is vast rangeland in the study area where the* nomads temporary migrate in summer season. The temporary migrant nomads are assumed to be included in the settled number of summer season in the census. Therefore above-mentioned number of settled nomadic population is estimated based on the settled number in winter season. Basic data for nomads' settlement is attached in the ANNEX H.

Economical condition, in addition to consciousness for a traditional nomadism, is another reason for slow progress of settlement. Livestock means not only a way of livelihood but also stock for future expenditure. Because farming has not been their own way of livelihood, livestock means security of life for nomads. However, nomads has been change their lifestyle, and they gradually accept new way of life. Nowadays, some of family member engage farming activities and/or bee keeping, on the other hand, another member keeps animal in rangeland. The number of settled nomads assumed to be more than the number in the census.

Nomadic people already have own land for farming through the land reform and the governmental policy of the settlement of tribal nomads. They own 2ha to 3ha of farmland for one family. The government provides farmland to nomadic people under the mentioned policy. By cultivate the land for 30 years (99 years in some areas), the land will be donated to the family. The cultivation period by nomadic family is provided by free of charge. In the nomadic lifestyle, the cultural change can be seen in eating habits (the same as rural people) and introduction of radio, TV, sawing machine and so on.

Generally, nomadic people use firewood for cooking collected around the camp. But some nomadic families have converted from firewood to propane gas and/or kerosene oil which materials provide by low price through the provincial office of nomad affair. This office promotes a conversion of cooking fuel in order to preserve the natural resources. Besides, water for drinking and living is available in the camping place. Excepting animal husbandry, nomadic people engage farming in their winter residence of the village. However, the village is located at mountain area and is unfavorable condition of farming due to lack of water and limited farmland. In addition, its productivity is extremely low because of lack of farming technology. Living foundation of nomadic people depend on

profits from traditional animal husbandry.

Public education service for nomadic children is a responsibility of the provincial education organization. The provincial organization established primary school with dormitory and dispatch teachers who come from tribes. In summer season, public health service for nomadic people is carried out by health center, which is located at near the camping place.
In the residential area of nomadic people, the cooperative store is established to provide daily necessities. Besides, wheat flour and essentials of living as coupon goods are on directly sale by the provincial office. This delivery system is traveling sales by truck. In nomadic community, there are organized cooperative and tribal youth camp.
Supporting authorities to nomadic people are the Nomad Affair Organization, Ministry of Jihad-e-Sazandegi Islamic Revolution Committee, Police, Provincial Governor, District Head, Heads of the Provincial Agricultural Organization, Provincial Education Organization, Provincial Jihad Organization and Ministry of Culture and Islamic Guidance.

3.2.7 Present Grazing Situation

In the study area, sheep and goats are grazed widely in the rangeland. It is suffered that the area is over grazed beyond its carrying capacity. Consequently, present grazing situation is studied roughly based on the following conditions.

(1) Livestock Feeding Conditions
Based on the data of fodder crops and rangeland in the area, the Iranian standard of animal unit and the nutrient requirement standard of Japan due to lack of the Iranian standard, livestock feeding conditions are assumed as follows:

- Livestock will be fed by forage in the rangeland, straw of barley and wheat produced in the rainfed farmland, and hay-cube of alfalfa in the irrigated farmland.
- Animal unit is calculated for the adult female goat/sheep weighing 40 kg.
- Cow and horse are equivalent to 5 animal units and sheep is equivalent to 1 animal unit.
- Number of livestock is converted into the number of goat.
- Animal units in month by each vegetation are adopted based on values mentioned in inventory of natural vegetation.
- Barley and wheat will be planted in dry farming land, alfalfa will be planted in irrigated land.
- In this estimation, it is not considered that nomad with livestock trips to the outside of the Study area because settlement of nomad progresses.
- Total daily nutrient requirement and coarse protein requirement are calculated based on "Japanese Feeding Standard for Sheep (1996)"

Calculation process of animal food demand are summarized as follows.

Total daily nutrient requirement : TDNR = 0.0268 x $W^{0.75}$

Here, TDNR : Total daily nutrient requirement (kg/day)

W : Weight (kg)

Then, TDNR = 0.0268 x $40^{0.75}$ = 0.4263 kg/day

DMI = TDNR/TDNC

Here, DMI : Daily dry matter intake (kg/day)

TDNC : Total dry nutrient content (0.96 kg/day)

Therefore, DMI = 0.4263/0.96 = 0.444

CPR = (FP+UP+WP)/EP

Here, CPR : Daily coarse protein requirement (g/day)

FP : Fecal protein (FP = 35 x DMI)

UP : Urinary protein (UP = 0.14675 x W + 3.375)

WP : Woolly protein (4.93 g/daily)

EP : Effective protein (= 0.58)

Then, CPR = (35 x 0.444 + 0.14675 x 40 +3.375 +4.93)/0.58 =51.233 g/day

Straw of rice :	Coarse protein	0.014 kg,	Total nutrient content	0.428 kg
Straw of wheat :	Coarse protein	0.012 kg,	Total nutrient content	0.443 kg
Straw of barley :	Coarse protein	0.009 kg,	Total nutrient content	0.464 kg

In case wheat is assumed to be representative straw, 4.3 kg of straw is required to meet CPR.

Alfalfa :	Coarse protein	0.117 kg	Total nutrient content	0.552 kg

Then, 0.8 kg of alfalfa is required to meet TDNR.

(2) Evaluation of Grazing Condition

In the results of the study, it is recognized that shortages of fodder and over-grazing are found in the study area widely. The results of study are as shown in the following table.

Table 3-2-7-1 Livestock Feeding Situation by Sub-Basins

Sub-basin	Total Heads of Livestock	Animal Unit fed by				Ratio to Total Heads by Sub-basins		
		Grazing	Straw	Alfalfa	Total	Min	Ave.	Max
K1	2,002,018	22,113 6%	2,167 1%	369,672 94%	393,952	2.9	5.1	25.3
K2	401,122	8,572 13%	2,308 3%	56,540 84%	67,419	3.4	5.9	14.0
K3	687,325	18,435 21%	9,208 11%	59,159 68%	86,801	1.4	7.9	25.9
K4	1,504,027	20,206 7%	3,832 1%	270,144 92%	294,181	3.0	5.1	25.9
K5	483,724	17,330 37%	4,383 9%	25,195 54%	46,909	4.9	10.3	33.0
K6	554,796	10,369 4%	3,996 2%	246,572 94%	260,937	1.0	2.1	18.7
K7	2,630,567	158,998 16%	18,695 2%	839,528 83%	1,017,221	0.0	2.6	36.3
K8	1,129,807	60,229 38%	23,512 15%	76,867 48%	160,608	3.4	7.0	40.1
Total	9,393,386	316,252 14%	68,101 3%	1,943,676 83%	2,328,028	0.0	4.0	40.1

(Note) derived from the Inventory of Grazing Situation.

Although above table is based on very rough estimation, following results can be pointed out;

- In the study area, over-carrying ratio is estimated at about 4 times of the carrying capacity of the area, and the area is over grazed as a whole.
- In the sub-basins K6 and K7, over-carrying ratio is about 2 times of the carrying capacity.
- In the sub-basins K1, K2 and K4, over-carrying ratio is 5 to 6 times of the carrying capacity.
- In the sub-basins K3 and K8, over-carrying ratio is 7 to 8 times of the carrying capacity.
- In the sub-basin K5, over-carrying ratio is about 10 times of the carrying capacity.
- Total feed of the study area is mostly composed of alfalfa that is equivalent to 83% of total. Grass of rangeland and straw of barley and wheat share only 14% and 3% respectively.

Taking above results into consideration, following issues are considered to be important subjects in the study area.

- Encouragement and stabilization of production of alfalfa.
- Proper management of rangeland to increase carrying capacity of grazing.

Above matters are necessarily to be studied deeply in the selected master plan study areas.

3.3 Socio-economic Condition

3.3.1 Administrative Division

The study area extends over five provinces of Chaharmahal va Bakhtiyari, Kohgiluyeh va Boyerahmad, Fars, Esfahan and Khuzestan. Especially, most of the area are covered by the Chaharmahal va Bakhtiyari province. Administrative division of the area is in accordance with the Law of Administrative Division, promulgated in 1992. Province (Ostan) is divided into several townships (Sharestan), each township into several districts, (Bakhsh) each District into several rural districts (Dehestan), and each rural district into several villages (Deh). Rural district consists of 15 to more than 100 villages. Besides, there are some towns in the district. Administrative division in the study area is tabulated as follows:

Table 3-3-1-1 Administrative Division

Province	Township	Town	District	Rural district
Chaharmahal va Bakhtiyari	Share Kord	6	4	7
	Borujen	3	2	3
	Farsan	4	3	5
	Ardal	2	2	6
	Lordegan	2	3	9
Kohgiluyeh va Boyerahmad	Kohgiluyeh	0	1	4
	Boyerahmad	2	4	13
Esfahan	Semirom	1	2	6
	Lanjan	0	1	3
	Mobarakeh	0	1	2
	Shahreza	0	1	2
Fars	Eghlid	0	1	2
	Sepidan	0	1	2
	Mamasani	0	1	2
	Abadeh	0	1	1
Khuzestan	Izeh	0	2	7
	Masjed Soleyman	0	1	7
	Dezful	0	1	1

Source: Census 1375 (1996), Statistical Center of Iran

On the other hand, the administrative division by sub-basin is as follows:

Table 3-3-1-2 Administrative Division related to Study Area

Sub-basin	Province	Township
K1	Chaharmahal va Bakhtiyari	Share Kord
	Esfahan	Lanjan, Mobarakeh
K2	Chaharmahal va Bakhtiyari	Farsan
K3	Chaharmahal va Bakhtiyari	Ardal
K4	Chaharmahal va Bakhtiyari	Boroujen
	Esfahan	Shahreza, Semiroum
K5	Chaharmahal va Bakhtiyari	Farsan
K6	Chaharmahal va Bakhtiyari	Lordegan
K7	Kohgiluyeh va Boyerahmad	Kohgiluyeh, Boyerahmad
	Esfahan	Semiroum
	Fars	Eghlid, Sepidan, Mamasani, Abadeh
K8	Khuzestan	Izeh, Masjed Soleyman, Dezful

3.3.2 Population

According to the Census 1375 (1996), total population of five provinces related to the study area is 12,792,587 inhabitants, and it accounts for 21.3% of the country. Population composition of related provinces is male 52% and female 48% and 2,525,265 families. Average family size shows 5.2 persons. The ratio of rural and urban population in the related provinces is 1:1.7 (as 1 for rural). In the study area, the ratio shows 1:0.6. Concentration to the cities of population was brought about rapid industrialization from 1976 to 1986. However, it continues such trends after the Islamic revolution. This trend also exists in the area. The Census records a migration of about 70,000 persons from Chaharmahal va Bakhtiyari province in the past decade. According to the master plan report of Ministry of Agriculture, concentration from rural area to urban area in the sub-basins of K1, K2, K3, K4, K5 and K6 was about 125,000 inhabitants in the decade (from 1976 to 1986) and 73,000 inhabitants for five years (from 1986 to 1991).

Annual population growth rate of the country presents 2.5% from 1986 to 1991, but 1.5% from 1991 to 1996. The growth rate has a tendency to decrease. However, the population increase in the area is considerably high and shows 2.5% in the census 1996. Age structure presents high rate of young age group by high population growth after the revolution. This population pressure indicates severe problems on the employment.

Population structure by sub-basin is as shown in the following table.

Table 3-3-2-1 Population, Economically Active Population Literacy and Unemployment Rates

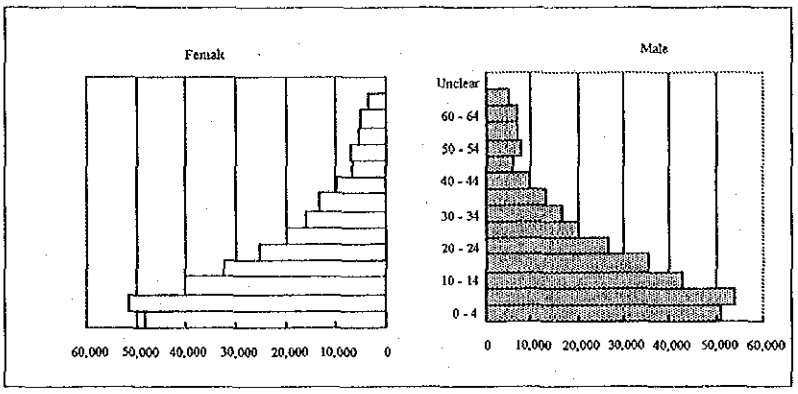
Sub-basin	Total population	Male	Female	Less than 9 years old	10 years old and over	Literacy rate (>age 6)	Unemploy-m ent rate
K1	420,520	212,462	208,058	123,212	297,308	79.0%	9.5%
K2	29,000	14,715	14,285	9,115	21,995	66.8%	1.7%
K3	54,235	27,297	26,938	15,273	36,852	62.5%	4.0%
K4	55,303	27,113	28,236	16,204	39,099	71.4%	4.2%
K5	19,154	9,687	9,536	5,612	13,542	54.9%	2.5%
K6	79,103	40,518	38,595	23,177	55,926	63.8%	3.7%
K7	363,266	190,674	183,687	128,233	235,033	67.7%	48.2%
K8	68,732	37,040	36,676	22,682	46,050	52.5%	26.2%
Total/average	1,089,313	559,527	546,010	343,508	745,805	64.8%	12.5%
Ratio	100%	51.4%	48.6%	31.5%	68.5%		

Source: Census 1375(1996), converted into sub-basin area

Based on the census 1375, total population of the study area is estimated at 1,089,313. It includes the population of nomadic people. The ratio of male and female on the population structure indicates 51.4% (male) and 48.6% (female). Only the sub-basin K4 is reversed such ratio. Viewing from the age group, the group of less than 9 years old accounts for 31.5% and this shows high percentage among the population. The percentage of the group of less than 9 years in the study area is higher than national figure of 24.4%. The ratio of the group of more than 65 years accounts for 4.6%, and is not so different from national figure of 4.4%.

According to the master plan report of Ministry of Agriculture, the population pyramid by age group

of the sub-basin K1 to K6, which covers large area of the study area, is as illustrated in the following figure. It shows that the age group of younger people under 9 years old is considerably high, but the age group of 0 to 4 has a tendency of decrease.



Source: master plan report of Ministry of Agriculture

Figure 3-3-2-1 Population Pyramid by Age Group in Sub-basin K1 – K6 (1991)

Life expectancy in Iran has been increased from 61.1 in 1988 to 69.5 in 1997. The most important factor in increasing life expectancy in the decade is the decline in the mortality rate among children. Expansion of primary health care services, provision of safe drinking water, promotion of immunization programs, and increased care for women and mothers has contributed to reduce in child and infant mortality. The mortality rate among children under 5 years has been decreased from 85.3 per 1,000 live births in 1988 to 37.3 per 1,000 live births in 1997. On the other hand, infant mortality fell from 63.5 per 1,000 live births to 30.7 in 1997. Life expectancy among provinces related to the study area is disparate, ranging from a high of 70.3 years in Esfahan province to a low of 61.6 years in Khuzestan province. Expansion of health care services is urgently needed especially for such provinces as Khuzestan and Kohgiluyeh va Boyerahmad. Life expectancy in the related provinces is lower than national average except for Esfahan province, however, it should be noted that the increase of life expectancy becomes one of factor of population pressure in the study area. Life expectancy both male and female in related provinces is as shown in the following table.

