Some Aspects of Shifting Cultivation in Ceylon

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ABSTRACT

THIS paper deals with Shifting (*Chena*) Cultivation in Ceylon mainly from the view-point of the forester. The practice of *chena* cultivation and its salient modifications in relation to the chief forest types, viz., dry mixed evergreen, wet evergreen and "intermediate" evergreen are described.

Plantations raised by the Forest Department by the "*Taungya*" (Co-operative) system have given successful results especially of teak in the dry evergreen forests and jak and mahogany in the intermediate forests. Suggestions are made for improvements in the future practice of *chena* cultivation.

Ecological changes brought about by *chena* cultivation are described and considered in the application of natural regeneration as a means for rehabilitating abandoned *chenas*. While this method is likely to be successful in some of the wet evergreen forests, it is ruled out for the dry mixed evergreen forests as natural regeneration is inadequate and its growth too slow.

Finally, the results of investigations carried out by Joachim in 1948 on soil fertility in relation to chena cultivation are examined. Further investigation, especially in the mixed dry evergreen forests, is necessary to determine the period of fallow for successful rotational cultivation.

GENERAL

Shifting cultivation in Ceylon, commonly known as "*Chena*" (adapted from the Sinhalese "*hena*") cultivation is probably a survival of a primitive form of agriculture prevalent in most countries in the Tropics, though not confined to the Equatorial Belt. In Ceylon, shifting cultivation is usually associated with the relatively flat tracts of dry mixed evergreen forests (i.e., the dry zone), where irrigation facilities for permanent agriculture are lacking. In this respect *chena* cultivation in its original form in Ceylon differs somewhat from the practice in other Asiatic countries, India, Burma, Malaya, Siam and Indonesia, in which it is prevalent mainly on the hills of the wet evergreen forests, where the slope of the land does not permit the use of animal-drawn implements. In Ceylon, *chena* cultivation also extends to the low foot hills of the central massif in the Matale District, generally below 2,000 feet altitude, but associated with the dry mixed evergreen forest type.

The accompanying map shows the distribution of shifting cultivation in Ceylon and is based on the figures of the Census of Agriculture taken in 1946. According to this Census, *chenas*, both "cultivated" and "uncultivated", the latter probably referring to recently abandoned *chena*, make up a total of approximately 230,000 acres representing less than 2 per cent. of the total land area of Ceylon. Of this 230,000 acres, roughly 160,000 fall in the dry mixed evergreen forest types and the balance, roughly 70,000 acres in the wet and montane evergreen forest types. It is almost certain that these statistics do not take into account, large tracts of forest, especially in the dry mixed evergreen forests, brought under *chena* cultivation within recent times and now consisting of degraded forest, scrub or grassland.

Chena cultivation in the wet and montane evergreen forests takes a somewhat modified form in that it is most often a purely transient phase to conversion into permanent peasant holdings, in which such agricultural crops as coconuts, tea, rubber and arecanuts, may be grown along with timber and fruit trees, such as jak (*Artocarpus integra Merr.*) and breadfruit.

FOREST TYPES IN RELATION TO CHENA CULTIVATION

Chena cultivation is chiefly carried out in forests under the ownership of the State, private ownership being limited to about 0·6 per cent. of the total area of forest (including savanna, scrub and grassland) which is estimated at roughly 17,000 square miles. The forest type felled is seldom virgin or pristine forest, but is usually a secondary forest type. In the dry mixed evergreen forests falling within a zone of less than 75 inches annual rainfall, the forest type felled varies from a high forest type to a degraded "low jungle" type. The former usually contains the valuable timber species, satin (*Chloroxylon swietenia* D. C.) and *palu* (*Manilkara hexandra* Dubard) in association chiefly with *wira* (*Hemicyclia sepiaria* W. & A.) and other understorey tree and shrub species. This type of forest is, ecologically, usually a seral or sub-climax stage. The degree of dominance and growth of satin and *palu* indicates the age of the secondary forest. Usually more ecologically advanced high forest types containing *ranai* (*Alseodaphne semecarpifolia* Nees), *halmilla* (*Berrya cordifolia* Burret) and ebony (*Diospyros ebenum* Koenig) are not felled for *chenas*. "Low jungle" comprises forest in an early seral stage in which *palu* and satin are less frequent. Other less valuable understorey species such as *wira*, *welang* (*Pterospermum canescens* Roxb.), *pannaka* (*Pleurostylia opposita* Alston), *mora* (*Nephelium longana* Camb.), *galseru* (*Premna tomentosa* Willd.), *seru* (*Syzygium sp.*), *deduwa* (*Eugenia bracteata* Roxb.), *kunumella* (*Diospyros ovalifolia* Wight), *malkera* (*Ochna squarrosa* L.) and shrubs form an inferior forest type in which the dominant height growth seldom exceeds 30 feet.

