



Vegetation, land cover and land use changes of the last 200 years in the Eastern Ghats (southern India) inferred from pollen analysis of sediments from a rain-fed tank and remote sensing



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ABSTRACT

A 98 cm core from *Potapuram Cheruvu*, a rain-fed tank in the Nallamalai Hills of south India, has been palynologically analyzed to study the changes in vegetation and climate of the recent past. This run-off harvesting reservoir, chosen on the basis of remote sensing analysis and field surveys, is not linked with any major river. Its water level is the lowest in the summer, for two to three months, during which time the sampling was carried out. The site, lying south of the “core monsoon zone”, gets most of its rains from the south-west monsoon. Palynological studies yielded 75 pollen taxa with “dryness”, “wetness”, and “human-impact” markers. The ecological attributes of the plant species assigned to the pollen taxa provide an indirect link to specific environments (wetter/drier) that supported the land cover. The analyzed core revealed the vegetation history around the site during the past two centuries through pollen analyses supported by remote sensing. Even during this short period, distinct fluctuations in the vegetation assemblages were observed. Remote sensing indicates that the forest cover did not change significantly during the past ~30 years. During this period there was also a change in the area covered by scrub and agriculture. Taken together and linked to the variations of the individual forest tree markers, this leads to the following story: a definitely drier period between ca. AD 1798 and AD 1846 and a definitely wetter one between ca. AD 1876 and AD 1920. The results from the RS and GIS show that while there was almost no change in the forest cover of the *Potapuram Cheruvu* watershed between 1973 and 2005, taking into account the tank’s seasonality by analyzing the wet and dry seasons, there was a notable decrease in the forest cover between 1924 and 1973.

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1. Introduction

Palynological analyses of Quaternary sediments in terrestrial sites traditionally involve sampling and analyzing deposits from natural lakes, peats, and fluvio-lacustrine archives (Wright, 1980; Vasanthi, 1988; Sutra et al., 1997; Kumaran et al., 2013). In the tropical south Indian context, undisturbed natural lakes are almost non-existent and the peats are restricted to some highlands abutting the Western Ghats (Nilgiris, Palnis and Anamalais), leaving a huge data gap in the drier Deccan plateau, a large part of which is in the rain shadow of the Indian monsoon. Very few attempts have been made (Morrison, 1993; Bauer and Morrison, 2008; Stephen, 2010) to analyze the sediments from the organically poorer non-system tanks or rainfed reservoirs, that occur in multitudes

throughout the south Indian landscape (Gunnell and Anupama, 2003; Gunnell et al., 2007). The present work, a part of a larger research programme on modern pollen rain and paleovegetation studies in south India, aims to fill this gap by studying the sediments of one such non-system tank from the Nallamalai hills of south India, for paleoecological reconstruction, with pollen as the main proxy, supported by remote sensing (RS).

Although the existence of such tanks in peninsular India has been long known, they have remained practically unexplored as sediment repositories. Reasons for this include skepticism regarding their “pristine”, “undisturbed”, or at least “minimally disturbed” status. Several of these tanks have closely been linked to human habitations for at least a century, and have been found in Survey of India topographical maps dating to the early 20th century. The undulating terrain offers the possibilities for several small “natural” inundation channels. These channels may have been made into non-system tanks by erecting a barrier (bund). Stone

