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FORESTRY SERIES

### Hill Family Foundation Series

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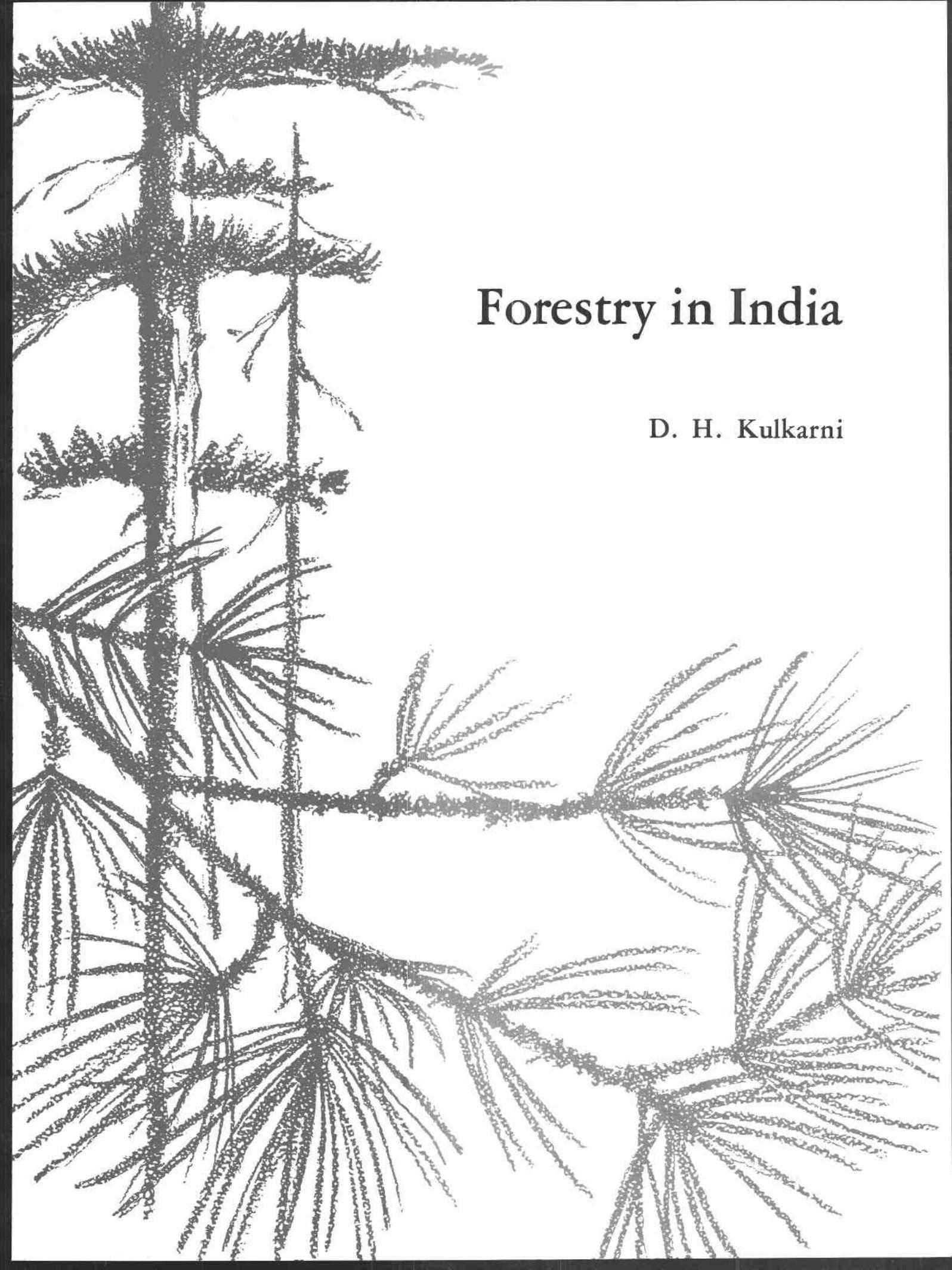
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# Forestry in India

D. H. Kulkarni

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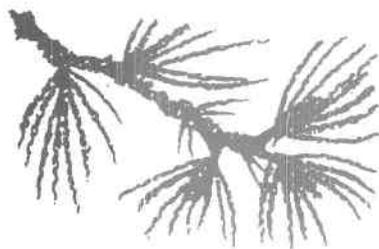
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## *Foreword*

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India, with a total area of about 40 percent of that of the United States, has about one-seventh of the world's population. Here in the United States we begin to feel the crowding, but India's population per square mile is about eight times greater than ours. India's National Forest Service has the management of about 180 million acres, or about 92 percent of the forest land of the country, a somewhat greater area than is managed by our own Forest Service. Only about 2 percent of India's forest land is in private ownership. India entered the field of professional forest management with the appointment of the first Inspector General of Forests in 1864, 41 years before Gifford Pinchot began the management of our own national forests.

In 1964, I had the privilege of a day's visit at Dehra Dun, India's great combined College of Forestry and Forest Research, originally established in 1878—the oldest in the world outside continental Europe. This institution has its home in a massive building said to occupy about five acres, which contains many offices, classrooms, research laboratories, and also the finest forestry and forest products museum that I have ever seen.

A few days after the visit to Dehra Dun, my wife and I had the pleasure of lunching and spending the afternoon with Professor and Mrs. Kulkarni in New Delhi. It was a never-to-be-forgotten opportunity to learn of the forestry of India from this man, who had for several years been the Dean of the institution at Dehra Dun. He had just then become Deputy Director General of Forests for the Government of India, a position corresponding to that of Associate Chief of the United States Forest Service, which he continued until 1968. After Dinoo H. Kulkarni received his Bachelor and Master of Science degrees at Nagpur University, he went on for research in Physical Chemistry at the Indian Institute of Science at Bangalore. In 1940 and 1941, he had an Associateship at the Forest College at Dehra Dun. Then came years of practice of professional forestry in central and western India in the Indian Forest Service, where he rose to the position of Conservator of Forests (at or above the level of National Forest Supervisor in the United States, as I understand it). In 1959, Kulkarni became Professor of Forestry at Dehra Dun.

Also in the course of his career, Professor Kulkarni has been a member of the editorial board of "Indian Forester". He represented India at a seminar on tropical forestry held in Berlin. He was for several years a member of the FAO (Food and Agriculture Organization of the United Nations in Rome) Advisory Committee on Forestry Education. He was the Founder Secretary of the Indian Panel on Forestry Education, and he participated in international forestry projects on numerous other occasions. He is now engaged in an FAO project in Trinidad.

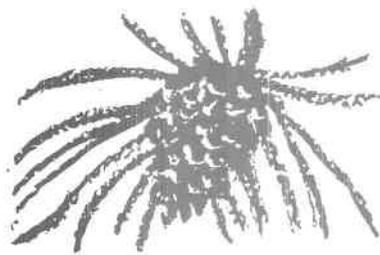
Professor Kulkarni was the first member of the Indian Forest Service to serve as a visiting professor at a university in the Western Hemisphere.

Professor Kulkarni's lectures at the Oregon School of Forestry in Corvallis are the product of a master of his field. They describe the history and present status of the various phases of forestry in India in an intensely interesting way. They compare Indian conditions with corresponding situations in other countries. Foresters will find benefit and pleasure in reading these fine lectures.

David T. Mason  
December 1970

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# 1. *Development of Forestry in India*

In world forestry, India is sometimes credited with being able to practice scientific forestry longer than anywhere else, except in some continental European countries. We celebrated the centenary of our forestry in 1961. We received felicitations and messages at that occasion. One was from Mr. Richard McArdle, Chief of the United States Forest Service, who remarked:

In the early years of forestry in the United States, Indian experience in forest administration was drawn upon by Gifford Pinchot and other leaders in developing American forestry institutions. In fact, Mr. Pinchot once said that the Indian Forestry term 'forest conservation' and 'forest conservator' suggested American use of the term 'conservation' in connection with what became the conservation movement in this country.

These words recall to my mind a kind of intimacy already existing between the foresters of the two countries.

It is true that in the pursuit of forestry, India has had the advantage of a long lead, in the sense of an early start. As early as 1806, the first Conservator of Forests was appointed in India; he was a policeman. The first regular plantation for production of the world famous timber, teak, was started in 1842 in Malabar, by a civil administrator, though with the technical assistance of a local forester. Likewise, it was an army colonel,

groomed as a Conservator of Forests, who introduced for the first time in the world's tropical forests systematic fire protection measures in the Central Provinces.

The appointment of Dr. Brandis, a German forester, as the first Inspector General of Forests for India in 1864, marked the laying of the foundation of the Forest Department and initiation of scientific forestry practices in the country. Soon the Indian Forest Service emerged, from which, later on, came distinguished foresters like Schlich, Stebbing, Troup, Champion, Laurie, and others who were destined to train more than 75 percent of the professional foresters of the then British Empire.

In India, forestry education commenced as early as 1878. Research in forestry and forest products followed in 1906. Our forestry legislation, too, is very old. The Indian Forest Law was promulgated in 1865 and was followed by the Indian Forest Act of 1878. Both of these, together with the Forest Policy of India, first enunciated in 1894, served as models to many countries not only within the Commonwealth, but also outside it.

We have, in India, only one institution that is devoted to both education and research in almost all aspects of forestry. That is the Forest Research Institute and Colleges at Dehra Dun, situated in the foothills of the Himalayas. For a long time, this

institution was the only one of its kind in the world, and it still continues to be a favorite place to visit with the international foresters and forest technologists. The Fourth World Forestry Congress was held here. The FAO (Food and Agriculture Organization of the United Nations) recognizes it as an international centre for research and education in forestry for Southeast Asia.

When an Indian forester hears praise for Indian forestry, what is his reaction?

First, of course, comes a sense of gratitude for the appreciation, but that is fast overtaken by a pervading and a somewhat harder realization of tremendous responsibility in a person connected with that institution, which leaves him with a strange uneasiness. In the present analysis of worldwide developments, how far do past achievements matter? And, how far does it pay to remain contented with them? Recently, dynamic changes have swept over the world of forestry, and in their context the real yardstick of satisfaction should now come from a pragmatic assessment of how far we have been able to keep up with the fast currents of modern trends.

In this context, we are well aware that we have been rapidly overtaken by some countries. The simple forestry of the past was comparatively less demanding on funds than modern forestry, which requires for its further development organized and integrated studies, long-term coordinated investigations, highly efficient instrumentation, elaborate equipment, and work facilities. Like atomic research or a space probe, modern forestry needs sizeable funds, besides, of course, the brainpower. Indeed, I know of a vigorous country that seems to find funds and brains in plenty—in fact, in surplus—and manages to be ahead of all others in almost every field of human activity. Of course, I mean your country, the United States of America. If your forestry is younger, it is so merely in terms of chronology. In terms of modern developments, you are ahead, so much so that we should pick up know-how from you in many fields.

The advantage of initiation must be kept alive by incessant follow-up. The monumental work of the first Surveyor General of India, Sir George Everest, who in the early nineteenth century

computed the height of the highest peak in the world, later named after him, to be 29,002 feet, will of course not be forgotten. But it required a greatly advanced instrumentation to refine this figure to 29,028 feet. As somebody once said, this small increase of 26 feet may be arithmetically insignificant, but it is a very significant extra height for the man who climbs that awesome elevation. No doubt there can be practically no progress without sustained initiative, an orderly change, and a continuous reorientation of aspects and methods.

In this light, in particular, I would like to bring forth in my present talks some of the stages in which forestry in India changed its face from the traditional past to the dynamic present.

### SOME BASIC FACTS ABOUT INDIA

Before I explain further, I would like to seek your indulgence for a little digression. I would like to indicate certain basic facts about India that concern forestry. It will perhaps be advantageous, first, to get acquainted with the stage on which our kind of forestry has been performed. If most of you already know much of this information, I should not be surprised, because, for centuries, men in the world have been curious to know and see India. Was it not the quest to reach the Indian shore that inspired Columbus to sail his ships and eventually hit on his discovery of the New World, a far greater world than what he sought?

Geographically, India is not Far East, nor Near East, nor even Middle East; it is simply the East. Although quite a few other countries in the world have larger geographic areas, India is by no means small. It stretches between the parallels of 8 degrees and 38 degrees North. It is not as small as would appear on the customary world map of parallel longitudes, which shows countries on and near the equatorial bulge greatly shrunken and islands like Greenland so inflated as to look equal to the whole of Africa. India is often regarded as a subcontinent, not only because of its size but also because of the great diversity one comes across in it. The vast land is in fact a curious assortment of many extraordinary features.

