

An Exploration of New Ways to Understand and Conserve Forest Canopy Biota

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Abstract:

Forest canopies are an emerging focus for conservation. Fragmentation and resource extraction increasingly exert negative effects on forest canopy biota. We propose innovative approaches to assess and integrate multiple values of tree canopies in pristine and human-affected temperate rain forests. A team of “forest experts” [ecologists, sociologists, and nature artists] and “forest novices” [people rarely exposed or historically unfamiliar with trees who may provide fresh insights on forests, including inner city children, Icelandic Laplanders, and incarcerated adults] – will collect data and produce images of forest canopies. Results will be integrated at workshops and in written reports. Protocols will be applied to other forests, using extensive contacts with ongoing projects and conservation institutions around the world.

Project Description:

Forest canopies are complex and integral parts of our landscapes. The forest canopy has been termed “the world’s last biotic frontier”, and is one of the richest yet most poorly studied habitats in the biosphere. Canopies house the photosynthetic machinery of the biosphere, influence exchanges of atmospheric energy and matter, and provide habitat for wildlife (1). However, the window of opportunity to conduct canopy research is dwindling rapidly as forests become degraded and fragmented due to human activities.

Humans tend to conserve only those objects or places whose values have been assessed and articulated. Understanding the value of tree canopies and their habitats is essential to their conservation. However, humans have only a poor and fragmented ability to assess their real value. Scientists have tended to focus only on their ecological values (2), which may not be considered compelling by policy-makers who are pressured to meet immediate social needs. Only recently have conservation-minded economists added the benefits of “ecosystem services” that forests perform (e.g., watershed protection, filtration of groundwater) to the traditional worth of forests (timber and fiber products) (3). The aesthetic and spiritual values of forests are difficult to quantify in any “currency”, and so they have been almost totally overlooked in previous assessments. Traditional assessments have also been limited by the cultural biases and historically-bound misconceptions that accompany single-discipline studies.

The project I describe here is part of a large vision for forest canopy conservation around the world, a vision that encompasses - but goes beyond - traditional approaches to conservation. I first present the larger scope for this vision, and then identify the pieces for which we request funds from NGS. Supporting documents for current and pending support that complement this request are attached. The proposed project will serve as a case study to address issues that accompany human attempts to conserve complex ecosystems in ways that address multiple facets of the human spirit.

The foundation for this work began in 1994, when I co-founded the International Canopy Network (ICAN), a non-profit group whose mission is to enhance canopy conservation by fostering links between researchers and educators (attached). This led to the conception of novel approaches to

assess the numerous values of forest canopies in quantitative, inclusive, and synthetic ways. My objectives are to understand how to measure and then consciously integrate the ecological, economic, and aesthetic values of forest canopy organisms and interactions. I wish to assemble an interdisciplinary team to examine these values in mosaics of forests that include pristine and human-affected stands (e.g., early successional and managed forests, forest fragments).

The general approach is to bring together people from a diversity of backgrounds to a single set of forest stands under consideration for conservation. I will first assemble a team of "forest experts" - ecologists, economists, and nature artists - who will document values of forest canopies of trees located in areas of different land use histories, using the tools of his/her specialty. I will then bring in a group of "forest novices" - people who have not been formally trained or who historically lack exposure to forests, and therefore can provide us with new and potentially important insights. These perspectives may differ considerably from those entrained in traditional disciplines.

The "forest experts" will include: a) ecologists, who will measure certain ecological values (e.g., canopy structural diversity and its relationship to energy capture (4); b) sociologists, who will measure economic values (e.g., abundance of horticultural and medicinal plants; enhancement of soil and watershed quality), and c) artists, who will articulate the aesthetic/spiritual values (e.g., inspiration for artists; places for personal, tribal, and societal renewal). Contacts for these groups will come from existing collegial relationships via the ICAN and with faculty colleagues at The Evergreen State College (TESC), where interdisciplinary teaching, research, and creative work is a seminal part of our pedagogy.

The three groups of forest non-experts include: a) children (9-12 yrs old) raised in an urban environment, whose contact with real trees and forests are limited; 2) adult inhabitants of polar or desert regions (e.g., Icelandic Laplanders or Bedouins), who have been culturally exposed to a treeless landscape and who may not have the language or background that classifies trees and forests in ways that temperate and tropical region dwellers have; and 3) incarcerated adults who have been deprived of access to trees and forests because they have been in jail for many years. Contacts for these will come from the ICAN, GCP, and TESC (the latter has a "College in Prisons" program, with contacts in medium-security penitentiaries).

For the proposed study, surveys and artwork will focus on single watershed in the Pacific Northwest, Ellsworth Creek. This 5000-acre landscape is a coastal temperate rain forest that is the locus of an active conservation effort by The Nature Conservancy (TNC). TNC staff are carrying out biotic inventories, taking aerial imagery, and developing land management plans at this site, using traditional ecological and social science techniques.

Canopy access techniques will include use of remote imagery (5), single-rope techniques (6), and the use of temporary hanging platforms used by mountain-climbers (7). Participants will converge on the field site for a two-week period between June-August, 2001. Each team of forest experts will gather appropriate data and create images, drawing upon expertise and equipment funded from our linked sources (attached). Forest novices will spend time in the field independent of the forest experts to describe forest canopies and their values from their own perspectives, using media that best suit their means of expression.

