Chapter- V

DISCUSSION

The results presented in Chapter IV are discussed in this chapter under two major categories.

5.1 State level analysis

5.2 Household level analysis

The household level analysis was further discussed under three sub-headings.

5.2.1 Socio-economic aspects

5.2.2 Aspects related to land degradation

5.2.3 Factors determining land degradation

5.1 STATE LEVEL ANALYSIS

The dynamics of land use pattern in the state over the last three decades showed that the total geographical area (based on records of village papers) in the state increased from 2930.90 thousand ha in 1972-73 to 4544.20 thousand ha during 2003-04 showing an increase of 35.50 per cent. The main reason advocated for this was that it was the area under village papers and showed an increase as more area was surveyed in districts like Kinnaur, Lauhal & Spiti, and Shimla etc. The percentage net area sown decreased consistently over the years from 19.07 per cent in 1972-73 to 11.89 per cent in 2003-04 but in absolute figures it remained almost same, whereas, the area under current fallow and culturable waste land which decreased in percentage term, noticed an increase in absolute terms. This all was due to the increase in the total geographical area of the state.

A sharp increase was observed in the land put to non-agricultural uses which was because of diversion of common lands for non-agricultural purposes like, building construction, road network, industrial development etc. (Chadha, 2003). The per cent area under non-agricultural
uses and culturable waste was highest in Una district because of more industrial development as the district is nearer to plain areas where the transportation of inputs and/or output is better. Over the years the growth rates were positive for land under non-agricultural uses, current fallow and other fallow. Giri (1966), Singh and Vasisht (1997) & Chadha (op. cit.) in their study also found that land for non-agricultural uses had increased over time. The growth rate was estimated to be negative for net area sown. This was mainly due to shift of area from net area sown to these lands due to rainfed agriculture and climate change causing low returns. Therefore, efforts should be made to increase the yield and profitability of rainfed crops. There is also a need to make people aware of the water harvesting technologies suitable for dry lands so that the area under cultivation may be stabilized if not increased. The instability was also high for land under non-agricultural uses, other fallow and culturable waste in almost all the districts. This may be due to the concentration of efforts and limited resources on the irrigated portion of land and neglecting the unirrigated areas (Nadkarni and Deshpande, 1979).

During 2001-03, the concentration of land for non-agricultural uses and culturable waste was highest in Una followed by Hamirpur, current fallow in Hamirpur, Kullu & Sirmour and other fallow land in Hamirpur, Una, Shimla and Bilaspur. This showed that concentration of fallow lands was relatively high in dry and drought prone districts, whereas, the culturable waste land and land under non-agricultural uses was higher in the districts where industrial development was higher.

5.2 HOUSEHOLD LEVEL ANALYSIS

5.2.1 SOCIO-ECONOMIC ASPECTS

AGE

In Zone I and Zone II, about half of the heads belonged to the age group of more than 60 years, whereas, in Zone III and Zone IV 42 per cent and 64 per cent, respectively were in the
age group of 30-45 years. This was mainly due to the fact that nuclear family system was prevalent in Zone III and Zone IV, thereby, implying that most of the heads of households were young. But the nuclear families might have led to more land fragmentation and reduction in labour force. The age wise distribution of the population showed that the working population was almost same in all the zones. Among working population, females outnumbered males thereby indicating higher labour availability on the farm as most of the fields work in hilly area was done by females. This is also expected to decrease land degradation. The higher female population might also be due to migration of male labour to urban/semi-urban areas in search of productive employment since the existing size of holding was unable to provide sufficient employment and income generating avenues for sustainable livelihood. This is particularly true in Zone I and Zone II. The average family size varied between 5.38 in Zone IV to 7.50 in Zone I. The average family size was higher on large farms than the small farms in all the zones which were mainly due to the fact that on large farms joint family system was found to be prevalent.

EDUCATION

As a result of young heads the education of head of household in Zone III and Zone IV was higher as compared to Zone I and Zone II. The higher education of head of family was likely to help the households for the access to various inputs, adoption of new technology etc. During survey it was observed that the educated farmers were also aware about the problems of land degradation and were keen to its minimization. The illiteracy was 2-6 times higher in females than the males. Among females the illiteracy was highest in Zone I (19.25 per cent) followed by Zone II (18.92 per cent). This can be attributed to the gender differences existing in the society. In the selected areas, it was observed that preference was given to the education of males whereas the females were supposed to work at home or in the fields.

