



Canopy in the Clouds:

Education Toward Whole Ecosystem Conservation

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The Challenge: Shifting Focus to Whole Ecosystem Conservation

Unprecedented global warming continues to attract attention as the most pressing environmental conservation crisis of our generation. Scientific research and outreach methods, while beginning to make significant gains and garner international attention, remain focused on the survival of a few charismatic species. This work highlights only a fraction of the complex interactions between changing global processes and local ecosystems, often neglecting to portray the interdependency inherent to nature. Our aim is to expand the discussion about conservation to include the preservation of whole ecosystem health and function by raising public awareness about the impact of human-driven global climate change on the entirety of a forest ecosystem. Partnering sound scientific research with the development of educational supplements and outreach for a diverse international audience, this project seeks to 1) promote conservation through progressive education and 2) promote the excitement of conducting scientific research.

The Setting: Global Warming in Tropical Montane Cloud Forests

Few places in the world possess the beauty and charisma intrinsic to tropical montane cloud forests. Defined by their geographic isolation and frequent immersion in clouds, these rare ecosystems are renowned for their unparalleled diversity of flora and fauna. Despite their prominence as international biodiversity hotspots and priorities for conservation, the world's tropical montane cloud forests are threatened by abrupt global climate change and deforestation. Changes to the frequency, intensity, and timing of the cloud events integral to the health of these ecosystems are of particular concern. Driven by rising land and sea surface temperatures, these cloud event changes are reducing plant canopy exposure to the moisture that creates the microclimate and the water cycles necessary to sustain tropical montane cloud forest flora and fauna. Scientists have already observed widespread local extinctions and population shifts in rare bird, frog, and salamander populations. The beauty of tropical montane forests is disappearing before our eyes.

The Science: Understanding the Influence of Clouds on Plant Health

Despite intensive research on changes to animal populations, little research has explored the effects of global warming on the tropical montane cloud forest ecosystem as a whole. Research on plant community response to global warming, with strong implications for habitat structure and functioning, has only recently been undertaken. A project initiated by scientists at University of California, Berkeley is beginning to explore the effects of altered cloud events on plant canopy physiology in tropical montane cloud forest. The project is among the first dedicated to understanding how global warming will alter the health, survival, and distribution of tropical montane cloud forest trees. These efforts will inform conservation efforts by identifying critical concerns and by prioritizing future research.

The Outreach: Targeting Classrooms and Popular Media

This research provides an ideal setting in which to promote conservation education and excitement for science. The project will achieve these goals by 1) using photographic images to tell the story of cloud forest canopy biodiversity and functioning in a changing world and 2) using high definition video to tell the story of the challenges and excitement involved in performing scientific research. By utilizing still and time lapse photography, as well as high definition video, we can capture both breadth and depth in our story.

Photography best captures individual moments, while video is capable of capturing rapid changes in the forest and the long-history of science through interviews. Finally, the associated research project will provide canopy access utilizing non-invasive fixed rope ascension and open a window into an entirely new ecosystem.

These stories will reach beyond the intrinsic beauty of the forest canopy, seeking to understand why the cloud forest is important, how we search for scientific understanding, and where there is hope for a new generation of scientists. As such, our primary target audience is the next generation of scientists in both the United States and Costa Rica.

To tell the story of the cloud forest and current canopy research, we will create a traveling exhibition incorporating both photography and video designed for display in local science and natural history museums across the country. This traveling exhibition, accompanied with slideshow lectures, will be designed to target the general public, with an emphasis on K-12 students. We will pair this exhibition with an educational supplement to be distributed free to classrooms. The supplement will contain five prepared lessons designed for rapid incorporation into classrooms through short films, lesson plans, and web-based supplements. Lessons will stress 1) an introduction to tropical montane cloud forest and climate change, 2) ecosystem complexity, 3) canopy biodiversity, 4) the challenges and excitement of science, and 5) creating conservation for the future.

The Timeline: Coordinated Release

Our fieldwork will occur during August 2008 and January 2009, ensuring exposure to both the wet and dry season and providing a more thorough understanding of life in the tree canopy. Postproduction work will begin immediately upon return from both trips. The educational supplement will be released for use during in the spring of 2009 and the traveling exhibition will premier at the same time, with all the project products coordinated through our website: www.canopyintheclouds.com. It is our hope that the exhibition will continue to travel for approximately three years and visit approximately twelve different institutions, maximizing our exposure and impact. The educational supplement will be distributed for free on the worldwide web and also use a targeted distribution through collaboration with the non-profit organization Teach for America to reach a wide audience of underserved student populations.

