SUMMARY

Kinnaur is a tribal district of Himachal Pradesh located between India and Tibet region of China, west of Nepal. The average elevation of the region is between 1,220 and 6,770 metres above sea level. The rugged landmass with uneven terrain is spread in 6,553 square kilometres with a total population of 71,270 heads. The population per square kilometre is only eleven. The district headquarters is Reckong Peo. The Kanaura or Kinnara tribe are the original inhabitants of this region.

Agricultural holdings are very small. The area is cold and hence the timetable of crops also differs from the plains. The area has been and is still deficient in food production. Agriculture is the mainstay of people here. Horticulture is yet another source of income to the people of the area. The land is ideal for the growth of chilgoza trees which have been nurtured there from time immemorial. Fruits like apple, apricot, peach and almond are grown in abundance.

Kinnaur, due to its geographical situation has a long winter from October to May, the snowy season, and a short summer from June to September. It has two distinct climatic zones - the wet and the arid. Only the area south of the great Himalaya receives monsoon rains. The means of communication constitute the greatest problem here.

The Kinneres are distinct from the people of other areas of western Himalaya. The people are frank, active generous, hospitable and highly honorable in their dealing. They are enterprising and travel far and wide in pursuit of trade and commerce and have acquired a reputation for honesty in their dealings.

The Kinnauri dialect, Homskad, is the mother tongue of Kinnaur. Like other parts of the country they have strong cast system. People are mainly Hindus or Buddhists. Because of the cold climate, people wear woollen clothes throughout the year.

The staple food of people is wheat, ogla, phafra and barley. They also relish meat. Drinking of alcohol popularly known as (ghanti) is common in the district. People are religious, superstitious and God fearing. The joint family system is still largely in vogue. Inheritance of prosperity is patrilineal. Polyandry though at its extinction stage is still prevalent in remote villages. For an outsider the morals of Kinnares may appear very lax.

The tribal population residing in Kinnaur for centuries employs majority of Indigenous Technical Knowledge (ITK) and practices. It was found during the study that they are an integral part of the tribal culture and have helped sustain their livelihood for generations. Most of these technologies demonstrate forest, water and soil conservation methods, intensive production systems and cultural rituals. The study also describes some of the tools used by tribal people that differ in size, shape and function from those of other places. An important finding of this study is that technologies are being
transferred from tribal to non-tribal people and vice-versa in a number of locations in the hill tracts.

This study is the first of its kind undertaken to identify and record indigenous ideas/practices prevalent in Kinnaur. During the course of this study need was felt to conduct a more vigorous study to overcome the shortfalls of this study and lay a solid foundation for future endeavors. To that end, this investigation suggests that the findings should be taken into cognizance by the concerned govt. or non-govt agencies at national and international levels. Thus, they may be further analyzed and improved and taken to the doorsteps of the user groups at the grassroot level. For that purpose the national database and monitoring framework in the member countries should be established through which a regional forum could disseminate the information among its members. It is also suggested that the technologies being used today in many cases should be revalidated, refined and improved incorporating the ideas of the local innovators.

The tribal people have a separate entity characterized by their somewhat different socio-cultural practices. These cultural rituals have deep roots in their landuse practices. These practices, though not all have been authenticated by modern agricultural and forest sciences, none the less a host of them have been found to be very useful and suited to the local conditions. These practices deserve more attention on two accounts.

- The indigenous employed in these areas have strong influence and tremendous potentials for increasing productivity and sustainability of these hilly areas.
- The practices are today endangered due to various socio-political problems in these areas.

The people living in Kinnaur understand the values and importance of soil and water conservation for their survival. With the changing environment the tribal people are also changing their lifestyle to a great extent and the scope of strengthening these technologies is becoming limited. Unless these traditional practices are collected and database is developed a wealth of indigenous environment friendly technical knowledge will be lost forever.

Located in the interior continents, Kinnaur manifests remarkable ecological variety and biological diversity. Its geographic remoteness and unfriendly climatic conditions greatly constrain economic growth and development. Environmental degradation, which is on increase, is an additional cause for concern.

Area has rarified atmosphere, fast blowing winds, extreme variations in daily and seasonal temperatures, unharvested glacial melts, frozen soil moisture in early spring, low relative humidity in growing season, sparse natural vegetation, high transpiration due to excessive heat, inadequate photo-hours in winter, high frost injury, poor plant growth etc. Natural vegetation is overwhelmingly herbaceous. There is also poor communication network, inadequate developmental institutions, lack of educational/
vocational facilities, inadequate outreach for relevant transfer of technology and untrapped and underdeveloped industrial potential.

