Introduction: Caribbean Forest Dynamics and Regional Forestry Initiatives

Tamara Heartsill Scalley[1] and Grizelle González[1]

Abstract – Herein we provide the context within which the 16th Caribbean Foresters Meeting took place, some background information about the meeting, and a general introduction to this Special Issue focused on that meeting.

Caribbean Forests in Changing Environmental Conditions

Forest types in the Caribbean are associated with gradients in elevation, topography, and rainfall regimes that give rise to a wide variety of plant species and forest communities (Lugo et al. 2000). Forest cover in the Caribbean is also influenced by the moisture-laden trade winds, which create steep humidity gradients on islands where the windward sides are much wetter than the leeward sides (González et al. 2013, Taylor et al. 2012). On Caribbean islands that barely extend above sea-level to some with peaks well over 3000 m, these environmental conditions combine with substrates such as coral-derived limestone karst, volcanic rock, and sandy-bottom and flooded-coastal deposits to create habitat for a wide range of forest types (Lugo et al. 1981, McGinley 2007). Forest types in the Caribbean vary from monospecific wetland forests such as mangroves and brackish water swamps, to the high-endemism forests on mountain peaks and serpentine soils (Beard 1948, Lugo et al. 1981). These forests support high levels of species richness and diversity; the region is considered a biodiversity hotspot (Lugo et al. 2012, Maunder et al. 2008).

The distribution of forests affects local climate and hydrologic connectivity (Dale et al. 2000, Ponette-González et al. 2013), and forest-vegetation dynamics also affect local climate and livelihoods. These recognized roles of Caribbean forests are potentially important factors to consider when developing management strategies. The relatively fast-growing forests in the Caribbean region are sources of raw materials and support subsistence living; they also provide ecosystem services that enhance human well-being and thus are inextricably linked to sustainable development in the Caribbean region (López-Marreno et al. 2012). Forests are key components of plans to mitigate changes in the regional climate (Barker et al. 2009, Taylor et al. 2012).

Recent statements by the United Nations Food and Agriculture Organization (FAO) Assistant Director General for Forests, Eduardo Rojas-Briales, suggested that in addition to considering forests and trees, efforts to collect forestry data and develop forest management practices need to include stakeholders and policy-makers to be effective in the long term (FAO 2014). In the Caribbean region, the practice of forestry has been broadly defined to include not only foresters, ecologists, and

[1]USDA-Forest Service, International Institute of Tropical Forestry, Río Piedras, PR.

natural resource managers, but also social scientists, community stakeholders, and conservationists, as evidenced by the widespread participation in and diverse themes of the regional forum of the Caribbean Foresters Meeting (Table 1, Fig. 1). Recent work presented in this Special Issue focuses on conservation networks of individuals and agencies in the Caribbean region (Gould et al. 2016, Jacobs et al. 2016) and the links between societal implications and forest-management practices (McGinley 2016).

People are aware of ongoing changes in Caribbean regional economies, agriculture, land cover, predicted changes in regional climate regimes, and of the importance of greater understanding of forest ecology and management practices for sustainability and human benefits (Barker 2012, FAO 2014, Taylor et

Table 1. Caribbean Foresters Meeting locations, dates, and themes.

