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A Technical Document Supporting the Forest Service 2020 RPA Assessment

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Abstract

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This publication provides forest resource statistics contributing to the 2020 Resources Planning Act (RPA) Assessment to provide current information on the Nation's forests. Resource tables present estimates of forest area, volume, mortality, growth, removals, and timber-product output in various ways within the context of changes since 1953. Additional analyses look at the resource from an ecological, health, and productivity perspective. Tables are available in .pdf and Excel format online at https://www.fia.fs.fed.us/program-features/rpa/index.php. Users may also query Forest Inventory and Analysis data using the online EVALIDator tool, selecting the radio button labeled "Use RPA definition of forestland" on the second page of the query tool, available online at https://apps.fs.usda.gov/Evalidator/evalidator.jsp.

▲ Maroon Lake, Aspen, CO. Courtesy photo by istockphoto.com/Sean Xu.

high-resolution data that are well suited for studying tree-level ecosystem dynamics, including assessment of forest health and productivity of forest stands and individual trees. In addition, G-LiHT data support local-scale mapping and regional-scale sampling of plant biomass, photosynthesis, and disturbance. The data are accurately georeferenced and can be matched very precisely with field plot data that are georeferenced using high-accuracy (dual-frequency, GLONASS-enabled) GPS.

Current Status and Future Plan for FIA Inventory in Interior Alaska

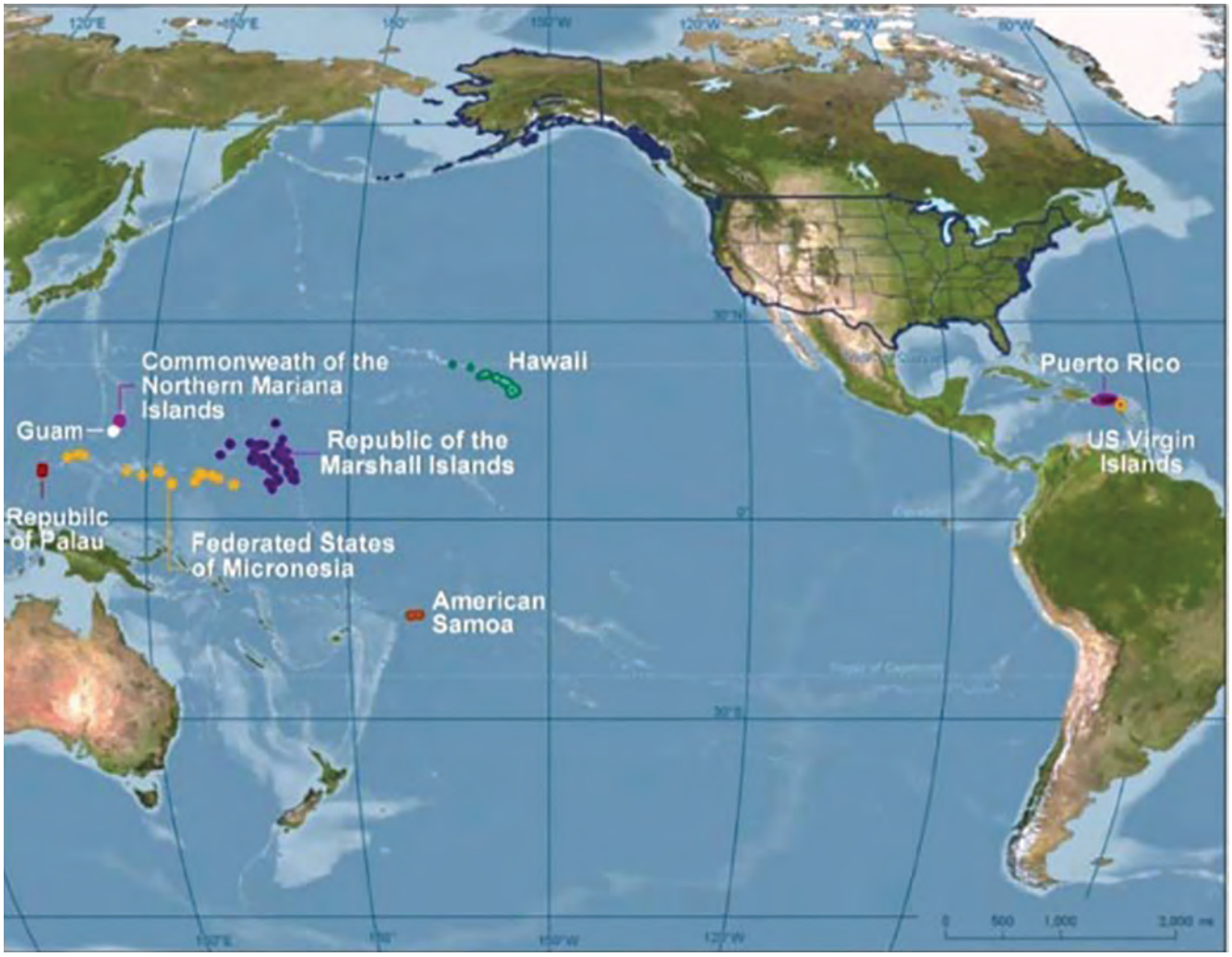
Since conducting the measurements and initial analyses for this pilot study, FIA was funded by Congress to implement a forest inventory for interior Alaska. Field work in the Tanana River Basin was initiated in 2016 and is planned for completion in 2018. The inventory will be periodic, in that field sampling will be completed at each of five inventory units (Tanana Valley, Susitna-Copper, Southwest Alaska, Lower Yukon, and Upper Yukon) before moving to another area. Based on the results of the pilot, as well as logistical and cost considerations, several changes were made to the interior Alaska inventory design, including (1) reduction of the field sampling intensity to 1 plot per 30,000 acres, (2) adjustment of inventory unit boundaries (previously based on river basins) to avoid splitting large national parks into separate reporting zones, (3) saplings are measured on a single, larger microplot rather than two microplots, and (4) soil cores are collected at three locations instead of one to improve precision of estimates of this large carbon pool.