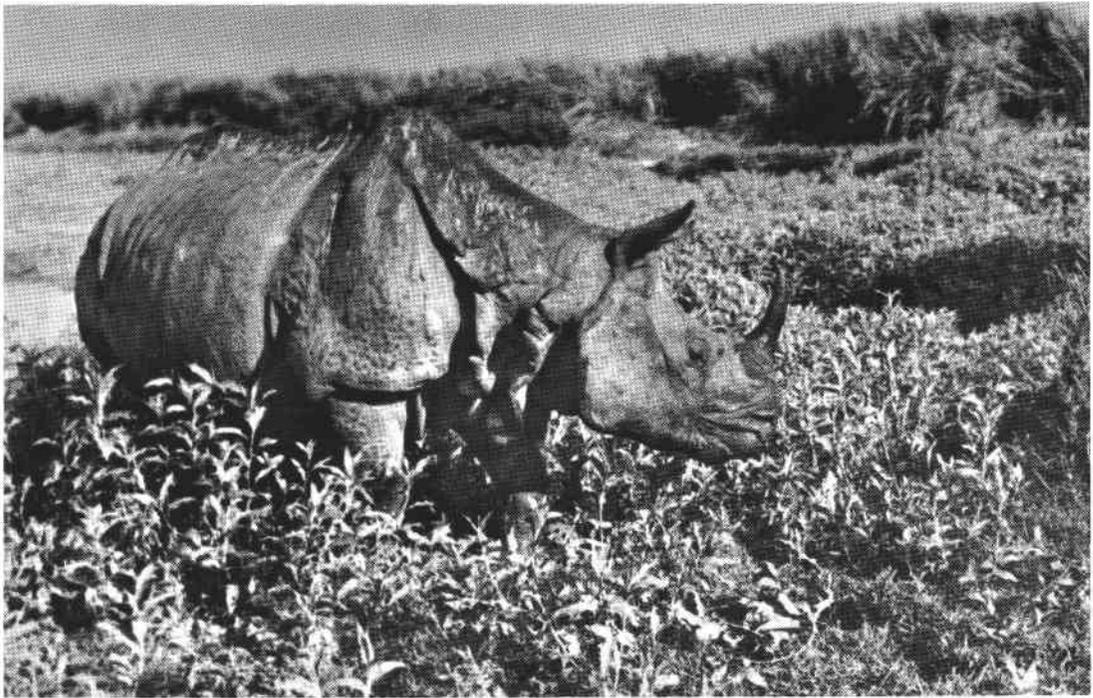


The oldest teak plantation in the world, planted in 1847 at Kerala. The tree with the man at the base is 7 feet 8 inches in girth. It was felled at the age of 80 years.

We have, for instance, the loftiest mountain system in the world, the mighty Himalayas, flanking like a curved sword along the northern border. Besides these mountains, there are tangled masses of low and high hills, well-defined ranges, vast plateaux, extensive fertile plains, and even deserts—both hot deserts and cold ones. From sea level, the altitude rises to the highest points of the world surface.

Climate ranges from the hottest tropical to almost arctic. In some places, the mercury rises to

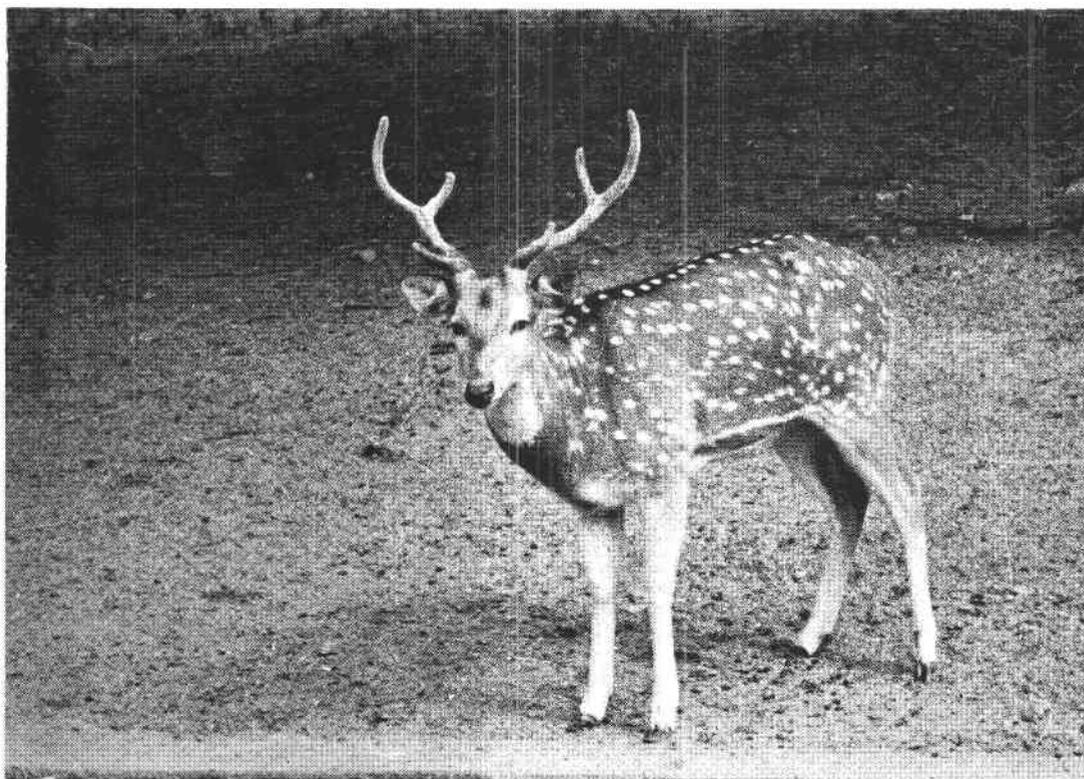
120 degrees Fahrenheit every day for some weeks in the year, and, in some others, there is perpetual snow. Rainfall shows a range that is the widest possible in the world. In some parts of the Great Indian Desert, the annual average comes to 4 inches and some years not a drop of rain falls. On the other hand, we have in Assam a place called Cherrapungi, where an inch becomes too small a unit to express annual rainfall, and where, on an average, the rainfall is 17½ yards, or roughly 1/3 of a furlong!



**The Indian rhinoceros, a protected animal.**



**King of the Indian jungles, the tiger.**



Cheetal or axis deer of central India.

The great diversity of topography and climate is well reflected in the sheer variety, luxuriance, and multiplicity of our flora and fauna. According to Professor J. B. S. Haldane, the number of known kinds of flowering plants or phanerogams in the world is about 210,000. About one-tenth of them are found in India, which has only 2.2 percent of the world's land surface. There is only one country that has an even larger number of species than India, and that is Brazil.

The forests, like the climate, are very variable. They range from tropical rain forests to desert nothingness, from the deciduous to evergreen, and from the hardwoods to conifers.

Some of our woods are very precious. Sandalwood, for instance, will fetch 40 dollars a cubic foot or even more. Special quality rosewood logs for decorative veneers are in such great demand in certain European countries that the price received for them soared to 50 dollars a cubic

foot. Teak, of course, continues to be the king of timbers. A few years ago, one single piece of teak log obtained from a wind-fallen, stalwart tree in our forest fetched, at the railhead auction, the high bid of 4,000 dollars. The government did not sell it, but decided to keep it for the museum where it can be seen even now. We have no giants in our forests to compare with your redwoods. But we have fat teak trees still standing in our forest, each of which can at any time be sold for a brand new Chevrolet car, delivered at its base.

India has an equally interesting variety of animal life, traceable to the same causes as the richness of the vegetation. I have figures for avifauna only. According to Salim Ali, the total number of bird species known to scientists the world over is estimated to be about 8,600. India alone has about 3,000 of them. I do not have the figure for the total number of mammal species in the world, but I know India has about 500

All this variety is more interesting, or course, than monotonous simplicity. One might recall Emerson's lines from his 'Mountain and the Squirrel':

All sorts of conditions and weather  
Are required together  
To make up a year  
And a sphere.

This is particularly true in the case of the Indian 'sphere'. But we have been talking in terms of number of species only. What about the population? Here we will have to turn from wildness to domesticity.

With a geographic land area that is hardly 2.2 percent of that of the world, India bears nearly 1/5 of the world's cattle, which includes half of the world's water buffaloes, and 1/6 of the world's goats. Although, fortunately, only 11 percent of the total cattle population and none of the goats actually graze in the forests in India, this itself causes a formidable pressure.

What about the human population? Perhaps you know that every seventh man in the world is an Indian. The only country that beats us in this respect is China. To balance India's 500 million put on one pan of a scale, you will have to put on the other not only the entire population of the United States, Canada, the South American countries of Argentina, Chile, Paraguay, and Uruguay, plus Australia, plus New Zealand, but also you will have to add the USSR! With this much population, no wonder India has to be classified on the world population map as belonging to the category of high density and rapid growth. This is unfortunate, for this demographic pressure tends to make insidious inroads not only into the forests but also into every field of national economy. Speaking generally, I should say that for her geographic size India has no real dearth of major resources—natural or other. Yet where we slip down—and I should say slip down terribly—is in the world lists of *per capita* figures.

### HISTORY OF FORESTS

Forests of India have been subjected to a consistent impact of civilization and human history during several millenia. In fact, in the face of such

a relentless and perpetual collision with man, how the forests—whatever we have in India today—could survive is itself a miracle that can be attributed only to the ancient Indian philosophy of reverence towards forests and compassion towards wildlife in them. The true aborigines of India, together with the Dravidians, followed by the Aryans and other races that immigrated to India, developed the Indian blend of culture in the past 4,000 years or so and appeared to be initially in consonance with the forests that were then in abundance. Ancient Indian culture was born amidst these silvan surroundings and it always treated *aranyas* (forests) with respect.

History inscribed on rocks tells that in the reign of Emperor Chandra Gupta Maurya around 300 B.C., there was a Superintendent of Forests in his kingdom who was assisted by staff. The notable forests in those days were classified according to their functions, either as a source of forest products or as wild game preserves. There was forest legislation, even if in a most elementary form. Unauthorized killing of elephants was punishable by death. Padina Purana, one of the ancient religious philosophies in India, reads:

A man who plants a tree  
Will enjoy bliss in heaven  
For as many years as there  
Are fruits, flowers, and leaves  
On what he planted.

One of the edicts of the Emperor Ashoka dated nearly 250 B.C. reads:

On the roads, wells have been dug and trees  
planted for the enjoyment of man and beast.

In *Abhayaranya* (or sanctuaries), no one would kill any wild game.

During the medieval times and up to the last century, the population of India grew and the forests correspondingly shrank. In these very times, the practice of shifting cultivation was started by the aborigines who were being constantly pushed back into the forest fastness and therefore had no other way of livelihood left.

The British who came over in the eighteenth century were themselves new to forestry as they had no such organizations in their own country. So, in early years of their rule in India, large

inroads on the timber resources of the country were made year after year. What made the British then turn to systematic forestry, and in India before they did in their own country? The answer was their navy. On the navy depended their Empire, and when quality oakwood became short in England, large quantities of teak shipped from India and Burma began to be used for building the British Admiralty fleet. This exploitation was haphazard and, within a few decades, the exploitable teak forests, which were hitherto regarded as inexhaustible, suddenly ran short of high-quality teak. In the wake of this scare, a commission was appointed by the British Government to inquire into the matter. From the deliberations of this Committee arose one great consequence, that is, the establishment of a Forest Department under the government of India, which thereby initiated scientific forestry in the country.

During the first half of the century that followed, the activities of the newly created forestry organization were confined mostly to survey, mapping, demarcation, and consolidation of the forests, enunciation of a forest policy, promulgation of forest legislation, and laying of foundations of education and research. This was followed by commencement of regeneration activities and the drawing up of a few working plans. A very fruitful period, one would say. But then came the two World Wars, which caused setbacks in the form of overfellings for supplies.

