

Habitat Status Assessment Methods— Hawaii

Current Condition Summaries

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Background

The Pacific Islands Fish and Wildlife Office (PIFWO) is evaluating the status of the 580 threatened and endangered (listed) terrestrial species it manages. If a habitat is degraded (e.g., by invasive species) or lost entirely (e.g., due to development) then the listed species that live there are less likely to survive into the foreseeable future than those species whose habitats are extant and ecologically functional. Self-perpetuating populations of plants and animals cannot exist outside of their habitats, so PIFWO staff is evaluating the condition of Pacific Island Habitats as a first step towards evaluating the status of each of these individual 580 terrestrial listed species.

Habitat Descriptions

The biological staff at PIFWO met to decide on the unit of analysis for the Habitat Status Assessments, the Habitat. Each Habitat had to be internally consistent enough to support a similar suite of species within it, yet broad enough to limit the analysis to a scope manageable within the timeframe allotted, approximately five months. During these meetings, biologists identified the habitats in Table 1 as their core units of analysis in Hawaii (Figure 1). Each habitat includes several different land cover or vegetation type categories (Table 1).

Approach

The Habitat Status Assessment (HSA) process included review and synthesis of literature to describe the current ecological condition of each habitat and its historic extent, dating to before human settlement. In addition to literature review, we summarized geospatial datasets describing landcover, hydrologic features (wetlands and streams), property ownership, and conservation status. PIFWO Biologists have summarized the literature in each individual Habitat Status Assessment Report. The Strategic Habitat Conservation branch has summarized the methods of geospatial analysis in this document.

Landcover Layers for Hawaii

For the Hawaiian Islands, we identified the following Habitats for HSAs. We used several different geospatial datasets to quantify areas currently in each of these Habitats (Figure 1).

- Developed
- Wetlands
- Streams
- Coastal
- Dry Forest
- Dry Grasslands and Shrublands
- Mesic Forest
- Mesic Grasslands and Shrublands
- Wet Forest
- Wet Grasslands and Shrublands

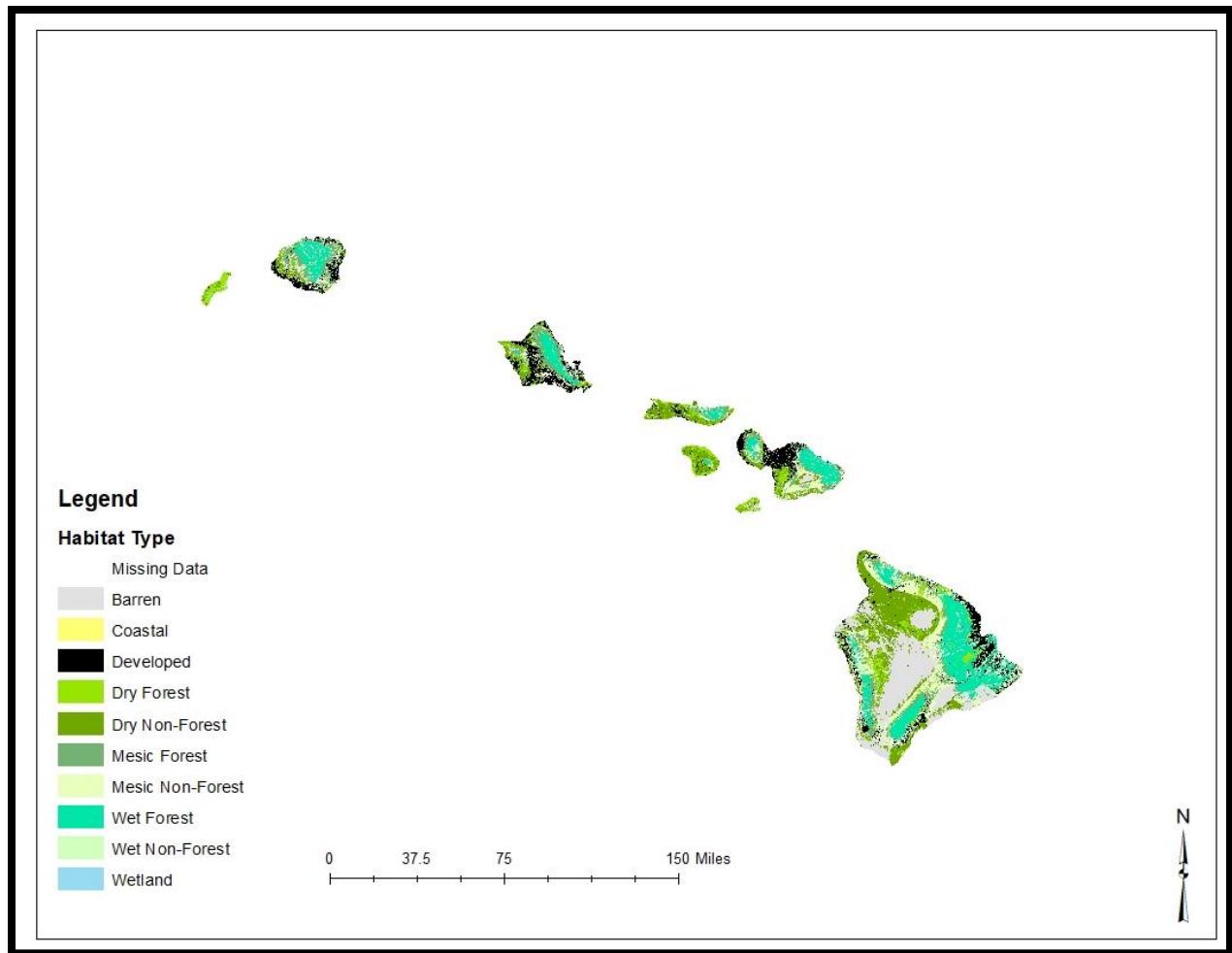


Figure 1. Statewide Map of Pacific Island Fish and Wildlife Office Habitats

Vegetation and Land Cover

We quantified habitat areas using the Hawaii Land Cover and Habitat Status Assessment layers for the Hawaii Carbon Storage and Greenhouse Gas Flux Assessment (“Carbon Assessment Layers”, Jacobi et al. 2017) for the main eight Hawaiian Islands (Figure 2). The Carbon Assessment Land Cover layer identifies 48 land cover or vegetation types on the main Hawaiian Islands (Table 1). Table 1 outlines how we grouped each of these types into Habitats for the HSAs.

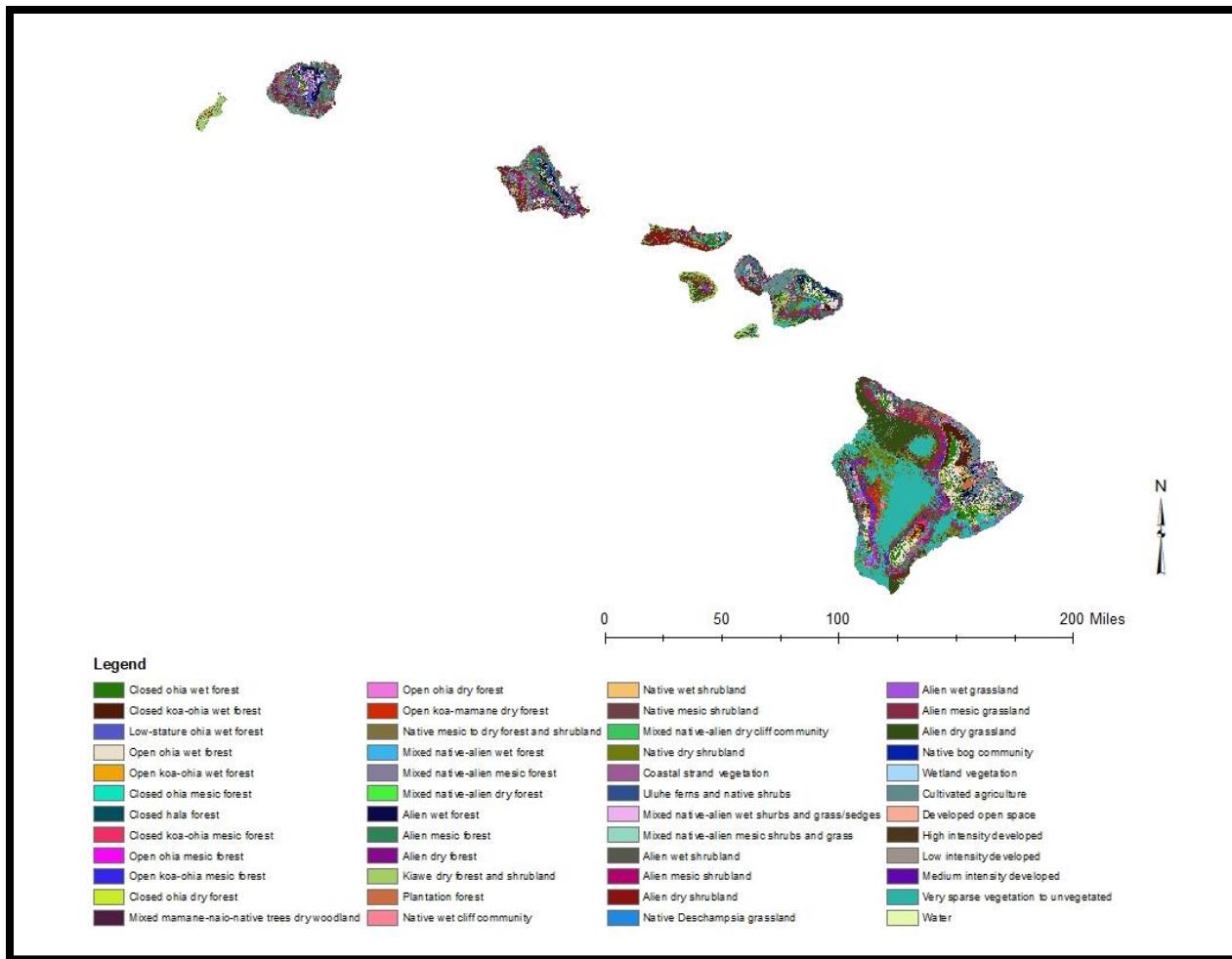


Figure 2. Land Cover Categories from the 2017 Carbon Assessment Layers (Jacobi et al. 2017).

All habitats except for wetlands, coastal areas, and streams were well represented in the Carbon Assessment Layers (Jacobi et al. 2017), which were used to generate the area summary figures and tables for the HSA reports. The Carbon Assessment Layers do not map streams at all, and represent wetlands and coastal habitats poorly. Although we used the Carbon Assessment Layers to generate summary information for wetlands and coastal habitats, we supplemented these analyses with summary of other spatial layers, described below. Due to poor coverage of the Northwestern Hawaiian Islands in the geospatial datasets, we did not create summaries for this area.