The wet evergreen forest type occurs chiefly in the west and south-west coastal plains and highlands roughly below 3,000 feet altitude with an annual average rainfall of over 100 inches of which over 40 inches fall in the south-west monsoon. The wet evergreen forest type is not normally associated with a regular *practice* of chena cultivation. The forest type is variable, and as in the case of the dry mixed evergreen forest, usually only secondary forest types are felled.

Milla (*Vitex pinnata* L.), *diyapara* (*Wormia triquetra* Rottb.), *hedawaka* (*Chaetocarpus castanocarpus* Thw.), *welipenna* (*Anisophyllea cinnamomoides* Gardn. and Champ.), *godapara* (*Dillenia retusa* Thunb.) and *pepaliya* (*Aporosa latifolia* Thw.) are the principal species occurring in the communities of secondary forest. Usually more ecologically advanced, i.e., climax type forests containing *Dipterocarpus*, *Doona* and *Mesua* species are seldom felled for *chena* cultivation.

Chena cultivation is also extensive in the "intermediate" wet evergreen forests, a borderline type between the wet and dry types proper occurring chiefly in the North-Western Province. In parts of the Central Province and Uva, montane evergreen forest, savanna, and grassland (*patana*) have also been recently brought under chena cultivation, but such cultivation is more of a sporadic nature.

FORMS OF CHENA CULTIVATION

The usual practice, in particular in the "dry" zone is the control of allocation of *chena* land by the Government Agent of the Province on permits issued by him. In areas under regular *chena* cultivation, particularly in parts of the North-Western Province where *chena* cultivation is the livelihood of peasant communities, land is set apart ("mapped out") for *chena* cultivation. The procedure in the past has been to allot land on some form of rotation, usually 10-15 years. Such a rotation is also the natural outcome of *chena* cultivation, as land containing under about 10 years forest regrowth is generally considered uneconomic for *chena* cultivation. In fact, in parts of the North-Western Province, Eastern Province and Uva, the primitive habit of the entire village, consisting of a few families, moving along with the cultivation, persists to a limited extent. *Chena* cultivation is often undertaken in the vicinity of permanent cultivation, chiefly paddy (rice), where there is forest available, to augment the villager's meagre income. In the wet and montane evergreen forests, as stated earlier, *chena* cultivation is more of a sporadic nature rather than a regular practice. It is either a precursor to permanent cultivation or the establishment of "peasant settlements", or, especially in recent years, encroachments into the Crown forests; such encroachments have been stimulated by the shortage of food during the last War and subsequently. Emergency Food Production permits have also been issued by the Government during the war. Such permits have generally been for *chena* cultivation in the wet evergreen and montane forests, savanna and grassland. Often steep and rocky slopes subject to erosion, have been cleared for this purpose. The grant of swampy low-lying land (*deniyas*) for paddy cultivation has often been associated with such encroachments into adjoining forest for *chena* cultivation.

MODERN PRACTICE AND MODIFICATIONS

Chena cultivation in any type of forest follows the same rigid lines as in other tropical countries. The forest is felled in the dry season prior to the monsoonal rains, the south-west or north-east monsoon as the case may be.

In the dry mixed evergreen forests, only one cultivation in the north-east monsoon (from October to January) is ussually possible. The drying winds prevalent during the months of May to July are conducive to rapid

drying and easy burning. The more complete the burn, the less the incidence of weed growth in subsequent years. Stumping of trees is seldom done. In the dry zone a rough palisade of branchwood is erected round the *chena* to keep out wild animals, chiefly the elephant and wild-boar. The *chena* is usually cultivated with short term crops of maize, varieties of millet, cassava, capsicum, pulses and vegetables. The land is usually cropped from one to three years and then abandoned, except in the wet evergreen forests, where permanent cultivation may follow.