The head of the forestry organization in India was called, and is still called, the Inspector General of Forests. The first three Inspectors General were Germans; Brandis, Schlich, and Ribbentrop. They were succeeded by the British. Indianization of forest services started soon after the First World War and was completed in 1947, the year in which India got political independence. Subsequent history of Indian forestry would essentially be an account of the developmental 5-year plans, three of which are over and our fourth is presently running.

## RECENT DEVELOPMENTS

Having described some of the facets of the Indian forestry scene and having a few flashbacks

on its course of development, I would now like to give you, briefly, some idea about our recent performance and about the current trends in different fields.

### Silviculture

In silviculture, the most notable trend is an increasing emphasis on intensive, as opposed to extensive, forestry. The intensive method of regeneration, namely the plantations, is fast overtaking the diffused natural regeneration methods. Only where environments are considered unsuitable for plantations are shelterwood methods being continued.

Today, India has nearly 1 million hectares of manmade forests, most of them raised in recent times. This, however, works out to only 1.4 percent of the total forest area in the country, which is much less than in some other countries, notably the United States, Spain, Italy, and the United Kingdom. In your country, for instance, I understand you have nearly 3.4 percent of your forest raised by man, and that is over 10 million hectares. Funds are the limiting factor in India.

The most conspicuous single development of recent years in Indian silviculture can be said to be the increase in plantations of fast-growing species of industrial importance, raised under a massive programme implemented throughout the length and breadth of the country. We are now in a position to advocate strongly the advantage of rapidity over mere productivity. In other words, we constantly stress the point that although 2,400 cubic feet in 80 years is arithmetically the same as 1,200 cubic feet in 40 years, the former costs more than 3 times the latter. For the past 5 to 6 years, we have been interesting ourselves in a significant way in raising plantations of fast-growing species, the proportion of which in the total manmade forests is going up rapidly. For instance, as against 85,000 hectares planted during 1963-1966, we hope that between 1966 and 1971 an additional 400,000 hectares will have been covered.

By definition, we call a plantation "fast-growing" if it produces a minimum mean annual increment average of 10 m<sup>3</sup> per hectare as against the average yield of a natural forest, only about 1 to 2 m<sup>3</sup> per hectare. This definition means that for a fast-growing plantation, not only the



**Black poplar provide shade to potted stock in a nursery in the sub-Himalayan region.  
Photo by I. M. Qureshi.**



Plantation of fast-growing *Eucalyptus globulus* shortly after thinning. Yield of fuel from the thinning was 11,466 stacked cubic feet per acre. Coppice regrowth from stumps of felled trees. Muthinad, Nilgiris, Madras.

species itself should grow quickly, but also it should be economically feasible to plant the species at a density that will yield this mean annual increment. Whenever *taungya* is required, a limitation is set to the space to be allowed for agriculture between the lines or plants of forest species. Our favorite fast-growing species of industrial significance are some selected eucalypts, hybrid eucalypts, teak, poplars, bamboos, and a few tropical and subtropical pines.

With eucalypts, the growth has been remarkable, often yielding up to 30 to 40 m<sup>3</sup> per hectare even in a seemingly poor site. On the Blue Mountains in the south, *Eucalyptus globulus* (used for viscose rayon pulp) attains a crop height of 150 feet at the rotation age of 9 years—which comes to almost 2 centimeters per day. Once the plantations are raised for the first rotation, simple coppicing can be relied upon for the subsequent three rotations, without any appreciable fall in height

increment. These eucalypt plantations have replaced either the bare grassy hills or else a kind of natural mixed forest, called the *sholas* where most species grow to a height of only 50 feet and a girth of about 4 feet in 200 years. The achievement of fast growth has given rise to the need for fertilizing forest soils.

Forestry organizations in my country are strong enough to undertake the plantations of such fast-growing species in an even bigger way, but as I have already said, our limitation is funds. The plantation techniques in vogue involve more mechanization, especially because of the tractor ploughing, than before, and therefore we need heavy, expensive equipment. It was in India that, for the first time, the attention of the World Bank (FAO/IBRD) was attracted to practical proposals to assist a forestry programme of raising plantations of fast-growing species. As a result, a new methodology was evolved, which we are following, for linking the plantation programmes with industrial objectives and sound economics. The position still stands that, given more funds, bigger targets of raising such plantations could be reached easily.

In the field of plant genetics, our research at the Forest Research Institute is not lagging behind, although its field application is still in its infancy. We are establishing stands of seed trees to ensure collections only of the choicest seeds at many important centres of plantations.

#### Forest Inventories

In forest inventories, noteworthy headway has recently been made in India. The Forest Research Institute at Dehra Dun has done considerable research and field experiments on ground enumeration techniques and sampling theories. But it is just in the present decade that the inventory methods really came out of the traditional shell and assumed the modern form involving aerial photography.

Thanks to the FAO and the United Nations Special Fund, with their know-how and material assistance, we in India have just been able to complete the inventory of forest resources over an area of about 10,000 square miles in three district

zones in north, south, and central India. I have been closely associated with the execution of this project from the government of India's side. Although the project is over, according to what was scheduled, the work is being continued by taking up fresh forest areas.

A central organization for carrying out forest inventories on a continuing basis has been established at New Delhi and we have now our own team of forest inventory men, aerial photographers, industrial feasibility reporters, data processing men, and computers, coordinating work in the organization, which is under the forestry wing of India's Ministry of Food and Agriculture. We would, nevertheless, welcome any new expertise or outside specialist that would add to our knowledge and experience in this direction, subject of course to the adequacy of that rare commodity, funds.

I have often wondered what place aerial photography and photo-interpretation have had in the inventory of tropical forests. And, I have my own ideas. After the completion of the recent inventory and some others elsewhere, my previous conviction that no inventory methods with aerial photography could be complete and final without ground checks has now found confirmation. We believe that with tropical forests, which are usually highly mixed both in composition and canopies, aerial photography can hardly go beyond the stage of mapping or "photo-mosaicing" or for delimiting the occurrence of certain economic forest types or species which come out differently on the air photographs taken in certain seasons of the year. Examples would be the bamboos (*Dendrocalamus strictus*) in late winter in Central India, *Virola surinamensis* in Surinam, or teak in flower anywhere.

Our experience in India tends to show that, although aerial photography for stock-determination by stereoscopic studies has been possible for the Himalayan conifers, it is not practicable for the highly mixed tropical forests. At places in the mountainous region, aerial photographs are worthy of consultation for planning the logging and transport based on topography. But with all these, I believe, aerial photography in tropical inventories generally

means "too much water with too little wine". Dr. Loetsch of West Germany, the author of the recently published book on forest inventories, is credited with completion of the extensive tropical forestry inventory in Thailand 10 years ago, and he also holds the same view.

With reference to India's tropical and near-tropical forests, there is one more point that further curtails the effectiveness of aerial photography. We have large forest areas already under a number of systematic working plans, most of them of some excellence and several times revised in the past 100 years. When these working plans were compiled, growing stocks were often assessed by ground enumerations and their figures are recorded. For such areas, a fresh inventory, even on modern lines, is hardly necessary, nor could it be expected to give any better results. Unless such forests occur as patches between or surrounded by unsurveyed forests, they can as well be excluded for the purpose of stock-determination by aerial photography.

Some years ago when I visited forests in Bavaria, I inquired from the local forest authority as to aerial photography in the Bavarian forest inventories, and I was surprised to hear them answer "We don't require any aerial survey for our forest inventories; but, of course, we have experts who can do that for any other country."

I hasten to add that not for a moment do I want to be misunderstood as suggesting that aerial photography has no place in tropical forestry. It has been, and still is, the quickest and the cheapest method of surveying the hitherto unexplored, unmapped, remote, extensive, and nearly virgin forests. For countries like yours, Canada, Australia, New Zealand, USSR, or parts of Africa, where forestry is making great strides and where vast expanses of forest land might be standing in urgent need of being brought under productive management, the most suitable method would unquestionably be by aerial photography, aerial photo-interpretation, and stereoscopic studies of stock determination.

#### **Pre-Investment Surveys**

A feature of the modern forest inventories is that they are invariably taken up in conjunction

with broader economic surveys or the pre-investment surveys, and not merely as a basis for regulating the timber yield. We have accepted this as yet another significant change from the past. Our forest inventories are now part of the wider pre-investment surveys and are accompanied with all necessary investigations of the industrial and economic aspects.

The common goal is the development of forest industries for promoting the growth of the national economy. The pre-investment survey of forest resources over the 10,000 square miles just completed has paved the way for establishing in the area a major factory for writing and printing paper, another for newsprint paper, a chipboard factory, other smaller units of miscellaneous forest industries, and a new railway line, besides a network of new roads.

Likewise, in almost all the techno-economic surveys that have been conducted in different regions of India in the past 10 years or so, forestry has figured significantly. During the period, no less than eight to ten such major surveys have been carried out in the country.

#### **Forest Economics**

It might be said that, in India, forestry has already entered the economic sphere of the country, and we have realized that an economic approach alone would often solve hosts of social questions to which we have otherwise no answers.

Perhaps we in India lingered much too long on traditional forest valuation, instead of going ahead towards real forest economics which deals with such things as demand studies, consumption studies, marketing structures, market developments, forecasting, and costs and returns. For instance, only a few years ago we started teaching elementary forest economics to our professional forestry trainees. Incidentally, we have been guided by the example of your universities, which have made significant progress in this branch of study. We have, however, much deficiency to make up.

As Indian forestry has stepped into the economic sphere, a new task has fallen upon the shoulders of the foresters; that is, to try to fit silviculture and management in the framework of

economics. When it came to increasing the production of a special type of forest raw material in demand to support viability of an industrial unit, we found that the problems were not only economic but also biological.

A traditional forester would be inclined to solve them only by a biological approach. A pure economist, on the contrary, is most likely to underestimate the biological dangers and take a one-sided economic point of view. A harmonious blend of the two is, we believe, the present day's need. The economic view must be there, in correct perspective, so that the forester's urge to surmount the biological barriers remains ever whetted, to the benefit of the people.

Forest valuation, as we teach it, unquestionably presupposes forestry as a valid use of a land and then proceeds to determine the soil expectation value and so on. Forest economics, as we understand it, puts forestry as one of the possible land-uses, always in competition with other uses, and leaves to the foresters the responsibility of establishing a case in favour of forestry as being the best use of the land in question. This often leaves him in an embarrassing situation. The difficulty is that, although an economist gives full credit for the tangible products from the forests, he does not seem to have yet standardized an acceptable methodology for satisfactorily evaluating the intangible products of the forests such as the services rendered by their productive, ameliorative, recreational, aesthetic, and cultural values. Strictly speaking, there is no reason why a forester should not take credit for all these services. Before the Ninth Commonwealth Forestry Conference held last year in New Delhi, Jack Westoby in his key address had said:

Social forestry, being a social service, should be paid for out of public funds.

We entirely agree with him. If this is not done, application of the principles of economics of forestry will face a serious limitation when it comes to judging forestry as a land-use where primary objectives are the intangible benefits rather than the direct returns. At times, the imponderable values of a forest assume such

paramount significance that conservation of the forest becomes a matter of much more than a mere local interest.

Meanwhile, we cannot help stressing that our forest economists should concentrate on developing a methodology for satisfactorily evaluating the various kinds of forest influences. This will greatly strengthen the forester's hand in securing a better appreciation of the role of forests and the vegetative cover in general towards the lasting welfare of mankind. Until an accurate method of evaluation is achieved, it would be justifiable to make ad hoc, quantitative allowances for the intangible services from forests.

When he seeks funds for raising commercial plantations for industrial purposes, the forester often has to face an uphill task, especially in justifying his demands on purely economic grounds. He agrees that all commercial plantations should be economically justifiable. He doesn't complain about listing costs of raising the plantations initially and maintaining them until the time of harvesting, or the compound interest charged by the bank. But he objects when a so-called "economic" rental based on alternate economic use is also charged in full for forest land when credits for intangible services rendered by the forest are ignored. Even if indirect benefits cannot be evaluated accurately, credit should still be given for them.

In a country where practically all forests are government-owned, it should not be difficult for the government to see justification in charging a lower rental on land to be used for growing a forest than for, say, agriculture. In fact, to promote a balanced economy, there should be in every country a rational distribution of productive land to agriculture and forestry. When the economics of forestry on government-owned lands is evaluated, only a nominal rent should be necessary. Indeed, when any piece of land is not required for a specific purpose, it would be desirable to grow a forest on it, even if it entails some loss, to preserve fertility of the land. There is no reason why national forest policy should not lay this down. I wonder what the reactions of the foresters here would be to this suggestion. Of course, it has never been my intention to give a handle to your private

forest owners to send bills to their government to charge for the "intangible services" rendered by their forests to the public!