Table 1. Habitat Units Analyzed for the Hawaiian Islands with Vegetation and Land Cover Sub-Types

Land Cover Category	PIFWO Habitat	Biome Unit	General Land Cover	Moisture Zone	Area (km ²)
Very sparse vegetation to unvegetated	Barren	Not Vegetated	Bare Ground	N/A	3155
Coastal strand vegetation	Coastal	Coastal Strand	Native Mesic Shrub	All Zones	0
Cultivated agriculture	Developed	Agriculture	Agriculture	N/A	948

Developed open space	Developed	Developed	Developed	N/A	191
High intensity developed	Developed	Developed	Developed	N/A	135
Low intensity developed	Developed	Developed	Developed	N/A	536
Medium intensity developed	Developed	Developed	Developed	N/A	176
Alien dry forest	Dry Forest	Dry Forest	Alien Dry Forest	Dry	186
Kiawe dry forest and shrubland	Dry Forest	Dry Forest	Alien Dry Forest	Dry	569
Plantation forest	Dry Forest	N/A Forest	Alien Tree Plantation	N/A	243
Mixed native-alien dry forest	Dry Forest	Dry Forest	Mixed Dry Forest	Dry	3
Closed ohia dry forest	Dry Forest	Dry Forest	Native Dry Forest	Dry	6
Mixed mamane-naio-native trees dry woodland	Dry Forest	Dry Forest	Native Dry Forest	Dry	149
Open ohia dry forest	Dry Forest	Dry Forest	Native Dry Forest	Dry	55
Open koa-mamane dry forest	Dry Forest	Dry Forest	Native Dry Forest	Dry	93
Alien dry grassland	Dry Non-Forest	Dry Grassland	Alien Dry Grassland	Dry	1538
Alien dry shrubland	Dry Non-Forest	Dry Shrubland	Alien Dry Shrub	Dry	680
Mixed native-alien dry cliff community	Dry Non-Forest	Dry Shrubland	Native Dry Shrub	Dry	15
Native dry shrubland	Dry Non-Forest	Dry Shrubland	Native Dry Shrub	Dry	810
Alien mesic forest	Mesic Forest	Mesic Forest	Alien Mesic Forest	Mesic	879
Mixed native-alien mesic forest	Mesic Forest	Mesic Forest	Mixed Mesic Forest	Mesic	50
Closed ohia mesic forest	Mesic Forest	Mesic Forest	Native Mesic Forest	Mesic	188
Closed hala forest	Mesic Forest	Mesic Forest	Native Mesic Forest	Mesic	9
Closed koa-ohia mesic forest	Mesic Forest	Mesic Forest	Native Mesic Forest	Mesic	123
Open ohia mesic forest	Mesic Forest	Mesic Forest	Native Mesic Forest	Mesic	191
Open koa-ohia mesic forest	Mesic Forest	Mesic Forest	Native Mesic Forest	Mesic	179
Native mesic to dry forest and shrubland	Mesic Forest	Mesic Forest	Native Mesic Forest	Mesic and Dry	20
Alien mesic grassland	Mesic Non-Forest	Mesic Grassland	Alien Mesic Grassland	Mesic	1006

Alien mesic shrubland	Mesic Non-Forest	Mesic Shrubland	Alien Mesic Shrub	Mesic	244
Mixed native-alien mesic shrubs and grass	Mesic Non-Forest	Mesic Shrubland	Mixed Mesic Shrub	Mesic	2
Native Deschampsia grassland	Mesic Non-Forest	Mesic Grassland	Native Mesic Grassland	Mesic	4
Native mesic shrubland	Mesic Non-Forest	Mesic Shrubland	Native Mesic Shrub	Mesic	598
Alien wet forest	Wet Forest	Wet Forest	Alien Wet Forest	Wet	591
Mixed native-alien wet forest	Wet Forest	Wet Forest	Mixed Wet Forest	Wet	11
Closed ohia wet forest	Wet Forest	Wet Forest	Native Wet Forest	Wet	872
Closed koa-ohia wet forest	Wet Forest	Wet Forest	Native Wet Forest	Wet	345
Low-stature ohia wet forest	Wet Forest	Wet Forest	Native Wet Forest	Wet	177
Open ohia wet forest	Wet Forest	Wet Forest	Native Wet Forest	Wet	910
Open koa-ohia wet forest	Wet Forest	Wet Forest	Native Wet Forest	Wet	133
Alien wet grassland	Wet Non-Forest	Wet Grassland	Alien Wet Grassland	Wet	242
Alien wet shrubland	Wet Non-Forest	Wet Shrubland	Alien Wet Shrub	Wet	89
Mixed native-alien wet shrubs and grass/sedges	Wet Non-Forest	Wet Shrubland	Mixed Wet Shrub	Wet	23
Native wet cliff community	Wet Non-Forest	Wet Shrubland	Native Wet Shrub	Wet	79
Native wet shrubland	Wet Non-Forest	Wet Shrubland	Native Wet Shrub	Wet	112
Uluhe ferns and native shrubs	Wet Non-Forest	Wet Shrubland	Native Wet Shrub	Wet and Mesic	96
Water	Wetland	Wetland	Water	N/A	31
Native bog community	Wetland	Wetland	Wetland	Wet	5
Wetland vegetation	Wetland	Wetland	Wetland	N/A	11

Streams

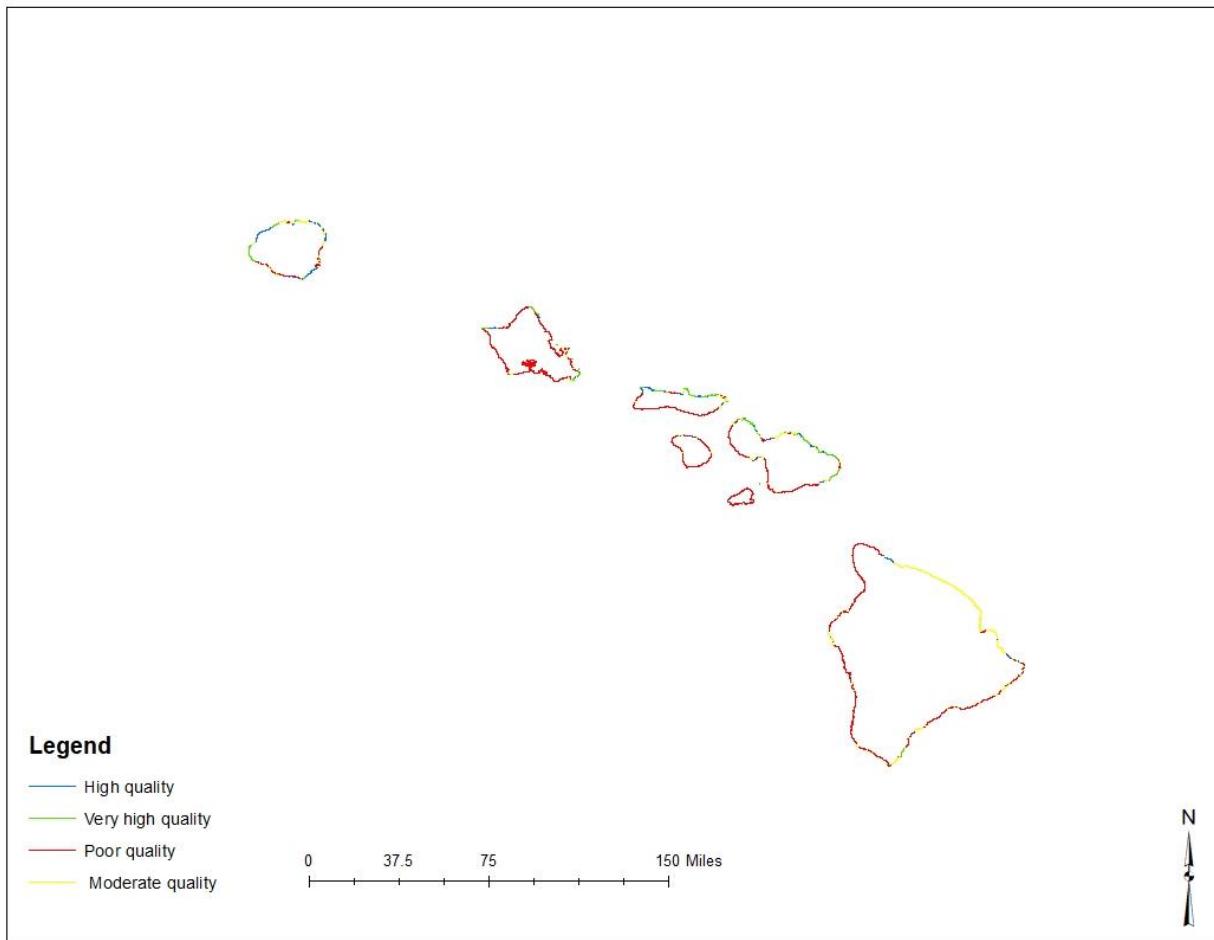
We summarized length of and type of streams using the State of Hawaii, Division of Aquatic Resources Streams layer (Statewide GIS Program 2013). We classified types of streams into categories from the raw data as shown in Table 2.

Table 2. Categories of Analysis of State Division of Aquatic Resources Stream Data

Original Classification in Dataset	Category for Analysis
L. BANK	BANK
LEFT BANK	BANK
RIGHT BANK	BANK
LAKE	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR
POND	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR
POOL	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR
RESERVOIR	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR
LAKE OR POND	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR
DAM OR WEIR	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR
ROCK	ISLAND, ISLET, ROCK, OR OTHER
ISLAND	ISLAND, ISLET, ROCK, OR OTHER
MISC	ISLAND, ISLET, ROCK, OR OTHER
ISLET	ISLAND, ISLET, ROCK, OR OTHER
INTERMITTENT	INTERMITTENT
PERENNIAL	PERENNIAL
NON-PERENNIAL	NON-PERENNIAL

Coastal Habitats

We summarized habitat length and quality for coastal habitats using the Hawaiian Islands Coastal Vegetation Survey (Jacobi and Warshauer 2017). We did not reclassify these data; rather we used their intrinsic habitat quality characterizations assigned by the authors. The point of this study (Jacobi and Warshauer 2017) was to assess the quality of the coastal strand vegetation in coastal habitats, therefore this was the best data available to meet the Habitat Status Assessment objectives.



Wetlands

We summarized wetland areas using the NOAA Coastal Change Analysis Program (CCAP) layer wetlands categories (<https://coast.noaa.gov/digitalcoast/training/ccap-land-cover-classifications.html>) listed in Table 3.