CO-OPERATIVE ("*TAUNGYA*") REAFFORESTATION

The Forest Department in Ceylon was not slow to realize the possibilities of utilizing *chena* cultivation (as in Burma) for the formation of forest plantations in forest reserves. The earliest forest plantations so formed date from about 1890 in the " intermediate " evergreen forests, where jak (*Artocarpus integra*. Merr.) and mahogany (*Swietenia macrophylla* King and *S. mahagoni* Jacq., mainly the former) were planted and in the dry mixed evergreen forests, chiefly in the Eastern Province, where teak was the principal species planted. These schemes have developed steadily and are in vogue, but on a somewhat restricted scale, at the present day. The method consists briefly in selecting suitable blocks of forest in units of usually more than 10 acres, and entering into legal " Co-operative reafforestation " agreements with suitable lessees for a 3-year period. The lessee fells the area, the utilizable trees are extracted and the area is burnt in the usual way. The lessee fences the land with barbed wire supplied by the Forest Department. He then dibbles teak or jak seeds, regularly spaced, usually 10 feet apart (in the early stages it used to be as close as 5 feet or 6 feet apart), and in between, he is allowed to plant approved food crops such as cassava, bananas, papaw and vegetables. The lessee is expected to keep the area free of weeds and interference from the food crops until the forest plants are established. At the end of the third year, the lessee usually hands back the land fully planted to the Forest Department. Stump planting of teak is now adopted as far as possible. Mahogany is usually underplanted in the jak stand at the end of the third year. Other species which have been planted along with teak in the dry mixed evergreen forests are margosa (*Azadirachta indica* A. Juss.), satin and ebony; with jak in the intermediate evergreen forests, *milla* (*Vitex pinnata*), *Alstonia macrophylla* Wall., *pihimbiya* (*Filicium decipiens* Thw.) and teak have all been planted with varying degrees of success. In the wet evergreen forests, similar planting has been attempted but with less success. In all, 6,685 acres of plantations in the dry mixed evergreen forests, 4,037 acres in the " intermediate " evergreen forests and 1,672 acres in the wet evergreen forests have been raised by this method. Of this about one half, chiefly in the dry and intermediate forest types may be considered very satisfactory, and compare favourably with artificial plantations raised by other means. Failures, especially in the wet evergreen forests, may be attributed to unsuitable choice of species (e.g. jak has generally failed in the wet evergreen forests), or faulty selection of site, chiefly too rocky or steep areas with shallow gravelly soils. Some of the older plantations created in this way have already yielded timber of good quality, and especially during the war years (1940–1945) have been of great value for the supply of timber and poles for hutments, firewood and

(*Block by Survey Department.*)

Photo. 1.—Chena reafforestation area, wet zone—Paradeniya in Kegalla District. One year old first crop of manioc (Manihot utilissima) recently uprooted. Tree crop of Nedun (Pericopsis mooniana) too small to be seen in photograph. Note rubble stone contour bunding with manioc sticks piled contourwise between them. Some pineapple and papaw are also to be seen.

