

Building a Collaborative Network to Understand Regional Forest Dynamics and Advance Forestry Initiatives in the Caribbean

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Abstract - Herein we provide concluding remarks drawn from and inspired by the discussions of the 5 working groups of the 16th Caribbean Foresters Meeting (CFM) about the needs, challenges, and recommendations to advance forestry in the Caribbean region. We also list key considerations and potential future research directions as presented in the various manuscripts contained in this Special Issue.

Introduction

The Caribbean Foresters have been meeting periodically since 1982 to bring together the broadly defined Caribbean forestry community. A welcome mix of previous participants and newcomers—a new generation of Caribbean Foresters—attended the most recent meeting. The theme of the 16th Caribbean Foresters Meeting (CFM) was “advancing an understanding of Caribbean Forest dynamics and creating long-term regional networks”. Participants presented reports that summarized the diversity of forestry activities in their home countries, which together described the range of conditions of forest cover within the region, particularly among the Caribbean islands (Fig. 1). These summaries stimulated discussions on regional forest dynamics and permanent sampling plots. The Caribbean Foresters also established and presented an award named for Gabriel Charles to honor outstanding contributors to Caribbean forestry (Table 1). Thus, the Caribbean Foresters community at large now has a formal platform to recognize the contributions of its members. Significant outcomes of this meeting were the reports of the working groups. These reports outlined a full agenda for forestry activities in the Caribbean for coming years. The Caribbean Foresters aim to not only facilitate and increase understanding of Caribbean forests, but also to play a role in the development of the next generations of forestry professionals in the region.

This Special Issue contains descriptive manuscripts focused on the various collaborative efforts to build a network for data sharing and advancement of forestry initiatives for the Caribbean (see Headley 2016, Heartsill and González 2016, Heartsill-Scalley et al. 2016, Lugo 2016, Marcano-Vega et al. 2016a). It also includes written contributions based on talks and posters during the 16th CFM (e.g., Banda Rodríguez et al. 2016, DeWalt et al. 2016, Gould et al. 2016, Jacobs et al. 2016, Marcano-Vega et al. 2016b, Rojas-Sandoval et al. 2016, Vallès and Carington 2016, Van Laere et al. 2016), and invited manuscripts of studies that could

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be fostered by the Caribbean Foresters to initiate collaborations and network-type comparisons (e.g., Lugo and Frangi 2016, McGinley 2016, Meléndez-Ackerman et al. 2016, Muscarella et al. 2016). The 16th CFM had 5 themed working groups: Biomass and Species Studies Across Islands, National Forests Inventories, Forestry Training Opportunities and Capacity Building, Information Sharing, and Mangroves and Dry Forests. We provide below a summary of the working groups' discussions about the needs, challenges, and recommendations for the community of Caribbean Foresters. In addition, here we provide key considerations for future studies, research questions, and directions drawn from the manuscripts published in this Special Issue.

Challenges, Gaps, and Recommendations from the Caribbean Foresters

Discussions among participants of the Biomass and Species Studies Across Islands working group resulted in consensus on 2 grand challenges associated with biomass studies. The first of these challenges was the difficulty of interpolating ecological variation in space and time across a multi-scale hierarchy. This challenge is described below in an excerpt from their workshop report:

“Small plots are usually necessary in rugged Caribbean island terrains where steep slopes make larger plots impractical. However scaling from small plot sizes to landscape scales incurs errors that need to be quantified and accounted. Errors can be quantified using calibration studies where plots are measured and destructively sampled. Unfortunately there is a lack of these types of studies in the Caribbean which makes the use of small plots