Table 3. Land Cover Categories and Descriptions Kept in Wetlands Summaries or Dropped from Analysis

NOAA Land Cover Category	Description	Keep or Drop
0	background	DROP
1	unclassified	DROP
2	impervious	DROP
5	developed open space	DROP
6	cultivated crops	DROP
7	pasture hay	DROP
8	grassland-herbaceous	DROP
9	deciduous forest	DROP
10	evergreen forest	DROP
11	mixed forest	DROP
12	scrub shrub	DROP

13	palustrine forested wetlands	KEEP
14	palustrine scrub shrub wetlands	KEEP
15	palustrine emergent wetlands	KEEP
16	estuarine forested wetlands	KEEP
17	estuarine scrub shrub wetlands	KEEP
18	estuarine emergent wetlands	KEEP
19	unconsolidated shore	KEEP
20	barren land	DROP
21	open water	KEEP
22	palustrine aquatic bed	KEEP
23	estuarine aquatic bed	KEEP
24	tundra	DROP
25	ice and snow	DROP

We generated preliminary summaries using the USFWS National Wetlands Inventory (NWI) layers, but decided that the quality of this data set was not adequate to perform the spatial analyses for the HSA reports, especially for islands that had not been mapped since the early 1980s (Peters 1984).

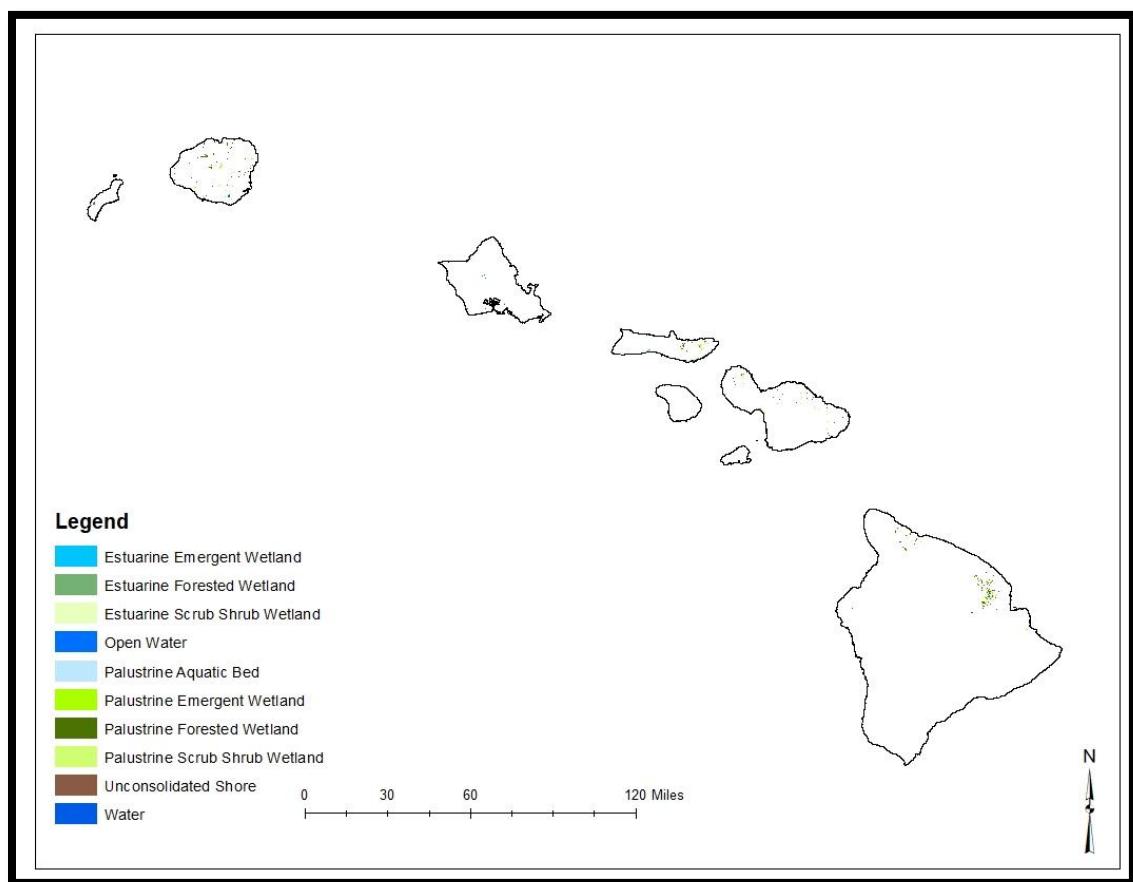


Figure 3. Wetlands from the NOAA Coastal Change Analysis Program layers (NOAA 2011)

To process the NWI data (Figure 4) and increase the comparability to the NOAA data (Figure 3), we dropped the wetland types “Estuarine and Marine Deepwater” and “Riverine” from the dataset. Even with this change, the NWI data (Peters 1984, USFWS at <https://www.fws.gov/wetlands/>) overestimates wetland areas relative to the NOAA Coastal Change Analysis Program (CCAP) layers (NOAA 2011), most notably on the islands of Hawaii and Maui (Figure 4, Figure 5). These islands both have large expanses of wet forest habitats on their northeastern windward sides, which the layers classify differently, leading to a large discrepancy in total area calculations.

