

## HOLOCENE VEGETATION AND CLIMATE CHANGE IN KUMAUN AREA BASED ON PALYNOLOGICAL EVIDENCES

REKHA DODIA

*Physical Research Laboratory, Ahmedabad 380 009, India.*

### ABSTRACT

Vegetation has left a fossil record, unrivalled in stratigraphic completeness and detail in the form of pollen grains preserved in Kamal Tal lake (Naukuchia Tal) sediments. A 5.5 m deep lake core going back to ca. 7150 yrs B.P. reveals a gradual decrease in the vegetation cover possibly due to anthropogenic activity in the area. Associated agriculture indicating pollen in the profile further supports the presence of man at that time in the area. Mineral magnetic studies show the presence of soil-rich components in the lake sediments which again suggest erosion of forest soil due to lack of forest cover.

### INTRODUCTION

MAN influences the natural vegetation in a variety of ways. First his actions may be purely destructive, as when he cleared the forest in Western Europe for crop cultivation, or burned it as he did in the case of the Valonia woodlands in Asia Minor in order to increase the area of pasture land, or ploughed up the grasslands of the North American prairies for cereal cultivation<sup>1</sup>.

In order to see the vegetation changes that have taken place in the Kumaun region induced by climate or man or by both this study has been undertaken. In the dry part of Naukuchia Tal known as Kamal Tal (29° 18' - 29° 20' N and 79° 31' - 79° 36' E) in Nainital District, a 5.5 m

deep core was taken for <sup>14</sup>C dating, mineral magnetic studies, pollen analysis, etc.

### MATERIAL AND METHOD

The lake core raised with the help of Hiller auger was sampled at 5 cm interval, but preliminary pollen investigation has been carried out at an interval of 1 m. The samples were prepared using Erdtman's<sup>2</sup> standard maceration method. Chemical treatment with 5% KOH, 10% HCl, HF (overnight), 10% HCl and acetolysis mixture are given in succession to the samples. The prepared material is preserved in 50% glycerine for counting different pollen types. The results are presented in the form of pollen diagram (figure 1) that show the percentage of the different