Table 3-3-2-2 Life Expectancy

Province	Total	Male	Female
Chaharmahar va Bakhtiyari	65.9	65.0	66.9
Kohgiluyeh va Boyerahmad	63.4	63.0	63.7
Esfahan	70.3	69.6	71.0
Fars	67.5	66.1	68.9
Khuzestan	61.6	60.5	62.7
Country (Iran)	69.2	68.2	70.3

Source: Human Development Report of the Islamic Republic of Iran, 1999

Economically active population (age 10 and over) in the study area is 68.5% of the total population

and the average unemployment rate shows 12.5%. High unemployment rate of the sub-basin K7 and K8 indicates 48.2% and 26.2% respectively. Literacy rate is low in the sub-basin K5 and K8. It is caused by remote mountainous area. Average rate in the area is 64.8%.

Because the study area is situated in the mountainous area and the upstream of the Karoon River, population density is low and shows 38 persons per km^2 in the study area. The sub-basin K4 is lowest population density and shows 8.9 persons.

Nomadic people in the study area concentrate in the provinces of Chaharmahal va Bakhtiyari, Kohgiluyeh va Boyerahmad and Khuzestan. According to the socio-economic census of tribal nomads 1999, the sub-basin of highest nomadic population is K8 (43.4%) and follows K6 (26.4%), K7 (25.5%), and only 24 persons (4 families) in K1.

3.3.3 Land Tenure and Land Holding

By the legislation of the law of land reform in the 60's from the landlord related to the Shah rule, land ownership of farmer was realized. However, its land reform was incomplete. Although the confusion centering the land occurred for a while after the Islamic Revolution, the land reform was settled at latter half of the 80's.

After the Revolution, the government has made the priority policy for an independent farm, instead of large-scale farm such as agricultural corporation and agribusiness. Consequently, own farmer takes leading part in agricultural production. However, it produced a large number of small-scale farmers who have less than 2 hectares of farmland. Land tenure in the study area is also presented the same situation. All farmers in the area are own farmers.
Average land holding and land use conditions per farmer in the area, according to the data of Rural Research Center, Ministry of Construction Jihad, are estimated as follows.

Table 3-3-3-1 Land Holding per Farmer Unit: ha

Sub-basin	Cultivated area w/irrigation	Cultivated area w/dry farming	Fallow area	Orchard	Total
K1	0.5	0.1	0.4	0.1	1.1
K2	0.9	1.1	0.8	0.1	2.9
K3	0.5	1.9	1.6	0.1	4.1
K4	1.5	1.1	1.8	0.3	4.7
K5	0.4	1.7	1.3	0.1	3.5
K6	1.0	0.8	0.7	0.0	2.5
K7	1.0	0.9	1.2	0.2	3.3
K8	0.2	3.3	1.1	0.1	4.7
Average	0.7	1.3	1.1	0.2	3.3

Note: converted from rural district to sub-basin Source: Rural Research Center, Ministry of Construction Jihad, Data 1372

The problem on land tenure and land holding is a subdivision of farmland by inheritance. This subdivision produces a difficulty and limitation of farm management by rural family.

3.3.4 Income Level

Main income of farmers including nomadic people in the study area derives from agriculture and animal husbandry. In order to grasp the living condition of farmers and nomadic people and to reflect to formulate the master plan, the inventory concerning income level has been made. The income level has been computed in the whole rural area including nomadic people (Refer to the Inventory of Income). Annual average income of farmer by the sub-basin is as shown in the following table.

Table 3-3-4-1 Income Level by Sub-basin Unit: Rial

Sub-basin	Agriculture	Livestock	Total
K1	122,597	3,356,980	3,479,577
K2	278,912	6,262,120	6,541,032
K3	254,121	4,179,595	4,433,716
K4	467,003	8,814,330	10,281,333
K5	235,354	7,529,115	7,764,469
K6	276,145	2,933,175	3,209,320
K7	335,703	2,192,270	2,527,973
K8	330,608	4,194,525	4,525,133
Average	287,555	5,057,764	5,345,319

Source: Inventory of Income

On the basis of the existing data of the master plan study by Ministry of Agriculture, this item of the inventory has been made. Regarding agricultural income, net income of represented crops is used. For livestock income, net income derived from sheep, goat and cow is estimated. Represented crops are forage crops (alfalfa) and vegetables in cultivated area with irrigation, and wheat with dry farming. Orchard is represented by grape.

For the estimation, the following criteria are adopted.

- Agriculture:
  - Irrigated farmland: forage crops (represented by alfalfa) ... 80%
    Vegetables 20%
  - Non irrigated farmland: wheat (with dry farming)..... 100%
  - Orchard: grapes (with irrigation)..... 100%
- Livestock:
  - animals (sheep, goat and cow) ..... per head

Annual net incomes of each farm crop per hectare and each animal per head are as follows.

Table 3-3-4-2 Annual Net Income of Farm Crops and Livestock Unit: Rial

Alfalfa (/ha)	Vegetables (/ha)	Wheat (/ha)	Grapes (/ha)	Sheep (/head)	Goat (/head)	Cow (/head)
222,975	90,078	82,297	304,640	52,815	33,715	310,805

Source: Master plan report of Ministry of Agriculture

As a result, income proportion of agriculture and livestock is5:95, and it becomes clear that income derived from livestock occupies large amount within farmer's income. This is presented that traditional livestock is a property and a mean of livelihood for farmers and nomadic people, and this trend is more severe for nomadic peoples. Nomadic people already have own land for farming through the land reform and the governmental policy of the settlement of tribal nomads. And nomadic peoples has been change their lifestyle, and they gradually accept new way of life. However, nomadic peoples haven't had enough experience for farming, and livestock keeping still means their security of life. The peoples in the study area, including both nomads and other peoples, tend to have livestock as property for future expenditure rater than money. According to the results of behavioral survey, families who stock money for future expenditure are only 4 among 205 samples families. Saving in the bank needs complicated procedure, and condition of access to the bank is poor in the study area. While livestock can be changed to money easily anytime they needs. For these reason, it can be said that livestock means a base of income structure in the study areas.

In the area, the sub-basin which is distributed most wealthy farmers is K4, and farmers earn more than 10,000,000 Rials. On the other hand, farmers who earn low income from their activities are distributed in the sub-basin K7, and it shows quarter of the K4.

3.4 Rural Infrastructure

3.4.1 Road Network

The road network in the Study area is generally subject to natural topography as the high mountain ranges are dominant in the basin. Chaharmahal va Bakhteyari Province is connected with adjacent provinces through 17 principal roads, including 12 with Esfahan Province, 4 with Khuzestan Province and 1 with Kohkilouyeh va Boyer Province.

Rural road network is undertaken by the Department of Road & Building, the Ministry of Jihad, however, the roads in Chaharmahal va Bakhteyari and Esfahan are managed by the office in Mashhad, Khuzestan and Fars are Teheran, and Kohkilouyeh va Boyer is in Yasuj.

3.4.2 Water Resources

(1) Surface Water Resource

In the Study area, surface water with 6,000 MCM volume can be utilized on the basis of estimation by JICA Study Team. And present volume for domestic water use and irrigation are estimated at 950 MCM. Of course, most of surface water will flow down in a short time. However it is possible to mention that the Study area has high potential to develop water use project for irrigation and groundwater recharge projects.

Table 3-4-2-1 Comparison of Runoff and Water Use

Sub-basin No.	Annual Runoff ($1000m^3$)	Domestic Water Use ($1000m^3$)	Irrigation Water Use ($1000m^3$)	Total Water Use ($1000m^3$)	Availability of Surface Water ($1000m^3$)
K1	599,134	16,883	161,898	178,781	420,353
K2	352,985	1,110	22,913	24,023	328,962
K3	521,815	1,924	36,123	38,047	483,768
K4	661,178	1,707	128,282	129,989	531,189
K5	792,839	733	17,444	18,177	774,662
K6	294,909	3,232	93,229	96,461	198,448
K7	1,740,827	10,354	392,204	402,558	1,338,269
K8	1,008,112	2,454	59,195	61,649	946,463
Total	5,971,799	38,397	911,288	949,685	5,022,114

At each gauging station, water quality satisfies the standard of WHO. In Bazoft, Kiyar, Lordegan, the upper reach of Kersan, and especially Karoon river, saline density is higher than the basin-wide average.

Table 3-4-2-2 Water Quality of Surface Water

ph	EC	TDS	Ca	Mg	Na	HCO_3	Cl	SO_4	K	CO_3	SAR
7.9	431	278	2.36	1.26	0.78	3.04	0.83	0.52	0.03	0.11	0.56
7-8.5	-	500	75	50	-	-	-	200	-	-	-
6.5-8.4	750	-	-	-	3	1.5	4	-	-	-	-

Note) upper:average data in the Study area, middle: WHO standard, lower : FAO standard

(2) Groundwater Resource

Major sources of groundwater are springs and qanaats. The Karstic structure is superb in the Study area, then discharge volume of springs is abandunt and its quality is high. It is mentioned that mean yield of a Karstic spring is equal to 224 liter/sec in the report prepared by MOA. On the contrary, yield of a alluvial spring is equivalent to 1.6 liter/sec. Then groundwater resources which are presently utilized are estimated as follows.

Table 3-4-2-3 Spring Water Use in K1-K6 Basin

Type	Number of Facilities	Unit Yield (liter/sec.)	Annual Volumu (MCM)
Karstic Spring	764	224	5,397
Alluvial Spring	492	1.6	25
Total	1,256		5,422

Qanaats which have been traditional way to make access to water. However, qanaats have not

developed compared to the central region of Iran and have been scattered around residential regions only. Wells have been developed in recent 30 years and mainly utilized for irrigation and industrial purposes.

In general, groundwater indicates alkalescence and high salinity in comparison with surface water. Especially, groundwater in Samirom plain which is located at northern part of K7 have TDS value of 639 mg/liter and EC value of 970 μ mhos/cm.

Table 3-4-2-4 Water Quality of Groundwater unit:mg/lit.

Item	Ph	EC	TDS	Ca	Mg	Na	HCO_3	Cl	SO_4	K	CO_3	SAR
Test Value	8.8	505	331	1.80	1.82	1.60	2.01	0.90	1.56	-	-	1.18
WHO	7-8.5	-	500	75	50	-	-	-	200	-	-	-
FAO	6.5-8.4	750	-	-	-	3	1.5	4	-	-	-	-

Note) upper:average data in the Study area, middle: WHO standard, lower : FAO standard

(3) Dams and Reservoirs

The Karoon River has abundant water resources and is considered to be one of the very important rivers in Iran, however, water resources development has not yet fully implemented and only several dams for hydropower generation and irrigation have been constructed in the Study area. At present, Masjed Soleyman Dam is under construction with the loan from Japan, other two more dams are also under construction in the Study area, and several dams are in the waiting list for implementation. The status of these dams in and around the Study area is tabulated in Table 3-4-2-5.

MOE is responsible for major dams and irrigation canals on main rivers, and MOA and MOJ are also engaged in dams with small scale.

3.4.3 Water Supply

In rural area, domestic water demand varies from 90 liter/day/person to 120 liter/day/person. It is considered to be low demand in K8 and southern part of K7 basin compared to the other basins. Main water source is groundwater and almost 100 % amount of total demand is supplied except K8 basin. In K8 basin, 50% of total amount is supplied by groundwater and the left is supplied by surface water. As to water supply for cities, groundwater is utilized in 100 %.

3.4.4 Irrigation

Gravity irrigation systems are largely conspicuous in the Study Area and furrow and border/basin irrigation method are general as irrigation methods. Only 2 % of total irrigation area in Northern Karoon are irrigated by pressurized irrigation such as sprinkler and drip. Annual water demand for farm land varies from 4,000 m^3/ha to 9,000 m^3/ha. This demand is weighted average of demands for rice, barley, sugarcane alfalfa and other crops.

Table 3-4-2-5 (1/2) Status of Dams in Karoon River Basin

Dam	BASE EL.	FOUND EL.	Crest Length	Crest Width	Annual inflow	Normal Volume	Dead Volume	USE Volume	Control Water	Agri. Dev. New	Agri. Dev. Upgra.	Dam Type	FLOOD (CMS) Design	FLOOD (CMS) 10,000 Return P.
	(m)				(MCM)					(ha)				
Garmook	39.0		310		22.4	92.1						EF		190
Tange hana	30.0	36.0	230	10	45.0	50.0	10.0	40.0	42.0	2,500	2,500	GF	100	
Yasuj	60.0		600		457.3	32.5						EF		1,662
Shahghasem	36.0	42.0	220		26.5	9.0	0.4	8.6	12.0	2,000		EF	70	
Shahid	80.0	85.0	463	10	153.0	140.0	5.0	135.0	135.0	15,000		EF		1,200
Beaedeh	75.0	84.0	1395	10	390.0	210.0	10.0	200.0	241.0	25,000		EF		2,000
Khersan I	170.0		365		3,754.7	550.0						EF		6,300
Khersan II	199.0		440		3,229.0	1,940.1						EF		5,288
Khersan III	191.0		480		3,371.2	845.7						EF		5,777
Khersan IV	151.0		390		3,248.2	864.0						EF		5,630
Ab Garmak	70.0		160		587.5	67.9						EF		1,440
Karoon 8(747)	165.0		940		2,194.6	928.8						EF		3,203
Karoon 7(705)	171.0		600		3,336.2	1,296.8						EF		4,904
Agh bolagh 1	45.0		700		119.8	2,180.0						EF		541
Koohrang 1 (Dam & Tunnel)		10.0	70		300.0				300.0			CD		
Koohrang 2 (Dam & Tunnel)		22.0	73		250.0				250.0			CD		
Koohrang 3 (W/Transfer Tunnel)	47.0	52.0	475	12	250.0	120.0	45.0	75.0	250.0			EF		956
Sulegan 4 (Vanak 1)	95.0	113.5	572	12	314.0	607.6	53.4	554.2	126.0			EF		2,870
Abadeen (Karoon 1)	50.0		200		1,356.0	370.6						EF		2,035
Vanak 2	76.0		300		571.7	21.4						EF		1,562
Chaghakhor	7.0	13.0	200	10	40.0	45.0	5.0	40.0	30.0	3,500	4,500	EF	7	
Naghan	12.0	13.3	506	8	6.0	6.0	1.0	5.0	6.0	500		EF	40	
Karoon 4	197.0	222.0	572	9	5,223.0	2,190.0	1,308.0	882.0	3,756.0			C-A/G	10,890	10,890
Kharadji (Kiar)		37.5	750	8	103.0	100.0	10.0	90.0	90.0	14,000		EF		520
Ghareh aghaj	32.4	36.4	450	10	14.5	16.0	0.2	15.8	14.0	1,500		EF	100	
Gargak	31.0	36.0	390	10	45.0	42.0	10.0	32.0	45.0	2,500	700	EF		
Bazoft	250.0		530		1,745.5	1,137.0						EF		4,211
Karoon 5	205.0		690		3,342.8	2,280.6						EF		5,408
Tashnavi	123.0		490		864.1	473.0						EF		2,142
Sulegan 2	60.0		190		138.1	114.0						EF		889
Marbaran & Tunnel	12.0	12.0	43		250.0				115.0			CD		8
Karoon 3	185.0	205.0	388	6	9,645.0	2,750.0	1,250.0	1,500.0	440.0	13,000		DA	21,400	
Shahid abbaspoor	177.0	200.0	380	6	12,000.0	3,139.0	1,275.0	1,864.0	12,800.0	98,000		DA	16,200	
Karoon 413	50.0		460		13,434.3	157.7						EF		12,519
Karoon 437	54.0		380		12,078.3	93.6						EF		11,267
Karoon 464	122.0		550		12,015.2	130.0						EF		11,100
Gedar landar	162.0	177.0	480	15	12,000.0	205.0	26.0	179.0				GF	21,700	
Masjed soleyman														
Karoon 2	40.0	70.0	149	8	10,750.0	152.0	122.0	30.0				EF	12,706	12,706
Karoon 466.5	74.0		270		12,015.2	64.6						EF		11,100