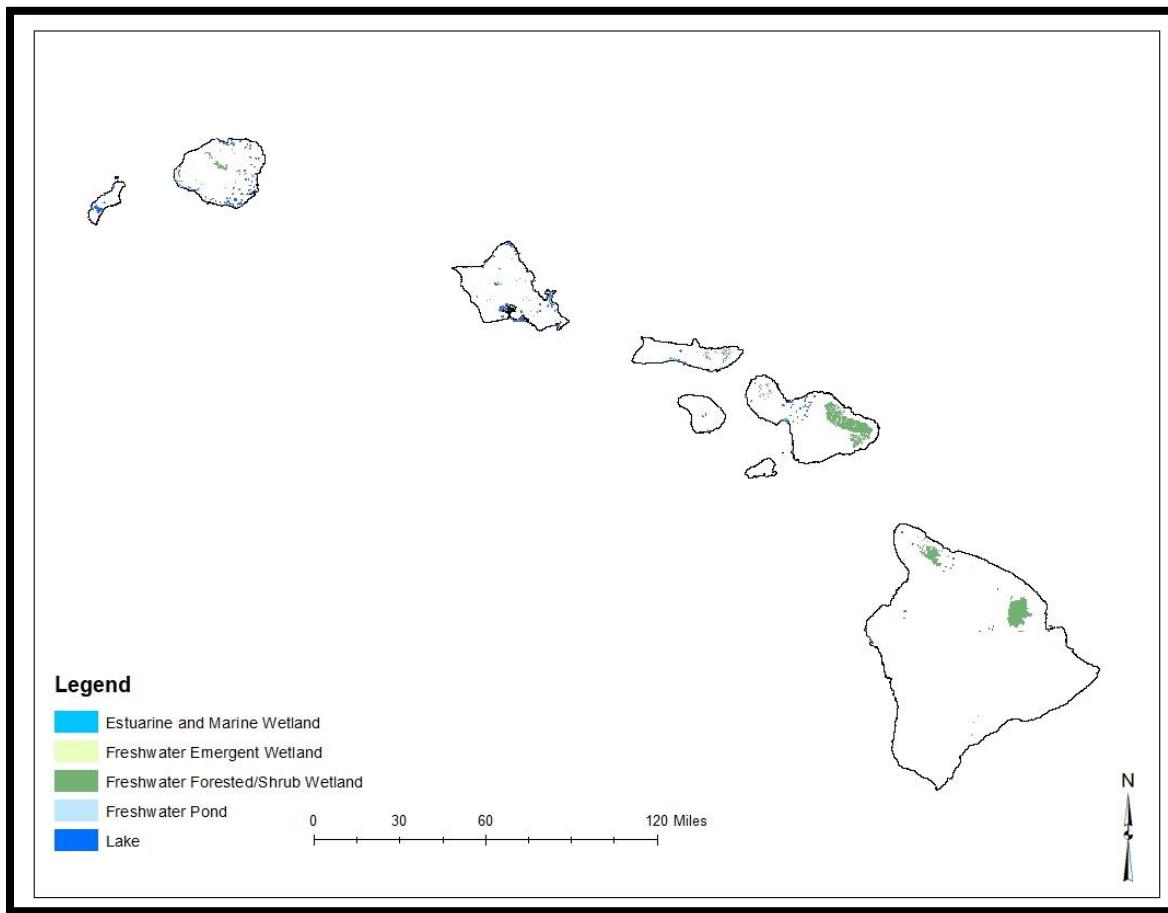


Figure 4. Wetlands from National Wetlands Inventory Used in Analysis

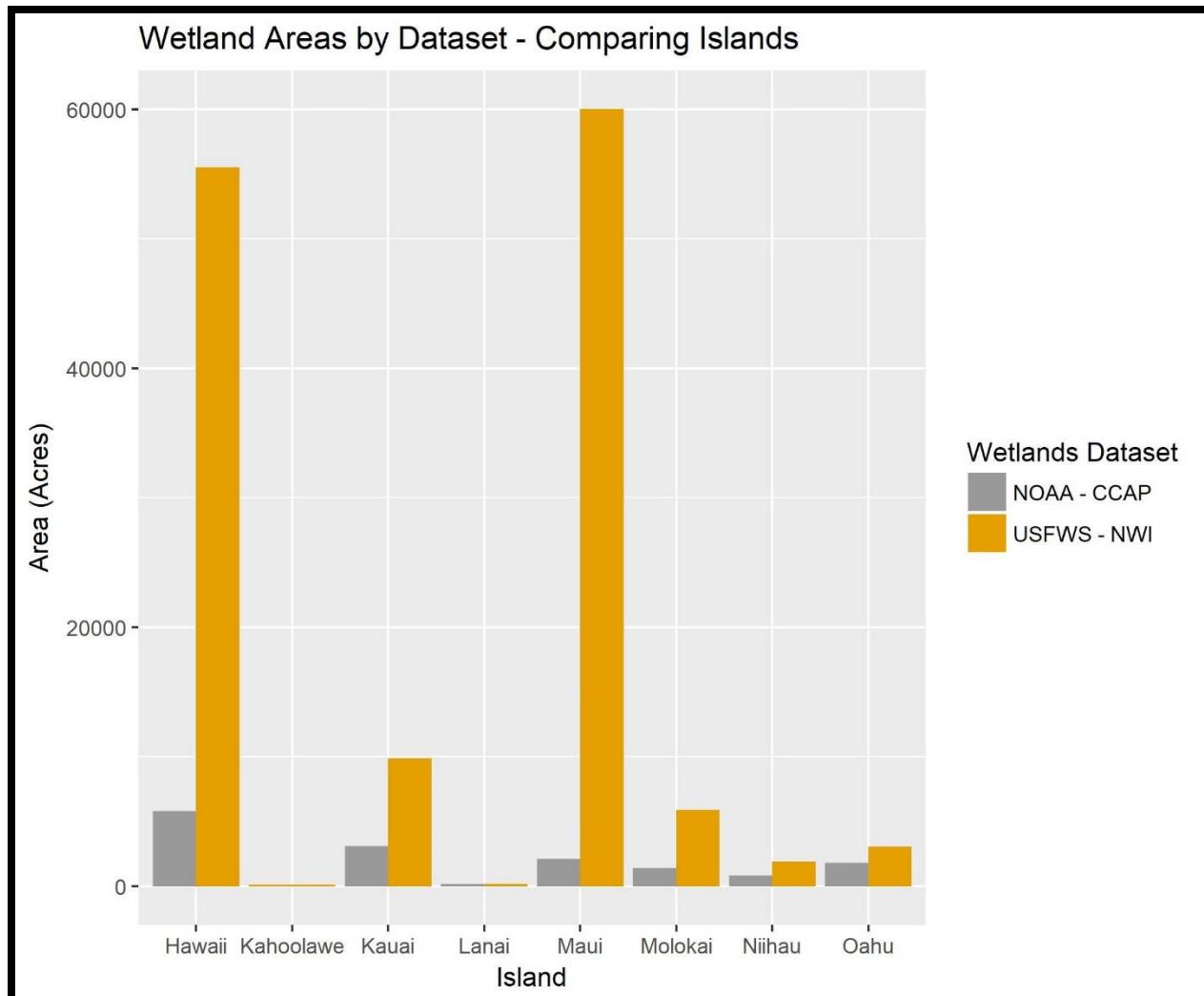


Figure 5. Comparison of Wetland Areas between NOAA and NWI datasets

Habitat Quality

We evaluated habitat quality using the Habitat Status layer from the 2017 Carbon Assessment (Jacobi et al. 2017). This layer describes the status of the land cover in terms of native versus non-native vegetative dominance, barren ground, impervious surface or other human development. To summarize the area of each habitat by its quality, we performed a spatial intersection of this layer with the habitat layers. We implemented these spatial intersections in either R or ArcGIS 10.3, depending on the dataset. R codes are included as appendices H through L. Habitat Quality for the coastal vegetation (Jacobi and Warshauer 2017) was included in that dataset, therefore we did not perform intersections for the coastal vegetation analysis—instead the habitat quality categories assigned by the authors were used.

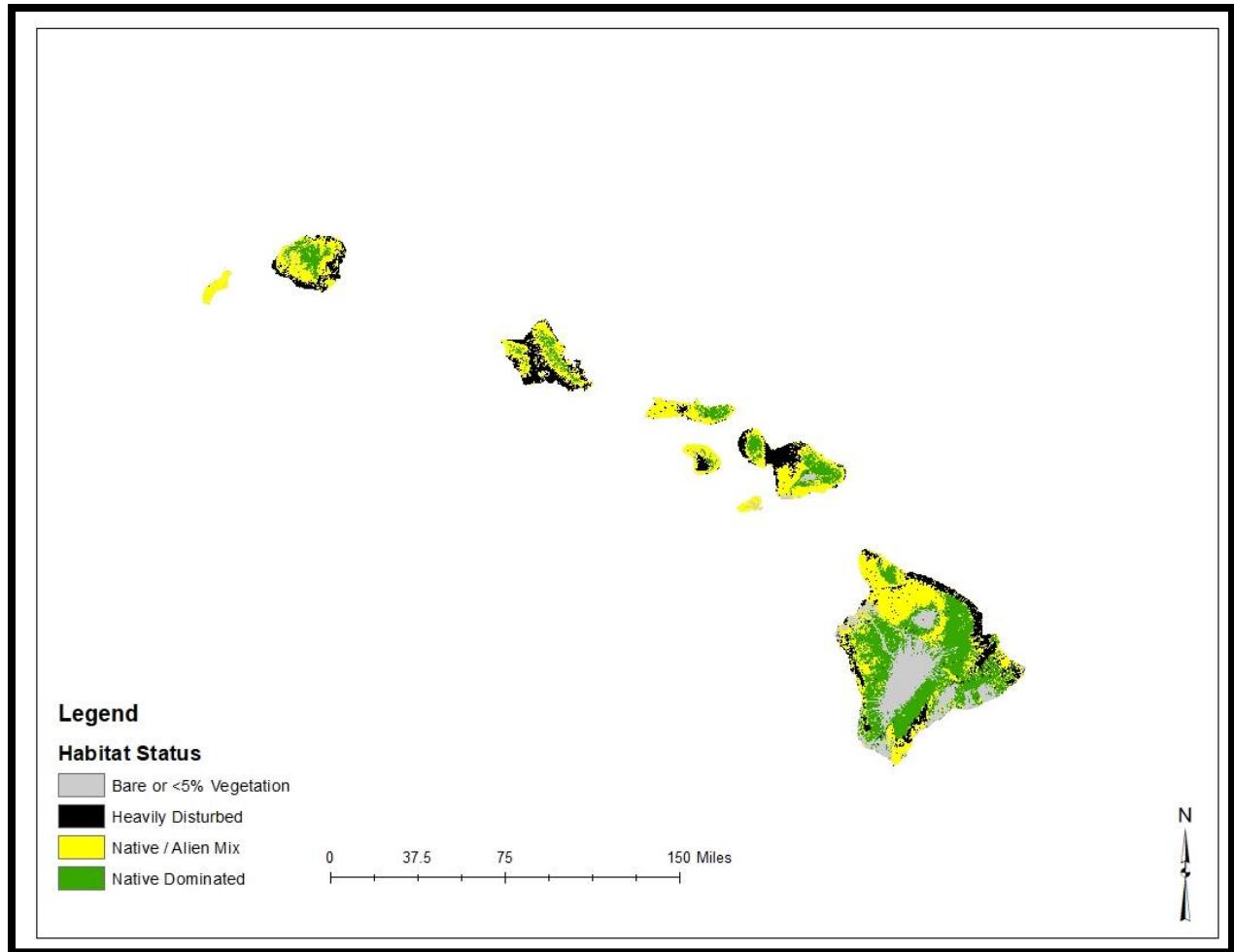


Figure 6. Statewide Habitat Quality based on the Carbon Assessment Layers (Jacobi et al. 2017)

Relative Moisture

Because the Carbon Assessment Layers comprised moisture determinations for most habitats in the related geospatial data, we used the categories the authors assigned to each habitat for relative moisture (Figure 7, Table 1). The authors did not assign Developed, Barren, or Wetland habitats to moisture categories, which we retained because it would not make sense to assign these habitats to a plant moisture availability based category (Price and Jacobi 2012). In addition, the authors did not assign plantation forests to moisture categories, however, we did this assignment for the forest analysis, using the moisture zone maps (Price and Jacobi 2012), created by Price et al. (2012) for each main island to divide plantation forests into dry, mesic and wet regions (Figure 7).

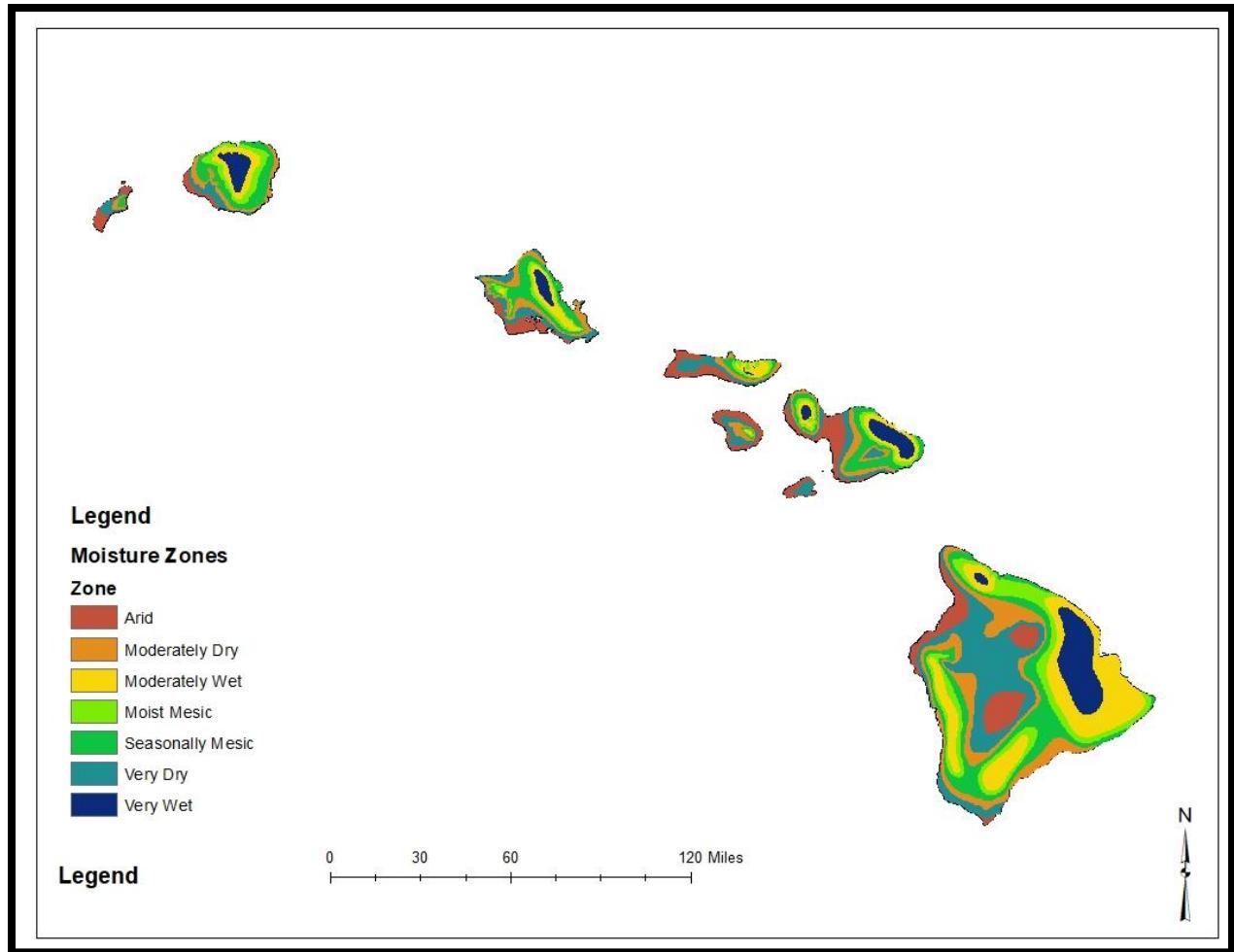


Figure 7. Statewide Moisture Zones based on the Carbon Assessment Layers (Jacobi et al. 2017)

Land Ownership

We obtained the land ownership layer from the Hawaii State Office of Planning Website (<http://planning.hawaii.gov/gis/>). We determined amount and proportion of each habitat in each land ownership category. We combined the two state-owned categories ("Govt. State DHHL" and "Govt. State") into a single "State" land ownership category. Aside from this, we used the original data for land ownership.