We also come across other circumstances where purely economic consideration has to be laid aside in forestry. For instance, it often becomes necessary to supply to an important industry raw material from the government forest at a subsidized low rate, with the justification that this initial loss can be made good by indirect benefits from the industry, such as employment, generation of national economy, and so on.

India is already undergoing a changeover from a simple agrarian economy to an industrial economy. Although self-sufficiency has been our central objective, we do not consider this as the highest goal. A gap exists between demand and supply of industrial wood in the country, and the problem is being met by intensification of forest management. But if that alone does not suffice, we will have to resort to imports. Of course, imports mean loss of exchange. A nation can reduce this loss, but I doubt if it can avoid it altogether. No country in the world has progressed without industrialization. And no industrialized country in the world can ever boast of being completely self-sufficient, unless the standard of living is allowed to remain very low. Even in forest products, one should prefer a market economy to a system of economic self-sufficiency. Recent liberalization in the timber export policy of India is an indication that the current thinking is in this direction.

### Multiple-Use Forestry

Let me now say a little about the place of multiple-use forestry in India. We shall not forget that multiple-use forestry, a major theme of the World Forestry Congress in 1960, was put forth by your country. I must say, we in India were not unaware of this concept in practice. But we must also admit that we had not gone about it, as in many other things, with the degree of emphasis it deserved, and in the way the United States Forest Service, with its characteristic thoroughness, has done. The concept was accepted in the practice of Indian forestry, but it remained unnamed and incompletely acknowledged. A direct consequence

in India of the deliberations on multiple-use forestry in your country was the increased recognition of the recreational values of the forests as in your country, in other western countries, and in certain African countries.

We have recently established many new game sanctuaries and national parks throughout the country, which besides helping conservation also increase recreational possibilities. Indian forests also render increasing services in recreation, although they have not yet started yielding appropriate revenue in return for these services. In your country, I understand, several million people annually avail themselves of the recreational facilities in your beautiful national parks.

In India, use of the forest for recreation is certainly increasing, but it is far behind yours. In your country, as also in most other developed countries, the national parks pay for their own maintenance and make additional returns to the state from admission fees. In my country, the spending capacity of the people will have to increase a lot more before anything like that could happen.

### Extension Forestry

In India, as also in some countries of the Middle East, forest products are generally in short supply. Attempts to step up production within the areas classified as forests alone do not suffice to close the gap between demand and supply, especially of firewood and small timber. Extension forestry has, therefore, recently come into prominence. By extension forestry we usually mean tree planting, mainly in conjunction with agriculture and rural life, rather than afforestation or reforestation.

As in most developing countries in the Old World, a man in the rural sector, which is also the biggest sector, is directly dependent on nearby forests for the requirements of day-to-day life: small wood for agricultural implements; grazing and fodder for his cattle; thorns for fence round his field; barks for ropemaking; grass and leaves for thatching; bamboos for basket weaving; and so on.

Experts from the western advanced countries who visit developing countries like mine often find it hard to grasp local forestry problems, mainly

because they are unfamiliar with the sort of rural economy that exists there. This rural economy is so intricately tied into local forestry that attempts to separate the two create serious problems, both social and economic.

An extreme example of the most ancient form of the rural economy in many developing countries is the pernicious practice of shifting cultivation. Thanks to the strong forestry tradition in my country, there is only a very small remnant of it now left. Our experience on the problem of shifting cultivation is that, if it is to be tackled successfully, it must be treated primarily as a human problem. Merely enforcing legislation to eradicate it is useless. Rather, the hill tribes, which for generations have been subsisting by shifting cultivation, have to be gradually weaned from it and attracted to a settled form of agriculture in the plains. The people can be attracted by giving them land, houses, cattle, implements, and even food rations. In the intervening period, shifting cultivation has to be tolerated, but on a rigid cycle of, say, 10 years. In exceptionally suitable places in India, shifting cultivation has been transformed into a scientific pursuit and retained, for the time being at least.

Firewood still continues to be a major problem in India. Firewood is the main source of energy in the domestic sector of the country. But it is often too scarce or too expensive for the poor to buy. Weight for weight, dry firewood in India is costlier than green sugar cane. Nearly 80 percent of the total wood consumption of the country is firewood. But still more intriguing is the fact that the bulk of this firewood, according to analysis actually carried out, comes from trees growing outside the forests.

We fear that with mounting population this outside source of fuelwood is fast becoming exhausted. Moreover, because firewood is expensive, the villagers have no choice but to use cattle dung in the form of dried cakes as fuel for cooking, instead of using it properly as farmyard manure. This results in gradual loss of fertility of the agricultural soil and continued poverty for the villager, so that he still cannot buy firewood. In a way, you might say that he is forced to burn *food* for cooking *food*.

To break this vicious circle, a massive programme of what we call "farm forestry" has recently been launched in India. Its success depends as much on the funds made available by the government as on the cooperation and the response from the common villager. The Forest Department has undertaken the responsibility of helping the villager who is interested in growing trees.

Under our scheme of farm forestry, the Forest Department would try to impress upon the villager who owns, say, 10 acres of land under agriculture, that if he could set aside only one acre of it for production of firewood, small wood, and some fodder, he would get enough of these essential supplies to meet his requirements. He would then be in a position to divert the valuable pen manure to his 9 acres of agricultural holding and he would still get more agricultural yield than from the 10 acres of unmanured land. As an added attraction, the Forest Department heavily subsidizes the cost of planting trees on his land. In village communal lands, if the village community agrees to spare it for farm forestry, the Forest Department undertakes to raise the plantation entirely free of cost and to distribute the produce amongst the villagers.

Because the bulk of the country's firewood supply comes from trees growing outside the forests, to step up, or even to keep up, this supply we obviously must increase the tree population of the nonforest lands. One way to relieve the problem is by pressing into operation the government-sponsored scheme of farm forestry. The other is through effective propaganda such as at the occasion of the National Festival of Tree Planting, the *Vahamahotsava*. This ancient Indian festival was revived some 20 years ago and it now aims at inculcating amongst the citizens a love for trees. On this occasion, considerable tree planting is done all over the country. Its success cannot be assessed merely by judging the percentage survival of the planted trees, but also by the extent to which the common man in the country has acquired love for trees. For, if this love is there, obviously more trees will surely appear.

It is largely because of these efforts that our countryside now has been blessed with many



Elephants dragging teak logs in Assam. Photo by Astrid Goshta.

beautiful roadside avenues, parks, and trees with bright blooms around schools, universities, and other public and private buildings. During the festival, many shelterbelts and windbreaks are raised, especially in the Rajasthan desert. To those of you who were in my country during the last war as soldiers, I would suggest that you come again (of course not as soldiers, but as tourists or guests) to see for yourself how much the countryside and landscape have changed.

#### Logging and Transport

Let me tell you now what we have done with logging and timber transport. Although the primitive axe for felling, the water buffalo for dragging, the bullock cart for carrying, and the mighty elephant for hauling the timber have not yet disappeared altogether from the Indian scene, their use has certainly diminished. In 1952, we

started with the establishment of a special branch for research in logging and transport at the Forest Research Institute of Dehra Dun.

The initiation of the use of modern logging equipment and transport methods took place in 1958 when short courses in the field were conducted in the country through the help of the FAO. This was followed by the first lot of improved logging tools coming from Switzerland. Still more headway towards the changeover from the traditional to the modern in this field came through the implementation of a logging training project with assistance from the UNSF/FAO during the years 1964-1968. In this project, just completed, many forestry technicians and several hundred officials from all over India received training in the use and maintenance of basic as well as mechanized logging tools and planning in logging and transport operations.

Although this first phase, that is the "training of the trainers" is satisfactorily completed, the second and more important one, training of the workers who are actually employed in this kind of job, has just commenced as a follow-up action. After all, it is the workers and the forest contractor who employs them, who have to take to the new equipment and the new methods.

Our strategy is to open a large number of training centres for workers all over the forested regions, headed by a couple of the departmentally trained men equipped with sets of improved equipment already supplied to them for training and demonstration. The idea is to use these training centres as foci for propagation of the actual use of modern methods and equipment. The success of this strategy will, of course, depend largely on the timely supply of adequate numbers of improved tools, together with facilities for the maintenance of these tools, to these workers.

Having attracted the worker and convinced him of the advantage of a changeover from the old to the new practices, we must ensure that he is supplied with such tools for routine work. Thus, an additional, ample supply of improved tools is imperative and this has become the real bottleneck now.

Although some equipment can be obtained through bilateral arrangements with international agencies such as the Swedish International Development Authority (SIDA), eventually these tools will have to be manufactured in India and as soon as possible. The know-how and the capital are not wanting.

What we need are, first, high-quality steel and, second, entrepreneurs ready to take up the manufacture in anticipation of escalation of use of modern tools. The usual attitude of the manufacturers to seek a guarantee of demand in the form of advance orders is not helpful. But I firmly believe that the use of modern logging tools is bound to spread; the chain action has already begun and soon the manufacturers themselves will undertake their local manufacture.

In the matter of introducing modern methods of logging and transport in partial replacement of the old ones in developing countries like India, certain special considerations should not be

overlooked. In India, we want this kind of changeover to achieve three main objectives: a reduction in wastage, which so far has been appalling; better economy to loggers as well as to their employers; and rescue of the forest worker from the risk of health and rigours of drudgery.

If one of you were to visit our tropical forest and see a puny hill-man chip-chopping with his tiny axe at the base of a giant tree, you would wonder when, if at all, the tree will fall. There is no reason why the worker should not be given a power saw. It will take away the drudgery, the felling cost will fall, and the worker will also get better wages. Developing countries like mine need mechanization for these purposes and to this extent, but not further than that for the present.

In the matter of mechanization, the developing countries need not blindly adopt the example of the advanced countries. We do not want too much and too sudden mechanization because it tends to throw off some men from their present employment. Secondly, if labour is already economically available, such as in India, mechanization may prove more costly.

What our loggers need most are the improved basic tools, made of good-quality steel, and the facilities and know-how to maintain them in excellent working condition. They also need other labour-saving devices and more efficient tools. But our need for highly mechanized and enormous machines like short and long skyline cranes is indeed very small.

We have also recognized the importance of work science as a preliminary study before adopting local specifications for selecting logging tools. Our experience in work science is, however, very little so far.

#### Forest Industries

It would perhaps be helpful if, at this stage, I give you some idea about the modern development in forest industries in my country, but for want of time I can do so only very briefly.

India is self-sufficient in production of match boxes. The forecast for the near future is that the demand will rise and if matchwood production does not parallel this rise, we will have to take increasingly to paper matches and boxes.

We have to import newsprint paper, pulp for newsprint paper, and certain special quality papers. In fact, this importation accounts for our negative balance of trade in wood and wood products. But the position is likely to ease slightly if the trend toward greater utilization of hardwoods for pulping continues. The production of rayon-grade pulp is increasing, and we encourage this just to reduce cotton imports and still keep all our textile mills running.

Up to the last war, the commonest way of converting wood in India was by handsawing. Since then, however, sawmilling has taken great strides and is likely to hold its own in the near future, despite increasing use of processed wood.

Use of solid wood here has shown a slight decline. We are now exporting plywood. The bulk of our commercial production of plywood is now made into tea chests, but production other than for tea chests is increasing.

Until last year India exported special-quality logs, like rosewood and figured teak, for decorative veneer. But now a factory has been built that is exporting these veneers themselves. Our decorative veneer logs are still in great demand in certain advanced countries.

We manufacture enough hardboard for our own need. Plastic-faced board is financially more attractive to the manufacturers than the board itself. India started manufacture of chipboard and particle board some 4 or 5 years ago with great expectations that remain to be fulfilled. Installed capacities have not been fully utilized so far, mainly because of the high cost of glue (urea formaldehyde) which we manufacture here. We have hope that these difficulties will disappear.

India exports significant quantities of sports goods like tennis rackets, hockey sticks, and cricket bats made of such woods as willow and mulberry.

Year before last, India liberalized export of such timber as teak, which is limited to certain quantities per year.

