"A loaded camel climbing up a steep slope is helped if its head is stretched forward." In the camel the "main force of locomotion is in the forequarters, rather than, as in the horse, the hindquarters, so that when a camel comes up to a hill it 'pulls' its body up slowly, instead of accelerating and pushing itself up quickly as a horse does." [From *The Camel*]

are usually avoided, though nonpoisonous parts may be eaten. The camel's ability to identify poisonous foods is apparently conditioned by learning. On unfamiliar pastures, for example, camels sometimes confuse toxic species with similar but nonpoisonous ones they are used to. When this happens nomads rely on a variety of folk cures to alleviate poisoning.

Like other polygynous ungulates camels exhibit an annual cycle of social organization. Stable groups averaging 11 head forage over an expansive home area. Management varies regionally, but in all cases camels depend on humans to be watered, at least during the summer when allowed to roam freely. The seminomadic Tibbu and Chaanba turn their camels loose when they tend seasonal crops, but the milk-thriving Reguibat are pure nomads who maintain herds throughout the year.

Contemporary and historical factors encourage nomads to become sedentary and reject time-tested values of the pastoral lifestyle. The authors argue convincingly that camels are a vital and economic means for gently reaping assets from low-productivity lands where other livestock cannot endure and cultivation is not a current option. Meat, milk, and wool are among the marketable resources into which only camels can convert the desert fodder. Even transmission belts have been made from camel hair. Western Saharan arid lands can support more than a million people, but water is the key to their exploitation. The future of the nomadic economy depends greatly on relatively inexpensive improvements to desert oglats and wells, a topic to which the authors devote thoughtfi attention. This fine contribution has value for biologists, historians, anthropologists, and conservationists.

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Tropical Trees

Age and Growth Rate of Tropical Trees. New Directions for Research. Proceedings of a workshop, Petersham, Mass., Apr. 1980. F. HERBERT BORMANN and GRAEME BERLYN, Eds. Yale University School of Forestry and Environmental Studies, New Haven, Conn., 1981. iv, 138 pp., illus. Paper, $6.95. Yale University School of Forestry and Environmental Studies Bulletin No. 94.

By now most scientists, conservationists, and concerned citizens are aware that species-rich tropical forest habitats are fast being destroyed by humans. Of more direct concern to Third World countries are the decreased water supplies, flooding, erosion, and soil infertility that result from the disruption of this complex ecosystem. If we are to utilize tropical forests without simultaneously destroying them, we must understand the natural biological mechanism for prolonged, steady-state productivity of the forest. To do this, we must conserve intact and healthy portions of forests for study and use by future generations.

Unfortunately, tropical forests are among the least-known forest ecosystems in the world. Our lack of understanding is, in large part, due to our inability to determine the ages and growth rates of tropical trees accurately. In most tropical trees that are evergreen or only briefly leafless, defined annual growth rings are absent. Even those trees growing under seasonally dry conditions often lack rings. Thus, neither individual trees nor their population can be aged. Size is an unreliable indicator of the age of a tree, since growth rates vary widely under different conditions. In the tropics there is nothing equivalent to the elegant dendrochronological studies carried out with archeological wood in North America or Europe. This ignorance of the age of trees in a mature rain forest, for example, critically limits any attempt to utilize similar forests on a sustained-yield basis. The prediction of long-term forest productivity is intelligent guesswork at best.

The present publication is the proceedings of a workshop on the subject in which 27 specialists in wood structure, ecology, forestry, and tree biology participated. The book consists of general introductions to some of the problems and a series of seven group reports on the present state of knowledge in a variety of fields that tackle them. Recommendations for the future direction of research conclude the proceedings. All sections are up to date and concise; several are written with the field and laboratory researcher in mind and indicate equipment needs. The relatively short lists of references for each topic are a sad commentary on our present state of knowledge of tropical trees.

The most optimistic report is on wood anatomy (A. Fahn *et al.*). Many tropical trees do form growth rings or have subtle variations in wood structure that might be useful in dating. It is still necessary to correlate such structural features with long-term (periods of five years or longer) growth observations to verify regular periodicity. Yet many tropical trees have extremely uniform wood without any evidence of seasonal differences that is visible with the light microscope.

The remaining reports offer other ways of attacking the problem. Changes in wood chemisry (T. Swain *et al.*) occur as wood cells age and may be of value for a rough determination of age. A variety of radioisotopes (M. Stuiver *et al.*) are incorporated into wood. The 1964 peak in ^{14}C found in wood formed during the years of atmospheric nuclear bomb testing may serve as a marker. However, such analyis is expensive and impractical for routine dating. The possibilities and problems of relating variations in wood anatomy to weather changes are covered

(D. Eckstein *et al.*), and several unpublished studies are reported. Finally, some indirect methods and models for determining population structure by means of tree size are reviewed (S. del Amo Rodríguez and J. Nieto de Pascual; K. D. Singh; N. Enright and G. Hartshorn).

Perhaps the most significant results of the workshop are the recommendations for future research. Trees are the longest-lived individuals on our planet. Their slow growth and long reproductive cycles have inhibited the study of them in this age of short-term grant support and the need for quick research results. Only prolonged and sustained studies will offer a solution to the challenge of utilizing our tropical forests without simultaneously destroying them. The book's appeal for a coordinated international effort with modest but, more important, sustained support for individual researchers should be heard.

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(Continued on page 690)