Reserve Status

We enumerated areas of each habitat in a conservation status using the State of Hawaii Reserves layer (<http://files.hawaii.gov/dbedt/op/gis/data/reserves.html>). We limited the reserves we considered to those areas that several members of the PIFWO biology staff thought were the most meaningful for conservation (S. Miller, C. Phillipson, and S. Machida, pers. comm.). We include further methods for this step in the analysis as Appendix M. From the full list of reserve types shown in Figure 7, we selected only the following nine reserve types:

- National Historical Park,
- National Park,
- National Wildlife Refuge,

- Marine Life Conservation District,
- Natural Area Reserve,
- Private Preserve,
- State Wilderness Park,
- The Nature Conservancy Preserve, and
- Wildlife Sanctuary

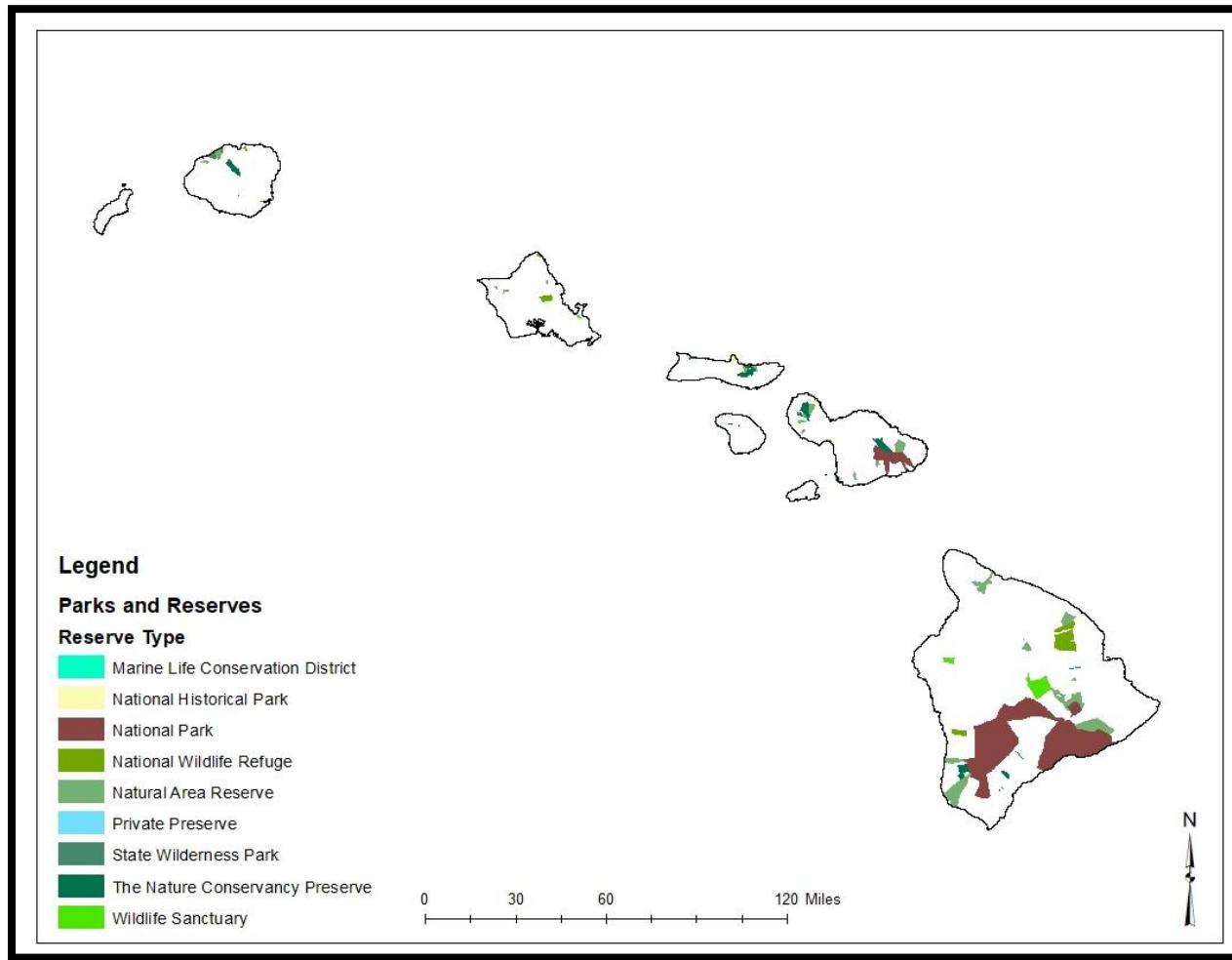


Figure 8. Reserve Types and Areas from the State of Hawaii Reserves Layer

Critical Habitat

We summarized areas protected by a Critical Habitat designation by performing a spatial intersection between the PIFWO Habitat areas and Critical Habitat areas designated by the U.S. Fish and Wildlife Service (codes for these analyses are included as Appendices G through K).

Habitat Areas before Human Contact

We used layers developed by The Nature Conservancy to enumerate and map approximate areas of Habitat believed to be present before human contact (The Nature Conservancy 1998; Pratt and Gon

1998). It is important to note that this layer is so generalized that one should not consider habitat areas reported in these tables as exact (Figure 9).

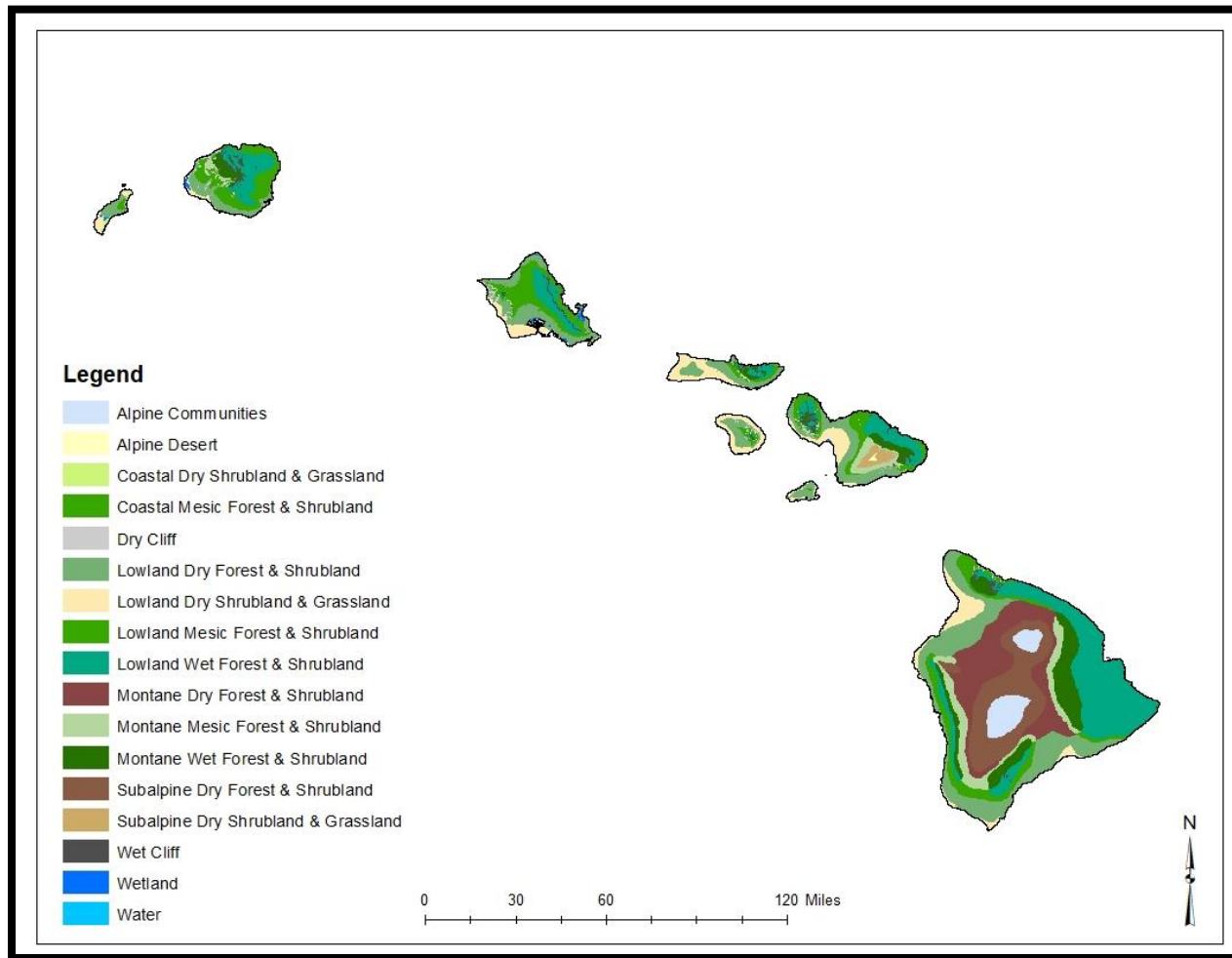


Figure 9. Pre-contact Habitat Areas from TNC 1998.

