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Jeffrey A. Klemens
Thomas Jefferson University

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Department of Biological and Chemical Sciences, Thomas Jefferson University, Philadelphia, PA

Jeffrey.Klemens@jefferson.edu

AREA DE CONSERVACIÓN GUANACASTE (ACG) IN NORTHWESTERN COSTA RICA IS ONE OF THE MOST REMARKABLE SUCCESS STORIES IN TROPICAL CONSERVATION AND ECOSYSTEM RESTORATION. The evolution of ACG in many ways mirrors the history and development of tropical ecology as a whole. From its beginnings as a small historic site and nature preserve ACG has expanded to encompass a continuous swath of conserved wildland extending from the Pacific coastal marine zone to the Atlantic slope rainforests of north central Costa Rica. The physical growth of ACG continues today, with a focus that has shifted from large-scale land acquisition to targeted additions of high conservation interest. In the terrestrial realm, parcels of high-quality habitat continue to be acquired in collaboration with the non-profit Guanacaste Dry Forest Conservation Fund. In 2018 the Área Marina de Manejo Bahía Santa Elena was established as an area of sustainable use that complements Sector Marino, ACG's marine protected zone. Conceptually ACG has grown as much. It began as a classic example of preserve-and-protect conservation. Early research efforts, helmed by mostly extra-national, lone-wolf researchers, were focused on species discovery and natural history in remnant habitats. Eventually, as the dire situation of tropical nature was recognized, new modes of management and avenues of research emerged that were focused on forest restoration, the interconnection of diverse habitats, and biodevelopment to benefit the surrounding society (Allen 2001).

Approaches developed and fostered in ACG have shaped conservation not just within Costa Rica but throughout the tropics and beyond. Two well-known examples are the invention of the parataxonomist concept (Basset et al. 2004; Janzen 2004; Pringle 2017), and the development of the biological education program of ACG (Cruz & Blanco 2010). Both of these programs succeeded by a radical departure from contemporary thinking regarding the relationship between

a tropical wildland and its neighbors. Offshoots include the ongoing marine bio-sensitization project, a hyper-local initiative focused on children in the key neighboring community of Cuajiniquil, and the national bioliteracy project, BioAlfa (Janzen and Hallwachs, this issue). The development and elaboration of these programs has been driven by the efforts of a homegrown community of practical scientists and biodiversity managers who collectively represent a critical component of the ACG project's success.

A unique aspect of ACG is that although it exists today as a large, state-controlled conservation area, it retains some of the character of an academic research station. Scientific research has been central to developing the mission and informing the management of the conserved wildlands that make up the core of ACG. As a result, ACG has generated, managed, and disseminated much knowledge of its biodiversity via in-house efforts, while also consistently attracting researchers from within Costa Rica and around the globe in a virtuous circle of knowledge acquisition. Despite the fact that thousands of scientific papers, theses, and reports have emerged there have been few efforts to publicly collate or synthesize this work. The papers in this special section therefore synthesize results from some long-term ACG research programs that highlight unique aspects of the ACG experiment. The studies represent diverse timescales, disciplines, and levels of biological organization and place those results in the conservation context of northwestern Costa Rica.

As appropriate given their role in envisioning and constructing ACG as it exists today, Dan Janzen and Winnie Hallwachs (this issue) kick off the special section with a historical overview of the growth of ACG as an exercise in applied biodevelopment. Srivastava et al. (this issue) provide a brilliant example of a classic kind of ACG study – showing how a deep understanding of the natural history of a particular site, gained over many years of research (in this case at the

Pitilla Biological Station of ACG) can provide insights into underlying ecological principles. Melin et al. (this issue) review results from a decades-long investigation into primate biology in ACG initiated by Linda Fedigan in 1983. Their review is focused around the particular aspects of behavior and ecology that can be revealed by long-term study and provides future researchers at this site or elsewhere with dozens of starting points for future investigation. Hulshof and Powers review plant ecology of ACG, taking as their organizing theme environmental gradients within ACG (this issue). They describe how these studies will play a role in our understanding of tropical communities and response to the environmental changes that face the tropics in the future. Continuing with the theme of gradients, Smith and collaborators (Warne et al., this issue; Smith et al. this issue) provide two examples of the kind of work that takes advantage of not only the elevational gradients within ACG but also the long-history of biodiversity surveys and sample collection in ACG, including DNA barcoding based approaches developed in part using ACG organisms to describe elevational gradients in arthropods distribution and how they may be affected by climate change. Montalvo et al. (this issue) present a study that is only possible because of ACG habitat diversity, focusing as it does on the movement of jaguars through a habitat matrix made up of turtle nesting beaches and adjacent tropical dry forest. As evidence that ACG continues to expand its scope of interest and influence, the final paper reports early results of a biodiversity survey of ACG's marine zone, which until recently was a critical knowledge gap (Cortés & Joyce, this issue). This novel collaborative effort between ACG and Costa Rican university researchers has developed from groundwork laid by ACG and its historic commitment to biodiversity inventory, the development of local expertise, and integration or research outputs with ongoing education and outreach efforts.

Although it is difficult to predict the course of research, it is possible to make a few guesses at likely future directions based on the projects that are happening now. As demonstrated by many of the papers in this special section, ACG will continue to be a desirable research site for ecologists conducting work on environmental gradients, natural or anthropogenic, and biological interactions that cross habitat types. ACG will continue to be a flagship site for biodiversity studies due to its well-characterized flora and fauna and its status as the most heavily barcoded site in the world. As a key site in the Tropi-dry network, data from the dry forests of Sector Santa Rosa, including unprecedented data on dry forest physiology and gas exchange, are now linked to other dry forests throughout the hemisphere (Sánchez-Azofeifa et al. 2013). Increased networking of such ecological data will be key to integrating local knowledge into an understanding of global tropical forest dynamics under climate change. Finally, the continued application of biodiversity knowledge to proximate economic and environmental concerns in ways that improve lives in local communities remains an essential area of challenge and promise. Ongoing research at the Horizontes Experimental Forest Research Station of ACG focuses on plantations of native tree species, curation of seed sources, and technologies for forest restoration on degraded lands. This research and associated outreach provide a template for how to conduct and communicate research on scales that are economically meaningful to surrounding communities.

Santa Rosa National Park was declared in 1971 and ACG was born in 1989 (Janzen & Hallwachs, this issue; Allen 2001). In the nearly five decades that have elapsed since this experiment in tropical conservation began, ACG has already made massive contributions to our knowledge of tropical nature and how we might use and conserve it. It is a given that the future of tropical biology will be defined by the threats posed by habitat destruction and climate

change. Both the lessons already learned and the future lessons that ACG surely holds will be critical in rising to meet these challenges.

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