The fauna of this region is quite unique. Due to poor/rudimentary communication facilities the yak has been the major animal for burden. Besides yaks, livestock comprise mainly sheep and goats.

This zone is characterized by mountaneous tracts of varying altitudes, steep slopes etc. Steeper slopes receive higher intensity of radiation and are not conducive to the growth of vegetation. Conversely, vegetation abounds on the relatively gentler slopes. Moisture from snow-melt and rich organic matter generate dense vegetation of fruit and forest trees.

The introduction of apple to the district was the corner stone of the overall horticultural development strategy. The economic transition was facilitated by the simultaneous development of supporting infrastructure by way of research and extension mechanisms, higher budgetary allocations, government policy initiatives etc.

Indigenous knowledge in Kinnaur is the inter-generational wisdom of local inhabitants to perform their livelihood operations in a most eco-friendly manner under remote, isolated and inaccessible conditions, characterized by harsh climate and limited survival options. Indigenous not only stands for ingrained intrinsic knowledge, but is also amenable to modifications based on latest technical know-how by local inhabitants through native means to suit their daily requirements. To discard any indigenous knowledge on connotations of superstition, conservation, primitivism etc. by modern science would only result into a failure of the developmental networks. Evidences have shown that the developmental projects which overtly rejected already acquired knowledge of the local inhabitants, have failed to achieve their targets.

Throughout the districts, resource use and productivity are based on crops, horticulture, pastures and forestry which is largely influenced by geographical and environmental diversity prevailing throughout the region.

In this document, ITK for Kinnaur comprising of high mountains, valleys with temperate climate and cold dry zone including desert are described/presented.

In Kinnaur, water continues to be the scarce commodity. The most common source of irrigation remains the small water channels locally called 'Kuhls'. The source of irrigation as well as drinking water is melting snow on the high peaks which is brought to the village or fields through 'Kuhls'. Participatory management is employed for distribution of water. 'Kuhls' water is also used to run water mills. Small ponds for spring water collection are made. There is traditional practice to plough the fields early in the morning before dew or fog water is evaporated. Harvesting of water is also done by constructing water ponds and water is collected in these ponds from melting snow.
To conserve soil moisture, covering the surface of soil, with chilgoza tree needles and grass from 'Kandias' (hill tops) is a common mulching practice. This is to improve hydro-thermal regime of soil. Besides, ploughing aids in moisture conservation, as the soil acts as mulch. To avoid soil erosion and water logging, during the preparation of a field the slope of a field is kept inside which is provided with a channel to take ways.

The most effective irrigation method for a particular area depends on the slope of the land, the nature of the soil, the type of the crop and availability of funds.

There are a number of soil management practices adopted in the district. After the snow melts, the bunds and corners of the fields are dug-out and weeds and grasses are removed with the help of spade and clods. This helps in weed control and soil separation from the grasses and weeds increases soil fertility. To avoid sheet erosion the surface is left covered with grasses, shrubs etc. Grazing is done in rotation. In the foothills, erosion capacity of stream flow is also reduced by spurs or loose boulders.

In crop rotation, the crops are chosen as per their nutrition e.g. from old ages protein rich pulses are part of cropping pattern. During peak run off periods sowing of close growing crops provides protection to the soil. With 'bench terracing practices' the menace of soil erosion is controlled. Maddim is used for levelling ploughed lands which is called planking. Curved land ploughing is done for intensive land preparation, soil conservation and water retention. Fields are irrigated in autumn to stop the top layer from blowing away. In some crops, the roots are allowed to stay in the soil for humus production, which improves the soil structure, porosity and water holding capacity of the soil.

Soil with human excreta is mixed and broadcast over the fields during winter months for enhanced fertility. The night soil/human excreta possess immense manural potentiality as it contains the major plant nutrients like N, P and K.