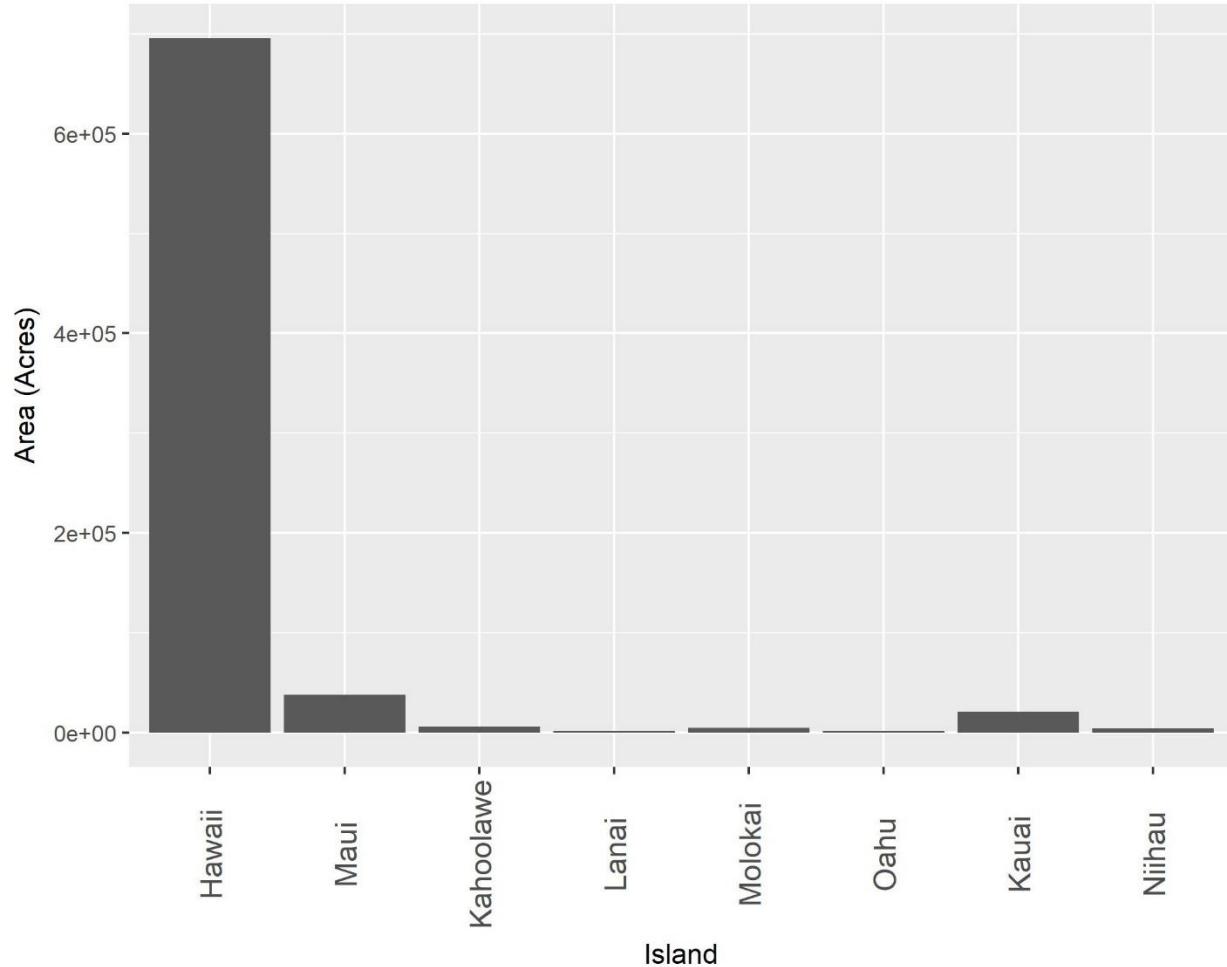
Summary Information Provided

The following figures and tables are the final versions of the summaries provided to the Habitat Teams in June of 2018. They show the following:

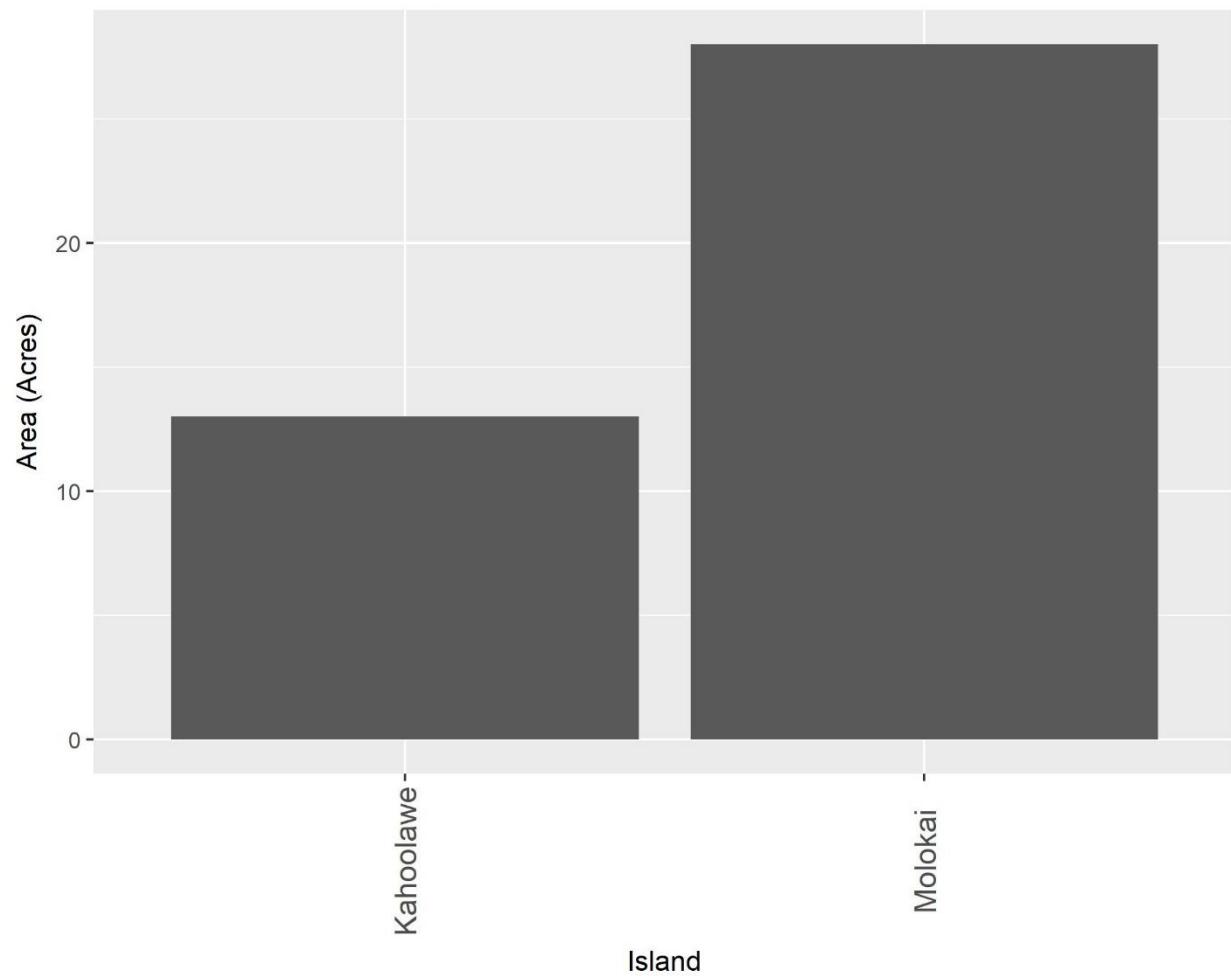
- Acres of habitat on each island,
- The proportion of that habitat on each island in each habitat status category,
- The proportion of that habitat on each island in each land ownership category,
- The amount of habitat protected within reserve areas,
- The amount protected by a federal critical habitat designation,
- The approximate areas of each habitat type thought to exist before human contact, and
- The current composition of each habitat in terms of vegetation type and vegetation quality.