Meeting	Location	Dates	Theme
1st	St. Lucia	24–28 May 1982	Forestry in the Caribbean
2nd	Saint Vincent and the Grenadines	19–23 March 1984	Watershed management in the Caribbean
3rd	Guadalupe	19–23 May 1986	Forest recreation in the Caribbean Islands
4th	Dominica	4–9 April 1988	Wildlife management in the Caribbean Islands
5th	Trinidad	21–26 May 1990	Wetlands management in the Caribbean and the role of forestry and wetlands in the economy
6th	Martinique	20–24 July 1992	Toward sustainable forest resource management in the Caribbean
7th	Jamaica	13–17 June 1994	Economics of Caribbean forestry
8th	Grenada	3–7 June 1996	Protected areas management
9th	Dominican Republic	1–5 June 1998	Biodiversity in the Caribbean: Management and benefits
10th	Guyana	13–16 June 2000	Possibilities and approaches toward community forestry in the Caribbean
11th	St. Thomas, USVI	9–14 June 2002	The future of trees in Caribbean biology: Planning and management possibilities
12th	Puerto Rico	7–11 June 2004	Wildland and fire management and restoration
13th	Jamaica	12–16 June 2006	Possibilities and approaches to idle lands in the Caribbean
14th	Dominica	28 April–2 May 2008	Linking conservation, tourism and sustainable development in the Caribbean
15th	Guadalupe	14–18 June 2010	Climate change and its link with forest management and biodiversity
16th	Dominican Republic	4–9 August 2013	Advancing an understanding of Caribbean forest dynamics and creating long-term regional networks

al. 2012). In spite of the many forest-research activities in the region (e.g., Lugo and Bayle 1992, Weaver and González 2005), Caribbean researchers are still documenting forest types, the species that inhabit these forests, and how these respond to disturbance. 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. Thus far, it has been challenging to integrate the maintenance of ecosystem services provided by forests into planning strategies for societal and human well-being and sustainability (Gould et al. 2016, McGinley 2016). Therefore, to meet these challenges and to improve conservation and management efforts, actions that increase knowledge and information sharing among the broadly defined community involved in the monitoring, conservation, and management of forests in the Caribbean region are continuously needed. Caribbean forest professionals have identified the need to increase capacity building and data sharing within the region, both of which will ultimately improve the way that inventories, technology, and best-management practices are implemented (Marcano Vega et al. 2016a).

Now more than ever, understanding Caribbean forest dynamics is linked to the role of forests in sustaining livelihoods while mitigating the effects of changing climate patterns. The Caribbean region serves as a model to measure and track ongoing responses to projected climate-regime changes, sea-level rise, and hurricane frequency and intensity. The region, with a range of elevation and temperature gradients, offers a many forest types in which to explore forest dynamics.

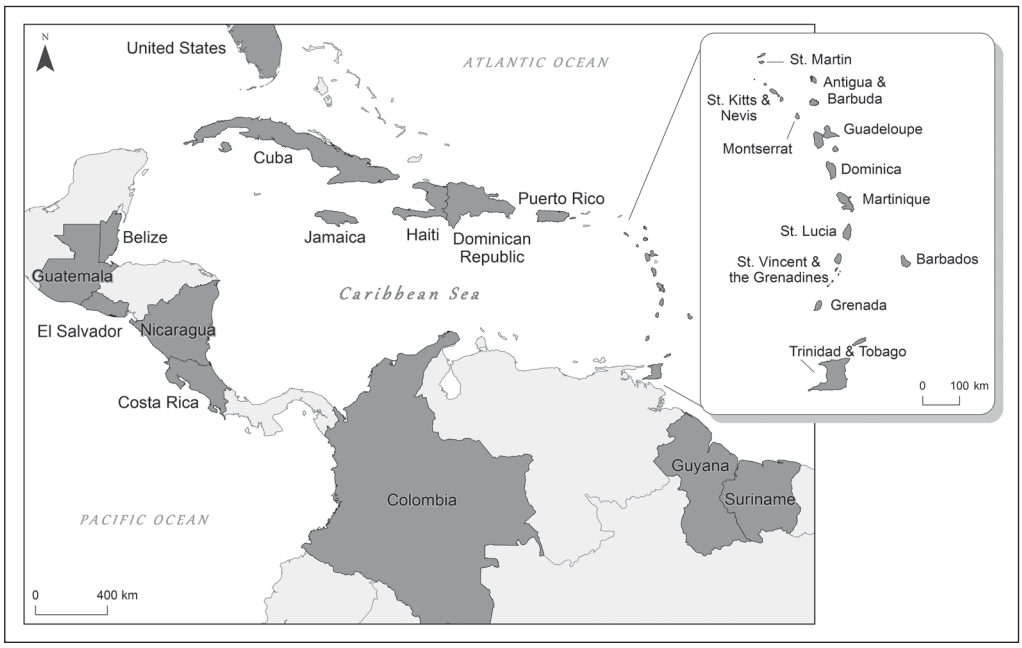

Figure 1. Regional participation in the 2013 Caribbean Foresters Meeting. Dark-gray shaded countries had representatives at the meeting.