FARM INVENTORY
The investment on farm implements was highest in Zone I (Rs 25,331) followed by Zone II (Rs 17,014) and was lowest in Zone III (Rs 2,389) due to the use of tractors, threshers in Zone I & Zone II. Big mechanical sprayers for orchards in Zone IV caused higher investment in Zone IV, whereas, in Zone III the low investment was due to small hand sprayers required for vegetables. The area under vegetables was also limited.

In Zone III and Zone IV local cows were preferred to buffaloes because of their adaptability to extreme climate, nutritive milk and low cost of rearing. In these zones stall feeding was almost absent and the cows were fed various shrubs and nutritive grasses which improved the quality of milk. The buffaloes were absent in Zone IV because they were unable to survive in the extreme cold weather and were not accustomed to steep slopes of the area for grazing due to heavy body weight whereas in Zone I and Zone II buffaloes were preferred due to good quality of milk in terms of fat & SNF and higher milk yield.

The total investment was Rs 2.70 Lakh in Zone I which was 9, 26 and 36 per cent higher than Zone IV, Zone II and Zone III, respectively. This was mainly due to investment on farm buildings (80-92 per cent). In hilly area residences were treated as farm buildings since these were used as farm stores. There was no provision for separate farm stores.

**AGRICULTURAL INFORMATION**

Agriculture Information Centers (AICs) played a vital role as about 84 per cent farmers in Zone III, 64 per cent in Zone IV and 45-50 per cent in Zone I and Zone II consulted these centres for information regarding agricultural techniques. Higher number of farmers consulted AICs in Zone III due to the cultivation of high value cash crops. The farmers were benefited in terms of increased, balanced and adequate use of fertilizers, plant protection measures, technical know-how and others like availability of inputs, credit accessibility, soil conservation measures etc.

**CREDIT**
Banks were the main source of borrowing on the sample households due to more reliability. More number of small farms borrowed capital than large farmers due to low income. The crop loan was main purpose of borrowing in Zone III because of the cultivation of off-season vegetables which required more cash for the purchase of inputs like hybrid seed, fertilizer, plant protection measures etc. The crop loan borrowers were absent in Zone II mainly because farmers cultivated cereal crops and for that the use of market-oriented input was comparatively low which the cultivators could arrange from their non-farm income.

**SOURCES OF ENERGY**

Fuel wood was the main source of energy during 1995-96 in the sample households due to the non-availability of any other source of energy in the rural areas in all the zones. But during 2004-05, the LPG was easily available in the state thus, a shift was observed from fuel wood to fuel wood plus LPG. This was expected to decrease land degradation through more conservation of natural resources.

**GROSS HOUSEHOLD INCOME**

The total household income was highest in Zone IV (Rs 1.78 Lakh/annum) followed by Zone III (Rs 1.43 Lakh). This was because of the cultivation of fruits (apple) in Zone IV and high value cash crops in Zone III which gave higher returns. In Zone III and Zone IV, the farm income was sufficiently high on both small and large farms. The per capita savings were estimated to be maximum (Rs.25, 206) in Zone IV and minimum (Rs.8306) in Zone I. The average propensity to save (APS) was also higher in Zone IV (0.76) than Zone III (0.72), Zone II (0.68) and Zone I (0.58). This indicated that the farmers in Zone IV had higher capacity to adopt suitable measures to control land degradation followed by Zone III, Zone II and Zone I.

**CROPPING PATTERN, PRODUCTIVITY AND FERTILIZER USE**

A decrease in the operational holding was observed from 1.023 ha/farm during 1995-96 to 0.877 ha/farm in 2004-05 in Zone I, from 0.425 ha/farm in 1995-96 to 0.247 ha/farm in 2004-
05 in Zone II. This was due to higher off-farm income and thus lack of interest in farming, unwillingness of young generation to work on the field, low farm income etc. This has led to increased land degradation (fallow land) by abandonment of land on temporary or permanent basis (Anonymous, 2003).