Simple Habitat Area Summaries

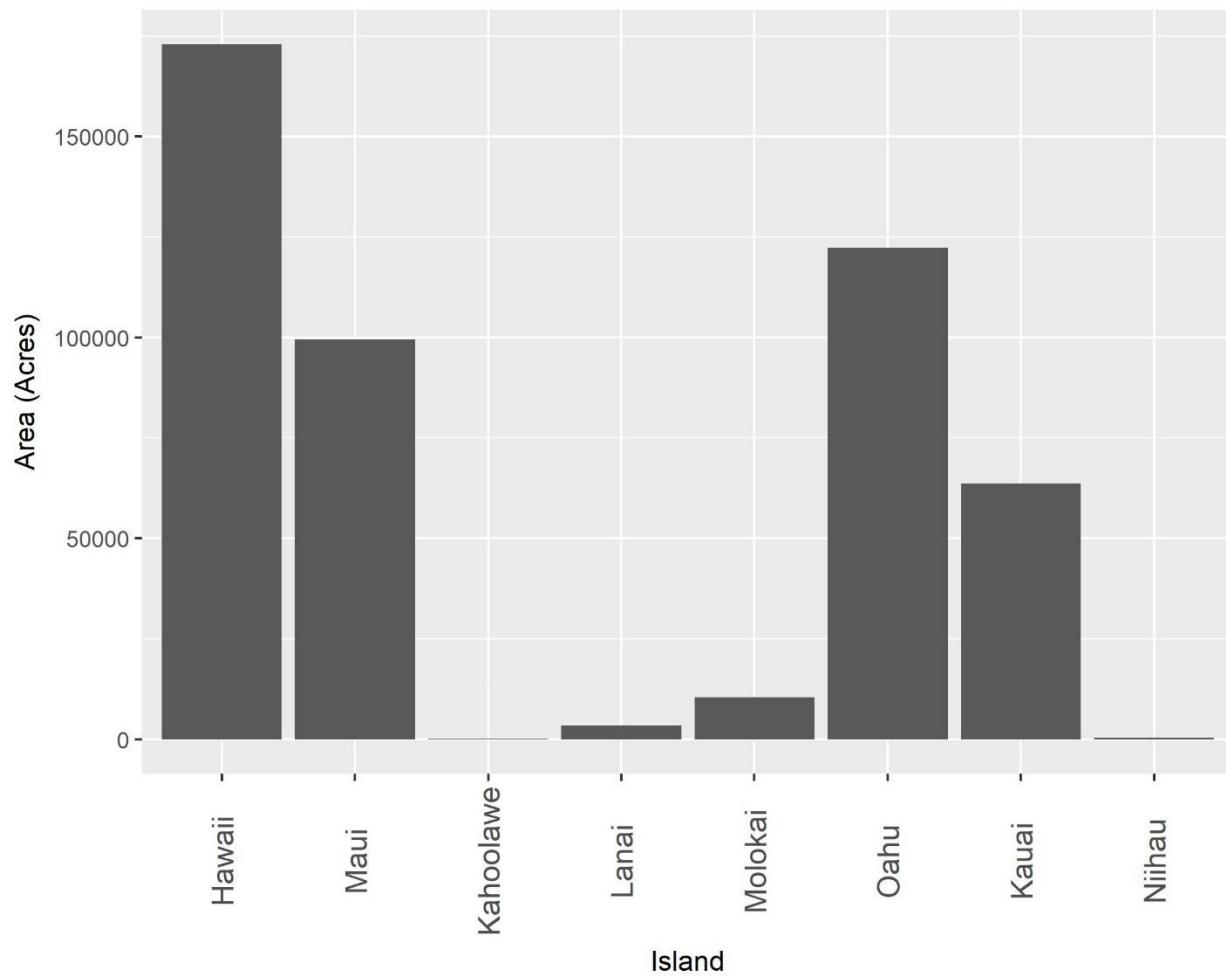
Barren Area Summary



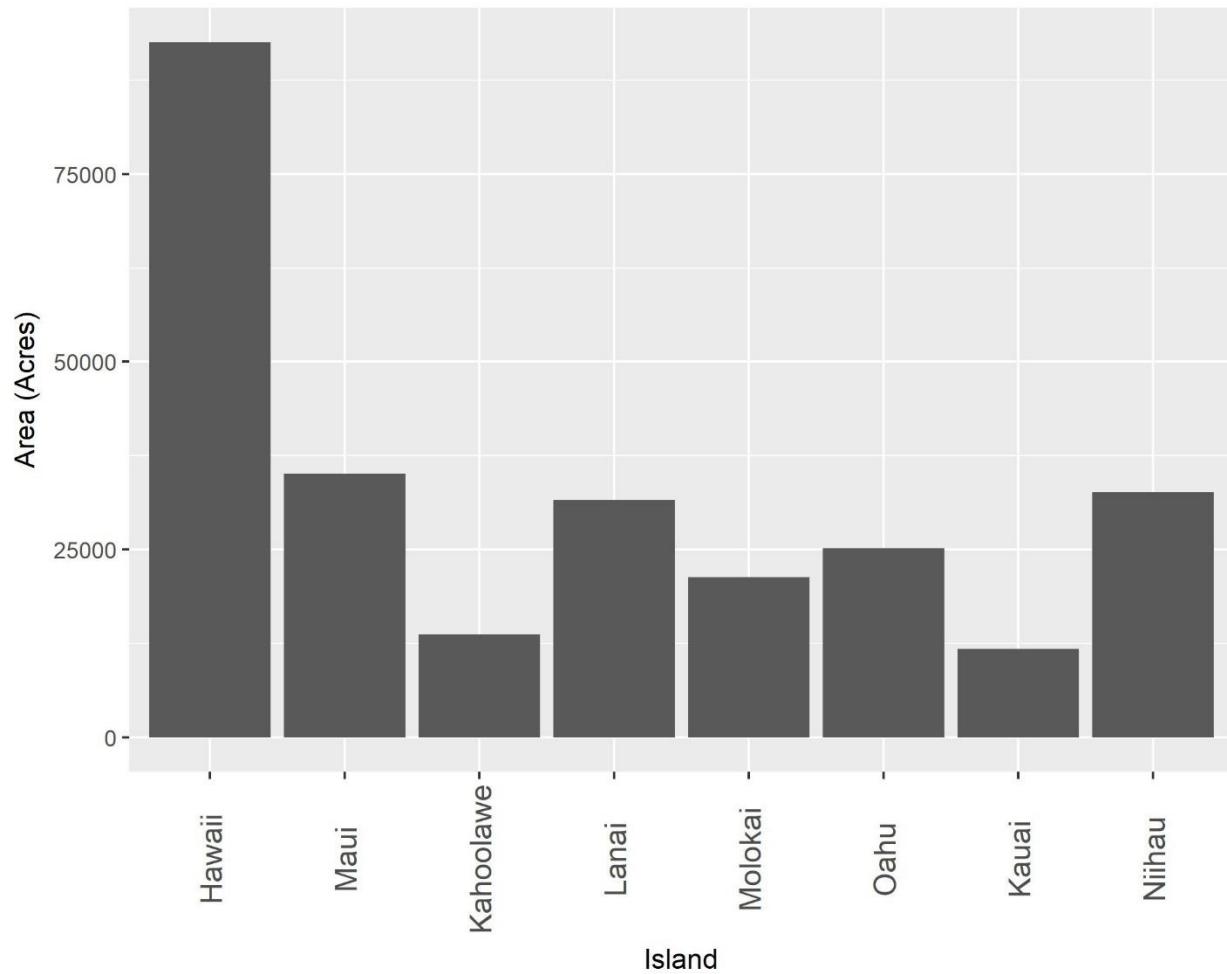
Coastal Area Summary



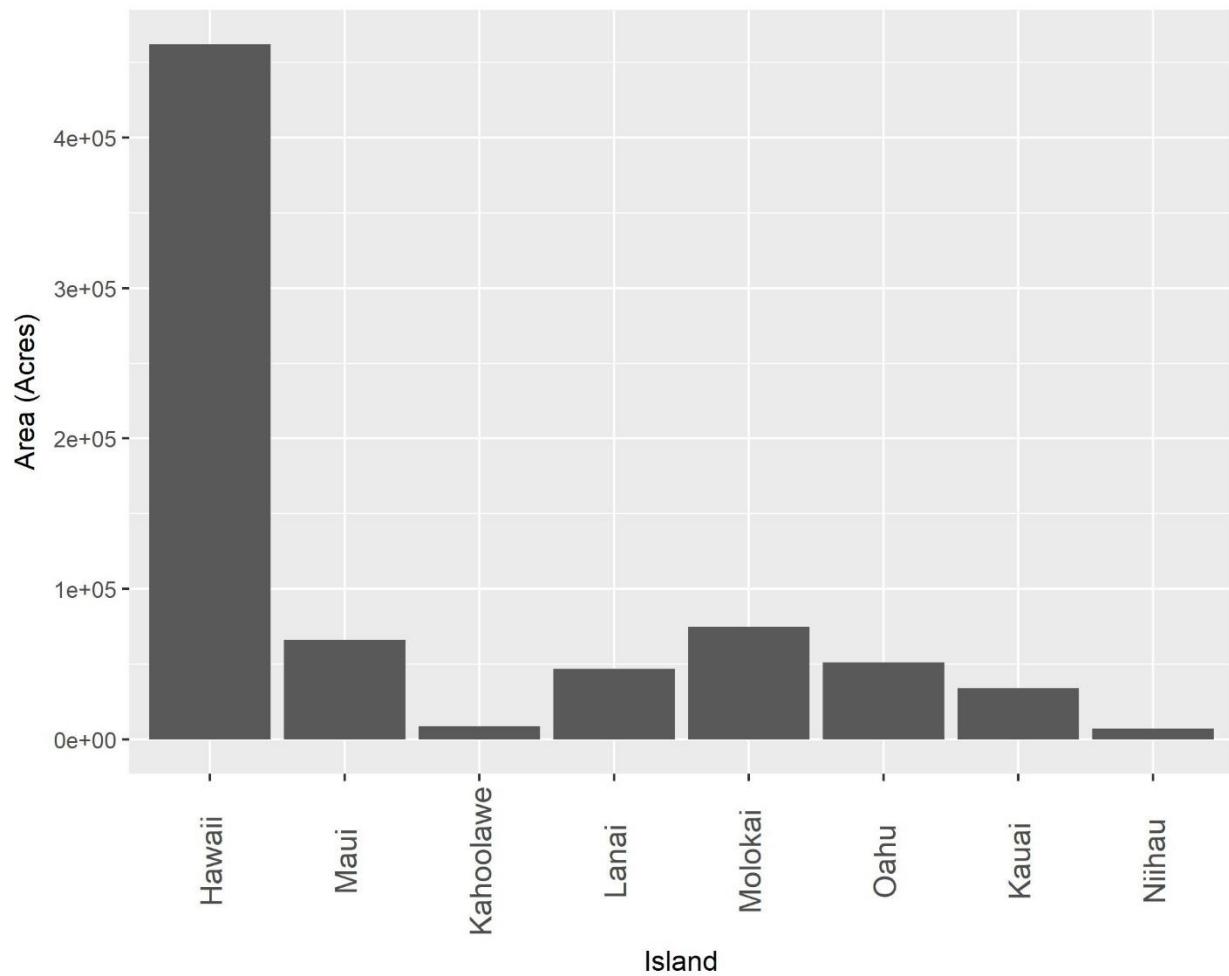
Developed Area Summary



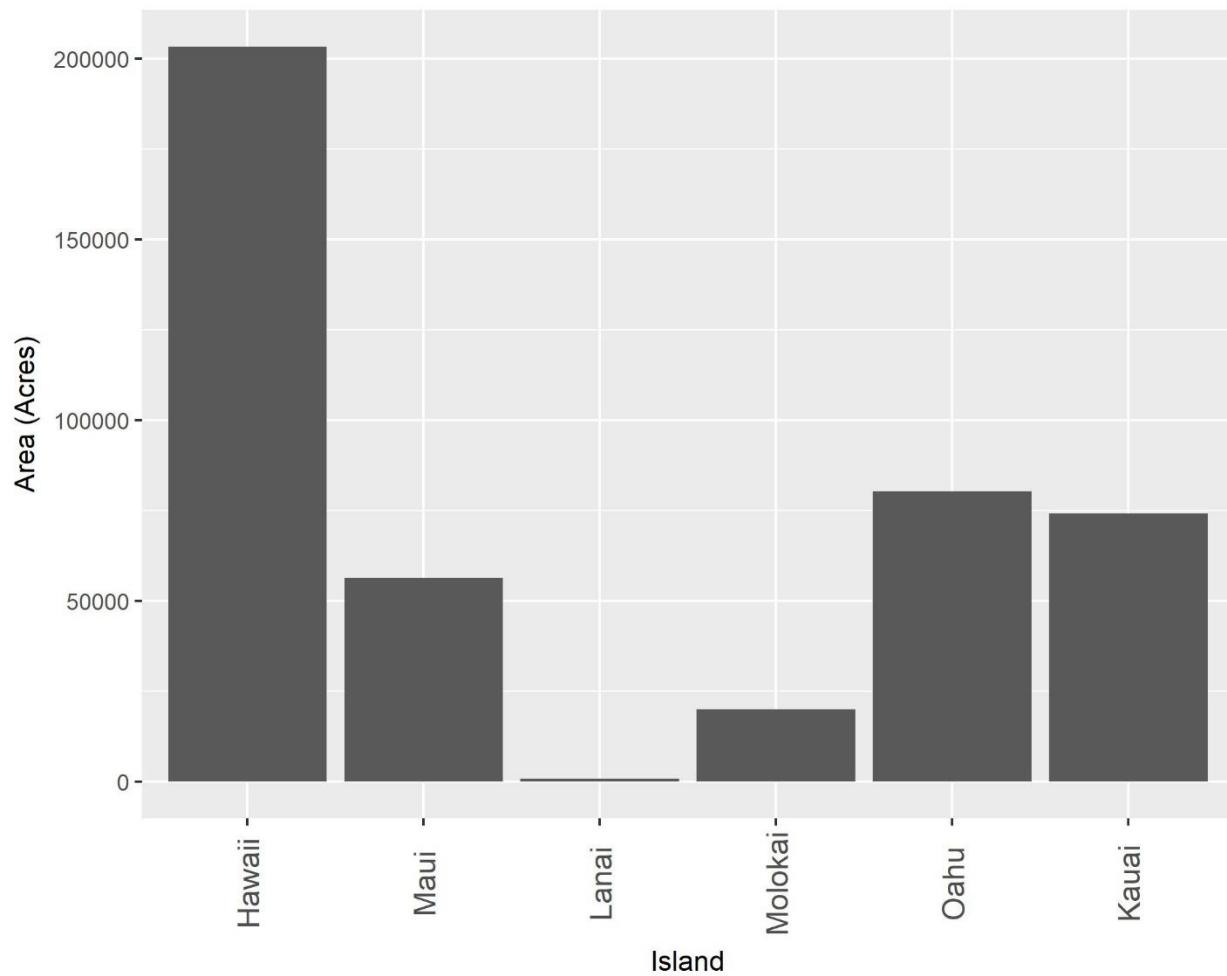