Note: BASE EL=Dam height from river bed, FOUND EL=Dam height from foundation, Agri.Dev.=Agricultural Development, Upgra.=Upgrading,
MCM=Million cubic meter, CMS=Cubic meter per second. Return P.=Return period. CONS=Amount of construction materials (1,000 cubic meters), MR=Million reals, MS=Million dollar

Dam Type: EF = Earth fill dams, GF = Gravel fill dams. CD = Concreate diversion dams. C-A/G = Conreate (arch or gravity) dams,
DA = Double arch concreate dams. FOUND = Foundation, Waiting = Waiting for further decision

Table 3-4-2-5 (2/2) Status of Dams in Karoon River Basin

Dam	RES.	P. Supply		CONS(1,000m³)		COST(MR)		TOTAL COST		STATUS			Coordinate	
	Area (ha)	MW	GWh	Soil	Cement	Spillway	Body	(MR)	(M$)	Start	End	Status	LONG	LATT
Garmook	637			723	0	210	46,670	51,145				Waiting	514135	311825
Range hana	850			570	0			26,000	2.6	92	97	In operation	514500	311300
Yasuj	200			2,528	0	2,000	119,940	133,351				Waiting	513700	303900
Shahghasem	900			575	200			10,000		94	96	In operation	513400	303400
Shahid	650			3,200	0			60,000		94	98	Under study	514500	305000
Beaedeh	900			8,100	0			120,000		94	98	Under study	513800	305600
Khersan I	2,275			11,769	0	25,550	382,470	450,312				Waiting	502640	313010
Khersan II	2,460			16,653	0	28,360	496,890	578,705				Waiting	503555	312515
Khersan III	1,445			22,919	0	28,495	632,175	726,342				Waiting	504640	311925
Khersan IV	5,055			10,809	0	19,685	358,685	416,715				Waiting	505830	311455
Ab Garmak	297			942	0	2,260	56,955	65,634				Jamab Suggestion	512325	310840
Karoon 8(747)	1,513			29,515	0	14,755	764,990	853,139				Waiting	503730	315225
Karoon 7(705)	2,249			21,659	0	21,380	605,785	688,270				Waiting	504325	313900
Agh bolagh 1	11,563			1,751	0	565	90,940	99,864				Waiting	511200	314535
Koohrang 1				0	0					48	53	In operation	500500	322900
Dam & Tunnel)				0	0									
Koohrang 2				0	16					73	85	In operation	500600	322600
Dam & Tunnel)				0	0									
Koohrang 3		36		1,900	0			220,000		91	2001	Under construction	502000	321400
W/Transfer Tunnel)				0	0									
Mulegan 4 (Vanak)	1,838	4	31	9,140	0			126,000		88	92	Waiting	511500	313900
Abadeen (Karoon)	1,362			639	0	1,770	42,540	48,684				Waiting	503630	320020
Vanak 2	77			1,909	0	2,715	97,040	109,325				Waiting	510620	313805
Shaghakhor	1,490			150	0		2,500	2,500		90	92	In operation	505600	315500
Yaghan	200			400	0					84	88	In operation	505000	315700
Karoon 4	2,700	1,000	2,170	0	2,400			1,207,000		96	2002	Under construction	502500	313600
Kharadji (Kiar)				3,500	0			40,000		95	99	Under study	504100	320500
Khareh aghaj				800	0			11,207		93	99	Under study	513300	313200
Kargak	125			847	0			16,900		95	99	Under study	503700	321700
Kazoft	1,325			38,879	0	33,635	941,645	1,070,388				Waiting	501750	315015
Karoon 5	3,488			35,047	0	30,145	870,785	988,585				Waiting	504105	313920
Kashnavi	119,750			8,985	0	7,050	312,035	352,545				Jamab Suggestion	495335	322045
Mulegan 2	847			824	0	1,255	51,485	57,760				Waiting	512555	313820
Marbaran & Tunnel				0	0			3,736		75	87	In operation	501000	322000
Karoon 3	4,600	3,000	4,137	0	1,984			1,934,000		94	2002	Under construction	500600	314700
Shahid abbaspoor	5,500	2,000	4,024	0	1,230			13,500		69	76	In operation	493600	320300
Karoon 413	806			1,796	0	15,095	92,685	120,771				Waiting	490705	321505
Karoon 437	494			1,380	0	15,525	75,980	103,125				Waiting	491625	321000
Karoon 464	630			9,463	0	39,680	324,455	405,557				Waiting	492430	320120
Cedar landar	600	2,000	3,700	13,463	760			1,134,000		94	2000	Under construction	492700	320100
Masjed soleyman				0	0									
Karoon 2		232		1,200	0					93	98	Under study	495000	320400
Karoon 466.5	215			1,986	0	22,195	99,965	137,993				Waiting	492630	320030

Note: BASE EL=Dam height from river bed, FOUND EL=Dam height from foundation, Agri.Dev.=Agricultural Development, Upgra.=Upgrading, MCM=Million cubic meter, CMS=Cubic meter per second, Return P.=Return period, CONS=Amount of construction materials (1,000 cubic meters), MR=Million reals, MS=Million dollar

Dam Type: EF = Earth fill dams, GF = Gravel fill dams, CD = Concreate diversion dams, C-A/G = Conreate (arch or gravity) dams, DA = Double arch concreate dams, FOUND = Foundation, Waiting = Waiting for further decision

Water sources for irrigation are surface water and groundwater. It is reported that each ratio of surface water and groundwater is 65 % and 35 % respectively. Irrigation efficiency have range from 30 % to 35 %. MOA have some implementation plans to reduce water loss and increase irrigation efficiency by lining canal and introducing pressurized irrigation system.

3.4.5 Health Care

Public health care facilities for rural people in the study area are established on the basis of the national health care system. There is a health house at the village level. Health center is established based on rural population at the rural district level. There are some public hospitals in town and the center of the district. In provincial capital, some general hospitals with high medical facilities are established. Distribution ratio of health center and health house in rural area by sub-basin is tabulated as follows.

Table 3-4-5-1 Distribution of Public Health Facilities in Rural Area Unit: %

Sub-basin	Health center		Health house	
	(%)	(person/place)	(%)	(person/place)
K1	31.6	13,300	58.6	7,200
K2	19.6	3,500	41.7	1,700
K3	13.0	4,300	31.1	1,800
K4	19.5	3,500	46.4	1,500
K5	5.9	5,700	31.4	1,100
K6	8.2	16,400	39.7	3,400
K7	4.1	25,900	16.8	6,300
K8	1.2	41,800	11.6	4,300

Source: Census 1375 (1996), converted into sub-basin

Population ratio of health center (person per place) shows there is large gap between sub-basins, which exist under the lowest condition and highest condition. The lowest sub-basin is K8 with 41,800 peoples per one health center, while the highest sub-basins are K2 and K4. K8 belongs to Khuzestan province, and a part of K7 belongs to Kohgiluyer va Boyerahmad province. Life expectancy in these two provinces is rather low compared to the national average, as mentioned in 3.3.2. Due to distribution of scattered small village in the remote mountainous area of the sub-basin K5, K7 and K8, distribution ratio of these facilities presents considerably low. Number of village in the sub-basin K5, K7 and K8 is estimated 51, 1,220 and 540, respectively. Distribution ration in K8 is the highest, however, population ratio shows the condition of K8 sub-basin is the lowest. The main reason of the result is Share Kord Township, capital city of Chaharmahar va Bakhtiyari province, is located in the K1 sub-basin.

3.4.6 Post, Telecommunication and Transport

At the village level, post office and public telephone, as post and telecommunication facilities, is

established. There are public and private transport facilities which links with towns, center of the district and other villages. A ratio of villages in the study area, which have access to these facilities, is shown in the following table.

Table 3-4-6-1 Post, Telecommunication and Transport Unit: %

Sub-basin	Post office		Public telephone		Transport facilities	
	(%)	(person/place)	(%)	(person/place)	(%)	(person/place)
K1	43.5	9,700	67.8	6,200	62.7	6,700
K2	16.1	4,300	27.1	2,500	43.8	1,600
K3	10.5	5,300	23.9	2,300	47.5	1,200
K4	30.2	2,300	39.8	1,700	54.8	1,200
K5	5.9	5,700	15.7	2,100	23.5	1,400
K6	7.4	18,100	26.6	5,000	46.7	2,900
K7	3.0	35,400	11.6	9,200	33.7	3,200
K8	1.1	45,600	3.1	16,200	12.2	4,100

Source: Census 1375 (1996), converted into sub-basin
Note: K7 of post office excluded Kohgiluyeh va Boyerahmad Province because of no data.

Telecommunication facilities in the sub-basin K5, K6, K7 and K8 are scarcity compared with other sub-basins. While conditions in the sub-basin K1 and K4 are better than these sub-basins which located in the south-west part of Zagros mountain range. From these circumstances, it can be said that social development in remote and mountainous areas is far behind the other rural area in the study area.

3.5 Agriculture and Other Rural Industry

3.5.1 Agriculture

Topographically, the study area is situated in a steep mountain region of the Zagros Mountains, the area spreading from the border of plains to places between mountains, and highlands. These geographical features limit the land and cultivated fields where agriculture can be practiced. In addition, there are climatic differences caused by difference in altitude. Water sources for agriculture in the area depend on snowfall in winter, and conditions for practicing agriculture are greatly restricted. For these reasons, agriculture without irrigation is practiced on most farmland.
The major crops in this area are wheat, barley, forage crops and beans. In some districts with abundant water, paddy rice, beans and vegetables are cultivated. On the other hand, on some hillsides in the area, spreading from the border of plains to places between mountains, grapes, apples and nuts are cultivated.

The distribution of farmland in each sub-basin within the area is tabulated as follows:

Table 3-5-1-1 Distribution of Farmland Unit: ha

Sub-basin	Cultivated area w/irri.	Cultivated area w/dry f.	Total cultivated area	Fallow area	Orchard w/irri.	Orchard w/dry f.
K1	12,985	3,334	16,309	10,846	2,281	9
K2	1,986	3,551	5,535	3,201	286	0
K3	2,078	14,168	16,250	11,021	640	0
K4	9,489	5,896	15,384	9,977	1,627	0
K5	885	6,745	7,633	4,327	203	0
K6	8,661	6,149	14,810	5,797	241	0
K7	29,489	28,767	58,259	29,894	6,161	243
K8	2,700	36,178	38,881	11,179	1,009	0
Total	68,273	104,788	173,061	86,242	12,448	252

Source: Rural Research Center, Ministry of Construction Jihad, Note: Data is converted into sub-basin.

Based on the data of the Ministry of Agriculture, the planted area and yield of major crops in each sub-basin are as shown in the following tables.

Table 3-5-1-2 Planted Area of Main Crops Unit: ha

Sub-basin	Wheat	Barley	Rice	Forage	Bean	Sugar beet	Other crop	Total
K1	6,540	2,397	82	6,181	424	163	522	16,309
K2	2,496	725	11	2,264	11	0	28	5,535
K3	4,453	1,463	4,583	5,590	33	0	130	16,250
K4	6,107	1,708	0	5,661	1,123	92	692	15,384
K5	3,435	725	481	2,985	0	0	8	7,633
K6	1,955	1,466	1,451	3,406	5,317	267	948	14,810
K7	20,449	7,341	4,195	10,487	9,263	4,486	2,039	58,259
K8	10,653	7,543	11,781	3,771	778	0	4,355	38,881

Source: Data of Ministry of Agriculture

Table 3-5-1-3 Cropping Rate of Main Crops Unit: %

Sub-basin	Wheat	Barley	Rice	Forages	Pulses	Sugar beet	Other crop
K1	40.1	14.7	0.5	37.9	2.6	1.0	3.2
K2	45.1	13.1	0.2	40.9	0.2	0.0	0.5
K3	27.4	9.0	28.2	34.4	0.2	0.0	0.8
K4	39.7	11.1	0.0	36.8	7.3	0.6	4.5
K5	45.0	9.5	6.3	39.1	0.0	0.0	0.1
K6	13.2	9.9	9.8	23.0	35.9	1.8	6.4
K7	35.1	12.6	7.2	18.0	15.9	7.7	3.5
K8	27.4	19.4	30.3	9.7	2.0	0.0	11.2

Source: Data of Ministry of Agriculture

Table 3-5-1-4 Crop Yield of Main Crops Unit: kg/ha

Area	Irrigated/ Non irrigated	Wheat	Wheat	Rice	Alfalfa	Clover	Sugar beat	Beans	Grapes	Apples
Study Area	Irrigated	3,180	2,990	4,710	9,780	7,010	20,990	2,470	9,520	18,245
	Non-irrigated	1,280	1,120							
Country	Irrigated	3,149	2,816	4,173	9,980	8,006	24,860	1,240	10,029	13,674
	Non-irrigated	821	834							

Source: Data of Ministry of Agriculture

Farming practices of major crops are as follows.

(1) Wheat

Wheat is cultivated in dry land in alternate years under a "wheat - fallow - wheat" or "beans - wheat - barley" cropping system. As farming practices, farmland is plowed with a tractor after harvesting, and the seeding period of spring wheat is from the end of October to November of the Iranian calendar. Seeding machines are used for sowing. Stable manure (made by mixing livestock dung, human feces and earth) is mixed with chemical fertilizer and plowed in before seeding. Harvesting is carried out from July to August. In areas where harvesting can be mechanized, harvester combines are used, but in general harvesting depends mainly on human power. Weeding is also done by human power. Cultivation area of wheat extends to the Study area.

The average yield of non-irrigated wheat is 1,280 kg/ha in the study area, and it is not largely different among areas. On the other hand, its yield in the country is relatively low at 821kg/ha, equivalent to 3/5 of the study area. It may be caused by difference of rainfall amount, 650 mm in the study area and 300 to 350 mm (Almanac Iran 1992) in the country. It is supposed that wheat of the country is cultivated in more sever condition than in the study area. In the case of irrigated wheat, its yield is not much different as 3,180 kg/ha in the study area and 3,149 kg/ha in the country. It means that cultivation condition is moderated by irrigation and resulting in less difference.

(2) Barley

Barley is also cultivated on dry land and planted in alternate years, similarly to wheat. In some places, there is a system of "barley - fallow - wheat - barley." The farming practices are almost same as that of wheat, while the seeding period is started earlier than wheat by about 15 days. The period of harvesting is June and July. As fertilizer, stable manure is mainly used. Only plowing is mechanized; weeding and harvesting are done by human power. Although the cultivation area extends to the whole Study area, cultivation is mainly carried out in places of relatively high altitude.

The average yield of non-irrigated barley in the study area is 1,120 kg/ha that is higher than its average of 834 kg/ha in the country. It may be caused by difference of rainfall amount as same as wheat. In the case of irrigated barley, the average yield is 2,990 kg/ha in the Study area, slightly higher than the average yield of 2,816 kg/ha in the country. Less difference of the yield is considered to be due to moderate cultivation condition by irrigation as same as wheat.