In Zone I the yield of all the crops was observed an increase in 2004-05 over 1995-96 except colocasia where the yield decreased to 71.9 q/ha from 81.3 q/ha. This was mainly due to use of hybrids and increased use of fertilizers etc. over the years. In Zone II, a decrease in the yield was observed in all the crops from 1995-96 to 2004-05 (Anonymous, undated). Pulses as sole crops and mixed cropping of pulses with cereals was not cultivated in the study area during 2004-05. This can be attributed to the fact that farm income was low due to lack of irrigation facilities, erratic climate, migration, wild animal menace, weed infestation, labour scarcity, dwindling interest of younger generation to work on the fields etc., whereas, in Zone III and Zone IV an increase in the productivity of all the cash crops was observed due to the use of hybrid seed, higher fertilizer doses, increased use of plant protection measures, irrigation etc.

The fertilizer consumption increased over the period for cereals in Zone I and Zone II and among vegetables in Zone III and Zone IV. There was no emphasis on phosphatic and potassic fertilizer in 1995-96 but their use increased substantially during 2005-06 for both small and large farmers. The use was also tilted towards balanced use although it was not optimum. This was mainly due to the unawareness, non-availability and higher prices of potassic and phasphatic fertilizers. But higher doses of these fertilizers might lead to decrease in yield/ increase in land degradation over the years. Chadha (op. cit.) in his study found the similar results that imbalanced use of chemical fertilizers removed soil nutrients and damaged the land quality.

5.2.2 ASPECTS RELATED TO LAND DEGRADATION

WASTE LAND
The waste land was observed to be the highest in Zone II (43 per cent of total owned land) followed by Zone I (21 per cent) and was very less in Zone III and Zone IV (8 per cent each). This was because of migration from rural to urban areas in search of employment, low farm income, animal menace, annual weeds etc in Zone I and Zone II. The less waste land in Zone III and Zone IV was mainly due to production of cash crops which were more remunerative. The waste land was higher on large farms than small farms due to more fragmentation of land and large distance of fragments from the residence of farmers. The increase in waste land was highest in Zone II followed by Zone I. Animal menace, annual weeds, nearby fallow land and decrease in family labour were some of the main reasons for increase in waste land. In Zone II, in addition to above reasons, migration was advocated as another major reason for increase in waste land. The increase was higher on large farms due to more per capita land availability, more fragmentation and higher non-farm income. The waste land was less or nil in Zone III and Zone IV because of better irrigation facilities. Ramasamy et. al. (2005) found similar results in Tamil Nadu that better irrigation facilities reduced the extent of fallow lands at the farm level.

**MONOCULTURE**

In Zone III, 30 per cent of farmers, who were practicing monoculture for more than 10 years, observed more than 50 per cent fall in the level of production followed by 20-50 per cent fall by 19 per cent farmers, whereas, in Zone IV, farmers opting for monoculture from 5-10 years, found 20-50 per cent reduction in the production. The effect on the production was due to the cultivation of cash crops over the years which required heavy input dozes. Although in some of the cases there was change of crop but it was, too, a cash crop and thus the effect on soil etc. was expected to be the same. The same crops were mainly grown because of off-season cultivation which were highly remunerative with low output price variability. Change in variety, increased fertilizer use and increase in plant protection measures were some of the
main measures taken by the farmers to maintain the production level. The overuse of inputs might lead to land degradation. Agyepong and Sosthenes (2003) also found that continuous cropping had led to soil improvishment and decreased crop yields inspite of use of chemical fertilizers and improved crop varieties. A few farmers in both the zones (Zone I and Zone II) observed more than 50 per cent land degradation in terms of soil fertility, whereas, large number of farmers noticed less than 20 per cent of land degradation. The land degradation was generally in terms of cultivable waste land, fallow land etc. Although by definition it did not form the part of land degradation but in the study area the farmers had started treating these areas as degraded since these would not be put to cultivation due to many reasons discussed later. Farmers in general observed very low ill-effect of plant protection measures on the soil fertility which was mainly because of the unawareness about the land degradation. Sharma (2002) found that overuse of inorganic chemicals and insecticides led to the destruction of soil. Switch over to varieties with low input requirements, leveling of fields and control of weeds in fallow land, use of FYM, mulching etc. were some of the measures adopted by the farmers to control the land degradation.