Funding and Affiliations: Building a Platform of Support

Initial funding has been secured through a Young Explorers Grant from the National Geographic Society's Expeditions Council. We are fortunate to include New Tribe, Inc., New England Ropes, and Tree Trek as our current sponsors for tree climbing equipment. Additional applications for funding are pending with the National Geographic Society, Lewis and Clark Exploration Fund, the Explorer's Club, Sigma Xi, and the Centers for Latin American Studies and Science, Technology and Society at University of California, Berkeley.

The project has been approved for affiliation with the non-profit research and education organization Monteverde Institute (MVI), based in Monteverde, Costa Rica. MVI will provide logistic support and facilitate access to field sites. Finally, MVI will serve as a conduit for our project team to share its expertise and interact with local students, scientists and members of the media in an effort to build local capacity.

The Project Team: Expertise and Dedication

We are fortunate to have assembled an interdisciplinary team of young professionals who bring to the project tremendous experience, dedication and passion. To build capacity and insure our success, our work will be carried out with strong local collaborators and an international advisory group. The photography and outreach is coordinated by photographer Drew Fulton, the videography by freelance videographer and production manager Colin Witherill, and the science by ecologist Gregory Goldsmith.

The Project Coordinators: Joining Science and Media

Drew Fulton (www.drewfulton.com) is a photographer with a passion for exploring the natural world. As an avid birder and lifelong naturalist, he brings his knowledge and experience to bear through his photographs. Fulton recently completed a year as a Thomas J. Watson Fellow, during which time he traveled nearly 40,000 miles through Australia in order to locate and photograph Australia's over 300 endemic bird species.

Previously, Fulton earned a B.A. with honors from Bowdoin College where he designed a major combining photography with environmental science and ecology. His honors thesis used a six-month residency in Everglades National Park as the basis for a book of photographs and essays entitled *Everglades Imagery: Intimate Detail of a Vast Landscape*. Fulton's photographic story of the modern Everglades, presented in both a scientific and historical context, earned him the College's Richard F. Martel Jr. Memorial Prize

Greg Goldsmith (www.ocf.berkeley.edu/~grgoldsm) is a doctoral student in the Department of Integrative Biology at the University of California, Berkeley, where he holds a National Science Foundation Graduate Research Fellowship. His research focuses on the use of plant ecophysiological techniques to understand the effects of climate change on plant communities. Goldsmith's work aims to generate mechanistic science with the ability to inform real-time conservation and restoration efforts. He has previously conducted arctic, alpine, neotropical, and paleotropical research with funding from the National Science Foundation, the Arctic Institute of North America, and the Freeman Foundation for Asian Studies. Goldsmith earned a B.A. with honors in biology and environmental studies from Bowdoin College.

In addition to his background as a scientist, Goldsmith brings significant experience in teaching and communicating ecological science. In addition to teaching tropical biology for the non-profit organization Ecology Project International, he has lectured to public and scientific audiences at Smithsonian Tropical Research Institute, Toolik Field Station, the Maine State Climate Summit, Simmons College, and the University of California, Berkeley. His research is published in *Forest Ecology and Management*, *Revista de Biología Tropical*, *Biotropica*, *Journal of Ecology*, and *Frontiers in Ecology and the Environment*.

Colin Witherill (www.broadreachimages.com) is a cinematographer specializing in adverse climates and remote locations around the globe. Captivated by natural beauty and the challenges of capturing its nuances through moving pictures, Witherill created a self-owned and operated production company, Broadreach Images. Since its launch in 2006, Witherill has been the primary camera operator on several nationally syndicated television programs, commercials, and feature films. His clients include Nike, PBS, The Weather Channel, Subaru, Fox Sports Network, CBS, Patagonia, Warren Miller Entertainment, and World Wildlife Foundation. Prior to beginning Broadreach Images, Witherill earned a B.A. in anthropology from Colby College.

Witherill's recent film *Ski For Nature*, captured on the Kamchatka peninsula in Russia, documented initial efforts to create a working model of sustainable, backcountry ski tourism for the region. Desperately needing funds to fend off the onslaught of environmental exploitation, steps were taken to capture the highlights and explore the potential problems of attracting eco-minded winter enthusiasts to experience Kamchatka's vast winter wilderness.