ECOLOGICAL STUDIES ON JHUM FALLOWS OF BYRNIHAT (MEGHALAYA) WITH PARTICULAR REFERENCE TO SOIL FAUNA

by

PRAMOD KUMAR VATSAULIYA, M. Sc.

DEPARTMENT OF ZOOLOGY

SCHOOL OF LIFE SCIENCES

SUBMITTED IN FULFILMENT OF THE REQUIREMENT OF THE DEGREE OF

DOCTOR OF PHILOSOPHY

TO

THE NORTH - EASTERN HILL UNIVERSITY

SHILLONG - 793001, INDIA

JULY, 1981

Grams : NEHU
Phone :

North - Eastern Hill University

LOWER LACHAUMIERE, SHILLONG - 793001

Dr. J.R.B. Alfred,
Reader

Department of Zoology,
School of Life Sciences,
Shillong-793014.

I certify that the thesis entitled "Ecological Studies of Jhum-fallows of Byrnihat (Meghalaya) with particular reference to soil fauna", submitted by Mr. Pramod Kumar Vatsauliya for the Degree of Doctor of Philosophy of the North Eastern Hill University, Shillong embodies the record of original investigation carried out by him under my supervision. He has been duly registered and the thesis presented is worthy of being considered for the Award of Ph.D. Degree. This work has not been submitted for any Degree of any other University.

DATED : 31st July 1987

PLACE : SHILLONG.

Signature of the Supervisor.

ACKNOWLEDGEMENTS

I take this opportunity to express my gratitude to Dr. J.R.B. Alfred, my mentor, for his optimism, creativity and needed support, more so, for his constant encouragement and direction throughout my work. Gratitude is expressed to Prof. M.K. Khare, Head of the Department of Zoology for his making available necessary facilities. I am indebted to my mother, Mrs. Sarwati Singh who encouraged me in the present undertaking. To Mr. Khambor Tariang, I am grateful for his help in the typing of the manuscript. Thanks are expressed to Dr. Keiko Niijima, Japan Forest Station for the identification of the Collembola species.

The investigation was possible due to funding from the Department of Science and Technology, New Delhi (Project M & B).

P. Vatsauliya 30.VII.81

(Pramod Kumar Vatsauliya)

CONTENTS

....

PLATES

FIGURES

TABLES

GENERAL INTRODUCTION

Soil fauna and its studies are a relatively recent field in biology, not only in the temperate latitudes but more so in tropics. Other than the initial general studies today the interaction and interrelationships of soil fauna and its habitats is seen from the Anthropogenic gradient. This relates to the study, taking "natural" as baseline ecosystems, the measurements of dynamic aspects of soil faunal variables, in systems which are subjected to either agricultural activities or to degrees of manipulation and perturbation by the impact of man. This was what is referred to as "rule of the zonal change of strata" (Ghilyarov, 1964). Studies on the ecology of the soil invertebrates, though have been undertaken in the humid tropics (Dammerman, 1945; Williams, 1947; Beak, 1962; Maldague and Hilger, 1963; Toye, 1967; Madge, 1969; Fittkau and Klinge, 1973), yet only that of Lasebikan (1975) is directly concerned with the impact of agricultural practices on the soil fauna. Other than the above studies on the immediate effects on land usage, interest in the restoration of severely damaged landscape is of very recent time, primarily due to increasing human populations and the threat of nuclear devastation.

With this background in mind the present study was undertaken to see the effects of excessive land use on soil faunal dynamics in tropical environments of this part of the world, particularly to aspects of recycling, succession and stabilization of soil fauna in lands left fallow after intensive agriculture for a number of years. The uniqueness of the situation was that these fallow lands were the results of shifting cultivation, as

practiced in many regions of the world. Shifting cultivation, though is regarded as the primitive agricultural systems of the tropics, it is not only confined to tropics, but elsewhere also in the world. In these regions of North-Eastern India, shifting cultivation is referred to as "Jhumming" where farmers move their homes and settlements as well as the fields they cultivate, at frequent intervals (UNESCO, 1952). Jhumming, as for general shifting cultivation involves a similar clearing of the forest by felling, logging and finally burning the undergrowth, then ploughed for agriculture (Plates 1,2,3). Hence it is frequently called as "Slash and burn" agriculture referred to as Swidden farming (Ekwall, 1955). Many studies have existed on the immediate effects of disturbing the ecosystem by either burning, logging or agriculturing (Nye and Greenland, 1960). However very little if at all exist on the land after such usage and the agricultural yield falls well below the inputs when it is left abandoned or fallow for a number of years. It is with this reason, that we were interested in such fallows left abandoned for a considerable time, to investigate the influences of soil fauna and soil on one another on an ecological approach. This was primarily due to the fact that land after cultivation, when abandoned, the life forms passes through several secondary successional stages with acute competition of elimination of undesirable species all directly correlated to the length of the fallow period.

The present investigation was taken up therefore on abandoned fallows of different ages from a period of one year to twenty years. It was seen in these fallows the general population dynamics of various groups of soil fauna in relation to the age of these fallows and to identify the colonization and successional

trend if existing in relation to the general physical factors of the environment and chemical nature of the soil. In addition to find out whether the biology and the nutrition affects the soil fauna for dominant species of Collembola, two from the youngest aged fallow and two from the oldest aged fallow were taken up for detail study. The second aspect therefore deals with these four species life history studies under the impact of various combinations of three environmental factors like temperature, pH and salinity, helping in the identification of the fecundity and mortality, therefore the population status comparable to the field. The third investigation was directed to the understanding of the nutritional status of these same four species and compared with field. This was thought to help in finding out the strategies involved in the life history processes and therefore the population dynamics in relation to either the abundants and scarcity of food resources studies.

The study though was aimed at the academic understanding of such disturbed ecosystems, yet it was thought to bring recommendation of land use practice based on such studies to the regional government.