Farmers tie small bags to the anal parts of the sheep and goat to collect excreta which is used as manure. Cattledung is also collected and used as manure. Due to the immense manural potential of cattle dung and urine, the use of this manure is very common among farmers. In the absence of chemical fertilizers, organic manuring is the chief mode of soil fertilization. All efforts are made to collect and use animal dropping and for their subsequent decomposition along with the leaves and grasses which are used in manuring the crops. In Kinnaur animals are kept primarily to meet the need of manure. Donkeys, cows, goats and sheep are the main source of manure. The woodash is mixed either with household waste or human excreta and used as manure. Ash primarily meets the deficiency of potash. Ash also helps in softening the hard soils. In upper Kinnaur, seabuckthorn is used as biofence as it is thorny in nature. It also fixes nitrogen, checks soil erosion, conserves soil moisture. In addition to it, it is a source of fuelwood and indigenous drung. The introduction, promotion and development of seabuckthorn in
this area seems meaningful and will not only help in vegetation rehabilitation, but also in ecological sustenance and economic gains.

In Kinnaur, community and private forests (wood lots) are protected at the community level. Here rotational lopping and grazing is practiced. Farmers make extensive use of the wood from both community and private forests for building all kinds of houses, shelters etc. and have devised their own technologies for postharvest processing of the wood. People also have rights to collect chilgoza and wild apricot fruits from the forest lands and to sell them in the market for economic remuneration. The government forests of these species are managed by the villages as common properties. These forests are divided into small blocks and each block is allowed to a family for protection, management and collection of produce.

Fodder tree forests in the vicinity of villages, be they on forest land, community land or private land are jointly managed by the villagers to meet their fodder need for cattle during lean periods.

Fuel or fodder/timber trees are retained on the field bunds and managed under agri-horti-silvicultural system. Besides providing fruits/fuelwood/fodder trees grown along bunds also restrict/check erosion.

The technologies for increased productivity in respect of animal husbandry include characteristics of migratory grazing by shepherds, health care, veterinary prescriptions and optimisation of animal breeding for milk and draught power. The indigenous resource management involving very limited external inputs, developed by gaddi shepherds in difficult and isolated hilly terrain, is an example in itself. This agro-pastoral resource use/adaptation is an example of sustenance and sustainability. Their adaptation to the hardships and diversity of the migratorial grazing system brings into focus the inherent sustainability element. Local methods for treating animal diseases have been in use since long which are quite effective and are still in use. These indigenous methods of treating common ailments are claimed to be highly effective. These methods have the advantage of utilizing locally available materials which have medicinal properties. These, however, lack scientific investigations and thus require further experimentation and critical appraisal/analysis for the broad base application of this indigenous knowledge.

Productivity in Kinnaur, as elsewhere, is centred around crops and animal husbandry. People through the ages, have developed need based and location specific indigenous technologies for enhancing productivity. The concept of quality seed is well known and agronomic practices are standardised for tiding up the limited cropping period. Rotation of crops, particularly with legumes, is adopted for improving soil fertility. Sowing and harvesting schedules are steeped in cultural heritage. Adequate care is taken to protect crops from both pre and post-harvest losses. This practice of crop rotation helps in maintaining soil productivity. Leguminous crops fix nitrogen. The growing of different crops viz., maize, wheat, barley and millets conserves soil due to their different
root systems which extract nutrients from different layers at the soil. This also helps in crop diversification and control of any soil borne or crop residue carrying diseases/insect pests. The practice of keeping lands fallow preserves/insect pests. The practice of keeping lands fallow preserves and restores soil fertility. The altitudinal gradation in land holdings is also harnessed through crop rotation.

Threshing by animals is preferred by the farmers as mechanical threshers are not available. Additionally, general feeling is that wheat straw/barley husk crushed by the mechanical thresher is not palatable to cattle as it is reduced to a fine texture. Also mechanical threshers crack more grains. Broadcasting is advantageous when compared to line sowing since it reduces labour requirement. Seeds for future cultivation are collected from selected plots manifesting vigour, early maturity, disease resistance and higher productivity. Fields are divided into smaller sub-plots for irrigation, otherwise land being sandy, water percolates immediately through one large plot. To stop water at each level sub-plots are made on sloping lands.