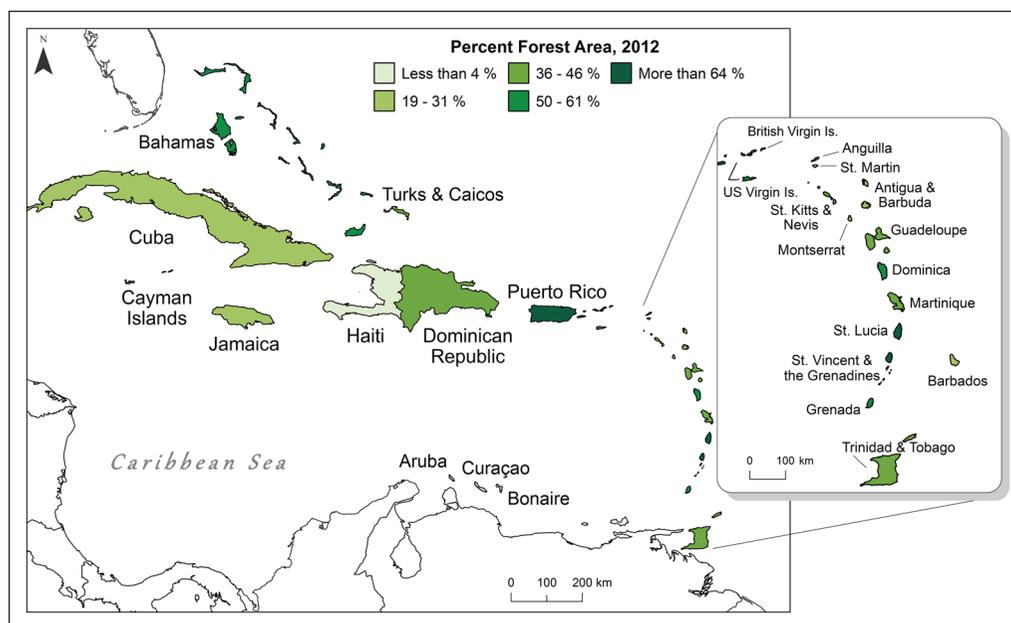


Figure 1. Caribbean island countries and their forest cover as reported for 2012 by the FAO. Accessed from World Bank (2015).

problematic [for large-scale extrapolation]. Because of this, mainstream biological and forest-management journals often reject biomass publications using small plots especially from researchers based in Caribbean institutions. This makes it difficult to share Caribbean information ...” (Torres-Santana et al. 2013).

Undoubtedly, most existing studies of vegetation and biomass in the Caribbean islands are based on field observations obtained from relatively small plots. Thus, the make-up of biomass studies as constrained by the inherent insular condition of most of the Caribbean is an issue that would need to be addressed if we are to increase the capacity for the synthesis of environmental issues—e.g., climate change, carbon sequestration, pollution, environmental degradation and health, resource depletion and waste—in this region. Specific recommendations

Table 1. The Gabriel Charles Award for Excellence in Caribbean Forestry Leadership.

Legacy	Gabriel Charles was a conservation pioneer and St. Lucia’s first Chief Forest Officer. He had many leadership roles in environmental protection and raising environmental awareness in St. Lucia and the Caribbean region. Among the many contributions he made were his efforts to establish St. Lucia’s Beaches and Parks Commission and the Environmental Commission. He also founded the St. Lucia Naturalist Society, and various other initiatives to increase environmental education and protection of forests and wildlife in the Caribbean region. Gabriel Charles was always looking for ways to promote forestry, conservation, and sustainable forest management in the island nations, and was very effective dealing one-on-one with people on behalf of Caribbean forestry. He was a leader and was comfortable whether he was addressing an international assembly of Caribbean foresters or explaining the importance of a single tree-species to a group during a field trip to a Caribbean forest. Gabriel was eager to improve the forestry situation throughout the Caribbean region. This motivation led to many successful ventures, including the idea of establishing periodic meetings of Caribbean foresters. In 1982, under the auspices of Gabriel Charles, the Caribbean Foresters met in St. Lucia for the first time.
Vision	The Caribbean Foresters Meetings (CFMs) have all been inspired by Gabriel Charles’ vision. This vision has 4 primary objectives that are addressed at every CFM: <ol style="list-style-type: none"> (1) To bring together regional leaders in forestry and natural resources to better address common problems, (2) To establish training programs for foresters, (3) To share information on the effects of natural disturbances and other events on forests and watersheds, as well as about their subsequent regeneration, and (4) To develop a regional system of communication, information collection, and data processing.
Award	Gabriel Charles passed away in August 1993, but left in place the foundations of his vision for Caribbean Forests. To unify and move us forward, we have added to the CFM an award, The Gabriel Charles Award, to recognize Charles’ vision. This award is presented to a person with knowledge and experience who works to bring together diverse people to advance forestry in the Caribbean region. The initial recipient of this award was Marilyn Headley, Chief Conservator of Forests, Jamaica, who was honored with this award by the Caribbean Foresters for her dedication and service to the forests of Jamaica and the Caribbean region. The award was presented in Boca Chica, Santo Domingo, Dominican Republic, on 7 August 2013. Afterwards, Marilyn presented the Keynote Address for the 16 th Caribbean Foresters Meeting.

to address this issue that were discussed within the working group are presented in Table 2.