## CONCLUSIONS

Friends, I have tried to summarize the various developments in my country's forestry. Some of

these developments may have pleased you, and others may be a disappointment. Well, I did not come here to impress upon you how wonderfully we have progressed, but only to tell you that we, surely, are struggling hard in our own way. Should you feel unable to see reasons for our 'backwardness' in some respects, do not jump to conclusions. Rather, think hard from the angle of a developing country, especially with its problem of explosive demographic pressure to which I referred earlier.

For the foresters of India, as for those of most developing countries of the world, I can foresee years of struggle and more stress. But I would not agree with Shakespeare's Shylock, who had said about his own people:

Sufferance is the badge of our tribe.

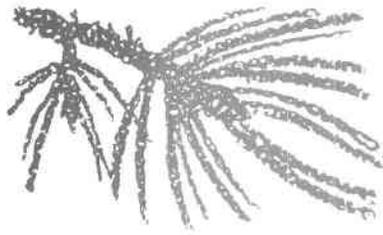
Sufferance, I am confident, shall not remain our badge. Rather, I would endorse the pithy lines of your great poet, Longfellow:

O, fear not in a world like this,  
And thou shalt know ere long,  
Know how sublime a thing it is  
To suffer and be strong.

Fellow foresters, what conclusion shall I bring you to? I would merely say that our struggle is a common struggle, common to both the undeveloped and the developed countries of the world. The struggle is for achieving a decent world. The developing countries must not falter or flinch in their efforts. But the advanced countries like yours must not allow time to run out. There is nothing new in demanding better schools for your own children, but the time has come for you to demand them for the children of others. Better housing you surely must ask for your own people, but this is no longer sufficient. You must ask for other people too. How decent the world would become if the crying need of others became our own need! Mahatma Gandhi's favorite prayer contained this passage:

*Vaishnava jana to tene kahiye, jo peed paraye jane re.*

It means: Call *him* the Great Soul who can feel the pangs of other's pain.



## 2. *Professional Forestry Education in India*

We know that current progress in the field of forestry education varies vastly from region to region—let us say, from just a beginning in some countries to almost perfection, according to present standards, in others. This progress does not depend primarily upon the local extent of the forest resource. Does it depend upon whether the country is ‘developed’ or ‘developing’? Well, generally, yes; but not always. Exceptions are countries like India, Pakistan, Burma, Thailand, and some others. Although well ahead in forestry education, they are, nevertheless, developing countries, a situation arising largely out of their political histories.

In analyzing the status of forestry education in the developing countries of the world, various stages are encountered—creation of new training centres, improvement of existing ones, and raising standards by introducing reforms in yet others. The FAO has been assisting in these developments mainly in the countries of Latin America, Africa, and Southeast Asia.

The position in India is somewhat singular, in that it is a developing country yet with well-organized and traditionally strong programs of research and education. Our forestry school at Dehra Dun, started in 1878, is the oldest in the world, except in continental Europe, where some

six other schools came into existence somewhat earlier. As recently as 1961, Dr. Glesinger, then Director of the Forestry and Forest Products Division of the FAO, cited India as one of three countries (the other two being Japan and Korea) in the Asia Pacific Region, where the best training in professional forestry is currently available. Students and working foresters come to the Indian Forest College for professional and other specialized forestry training from such countries as Nepal, Thailand, Iran, Ceylon, Tanzania, Phillipines, Burma, and Afghanistan. I even had one student from your country; he was a graduate of Syracuse University, wanting to take a specialized course in tropical forest economy.

How does our system of forestry education compare with yours? Even though education in forestry started in your country about 1900, today you have an extensive and, indeed, efficient structure of forestry education in operation. You have today over forty schools of forestry, which, undoubtedly, must be the highest for any single country in the world. We in India have wondered how you could achieve so much in such a short time. Our first thought was the usual and the easiest answer; after all, the United States is a very advanced nation. A little deeper probe, however, revealed to us a more specific answer than this

general one. We believe there are two main reasons for your remarkable progress in the field: first, the great importance you have attached to education from the very beginning, regarding it as the very foundation of professional forestry; and, second, the support of a strong organization, the Society of American Foresters, which was formed at more or less the same time as professional forestry began and was always ready to take the lead in guiding policies in forestry education and giving priority to its cause.

We noted with great satisfaction that the Society of American Foresters has a separate division for education and a specially instituted committee for its advancement. The recent publications of this directorate, like the Dana-Johnson Report on Forestry Education in America, fascinated us. Until recently, we had no special forum for discussing forestry education here. We drew much of our inspiration from the work of the Society of American Foresters in this sphere. Finally, in 1967, we succeeded in establishing our Panel on Forestry Education, of which I was the first member secretary. In the 2 years of its existence, the Panel has revised the syllabus of our professional forestry course along with other useful work.

In the spirit of such mutual exchange of ideas, I would like to place before you some of the striking features of our system of education in forestry. Although I shall confine my discussion to the higher, or professional, forestry education, I emphasize that we have an equally elaborate system of technical education in forestry, carried out on separate campuses. We attach no less importance to it, for we in India believe that forest technicians at the ranger or subprofessional level are the backbone of the profession. Further, we believe that it is unfair and inadvisable to make trained professionals spend much of their service doing subprofessional work. Thus, like Canada and most European countries, but unlike your country, we have at least three rangers at the technical level for each professional forester in service. I understand the opinion in your country has been in favour of creating a specially trained class of subprofessionals in forestry, but I am told you intend to bring about this change gradually.

## THE INDIAN FOREST COLLEGE

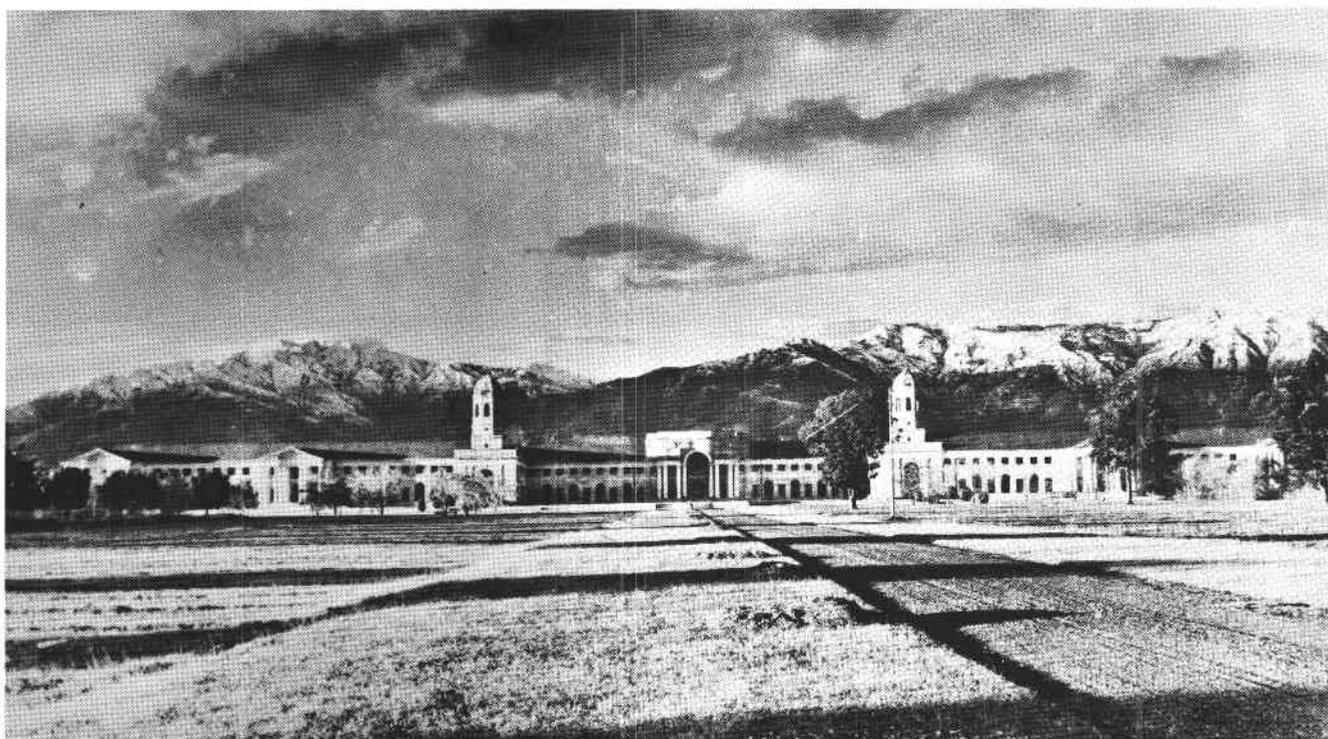
For professional forestry education we have only one school, called the Indian Forest College, which is a part of the Forest Research Institute at Dehra Dun. We take in about eighty students per year, and the total strength of the professional foresters in the country is about 1,200 at present.

### University Status or Mere State Support?

A striking fact shown in the World Directory of Forestry Schools is that out of nearly 140 schools, colleges, and institutions presently imparting higher education in forestry, only the Indian Forest College at Dehra Dun is neither affiliated to any university nor is it a university by itself. In India, forestry training has almost always remained the sole responsibility of the central government and not of the universities, which control it elsewhere. How has this singular position come to be? It certainly emerged at a very early stage. In the time of British rule first arose the need for training forest administrators and with it came the forest education necessary to meet the goal. In other words, the aim throughout was training of forest administrators for proper management of the country's forests, education in forestry became a consequence of it, and rendering the education as a government responsibility was the only effective possible arrangement to achieve it in the circumstances that existed in my country.

The continued emphasis on training of officers in forestry should be understandable in a country like India where as much as 93 percent of the total forest area is government-owned, about 5 percent communally owned and only 2 percent private. The demand for specialized training of the forest technologists required for the industries based on forest products is just arising, and is being met by keeping a small percentage of seats open to such industries.

Because of the historical background, and also in accordance with local laws and university regulations, the Indian Forest College of Dehra Dun does not award a degree, as is usually awarded by a university, but a diploma AIFC (Associateship of the Indian Forest College). Although one can argue that the intrinsic value of any education does



**Forest Research Institute and Indian Forest College, Dehra Dun.**

not depend upon whether a degree or a diploma is awarded, but rather on the curriculum adopted and teaching standards applied during the course, we are not really happy about the lack of university connection with our forestry education. We have to take into account some other considerations too—for instance, the desirability of falling in line with the worldwide university system, the obvious advantage of being able to award degrees that gain easy recognition abroad, the possibility of encouraging research and specialization in forestry by the award of higher degrees, and the generally accepted advantages of subjecting education to a university discipline. All these are possibilities when the institution acquires the status of a university. So, a decision to impart a university status to our forestry institution at Dehra Dun has already been taken by the government, and a special bill is being introduced in Parliament. The bill will enable the government to declare the Institute an “Institute of National Importance”, so that automatically it will acquire the full status of a university with retroactive effect.

Even while working to achieve university status, we keep ourselves fully alive to the danger of ignoring, or even belittling, the importance of those special characteristics of the nonuniversity organization that have enabled the Indian Forest College to play the significant role it has in professional forestry training in the region. Thus, even after we have university status, we are anxious to ensure continuance of the close relations that presently exist with the state forest departments, retain emphasis on the applied and practical side of forestry, give special attention to indoctrinating trainees with dedication to public service, formulate a positive policy of physically toughening them for endurance in the rough outdoor work, and so on.

#### **Restricted or Unrestricted Enrollment?**

In India, a candidate is first selected by the government for appointment as a professional forester or as an employee in one of the similar services and then sent by them to the college for training. His appointment is strictly subject to the

condition of his completing the training successfully. The admission to the Indian Forest College is open only to:

probationers of the Indian Forest Service; students or in-service candidates sponsored by foreign countries; and, candidates sponsored by the forest-based industries (not more than 4 percent of the total).

