SUMMARY

The Siwalik hill ranges extend in the form of an arc in front portion of Himalaya for a total length of 2400 km and have an average width of 24 km. They occupy a total area of 57,600 Km² constituting about 2% of the total area of India. Being friable and fragile hills of mostly unconsolidated mineral matter deposited by water in the recent geological history they are very highly prone to soil erosion. Even when they are left to themselves they rapidly change contours. Growth of population of man and animals has further aggravated deterioration of the area. Modern agriculture and animal husbandry have by passed areas under Siwalik hill ranges. They represent one of the eight most degraded zones of India. The rivers of north India viz., Ravi, Beas, Satluj, Ghaggar, Yamuna and Ganga, while they emerge to plains course through these hills which happen to be part of their watersheds. Because of ecological degradation in Siwaliks a disproportionately large silt load is shed in to above river courses. These hill ranges have treasure of biodiversity that is required to be harnessed for the benefit of society. Intensive watershed management and conservation of biodiversity are two prongs of development intervention that are being done to prop up socio-economic status of residents of the Siwalk hill ranges.

The Siwalik hill ranges are located in Ambala, Yamuna Nagar and Panchkula districts of Haryana state. They have an area of 2741 square kilometers i.e., about 5% of the total national area of Siwaliks and 6.2% of area of the state. They are strategically situated and epitomize diverse problems peculiar to this zone. One prong of development is through tying economic benefits of the people to the intensive watershed development. Construction of rain water harvesting dams and social protection of forested micro-watershed is reducing silt load in to rivers as exemplified by ‘Sukhomajri’ model of development. This model is being emulated in other states also. Second prong of development has to come from integrating cultivation of multi-use indigenous trees on private land. Low soil depth and post monsoon water crunch makes growing of short rotation timber producing agroforestry species economically un- remunerative in hills. In
this direction harnessing biodiversity by fresh domestication initiative is likely to be useful.

In the present investigations viz., ‘regeneration studies in some important tree species from Haryana segment of Siwalik hills’ above perspective was kept constantly in view. Therefore, four indigenous tree species have been studied by assessing present status of base population, regeneration status, natural genetic variation, selection of superior phenotypes, collection, germination trials of seeds and vegetative propagation for establishing mass multiplication methods. The species studied were as under.

*Terminalia chebula* Retz., *Terminalia arjuna* Wright & Arn., *Holoptelea integrifolia* Planch., *Artocarpus lakoocha* Roxb.,

Most of the work was field oriented with the intention of transferring the advantages of newly acquired knowledge to forestry works. To what extent above objective could be realized is narrated species-wise as under.

**Harar** (*Terminalia chebula* Retz.)

This tree species occurs naturally in valleys of middle and upper Siwalik hills of core area of investigation viz., Siwalik hill ranges of Haryana state. Apparently discrete populations that can be termed as provenances exist in three places as detailed. But they constitute fringe areas of natural distribution of the species in higher Siwalik ranges and lower Himalaya of Himachal Pradesh.

Being a fringe area of natural occurrence difficulty of natural regeneration is expected; aggravating factor was indiscriminate collection of raw fruits for murabba making that is totally depleting seeds especially of the large fruits.

Natural genetic variation exists among other things for fruit character in the base population of 2646 trees studied. Phenotypic superior trees were selected from the base population. Compared to wild variety of trees (99.45%) superior trees were found to a very small extent of 5.55%. By selecting them for further multiplication there was a selection advantage of 25% for various traits studied.

Ever since selected trees are being used as mother trees and seedlings are being raised utilizing selected tree seeds.

To increase number of above seedlings it was possible to multiply them by stem cuttings up to second year of age.
Mature stem cuttings only callused and failed to root using PGRs. Rejuvenated stem cuttings and lopping induced stem cuttings also did not respond to PGR aided root formation.

Seedlings between 2-5 years could be successfully air layered using PGRs and the method was promising. Mature stem responded with difficulty to air layer with PGRs. Stub-like roots were produced that differentiated during next year.

Grafting using scion of selected trees was successful, ex situ conservation in the form of germplasm collection begun.

**Arjun (Terminalia arjuna Wright & Arn.)**

There is no natural population of arjun within Siwalik hills of Haryana, plantations made in New Delhi, Karnal, Kala Aamb, Kurukshetra, Chandigarh and Panchkula were used for studies.

Natural variation in the rate of growth of same aged plantations existed and 21 trees that were superior were selected.

CPT-wise seedlings were raised and method of multiplication of juvenile seedlings standardized.

Mature stem cuttings were rooted using PGRs; treatment of IBA and catechol together gave good results.

A hedge of rooted plantlets for obtaining explants was prepared for continuing further cycles of propagation.

**Indian Elm (Holptelea integrifolia Planch.)**

In this species natural variation for superior growth character was very difficult to identify. In younger plantations up to 8 years of age there was hardly any beneficial variation that could be selected. Selection was made on the basis of trunk and crown characters of some of the mature trees.

Viability of seeds was found to be limited to about three months. Regeneration required under growth in forest floor in whose protection seedlings could establish.

Germination tests indicate that problem of non-availability of seed and germination was not responsible for reduced regeneration. Forest floor cover has to be maintained to provide shelter to seedlings.

Growth of seedlings during first year is very slow; they can be multiplied vegetatively using stem cuttings.
Mature stem cuttings can also be multiplied using PGRs. There were two distinct flushes; first was a reproductive flush and second was a vegetative flush. The tree was found to be agroforestry compatible.

**Barhal (Dehu) (Artocarpus lakoocha Rox.)**

In the higher reaches of Morni hills very small area naturally has transitional population of dehu trees numbering not more than 50. Being the fringe of distribution natural regeneration is very meager. Fruit picking effectively removes seeds from the area; non-availability of seeds is a major cause of absence of natural regeneration. Problem has got accentuated because of limited viability of seeds that was not more than a fortnight.

Seeds collected during plucking season germinate satisfactorily. Roots can also be inducted in juvenile stem cuttings using PGRs up to two years. Mature stem cuttings only callused and produced shoots. It was possible to get rooting in air layers of mature trees.

Difficulty that existed in nursery technique has been overcome effectively so also mass multiplication. This species is compatible with agroforestry only during winter crop when it is leafless. Raising of 3m tall seedlings has scope for further plantation activity in difficult areas beset with herbivore damage.

Work begun for these studies and useful results have been incorporated in to a project that is to be implemented by Haryana Forest Department during next seven years. Transfer of knowledge from ‘lab to land’ was immediate and was of practical worth.