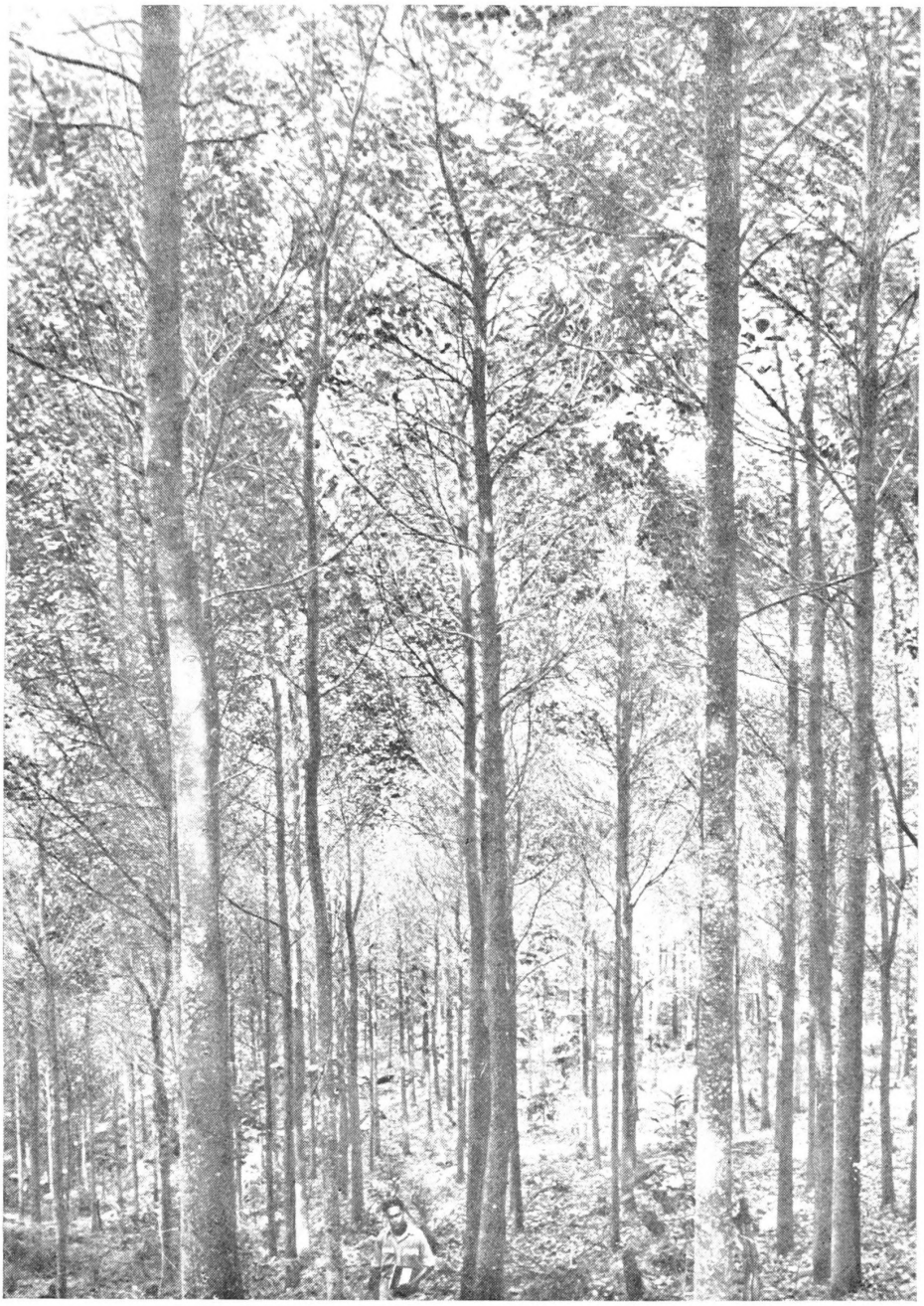

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Photo. 2.—*Chena* reafforestation—Intermediate zone. Eight year old stand of Jak (Artocarpus integra Merr.), Marukwatura in Kegalla District, raised under the Co-operative Reafforestation system and under-planted with Swietenia macrophylla.

(*Block by Survey Department.*)

Photo. 3.—*Chena* reafforestation—Intermediate zone. Similar mixed plantation of jak and Mahogany about 30 years of age—Sundapola in Kurunegala District. Note profuse regeneration of Mahogany on the floor and the dense sub-canopy formed by the older trees of this species under the jak.

(Block by Survey Department.)

Photo. 4.—Chena reafforestation—Dry zone, Tiraliodai in Batticaloa District showing type of palisade fencing for protection of cultivation against red deer, sambhur and wild pig. Typical dry mixed evergreen forest in the background.

(Block by Survey Department.)

Photo. 5.—*Chena* reafforestation—Dry zone, Batticaloa District. Two year old area after extraction of manioc. Note heap of manioc sticks, and plantain 10′ × 15′. Tree crop—Azadirachta indica, planted 10′ × 5′.