The Biomass and Species Studies Across Islands working group also identified as a second major challenge the need for information sharing and local archiving of scientific knowledge. The following excerpt from the working group report illustrates the necessity for more collaboration among local and visiting scholars:

“Perhaps accompany them [visiting scientists] in the field as time allows [would increase collaboration]. In many cases [it] is outsider scientists [making] new discoveries on an island, but if no local person is with them, the work [and] knowledge that could be gained is not learned. Outsiders should ensure they communicate results (whether good or bad) back to the local entity in charge of forestry and/or natural resources. This could be enforced by permits and following up with annual reports.” (Torres-Santana et al. 2013).

The National Forests Inventories working group reported that most of the forest-inventory data from territories represented by conference participants are over 20 years old or are localized and without a national context. Also, most of these inventories were conducted by contracted foreign biologists and few local personnel remember the inventory techniques employed during those surveys (Marcano-Vega et al. 2016a). Consequently, future forestry studies in the Caribbean would benefit by building on results drawn from a larger collective of knowledge gained by both local and transient researchers rather than isolated studies and data. Caribbean researchers can advance our understanding of regional forestry and environmental issues by collating and integrating the results of work carried out by experts in various fields without consideration of whether or not they were Caribbean scientists. To strengthen the collaborative network of Caribbean Foresters, the National Forests Inventories working group also highlighted the need for adequate region-specific training in environmental sciences and the need to establish guidelines for collaboration.

Table 2. Recommendations from the Biomass Studies Across Islands working group (Torres-Santana et al. 2013).

- Find, share, and if necessary, publish previous calibration studies conducted in Caribbean forests of different types (mangrove, lowland evergreen/seasonal, montane/sub-montane and cloud forests).
 - If calibration studies are lacking in a particular forest type, perform the study. Calibration studies can be carried out in an opportunistic way when forests are cleared for development (such as roads or quarrying).
 - Compare estimates from different Caribbean studies to determine whether results vary among similar forest types.
 - If publication of biomass studies using small plots is still problematic in the mainstream biological and forest-management journals, then perhaps the Caribbean Foresters could develop their own forum or target a journal that will publish them (e.g., *Caribbean Naturalist*, *Caribbean Journal of Science*, *Acta Científica*).
 - Develop a special publication dedicated to the theme “biomass in Caribbean Forests”.
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Several working groups at the meeting addressed the specialized gaps, challenges, and recommendations associated with education and collaboration related to Caribbean forestry. In terms of education, the National Forest Inventories working group drafted a proposal to develop a series of training modules and regional workshops to enhance technical capacity (e.g., how to conduct forest inventories and analyze data collected using internationally acceptable standards; see Marcano-Vega et al. 2016a). Such efforts would represent progress toward addressing the knowledge gap highlighted in the the Global Forest-Assessment Report 2010, which indicated that the Caribbean was the only region for which forest data were lacking (FAO 2010, Marcano-Vega et al. 2016a). Furthermore, the Forestry and Training Opportunities and Capacity Building working group ranked candidate topics for short courses that could be included in a formal training curriculum in the following order of importance: (1) forest inventory practices including plant taxonomy methodology with standardization of species identification by listing the various common names, and the use of forestry tools like GIS and GPS, (2) forest utilization involving use of sawmills, reduced-impact logging techniques, timber technology for tropical species, dendrology, and the development of non-wood and non-timber forest products, (3) entomology and pathology, and (4) watershed management (Bloom et al. 2013). The Forestry and Training Opportunities and

Table 3. Some challenges and recommendations related to training needs identified by the Forestry and Training Opportunities and Capacity Building working group (Bloom et al. 2013).