(3) Alfalfa

Alfalfa, which is used as feed for livestock, is cultivated in irrigated areas and planted continuously or in alternate years. Harvesting is carried out three or four times a year. Plowing, fertilization and seeding are done after the last harvesting of the year. Places of cultivation are flatland of plateaus and spread in the sub-basin K1 and K4.

The average yield of alfalfa in the Study area is 9,780 kg/ha, slightly lower than the average of 9,980 kg/ha in the country.

(4) Pulses

Pulses, including kidney beans, lentils and green peas, are cultivated mainly in irrigated areas. The period of cultivation is three months in summer, and that of harvesting is July and November in the Iranian calendar. As fertilizer, stable manure is plowed in, and chemical fertilizer is applied in the period of growth. As a cropping system wheat or barley are cultivated after pulses.

The yields per hectare of kidney beans, lentils and green peas are 2,470 kg, 1,350 kg and 1,230 kg, respectively. The yield of kidney beans in the country is 1,240 kg, about 1/2 of that in the Study area. It may mean that beans are cultivated intensively due to small-scale agriculture in the Study area. The yield of non-irrigated green peas is only 120 kg/ha, that is only 1/10 of irrigated ones. It means that irrigation is essential for cultivation of beans.

(5) Rice

Paddy rice is cultivated in places of 1,500 m or lower altitude where water sources are abundant. The sub-basins of K6 and K7 are the main production places in the Study area. The period of cultivation is from mid-May to October, and transplanting is carried out from mid-June to early July. The period of harvesting is October. While plowing and soil preparation are done with tractors or buffaloes, all other work is carried out by human power. The average yield of rice in the Study area is 4,710 kg/ha, that is slightly higher than the average of 4,173 kg/ha in the country. It may be due to difference of variety. While tasteful variety, but little lower in yield, is extensively grown in the large growing districts such as in the Caspian coastal area, cool weather resistant variety is grown in the Study area.

(6) Grapes

Grapes are widely cultivated in semi-dry land on the slopes of mountains in areas spreading from the border of plains to places between mountains. In the case of new planting or renewal, planting pits are made in late October and early November before snowfall, or in March. Seedlings are planted in November or in March and April. Land is plowed from late March to early May. Chemical fertilizer is applied at the time of planting and several times a year. Pruning is carried out in late March and April, in August, and in November. The period of irrigation is from July to early October. Prevention and of extermination of plant pests with agricultural chemicals is done from late May to mid-August. The period of harvesting is between late September and early November. The average yield of grapes in the Study area is 9,520 kg/ha, slightly lower than the average of 10,029 kg/ha in the country.

(7) Apples

In Semirom District containing the sub-basin K4 in Esfahan Province, the cultivation of apples is the most flourishing of all sub-basins and special production localities are formed. In the case of new planting or renewal, planting pits are made early in November before snowfall or in March and April, and seedlings are planted early in December or from late March to middle April. Land is plowed late

in March. Chemical fertilizer is applied at the time of planting and several times a year. Pruning is done late in March. The period of irrigation is between middle June and early October. Prevention of breeding and extermination with agricultural chemicals is carried out four times, i.e., late in March, late in May, late in June and early in August. The period of harvesting is from mid-September and mid-October. The yield of apples in the Study area is 18,245 kg/ha, relatively higher than the average of 13,674 kg/ha in the country.

3.5.2 *Livestock*

In rural area of the Study area, each rural families raises animal traditionally. Nomads scattered in the area earn their livelihood by animal husbandry and live the traditional nomadic migration life. The kinds of livestock raised in the village include sheep, goats, cows, horses, donkeys, camels, domestic fowls, turkeys, ducks and geese as well as bees. Among these, sheep and goats are major animal husbandry, which have been traditionally raised. The numbers of major livestock classified by sub-basins in the area are as shown in the following table.

Table 3-5-2-1 Number of Livestock

Sub-basin	Sheep and lamb	Goats and kids	Cows and calves	Equines	Poultry	
					Natives of farm	Industrial
K1	826,565	287,514	95,960	64,944	1,741,674	408,000
K2	300,000	70,000	2,200	1,700	17,600	0
K3	280,290	185,645	31,602	17,697	145,100	0
K4	444,621	900,420	24,863	5,165	116,570	10,000
K5	320,000	150,000	750	2,100	46,970	0
K6	261,283	171,622	13,590	8,912	343,500	0
K7	860,727	1,010,375	101,262	50,631	2,936,600	0
K8	526,512	438,760	10,969	21,938	449,730	0
Total	3,819,998	3,214,336	281,196	173,087	5,797,741	418,000

Source: Livestock organization of the Provincial Jihad Organization

Note: Data is converted by sub-basin. Due to no classified data by rural families and industry in the sub-basin K7, number of poultry is evaluated by farm

(1) Representative livestock

a) Sheep

Fifty percent of the sheep raises in the study area are Lori Bakhtiyari breed. Other breed of sheep include Turki Ghashghay, Naini, Iraqe and Dober. Lori Bakhtiyari breed is bred for meat and milk, and these sheep give two lambing per year. They produce milk of 10 to 15 lt. monthly. While the weight of lambs at the time of delivery ranges from 2.6 kg to 3.0 kg, that of adult (female) sheep reaches 60 kg. A male sheep weighs 10 kg to 15 kg. Wool (white fleece) of 1.0 kg to 1.5 kg is produced in a year. Turki Ghashgay are also bred for meat and milk; these sheep produce milk of 15 lt. monthly. They produce brown long wool of 1 to 1.5 kg in a year. Weights of male and female sheep at the time of delivery are 3.8 kg and 3.4 kg, respectively, and those of adult female and male sheep are 45 kg and 10 kg, respectively.

Sheep of this breed are resistant to diseases.

b) Cows

Milk cows are mainly bred. Due to the recent import of pure milk cows, the ratio of pure breeds to breeds mated with local ones is 1 to 2. Among pure milk cows, while the percentage of Holsteins is low, that of Brown-Swiss is increasing rapidly. Besides, there are Danish Jersey. Holsteins are raised in villages and the suburbs of cities and towns whether the proportion of rural families is small or large. For this reason, there is a potential of nearly 3 tons of annual milk production in the area. Holsteins mainly spread in the sub-basin K1, and many Brown-Swiss are bred in the sub-basin K4. Cows of local breeds produce milk of 4 to 6 lt. a day, and the grade of their fattening is middle. Many cows of this breed are seen in the sub-basins of K4 and K6.

(2) Animal husbandry of nomads

The main nomadic tribes in the area are the Haft Lang Bakhtiyari, Gashghay and Boyerahmad-olia tribes. The period of nomadism of these tribes in summer including nomadic migration is about six months, from late April to mid-October. In the sub-basin K1 to K6, it is about five months. Nomads have obtained land use permits from the Office of Forest and Rangeland, the Provincial Jihad Organizations, and graze livestock. Regarding nomadic breeding, a shortage of feed occurs in years of droughts, low precipitation and cold. This results in a limited number of raised livestock and a large number of deaths.

Nomadism in a day continues from 4 o'clock in the morning to 10 o'clock in the evening, with a break of 1 to 2 hours, seeking grass of good quality. In these years, there are many cases where borrowing cultivated fields of rural families that have finished harvesting carry out pasturage in summer. Nomads purchase alfalfa and wheat straw as feed in winter from farming houses on their way home. Some nomadic families now borrow farmland near their camping places and cultivate grains for feed. The MJS has determined to provide farmland for promotion of settlement of the nomads, and lend it free of charge for ten years and give nomads the right to that land without payment if they do not give up farming in the said period.

Nomads' livestock are their property and are not slaughtered for their families. Recently, however, nomads slaughter livestock when feed is short, and also sheep producing only small amounts of milk. Nomads have increased the number of goats they keep over the last several decades and have used the milk of goats in the same way as that of sheep. However, because the destruction of grassland is severe and because goats are not economical, recently there is a tendency that the ratio of sheep to goats has become four to one. As to veterinary service of livestock, since nomads practice nomadism in remote places, the number of public services provided by livestock service stations is smaller than

in village. Because of this, the mortality rate of livestock is higher than in village.

(3) Livestock production in rural areas

Typical production (establishment type) of livestock in villages is carried out by traditional methods. Breeding livestock in rural communities has secondary importance and play a supplementary role in agricultural production. On the other hand, agriculture is the main base of production that supplies necessary articles for families. The method of livestock production in the area is not different from the general one, but is influenced by the method adopted by neighboring nomads. In this method, the ratio of sheep to goats is 2 to 1, and the number of milking cows is 5.83 times larger than that of nomads. In the case of farm village communities, the possibility of feed supply from cultivated places is high, and such communities are close to the consumption market where demand for sheep meat is large. These circumstances are considerably related to production.

Animal husbandry in villages is realized by pasturage with free grass and use of feed remaining after harvesting. There is feed on hand equivalent to a 5 to 6 month supply in the sub-basins of K2 and K5 and a 3.5 month to 4.5 month supply in K6 and K3, although this is influenced by production in winter. Though production of milk in rural areas was not a custom before, it has increased year by year. Families in villages have begun to consume milk by making yogurt and are shipping it to market. Some villagers process milk to butter, oil, whey, etc. and sell these products in the market, although this is still rare. Poultry is also a usual practice for the production of eggs and meat. Sheep shearing is carried out once a year, in July, but goat shearing is not economical. Rural families use livestock dung as fuel for bread baking and stable manure.

Beekeeping is carried out in villages. Two types of beehives are seen in villages; a local one (clay) and a new one (boa). The production of honey from one beehive in a year weighs 6 to 7 kg. Beekeeping in villages is conducted by the traditional method around communities when alfalfa and white Dutch clover, which are farm products, bloom. Sugar is given as artificial feed in winter.

3.5.3 Inland Fishery

There are abundant water sources in areas spreading from the border of plains to places between mountains and mountainous areas in the study area. Inland fishery is prosperous there, using river, fountains, qamaat lakes, mashes, swamps and so on under conditions of cold and warm climate. The species of fishes cultivated in cold water are rainbow trout and red trout. The Office of Fishery (Silat Company), the Provincial Jihad Organizations manages inland fishery in the area and is promoting fishery.

Fish farms are scattered around places of fountains and rivers in the sub-basin K2 to K6 of the Karoon

River. In the sub-basin K7, fish farms exist in mountain torrents. The fry production is carried out by the Freshwater Fish Multiplication Center in the sub-basin K7, and fry are distributed to fish farms in the sub-basins. The main bodies operating fish farms take two forms: village cooperative and rich men living in towns. Fishermen's unions are organized for two lakes in the sub-basin K4. The number of fish farms registered in the Office of Fishery and the production in a year are as follows. Besides, annual production in two lakes in the sub-basin K4 is 350 tons.

Table 3-5-3-1 Registered Fish Farms and Production

Sub-basin	Fish farms	Annual production(ton)	Remarks
K1	1	5	Fishculture center
K2	10	175	
K3	10	325	
K4	5	100	
K5	5	240	
K6	7	160	
K7	22	460	
K8	0	0	
Total	60	1,465	

Source: Office of Fishery (Silat Company), the Provincial Jihad Organizations

3.5.4 Rural Industry

Traditional rural industry in Iran is represented by carpets, which are pieces of woolen handicraft closely related to animal husbandry in villages. Besides carpet weaving, there is gelim weave (rug) as well as traditional hats, shoes and daily necessities among nomads. The rural industry is rural home industry, and production depends on the labor of women of the families. Cash income obtained from these products accounts for a large proportion of household income next to agricultural products.

In order to promote traditional rural industry, the Office of Handicraft of each province established rural industry cooperatives aiming at carpet makers in rural areas. Through these cooperatives, they give support such as guidance for quality control and design, processing and sale of raw materials and improvement of quality and sale of products. These rural industry cooperatives have been established as follows: three in Chaharmahal va Bakhtiyari Province (4,045 members), one in Kohgiluyeh va Boyerahmad Province (219 members), seven in Fars Province (6,253 members), 22 in Esfahan Province (44,992 members) and one in Khuzestan Province (1,256 members).

In carpet weaving in villages, wool of about 1 m^2 is woven by one person in a month, and the profit including labor force is 400,000 Rials. According to the Office of Handicraft in the Chaharmahal va Bakhtiyari Province, quantities of production of carpets and gelim in the province are 250,000 m^2 and 100,000 m^2, respectively.

3.5.5 Marketing System

(1) Agricultural products

The policy to maintain the prices is adopted for basic foodstuff such as wheat and barley among agricultural products by the Government, and these products are shipped through village cooperative. Other agricultural products are sold directly by farmers to the markets near village or shipped to markets through middlemen; there are no fixed shipping systems.

(2) Livestock

Livestock is mainly shipped to markets through middlemen because the markets are far distant, while homemade-dairy products are sold directly by farmers to the markets near village. Livestock of rural families are dealt with merchants for cash: the prices of one sheep, goat and milk cow are 300,000 Rials, 150,000 Rials and 400,000 to 700,000 Rials, respectively. Livestock of nomads are sold directly to merchants and farmers, in nomad camping places or during nomad movement. There are no fixed distribution systems.

(3) Handicrafts

For carpets representing handicrafts, there are two distribution systems. In the distribution channel of the Office of Handicraft, the Provincial Jihad Organization, prices are determined according to quality, standards, design, etc., and are paid in cash to makers two months after the purchase. Carpets of high quality are sent to the Handicraft Organization, MJS and exported to foreign countries. In the other distribution system, carpet merchants purchase carpets directly from makers in villages and ship them to trading companies.

3.6 *Natural Disasters related to Watershed Management*

3.6.1 Flood and Debris Flow

There is no distinction between food and debris flow in Iran and debris flow is generally included in "flood". Based on the observation during the site reconnaissance and the gradient of rivers obtained from the topographical map, debris flows are separated from flood as much as possible in the inventory.

Since the Study area is mountainous, debris flows are dominant in the tributaries. On the other hand, flood occurs along the Karoon River, major tributaries and flat plains such as the vicinity of Share Kord.

(1) Flood Damage Areas

Flood damage areas are mainly located on the rivers of Sarkhun, Aghabolugh, Jahanbin and Bazoft in Chaharmahal va Bakhtiyari Province, of Marbor, Garmak, Rahimi in Esfahan Province, of Boshar in Kohgiluyeh va Boyerahmad Province, and of Karoon main stream in Khuzestan Province. In particular, the Jahanbin River in Chaharmahal and the Marbor River in Esfahan have many damaged areas, and the latter river basin received more damage.

In the following table, flood damage areas are sorted by provinces and by watershed. The location of flood damage sub-basins is shown in Figure. 3-6-1-1.