Caribbean Foresters Meetings (CFM) can serve to improve the availability of forest-dynamics information for Caribbean forest professionals, assist with capacity building, and develop management strategies adaptable to the changing economic and climatic scenarios with which forest conservation is faced. CFM participants are engaged in the study, sustainable management, and protection of forests in the Caribbean region. All Caribbean Foresters members—among them natural resources specialists, including foresters, researchers, and educators—share a dedication to understanding Caribbean forests. Since 1982, the International Institute of Tropical Forestry, in collaboration with many regional entities and

Table 2. International participation in Caribbean Foresters Meetings from 1982 to 2013.

	Year of meeting and participation															
	’82	’84	’86	’88	’90	’92	’94	’96	’98	’00	’02	’04	’06	’08	’10	’13
Antigua			•	•			•	•	•	•				•		•
Bahamas												•				
Barbados	•		•		•			•	•	•	•	•	•	•	•	•
Belize				•				•			•					•
Canada	•	•	•			•										
Chile																•
Colombia																•
Costa Rica													•			•
Cuba							•	•	•							•
Dominica	•	•	•	•				•	•	•	•	•	•	•	•	•
Dominican Republic							•	•	•	•		•		•	•	•
El Salvador																•
France														•		
French Guyana															•	
Grenada	•	•		•	•	•	•	•	•	•	•	•			•	•
Guadeloupe	•	•	•	•	•		•	•			•	•		•	•	•
Guatemala												•				•
Guyana	•						•	•	•	•	•	•	•	•		•
Haiti		•	•				•	•	•	•	•					•
Hawaii					•		•									
Jamaica	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•
Martinique	•	•	•	•				•	•						•	•
Montserrat		•	•	•	•		•	•			•		•	•	•	•
Nicaragua																•
Puerto Rico	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Saint Croix							•			•	•			•		
St Kitts and Nevis				•	•				•		•			•		•
Saint Lucia	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•
Saint Martin																•
Saint Tomas										•	•	•		•		
St. Vincent & the Grenadines	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•
Surinam							•	•	•	•		•		•		•
Trinidad and Tobago	•		•		•		•	•	•	•	•	•	•	•	•	•
United Kingdom				•						•						
USA	•	•		•	•		•	•	•	•	•	•	•	•		•
Venezuela					•											

organizations, has sponsored and organized meetings that bring together foresters, researchers, and government officials from the Caribbean region (Tables 1, 2). The CFMs provide a unique opportunity for participants to share forest research and management case-studies, site descriptions, recent reports, papers, and other relevant information from their respective countries. There is a sense of connection among members promoted by the active exchange of ideas and the facilitation of discussions at the meetings (Fig. 2). These active exchanges help to generate a series of conclusions and recommendations related to the meetings' topics that keeps CFM meeting agendas current. These meetings seek to gather and integrate the knowledge and experiences collected at different sites in order to work toward common goals and objectives at the Caribbean regional scale.

The 16th Meeting

During the 16th CFM that took place 4–9 August 2013 in the Dominican Republic, participants presented posters and oral presentations and met during working-group discussions on the theme of advancing the understanding of Caribbean forest dynamics and the importance of creating long-term regional networks to promote scientific-data analysis (Figs. 1, 3, 4). As part of the meeting's agenda, there was a scientific workshop focused on assessment of long-term forest dynamics in the Caribbean. This workshop aimed to facilitate data analysis by identifying and registering sites for inclusion in regional analyses. As a result of this workshop, participants of the 16th CFM identified over 70 forest sites with permanent plots in the region through tools available at the Caribbean Foresters website.