U.S.-Affiliated Jurisdictions of the Insular Caribbean and Pacific

Authors: Humfredo Marcano, Michelle Lazaro, Sharon Stanton

Extending over expansive areas of ocean, the U.S.-affiliated Atlantic (Caribbean) and Pacific Islands encompass nearly all the tropical forests in the country. Puerto Rico (PR) and the U.S. Virgin Islands (USVI) represent an archipelago in the Caribbean with a tropical maritime climate that varies according to the effects of a diverse topography, predominantly regarding total rainfall patterns. The Pacific Islands are generally subject to climatic variables driven by the larger Pacific Ocean and lie within tropical latitudes resulting in consistently warm temperatures and high humidity. The diverse geology, soils, and land-use history within and among islands also interconnect to influence the structure and composition of forests. Puerto Rico, Culebra, Vieques, and Mona comprise the islands of PR included in the FIA program, whereas St. Croix, St. John, and St. Thomas comprise the USVI. American Samoa, Commonwealth of the Northern Mariana Islands (CNMI), and Guam are U.S. Territories, and the Republic of the Marshall Islands (RMI), Federated States of Micronesia (FSM), and the Republic of Palau make up the Freely Associated States (figure 2-6). PR represents around 2.19 million acres of land with a human population of 3.7 million, the

▲ Mount Denali, AK. Courtesy photo by istockphoto.com.



Source: Ramos (2012) in McGinley et al. (2015)

Figure 2-6. U.S.-affiliated jurisdictions of the insular Caribbean (Puerto Rico and the U.S. Virgin Islands) and Pacific (Hawaii, the Commonwealth of the Northern Mariana Islands, Guam, the Republic of Palau, the Republic of the Marshall Islands, the Federated States of Micronesia, and American Samoa).

USVI represent 82,164 acres of land with a human population of 106,405, and 1.8 million people and 4.6 million acres of land are across the Pacific Islands including the State of Hawaii (appendix table 50).

Forest Area and Stand-Size Trends

Mainland PR transitioned to a phase of total forest cover steadiness after a high rate of forest cover increase from 1980 to 2004 (Marcano-Vega 2017). Total forest area in PR was around 56 percent forest cover in 2014 (appendix table 50). The total forested area in the USVI also shows relative stability with 57 percent forest cover in 2014 (appendix table 50). Hurricane María made landfall in the USVI and PR during September 19–20, 2017, however, causing overall defoliation and substantial loss of branches and apical dominance in nearly all trees. Consequently, canopy cover was extensively reduced to values around 10 to 20 percent especially within highly disturbed forest areas. Nonetheless, new foliage was observed 2 weeks after the storm in most individuals, suggesting that rain events following the event may have helped reduce physiological stress due to the widespread loss of tree crowns and high temperatures. Total forested area across the Pacific Islands range from 36 percent in the State of Hawaii in 2015 to 94 percent in the Republic of Palau in 2014 (appendix table 50). Stand size trends in PR and the USVI by 2014 suggest a transition to more mature stages of forest development as the area occupied by small diameter stands decreased whereas that of medium and large diameter stands increased. Then again, however, limited data from PR after Hurricane María suggest that the event resulted in around 20 percent tree mortality in areas without major landslides. Higher mortality can be expected within rugged terrain and higher elevations due to

uprooting. Therefore, the transition to a mature stage is likely to change in particular forest stands according to the severity of storm effects regarding mortality, loss of tree crowns, and consequent colonization of new ingrowth. Stand sizes vary across the Pacific Islands and tend to be dominated by trees less than 5 inches diameter at breast height on Islands where tropical cyclones are a reoccurring natural disturbance that can impact the structure of the forest and reinitiate new growth of the forest stand.

