

WORKING PAPER 335

QUATERNARY ENVIRONMENTAL CHANGE IN  
EQUATORIAL REGIONS WITH PARTICULAR REFERENCE  
TO VEGETATION HISTORY : A BIBLIOGRAPHY

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QUATERNARY ENVIRONMENTAL CHANGE IN EQUATORIAL REGIONS WITH  
PARTICULAR REFERENCE TO VEGETATION HISTORY : A BIBLIOGRAPHY

1. A brief summary of the topic

It was thought for a long time that equatorial regions had remained virtually unchanged at least since the Tertiary period - it is only from the late Tertiary that we can talk of the present disposition of land and sea about the equator. Our teaching has supposed that these regions were the hearth from which genera spread to the remainder of the planet's surface by gradual adaptation and speciation. This warm, humid zone has been seen as a refuge for species unable to maintain temperate ranges in the face of stresses and fluctuations to north and south. The diversity of species in rain forest environments was assumed to reflect their essential stability. So indeed it may but not in quite the manner supposed originally by ecologists. The variety of species present in the various regions of rain forest are greatly different, with Africa exhibiting a relatively poor list compared with South America. This, as it turns out, may well be a function of disturbance.

During the last 25 years and gathering momentum within the last decade a variety of studies have demonstrated that the concept of equatorial biological stasis is no longer tenable. Evidence for equatorial environmental changes is derived from theoretical as well as empirical studies. Regarding the former, various attempts have been made to model the earth's atmosphere at different periods of the Pleistocene and there is now fairly good agreement about the consequences for equatorial regions of a general global cooling, namely a critical drying at lower elevations. The empirical evidence is derived on the one hand from stratigraphic studies of peats and lake muds and also the analysis of ocean cores. It is also derived from studies of the geographical ranges of plant and animal species.

The stratigraphic - palaeoecological methods have now given us unequivocal evidence for substantial environmental change throughout low latitudes; changes which are very well correlated from one region to another. During glacial phases the temperature of the equatorial zone appears to have fallen by  $6-7^{\circ}\text{C}$  leading, as predicted, to decreased rainfall in the lowlands and to a shift of vegetation belts both latitudinally and altitudinally. Also, the fall of sea level imposed hydrological change as well as greatly altering coastal distributions. The treeline in the Andes and Malesia is believed to have descended by as much as 1000 m during the last glacial maximum. Massive changes of this sort would clearly have led to local extinctions, to the fragmentation of previously continuous rainforest and to its survival only in particularly well-favoured places. Plant geographers had long been puzzled by the disjunct nature of many distributions, the intuitive solution to which was that they were once continuous but had become disconnected through disturbance and the subsequent creation of barriers to migration. Confirmation of environmental change from other sources therefore provides phytogeographical studies with the mechanism they so obviously lacked before.

But if glacial periods led to major contraction of rainforest, indeed to its fragmentation, they also led to montane and savannah distributions becoming more continuous. It is at times of range continuity that migratory corridors are opened and species enrichment may occur, e.g. the introduction of Australian components into the Malesian flora during the period of glacially-lowered sea level.

The study of vegetation history in the equatorial regions is of interest from several points of view. It confirms that Quaternary climatic changes have been world wide in their effects. It offers an opportunity for the fusion of biogeographical and palaeoecological methodologies and it provides a basis on which to evaluate hypotheses of speciation and of the diversity of organisms in relation to habitat size and stability.

## 2. Rationale, structure and sources of the bibliography

This bibliography contains a virtually complete set of works on the vegetation history of equatorial regions to this date. Additional or related material will be found in the individual bibliographies in books and articles, particularly the major works by Bowen (1979), F.A.O. (1978), Flenley (1979), Larsen and Holm-Nielsen (1979) and Street (1981). A principle aim of this compilation has been to provide a basis for discussion of the history and present status of the tropical rain forest and therefore emphasis has been placed on the humid tropical regions, whether equatorial or monsoonal in character. Nevertheless a certain flexibility has been necessary in the selection of items in order to increase the utility of the bibliography. The former distribution of humid conditions in parts of the tropics makes it legitimate to include certain areas which now fall within semi-arid or arid zones but the bibliography only contains a fraction of the available literature on environmental change in the dry tropics. Again, not all equatorial regions are associated - even potentially - with humid forest vegetation (e.g. coastal deserts, hydrogeomorphic and altitudinal effects) and these, together with the history of coastal mangroves, deserve to be included. Indeed an argument for extending coverage beyond the strict present limits of the tropical rain forest regions is that additional data is available on periodicity, dating and correlation.

The importance of having independent evidence for changes of climate and vegetation must be appreciated in order to avoid circular reasoning on matters of cause and effect. A selection of entries included here therefore deal with evidence for climatic and environmental change which relate to vegetation only by implication. This bibliography is not intended to cover the considerable material available on tropical pollen morphology and palynological method. It is also not concerned with the vast area of general ecology of tropical species or with the effects of massive recent deforestation in rain forest areas and the conservation issues which this raises.

The botanical, biogeographical and ecological study of equatorial regions considerably predates palaeoecological research in these areas, the bulk of the latter having been carried out in the last 15 years. The majority of research in this latter field is available in English language publications (mostly International Journals) so that although the search procedure adopted may contain some bias, the relative paucity of foreign language material can be assumed to have little significance.

The bibliography is in seven parts (A-G). A general category includes books and reviews essential to an overall understanding of equatorial forests, their ecology, history and the pattern of climatic change which has occurred during the Quaternary. The remainder of the bibliography is divided into the various regions which, although categories of convenience, are to some extent distinct on floristic grounds. Separation is probably least natural in the case of Australia and Malesia (= Malaysia + Indonesia) which have been connected at various times during the Quaternary.

The bibliography was compiled using key references supplemented by the following abstracting and indexing services.

Geo Abstracts 1970-1981

- A. Landforms and the Quaternary
- B. Climatology and hydrology

Bibliography and Index of Geology 1965 - Feb. 1982

Biological Abstracts 1977-1981

Bioresearch Index 1965-1980 (now absorbed into Biol. Abstr.)

Science Citation Index 1970-1981

Bibliographie Palynologie 1960-1980

For current awareness, recent numbers of the following journals were scanned :

Journal of Ecology

Palaeogeography, Palaeoclimatology, Palaeoecology

Quaternary Research

New Phytologist

Ecological Monographs

Additionally, Geo-Titles Weekly was searched for the period July 1981 - April 1982.

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