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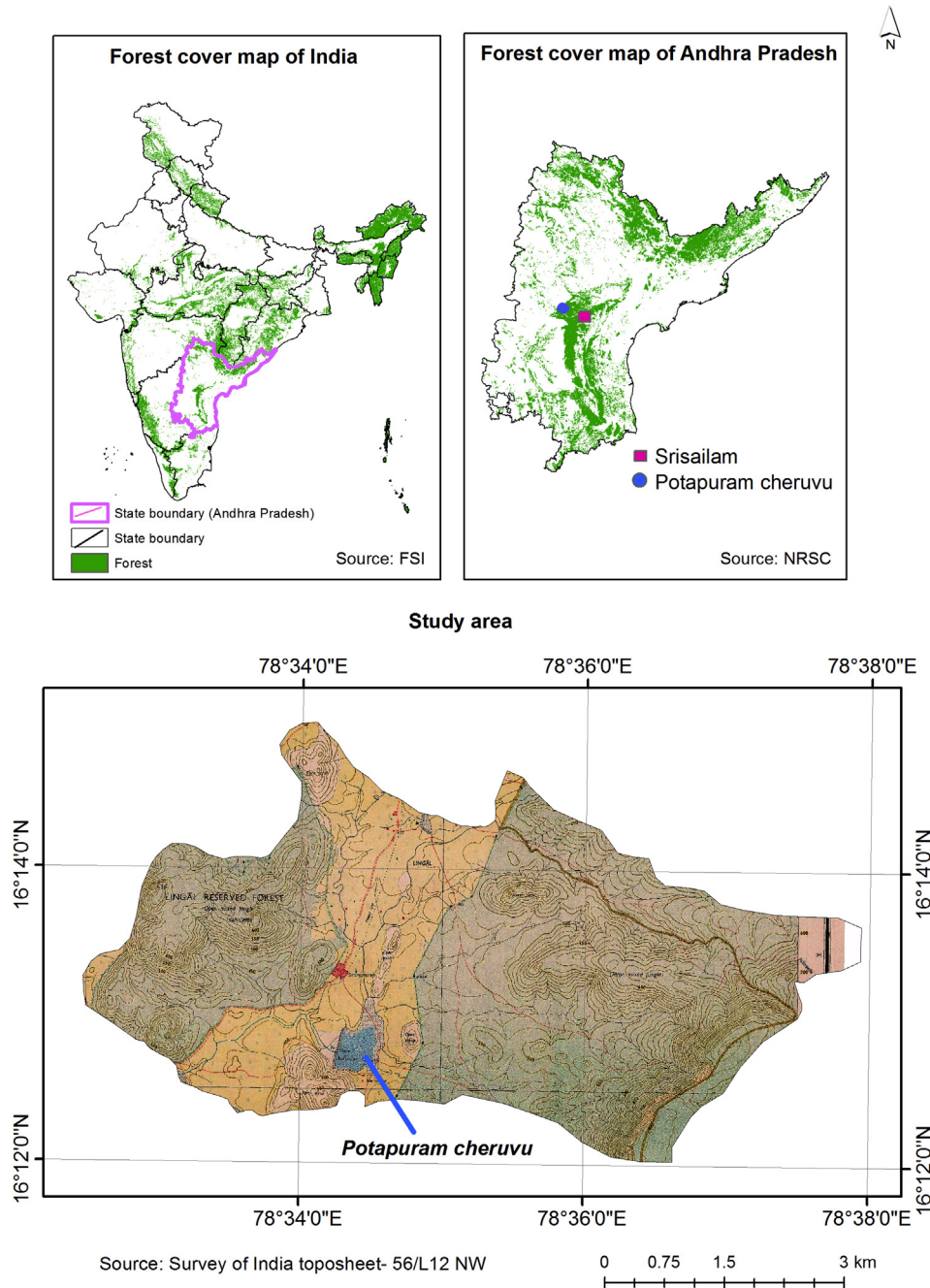


Fig. 1. Study area, locating the coring site Potapuram Cheruvu.

inscriptions (epigraphical records) often found in the site are used to date the construction of this bund, which indirectly provides an estimate on the chronology of the tank.

These tanks date to AD 450–500 (Subbarayalu, 2012), although sources from ancient Tamil literature take the date further back (Srinivasan, 1991). The sediment record is likely to be much older. Finer changes over even short periods of the last few centuries are efficiently captured in the sediment records of these tanks. One important advantage of analyzing such non-system water bodies, not linked with major rivers, is that the organic inputs to the tank, including pollen grains, probably originate mainly from within a relatively short distance, which should allow reconstruction of the local vegetation more precisely. Topographic maps of the area clearly show that no major river or stream feeds the tank and even

during the monsoons it is fed only by runoff from the slopes. The available instrumental records of rainfall of the station close to the site – Achampet, Mahabubnagar district, Andhra Pradesh, and RS imageries of the tank and its watershed during the past three decades facilitate an easier correlation of the inferred vegetation with climate and land use.

2. Materials and methods

2.1. Site selection and regional setting

The short-listing of potential sites and the final selection were made based on a combination of remote sensing and field surveys of the selected areas. Based on an initial RS analysis of imageries of

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