Challenges

- Learning from completed and on-going research projects across Caribbean Islands.
- Downward trend in funding from governments for forestry.
- There is a knowledge and experience/technology explosion but no refresher courses to assist Caribbean foresters in staying current with developments.
- Many forestry officers will retire soon and there are no recruitment plans for those positions.
- How to improve management efficiency and deal with gaps and transitions in recruitment.
- Countries are at different levels of forest management.
- Organizations lack capacity, e.g., research expertise.
- Students take loans but find it hard to obtain appropriate employment and promotion.
- Insufficient notice of training opportunities.
- Governments' de-emphasis on and fragmenting of forestry departments.
- How to capitalize on the benefit of research done by visiting professionals in a hosting country.

Recommendations

- Reformulate forestry schools' curriculum to augment formal training with short courses (hands-on training).
 - On-the-job training with smaller, shorter courses on specific subjects related to the general understanding of natural resources.
 - Establishment of a scholarship program for Caribbean foresters.
 - Improve information sharing by adding an event calendar on the Caribbean Foresters Meeting website so all countries are aware of international and regional training opportunities.
 - Link training opportunities in forestry, climate change, and other natural resources areas to prevent knowledge gaps.
 - Centralize forestry-data collection and management of GIS/GPS layers in forestry organizations (although the appropriate software needed is costly).
 - Promote awareness of the different forestry management models available.
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Capacity Building working group also identified numerous challenges and recommendations related to training needs (Table 3). Although the various working groups identified many educational needs, one training priority—plant taxonomy with standardization of species identification—emerged from all working group deliberations as an unmet need and points at the core necessity of using systematics and technology for the advancement of forestry initiatives. The Biomass and Species Studies Across Islands working group articulated the need as:

“Species identification and systematics are critical for [the] management of forest resources. Correct naming of species allows [the] use of research and information gathered for the species previously to be applied to the management of the species. Correct taxonomic placement of the species relies on up-to-date systematic studies, these days most often involving molecular genetic studies. Although currently some work is ongoing and increasing, there is still [a] need for systematics studies on Caribbean plants. These studies on plant systematics need to be continually carried out and further need to be communicated to forest managers in the region so that they may draw on information from the studies on the correct species carried out in the past in different places. Plant species identification is heading for a period of crisis as many older para-taxonomists retire and their hands-on field knowledge is lost. Many Caribbean countries do not even have a botanist employed in their [governmental] staff, yet they still have the responsibility to properly manage forests and to address the 16 targets of the Convention of Biological Diversity’s 2020 Global Strategy for Plant Conservation. Others, such as Cuba, do employ many botanists, but their flora is quite large. Islands Territories (UK, French, Netherlands, USA) have more opportunities to learn abroad. The knowledge is not being sufficiently passed on for various reasons. This may be somewhat rectified by effectively archiving the information and skills, particularly through the use of modern technologies such as in digital formats, otherwise forest management in the Caribbean will be severely compromised.” (Torres-Santana et al. 2013).

The successful development of reliable and comparable studies of species across the Caribbean depends on closing the gap in knowledge of species identification present in many of the islands and countries, and in establishing cross-boundary naming conventions that will facilitate research collaborations within a regional framework and advance large-scale assessments. A step forward in building the needed framework to foster such collaborative initiatives is the new information-sharing platform presented at the 16th CFM. The purpose of the platform is to increase communication among forestry practitioners by allowing for data sharing and to define the roles of information management, forest management, and information users; it can be accessed through the Caribbean Foresters website (www.caribbeanforesters.org). The Information-Sharing working group drafted conditions and requirements for data sharing, processing information requests, and publication of any products prepared with the data contained in this platform,

which the participants of the 16th CFM approved, and they are explicitly delineated in this Special Issue (see Heartsill Scalley et al. 2016). The core goals of this information-sharing platform are to (1) promote and facilitate the secure exchange of information among forest officers, managers, researchers, and other members of the Caribbean Foresters community at large; (2) identify forest types for which there are long-term data from permanent forest plots; (3) identify potential themes for regional synthesis; and (4) determine the forest types for which information is lacking (Heartsill Scalley et al. 2016).

