

Saving Tropical Forests Through International Research Collaboration

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SAVING TROPICAL FORESTS THROUGH INTERNATIONAL RESEARCH COLLABORATION

Tropical forests are some of the most biodiverse ecosystems on the planet, but extensive deforestation has pushed many species to the brink of extinction. Conservation efforts have been limited by political and socioeconomic backgrounds of each region. By integrating ecological and social research techniques, **Dr Peter Beck** at St Edward's University, **Dr Michael Wasserman** of Indiana University and their colleagues examine the effectiveness of tropical forest conservation strategies and the factors that encourage people to conserve their forests. Their extensive project also provides international research experience to STEM students from underrepresented backgrounds, and helps foster scientific and cultural exchange between countries.

Precious Ecosystems

Tropical forests are home to at least half of all biodiversity on Earth, including many 'endemic' species – those only found in that region or habitat. These forests also provide valuable ecosystem services, at both local and global scales. For example, with their high year-round productivity, tropical forests help to regulate the climate by capturing and storing atmospheric carbon. They help to purify air and water, while also providing vital resources for local communities.

However, the area occupied by tropical forests has been reduced by half through deforestation over the past fifty years. Vast swathes of forest have been cleared to create cattle ranches or to grow produce such as bananas, palm oil and pineapples. With their natural habitat shrinking, many wildlife populations have also declined, with some becoming extinct.

Primate populations have been particularly affected, with more than half of all species classified as vulnerable or endangered. As well as being some of our closest relatives, non-human primates act as 'ecosystem engineers' by dispersing seeds and altering vegetation. Therefore, the loss of primates from tropical forests has the potential to irreversibly change these habitats. Primate populations occupying degraded habitats are also more likely to become stressed and more susceptible to diseases, and are more likely to be exposed to pollution, such as agricultural pesticides.

Historically, conservation efforts have focused on preserving a portion of the remaining forested areas and species by creating protected areas, such as national parks. However, local communities often rely on natural resources for their livelihoods, and as such, it has become increasingly difficult to create new protected areas. A lack of political support and enforcement has



Student researcher Desirée Nieves Canabal in Costa Rica.

also impacted the effectiveness of these strategies. As a result, policies providing incentives to local communities to preserve the health of forests without the creation of additional protected areas have become more widespread. These alternative strategies, however,



Dr Wasserman (left) and Dr Beck (right).

may not be any more effective at conserving tropical forests than protected areas.

Dr Peter Beck, Professor of Environmental Science and Policy at St Edward's University, has been examining the effectiveness of various tropical forest conservation strategies in Costa Rica and Uganda since conducting his dissertation research at Indiana University. Along with his colleague, Dr Michael Wasserman at Indiana University, Dr Beck leads an international research project funded by National Science Foundation's International Research Experience for Students (NSF – IRES) grants.

As part of this initiative, STEM students are trained in ecological and social research methods through independent projects facilitated by Costa Rican hosts at the Organization for Tropical Studies and Osa Conservation. These students, the majority of whom come from groups underrepresented in STEM, are given the opportunity to gain valuable research experience while contributing essential knowledge to improve conservation outcomes.

Investigating Conservation Strategies

Dr Beck and Dr Wasserman successfully devised and implemented the IRES project in Costa Rica, providing international research experience to 16 students, and have recently received IRES funding to continue the project and expand their research to include Panama and Uganda. Rather than serving as research assistants, students design and conduct their own research projects under the guidance of the principle investigators and the foreign hosts.

To collect information on forest conditions and primate populations, students implement a range of field techniques, such as camera traps, air and water quality sampling, and



Amy Hall and Meagen Wallace setting an acoustic recorder to monitor bat diversity in Costa Rican forest.

measuring primate hormone levels through faecal sampling. This information provides a measure of the effectiveness of conservation strategies in these areas, revealing the extent that economic incentives and agricultural practices influence conservation outcomes.

Costa Rica, Panama and Uganda are ideal regions for comparisons, because they have significant differences that have caused complications during previous evaluations of conservation strategies. 'By examining similar forests with different conservation incentive policies (Costa Rica and Panama) and different forests with similar conservation incentive policies (Costa Rica and Uganda), we will be able to evaluate the largescale effectiveness of conservation incentive policies, such as payments for ecosystem services and ecotourism, alongside the effects of agricultural practices linked to deforestation, air and water pollution, and biodiversity loss,' explains Dr Beck.

So far, the students' projects have measured the levels of stress hormones in primate faecal samples to investigate the effects of human disturbance, investigated bat distribution and diversity, examined the effects of forest fragmentation by measuring tree size and abundance, surveyed local landowners about agricultural chemical use and conservation practices to assess their impact on local forests, and compared the effectiveness of ecotourism versus direct landowner payments in forest conservation.

