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FIFTY YEARS OF ECOLOGICAL AND PHYTOSOCIOLOGICAL RESEARCH IN INDIA

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Dedicated to J. Braun-Blanquet on the occasion of his 90th birthday

Early history

The growth of research in botany, and especially in ecology, started in India only about 1920. Prior to that, however, monumental work had been done by members of the Forest and Agriculture Departments of the Government of India. These enthusiastic workers included foreigners, chiefly British officers of the Indian Civil Service and the Medical Service attracted by the unexplored field for research which the country offered, and the Indian scientists which the country was beginning to produce. Bentham & Hooker (1862–1880) and Hooker (1875) rendered a valuable service to India, and to the cause of botany in India, both through their monumental *Genera Plantarum* and Hooker's exhaustive *Flora of British India*, and by their collections of herbarium material now at the Herbarium of the Royal Botanic Gardens, Kew, England. A very complete list of the Flora of western India was compiled by Thomas Cooke (1901–1908). Hole (1919) made a study of the sal tree (*Shorea robusta*) and the forest grasses. This early period of botanical research will be remembered as the one that laid the foundations of systematic botany upon which ecology entirely depends.

The period 1920–1936

Before the beginning of the First World War, S. P. Agharkar, a young student of botany of the University of Calcutta, was working in Berlin as a research student. Fortunately, he was allowed to pursue his studies there. His work on 'The means of dispersal and the present day distribution of the xerophytes and the sub-xerophytes of north-west India' was published in 1920, and hence he may be considered as the pioneer worker on Ecology in India. About the same time two Jesuit Fathers of St. Xavier's College, Bombay, namely Fr E. Blatter & Fr F. Hallberg (1918) were studying the vegetation of the Desert of Thar, and Saxton & Sedgwick (1918) turned their attention to a similar study of the arid regions of Gujarat, but these studies were essentially floristic. Dudgeon's (1920) study of the Gangetic Plains and Kenoyer's (1921) study of plant succession in the subtropical forests of the central Himalayas were the first attempts at genuine ecological work. From the same period are the accounts of the plant formations occurring in Bihar and Orissa and of the riverine tracts of Burma by Dudley Stamp & Lord (1923). This was the first time Indian ecologists turned their attention to the groupings of plants which they loosely termed 'Formations' (not 'Associations' as wrongly interpreted by some Indian ecologists). Slowly the early work in India turned to another branch of botany, namely plant geography.

The pioneer phytogeographical work of Burkill (1924) on Arborland was followed by the studies of Dudgeon & Kenoyer (1925) on the vegetation of Tehri-Gharwal, Cowan (1929) on the forests of Kalimpong, Kashyap (1932) on the vegetation of the Himalayas and west Tibet, and by Sabnis's work on the flora of the Punjab and the associated hilly regions (1920–1921, 1929, 1942).

Also during this period, Mullan (1923–1933) worked on ecological plant anatomy, particularly on the mangrove species so abundantly found in Bombay in the mangrove swamps. Burns (1931) studied the Deccan grasslands from an ecological (but chiefly successional) point of view, and Gorrie (1933) studied the ecology of the Sutlej deodar (*Cedrus deodara*). The period was crowned by the work of Champion, whose survey of the forest types of India

and Burma was published in a preliminary form in the Indian Forest Records in 1936. It has recently been revised by Champion & Seth and was published by the Government of India in 1973.

The period 1936–1965

During this period ecology was introduced as a special subject in Indian universities and its study was facilitated by the return from Europe of two Indian students trained in ecology, namely Dr. F. R. Bharucha and Dr. R. D. Misra. The latter having studied autecology in London under the guidance of the late Professor W. H. Pearsall started his ecological work with studies on the autecology of Indian plants. Later he combined these studies with synecological studies on forests and grasslands (Misra 1946) and thus established his School of Plant Ecology at the University of Benares which is the largest and most widely known in India. These studies continued till 1965 when, influenced by Odum, he turned to work on productivity and ecosystems.

Whereas Dr. Misra specialised in ecology, Dr. Bharucha specialised both in ecology and phytosociology, having worked at Cambridge under Dr. (later Professor) H. Godwin and subsequently under Dr. Braun-Blanquet at Montpellier. He established his school of ecology and phytosociology in Bombay in 1935. He began his studies with work on the ecology of Mangroves, which abound around the Bombay Island (Bharucha & Nawalkhar 1942–1950). Subsequently he turned to the study of the grasslands of India, which even now are an acute problem since the production of fodder and grasslands are not very abundant in proportion to the growing population of cattle (Bharucha 1940, Bharucha & Dave 1952, Bharucha & Whyte 1954, Bharucha & Shankernarayana 1958). These ecological studies induced studies on biological spectra of the grasslands of Bombay and of the evergreen forests of *Memeaglon edule* and of the Madras flora by Bharucha and his students (1938–1941). After this he turned his attention to the study of arid lands and studied the Thar Desert of Rajasthan on which he was commissioned by UNESCO to write a report, and still later he studied the arid lands of the Middle East. Pari passu with these studies he worked also on phytogeography (Bharucha & Meheromji 1965), and in his most recent studies on the arid and semi-arid lands of the north and south of India he has created a new system of delineating the vegetational zones on the basis of vegetation as the parameter, and not on the basis of climate as has been done by all previous workers on this problem.

Recent work, 1965–1975

Recent studies by Misra and his students concentrated on ecosystem productivity. Both productivity and the ecosystem are new concepts in Indian ecology. They have influenced many of Misra's students.

The theoretical aspect of the concept and its implementation in modern biology date only from Lindeman (1942) and the major development of ecosystem analysis has taken place since 1950 (cf. Odum 1971).

Furthermore, reference may be made to Pandeya, who has done work exactly on the lines of his teacher, Dr. Misra, and has also worked on lines of his own. He began with autecological work on various species, and then made larger scale studies of the grasslands of Saugaur. From his autecological studies on grasses, weeds and trees, he found that several species show ecotypic differentiation (Pandeya 1970). This differentiation has been correlated with abiotic factors, indicating edaphic, photoperiodic and latitudinal ecotypes. Finally he has followed Misra in work on productivity and ecosystems.

The recent work of D. N. Sen (Sen &Chatterji 1966) on ecophysiological studies is a very welcome innovation since physiology plays an important part in the growth of plants and the ecological studies of different types of vegetation.

Lastly reference may be made to the recent world-wide developments on the problems of pollution of different kinds. Pollution studies in India as carried out just now may be considered in the primary stage. These studies are mainly done by physicists, chemists and biochemists rather than by ecologists, and no more can be said here than that this problem is in its infancy.

This review may fittingly be concluded by mentioning the names of Indian Schools of Ecology and the titles of ecological journals published in India. The main literature on the subject is mentioned in the reference list. A further source is the Bibliography by Bharucha & Meheromji (1963).

a. Bharucha's School of Ecology and Phytosociology, started in Bombay in 1935.
b. Misra's School of Plant Ecology, started at Benares in 1940.
c. Sen's School of Experimental Ecology, started at Jodhpur in 1973.

1. The Indian Ecologist, started in Bombay by the Indian Ecological Society in 1947.
2. The International Journal of Tropical Ecology, started in Benares by Dr. R. D. Misra in 1960.
3. Annals of the Arid Zone, started by the Central Arid Zone Research Institute at Jodhpur in 1960.
4. The Scavenger, started at Bombay by the Society for Clean Environment (SOCLEEN) in 1972.
5. Geobios, started at the University of Jodhpur by Dr. D. N. Sen in 1973.

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