



Review: Mechanisms of Succession in a Tropical Rainforest--A Contribution from Mexico

Author(s): Julie Sloan Denslow

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REVIEWS

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MECHANISMS OF SUCCESSION IN A TROPICAL RAINFOREST— A CONTRIBUTION FROM MEXICO

Theoretical and empirical studies in the last several years suggest that the frequency and nature of disturbances are important in determining the organization and composition of communities. These investigations¹ on the establishment and survival of rainforest plants are particularly pertinent to this growing body of theory on the mechanisms of secondary succession. The papers collected here are reports of research carried out at the Estación de Biología Tropical Los Tuxtlas, a facility of the Universidad Nacional Autónoma de México in Veracruz, México. The majority of the twenty chapters was written by faculty, and the graduate and undergraduate students of the U.N.A.M. and for the most part report on the first five years of research on characteristics of seeds and seedlings of both early successional and primary forest species. Gómez-Pompa and his associates concentrate on the ecology and physiological mechanisms of seed germination, allelopathy, the behavior of seedlings and seeds in the soils of primary and secondary vegetation, and the role of birds in seed dispersal. They believe the understanding of the processes of secondary succession must come primarily from an appreciation of the variation in adaptive strategies of the species involved and will lead eventually to the enlightened management of these rapidly dwindling forests.

Although the studies discussed are reported as a series of independent research projects, the book includes an introduction to old-field succession in tropical rainforest climates, descriptions of the climate, vegetation, and history of the biological station at Los Tuxtlas, a summary of life history strategies of secondary successional species and a discussion of slash-and-burn agriculture and the potentials of sustained-yield management of rainforest. In addition there are literature reviews of stored-seed viability and of the ecophysiology of seed germination.

Early succession following forest clearing in the vicinity of Los Tuxtlas is described as a base with which to compare the vegetation of Veracruz with that in other tropical ecosystems. Rico Bernal and Gómez-Pompa report on detailed growth and survival data from permanent quadrats established in stands with different disturbance histories. Although here, as in several other papers in this volume, replication of the experimental design would have greatly increased the utility of the data, the data set obtained will be of significant interest as it is used to examine broader questions on variation and function of life history strategies among different elements of a successional community. At the point of publication, results were only briefly outlined, consisting of general observations of the patterns of species diversity and examples of the growth of individual plants over the observation period.

Vázquez-Yanes investigated ecological separation as demonstrated by germination characteristics within a group of species in the genus *Piper* (Piperaceae) which, Gómez-Pompa has previously suggested, partition a temporal gradient represented by secondary succession. Germination requirements, seed size and number, and duration of fruiting times

were all found to vary markedly between groups of species found in early successional and old-growth forest habitats. These data are consistent with the suggestion of Gómez-Pompa, myself and others that succession, through the temporal partitioning of resources among similar and closely related species, has been an important factor in the diversification of rainforest species.

In a subsequent paper, Anaya Lang found evidence of germination- and growth-inhibiting compounds in the leaf extracts of several species common in early successional communities. Variation in modes of action of the extracts and in the responses of the assayed species (also common second-growth species) was seen as an indication of the complex biochemical environment within plant communities.

In an investigation of fruits eaten by birds, Trejo Perez examined the contents of the digestive tracts from 106 species of birds from monthly samples taken in both primary and secondary vegetation over the course of a year. Three of the four seed species that had been eaten by the greatest number of birds examined are also among the species of viable seeds of second-growth species encountered by Guevara Sada and Gómez-Pompa in the soils of primary forest (also in this volume). I suggest that these data are consistent with the strategy of blanket seed dispersal in some early successional species in contrast to gap-to-gap, i.e., "safe site" to "safe site," dispersal as often assumed. The results of these studies contribute to the baseline information necessary to test hypotheses like the above.

Serious limitations to the volume arise in that many of the studies lack sufficient replication to allow use of either simple or multivariate statistical techniques. As a result the interpreter is overwhelmed by individual variation in the data and is prevented from extrapolating to generalizations that might enhance the importance of these studies. It is often difficult to determine precisely what is being tested when statistical tests are used and graphs and tables frequently appear with no captions and incomplete labels. Likewise the methods used in several experiments are described too sketchily to allow replication or assessment of the experimental design by other workers. This is particularly unfortunate since this volume will be used as a model for similar studies elsewhere in the tropics.

The paucity of information available on vegetation dynamics and the life history characteristics of species from New World rainforests make studies of this kind particularly valuable as a basis from which to draw broader generalizations to be tested through more circumscribed experiments and observations. Although non-Spanish-speaking readers will be frustrated at the lack of more extensive English language summaries, its publication in Spanish serves to make this information available to those ultimately responsible for managing these forests. The influence on the experiments and ideas in *Regeneración de Selvas* by Arturo Gómez-Pompa, a tropical ecologist of international reputation, makes this a volume of particular interest to all students of tropical ecology in particular and to those interested in the processes of vegetation change in general.

JULIE SLOAN DENSLow

DEPARTMENT OF BOTANY
University of Wisconsin, Madison
Madison, Wisconsin 53706

¹ Gómez-Pompa, A., S. del Amo R., C. Vázquez-Yanes and A. Butando C. (eds.). 1976. *Investigaciones sobre la regeneración de selvas altas en Veracruz, México*. Cia. Editorial Continental, S. A., Calz. de Tlalpan Núm. 4620, México 22, D. F. 676 p. \$12.00 U.S.