People adopt eco-friendly approaches which are not destructive to natural enemies and keep the pest populations under check. Ploughing, hoeing and harrow preparation dislodge the pests from their protective habitat and subject them to unfavourable conditions. Hand picking of pests and their destruction is time tested method of pest control. The practice of applying a thin paste of cow dung, clay and cow urine, as a disinfectant on floor of mud houses, wounds and injured limbs of fruit trees and pruned twigs/limbs is an age old practice. Cow dung and cow urine possess complex degrading substances having antibacterial properties. Addition of clay results in better adhesion. Pruning aids pest control as it releases overwintering population, improves general health of the tree and helps in maintaining a balanced foliage distribution. Walnut leaves are used against pests in stored grains as the walnut leaves are astringents and possess bactericidal action while mature leaves contain 9-11 per cent tannin. Tannins are known to act as feeding deterrents. Rich indigenous knowledge of beehkeeping in a variety of hives such as wall cavities, hollowed logs, skeps etc. served to preserve this heritage. These indigenous hives resemble closely the natural nesting sites of the native honey bee (Apis cerana). Swarms of feral populations of this bee descend to colonize these nests.

The methods of handling, packaging, storage and preparation of different products and their subsequent consumption varies with the wide agroclimatic diversity in the region. Most food products currently available in the market are essentially improvements/refinements of ITK of postharvest management of food crops. However, there are still a number of traditional postharvest skills which can be commercially exploited. Some traditional foods/products help to cure ailments and have been used as home remedies while others are environment friendly and do not cause any health hazards despite their continuous use. Stacking of maize ensures ripening and it also facilitates the easy separation of cobs from the husk. Curing results from heat and moisture equilization in the grains. It has also been observed that initially sweet grains, upon
complete drying and curing, become tasteless which is attributable to the conversion of sugars to starch. Stacking bundles in heaps possibly aids heat and moisture regulation thereby resulting in uniform ripening. The creation of moist heat also helps in curing which eases the process of threshing the grains. The procedure of covering harvested cones of chilgoza with pine needles, leaves and soil possibly helps in maintaining desired temperature and humidity inside the heap, which results in the curing of cones. The cones are then cut open using a sharp edged axe, with a gentle strike the seeds are easily separated.

Winnowing of grains and pulses, using Shooop or Chhaj is a common practice in Himachal. It leads to separation of dirt and husk from the grain. In bulk cleaning, the dry grains are put in a container made up of bamboo sticks called Panwadi and are allowed to fall from a height of about 4-5 ft in a thin vertical flow in the path of a cross wind. The lighter dirt particles and husk are blown away and the heavier grain is thus separated as it falls straight to the ground. The use of a fan greatly accelerates this process of cleaning. This method is based on the differences in density of the materials to be separated. The use of modern air separators/cyclone separators for grain cleaning is based on this principle.

Different types of containers are used for packaging food commodities. For packing grain, maize cobs, potato, ginger, turmeric etc. and transport of material from the field to the house Ddalh is used which is internally lined with cow dung for packing clean grain, pulses and flour. In some areas Kiltas are used for this purpose. For transportation of celled apples and vegetables to distant places gummy bags are used as the packing material. Packing of delicate/perishable crops, like tomatoes is done in Tokra which are then covered with thin gummy bags in the top. The shapes of these locally made structures provide easy carriage on human head or back. These are easy to clean and dry even after washing them with water. In some parts wooden boxes made up of very thick wood are used to pack and transport apples. This box is sturdy to enable its carriage on mule back to different places.

The people sterilize the pots before storing pickles in them. For curing red chillies, asafoetida and little mustard oil are burnt in the pot. The antimicrobial properties of fumes of these not only sterilize the containers and result in increased shelf life of its contents but also has potential for preservation which serves as a replacement to inorganic chemical. An excess use of inorganic chemicals may pose health problems.

The grains are stored in wooden structures called Peri or Peru plastered with cow dung and clay from inside. The use of these structures allows free exchange of gases inside the grain and keeping containers on ground ensures cool temperature for storage. In most of the villages the grains are stored in isolated wooden houses which check the entry of rodents and other pests into them. Storage in such rooms also provides a cool temperature so essential for the storage of grains. The logic behind constructing these storage houses/rooms at some distance from the family units was to save the food grains from the hazards such as fire, which was a common feature in the early days, as the
entire structure of living rooms was fabricated from wood. Grain is also mixed with leaves of Neem/Walnut/Bhera/Mint and then stored in bins. Turmeric powder and mustard oil are also used. Tuber crops such as potato, ginger, colocasia etc are stored in underground pits. Storage of cabbage heads, meant for seed crop is done in underground pits dug in the fields. Apart from other storage benefits, the crop is protected from the hazards of snow. These methods of storage provide cool conditions for storage of these commodities, ensuring freshness for prolonged use. The apples are stored in underground pits, prior to the onset of winter after packing them in wooden boxes. The development of the zero energy cool chamber (ZECC) appears to have its genesis in this technology. Open sun drying of cereals, pulses, oil seed crops and fruit/vegetables is an age old practice used for storage of food grains for long periods throughout the district. The dried vegetables are used during the lean season.