Land Tenure Systems

Around 83 percent of the forest land area in PR is privately owned, whereas State and local Government or the U.S. Fish and Wildlife Service manage the rest as national forest. In the USVI, 75 percent of the forests are privately owned, 21 percent represent national park, with the rest being managed by local Government. Land tenure systems in Pacific Islands are a mix of individual private, shared family, public land owned by various levels of government and in American Samoa, Republic of Palau, FSM, and RMI indigenous tenure systems (see McGinley et al. 2015 for more information).

Tree Species Composition and Richness—Dominant Native and Naturalized Species

Dominant secondary forests in PR represent the legacy of past agricultural activities with combinations of native and introduced tree species. From a total of 349 species of live trees recorded in PR, the naturalized African tulip tree accounts for the highest biomass storage, cohabiting with native trees (Marcano-Vega 2017). On the USVI, from a total of 118 species of live trees recorded, the tan tan tree accounted for the species with highest biomass storage. In CNMI, the tan tan tree also accounts for the species with the highest biomass storage from a total of 46 species recorded. Species that account for the highest biomass storage in the other Pacific Islands are Maota in American Samoa, lagundi on Guam, bkau or apgau in the Republic of Palau, and ʻōhiʻa lehua in Hawaii.

Forest Volume and Carbon Dynamics

The trend of increasing stand-size class in PR has occurred parallel to an increase in total values of aboveground live-tree net volume and total (aboveground and belowground) live-tree

▲ Forest and waterfall in Hawaii. Courtesy photo by istockphoto.com.

carbon (but see the *Forest Area and Stand-Size Trends* subsection for information on the effects of Hurricane María). Net volume in PR's forests was estimated at 1,392.7 million cubic feet with values of total carbon at 25.4 million tons in 2014. Average annual growth increased while mortality decreased, and data showed a positive growth-to-removals ratio. Total net volume and carbon of live stems in USVI's forests were estimated at 20.9 million cubic feet and 611,622 tons respectively, whereas values of annual growth, mortality, and removals held steady, revealing a positive growth-to-removals ratio in 2014. Stand-size class in the Pacific Islands also closely follows the pattern seen in volume and total live tree carbon, where the majority of volume and carbon is concentrated in small to medium stand-size classes. Total net growing stock volume across the Pacific Islands were estimated at 1,039.4 million cubic feet and 19.3 million dry tons of biomass (appendix table 53).

Timber and Nontimber Forest Products

Across the Islands, many tree species serve multiple purposes and are harvested for timber, medicinal, cultural, and subsistence-food purposes. The naturalized mango tree stands out as the species with fourth highest biomass in PR's forests in 2014 and other species used by local artisans have generally increased in volume (but see the *Forest Area and Stand-Size Trends* subsection for information on the effects of Hurricane María). The naturalized genip tree offers a favorite fruit and figured as the tree species with the second highest biomass in the USVI in 2014. In the Pacific Islands, *Cocos nucifera* is a major source of food, fiber, oil, and wood; *Pandanus tectorius* is used as a food product and weaving material; breadfruit is cultivated as a subsistence crop and can be sold in markets as a fresh fruit or processed into chips; and Noni is valued as a medical crop, dye, and juice product (Neville 2014).

American pika eating clover, Wallowa-Whitman National Forest located in Idaho, Washington, and Oregon. USDA Forest Service photo by Mark Penninger.

Major Forest Health Issues

Systematic and reoccurring FIA inventories can be used to understand the current extent and distribution of forests and also assess effects on the forest due to introduced species. In Guam, an unintentional introduction of cycad scale in 2003 resulted in a steep decline in the population of native cycad species and, in 2007, Rhinoceros beetle was found. The introduced South American Harrisia cactus mealybug has become an important herbivore of PR's and USVI's cactus, causing mortality in the tree cactus. Additionally, the introduced rust fungus has been confirmed affecting the naturalized rose-apple tree in PR, whereas in the USVI the introduced palm leaf skeletonizer has been observed as a heavy defoliator in palm species and the larva of the introduced cactus moth as a heavy feeder of native cacti.