In Costa Rica, a portfolio of protected areas, payments for ecosystem services, and ecotourism activities implemented in the 1990s have successfully restored forest cover from around 25% to over 50% by 2011. With the aim of quantifying the effectiveness of each conservation strategy, Dr Beck's and Dr Wasserman's students conducted surveys of private



Project Manager Eric Johnson and student researchers Amanda De La Rosa and Meagen Wallace in OTS laboratory.

landowners to determine their participation in ecotourism and whether they received payments for ecosystem services. Their results indicated that a combination of incentive strategies was the most successful in slowing the rate of deforestation and improving the number of primate species visiting these areas.

By expanding this research to Panama and Uganda, Dr Beck and Dr Wasserman also hope to incorporate evaluations of how socioeconomic factors impact the effectiveness of conservation strategies. The researchers found that wealthier landowners with larger landholdings in Costa Rica were better able to take advantage of ecotourism and payments for ecosystem services.

‘As Costa Rica and Panama have much lower levels of deforestation and are significantly wealthier than Uganda, our international comparisons will enable examination of whether level of threat and income level affect the effectiveness of incentive policies,’ Dr Beck explains. ‘Moreover, Costa Rica and Uganda have implemented payments for ecosystem services, while Panama has not, thus enhancing our examination of the effectiveness of this incentive. Further, although all three countries promote ecotourism and have reserved relatively large amounts of land as protected areas, levels of tourist activity vary across the countries.’

Central Nodes for Collaboration

Collaboration is an imperative part of addressing global environmental problems, such as the largescale deforestation of tropical forests. International arrangements that take advantage of the cultural, infrastructural, educational and economic strengths of each partner help to produce robust research and improved environmental outcomes. However, establishing effective collaborative networks can be a challenging endeavour. Through their IRES project, Dr Beck and Dr Wasserman have demonstrated that research stations can act as ‘central nodes’ – connecting all participants of the network.

During the initial phase of their IRES projects, researchers at three Costa Rican biological research stations were trained in a variety of ecological and social research methods, including the use of new, advanced equipment. In addition, the IRES funding has helped support the development of a fully functioning endocrinology laboratory for investigating the hormone levels of primates.

Dr Beck, Dr Wasserman and their colleagues demonstrated that participating in social research helped to foster cooperative relationships between field researchers and local communities. ‘Collaboration on non-biological topics, such as economic incentives and social networking, has expanded the areas of study of local researchers and enhanced their capabilities to participate in future interdisciplinary projects,’ says Dr Beck. Increasing cooperation and collaboration between researchers and the local community may prove to be vital in the efforts to overcome conservation threats outside of protected areas and field stations in tropical forests.

By applying ‘social network analysis,’ which examines the structures and types of interactions between participants in a group, the team illustrated how research stations act as central nodes by connecting governmental agencies, non-governmental organisations, tourists, students and researchers.

These research stations facilitate the establishment of local connections that cannot be achieved by Northern partners in the network directly, such as identifying research sites surrounding the station, negotiating permissions to conduct research at farms in the local community, arranging meetings with landowners and government officials, handling research permits, making reservations, and hiring field assistants or translators. These repeated in-person interactions facilitated by the research stations help to enhance communication and build trust.

The Work Continues

This IRES initiative demonstrates the potential power of collaborative networks to enhance environmental research and conservation outcomes. Additionally, it highlights the importance of multidisciplinary research in addressing global challenges. The incorporation of both ecological and social research techniques allows for a thorough examination of the decision-making trade-offs between payments for ecosystem services, ecotourism, and specific agricultural practices, and how these decisions impact tropical forest and primate conservation.

By continuing their research in Costa Rica and expanding to include Panama and Uganda, Dr Beck, Dr Wasserman and their network of collaborators aim to further untangle the factors contributing to conservation of these precious tropical ecosystems.



Meet the researchers

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Dr Peter Beck earned a joint PhD in Environmental Policy and Political Science from Indiana University, USA, before continuing his research career at St. Edward's University in Austin, Texas. Here he currently holds the position of Professor and Coordinator of Environmental Science and Policy, where his research and teaching interests lie in policies that integrate environment and development goals, conservation incentives, and campus sustainability.

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Dr Michael Wasserman received his PhD from the Department of Environmental Science, Policy, and Management at the University of California, Berkeley, in 2011. He is currently an assistant professor of Anthropology and Human Biology at Indiana University Bloomington, as well as principal investigator of the Primate Environmental Endocrinology Lab (PEEL). His research interests include primate ecology and evolution, environmental endocrinology, nutritional anthropology, evolutionary medicine, and conservation and sustainability.

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FURTHER READING

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