

Unexplored Indian Forest Canopies: Are we dealing with an eclipsed view of our biodiversity?

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Considered as the next biotic frontier, forest canopies are among the most species rich and highly threatened terrestrial habitats. Unlike the sheltered under storey in the forest, the forest canopies are a highly variable environment. They are exposed to greater daily temperature and humidity fluctuations, experience high levels of solar radiation, strong winds and pelting rain that could make the habitat extremely inhospitable for most organisms. Despite these extremes, canopies contain a major portion of the diversity of the organisms and constitute the bulk of photo synthetically active foliage and biomass in forest ecosystems.

Unlocking the secrets in the forest canopies has been a fascinating topic of research and adventure in the past and continues to be one of the priorities of biological research today. Studies on canopy arthropods have changed our estimates of global species diversity from 1-5 million to 30 million (Erwin 1983). Research in this high frontier continues to uncover new species. The discovery of a new species of canopy scorpion, by scientists from the Indian Institute of Wood Science at Bangalore in the evergreen forests of Western Ghats made international news. Similarly there are still several species of arthropods and lesser organisms, of both the plant and animal kingdom, that are yet to be discovered and identified. The diversity in the forest canopies can be attributed to its complex three-dimensional structure which affords opportunities for niche diversification and vertical stratification (August 1983, Ozanne, et. al. 2003). With such high biodiversity one could easily expect that the tropical forest canopies are also an arena for multitude of interactions; many of which still needs to be understood (Ozanne, et. al. 2003). The function of forest canopies and the ecosystem services that it provides remain fairly unknown.

In the early years of canopy research, studies were conducted either by training monkeys to collect leaves or fruits, or by making occasional and opportunistic forays into the canopy by biologists, or as in India by building ladders on tree trunks. Advances in climbing techniques borrowed from disciplines like speleology and rock climbing, provided canopy research a much needed impetus. The Single



Construction of Sarawak canopy crane [credit: T. Nakashizuka]

Rope Technique (SRT) has been popular with scientists over the world for the past three decades (Perry 1978)(srt pics). SRT and adventurers to access the canopies for a multitude of research and recreational pursuits. The use of large construction cranes and walkways to gain access to the canopy has emerged as a favored method recently. There are 11 such cranes in operation around the world in tropical as well as temperate forests. (Mitchell 2001).



Accessing the canopy through ladder-
Soubadra Devy

And other innovations like the remarkable lighter-than-air “*Redeau de Cimes*” or sky raft, envisaged and developed by Francis Halle’ and his team in France (Halle’ 1990) have also been used. The COPAS tower and cable system in French Guiana is another installation that offers low-cost access to the canopies.

Being the interface between the earth and the atmosphere, many important interactions take place in the forest canopies especially those relating to gas exchanges. Atmosphere interactions of the canopy contribute to the carbon cycle and it is a key habitat for monitoring global climate change drivers such as CO₂ and habitat degradation. The international network of FLUXNET towers, that measure canopy flux of water vapor, CO₂, and energy, have led to a better understanding of transpiration and photosynthesis regulation. In the recent scenario of global climate change, these phenomena acquires significance for understanding elevated CO₂ concentration and its effects on the forest canopies, as well as the cascading effects it may have on the plants and animals that live and depend on it (Devy and Ganesh 2003). Canopies play an essential role in the hydrological cycle at the local, as well as the regional scale. The knowledge of ecosystem processes such as pollination and herbivory are being significantly enhanced by canopy research. The mechanisms underlying these processes may be critical for the survival of these forests in the long-term, as extreme specializations are essential for the perpetuation of certain species.

Canopy research in India

Canopy research in India is still in its infancy. Despite encompassing four of the 25 biodiversity hotspots of the world, the canopies of our forests remain relatively unexplored. A study on the social bee pollination of canopy trees in Kalakad Mundanthurai Tiger Reserve (Devy 1999) was a pioneering canopy study in India. The same site has also witnessed other canopy related work over the years (Devy and Davidar 2003, Ganesh and Devy 2000). Currently, research on canopy birds and small mammals, as well as epiphytes is being carried out by ATREE at KMTR.

The development of canopy research in India requires infrastructure that would help more people take up this challenge to explore the unknown. Researchers require easy access to safe and standard canopy access techniques and equipments. It is essential for scientists working in the canopy and related fields to come together and form a network to help facilitate interaction, knowledge sharing and collaboration. A national forest canopy program is the call of the hour.



ATREE team up a canopy through single rope technique: Photo R.Ganesans

Institutions working on Canopies

Ashoka Trust for Research in Ecology and Environment (ATREE) -www.atree.org-

ATREE - is a non-profit organization that combines the principles of natural and social sciences to conserve biodiversity and promote sustainable development. ATREE has made the wet forest canopies accessible to canopy studies in Kalakad-Mundanthurai Tiger Reserve. So far, more than 5 ? trees have been rigged and are accessible for single rope access.

Institute of Wood Science Technology (IWST)

IWST has developed facilities and expertise in identification of woods and provides service in this field. Its user organisations include public sector enterprises, defence establishments, police, forest departments and industries. YB Srinivasa from IWST has been a pioneer in studying the canopy insects through knock down technique in lowland evergreen forests of Karnataka. He discovered a scorpion which occurs exclusively in the canopy of the evergreen forest.



Canopy scorpion: YB Srinivasa

International networks

Canopy scientists have been coming together in the recent years at the International Canopy conferences held once every four years, the fifth one will be held in Bangalore from 25th to 31st October 2009. Organizations like the International Canopy Network (ICAN) and the Global Canopy Programme (GCP) have played a major role in fostering communication and partnerships between canopy researchers worldwide.

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