The Mangroves and Dry Forests working group, with representatives from Suriname, Dominican Republic, Cuba, and Colombia, expressed the importance of mangroves and dry forests in the region, provided input regarding gaps in data, and prepared a list of perceived threats and pressures on these systems (de los Santos et al. 2013). Working-group participants expressed the strong need to manage and protect mangroves and dry forests without compromising sustainable economic development for tourism and agriculture. In addition, they identified continued inventories and monitoring of these forest types as important to understanding the economic and cultural pressures, challenges, and effects of resource extraction from these systems (Table 4). To establish proper adaptive-management strategies for these forest types, the Mangroves and Dry Forests working-group participants listed research topics to address regeneration after harvest, succession after hurricanes, and responses to sea-level rise.

Key Considerations for Future Research Identified in this Special Issue

- To understand the resilience of Caribbean forests in light of anthropogenic and climate-change effects (DeWalt et al. 2016, Lugo 2016, Marcano-Vega et al. 2016b), we need to understand how Caribbean forests respond to environmental change and disturbance, and determine if Caribbean forests have unique responses as compared to other tropical regions (Lugo 2016).
- Sustainable forest management is critical to livelihoods and economies in the Caribbean Region (Headly 2016).
- The practice of forestry in the Caribbean Region is broadly defined not only to include foresters, ecologists, and natural-resource managers, but also social scientists, community stakeholders, and conservationists (Heartsill Scalley and González 2016).
- It is important to integrate the scale of resolution when designing a forest-sampling regime to evaluate biodiversity and ecological functions across broad environmental and geographical gradients (Muscarella et al. 2016, Van Laere et al. 2016).
- Long-term studies of forest dynamics across environmental gradients are required to understand the processes governing biomass dynamics (Muscarella et al. 2016).

Table 4. Report from the Mangroves and Dry Forests working group convened at the 16th Caribbean Foresters Meeting (de los Santos et al. 2013).

Pressures	Challenges
Mangroves	Understanding succession in mangrove systems.
Hurricanes and sea-level rise.	Coastal economic development without compromising mangrove forest conservation.
Coastal tourism development.	Protecting not only species, but whole coastal ecosystems.
Harvesting for wood, inks, medicinal properties and charcoal production.	Continuing mangrove forests inventories in the region.
Dry Forests	
One of the most threatened forest types. Threatened by conversion to pasture for cattle grazing, forest products harvesting, extraction of wood for charcoal production, and development associated with tourism.	There are various plant communities and forest types that can be considered under the “dry forest” category.
Regeneration of dry forests needs continued research and greater documentation.	In Cuba, regeneration of dry forests has been done by planting <i>Leucaena leucocephala</i> , under which <i>Guaiacum</i> spp. (Guayacán) has been emerging.
Expansion of urban centers encroaching on dry forests in the Caribbean region.	Fewer conservation efforts have been implemented in dry forests of the Caribbean than in other forest types.
Delineation of many protected areas does not reflect “on the ground” situations and may not be effective instrument of conservation.	Delimitation of protected areas needs to be done with local communities and stakeholder inputs to be functional and effective.
Lack of management plans that contain specific aspects of dry forest ecosystems and species ecology to address certification and permits for extraction and use of resources.	Examples: Extraction/gold prospecting (Suriname), harvesting of <i>Amirivis elemifera</i> for essential oils (Dominican Republic), habitat for unique species such as <i>Saguinus oedipus</i> primates (Colombia).

- Permanent forestry plots can be effectively integrated into biology courses where the hands-on, inquiry-driven students' direct participation in the field will encourage them to connect with nature. Such experiences will enhance students' understanding of core concepts and competencies in biology (Vallès and Carrington 2016).
- Seasonally dry tropical forests are the most threatened tropical-forest type in the world, and understanding their floristic composition at broad geographical scales can help in conservation planning at both local and regional scales (Banda Rodríguez et al. 2016).
- Technical assistance in planning forest-monitoring projects and data analysis are much needed in the Caribbean Region and would involve balancing the cost and the precision of measurements to answer specific monitoring questions (Marcano-Vega et al. 2016b).
- Caribbean palm forests are dynamic systems whose structure, species composition, species density, and processes are coupled to the frequency and intensity of hurricanes (Lugo and Frangi 2016).
- Few studies of structure, diversity, and species composition are available from plots in the Caribbean, in general and from the Lesser Antilles in particular (DeWalt et al. 2016).
- The Caribbean Foresters information-sharing platform can help facilitate comparisons of forest-stand dynamics in the Caribbean region (DeWalt et al. 2016, Heartsill-Scalley et al. 2016).
- Boundary organizations—designed to facilitate collaboration and information flow between the research and public policy communities—can be an overlooked link in the path to a sustainable future in the Caribbean (Jacobs et al. 2016).
- The conservation of Caribbean landscapes depends on the development of shared knowledge, prioritized resources, and clear communications across sectors, cultures, education levels, expertise, and languages (Gould et al. 2016).
- Understanding the connections and interactions between humans and the environment is crucial to sound policy and sustainable resource use (McGinley 2016).