The programme of education of this sort may be said to be "restricted" or "fixed". One may recall at this stage the account of the debate on "fixed versus free" education and "restricted versus unrestricted" courses held at the Fifth World Forestry Congress in 1960, which gave us a clearer idea about the merits and the demerits of the two systems. In the United States, education in forestry has always remained unrestricted; perhaps the restricted enrollment has no chance of meeting general approval in your country. I understand this attitude when I realize from the Dana-Johnson report that of the 19,350 foresters in your country, nearly 50 percent are employed by government, 37 percent by private employers, 6 percent by educational institutions on teaching and research, and 7 percent by other employers. There is, therefore, a wide range of different kinds of demands for your professionally trained foresters. But the situation in India is different. We have hardly any private ownership of forests left, so our professional forester or a forest technologist today has hardly any place except under the government. Our intake in service of forest technologists in the private sector is as yet very small. An unrestricted education in forestry would thus result in considerable waste; to avoid that, we prefer the fixed or the restricted system. Our National Forest Policy, on this point reads:

A common forestry education is a very effective means of inculcating an *esprit de corps* among forest officers: of developing common outlook in forestry matters: of ensuring concerted and integrated policies throughout the country: openings in the profession of forestry being limited, the decentralization of forest education will militate against economy and efficiency, encourage fissiparous tendencies, create unemployment, and render planned development of forest resources difficult.

Even in some countries like the United Kingdom, where universities have been adopting a "free" system for forestry, most candidates from foreign countries are under fixed systems. If the total admission is severely restricted, as it often is, based on specific employment prospects, leaving only a few of the candidates to follow their particular bents after graduation, this system in effect hardly differs from the fixed one. With the fixed system, on the other hand, the goal is more specific, which permits drawing up of the curriculum more precisely, and it thus becomes more effective.

An oft-levelled criticism, that the rigidity of the education system inhibits the spread of support for forestry in a society, is not valid. For enlisting support from the public we need a public relations branch, which cannot correctly come under forestry education as we understand it. Inserting lessons in the readers for school children, prescribing books on popular expositions for young students, showing documentaries for instructing farmers, addressing legislators, and distributing audio-visual aids to the public are some examples of activities for creating a forest sense in society. But these are not the functions of forestry education. General forestry can even be introduced as an elective subject to be taught in the final year of a university degree course, as has actually been done by the two recognised agricultural universities in India. But this, again, should not be misunderstood as typical forestry education.

In many developing countries, the largest single need in higher education in forestry is still for training of professionals mostly for government posts. The training programme must be more specific; it requires certain special features that may not quite fit the recognized structure of a university. For this reason, we in India have chosen, for our institution at Dehra Dun, to enact a law bestowing upon it a status of a university, rather than transforming it into a typically autonomous university.

#### Entrance Qualifications

In the majority of the world's forestry schools, admission is open to youngsters who do not hold degrees from a college or university; the

minimum educational qualification prescribed for entrance into the Indian Forest College, however, is a bachelor's degree from a recognized university, in natural sciences, agriculture, mathematics, geology, mechanical engineering, or chemical engineering. These are minimum qualifications; candidates who enter the Indian Forestry College often hold master's and sometimes even doctor's degrees. Besides the educational qualifications, we have certain minimum physical standards in height and chest measurement, and the successful completion of an endurance test of hiking 16 miles is also required. In the last 2 years, admission to the Indian Forest College has been open to female candidates. Although so far no girl candidate has been successful in gaining entrance, to the obvious relief of the college management, and perhaps to the greater disappointment of the students, we can never say what will happen in the future. Selection of candidates sponsored by the government is by open, competitive examination followed by interviews. Usually the number of competitors is more than fifty times the number selected.

The mere fact that the Indian Forest College was not a university nor a part of one should not imply that its students in any way lack university discipline or outlook; in fact, the students acquired it before they were admitted to the professional forestry course.

The minimum educational qualifications prescribed for admission are obviously linked to the extent to which students must be coached in basic sciences and, secondly, with determining the duration of the degree course in forestry. The institutions that adopt lesser qualifications for entrance will naturally need more time to teach the necessary basic sciences. This time, of course, will have to be determined in the beginning and the duration of the course must be long enough to make up whatever deficiencies the candidates have. Those with higher entrance qualifications will be able to accomplish the same work in a shorter time. In India, the duration of the professional forestry course is 2 years. Although I personally believe that this should be extended a little, say by 6 months or so, I am not in favour of extending it more than that in view of our high entrance qualifications.

The subjects of forestry and forest products are expanding so fast and the numerous branches are getting so diversified, each getting deeper and deeper with progressive advancement in research and technology, that we cannot possibly teach everything in one course, however meticulously it might be planned. The hard fact is that no amount of lengthening the course can ever fully satisfy a pure educator, and a country can ill-afford to wait for that. Besides, we do not require every single trainee to master every single branch. We cannot, therefore, escape from differentiating a basic course from the various specializations that will be followed up separately whenever necessary and possible. Even in the basic course itself, a line must be drawn between the compulsory subjects and the secondary electives, which are kept optional depending upon the educational history of the student at the time of his admission and his estimated aptitude. The basic course in professional forestry at the Indian Forest College thus aims at a thorough grounding in essential forestry subjects without choice, leaving a fair scope for taking up future specializations in any suitable direction.

#### Initial Grouping and Electives

When university graduates holding degrees in various basic subjects, or combinations of them, enter the same college simultaneously, application of a compulsory, uniform curriculum naturally would result in differential absorption of instructions in various subjects and also in wastage of time. The initial needs of the individual student in respect to learning basic sciences differ. For instance, botany graduates would waste time sitting with mathematics graduates learning elementary botany and mathematics graduates would waste time learning elements of trigonometry along with botany graduates. What is true with respect to basic sciences and mathematics in the beginning of the course is also true with respect to special subjects to be taught at its conclusion. Thus, it is doubtful that a mathematics graduate (not having even the elementary knowledge of botany to start with) will ever get interested in advanced genetics, or a biology graduate in timber mechanics. The general policy

we follow at Dehra Dun in the basic professional forestry course is to group the students into categories depending upon their previous education, so that each of them gets, or has, the necessary minimum knowledge in all basic sciences and, secondly, each student receives, at the conclusion of the course, proper and timely orientation in specialized secondary subjects. The depth and coverage of each subject has been determined according to the requirements and also according to what is possible within the time. This arrangement saves wastage, avoids crowding in timetables, and also leads each student to his future specialization.

### Specialization

Although our progress in organizing the so-called postgraduate courses in forestry is not yet adequate, we fully recognize the need for more and more specialization in the various branches connected with forestry. We also believe, as Professor Champion indicated some time ago, that permitting specialization at an early stage of educational attainment is not advisable. For example, a forest entomologist must first have a basic degree in zoology; this is one argument for recruiting graduates rather than schoolboys to our professional forestry course. Starting from recruits that are already graduates in a variety of subjects, and subsequently grouping them during the course of the basic forestry training, we expect potential specialists to emerge in *all* the necessary fields, which is what the country basically needs. We admit, however, that in the matter of organizing specialized courses and also in the training of forest products technologists, we have only made an humble beginning.

Specialization in the branches of forestry in your country is indeed strong and your syllabi are much diversified. In fact, a characteristic feature of forestry education in the United States is the great variation in educational policies amongst the large number of schools that are here. To quote Dean Graves, this situation "offers educational opportunities for those who wish to specialize in a given branch of forestry" and "makes our general system more elastic and better adapted to varying demands of the profession." Of course, since the

time of Dean Graves, the specialization in your country has multiplied several-fold. This is one advantage of having several schools of forestry in a country. Because India can afford only one school, we must offset this disadvantage by increasing the courses and the specializations there. Unfortunately, putting these thoughts into action is not easy. It calls for funds which a developing country can spare only with great difficulty.

### Revision of Syllabus

As previously stated, the Panel on Forestry Education has just completed revising the syllabus of the Indian Forest College. Our intention is that henceforth such revisions will be done periodically at the end of each decade or so. The main feature of the current revision has been the modernization of the curriculum consistent with the changing needs of the country, new outlooks, and recent progress in research and development of new techniques and forest-based industries.

The recasting of the syllabus has taken into account not only the various changes since inception, but also the anticipated future position, say in two decades, that can be visualized by projecting recent trends. The grouping of students into categories for quick absorption of essential basic sciences in the beginning of the course and the offering of elective advanced subjects later, depending upon the educational history of the student, are fully in effect. The difficult part of the task was to arrange all necessary instruction and field work within the limited duration of the course, that is, within 2 years. As a general policy, the ratio between outdoor time (that is, time spent in field work) and indoor time (that is, time spent on the campus) was fixed at 40:60. Unfortunately, the growing pressure of the indoor syllabus tends to cut into the outdoor work.

The new syllabus gives extra emphasis to certain subjects, such as multiple forestry, plantations of fast-growing species of industrial importance, the new role of forest-based industries, mechanization in logging and extraction, recreational aspects of forestry, landscaping, forest productivity, modern inventories of forest resources (including aerial photography and photo-interpretation), genetics and tree breeding,



Professional foresters take a test in the open air. Photo by J. Borota.

statistical design of experiments, public relations and administration, and so on. Entirely new subjects added are forest economics and world forestry.

We could not have inserted so many new items in a curriculum for the same length of course without reduction of certain portions that seemed to have been given disproportionately large space in light of revised priorities. We had, therefore, to reduce the time given to such courses as forest

zoology (including entomology) and forest engineering (that is, construction of buildings, roads, and bridges). Similarly, the pace of teaching certain subjects, like elementary mensuration and surveying, had to be quickened.

Despite great temptation to eliminate them, we decided to retain certain extramural activities of the students, such as their horseback riding, rifle shooting, swimming, automobile instruction, and the camera club. Attendance at the morning

physical training and the evening games is compulsory. The toughening tests include a 28-mile nonstop march on the bridal paths of the rugged Himalayas and some mountaineering up to the altitude of about 15,500 feet. The students' tours consist of visits to all types of forests, which take them to practically all parts of the country. Because of the many activities, the daily schedule of student's work on the campus is somewhat tight, starting from the presunrise physical training to the late evening dinner. A week consists of 5½ such working days and the vacation lasts only 5 weeks in the whole year.

I hasten to add that not for a moment even, do I want to suggest that student life during training is drudgery. Far from it! Of course, complaints and grumblings are not wanting, but, by and large, at the conclusion of the course the students depart with many fine memories. Professional foresters in India unanimously agree that the 2 years spent by them amidst the beautiful campus at Dehra Dun while in training were by far the most interesting in their lives.

### Teaching Staff

Before I conclude, I should perhaps tell you how we procure our teaching staff for our Dehra Dun institute. Our forestry education is a government responsibility, so the teaching staff is appointed from amongst the experienced professional foresters of the country for different tenures, normally not exceeding 5 to 7 years. Between the Dean, who is also the only professor of forestry in the country, and his lecturers, there are no intermediate rungs. Our teaching staff in forestry have little time or facilities to carry out research on original work and their limited tenure creates instability which tends to disturb concentration, especially toward the end of the period. Not uncommonly, our staff members leave the college midstream to avail themselves of promotions in their substantive territorial line. This is not at all an ideal situation, but we must mark time until the institution acquires university status so that men who are willing to devote their whole career to teaching are able to do so in the Indian Forest College. This difficulty, fortunately, does not arise with teachers of forest products, all of

whom are permanent research members of the Forest Research Institute.

Not all men competent in their fields are competent teachers. As Dana and Johnson say in their report, "Teaching is an art, for which the same preparation is necessary as for any other art." There is no doubt that students like to be taught by men they regard as masters of their subjects. Often, the reputation first goes to a teacher and through him to the institution he is serving. I find that full attention is being given in your country to selecting the right men as teachers and, secondly, what is still more important, training them to be ideal teachers.

About this teacher-education, some time ago I read an article by an American, Dr. James B. Conant, with a rather catchy title, "A Quarrel Among Educators". His article contained many useful suggestions, some of which I thought would apply with added emphasis to our teachers in forestry. These were the programme of practice teaching, the initial probationary period of employment, leave concessions for further education of teachers, in-service education of teachers, foreign language learning, establishment of professors to supervise and assess the practice of teaching, and so on. I wish we were in a position to introduce all these into our teaching of forestry.

The most practical advice given to young assistants by a professor was probably by Professor Miller (I think he, too, is from your country) that I used to repeat to my assistants in the Indian Forest College. The advice is, "If you offer a dead teaching, merely from dead textbooks, you are sure to get dead students also."

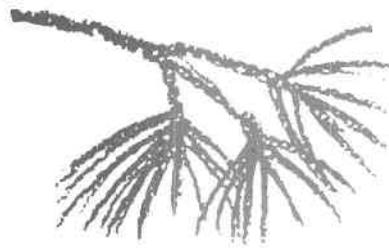
### CONCLUDING WORDS

Friends, I have tried to convey to you some information and ideas about the education in forestry in India. I do not think you need to borrow any of these ideas, for you are already far more advanced. But perhaps a knowledge about how things are in different parts of the world is to anybody generally, and to you specifically, not without interest. I understand you have three main

objectives before you in planning your own forestry education: government service at home; private service at home; and government and private service abroad.