Table 3-6-1-1 Flood Prone Sub-basins

Province	River	Sub-basin	Total
Khuzestan	Karoon	K 8-13b, K 8-25-1b, K 8-28	3
Kohgiluyeh	R. Boshar	K 7-48, K 7-42-1, K 7-43	3
Esfahan	Ab. Garmak (①)	K7-0-10-1, K 7-0-10-2	2
	R. Marbor	K 7-0-18, K 7-0-19-1, K 7-0-19-2, K 7-0-20a, K 7-0-20b, K 7-0-21, K 7-0-22, K 7-0-23, K 7-0-24	9
	R. Rahimi (②)	K 7-0-10-6j, K 7-10-6k, K 7-0-10-9	3
Chaharmahal	Ab. Kurang	K 2-1	1
	M. Karoon	K 3-1-9, K 3-1-7, K 3-1-11, K 3-1-13, K 3-4-1, K 3-4-2	6
	Ab. Kali	K 3-1-16, K 3-5, K 3-6	3
	Ab. Sarkhun	K 3-2-4, K 3-2-5, K 3-2-2, K 3-2-3, K 3-3-2a	5
	R. Aghabolugh	K 4-1-8, K 4-1-9, K 4-1-11, K 4-1-12, K 4-1-8a	5
	Khersan	K 7-0-5, K 7-0-3, K 7-1, K 7-2	4
	Ab. Bazoft	K 5-20, K 5-21, K 5-23	3
	R. Lordegan	K 6-4-1, K 6-1-6	2
	Ab. Jahanbin	K 1-2-6a, K 1-2-6b, K 1-2-6c, K 1-2-6d, K 1-2-6f, K 1-2-6i, K 1-2-6m, K 1-3	8
	Ab. Vanak	K 4-1-4,	1
	Ab. Beshet Abad	K 1-1	1
	Ab. Jounghan	K 1-1-3, K 1-1-4, K 1-1-5, K 1-1-7,	4
	Ab. Shelamzar	K 1-2-3b	1
	R. Kiyar	K 1-2-5g,, K 1-2-5j, K 1-2-5k, K 1-2-5m,	4
	R. Gorgak	K 1-4-1	1
	R. Sulegan	K 4-1-6, K 4-1-7,	2
	R. Monj	K 6-2	1

Note ; ①Tributary of Khersan、②Tributary of R. Hana

(2) Flood Damage

The flood group of SED, the Ministry of Jihad, has engaged in compilation of flood data and flood damage, such as houses, human lives, agriculture land (farmland and garden), livestock, infrastructure (road, canal, bridge, well, ganat), and amount of damage. These data are shown in ANNEX E.

The recent flood occurred in 1997/1998 and the flood group has investigated the flood damage mainly in Chaharmahal Province. The amount of flood damage does not cover all the flood records, and it is

difficult to evaluate the degree of flood damage with this amount.

In Khuzestan Province, the lower reaches of the Karoon river basin, a huge flood occurred in 1923, and caused death of around 3,000 people. In addition, floods hit in 1928, 1939 and 1949, and significant damage on human lives and economy had been given to the Province. In the study area, damage on human lives is reported as five dead and three missing in K5-23, and one dead in K8-13B (Refer to the Inventory – Flood/Debris Flow Damage B). As for the reconstruction after disaster, the Ministry of Jihad take the responsibility of infrastructures such as bridges and roads, while Housing Foundation of Islamic Revolution consult housing reconstruction depending on the degree of damage.

(3) Time of Occurrence

In the provinces of Kohgiluyeh and Khuzestan, the southwest part of the Study area, flood occurs frequently in November and December, while in Chaharmahal and Esfahan, the snow-melting period of March to May is predominant.

In Ahwaz, the capital of Khuzestan Province, flood is frequent from November to April, and March is most predominant.

(4) Cause of Flood

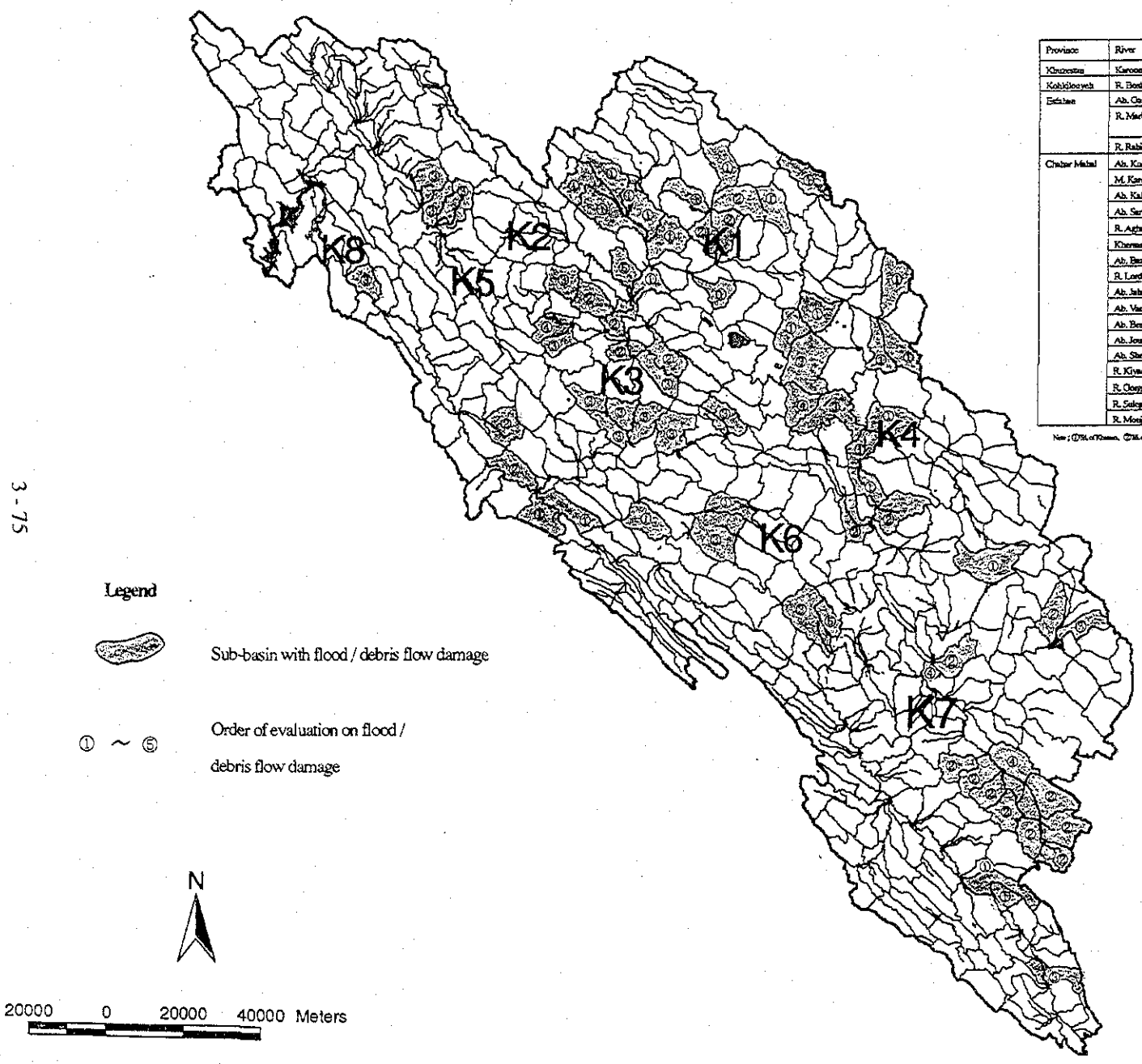
There are many causes on flood, and it is pointed out that heavy rainfall and snow melting as meteorological condition, and steep rivers (steep longitudinal gradient of rivers) and sedimentation and river bed rise caused by soil erosion as natural condition.

The steep rivers are the Sarkhun, the upper reaches of Bazoft and Kurang, and Sulegan. Sedimentation and soil erosion are remarkable in the Boshar river basin, upstream of Yasuj.

The drain capacity of the Karoon River at Ahwaz is estimated around 12,000 m^3/s, however, the capacity is decreasing because sediment from upper reaches rises the riverbed, which is said to be the main cause of flood.

(5) Flood Discharge

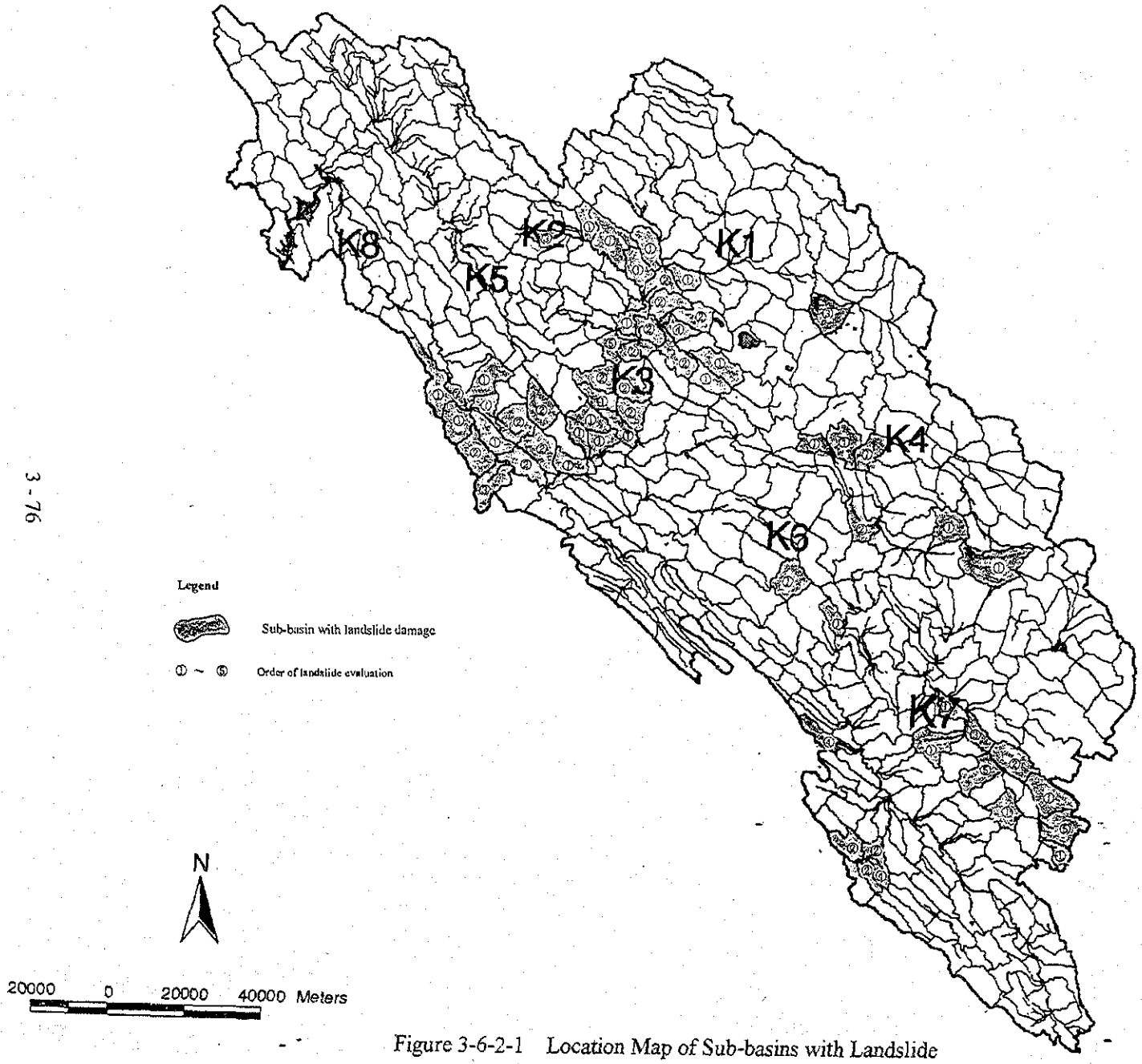
On the Shahid Abbasspur Dam, located in the most downstream of the Study area, the maximum inflow in the reservoir in February 1979 was recorded 4,000 m^3/s. The maximum discharge from the Dam was 565 m^3/s (This flood caused damage to Ahwaz with 80 houses, 22 peoples death, 5,000 ha of farmland, and 15,000 sheep). In March 1987, the maximum discharge of 770 m^3/s from the Dam was also recorded because of heavy rainfall in the upstream (This flood is recorded in the Inventory, but no remarks on flood damage).



Sub-basin with flood / debris flow damage

Province	River	Sub-basin	Total
Khuzestan	Karoon	K8-13b, K8-25-1b, K8-28	3
Kohkiloeyeh	R. Bordar	K7-48, K7-42-1, K7-43	3
Esfahan	Ab. Germak(①)	K7-0-10-1, K 7-0-10-2	2
	R. Marbor	K7-0-18, K7-0-19-1, K7-0-19-2, K7-0-20a, K7-0-20b, K7-0-21, K7-0-22, K7-0-23, K7-0-24	9
	R. Rahimi (②)	K7-0-10-6, K7-10-6k, K7-0-10-9	3
Chahar Mahal	Ab. Kuzang	K2-1	1
	M. Karoon	K3-1-9, K3-1-7, K3-1-11, K3-1-13, K3-4-1, K3-4-2	6
	Ab. Kali	K3-1-16, K3-5, K3-6	3
	Ab. Serkhun	K3-2-4, K3-2-5, K3-2-2, K3-2-3, K3-3-2a	5
	R. Aghabolagh	K4-1-8, K4-1-9, K4-1-11, K4-1-12, K4-1-8a	5
	Khersa	K7-0-5, K7-0-3, K7-1, K7-2	4
	Ab. Bazoft	K5-20, K5-21, K5-23	3
	R. Lordegan	K6-4-1, K6-1-6	2
	Ab. Jahanbin	K1-2-6a, K1-2-6b, K1-2-6c, K1-2-6d, K1-2-6f, K1-2-6i, K1-2-6m, K1-3	8
	Ab. Vanak	K4-1-4,	1
	Ab. Beshet Abad	K1-1	1
	Ab. Joungban	K1-1-3, K1-1-4, K1-1-5, K1-1-7,	4
	Ab. Shatorrar	K1-2-3b	1
	R. Kiyar	K1-2-5g, K1-2-5j, K1-2-5k, K1-2-5m,	4
	R. Oonyak	K1-4-1	1
	R. Sologan	K4-1-6, K4-1-7,	2
	R. Mosj	K6-2	1

Note ; ①Ab. of Khersan, ②Ab. of R. Hasa



Evaluation of Landslides

Basin No.	L/S Area (ha)	Order	Basin No.	L/S Area (ha)	Order
K1-1	13.5	2	K5-1	0.6	1
K1-1-2	0.4	1	K5-3	0.0	1
K1-2-1	2.2	1	K5-5	38.5	2
K1-2-5g	49.0	3	K6-4-4	0.6	1
K2-1	1.4	1	K7-0-5	0.3	1
K2-3	3.1	1	K7-0-10-9	0.4	1
K2-5-1a	42.2	3	K7-0-12	1.4	1
K2-6	1.2	1	K7-0-16	0.3	1
K3-0a	2.2	1	K7-0-17	50.0	3
K3-0b	13.7	2	K7-0-18	10.4	2
K3-1-1	0.3	1	K7-0-19-1	207.2	5
K3-1-13	8.9	2	K7-0-20b	2.8	1
K3-1-14a	199.6	5	K7-0-21	1.6	1
K3-2-3	18.4	2	K7-0-23	1.1	1
K3-2-4	2.8	1	K7-0-24	197.3	5
K3-2-5	5.0	1	K7-30	82.7	4
K3-2-6	7.5	2	K7-37-3	13.9	2
K3-2-7	13.2	2	K7-37-5a	55.6	4
K3-3-1	11.8	2	K7-37-6a	20.5	2
K3-3-2a	15.5	2	K7-37-7a	6.0	2
K3-3-2b	0.8	1	K8-21	3.7	1
K3-3-2e	71.5	4	K8-22	11.7	2
K3-3-2g	2.7	1	K8-23	0.0	1
K3-3-3a	11.3	2	K8-24	0.0	1
K3-3-3b	22.2	2	K8-25-1a	2.7	1
K3-4-1	0.2	1	K8-25-1b	22.2	2
K4-1-4	6.8	2	K8-26	4.8	1
K4-1-7	3.8	1	K8-27	15.3	2
K4-3-1	0.5	1	K8-28	5.6	2
K4-3-2	0.1	1	K8-29	31.0	3
K4-4-2b	0.7	1			

Note: L/S Area is accumulated area in each sub-basin

Figure 3-6-2-1 Location Map of Sub-basins with Landslide

3.6.2 Landslide

A lot of landslides are seen in the Study area and they destroy houses, farmland and other infrastructure. Also peoples and the domestic animal are deprived of the life (see Annex :Disaster Record of Landslide), and some villages have migrated.