In addition, CFM participants defined 5 working groups. These working groups focused on (1) forestry training opportunities and capacity building, (2) national forests inventories, (3) biomass and species studies across islands, (4) mangroves and dry forests, and (5) collaboration and information-sharing agreement among Caribbean foresters.

Overview of this Special Issue

This Special Issue brings together manuscripts that address the history and new developments of the collaborative efforts taking place at the CFMs through reports by long-time participants in the CFM, reports of deliberations from working groups, manuscripts developed from poster and oral presentations delivered at the 16th CFM, and invited research contributions that pertain to the Caribbean agenda as they explore long-term trends as well as local variability of data at particular forest sites.

Lugo's manuscript (2016) singles out this meeting from those previous to it because if fully implemented, the idea of adopting a data-driven strategy for the analysis of changing forest conditions in response to climate change at the regional scale would advance the understanding of critical information needed for resource conservation across broad scales. Marilyn Headley's (2016) keynote address summarized well-established conventions, legislative frameworks, and the global

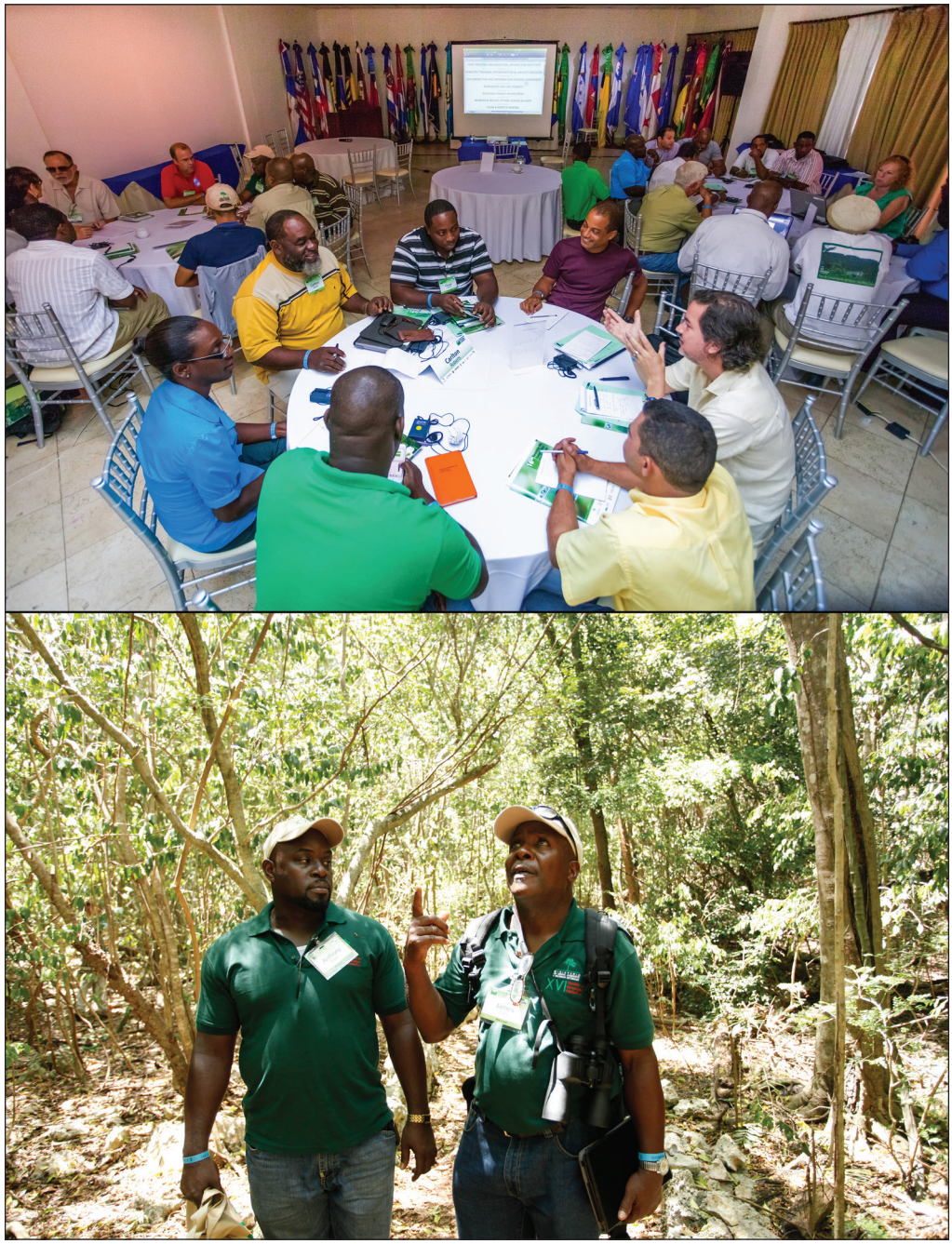

Figure 2. Discussions and exchange of ideas at 16th Caribbean Foresters Meetings. Top: The National Forests Inventories Working Group, composed of Dennis Lemen (Surinam), Floyd Liburd (St. Kitts and Nevis), Christian López (Dominican Republic), Henri Valles (Barbados), Kevin Boswell (Jamaica), Jacqueline Andre (Dominica), Humfredo Marcano Vega (Puerto Rico), and Carlton Roberts (Trinidad and Tobago); and Bottom: James Daley (Montserrat) and Anthony Simon (St. Vincent) discussing permanent forest plots in a dry forest during a Meeting field trip.

Figure 3. Participants to the 16th CF Meeting in Santo Domingo. See Figure 4 on the follwong page for indentifications of many of those in the photo.