In the context of growing requirements of extending 'know-how' and other forms of aid to the developing countries of the world, I should like to imagine that the last objective, namely service abroad, is gradually coming into greater prominence. If so, I believe that for you to have

insight into the Indian sphere of forestry education does have some justification. I was serving in New Delhi last year when the second UNCTAD conference was held there and I remember what your learned delegate, Eugene V. Rostov, said before the last plenary session. He said: "We should avoid situations which would isolate developing countries from the world economy." As a forester, I believe that these remarks apply for world forestry as well.



### *3. Forestry Planning in India*

With over a hundred years' history of forestry practice and a traditionally strong forestry organization, administration, research, and education, India nevertheless stands classified on the world map of forest resources as belonging to a "deficit" zone, mainly because of her mounting population. The nearly 1/7th of the world's population that lives in this country has hardly 1/55th of the world's forest area to depend upon. An added handicap is the fact that the available forests in India are not yet fully productive. But this is not all. The situation is further aggravated because, with the rapid pace of industrialization and the rising standard of living in recent times, the requirements of forest products in this country are steadily mounting and, therefore, the gap between supply and demand is widening.

#### **FACTORS IN FORESTRY PLANNING**

The development of forestry and forest products in this country is truly bristling with multitudes of difficulties, of which our planners in the field are already aware. They have accepted these difficulties as challenges and treated them as such, throughout the last 20 years of planning since the country gained political independence.

Perhaps India provides a typical example for study and investigation of problems of planning in forestry that have to be faced in a heavily populated "deficit" country. India also shows the importance of forestry planning in the overall development in the economy of such a country.

Although we have obvious limitations from natural and local conditions in pushing forward our extension forestry, we still have plenty of leeway left in concentrating our planned efforts to reach our goals. We believe that such efforts are likely to be most fruitful if they are integrated with the overall programmes for economic development of the country.

#### **Planning Commission**

In India, the country's overall development is entrusted to a top-level high-powered body called the Planning Commission, the chairman of which is no less a person than the Prime Minister herself. The Planning Commission is assisted in its task by a large team of experts on almost all conceivable fields of national economy. Since the constitution of this supreme planning body in 1951, India has had three successive 5-year plans, with targets and achievements rising at each new plan. In 1966-1967, and for a year thereafter, this upward

trend had to be levelled because of the economic crisis arising out of the countrywide, severe drought that took place in the 2 successive years. The fourth plan has now been launched in 1968-1969 with the upward trend restored.

Within the framework of the country's integrated plan, the agricultural sector, which includes forestry, takes its place in getting its share of funds. Within the house of agriculture, does forestry stand to gain or lose? We would have to answer, yes and no. In a country like India, where production of food has constantly been a burning problem, agriculture tends to get the highest priority and a lion's share in the country's development budget. The slogan is, "everything else can wait, but agriculture cannot." But when it comes to a further breakup of the aggregate allotment of agriculture, the same principle of "everything else can wait, but agriculture cannot" works in reverse for forestry.

Subject to the fixed allocation to the forestry sector, the Forestry Division of the Ministry of Food and Agriculture of the government of India prepares a detailed 5-year plan, which nevertheless has to have the Planning Commission's final assent.

What guidelines do we have to observe in India while preparing a 5-year plan for forestry? One is the National Forest Policy and the other is the plan for forestry 20 years from now. A 5-year plan has to be within these long-term policies to ensure continuity.

### General Forest Policy

India enunciated her first Forest Policy in 1894 and revised it in 1952. The National Forest Policy of 1952, which operates today, is based on paramount needs and the well known functions that forests are meant to fulfil. It aims at evolving a system of balanced and complementary land-use, under which each type of land is allotted to that use under which it would produce most and deteriorate least. India, as a whole, aims at maintaining one-third of its total land area under forest (60 percent in the hills and 20 percent in the plains). The National Forest Policy also aims at ameliorating physical and climatic conditions; checking denudation, erosion and sand-invasion; supplying forest products at maximum sustained

rates for purposes of defence, communication, and industries; and, consistent with fulfilment of these needs, realizing maximum revenue.

While the general management of forests is being guided by these broad principles of the National Policy, new trends and dynamic outlooks related to problems of forestry and forest products have emerged in the country in the last decade, which emphasize the need for intensification of management practices, increase in production from forest resources, and reorientation of related planning, in the context of the changing socioeconomic conditions. Recognition has already been given to the fact that if the forest resources are to contribute fully to national economic development, their exploitation must be integrated with other sectors of the country's economy. The thinkers within our forestry sphere have already observed that, since 1952, far more changes have taken place than between 1892 and 1952. The current forestry policy of the country must be revised further and dynamically oriented, if forestry is to contribute fully to the national prosperity.

### Socioeconomic Background

To appreciate the general strategy of our forestry planning, you will need to be acquainted with our present socioeconomic conditions. In India, agriculture continues to be the major occupation and the main source of income. About 71 percent of the population depends on agriculture, which gives 47 percent of the national income. Yet, agricultural land *per capita* is only half of the world average and production per unit area, although rising recently, is far too low. While agriculture is being intensified, urbanization in the country is steadily increasing. India is comparatively rich in certain minerals, especially coal, iron, and manganese. About 19 percent of the national income comes from mining, manufacturing, and small enterprises. The income from forestry, which is included in the income from agriculture, is only 1.5 percent of the total national income, but it is rising at the rate of 15 percent a year, as against the rate of 3 percent a year at which the total national income has been rising.

The 15 percent of the world's population that lives in India is increasing at an annual rate of 2.13 percent. In other words, during the time I presented this talk India's population rose by 12,000. The population projection, in millions, is as follows:

Year	1965	1970	1975
Population	492	555	625

If unchecked, these population increases will generate tremendous pressures on the country's natural resources, which include the forests. This, coupled with the fact that the standard of living has to go up, and is actually going up, necessitates concerted efforts on economic developments.

At this stage, you might ask what our country has been doing regarding family planning. The government is supporting family planning to the maximum possible extent. An entirely new organization devoted to family planning has arisen in the last 4 or 5 years, to which foreign countries such as yours and Sweden are giving help and encouragement. Despite impediments arising from religious and orthodox beliefs, the response of the people is very hopeful. Even if family planning could not actually reduce, but could only arrest further increase in the population, we would still be pleased. It is too early to assess the actual success of the family planning movement in our country. The economic planners, I presume, haven't depended entirely upon its success, but insured their plan against failure of family planning.

Employment provided by the forests and forest products is only 0.2 percent of the population. Meagre as this figure looks, it is nevertheless significant that this 0.2 percent of the total working force in the country gives 1.5 percent of the national income, which is rising at the annual rate of nearly 15 percent.

#### Forest Resource

To cater to the needs of the population, what is our forest resource? The total area of lands classified as forests in India is about 78 million hectares, which is about 24 percent of the

geographical area (as compared to the 33 percent desired by the National Forest Policy.) Thus, forest land *per capita* in India is only 0.16 hectare, contrasted to the world figure of 1.6 hectares.

Out of the total forest area of 78 million hectares in the country, about 52 million are accessible. As means of communications and transport develop, more and more of the forests are becoming accessible. In the last 2 years, nearly 1 million hectares of hitherto unexploited forests have thus been opened up.

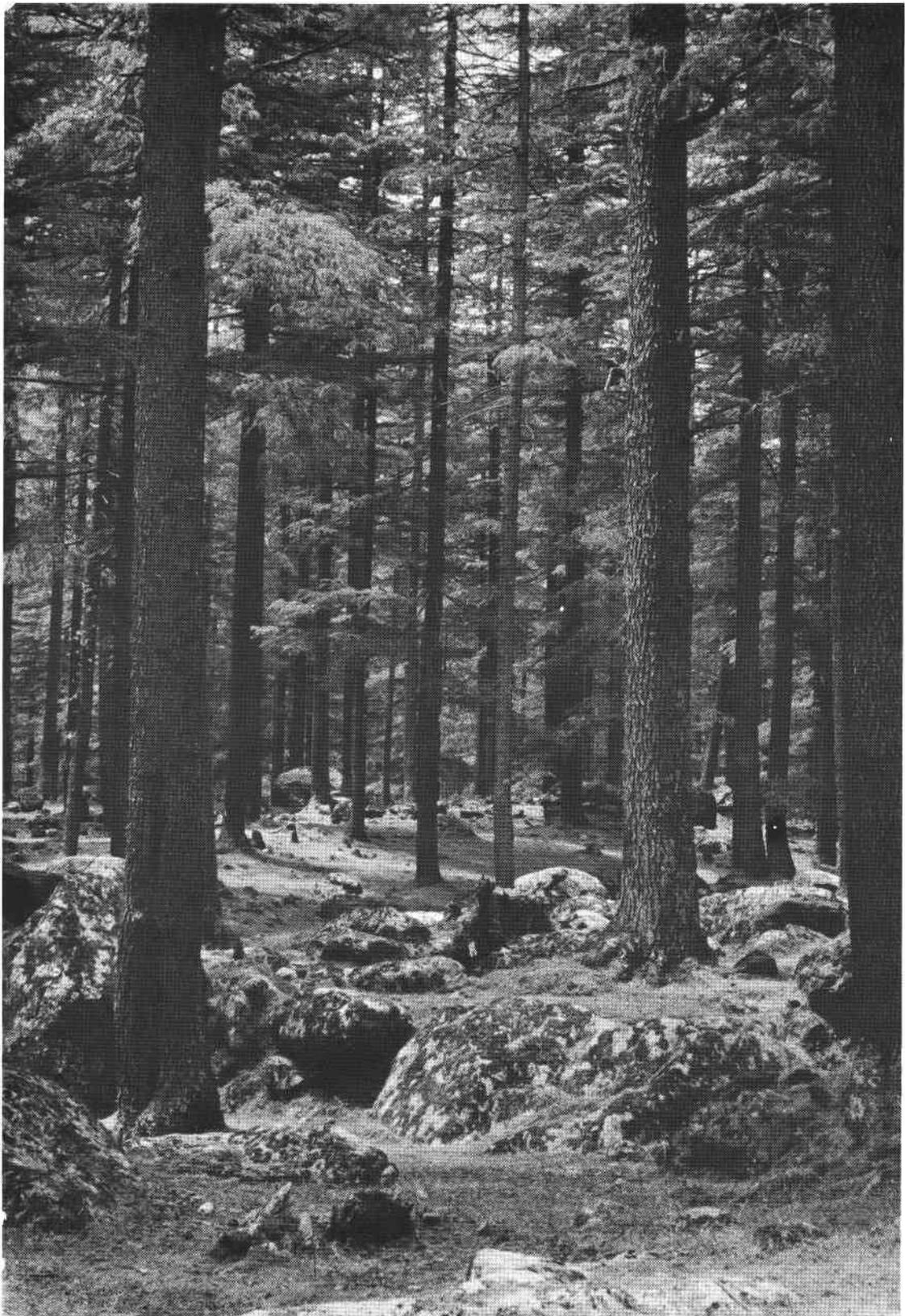
Nationalization of forests was vigorously pursued in my country during the last 20 years. Today, as much as 92.3 percent of the total forest area is government-owned, about 5.4 percent is community-owned, and only about 2.3 percent still remains under private ownership. Experience in this country is a pointer to the general lack of sustained interest amongst private owners in managing their forests scientifically. Legislation, therefore, is gradually being passed for acquisition of whatever forests are still left in private hands.

I understand your country has extensive and well-managed, privately owned forests and perhaps your experience with private ownership in forests may not coincide with ours. If so, the reason, I should like to imagine, might be that your country does not belong to the "deficit" zone of forest resources, on the basis of demand and supply, while mine does.

About 93 percent of India's total forest area is tropical (consisting of 80 percent deciduous trees, 12 percent evergreen, and 1 percent other) and only 7 percent is temperate (containing 3.3 percent conifers and 3.7 percent broad-leaved trees). Some of our famous forest species are teak (*Tectona grandis*), sal (*Shorea robusta*), deodar (*Cedrus deodara*), sandalwood (*Santalum album*), rosewood (*Dalbergia latifolia*), and bamboos.