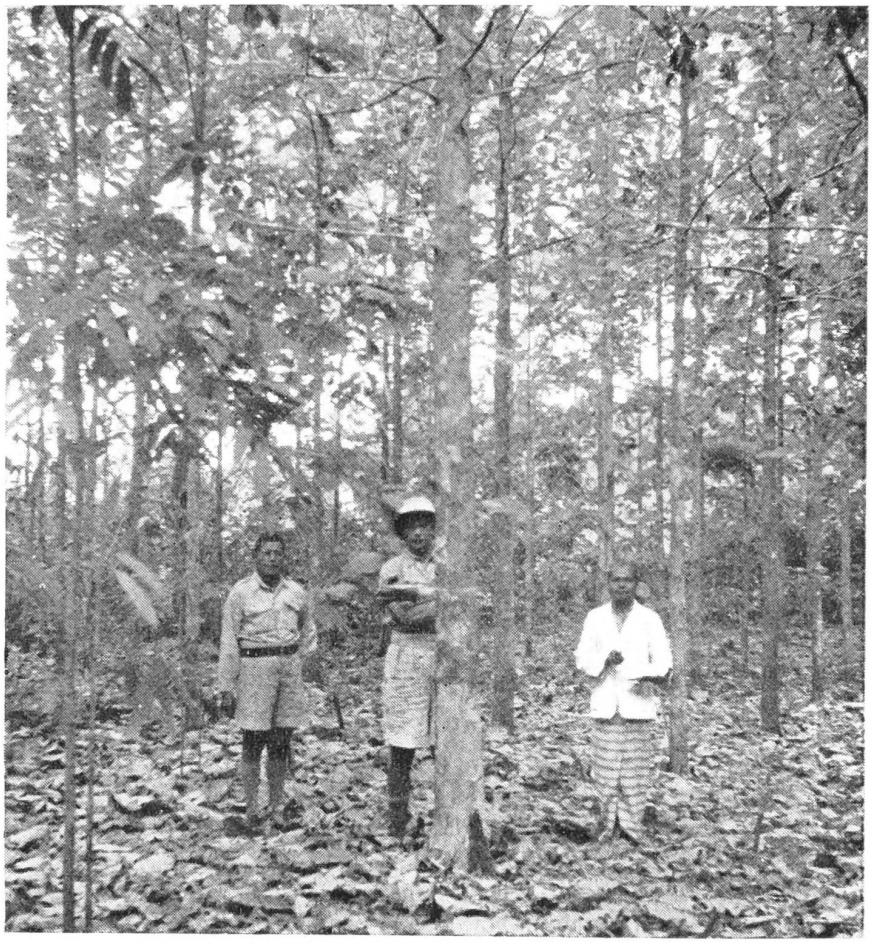

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Photo. 6.—Chena reafforestation—Dry zone, Hambantota District, Middeniya Reserve. Seven year old teak plantation with under-planted Mahogany raised by Co-operative reafforestation. The average girth of teak is 21 inches and the average height about 35 feet.

fodder for military requirements. In hilly country, particularly in the North-Western Province, inexpensive but effective methods of soil conservation have been recently adopted in co-operative reafforestation on lines prescribed by the writer. These methods are a combination of contour drains, stone terracing and the arrangement of felled logs contourwise. Such measures are in direct contrast to the almost complete absence of soil conservation in the ordinary practice of *chena* cultivation, even on steep land.

RESULTS OF CHENA CULTIVATION

The practice of *chena* cultivation in Ceylon, coming as it does from past ages, is held responsible for the destruction of large tracts of valuable forest, especially of the dry mixed evergreen type. Evidence of degradation of the soil and the establishment of uneconomic and infertile grasslands is certainly found in some districts, chiefly in the Eastern Province where large tracts of forest have degenerated through *chena* cultivation and subsequent fires into grasslands of *illuk* (*Imperata arundinacea* Cyrill) or *mana* (*Cymbopogon confertiflorus* (Steud.) Stapf.). To apply such a criterion indiscriminately to other parts of the Island, in the absence of similar evidence, is, however, not ecologically sound. For instance, the large tracts of grassland amounting to some 250,000 acres in the *patanas* (montane grasslands) cannot be indiscriminately ascribed to chena cultivation. Unless intensive fire and grazing follow *chena* cultivation, the normal tendency is succession back to the forest type ; in fact many of the forests of Ceylon show evidence of being secondary in origin.