Figure 4. Some of the participants identified in the group photo include: 1. Rolando Montenegro, 2. Patricio Emanuelli, 3. participant , 4. Francisco Rodriguez, 5. Jerry Bauer, 6. Ramon A. Diaz, 7. Donatian Gustave, 8. Saul Cruz, 9. Efrain A. Duarte, 10. participant, 11. participant, 12. participant, 13. participant, 14. Maria Isabel Echevarria Espinoza, 15. participant, 16. Toby Bloom, 17. Humfredo Marcano-Vega, 19. participant, 20. Ariel E. Lugo, 21. Sol Teresa Paredes, 22. William Trim, 23. Floyd Liburd, 24. Algernon Grant, 25. participant, 26. Ryan Wijnerman, 27. participant, 28. Aloysius Charles, 29. participant, 30. Wayne Arendt, 31. Kasey Jacobs, 32. participant, 33. Yira Arlene Rodriguez jerez, 34. participant, 35. Reshma Jankipersad, 36. Santa Rosario, 37. participant, 38. Gamaliel Pagan, 39. participant, 40. Claritza de los Santos, 41. Jacqueline Andre, 42. Claus Eckelmann, 43. Bernabe Manon Rossi, 44. Dillon Palmer, 45. participant, 46. MacDonald Greenaway, 47. Carlton Roberts, 48. Tomas Montilla, 49. Ostine Louverture, 50. Guy Van Laere, 51. Dennis Lemmen, 52. Esther Rojas, 53. Henri Vallès, 54. Isabel Katsi Pares Ramos, 55. Angela Arendt, 56. Kurt McLaren, 57. Tamara Heartsill Scalley, 58. Christian Torres Santana, 59. Seth Panka , 60. Kenneth Rodney, 61. Victor Cuadrado, 62. Fernando Jimenez Gutierrez, 63. participant, 64. Christian Lopez, 65. Benedicto A. Foña Mejia, 66. participant, 67. Humberto Checo Herrera, 68. Manuel Serrano, 69. Albert Gallion, 70. participant, 71. Anthony Jeremiah, 72. James Daley, 73. Saara DeWalt, 74. Kevin Boswell, 75. Michael Oatham, 76. Lindsey Archibald, 77. Osa Samuel, 78. François Korysko, 79. Joe Torres, 80. Lawrence Nelson.

movement toward more involvement in forestry by community-based and non-governmental organizations; all efforts that can help further greater collaboration among countries. The address also provided a word of caution on the trade-offs of management decisions that need to be made between economic development and forest-conservation efforts.