Future Research Questions and Directions as Identified in this Special Issue

- The interaction between forest vegetation and disturbances, including management actions, resource extraction, and the role of forest ecosystems under changing economies and climate conditions in the region still need to be better-documented and understood (Heartsill Scalley and González 2016).
- What are the fundamental implications for forest conservation of the rapid succession and changes in structural, functional, and species composition after each disturbance event in the Caribbean region (Lugo 2016)?

- How do abiotic factors affect different pools of carbon and the proportion of biomass stored above- vs. belowground (Muscarella et al. 2016), particularly given varying climate-change scenarios.
- How can biodiversity affect aboveground biomass and ecosystem function in Caribbean forests (Muscarella et al. 2016)?
- What are the floristic relationships among the seasonally dry tropical forests within the Caribbean region and how do they compare to others within broader continental scales (Banda Rodríguez et al. 2016)?
- Establish long-term monitoring and experimental studies for examining the effect of feral ungulates on forest dynamics (e.g., plant densities, distribution, population dynamics, and soil seedbanks) to clarify the underlying mechanisms of this disturbance on forest change and enhance restoration efforts in the Caribbean Region (Meléndez-Ackerman et al. 2016, Rojas-Sandoval et al. 2016).
- Include social-science research to improve links among science, policy, and management, and to provide new conservation information for the effective management of Caribbean natural and cultural resources (Jacobs et al. 2016).
- How do socioeconomic dynamics influence forest condition and trends and vice-versa? (McGinley 2016).

Finally, we support a better integration of socioeconomic information into forest planning for the Caribbean Islands. The case study from El Yunque National Forest in Puerto Rico (see McGinley 2016) suggests the importance of using a social-ecological approach to establish a baseline assessment of forests and associated ecosystem services to improve forest management and human well-being. Such long-term data sets are critical to understanding regional assessments, particularly in light of global changes.