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Table 50. Caribbean and Pacific Islands population, land area, population per square mile, forest area, percent forest cover and date of latest forest inventory

Region and island group	Population[a]	Land area	Population per square mile	Forest area	Percent forest cover	Number of field plots	Inventory date
	Persons	*Acres*	*Persons*	*Acres*			
Caribbean							
Puerto Rico	3,725,789	2,192,325	1,088	1,219,177	56%	506	2014
US Virgin Islands	106,405	82,164	792	46,967	57%	106	2014
Pacific							
American Samoa	57,663	48,434	762	39,156	81%	20	2012
Guam	173,456	132,230	818	69,851	53%	48	2013
Republic of Palau	21,032	108,227	122	102,130	94%	56	2014
Commonwealth of the Northern Marriana Islands	51,395	74,907	436	60,207	80%	37	2015
Federated States of Micronesia	106,487	161,917	421	143,466	89%	79	2005
Republic of the Marshall Islands	68,480	33,120	1323	23,252	70%	58	2006
Hawaii	1,360,301	4,109,962	210	1,471,180	36%	246	2015
Islands total	5,671,008	6,943,286	523	3,175,386	46%	1,156	

[a] Population figures are from the 2010 U.S. Census.

Table 51. Number of live trees on forest land in the Caribbean and Pacific Islands by diameter class

Region and island group	Total	Diameter (inches) 1.0-4.9	5.0-8.9	9.0-12.9	13.0-16.9	17.0-20.9	21.0+
	Thousand trees						
Caribbean							
Puerto Rico	1,421,466	1,274,703	98,641	30,702	9,775	4,077	3,568
US Virgin Is.	92,201	88,786	2,652	553	139	20	50
Pacific							
American Samoa	28,898	22,575	3,878	1,483	520	177	266
Guam	72,994	62,071	8,021	2,204	521	98	80
Republic of Palau	95,721	74,660	14,007	4,215	1,560	617	662
Commonwealth of the Northern Marriana Islands	83,814	76,927	5,811	787	178	56	55
Federated States of Micronesia	94,125	66,890	15,113	7,571	1,984	967	1,600
Republic of the Marshall Islands	12,426	8,742	1,580	1,229	758	90	27
Hawaii	214,634	182,036	23,234	6,035	1,795	640	895
Islands total	2,116,279	1,857,389	172,938	54,779	17,229	6,742	7,203

Table 52. Caribbean and Pacific Islands growing stock volume on forest land by diameter class

Region and island group	Total	Diameter (inches) 1.0-4.9	5.0-8.9	9.0-12.9	13.0-16.9	17.0-20.9	21.0+
	Thousand trees						
Caribbean							
Puerto Rico	191,265	–	21,745	43,298	37,803	33,382	55,038
US Virgin Is.	857	–	308	172	87	–	290
Pacific							
American Samoa	62,501	–	11,320	16,777	11,646	5,405	17,353
Guam	50,981	–	20,096	17,194	7,324	2,533	3,834
Republic of Palau	261,562	–	57,127	60,484	45,224	30,924	67,802
Commonwealth of the Northern Marriana Islands	32,563	–	12,670	7,101	4,193	2,241	6,357
Federated States of Micronesia	577,122	–	67,867	128,682	69,559	59,034	251,980
Republic of the Marshall Islands	54,691	–	7,487	19,232	21,217	3,852	2,903
Hawaii	-	–	n/a	n/a	n/a	n/a	n/a
Islands total	1,231,542	–	198,621	292,940	197,053	137,371	405,558

Table 53. Caribbean and Pacific Islands aboveground live tree biomass on forest land by diameter class

Region and island group	Total	Diameter (inches) 1.0-4.9	5.0-8.9	9.0-12.9	13.0-16.9	17.0-20.9	21.0+
	Thousand trees						
Caribbean							
Puerto Rico	34,084	7,668	8,929	8,967	5,893	4,145	6,737
US Virgin Is.	713	480	225	131	78	18	82
Pacific							
American Samoa	1,101	69	116	175	57	22	14
Guam	1,008	278	235	303	100	51	30
Republic of Palau	5,259	13	44	164	52	18	237
Commonwealth of the Northern Marriana Islands	540	382	144	141	89	–	60
Federated States of Micronesia	10156	1165	1081	2029	1095	928	3858
Republic of the Marshall Islands	1194	351	117	300	331	60	35
Hawaii	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Islands total	54,055	10,405	10,891	12,210	7,695	5,243	11,052

[a] Estimated aboveground dry stem weight biomass.