There are about 450 landslide records in the Study area according to the landslide data of Jihad. The features of the landslide in this region are enumerated as follows.

a) Cause of landslide
The highest percentage of cause of the landslide is "trouble of trashed mine" Erosion by rivers and stream" is second and "rainfall" is third. Another causes is " destroy of plant cover "and " mineral and chemical composition of litho logy. Artificial power like road construction or development of mine is a main cause of landslide. However, the large-scale landslide is very few by these reason and damage is not very large either.

b) Disaster area
Small-scale landslides with range within 10000 m^2 accounts for 60% or more of generation in relation to the above mentioned reason. Next, the medium range from 10000 to 50000 m^2 is about 30%. Large-scale landslides of more than 50000 m^2 is about 10%.

c) Kind of disaster
Rangeland and farmland are high damage area of the landslide and damage of the national road and village road are the second. Additionally, there is a lot of damage on water pipeline, gas pipeline and irrigation cannel .

According to the field investigation, the analysis of aerial photograph and the landslide data, the occurrence of the landslide in the project area are described as follows.

- Most of the landsides of bedrock have been generated in an old age and many landslides have relapsed in recent years for above reasons.
- In geological features of the landslide, there are a lot of area of Marl, talus and the river terrace deposits.
- A direct cause of generation is erosion of the slope foot by rivers and artificial cutouts by the road construction, etc.

Therefore, a part of disaster can be prevented by the investigation before construction or area development. However, many areas have risks of generation of landslide in viewpoint of geographical and geological features. Control or the prevention of many kinds of landslides is possible by present technological level. However, the preventing construction for the Sabo against these landslides needs the enormous capital. Therefore, the study in the future should focus on important areas suitable for the capital investment in consideration of disaster prevention by

participation of resident. Moreover, it is also important to select Master Plan areas to improve a technological level, and to scrutinize the method of preventing a natural disaster.
Various investigations should be applied to the selected area for the improvement of countermeasures in the future. Especially, observation investigation is also important.
The location of Sub-basins with landslides is shown in Figure 3-6-2-1.

3.6.3 Surface Soil Erosion

Soil erosion has been already studied by several studies under JIHAD and MOA. Those studies are as follows:

Table 3-6-3-1 Previous Studies on Soil Erosion in the Study Area

River Basins	Studies	Study Area
K1-K6	Agricultural Master Plan for the North Karoon River Basin By YEKOM Consulting Engineers under MOA, 1999	Whole area of K1-K6 river basins.
K7	Explanatory Study of Natural Resources Management in the Boshar and Marbor River Basin By ZOUMAR Consulting Engineers under JIHAD, 1994	Upper part of K7 bounded by Marbor and Boshar river basins.
K8	Explanatory Study of Karoon Watershed 2 & 3 By JAME Iran Consulting Engineers under JIHAD, 1999	Lower part of K8 river basin.

(Note) Study area of each study is shown in Figure D-2-1 in ANNEX D.

As shown in above table, three studies have been carried out in the Study Area. However, upper part of K7 river basin (river basins of Semiron river and Khersan river) and lower part of K8 river basin have not been studied yet. Due to no available study for the said parts of K7 and K8 river basins, preliminary study has been carried out for evaluating soil erosion of the study blank area.

(1) Assessment Methods for Soil Erosion

There are several assessment methods for evaluating soil erosion.

a) Universal Soil Loss Equation (USLE)

The USLE was developed for assessing soil loss of farmland by U.S. Department of Agriculture (USDA), Agricultural Research Service (ARS) and Soil Conservation Service (SCS) in the late 1950s. The USLE is explained as below:

$E = R \times K \times L \times S \times C \times P$

E : mean annual soil loss (ton/ha/yr)
R : rainfall erosion index
K : soil erodibility index
L : slope factor (slope length)
S : slope factor (slope steepness)
C : crop factor
P : conservation practice factor

The USLE is generally applied for assessing soil loss in farmland. It is, therefore,

necessary to take appropriate consideration for applying this method for the land other than farmland. Moreover, this method needs more detail data than other methods. Consequently, it is difficult to apply this method to the study of the large river basin without enough physical information such as on soil properties, land cover and vegetation.

b) Erosion Potential Method (EPM)

The EPM was originally developed in Yugoslavia, and it is explained as following equation:

$Z=Y*Xa(\Phi+I^{0.5})$

Z: Soil loss from land (ton/ha/yr)
Y: Soil resistant coefficient
Xa: Land use coefficient
Φ: Watershed erosion coefficient
I: Average slope

Above equation is able to apply not only to farmland but to any other lands, however it is not enough experienced yet in Iran.

c) PSIAC Method

This method was developed by the Pacific Southwest Inter-agency Committee (PSIAC) for application to arid and semi-arid areas in the southwestern United State in 1968. The assessment of PSIAC involves nine (9) factors of which two are essentially concerned with climate and runoff characteristics, one reflects land use, and the remaining six factors introduce measures of geology, soils, topography, ground cover and two erosion development factors on upland erosion and channel erosion. Soil erosion is assessed by the total number (S) of marked scores (R_1, R_2, ...R_9) of 9 factors.

$$S = \sum_{i=1}^{9} R(i)$$

Factors and markings are explained in Table 3-6-3-2, and erosion is assessed as below by the total marked score (S):

Table 3-6-3-3 Erodibility by Total Marked Score (S) in Five Classification

Erodibility Class	Erodibility	Total Marked Score (S)	Erosion Quantity (Q_s) ($m^3/km^2/yr$)
1	Trace	0 ~ 25	<95
2	Low	25 ~ 50	95 ~ 232
3	Fair	50 ~ 75	232 ~ 568
4	High	75 ~ 100	568 ~ 1390
5	Severe	100<	1390<

(Note) $Q_s=38.77e^{0.0358S}$

(Source) Explanatory Study of Natural Resources Management in the Boshar and Marbor River Basin. By ZOUMAR consulting Engineers under JIHAD, 1994

Table 3-6-3-2 Effective Factors and Marks for PSIAC Method

Effective Factors		Original PSIAC				
		Mark (Range)	Major Elements of Soil Erosion	Evaluation and Descriptions		
1	Surface geology	0 - 10	Formation type, Weathering, Hardness or Looseness	High	10	A)Marls and shales, B)Gypsum and anhydrite and mineral marl, C)Lification rock with marl or shale beds, D)Sandstone
				Med	5	A)Metamorphic rock with medium hardness, B)Grounded rocks or weathered , C)Conglomerate, D)Soft limey rock, E)Massive limestone, F)Rock with medium joints
				low	0	A)Igneous rock, B)Dolomite, C)Crystal rocks, D)Alluvium thik layers
2	Soils	0 - 10	Texture, Salinity, Alkalinity, Structure, ...	High	10	A)Soft texture with high saline and alkalinity, B)Granular silt and soft sand, C)Sandy soils, D)Sandy loam soils
				Med	5	A)Medium texture soils, B)Soils with sparse coarse stones, C)Soils with limestone layer, D)Soils with coarse texture
				Low	0	A)Soils with high percentage of coarse stones, B)Clay soil with firm structure, C)Soils with high organic matter
3	Climate	0 - 10	Rainfall duration, Intensity, Frequency, Snow melting	High	10	A)Short and high intensive rains, B)Alternate and intensive rains, C)Long icy period, D)Snow melting flow
				Med	5	A)Long durable and medium intensive rains, B)Alternate showers
				Low	0	A)Low maximum specific runoff discharge (flood), B)Low specific runoff height (long term runoff), C)Rare occurrence of surface flow, D)Soil with hydrological group A
4	Runoff	0 - 10	Specific flood discharge, Flood intensity, Duration and frequency, Hydrogical group of soil	High	10	A)High specific peak discharge (flood), B)Large flood volume per unit area, C)Soil with hydrological group C & D
				Med	5	A)Average maximum peak discharge, B)Medium flood volume per unit area, C)Soil with hydrological group B
				Low	0	A)Areas with slope<5%, B)Large alluvial plains, C)Soil with hydrological group A
5	Topo-graphy	0 - 20	Land use percentage, Grazing intensity, Road network, Intensity use of forest	High	20	A)Areas with steep slope>30%, B)High elevation and topography areas, C)Skirt with sharp slope, D)Steep channel beds and deepening stage, E)Flooding and submergible areas
				Med	10	A)Areas with medium slope<20%, B)Apandag pediments, C)Skirt with medium topography, D)Erosion pediment
				Low	0	A)Areas with slight slope<5%, B)Large alluvial plains, C)Coverd pediment
6	Ground cover	-10 - 10	Vegetation cover, Litter, Under trees cultivation	High	10	A)Less ground cover<20%, B)No gravel stones on ground surface, C)Plant cover is dispossessed
				Med	0	A)Less ground cover<40%, B)Sparse and less intensive plants, C)Trees are dispossessed
				Low	-10	A)High ground cover with plants and gravel>70%, B)Low soil erodibility
7	Land use	-10 - 10	Land use percentage, Grazing intensity, Road network, Intensity use of forest	High	10	A)Cultivation>50%, B)Grazing>50%, C)Recent tree cutting, D)Land cutting by road construction
				Med	0	A)Cultivation<25%, B)Medium grazing<50%, C)Forest tree cutting<50%, D)Normal road network
				Low	-10	A)Land uncultivated, B)Limited grazing, C)No forsty tree cutting, D)No road network
8	Upland erosion	0 - 25	Intensity of rill, gully, sheet, massive and landslide erosion	High	25	A)Area of gully and rill erosion>50% of area, B)High erosion and sediment, C)Seasonal and distructived wind erosion
				Med	10	A)Various types of erosion in 25% of area, B)Wind erosion with sedimentation in agricultural area and irrigation channel, C)Medium water and wind erosion
				Low	0	A)No active water and wind erosion, B)No mechanical erosion, C)No chemical erosion
9	Channel erosion	0 - 25	River bank erosion, River bed erosion, Flow depth, Hydralic slope, and Vegetation of river bed.	High	25	A)Slide river erosion with severe damage, B)Erosion in minor floodways with medium to high depth and active alluvial fan at the end of floodways
				Med	10	A)Slide river erosion with medium damage, B)Small meandering of river channel
				Low	0	A)Wide and shallow floodway with gentle slope, B)Rocky river bed, C)Stable river bank and bed with plant cover, D)Controlled floodway

(Sourse) Soil Conservation and Water Erosion, Agricultural Development Master Plan, Kohkilouye Boyer Ahmad Province, Vol 3, 1999

d) *Discharge-Sediment Rating Method*

This method is commonly utilized for sediment analysis in hydrology. This method is good for estimating total sediment discharge where discharge and sediment are observed and rated in the vicinity. However, it is not so suited to analyze erosion in the upstream basin, because observed sediment discharge is a balance of sediment transport and deposit in the upstream. It is, therefore, this method is considered to give supporting data for erosion assessment. Discharge-sediment rating equation is generally as below:

$Q_s = a\ Q_w^b$

Qs: Sediment discharge (t/sec)
Qw: Discharge (m3/sec)
a, b: rated constants

(2) Erosion Analysis of the Study Blank Area

a) Applied Method for Erosion Assessment

PSIAC method is commonly applied for erosion assessment in Iran, and all mentioned previous studies have applied PSIAC method for assessing soil erosion in the area. However, the output of this method is not correctly erosion amount but sediment amount. Sediment is the outflow in the form of suspended and bed loads from the certain extent of river basin. Erosion is the soil loss at the site of certain land. Erosion is generally much larger than sediment because sediment is the result of outflow after several deposits in the stream or in the plain. However, sediment amount is a key index of erosion in the upstream basin. It is, therefore, recommendable to select PSIAC method for studying the blank area. In previous studies, erodibility has been classified into different level of class so that nine(9) classification level has been applied to integrate previous studies as below.

Table 3-6-3-4 Applied 9 Classification of Erodibility in the Study Area

Class	Erodibility			Classes by Previous Studies		
	Level	Marked Score (S)	Erosion Quantity (Qs m3/km2/yr)	K1-K6 Basin	K7 Basin	K8 Basin
1	Trace	0-25	<95	I	1	1
2	Trace-Low	0-50	<232			2
3	Low	25-50	95-232	II	2	3
4	Low-Fair	25-75	95-568			4
5	Fair	50-75	232-568	III, IV	3	5
6	Fair-High	50-100	232-1390			6
7	High	75-100	568-1390	V, VI	4	7
8	High-Severe	75<	568<			8
9	Severe	100<	1390<	VII	5	9

b) Classification of topography

Major factors relating to soil erosion such as geology, soil, ground slope, vegetation cover and

land use are generally reflecting to the topography. Therefore, erosion has been studied based on topography classified into following 6 categories on the map of 1:50,000.

A: Mountain
B: Hill
C: Terrace
D: Alluvial Flat Plains
E: Alluvial Fan
F: Water

(Note: Analysis of topography is described in Section 3.1.2)

c) Erosion Analysis of the Study Blank Area

Erosion analysis has been carried out based on assessment of the related factors for each sub-basin in the study blank area. Criteria and procedure of assessment are as below. Result of erosion analysis is described in Table D-2-1 in ANNEX D.

d) Surface Geology Factor

Surface geology is evaluated with a mark R_1 to be scored from 0 to 10 in PSIAC method as explained in Table 3-6-3-2. In the study blank area, surface geology has been analyzed based on categorized topographies utilizing geological maps of 1:100,000 and 1:250,000 scales. Very severe geological formations on erodibility are Aghajari Formation, Gachsaran Formation, Razak Formation and Gurpi Formation. These formations are marly geology which is very weak to erosion, and they were formed in Tertiary and Mesozoic Era. Marking score of very severe formations is considered to be 9.5. Quaternary deposits and alluviums, Bakhtiari Formation, Asmari Formation, Jahrum Formation, Sarvak Formation, Darian Formation and Surmeh Formation, they are classified into a group of small erodibility with a marking score of 2. Geological formations and their classification are summarized as below:

Table 3-6-3-5 Geological Formation and Erodibility

Geological Era	Geological Formation by Erodibility			
	Small (R_1=2)	Medium (R_1=3.5)	Severe (R_1=6)	Very Severe (R_1=9.5)
Quaternary	Quaternary Deposits and Alluviums		Pabdeh Formation	
Tertiary	Bakhtiari Formation Asmari Formation Jahrum Formation			Aghajari Formation Gachsaran Formation Razak Formation
Mesozoic	Sarvak Formation Darian Formation Surmeh Formation	Neyriz Formation		Gurpi Formation

i) Soil Factor

Soils are evaluated with a mark R_2 to be scored from 0 to 10. Soils of good mixed texture are generally hard and strong to erosion but clayey and sandy soils are weak to erosion. Such clayey and sandy soils are generally extended at the downstream of marly formation.