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Literature Cited

- Banda-Rodríguez, K., J. Weintritt, and R.T. Pennington. 2016. Caribbean dry forest networking: An opportunity for conservation. *Caribbean Naturalist Special Issue 1*:63–72.
- Bloom, T., A. Charles, K. Rodney, A. Gallion, M. Greenaway, W. Trim, R. Wijnerman, A. Jeremiah, D. Palmer, A. Simon, O. Samuel, A. Grant, E. Auguste, Christian Torres, and C. Eckelmann. 2013. Forestry training opportunities and capacity-building working group. Available online at <http://caribbeanforesters.org/working-group-forestry-training-opportunities-and-capacity-building/>. Accessed 9 October 2015.
- de los Santos, C., R. Jankipersad, F. Rosario, Y.A. Rodríguez, B.A. Faña, K. Banda, S. Rosario, F. Jiménez, and S. Marte. 2013. Mangroves and dry forests working group report. Available online at <http://caribbeanforesters.org/mangroves-and-dry-forests-2/>. Accessed October 9 October 2015.
- DeWalt, S.J., K. Ickes, and A. James. 2016. Forest and community structure of sub-montane rain forests on the island of Dominica, Lesser Antilles. *Caribbean Naturalist Special Issue 1*:116–137.
- Food and Agriculture Organization of the United Nations (FAO). 2010. Global forest-resource assessment 2010, main report. FAO Forestry Paper 163. Rome, Italy.
- Gould, W.A., K.R. Jacobs, and M. Maldonado. 2016. The Caribbean landscape conservation cooperative: A new framework for effective conservation of natural and cultural resources in the Caribbean. *Caribbean Naturalist Special Issue 1*:73–86.
- Headley, M. 2016. Keynote address: Forest management, climate change, and biodiversity: Advancing an understanding of Caribbean forest dynamics and creating long-term regional networks. *Caribbean Naturalist Special Issue 1*:18–24.
- Heartsill Scalley, T., and G. González. 2016. Introduction: Caribbean forest dynamics and community and regional forestry initiatives. *Caribbean Naturalist Special Issue 1*:1–12.
- Heartsill Scalley, T., S. DeWalt, F. Korysko, G.V. Laere, K. Jacobs, S. Panka, and J. Torres. 2016. Communication from the information-sharing working group: Agreement for data sharing among Caribbean Foresters. *Caribbean Naturalist Special Issue 1*:30–34.
- Jacobs, K.R., L. Nicholson, B.A. Murry, M. Maldonado, and W.A. Gould. 2016. Boundary organizations as an approach to overcoming science-delivery barriers in landscape conservation: A Caribbean case study. *Caribbean Naturalist Special Issue 1*:87–107.
- Lugo, A.E. 2016. Caribbean Foresters take steps towards a network of permanent forest plots in the Caribbean: A meeting report. *Caribbean Naturalist Special Issue 1*:13–17.
- Lugo, A.E., and J.L. Frangi. 2016. Long-term response of Caribbean palm forests to hurricanes. *Caribbean Naturalist Special Issue 1*:157–175.
- Marcano-Vega, H., C. Roberts, H. Vallès, J. Andre, K. Boswell, D. Lemen, F. Liburd, C. López. 2016a. Communication from the national forest inventories working group of the 16th Caribbean foresters meeting: Proposal for a regional workshop. *Caribbean Naturalist Special Issue 1*:25–29.
- Marcano-Vega, H., A. Lister, K.A. Megown, and C.T. Scott. 2016b. Applicability of the Design Tool for Inventory and Monitoring (DTIM) and the Explore Sample Data Tool for the assessment of Caribbean forest dynamics. *Caribbean Naturalist Special Issue 1*:35–51.
- McGinley, K.A. 2016. Human dynamics and forest management: A baseline assessment of the socioeconomic characteristics of the region surrounding the El Yunque National Forest. *Caribbean Naturalist Special Issue 1*:218–244.

- Meléndez-Ackerman, E., J. Rojas-Sandoval, D.S. Fernández, G. González, H. Lopez, J. Sustache, M. Morales, M. García-Bermúdez, and S. Aragón. 2016. Associations between soil variables and vegetation structure and composition of Caribbean dry forests. *Caribbean Naturalist Special Issue 1*:176–198.
- Muscarella, R. M. Uriarte, D.L. Erickson, N.G. Swenson, J.K. Zimmerman, W.J. Kress. 2016. Climate and biodiversity effects on standing biomass in Puerto Rican forests. *Caribbean Naturalist Special Issue 1*:199–217.
- Rojas-Sandoval, J., E.J. Meléndez-Ackerman, J. Fumero-Cabán, M. García-Bermúdez, J. Sustache, S. Aragón, M. Morales-Vargas, G. Olivieri, and D.S. Fernández. 2016. Long-term understory-vegetation dynamics and response to ungulate exclusion in the dry forest of Mona Island. *Caribbean Naturalist Special Issue 1*:138–156.
- Torres-Santana, C., M. Oatham, L. Nelson, L. Archibald, K. McLaren, F. Diaz Santos, J. Daley, T. Heartsill Scalley, and D. Gustave. 2013. Biomass and species studies across islands working group report. Available online at <http://caribbeanforesters.org/working-group-report-biomass-and-species-studies-across-islands-2/>. Accessed 9 October 2015.
- Vallès, H., and C.M.S. Carrington. 2016. Forestry plots: A potentially valuable teaching resource in undergraduate biology programs for the Caribbean. *Caribbean Naturalist Special Issue 1*:52–62.
- Van Laere, G., Y. Gall, and A. Rousteau. 2016. The Forest Ecosystems Observatory in Guadeloupe (FWI). *Caribbean Naturalist Special Issue 1*:108–117.
- World Bank. 2015. Environment: World development indicators, Table 3.1. Available online at <http://wdi.worldbank.org/table/3.1>. Accessed 17 March 2015.