In recent years, however, there has been an alarming increase in *chena* cultivation in steep, rocky land or within catchments or stream " reservations " chiefly within the wet evergreen and montane forest zones. Such misuse of land, unless stemmed immediately, may lead to irreparable damage.

REGULATIONS GOVERNING CONTROL OF CHENA CULTIVATION

Rules framed under the Forest Ordinance prohibit the clearing of Crown land for *chena* cultivation without a permit. In the past, conditions for the issue of *chena* permits prohibited cultivation within 100 yards of a high road, or 50 feet of a stream or ridge, or in any piece of forest containing full grown trees if there was available sufficient land containing secondary growth not more than 10 years old. Such conditions, however, do not form an integral part of the regulations framed under the present Forest Ordinance, and are now not strictly observed. The clearing of land liable to erosion or required as protective catchments is prohibited by a Land Order (1940) which precludes from cultivation, land with a slope of over 30 degrees and the tops or whole of forest clad hills. There is also a Government General Order prohibiting the alienation of land over 5,000 feet elevation and a further order prohibiting the alienation of land at any elevation which is required for protecting the sides of ridges and the sources and banks of streams.

FUTURE PRACTICE IN CONTROL OF CHENA CULTIVATION

The problem as we face it in Ceylon is to substitute for *chena* cultivation some form of permanent farming especially in the dry zone. To quote from a

recent Editorial of the Tropical Agriculturist (Vol. CIV. No. 1, 1948): "In Ceylon there is no tradition of rotation agriculture on dry lands and there does not exist a peasant community who will readily adopt such a system of their own volition. In fact, the "chena" cultivator cannot escape from the jungle because he lacks the means, financial and physical, of clearing the land sufficiently to permit the use of implements. Something has been done to work out systems of rotations suitable for the dry zones of Ceylon", but further research is necessary before a suitable system of agronomy for the dry zone can be evolved. Until such time as a clear and progressive policy on these lines is arrived at, the practice of *chena* cultivation cannot be entirely obviated, so that some form of control is necessary to minimize its ill-effects. In the dry mixed evergreen forests, wherever control by the Forest Department is possible, *chena* cultivation can be often effectively combined with the establishment of useful plantations. Where this is not possible, for instance, in inaccessible dry mixed forest areas under the control of the Revenue Department, *chena* cultivation should be confined to a delimited forest zone and a proper system of rotation of *chenas* adhered to, as far as possible. Excessive burning should be avoided and State aid given to encourage the cultivator to protect his *chena*, market his crops successfully and cultivate it systematically for as long a period as possible.

In the wet evergreen and montane forest zone, *chena* cultivation in its recent form of encroachments on Crown land will continue to appear wherever population pressure is being experienced, for instance, in the south-west coastal belt of the Island, with lack of available land for settlement of the peasants. Unlike in the dry zone, *chena* cultivation in the wet and montane zone is now too often a step towards illegal possession. The new Government policy of acquiring suitable privately owned land (chiefly rubber and tea plantations) for the settlement of landless villagers is a step in the right direction.

ECOLOGICAL CHANGES IN RELATION TO CHENA CULTIVATION

On account of the large extent of forests brought under *chena* cultivation in Forest Reserves during the war years (1939–1945) and subsequently abandoned, a series of observation plots were laid down in 1947–48 by the Forest Department in all types of forests to investigate the possibilities of the rehabilitation of these areas by fostering the natural regeneration of tree species. Counts were made of all regeneration, seedling, unestablished, established and saplings of all tree and shrub species in abandoned *chenas* of different ages. In the dry mixed evergreen forests, the ecological succession to forest, in particular the regeneration of preferred tree species is extremely sparse and slow. The first stage after the abandonment of cultivation is the appearance of shrubs including chiefly *Calatropis gigantea* Br., *Cassia auriculata* L., *Randia spp.*, *Zizyphus spp.*, *Carissa spinarum* L. and herbaceous species. The absence of seed-bearers and the damage which follows grazing by cattle and goats retard the establishment of timber species. In abandoned *chenas* of 2–3 years old re-growth, established plants of tree species (mentioned earlier in this paper) are less than 50 to the acre, while seedling and unestablished regeneration seldom exceeds 500 plants per acre. This method will be extended to *chenas* of older re-growth, but observations made so far