Meat is dried for use in winter, by hanging strips of meat on strings tied across the room. In some parts salt is sprinkled on the carcass prior to drying. In some parts it is hung in kitchen. Low temperature checks the growth of micro-organisms. Reduction in water activity by drying and use of salt helps in preservation. Smoking is one of the oldest methods of food preservation.

Preparation of alcoholic beverages by distillation is common throughout the tribal belt. Government excise department too permits this practice, thereby, acknowledging the socio-culture fabric of the region. The liquor is prepared from the fruits like local grapes, apricot, wild apricot, pear, apple, wild almond and from millet. Country liquor is a strong alcoholic drink obtained after distillation of fermented must by different methods. Due to extreme winters, the consumption of country liquor is extensive in the entire cold desert regions for medicinal purposes. Besides social use the product is also used during rituals and religious occasions.

The crop losses can be reduced substantially by affecting adjustments through timely and accurate weather forecasts. Such weather forecast supports and also provides guidelines for long range or seasonal planning and selection of crops best suited to the anticipated climatic conditions.

In present times we have many improved technologies for making weather forecasts as well as for their dissemination. Previously when there was no such technology available farmers based their prediction on many natural, cultural and social phenomena. Forecasts about weather were made seeing the visible spectrum around the sun and the moon, cloud and wind direction, behavior of birds and other animals. Besides there were social and cultural beliefs regarding weather forecasting.

Out of various factors which control agricultural production, weather is the only factor over which man has no control and hence it has an overwhelming dominance over the success or failure of agricultural enterprise. It is an accepted fact that food production is inextricably linked with climate and weather. It is also reported that weather induced variability of food production is more than 10 per cent. This variability can be as high as
50 per cent of the normal production in respect of smaller areas situated in arid and semi-arid regions. In order to reduce risks of loss in food production due to the vagaries of weather, weather per se, should be taken into account as one of the major inputs in agricultural planning. That is why forecast of weather parameters play a vital role in agricultural production. It also aids in minimise crop losses to a considerable extent. Thus development and refinement of the art of weather prediction has been essential since time immemorial.

In the upper Himalayas, varied topographic and agro-climatic conditions ranging from subtropical to cool temperatures permit the cultivation of a wide variety of crops and fruits. However, agriculture in general is handicapped due to steep and hilly terrain, hazards of climate, uneconomic scattered holdings comprising of shallow and stony soils. The tools and implements used are of a primitive nature throughout the district. Traditional farm tools and implements for self-sustenance have been developed/modified through experience over generations to meet emerging socio-economic and farming challenges. The type of soils and topographic conditions largely influence the type, size and shape of particular tillage tools/implements. Despite their widespread use, even today, these indigenous tools/implements in general are not agronomically sound and as a result lower the efficiency and increase tiredness of the operator. There is an urgent need to improve upon the traditional implements so as to redress this serious limitation. The standardization of their design in accordance with the requirements of hill farming is long overdue.

For decades prior to economic transformation the societies were part of economic conditions that centred chiefly around the security and precautionary motives. The absence of physical infrastructure, low economic resource base etc. translated people to adapt their lifestyles to suit their specific locational situations. Subsistence farming with a focus on crops that met this goal was the common practice. These 'adaptations' ensured that agriculture was practiced on 'sustainable' lines with better income distribution and equity consequences. Undeniably, such farming/agricultural practices evolved under low population pressure in the different agro-ecological regions and depended entirely on locally available resource. Yet they do hold lessons for us even today. This is to be appreciated in light of the realization that increasing populations and the consequent reduction of per capita resource availability dictate that a more efficient resource utilization regime be adopted. Such a regime is embodied in indigenous technological practices. Attempts to document such ITK also serve the purpose of preserving such knowledge for posterity, otherwise much of it would be lost due to the largely oral tradition of transferring such knowledge to successive generations. Such an exercise also has relevance for development agencies and extension services for proving relevant (technical) support for sustainable development and management of natural resources.