In addition, this Special Issue includes communications from 2 working groups convened at the 16th CFM. Marcano-Vega et al. (2016a) propose to improve the regional capacity for carrying out forest inventories by using standardized training modules on forestry techniques, data quality and controls, and statistical and computer skills. Their manuscript includes specific forest-monitoring and technical challenges identified by each country represented at the CFM. In a second contribution to this publication, Marcano-Vega et al. (2016b) focus on the applicability of a design tool for inventory and monitoring (DTIM) and the Explore Sample-Data Tool as a way to promote efficient inventory planning, monitoring, and data analysis. Further, Heartsill Scalley et al. (2016) outline the first agreement ever reached among Caribbean foresters to facilitate and promote collaboration via data-sharing policies that cover expectations and roles of users of the Caribbean Foresters website's new information-sharing platform for identifying potential collaborations and permanent forest-sample plots. Banda Rodríguez et al. (2016) present the details of a similarly formulated research network that originated in Colombia and extended to the broader Caribbean region, the Latin American Dry Tropical Forest Floristic Network (DRYFLOR). This database contains 148,000 species-occurrence records and seeks to understand the flora of dry forests within the Neotropics (including Greater and Lesser Antilles). All of the manuscripts mentioned above support the contention that the establishment of permanent forestry plots can help provide baseline information essential for the development of effective conservation and management strategies (Banda Rodríguez et al. 2016; Marcano-Vega et al. 20166a, b). Vallès and Carrington (2016) propose that permanent forest-sample plots and their data can also be a valuable teaching resource in biology and forestry programs in the Caribbean region.

One of central themes of the 16th CFM was the importance of improving networking opportunities to discuss participatory forest management and forest policy in the Caribbean region (Headley 2016). Thus, Gould et al. (2016) describe a framework for effective science development and delivery for conservation of natural and cultural resources in the Caribbean, and Jacobs et al. (2016) explore the roles of boundary organizations that bridge the gap between research and conservation practitioners through conscious exploration of the knowing–doing gap in resource management.

This Special Issue contains scientific contributions presented at the 16th CFM as well as invited research contributions based on studies conducted throughout the Caribbean region (Fig. 1) that addressed particular forest types such as those of Guadeloupe (Van Laere et al. 2016), Dominica (DeWalt et al. 2016), and from Mona Island, PR (Meléndez-Ackerman et al. 2016, Rojas-Sandoval et al. 2016) and the Luquillo Experimental Forest, PR (Lugo and Frangi 2016). Muscarella et al.

(2016) report on an analysis of standing biomass within various forests in Puerto Rico that helps describe the spatial variation of forest attributes in relation to precipitation gradients and soil types. Finally, McGinley (2016) suggests the need for a better understanding of the connections and interactions between humans and the environment to develop sound policy and ensure sustainable resource use, using El Yunque National Forest, PR, also known as the Luquillo Experimental Forest, as a case study of socioeconomic dynamics and implications for the development of forest conservation and management strategies.

Caribbean researchers are making progress in applying the knowledge of local forest systems to improve livelihoods and wise use of resources. Yet within the region, there is a need to address advancement in capacity building and improving tools of insular forestry professionals. We expect that a new perspective on Caribbean forests will be gained as a result of the various emerging networks and initiatives being proposed for the region and reported in this Special Issue. The result will be improved sustainability and human well-being in this region.

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