indicate that the ecological change to a forest type is so slow that the rehabilitation of *chenas* by natural regeneration alone is impracticable. Instead, attempts are being made to introduce plantations in such areas by the co-operative system described earlier, inducing suitable lessees to take up these degraded areas by the inclusion of equivalent extents of the adjoining unfelled forest. Slightly better results have been obtained in the "intermediate" evergreen forests, but natural regeneration is still insufficient. The adoption of co-operative reafforestation is, however, often precluded by the steep nature of the clearings and impoverished soil conditions making further disturbance and exposure of the soil undesirable. In the wet evergreen forests, the results are very variable. In some forests, natural regeneration is quite appreciable while in others, it is poor. For instance, in Viharakelle Forest Reserve in the south-west wet evergreen forest zone over 700 established plants and roughly over 3,000 seedlings and unestablished plants to the acre were observed. As a contrast, in Masmullakelle Forest Reserve in the near vicinity only 55 established and 300 unestablished plants and seedlings to the acre were observed. The ecological succession from scrub to forest is retarded by fire, the normal succession from the scrub sere, characterized as the *Hedyotis fructicosa* L.—*Melastoma malabathricum* L. (or *Osbeckia aspera* Bl.) associes to forest being deviated to fernland with *kekilla* (*Gleichenia linearis*) or more rarely grassland. In the latter types, regeneration of tree species is naturally poor. The principal tree species which appear in the early seral stages are *milla* (*Vitex pinnata*), *welipenna* (*Anisophyllea cinnamomoides*), *walukina* (*Calophyllum bracteatum* Thw.) *godapara* (*Dillenia retusa* Thumb.), *diyapara* (*Wormia triquetra* Rottb.), *del* (*Artocarpus nobilis* Thw.) and *pepaliya* (*Aporosa latifolia* Thw.), all useful timber species. The possibility of utilizing natural regeneration as the method of rehabilitating some of the wet evergreen forests destroyed by *chena* cultivation has been amply demonstrated.

SOIL FERTILITY AND CHENA CULTIVATION

Joachim has carried out an investigation to determine (*a*) whether the adoption of the *chena* system of cultivation is necessitated by the reduction of soil fertility and (*b*) the rate of recuperation of the soil during the period of re-growth. His results indicate that the reduction of soil fertility is not incompatible with any system of rotational cropping. The factors limiting the continuance of cultivation are chiefly weed growth, the lack and impracticability of tillage, and in some areas, soil erosion. Joachim's results are however open to question as the initial choice of site has not been fortunate. In fact most of the areas selected were *degraded* forests before cultivation, so that no marked change in an associated degenerate soil type could be expected. Mention has already been made of the Forest Department scheme to include such abandoned *chenas* within the co-operative reafforestation ambit. The growth of introduced forest tree species on such sites has been strikingly poor in comparison with adjoining high forest sites. This clearly shows that there is a fall in the soil fertility gradient between actual high forest and abandoned *chena*. The invasion of weeds which is regarded as a retarding factor in the agricultural usage is normally what one associates with soil exposure and its impoverished condition.

CONCLUSIONS

The question of soil fertility in relation to *chena* cultivation and the period of fallow required for successful rotational cultivation requires further investigation, especially for the dry mixed evergreen forest types. Natural regeneration as a means of rehabilitation of forests impoverished by *chena* cultivation in the dry mixed evergreen types is not successful; the simultaneous raising of crops (co-operative reafforestation) in Ceylon has had a great measure of success and with careful choice of site and species, this method is capable of wider application than hitherto. The solution to the problem lies, however, in the introduction of better agricultural methods combined with better facilities for health and education. Unless a radical improvement in these respects is afforded to the peasant, no substantial progress from the primitive method of *chena* cultivation can be expected.

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