I will then convene forest experts and novices in a workshop format at TESC within four months of the field season. All participants will present their results e.g., artists will assemble a show of their work, forest ecologists will present their spatial data, biodiversity experts will display their collections, prisoners will display whatever they create. The group will then return to the field for another week to re-evaluate the forest canopy. Forest experts and novices will be grouped to collect data or images, using each other as co-workers. For example, an ecologist will have an economist assist with bird data collection; an American artist will work with a Laplander to create a piece of 2-

dimensional art. After this round, the new results will be displayed and discussed at a second workshop.

I then anticipate applying this approach to other forest canopies in other forest types around the world by linking to other researchers and study sites with whom I have contact via the existing networks of the ICAN and the GCP (attached), prioritizing sites where there is significant ongoing canopy research. These include Monteverde, Costa Rica, where I have a current NSF grant and 23 years of canopy ecological research (9). There, a vibrant art community (painters, sculptors, musicians) has historically created images of forests and trees, and they are interested in integrating their work with conservation. A second site is the Apolobamba N.P., Bolivia, where I have a pending NSF grant with the Amer. Museum of Nat. History to carry out biotic inventories of many taxa (e.g., invertebrates, birds, epiphytes). I then intend to extend these protocols to many of the nine existing field stations that support canopy cranes (attached). Many of these sites have existing NGS projects funded by the CRE.

Data and images generated from this project will be stored, analyzed, and archived into an existing canopy database, which was created in 1998 as part of an NSF project to develop software and database tools for the emerging field of canopy studies (attached). To date, we have structured a centralized and relational web-based database (written in Sequel Server) that includes cross-referenced fields of researchers, projects, scientific citations, images (photographic and art), visualization programs, meetings, and study sites (<www.evergreen.edu/canopydb>). By having one central repository for a wide diversity of data types, canopy information can be more easily linked, shared, and re-used by others in allied fields around the world than ever before.

The protocols we develop in this project will assist the forest canopy research community to harmonize and develop protocols that will generate much-needed comparable data. As with other "youthful" fields of science, canopy studies currently suffer from lack of standardized ways of collecting, storing, and analyzing data. Although no one can force protocols on scientists or artists, the existence of a well-planned and well-coordinated set of projects that provide for comparative work will jettison the nascent field of canopy research to a more mature state - and one that can move far faster and more efficiently to answer pressing environmental questions.

In addition to the forest canopy information we generate and integrate, this NGS project can serve as a model for other emerging fields of ecology and environmental studies. Other parts of the natural world are also under threat from human activities (e.g., arctic tundra regions, marine kelp forests) and their values must be fully and fairly assessed. We plan to disseminate the strengths and challenges of our approach to researchers in other fields by publishing results in general science journals and participating in meetings such as the American Association for the Advancement of Science, that is, to step outside and beyond our narrow disciplinary fields.

My desire to forge links between the collection of research data and its dissemination to the general public can be bridged more easily with the NGS than with standard scientific agencies where emphasis is almost entirely placed on communication with other scientists. Recently, the NGS has publicized forest canopy research in its magazines and television programs, which has greatly contributed to the high public interest in treetop investigations. Their film on tropical canopy research ("Heroes of the High Frontier"), received the Emmy Award for Best Documentary Film (2000). Another program (possibly a series) on forest canopy ecology, with me as "presenter", is under NGT's consideration (Jan. 2001). We anticipate including results from the proposed research into the film.

This project, with its multiple contributors, interdisciplinary approaches, and multiple links to large-scale international projects, might seem to be a "high risk" project to more conventional and tradition-bound institutions such as the NSF. However, the NGS is uniquely adapted to support this

project and the work that extends from it, as it has a long history of fostering research in all fields that relate to human exploration and research. It recognizes that such complex human dreams as wisely using and conserving all values of forests requires this integrative approach.

1) Longino J. & R. Colwell. 1997 *Ecological Applications* 7:1263-1277. 2) Lowman M. & N. Nadkarni 1995. *Forest Canopies*. Academic Press, San Diego, CA. 3) Barrett G. & A. Farina 2000. *Bioscience* 50:311-313. 4) Parker G. 1997. *Northwest Science* 71:261-270. 5) Merenti M. & J. Ritchie. 1994. *Wat. Resour. Res.* 30:1329-1337. 6) Perry D. *Biotropica* 10:155-157. 7) Nadkarni N. *Biotropica* 20:350-351. 8) Nadkarni N & N. Wheelwright. 2000. *Monteverde: Ecology and Conservation of a Tropical Cloud Forest*. Oxford Univ. Press, New York.

Significance of the Research:

Understanding forest canopies is central to three of the most pressing environmental issues facing humans today: a) maintenance of biodiversity, b) stabilization of global climate change through carbon sequestration, and c) sustainability of forest resources. Our research will add to the base of ecological and economic knowledge for a mosaic of forest types, and provide harmonized protocols to make comparable measurements in other forests around the world.

This project will help launch new and interdisciplinary ways to understand forest canopy biota and processes, and human effects on them. Integrating the fields of ecology and economics with input from expressive artists will help breach the wall that has often blocked traditional efforts to implement conservation. This could provide a model approach for other emerging areas of science.

The NGS is currently creating educational materials on forest canopies through its Magazine and television programs. The proposed project will vividly illustrate how your Society is uniquely able to bridge the typically wide gap between scientific research and communication to the general public about issues concerning conservation of natural and human-affected landscapes.