### KAMAL TAL (NAUKUCHIA TAL)

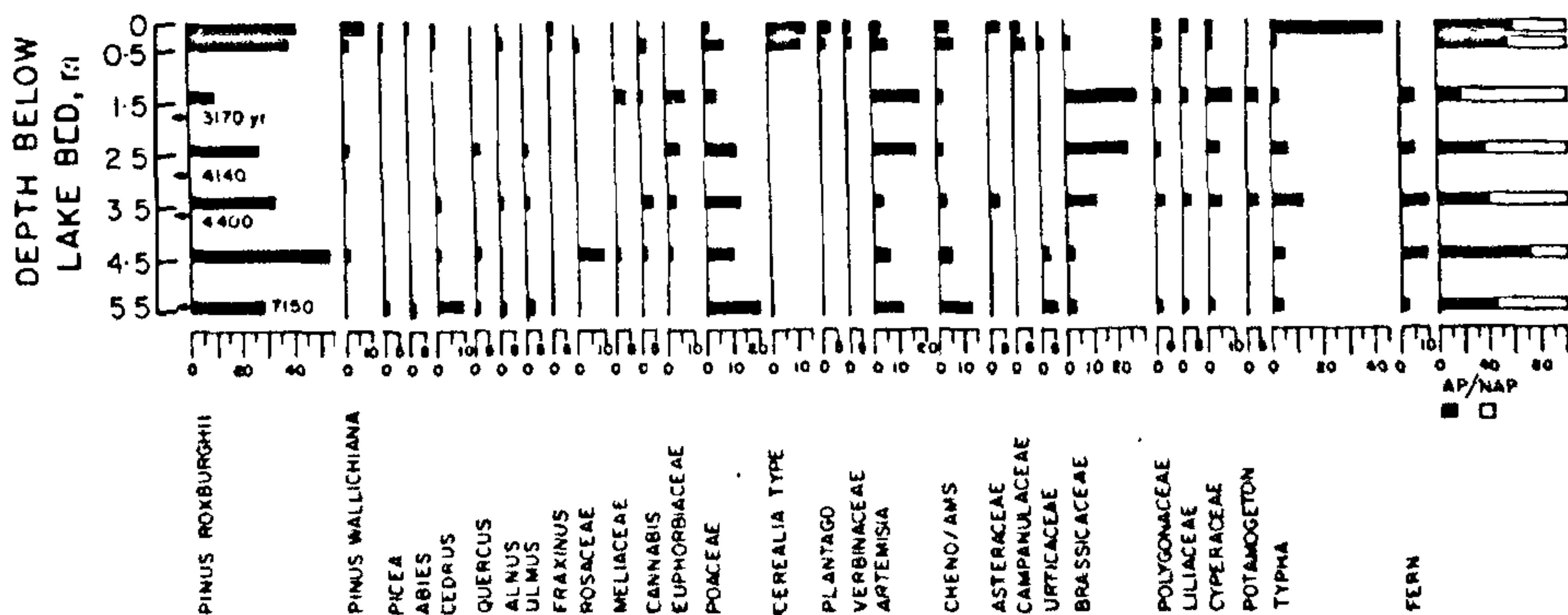


Figure 1. Kamal Tal pollen diagram showing percentages of the total land plants pollen grains on the x axis while y axis indicate depth of the core. <sup>14</sup>C dates are also shown in yrs B.P.

pollen types at different stratigraphic levels. The pollen percentages represent the percentages of species in the vegetation.

### <sup>14</sup>C DATES

Radiocarbon method gives a date of ca. 7150 years B.P. for the 5.5 m deep core. Radiocarbon dates for different levels in the profile are given in table 1.

### RESULTS

The vegetation history starts with chirpine woods at the bottom of the profile (figure 1). Other conifer constituents are spruce, fir and deodara and show low frequencies. Broad-leaved elements such as oak, alder and elm also display poor values. The non-arboreal taxa are dominated by Poaceae, *Artemisia*, Chenop/Ams and Brassicaceae. AP/NAP ratio rests at value 40 indicating high values of the non-arboreals possibly due to open woods which favours a growth of herbaceous plants. Presence of spruce, fir and deodara, although in low frequencies, possibly indicates cooler climate than what would have been prevailing during the period after ca. 7150 and up to ca. 3170 yrs B.P.

The open vegetation replaced by the closed woods of chirpine around 5650 yrs B.P. (extrapolated date) at 4.5 m depth. AP/NAP ratio increased here to 70 from 40 of the previous level indicating scanty growth of ground vegetation under closed woods. Absence of cold-loving conifers such as spruce and fir possibly indicate warmer conditions than the previous level.

The closed woods of chirpine was followed by the open woods at ca. 4400 yrs B.P. Around 3170 yrs B.P. open woods established them fully as indicated by extremely high values of non-arboreal elements such as *Artemisia*, *Cannabis* (Hemp) and Brassicaceae. *Artemisia* is characteristic of abandoned, barren, sunny slopes. Brassicaceae possibly indicate cultivation of vegetable and oilseeds while hemp in order to produce tough fibres. Presence of charcoal

particles in the sediments suggests fire activities. Appearance of *Cerealia* type of pollen grain in the top at ca. 3170, indicates starting of cereal cultivation.

### MINERAL MAGNETIC STUDIES

The mineral magnetic studies carried out on the Kamal Tal lake core<sup>3</sup> to understand erosional processes show slight variation in  $\chi_{fd}$  (frequency-dependent magnetic susceptibility) values at the depth range 3.7–5.4 m, i.e. ca. 4400–7150 yrs B.P. while after 3.7 and up to 1.9 m show increased  $\chi_{fd}$  values reaching maximum values between 1.5 and 0.4 m.  $\chi_{fd}$  value decreases towards the top.

The values of  $\chi_{fd}$  of sub-soil vary according to the lithology of the basement and the degree of weathering, the values increasing with the weathering intensity. Thus high values of  $\chi_{fd}$  indicate a concentration of weathered material like soil in the lake deposits from the catchment area.

Sedimentation rate of the core also increases upwards. The sediments below 3.7 m show a rate of 0.62 mm/yr while above 3.7 a rate of 0.84 mm/yr is observed.

### CONCLUSION

Pollen evidences show no major climatic changes as they do not seem to have much impact on the vegetation changes. Major vegetation changes are possibly brought about by man as the decrease in pollen influx and low frequencies of arboreal taxa are associated with agricultural activity. High  $\chi_{fd}$  values with increased *Artemisia*, *Cannabis*, Brassicaceae and Poaceae frequencies suggest clearance of forest for agriculture and consequent enhancement in soil erosion.