In this study, such clayey and sandy soils are assessed and marked at 10, and 5 for other soils. Score 0 has been applied to the mountain areas where ground surface is covered by outcrops of rock.

ii) Climate Factor

Climate is evaluated by a mark R_3 to be scored from 0 to 10. Short and high intensive rains are evaluated as high and low intensive rains are low. As an index of rainfall intensity, intensity of average annual maximum daily rainfall has been utilized for assessing climate factor. Average mark of climate factor was evaluated at 8 in K1-K6 basin by the study of YEKOM. Consequently, following equation, which gives an average value of 8 for R_3 in the study area, has been applied for assessing climate factor.

$R_3=0.592\ I$

I: Intensity of average annual maximum daily rainfall (mm/hr)

iii) Runoff Factor

Runoff is evaluated by a mark R_4 to be scored from 0 to 10. High specific peak discharge and large flood volume per unit area are marked by high score, and low floods are marked with low score. In this study, mean annual maximum daily discharge height was used as an index of runoff factor. Average mark of runoff factor was evaluated at 6 in K1-K6 basin by the study of YEKOM so that equation is developed to give an average value of 6 for R_4 in the study area.

$R4=2.14\ H$

H: Mean annual maximum daily discharge height (mm)

iv) Topography Factor

Topography is evaluated by a mark R_5 to be scored from 0 to 20 so that weight of topography is much higher than above 4 factors. Topography is generally evaluated by the slope of ground surface. In case of slope more than 30%, a value of 20 is given to R_5, and 10 and 0 for 20% and 5% respectively.

v) Ground Cover Factor

Ground cover is evaluated by a mark R_6 to be scored from -10 to 10. In case of ground cover less than 20%, erodibility is considered to be severe and marked by 10. In case of ground cover about 40%, it is marked with 0 as medium, and marked with -10 for more than 70% as low erodibility.

vi) Land Use Factor

Land use is evaluated by a mark R_7 to be scored from -10 to 10 based on cultivation, grazing

and road network conditions. In case the land is intensively cultivated or grazed in more than 50% of area as well as with intensive road network, high value as 10 is given to R_7. In the study area, road network causes sometimes severe erosion when the slope protection works are not properly provided. In case of no cultivation, limited grazing and no road network, a value of -10 is given to R_7. In case of medium land utilization and less road network, a value of 0 is given to R_7.

vii) Upland Erosion Factor

Upland erosion is evaluated by a mark R_8 to be scored from 0 to 25 based on the area ration of gully and rill erosion. When the area is eroded more than 50%, high score of 25 is marked. In case 25% of area is eroded, 10 is marked, and 0 for negligible erosion. Upland erosion conditions have been checked by aerial photographs and field confirmation. In this study, aerial photographs are exclusively utilized as well as field reconnaissance survey.

viii) Channel Erosion Factor

Channel erosion is evaluated by a mark R_9 to be scored form 0 to 25 based on the channel erosion conditions. When rivers or floodways are severely eroded and damaged both on banks and riverbeds, high score is marked as 25. In case with medium erosion and damage, 10 is given, and 0 for steady rivers and floodways or for rocky river bed. Channel erosion conditions have been checked by aerial photographs and field confirmation. In this study, aerial photographs are exclusively utilized as well as field reconnaissance survey.

(3) Modification of Erodibility of Previous Study

In K7 basin, Pabdeh-Gurpi Formation extends widely along the upper most reach of the Rudeh Beshar. This formation is very sensitive formation to erosion and causing severe sediment to the Rudeh Beshar. However, erodibility has been evaluated at class 3rd or 5th by the previous study. It is, therefore, necessary to increase the level of erodibility in this area. Erodibility has been increased to level 9th where Pabdeh-Gurpi Formation is extended. Modified sub-basins on erodibility are five sub-basins, namely K7-48, K7-49, K7-50, K7-52 and K7-53.

(4) General Condition of Erodibility in the Study Area

As shown in Table 3-6-3-6, the area of severe erdibility or Level 9^{th} is estimated at 1,113 km^2, that is equivalent to 4.2% of the total area. Out of 1,113 km^2, the area of 606 km^2 locates in K7 basin, and 262 km^2 and 189 km^2 in K2 and K3 respectively. In K2 Basin, 21.4% of area is classified into severe erodibility. In K2 basin, severe erodibility is largely extended along the Ab Kurang river. Severe erodibility is also observed in K3 and K7 basins as 7.5% and 6.7% respectively.

On the other hand, erodibility is generally low in K1 and K4 basins where topography is gentle. In

these two gentle topographical basins, such large cities as Share Kord, Farokh Shahr and Boroujen have been developed. Total amount of erosion is estimated at about 10 MCM per year in the Study Area. Out of 10 MCM of erosion, 37% is produced in K7 Basin and 13% both in K5 and K8.

Table 3-6-3-6 Erodibility by River Basins in the Study Area

Basins	Water	Level of Erodibility ($m^3/km^2/yr$) 1 Trace <95 48	2 Trace-Low <232 116	3 Low 95~232 164	4 Low-Fair 95~568 332	5 Fair 233~568 400	6 Fair-High 232~1390 811	7 High 568~1390 979	8 High-Severe 568< 979	9 Severe 1390< 1390	Total	
Area (km^2)												
K1	0.0	1,923.8	0.0	572.2	0.0	843.2	0.0	561.5	0.0	19.6	3,920.2	
K2	0.0	295.6	0.0	196.4	0.0	149.5	0.0	320.4	0.0	261.9	1,223.7	
K3	1.6	337.9	0.0	1,190.0	0.0	745.3	2.8	42.0	0.8	188.7	2,509.1	
K4	39.0	1,094.3	0.0	1,139.0	0.0	716.5	0.0	201.2	0.0	24.8	3,214.8	
K5	0.0	607.4	0.1	75.7	0.5	312.7	0.5	1,177.8	0.0	0.0	2,174.7	
K6	4.0	413.4	0.0	698.4	0.0	163.1	0.0	195.1	0.0	0.0	1,474.0	
K7	0.0	375.4	0.0	3,510.5	0.0	3,723.5	0.0	805.4	0.0	606.2	9,021.0	
K8	64.9	190.0	103.3	928.7	196.7	1,144.6	281.1	259.5	97.9	11.9	3,278.5	
Total	109.4	5,237.9	103.4	8,310.8	197.2	7,798.2	284.3	3,562.9	98.7	1,113.1	26,816.0	
Area Ratio												
K1	0.0%	49.1%	0.0%	14.6%	0.0%	21.5%	0.0%	14.3%	0.0%	0.5%	100.0%	
K2	0.0%	24.2%	0.0%	16.0%	0.0%	12.2%	0.0%	26.2%	0.0%	21.4%	100.0%	
K3	0.1%	13.5%	0.0%	47.4%	0.0%	29.7%	0.1%	1.7%	0.0%	7.5%	100.0%	
K4	1.2%	34.0%	0.0%	35.4%	0.0%	22.3%	0.0%	6.3%	0.0%	0.8%	100.0%	
K5	0.0%	27.9%	0.0%	3.5%	0.0%	14.4%	0.0%	54.2%	0.0%	0.0%	100.0%	
K6	0.3%	28.0%	0.0%	47.4%	0.0%	11.1%	0.0%	13.2%	0.0%	0.0%	100.0%	
K7	0.0%	4.2%	0.0%	38.9%	0.0%	41.3%	0.0%	8.9%	0.0%	6.7%	100.0%	
K8	2.0%	5.8%	3.2%	28.3%	6.0%	34.9%	8.6%	7.9%	3.0%	0.4%	100.0%	
Total	0.4%	19.5%	0.4%	31.0%	0.7%	29.1%	1.1%	13.3%	0.4%	4.2%	100.0%	
Erosion Amount ($1000m^3/yr$)												
K1		92	0	94	0	337	0	550	0	27	1,100	11%
K2		14	0	32	0	60	0	314	0	364	784	8%
K3		16	0	195	0	298	2	41	1	262	815	8%
K4		53	0	187	0	287	0	197	0	35	759	7%
K5		29	0	12	0	125	0	1,153	0	0	1,319	13%
K6		20	0	115	0	65	0	191	0	0	391	4%
K7		18	0	576	0	1,489	0	789	0	843	3,715	37%
K8		9	12	152	65	458	228	254	96	17	1,291	13%
Total		251	12	1,363	65	3,119	230	3,489	97	1,548	10,174	100%
Erosion Ratio		2%	0%	13%	1%	31%	2%	34%	1%	15%	100%	

(5) Water and Soil Conservation Facilities

Water and soil conservation facilities have been surveyed based on the questionnaire to the concerned JIHAD provincial offices. The provincial offices have own different compiling form for facilities so that it is difficult to compile facilities into an integrated form. Facility list is important and useful not only for recording and grasping the facilities so far provided but also for maintenance of them. As shown in Table D-2-2 ANNEX D, implemented works and their amount and cost are compiled only in Kohgiluyeh-va-Boyerahmad Province. Due to difficulties to compile the facilities into integrated form, only constructed years are compiled into inventory by facility categories and sub-basins. Quantity and cost are not compiled into inventory. In Khuzestan province, there are two areas where conservation facilities have been so far provided. However, locations were not exactly identified so

that the facilities of Khuzestan province were not listed in the inventory.

Based on the inventory, situation of conservation facilities has been summarized and reported in following Table.

Table 3-6-3-7 Conservation Facilities in the Study Area

Sub-Basins	K1	K2	K3	K4	K5	K6	K7	K8	Total
Number of Sub-basins	63	21	47	40	41	20	164	59	455
Sub-basins provided with Facilities	18	3	13	7	4	5	10	2	62
	29%	14%	28%	18%	10%	25%	6%	3%	14%
Sub-basins provied with Physical Conservation Facilities	15	3	9	6	3	3	10	2	51
	24%	14%	19%	15%	7%	15%	6%	3%	11%
Check dam	8	3	4	3	1	2	2	1	24
Soil dam w/ comp	2	0	1	0	0	0	0	0	3
Soil dam w/o comp	2	0	1	0	0	2	0	0	5
Stone dam	1	0	1	2	1	0	1	2	8
Gabion dam	1	2	1	2	0	0	0	1	7
River dike	5	0	2	0	0	1	0	0	8
Revetment	0	0	0	1	0	0	0	0	1
Contour Bund (Banquette)	1	1	2	2	1	1	4	0	12
Terracing	0	0	0	0	0	0	4	0	4
Sub-basins provied with Biological works	5	1	7	5	1	4	4	2	29
	8%	5%	15%	13%	2%	20%	2%	3%	6%
Plantation (tree)	-	-	-	-	-	-	1	2	3
Plantation (fruit)	-	-	-	-	-	-	4	0	4
Seedling (grass)	-	-	-	-	-	-	1	2	3
Seedling (spot)	-	-	-	-	-	-	1	2	3
Sub-basins where rangeland is conserved	3	0	3	1	0	1	1	2	11
	5%	0%	6%	3%	0%	5%	1%	3%	2%
Fencing works	3	0	3	1	0	1	0	2	10
Rangeland conservation	0	0	0	0	0	0	1	0	1

(Notes)
1) Above figures are obtained from the Inventory of water and soil conservation facilities.
2) -: not specified.

Although there is no list of facilities of Khuzestan province in the inventory, said two sub-basins are counted in the table. Among 455 sub-basins in the Study Area, 62 sub-basins are so far provided with conservation facilities by JIHAD, that is only 14% of total sub-basins. Conservation facilities can be categorized into three categories. Facilities and their purposes are as follows;

i) Physical facilities

Check dam: (Protection of gully erosion)

Soil dam, Stone dam, Gabion dam: (Retention of sediment as well as water conservation)

River dike, Revetment: (Stabilization of river channel and bank protection)

Contour bund, Terracing: (Protection of surface soil erosion)

ii) Biological works

Plantation (trees and fruit trees), Seedling: (Surface soil protection and water conservation as well as increase of productivity of woods and fruit)

iii) Rangeland conservation

Fencing works, Rangeland conservation: (Surface soil protection and water conservation as well as increase of carrying capacity of livestock)

Among above works, physical facilities have been provided in 51 sub-basins, and biological works in

29 sub-basins and rangeland conservation in 11 sub-basins. It is difficult to evaluate the effects of those facilities so far implemented due to lack of information. It is recommended to prepare an integrated form to grasp important factors such as location map of the project, list of facilities, cost, effects of the project for future monitoring.

3.7 Social Status in Rural Area

3.7.1 Rural Community

Islamic Rural Councils were formerly promoted by the Ministry of Jihad-e-Sazandegi (MJS) at the village level. MJS took a participatory approach in its responsible areas: livestock, natural resources, rural industries and rural infrastructure, through (1) training of Islamic Rural Councils in management skills, (2) establishment of small projects to be participated by the rural villagers, and (3) promotion of market economy with a cooperative system.

Islamic Rural Councils are three to five men councils, elected by the villagers in the ordinary election process. The responsibilities could be summarized as "management and mobilization" at the lowest level of administrative hierarchy. Owing to its nature, Islamic Rural Councils are now administered by the Ministry of the Interior, and carry on the responsibilities in the lowest administrative chain: one of the Councilor is regarded as a village chief. In the background, a collapse of traditional community structure lurk in the village after the Islamic Revolution.

People's Committee, consisting of old men (gray-bearded), Islamic Consultant in the village, financial responsible clergymen, government employees, rural teachers and comfortable land owners, determines general directions in the village and tribal community, and solves in-between disputes among the villagers and the tribes, and, in the case needed, villagers-tribes disputes. Besides directly interfering in general affairs, an active role in stimulating cooperative activities for the improvement, conservation and restoration of customs, and protection of their predecessors' culture. For the continuation of village or tribal cohesion, the Committee has an important role, and it is observed to be still effective.

3.7.2 Public Organization

The organization most close to the villagers is Agriculture Services Center (ASC), which is functioning as an agricultural extension house, directly in contact with the farmers. ASC is established at the center of almost every Rural District, after 1980, and the smallest unit of the Provincial Agriculture Organization. Implementation of extension services is delegated to Agriculture Extension Agents, to whom ASC has provided with a facility of anchorage during on-farm

extension services; also, neccesary instructions are given at ASC from the agriculture officers.

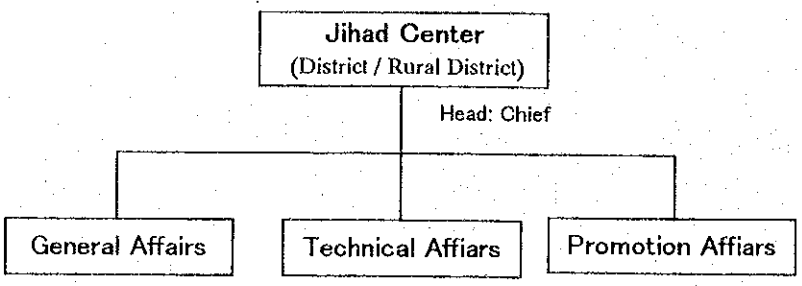


Figure 3-7-1 Set-up of the Jihad Center at the District/Rural District Level

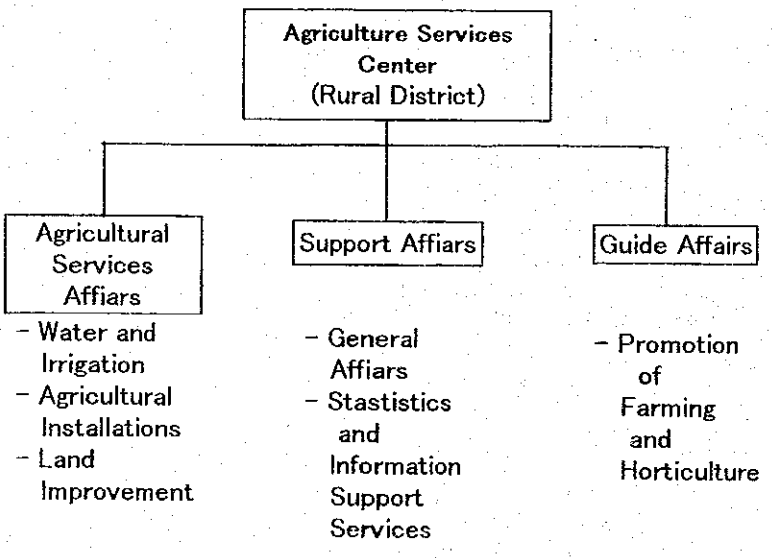


Figure 3-7-2 Agriculture Services Center in Every Rural District, Provincial Agriculture Organization

As shown in Figure 3-7-2, there are 3 sections inside ASC: Agricultural Services, Support, and Guide. The staff duties include: promotion of farming and horticulture, general affairs, statistics and information support services, water and irrigation, agricultural installations, and land improvement.