About 12 percent of India's forests are required to be preserved as "protection" forests, and out of the remaining 88 percent that is "production" forest, about 70 percent is merchantable. The proportion of nonmerchantable forest is gradually diminishing.

Nearly three-fourths of the government-owned accessible forests have working plans that are revised from time to time. In another





*Left: Deodar, the Himalayan cedar, Kulu Division. Photo by J. Borota.*

*Right: Conifers at high elevation, Nogli Range, Lower Bashahr Division, Punjab.*

10 years, all the accessible forests under the forest departments will have such plans or schemes.

The total livestock population in the country, at the last counting, was 307 million. In the forest area, there are an average of four cattle per hectare and in the agriculture area there are two cattle per hectare. The population of cattle presents a big problem to the practice of scientific forestry.

#### **Growing Stock**

Extensive forest inventories have not been carried out in the country until recently. Available figures on existing growing stock and increment of all the forests in the country are only rough, although they are the best available estimates obtainable from local investigations and enumerations. The total estimates had to be



**A typical, mixed deciduous forest, Ramnagar, Uttar Pradesh.**

worked out from the figures available for those forests for which inventory data were available. The total growing stock in all the forests thus estimated is nearly 2,128 million cubic meters, of which broad-leaved species account for 86 percent and conifers for 14 percent. The stocking per hectare works out to about 29 cubic meters for broad-leaved species, compared to 90 cubic meters for the Asia-Pacific region. This low figure for India needs an explanation. Enumeration of trees for computation of growing stock and increment excludes trees below a certain minimum diameter, which varies in different states and also with reference to different species. Also, enumeration is often restricted to commercial species, and is not

made for all species. In a tropical mixed broad-leaved forest with many species of which only a few are enumerated, this leads to gross under-estimation of growing stock. In countries where the crop consists of only a few species, all of them marketable, the growing stock is almost wholly enumerated.

The fact remains, nevertheless, that India is not well endowed with forest resources as compared to several other nations, even in Southeast Asia. Not only is the total forest area less, but also the existing growing stock and increment per hectare are much below what they could be. The distribution of forests is uneven and water and land communications are inadequate.

### Removals

Total removals from the forests in use in 1968 were nearly 25.5 million cubic meters (11 million cubic meters of industrial wood and 14.5 million cubic meters of fuelwood.)

From sources outside the forests, nearly 89 million cubic meters of fuelwood and 1.7 million cubic meters of industrial wood are estimated to have been removed in a year from unrecorded sources. The figures, especially for fuelwood, appear high. A fear has been recently voiced that the outside source of fuelwood supply is rapidly diminishing and we need to plant fast-growing fuel species on waste lands as well as on forest lands to meet the shortage from this source in future years.

### Demand for Industrial Wood

India accounts for less than 1 percent of all the wood consumed in the world, which shows how low the present consumption *per capita* is in the country. The way in which the demand will develop in the future will depend upon a variety of factors, such as population and income. During the next 10 years, the country's requirements of industrial wood have been assessed at 14 million cubic meters for 1970 and 24 million cubic meters for 1980. The present production of industrial wood is just sufficient to meet the demand, but a gap between production and demand will progressively widen, unless steps are taken to increase production.

### Fuelwood Problem

The fuelwood situation in the country as a whole continues to be a headache for the planners. Fuelwood is only a part of the bigger problem, the total supply of energy. Fuelwood alone provides almost 40 percent of India's energy; more energy is derived from cow dung than electricity!

In the domestic sector, we find that noncommercial sources of energy are the most common. Recently, the Indian National Council of Applied Economic Research conducted an inquiry by stratified sample of 9,000 rural family units, spread over the whole of India. The survey provided a basis for estimating rural consumption of energy. A large proportion (88 percent) of all the energy consumed in the domestic sector came

from traditional noncommercial sources, fuelwood, cattle dung, and vegetable waste. The stratified sample inquiry showed also that the consumption patterns of the rural and urban areas were markedly different; the rural area consumed more noncommercial energy than the urban. Wide differences also occur among different parts of the country.

Today, India consumes some 103 million tons of firewood (measured in natural units), equivalent to about 0.23 ton per person, each year. Of this, according to estimates for 1968, only 14.7 million cubic meters or an equivalent of about 10.1 million tons is available as recorded removals from the forests, or only about 10 percent of the country's total consumption of fuelwood. Even if this greatly underestimates what actually comes from the forests, the greater part of the firewood in India comes from the cutting of trees in areas not technically defined as forests and for which we have no statistics.

The unrecorded sources outside the forests are mostly trees growing on private lands, along roads and canals, on the fields, inside compounds of buildings, and on village wastelands. The extremely wide gap between the total estimated consumption of firewood and the recorded removal from forests continues to baffle us. The possible explanations are that the actual removal of fuelwood from forests is much larger than what has been recorded, or the potential supply of firewood on nonforest lands in the country, which has not been assessed so far, may be larger than we believed and it is being fully utilized. No one knows how long the present rate of fuelwood cuttings from trees on nonforest lands can be maintained or whether this source of fuelwood is fast diminishing. The problem of fuelwood supply has aroused concern, and is, at present, engaging the serious attention of the foresters and the planners.

After the forecasting trends of the past decade, we can see that the amount of commercial energy consumed domestically doubles each 10 years and the remainder of the increased demand falls on traditional noncommercial sources. On the assumption that the trends would continue, the demand on noncommercial sources has been forecast. The estimate is that demand for

fuelwood, cow dung, and waste products of agriculture will rise by 25 percent for each decade.

Waste products can be assumed to increase roughly in proportion to agricultural output. But we have always wanted, for improved agriculture, to secure more cowdung as fertilizer and less as fuel. The use of commercial fuels is no doubt increasing, but that increase has a limit. The bulk of the burden, therefore, ultimately falls on fuelwood.

A vigorous campaign to increase the growing of trees has already been cited as one solution. On nonforest lands, the vital importance of our *Vahamahotsava* (the national festival of tree planting) and farm forestry has been highlighted. On forest lands, we have had to plan separately the raising of fast-growing species mainly for production of fuelwood.

Long before results are achieved from these measures, the ordinary economic forces of scarcity of firewood would enforce substitution of the traditional fuel by other fuels. Commercial fuels may have to be released in larger quantities for domestic consumption than was indicated by the forecast based merely on study of consumption in the last decade. The investigation conducted by the recently established Energy Survey Commission has made the country aware of the need for rapidly increasing the supply of energy.

### Trade

India's international trade in timber and timber products is small. Values of her imports and exports constitute only 2.15 percent and 0.15 percent of the total imports and total exports.

On the whole, India is an importing country for wood and wood products. The adverse balance of trade amounts to nearly 200 million rupees (17 million in wood and 183 million in wood products.) The trade balance is negative in both value and volume. This is largely because of dependence on imports of pulp and paper products and other manufactures.

The Indian Standards Institution (ISI) continues the work of formulating standards in the fields of timber, wood products, and forest products through various committees. Timber

trade and wood products industries inside the country are becoming more and more conscious of quality and are attracted to the ISI certification marking scheme.

### Planning Needs

The main feature of our forestry planning is its emergence as a logical consequence of the country's overall economic planning. Forestry planning is not allowed to be an adventitious or isolated series of adventures. Consistent with the country's overall economic policy, forestry planners have aimed to balance the national requirement of forest products from internal sources and to reduce imports to a minimum. The core of such planning would obviously be phased programmes intended to step up production as rapidly as possible.

In the context of the mounting future demands that have been already forecast, achievement of this central objective obviously would be impossible unless tremendous, concerted, and planned efforts are made.

Increase in production may become possible by adoption of the following methods:

- Increasing the area of the forest under use,
- Increasing the exploitation of the secondary species in the forest under use,
- Raising growth potential of the forests, and
- Raising the growth potential of trees on lands outside the forests.

### Five-Year Plans

The establishment in 1950 of the Central Board of Forestry preceded the launching of successive development plans of forestry in India. This board is now the highest body in India that advises the states and the central government on all matters concerning forestry. It serves as a regular forum for discussing various forestry problems, criticizing the planning, evaluating the results, identifying difficulties and bottlenecks in executing schemes and suggesting remedies, and making proposals for future planning.

On the whole, the first two plans laid special emphasis on consolidation, conservation, and protection of forests; rehabilitation of degraded

forests; improvement of communications; plantations of traditional species of well known economic value; improved utilization of secondary woods by seasoning and application of preservatives; introduction of modern logging techniques, mechanized means of transport, and forestry operations; forest research; and education.

In the third 5-year plan, not only were practically all of the programmes of the first two plans continued and intensified, but also new programmes were added, in keeping with recent trends. Amongst the special projects in the third plan were the centrally sponsored plantations of fast-growing species for industrial use; a pre-investment survey of forest resources; the establishment of logging training centres; and strengthening of the training capacities of the forestry colleges, nature conservation programmes, and introduction of farm forestry.

The main feature of the draft of the fourth plan, which has just been launched, is bold escalation of the already approved programmes so that the quantitative targets have a definite relation to the assessed requirements of the country in respect to forest products during the next 15 to 20 years. The projected requirements of the rapidly developing forest-based industries in supply of raw materials from the forests have been given special attention. For example, in the project for raising plantations of fast-growing species, a target of 400,000 hectares has been fixed in the fourth plan, as compared to the achievement of 65,000 in the third plan. The need for increasing the numbers of trees outside the forest land, even by encouraging the individual citizens and village groups like the *panchayats* has also been highlighted along with a formulation of revised proposals in farm forestry.

Because forestry is a long-term productive enterprise, even the 5-year span is too short for the purpose of planning. A look into the future is also considered necessary. As detailed programmes for the fourth plan were spelled out, therefore, a skeleton of the next (fifth) plan was also prepared.

The rising tempo of developmental activities in the forestry of the country during the last 15 to 20 years can be shown by the progressively increasing outlays for the different plans, starting from 95 million rupees in the first plan to 193

million in the second, 490 million in the third, and 1,490 million in the fourth.

Indeed, the tempo of developmental activities seems to be rising, not merely in my country, but in most developing countries like mine. But how near to the cherished goal of prosperity have these activities taken the developing countries? Not very close so far, I would answer. In fact, the greater the progress, the farther away the horizon of fulfilment seems to be receding. We hardly seem to have touched the fringes of the real problems.

Two forces in opposite directions are working simultaneously. One force consists of developmental activities that tend to increase production and the other is a formidably growing consumption because of the rising population and standard of living. To a planner, matching these two is like the much-hated arithmetic homework my village school teacher gave me, in which a lizard sticking at a point on a wall creeps upwards 12 inches only to slip down 1 1/4 inches every day and therefore does not reach the ceiling even in a whole year. That lizard was at least a climbing variety! I do hope our developmental "lizard" in developing countries is not another type—slipping MORE than climbing.

Excess population is the root-cause of trouble in many developing countries, especially in the Old World. In the good old days, Leigh Hunt could say of Abou Ben Adhem "May his tribe increase." Now he should rather say, "May his tribe flourish through family planning."

## OUTLOOK FOR THE FUTURE

In the prevailing atmosphere of deficit conditions, the campaign for more production in forestry needs to be constantly watched, lest it be misunderstood, as it sometimes is for overremovals or depletion in the growing capital. John F. Kennedy once said:

Each generation must deal anew with raiders, with the scramble to use public resources for private profit, and with the tendency to prefer short-run profits to long-run necessities. The nation's battle to preserve the common estate is far from won.

How truly are these words applicable to our forest

estates! Yes, when population and demands are mounting, we cannot escape from regarding forest planning as a continuous crusade, each plan uncovering new pressures, new crying needs, new problems—in short, new challenges to be dealt with.

In my own forestry school, our professor once told us this old French proverb: "Forests precede mankind and deserts follow." Are the foresters of today, who want to disprove this saying in the context of modern civilization, which recognizes wise use of resources, going to fail in the end?

I do not want to sound a pessimistic note, but I really wish some composer would put to music how we feel. Something like our feelings, perhaps, must have been in the mind of Robert Frost when he was "Stopping by Woods on a Snowy Evening."

The woods are lovely, dark and deep,  
But I have promises to keep,  
And miles to go before I sleep,  
And miles to go before I sleep.

Indeed, the glory of life is that it is worth the struggle.