INTRODUCTION

Agricultural development in the mountain region is circumscribed by mountain specificities, namely, inaccessibility, marginality, fragility, niche and human adaptation mechanism created by unique vertical dimensions that distinguish them from plains and other ecosystem. While the first three features contribute in varying degree, inter alia, to physical isolation, distance and high transportation costs, the later two indicate positive features and the potential for agricultural development. The mountain agriculture in general is cereal based and characterized by low and stagnant productivity. The diversification of agriculture from cereal based systems towards high value cash crops including fruits and off-season vegetables, compatible with the comparative advantage of the region, is suggested as a viable solution to stabilize and raise farm income and increase employment opportunities. (Vyas 1996; Joshi et al 2004, Sharma, 2005).

The transition from subsistence-oriented, cereal-based agriculture to high-value cash crop-based commercial agriculture has both positive and negative impacts on the natural resource base. The positive aspect of commercialisation is that the adoption of high value cash crops, particularly fruit crops, helps the mountainous region in two ways. First, it promotes productive use of abundant marginal lands available in these regions which otherwise are either lying idle or are devoted to low value subsistence crops. Second, these crops help in maintaining and improving the
ecology and environment by promoting soil conservation and improving soil fertility. In economic terms, it leads to significant improvement in the quality of life of the people.

Negative aspects of agricultural commercialization is the excessive mining of the natural resource base coupled with excessive use of agro-chemicals leading to soil degradation and loss of rich agro-biodiversity available in these regions. Studies have shown that excessive use of chemical fertilizers and pesticides has impacted adversely on the soils. For example, according to (Oldeman et al, 1991) globally a total of 239 M ha is affected due to excessive and or imbalanced use of agro-chemicals. Out of such lands, 135 M ha is degraded due to loss of nutrients, 76 M ha is affected by salinity, 22 M ha is affected by chemical pollution and 6 M ha of land is affected acidity. These estimates give a rough idea about the extent of chemical–related soil degradation worldwide. The adoption of monoculture by the farmers and the use of high yielding varieties in place of traditional varieties in commercialized agriculture have led to a significant loss of genetic diversity. The contribution of monoculture and intensification towards the loss of nutrients, chemical pollution and acidification is, however, not known.

Agrochemicals used to increase agricultural productivity, have also been associated with many direct and indirect negative impacts on human health. These effects are increasingly manifested in loss of working efficiency resulting in higher cost of production. In recent times, the effects of commercialization of agriculture on environment and human health have attracted the attention of both the scholars and policy makers (Postel, 1989; Pingali et al, 1997; Pingali and Rosegrant, 1994). The
severity and risks of adverse impacts are higher in developing countries where users are quite often illiterate, ill trained, and do not possess appropriate protective equipments. It is estimated that only 0.1 per cent of applied pesticides reach the target pests, leaving the bulk of pesticides (99.9 percent) to impact the environment and human health (Pimental, 1995). The emphasis on organic agriculture is the direct outcome of the increasing awareness of the adverse effects of the excessive use of agro-chemicals.

Himachal Pradesh is a small mountainous state with a total geographical area of 55,673 square km. Its altitude ranges from 350 meters to 6,975 meters above the mean sea level. Situated in the heart of the Western Himalayas, the state is primarily an agrarian economy. More than two thirds of the population depends on agriculture for their livelihood. The process of crop diversification in the state started with the introduction of apple in the late fifties and sixties in district Shimla and Kullu. The process has now spread to different regions in many other districts, namely, Solan, Sirmaur and even to low and mid hill districts and encompasses cultivation of high value crops like seasonal and off-seasonal vegetables. Over the years, the state has emerged as a leading producer of temperate fruits and off-season vegetable. The area under fruit crops increased from 26,307 hectares in the triennium ending 1967-68 to 1.87 lakh hectares in the triennium ending 2005-06. The production of fruit during the period increased from 48 thousand tonnes to 6.28 lakh tonnes. The area under vegetable crops increased from 23,000 hectares in 1990-91 to 50,000 hectares in 2006-07 and the production during the period rose from 3,65,000 tonnes to
10,00,000 tonnes registering compound growth rates of 5.49 per cent and 5.90 per cent per annum respectively

A plethora of micro studies are available on different aspects like marketing, costs, returns, income, employment, ecological sustainability of the cultivation of high value cash crops. In net terms, these studies have shown that switching over to the cultivation of these crops from cereal crops has made a significant improvement in the economic status of the farmers in terms of their income and employment. More importantly, however, these studies have overlooked adverse impacts of the cultivation of these crops on the natural resource base, particularly soil and human health. Perhaps, this was also not required, ab initio, inasmuch as the policy makers and other development agencies were, primarily concerned with improving upon standard of living of the local people. However, over the period the mono-cropping without adequate nutrient replenishment of the soil and excessive use of agro-chemicals have started manifesting in terms of dwindling crop productivity and increasing incidence of health related problems, especially in areas where cultivation of high value cash crops started 25-30 years back. Over the past decade, farmers have been complaining about the decline in apple production despite using all agronomic inputs and following orchard management practices including irrigation, fertilizers and pesticides. Most of the farmers in Hindu Kush Himalayan region feel that productivity of apple has declined by as much as 50 per cent as a result of the decimation of the bees and other useful insects (Partap T. 1998). While the impacts of the mono-cropping and excessive use of chemical inputs are not so conspicuous in some areas, in others these are getting increasingly manifested in terms of reduced
life span of the orchards, in many cases by about five to ten years, decrease in the physical productivity, deterioration in the quality of produce and loss of arable land.

The anecdotal evidence from these areas suggests that mono-cropping and excessive use of agro-chemicals has started impacting adversely on the natural resource base, particularly soil and agro biodiversity. Agro biodiversity includes weedy populations, agricultural crops, crop pollinators, soil micro fauna and micro flora. Some land use practices, such as the indiscriminate use of pesticide, destroy some crop pollinators and have tangible effects on agro biodiversity. Overuse of pesticides has also led to the elimination of predators of crop pests, which then develop resistance to pesticides.

In brief, though environmental related issues have assumed importance, these aspects of the cultivation of high value cash crops have not been studied and looked into. In fact, we have not come across any study that did document and value the myriad of adverse impacts on the natural resource base and environment in those areas of the state where the cultivation of high value cash crops is in advanced stages. The present study is a modest attempt in this direction. Against this background, the present study aims at documenting the high value cash crops cultivation led adverse changes in the natural resource base, the strategies adopted by the local people to minimize the adverse impacts, monetary valuation of environmental costs, understand their implications for the livelihoods of the local people and suggest possible solutions. Such a study is essential in estimating the
true cost of the cultivation of these crops. Keeping this in view, the study has been undertaken with the following objectives:

Objectives

To document the commercialized agriculture led adverse changes in the natural resource base and their impact on the production, productivity and human health;

To document the strategies adopted by the farmers to minimize the adverse effects of these changes;

To estimate the cost of these changes in terms of the losses in income and employment and;

To understand the implications of these changes for the livelihoods of the farmers and suggest policy measures.