The smallest unit of Provincial Jihad Organization is Jihad Center located at the District / Rural District level (Figure.3-7-1). Previously, Jihad Centers have been functioned in almost every District / Rural District; however, from the functional separation between Ministries of Agriculture and Jihad-e-Sazandegi in 1990, Jihad Ministry has been withdrawing. In the country, 5-10% of Districts / Rural Districts have Jihad Centers, at the moment. In each Jihad Center, 3 sections render services, and number of staff is 10-15, varying according to work loads.

Besides the Ministries of Agriculture and Jihad-e-Sazandegi, executive arms of the public organizations are operating in the province; such as, Department of the Environment, Ministries of Health and Medical Education; Education; Roads and Transportation; Post, Telegraph and Telephone; Energy; and Cooperatives; Agriculture Bank; and so on.

3.7.3 Farmers Organization

Farmers' organizations have been promoted by the Ministry of Agriculture (MOA), in considerable duration. MOA has, as its attached organization, Central Organization of Iran Rural Cooperatives, which has a direct responsibility of promotional activities for the creation of rural cooperatives. Ministry of Cooperatives is administering the cooperative societies aiming at the purposes other than agriculture, such as for housing and commodity purchasing.

The Rural Services Cooperatives (RSC) are multi-purpose: the major responsibilities are supply of chemical inputs and purchasing of crops with support price, on behalf of the government. RSC is the channel of agricultural equipment, pesticides and seeds, and sales of consumer goods also being undertaken. RSC is the channel of credit facilities of Agriculture Bank, to its members. ASC utilizes, in its extension activities, RSC in distributing agriculture inputs and machinery.

Agricultural Cooperative Society (ACS) serves the members specialized in a particular activity, such as poultry raising and machinery services. RSC and ASC are both administered by the Central Organization of Rural Cooperatives

Production Cooperatives aim at finding out the best way in agriculture development through consolidation of peasants and fragmented lands, introduction of new farming practice and machinery.

Moshaa Production Cooperatives were initiated in accompany with the 1980 Land Reform to enable

peasants to farm small entitled land, with access to common services like plowing. They are supported also by MOA.

3.7.4 Public Services

Before the land reform in the 60's, rural people oppressed by feudal landlords was kept at a distance from the administration and they could not obtained good public services. The last regime was negligent of the public services for rural people owing to gave priority over the reorganization of agricultural system than improvement of living conditions and social welfare in rural area. After the Islamic Revolution, the government has been carried out various policies aiming to stabilize rural living conditions and to improve social welfare in rural area, and pays attention to improve rural environment.

Presently, public services for rural people cover education, health, living, agriculture and livestock and so on.

(1) Educational service

In the study area, related provincial education organizations take the responsibility on primary and secondary educational services, under the control of the Ministry of Education. Primary school (compulsory education: 5 years schooling) is established at the village level and it strives for the spread of basic education in rural area. In major villages of the rural district, there is secondary school (3 years schooling) and it contributes to improve rural education. High school (3 years schooling) is established at towns and center of the district. In nomadic residential area, primary school for tribal nomads is established and tribal teacher teaches nomadic children.

According to the statistics 1999, average number of primary school pupil for one teacher is 21.3 in the country. In the related province to the area, it shows: 20 pupils in Chaharmahal va Bakhtiyari, 18 pupils in Kohgiluyeh va Boyerahmad, 20.8 pupils in Esfahan, 17.3 pupils in Fars and 27.5 pupils in Khuzestan. Higher educational institutions such as university and college are established in Share Kord, Borujen and Yasuj within the study area.

(2) Health service

Public health service in the area is carried out by related provincial health organizations under the control of the Ministry of Health and medical education. On the basis of the national health care system, the health network is established throughout country. In rural area, health house is established at the village level. Two health technicians station in one health house and conduct basic health consultation for family, vaccinations and guidance of family planning. Health center is stationed at major village in the rural district. The center carries out medical service for rural people. There are hospitals in towns and center of the district. These hospitals have ambulance service. Central hospital

of the province treats for serious diseases and injuries. Establishment criteria of health care facilities are a health house for 500 to 1,500 inhabitants and a health center for more than 2,500 inhabitants.

(3) Agricultural service

Provincial agricultural organizations related to the area take the responsibility on agricultural service for farmers who live in plain area. Besides, the Provincial Jihad Organizations related to the area are carried out agricultural service in the hillside and mountainous area in collaboration with the Provincial Agricultural Organizations. These agricultural services are conducted through the agricultural service center, which is established at the rural district level. Activities of this center are farming assistance including technical support, provision of agricultural foundation, and planning and counseling of training, investigation, and development of markets. In addition, study on land tenure and land holding and establishment of small-scale rural industry are carried out.

On the other hand, village cooperative is established at the rural district level. The cooperative is carried out public service directly to farmers. It includes instruction and supervision for purchasing and distribution of seeds, saplings, farm inputs and domestic animals and breed improvement, and harvesting and selling of farm products, farm credit, and sale of daily necessities. In order to research and develop regional agriculture, agricultural research and experimental station is established in each province.

(4) Livestock service

Public service for animal husbandry of nomads and farmers is carried out by livestock office of the provincial jihad organization. Its activities are management of animals and animal health (formation of veterinarian's group, dispatch veterinarian to village and tribal residence area, vaccination and supply of medicine). Directly service to nomads and farmers is conducted through the livestock service station, which is posting at the district level.

(5) Handicraft service

Provincial Jihad Organization supports to handicraft making such as carpet, gilim and other woven goods production in rural area. It includes guidance of design and quality control, improvement of production technology, and marketing (provision and processing of law material, purchasing and selling of handicraft). On the other hand, this organization promotes formation of rural industry cooperative among rural people in order to improve quality and technology of handicraft.

3.7.5 Education

As mentioned in the section 3.7.4, after the Islamic revolution, the government promotes the encouragement of education and to improve the literacy rate of the people, as one of the important

policies. As a result, adult literacy at the country level improved from 41.8% on the eve of revolution (1979) to 74.5% in 1997. On the other hand, the combined enrolment ratio (first, secondary and tertiary levels) increased from 46% in 1980 to 75% in 1997.

Educational environment in the provinces related to the study area, as well as the country, has been improved remarkably after the revolution. It includes the expansion of educational infrastructure and facilities, and teacher's training.

The enrolment ratio of primary and secondary education by the Human Development Report 1999 is as follows.

Table 3-7-5-1 Enrolment Ratio of Primary and Secondary Education Unit: %

Province	Primary Education		Secondary Education	
	Total	Female (as % of male)	Total	Female (as % of male)
Country (Iran)	119.1	107.8	76.8	88.8
Chaharmahal va Bakhtiyari	114.7	101.6	76.0	79.9
Kohgiluyeh va Boyerahmad	131.4	115.5	85.0	68.3
Esfahan	115.3	112.0	83.0	95.3
Fars	115.6	105.4	76.2	87.9
Khuzestan	117.4	100.3	70.5	82.4

Source: Human Development Report 1999, Plan and Budget Organization

As mentioned above, the enrolment ratio of primary education in the area is lower than that of the country, except for Kohgiluyeh va Boyerahmad province. The ratio of female to male students increased from 66% in 1976 to 90% in 1996 at primary level in the country. And the significant increase of female student who go on to the secondary education course is presented compared with that of male. The adult literacy of female is also improved similarly. It is assumed that these trends are similar to the country. Excepting the provinces of Esfahan and Fars, the literacy rate by sex of the related provinces to the study area is lower than that of the country.

Table 3-7-5-2 Adult Literacy Unit: %

Province	Male	Female
Country (Iran)	79.7	65.9
Chaharmahal va Bakhtiyari	76.2	58.3
Kohgiluyeh va Boyerahmad	74.2	55.9
Esfahan	84.5	74.1
Fars	80.7	68.6
Khuzestan	77.8	60.3

Source: Human Development Report 1999, Plan and Budget Organization

Traditional custom and behavior in rural society produce low literacy rate of female. Since the government strives for eradication of adult illiteracy through literacy movement, this situation is being improved. This movement is carried out by the Literacy Movement Organization.

Regarding the item of education in the inventory, this will be basic data for regional development. Therefore, it is desirable to make an entry of newest accurate numeral value in the form. However,

because the data of education could not be obtained in the fieldwork, the education inventory item is filled with the provincial data of the Human Development Report 1999.

3.7.6 *Human Development Index*

The social environment has changed remarkably in the 20 years since the Islamic Revolution. The value of the HDI rose to 0.457 in the period between 1960 and 1995. Social changes and the tendency of human development are rooted in the past half-century and the recent twenty years of the country.

The average life expectancy at the time of birth lengthened from 49.5 years to 61.6 years over a period of about 30 years, from 1960 to 1988, and has lengthened from 61.6 years to 69.5 years old in the recent ten years (from 1988 to 1997). Improvement in the health of the nation's people for the past 10 years has contributed to this. The adult literacy rate rose from 41.8% before the Islamic Revolution to 57.1 % in 1988, and has improved remarkably to 74.5% in the 10 years after that. Improvement of the percentage of school attendance has contributed greatly to this.

From the viewpoint of gross national product, per capita GDP before the Revolution had increased from $1,985 in 1960 to $4,976 in 1976 at a steady rate. Although stagnation and declines had been seen for the first ten years after the Revolution, per capita GDP has increased from $3,715 to $5,222 in the recent ten years.

Values of the HDI in provinces related to the study area in 1996 are as follows.

Table 3-7-6-1 HDI in Provinces concerned

Province	Life expectancy at birth (years)	Adult literacy rate (%)	Combined first-second and third level gross enrolment ratio (%)	Adjusted real consumption expenditure per capita (1000 Rials)	Human development index (HDI) value
Country (Iran)	69.2	72.9	75.9	1899	0.790
Chaharmahal va Bakhtiyari	65.9	67.2	75.6	1437	0.682
Kohgiluyeh va Boyerahmad	63.4	61.9	86.7	1160	0.623
Esfahan	70.3	79.5	77.8	1758	0.789
Fars	67.5	74.7	74.6	1909	0.785
Khuzestan	66.9	69.2	72.6	1781	0.746

Source: HDI Report in Iran in 1999

Here, the difference in HDI among provinces related to the area based on the data in 1996 is examined. The rank of Chaharmahal va Bakhtiyari Province, accounting for the most part of the area, is medium (18th place), and Khuzestan Province containing the sub-basin K8 is similar (10th place). Esfahan Province covering the sub-basin K4 and a part of K7 is ranked high (3rd place). Fars Province with the sub-basin K7 is also ranked high (4th place). Kohgiluyeh va Boyerahmad Province with the sub-basin

K7 is ranked low (24th place), because this province is located in the mountainous region of the Zagros Mountains and its underdevelopment is reflected in the value.

3.7.7 Gender Issue

Women of nomad tribes and in rural areas in the study area perform in the sectors of agriculture, animal husbandry and handicrafts (carpet weaving and others) among economic activities. These activities play an effective role in reduction of production cost and improvement of family income. In addition, the domestic activities, i.e., housekeeping, childcare, are an es0sential part of women's work. According to the HDI study, women's participation in work of agriculture and animal husbandry in Iran is more than 50%. It is supposed from interview with farmers in the area that the actual situation in this area is also similar to this.

The cultural manner of thought and social circumstances in rural society is deprived of access to education and training from rural women and girls. The role of rural women and girls who satisfy economic needs and earn family income further worsens this plunder. After the Islamic Revolution, however, improvement of the literacy rate has been seen as a result of the campaign to eradicate illiteracy and improve the school attendance for rural women. As a result, the effect of public assistance for rural women such as health, education, extension and training and others, is appeared gradually by enlighten and enhance woman's willingness for improvement of rural life. And it contributes to improve the social status of rural women. According to the Human Development Report 1999, the literacy rate of rural women in the country was only 17.4% in 1976. However, in 1996, its literacy rate is remarkably improved as 62.4%, and the report express that it is more improved compared with that of rural men.

Due to the necessity of self-sufficiency in village, rural women's participation in community exists automatically because they work in a group from the initial stage of farming. This group is called "Boneh," which is one of the traditional forms organized at the village level. Men and women in rural area always carry out community work according to their own roles. The organization of farm village women is promoted under guidance of the Provincial Jihad Organization and the Provincial Agriculture Organization. In the field of handicrafts, rural industry (village carpet weaving) cooperatives are organized. Management of this cooperative carries out by women. The office of handicraft of the Provincial Jihad Organization supports the cooperative on dyeing of wool materials, purchasing of materials for weaving, and guidance of design. However, there are few cooperatives in the study area.

Gender based division of labor is as follows.

Men: Farm works including plows farmland, seeding, fertilizing, chemical application

and irrigation work, and boys help the father's farm work and graze domestic animals.

Women: Daily works including raising small animals, milking and making dairy products, collecting firewood and help to farm work such as weeding and harvesting. In addition, they are engaged in handicraft work.

Most activities related to capital acquisition and maintenance is the responsibility of men. The source of wealth controlled by women is few and more related to household consumption. In the traditional rural society, woman's participation to decision making within her home is few. An intention of a head of family and elders is given the priority for decision making.

Public institutions supporting rural women include the Ministry of Agriculture, the Ministry of Construction Jihad, the Ministry of Health and Medical Education, the Imam Homeini Relief Commission, the Iranian Handicraft Organization and the Welfare Organization. As NGO activities, the Women and Sustainable Development Association endeavor for improvement of women's social status.

3.7.8 Religion

In the last regime, religious world has nothing to do with the development. With the dictatorial development under the Shah, it was not based on the needs of the people. Consequently, rural areas were laid the outside of development. After the Islamic revolution, the Islamic government has been accelerated the policies which are big two slogans for reconstruction of the nation which are "independent economy" to economical self-reliance and "liberation of the oppressed" to social fairness. These policies include rural development such as provision of social and living infrastructure. Executing agency of this development is the Ministry of Jihad-e Sazandegi. Among the oppressed such as farmers and nomads, in particular, liberation of women who were the oppressed in social and cultural environment is promoted. The leader of the Islamic Revolution of Iran, the late Imam Khomeini, called for women' presence in the appropriate fields, be them political, social and economic. This created serious changes in social and traditional vision and mind-sets. And it has a strong effect on the improvement of social status of women. For the development on the independent economy and the liberation of the oppressed, the religious world plays an important role of moral support for them.

At village level, the Islamic priest is given advice and consultation on the problems of inhabitants and community. Ministry of Islamic Guidance and Arts and Mass Media is conducted social enlightenment and publicity activities for the people.