SOIL CONSERVATION MEASURES

No farmer was observed to be using any soil conservation measures in Zone I and Zone II. In Zone III only 2 per cent of farmers used these measures against 18 per cent in Zone IV. This is attributed to the fact that the off-farm income was higher in Zone I and Zone II so they did not take care of the land (Holden et. al., 2005), whereas, in Zone III and Zone IV the farm income contributed significantly to total household income. Thus, the farmers were taking interest in the soil/ land conservation but the awareness among the farmers about these measures was very less. Reddy (2003) also suggested that there was an urgent need to strengthen the agricultural extension services in India which were poor when compared to other Asian countries like China.
TENURAL STATUS

Leasing-out of land was higher in Zone I and Zone II (22 and 24 per cent farmers) than in Zone III (6 per cent farmers) and was absent in Zone IV. This was mainly due to migration of farmers in search of productive employment as the existing size of holding was unable to provide sufficient employment and income to the family. Erratic climatic conditions and unwillingness of young generation to work on the field were other important reasons for leasing-out land. In Zone III and Zone IV agriculture was the mainstay of people and farm income was also quite high. Thus, leasing-out land was almost nil. The leasing-out of land was higher on small farms than large farms due to uneconomic land holdings and very low farm income. Leasing-in of land was observed in Zone I and Zone II only. Less land to cultivate, low income source(s) due to unskilled labour, reduction in operational holding etc. were the main reasons for leasing-in the land.

MIGRATION

Migration was observed to be higher in Zone II and Zone I mainly in search of productive employment, education of children, low farm income due to lack of irrigation, uneconomic land holding, animal menace, erratic climate etc. The other reasons are minimum statutory wages and growth rates of agricultural sector, technological development of agricultural sector which caused a withdrawal of family labour and increase in the hired labour input (Narayanamoorthy, et al., 1999). Migration was found to be higher on small farms than the large farms. Migration was expected to increase land degradation (Rani, 2003; Codjoe, 2006) as the migrants, in general, kept their land fallow due to restrictive tenancy laws or leased-out land to other villagers who might not take adequate care off the land.

5.2.3 FACTORS DETERMINING LAND DEGRADATION

It was hypothesized that the total owned land and number of fragments of land will have positive relationship with land degradation and this hypothesis was accepted in case of all the
zones. The family labour had mixed effect on land degradation. The positive effect in Zone I was due to more non-farm income opportunities, whereas, negative effect in Zone III can be attributed to intensive cultivation which required higher labour.

Higher non-farm income had positive effect on land degradation in Zone I and Zone II because due to higher non-farm income the farmers did not take care about farming and this led to higher land degradation. Holden et al. (2005), in their study also found that the better access to off-farm income reduced farm household incentives to invest in conservation and that this led to more overall soil erosion and more rapid land degradation, whereas, in Zone III and Zone IV, due to higher farm income, the farmer invested his higher non-farm income for the improvement of land and, thus, decrease in land degradation. The hypothesis was rejected in case of farm income in all the zones i.e. an increase in land degradation was observed with increase in farm income which might be due to overexploitation of land for getting a higher farm income.

In case of migration, the results were as per the expectation i.e. migration increased land degradation on the sampled households. Leased-in land had positive effect on land degradation in Zone I and Zone III as the farmer who leased-in the land did not take adequate care of the land which led to more degradation whereas in Zone II, leasing-out of land was better than fallow land because of negative marginal productivity so it had negative relation with land degradation. The highest education in the family, as expected, had a mixed effect on land degradation.

The total owned land had higher probability for moving a household towards land degradation in Zone I and Zone II. This was mainly because of higher off-farm income, migration and low farm income, whereas, in Zone III and Zone IV the probability was positive but very less due to higher farm income. The number of fragments had higher probability for taking a household toward land degradation in Zone II due to small and fragmented land holding with
low farm returns, whereas, in Zone III it had more probability of a household towards no land degradation due to intensive cultivation. Family labour increased the probability of land degradation in all the zones except Zone IV. This was due to higher income from fruits in this zone and more owned land which required higher labour for maintenance. The less probability was also due to non-farm income in all the zones except Zone II because in this zone the higher non-farm income led to the abandonment of land because of many reasons like migration, low farm income, unwillingness of young generation to work in the field etc. Higher farm income had less probability of moving a household toward no land degradation in all the zones except Zone IV because high farm income required the household to take more care of land. Migration also had a higher probability for land degradation as more migration caused more land degradation mainly due to labour scarcity. Leased-out land had more probability in Zone I as the tenants did not take care of the land, whereas, in Zone II it had more probability towards no degradation. Highest education in the family had mixed effect on the probability distribution. The highest probability for moving towards land degradation was in Zone I as highly educated person preferred non-farm income opportunities than farming. The more probability towards no land degradation was in Zone III as more educated person had better access towards land management practices.