In the beginning man might have started cultivating vegetables like *Brassica* and oilseeds like mustard as discussed by Sauer<sup>4</sup>. The initial domestication would be multi-purpose plants set out around fishing villages to provide food, substances for toughening nets and for drugs. *Cannabis* might have been grown for its tough fibre and for medicinal purpose. *Brassica* might have remained one of the leading crops of the Neolithic man in India as noted by Hutchinson<sup>5</sup>. Presence of charcoal particles in the sediments possibly suggests slash and burn type of farming method. Cereal cultivation seemed to have started only after ca. 3170 yrs B.P. as indicated by the appearance of *Cerealia* type pollen at the top of the pollen profile.

Table 1 Radiocarbon dates for different levels

Sample no	Sample depth (m)	Age (years B.P.)
PRL-1107	1.80	3170 + 100
PRL-1100	2.90	4140 + 170
PRL-1099	3.70	4400 + 120
PRL-1098	5.40	7150 + 160

In order to carry out cultivation, the Neolithic man might have cleared the forest vegetation as shown by all the three studies, (i) pollen analysis, (ii) mineral magnetism and (iii) rate of sedimentation which show acceleration in erosional processes of the forest soil with decreasing forest cover. Since soil is a relatively incoherent material it is subjected to much disturbance and displacement. Some protection from disturbance is provided by the vegetation and stability against displacement is provided by plant roots and by the structure of the soil itself.

#### ACKNOWLEDGEMENTS

The author thanks Prof. D. P. Agrawal and his colleagues for their help.  $^{14}\text{C}$  dates were provided by Dr S. Kusumgar.

8 June 1987; Revised 11 September 1987

1. Bender Barbara, *Farming in prehistory from hunter-gather to food production*, John Baker, London, 1975.
2. Erdtman, G., *An introduction to pollen analysis*, Waltham, Mass, USA, 1943.
3. Agrawal, D. P., Dodia, Rekha, Kotlia, B. S., Kusumgar, Sheela and Sharma, P., Quantification of erosion rates: some new perspectives, *Proc. Int. Symp., Erosion and Sedimentation in Arab countries*, 1986 (to be published).
4. Sauer, C. O., *Agricultural origins and dispersals*, (ed.) Bender Barbara, 1975.
5. Hutchinson, J. B., *Conclusion: the biology of domestication*, (ed.) E. S. Higg, 1972, p. 195.

---

## NEWS

---

### SOCIAL ASPECTS OF AIDS PREVENTION AND CONTROL PROGRAMMES

The World Health Organization (WHO) Special Programme on AIDS issued a statement giving its first global summary of the common social aspects of AIDS prevention and control programmes, based on the experience of countries around the world.

In "Social Aspects of AIDS Prevention and Control Programmes", a statement developed over the past 10 months of intense work with over 100 countries, the WHO special programme on AIDS concludes that AIDS can be prevented and controlled without violating human rights and that discrimination against people infected with the AIDS virus HIV can threaten public health.

The statement was fashioned from an analysis of individual nations' responses to such complex AIDS issues as screening housing, health care, education and employment.

In an attempt to identify the primary social issues in the AIDS pandemic, as they emerge from nations throughout the world, the statement stresses the following social aspects of AIDS prevention and control: 1. AIDS prevention and control programmes can be implemented without endangering human rights; 2. Information, education and counselling on HIV-infected persons are required to prevent

HIV infection; 3. Any routinely applied exclusionary measures such as quarantine or other discrimination against HIV-infected persons are not justified on public health grounds; 4. Public health is best protected by keeping HIV-infected people integrated within society and helping them assume their responsibility to protect others from infection; 5. Testing for HIV-infection should be done on the basis of informed consent, counselling and assurance of confidentiality.

"During 1987, virtually every country in the world has considered implementing routine exclusionary or other discriminatory measures — and has then decided against them", said Dr Jonathan Mann, Director of the WHO Special Programme on AIDS. "This is because such discrimination will not protect public health, but will jeopardise educational programmes and risk, driving infected persons and those concerned about infection 'underground'".

"Therefore discrimination itself is a threat to public health and a threat to our ability to stop AIDS", Dr Mann said. (Press Release, WHO/32 dated 1st December 1987; WHO, Media Service, 1211 Geneva 27, Switzerland).