Dry Forest Area Summary



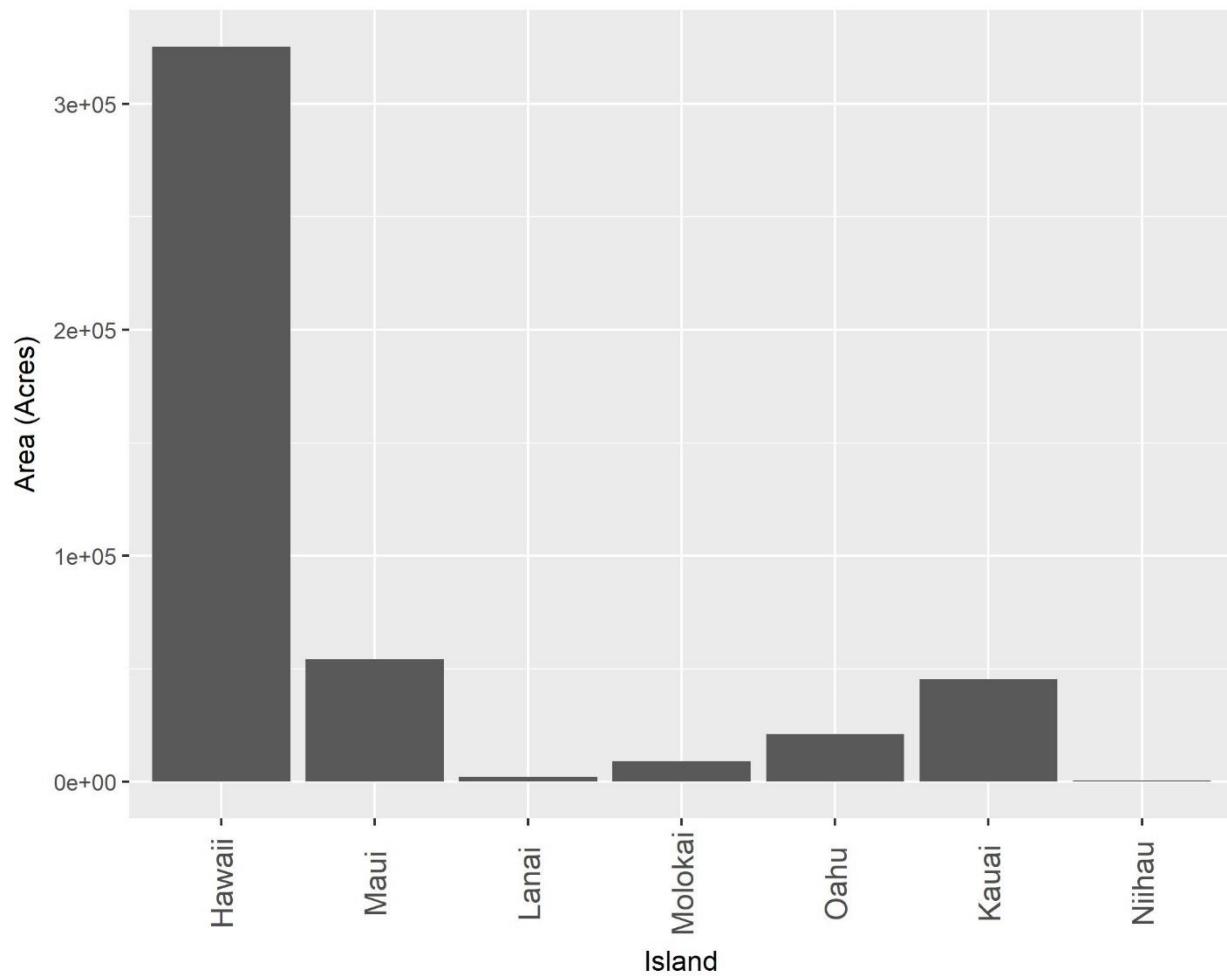
Dry Grasslands and Shrublands Area Summary



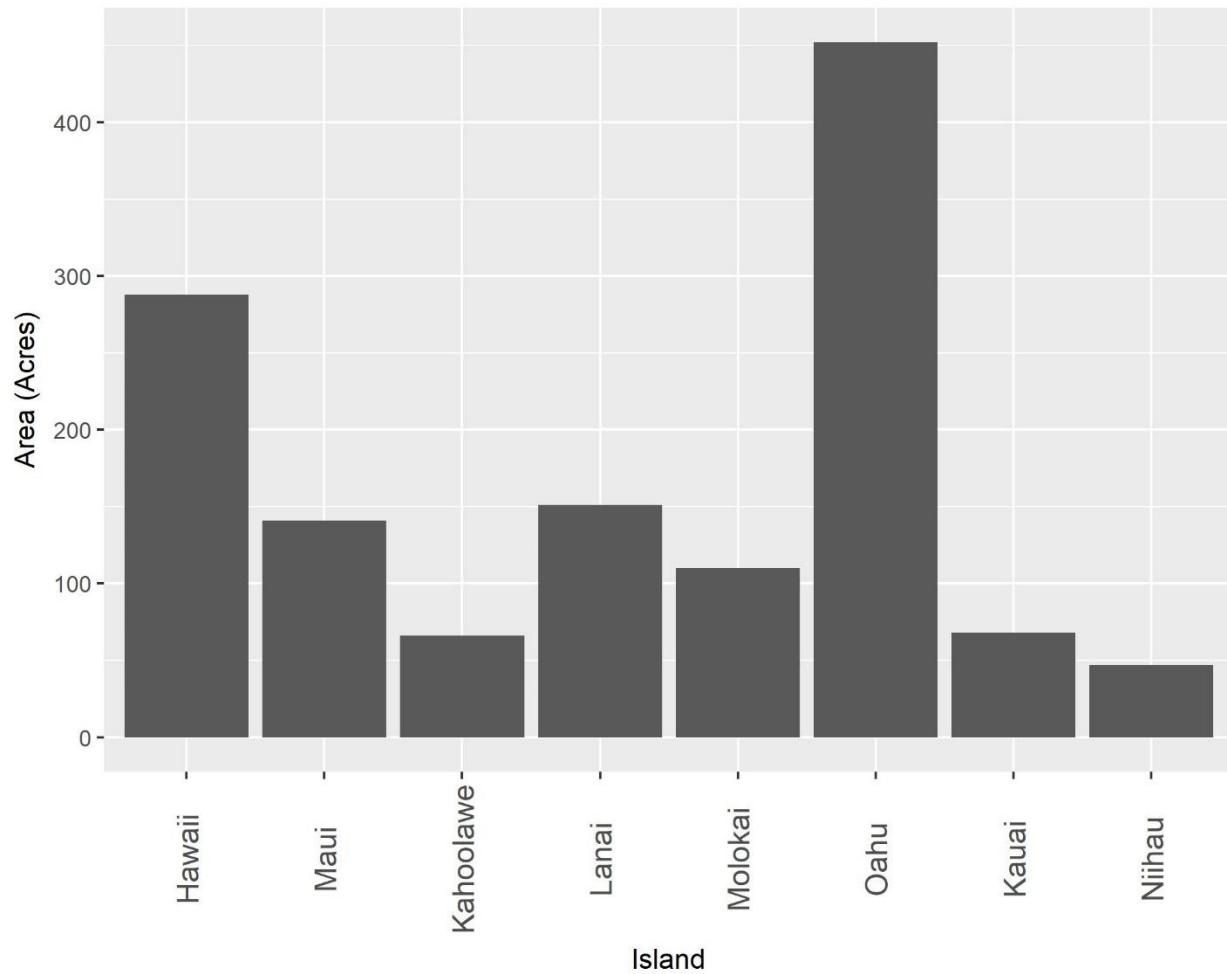
Mesic Forest Area Summary



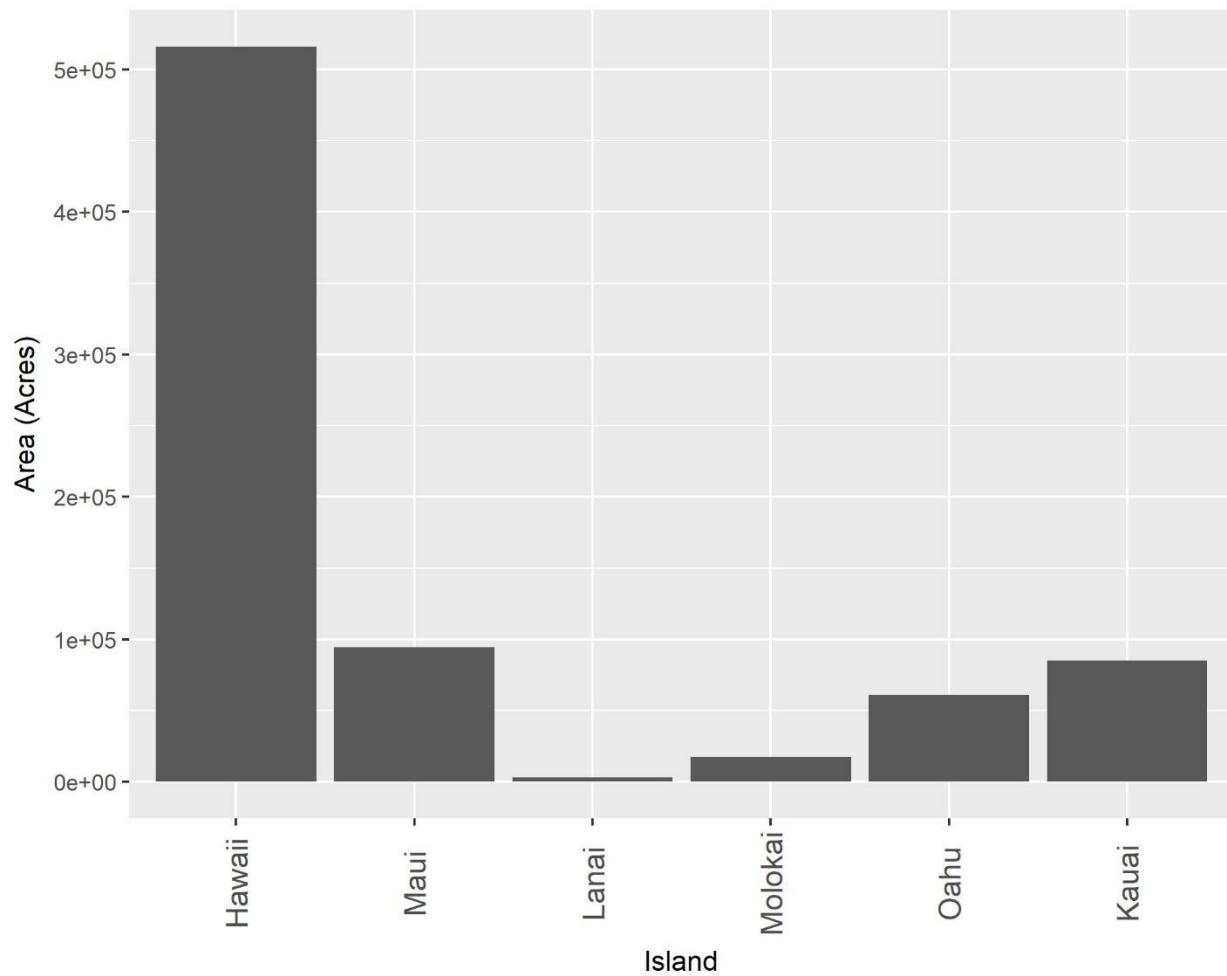
Mesic Grasslands and Shrublands Area Summary



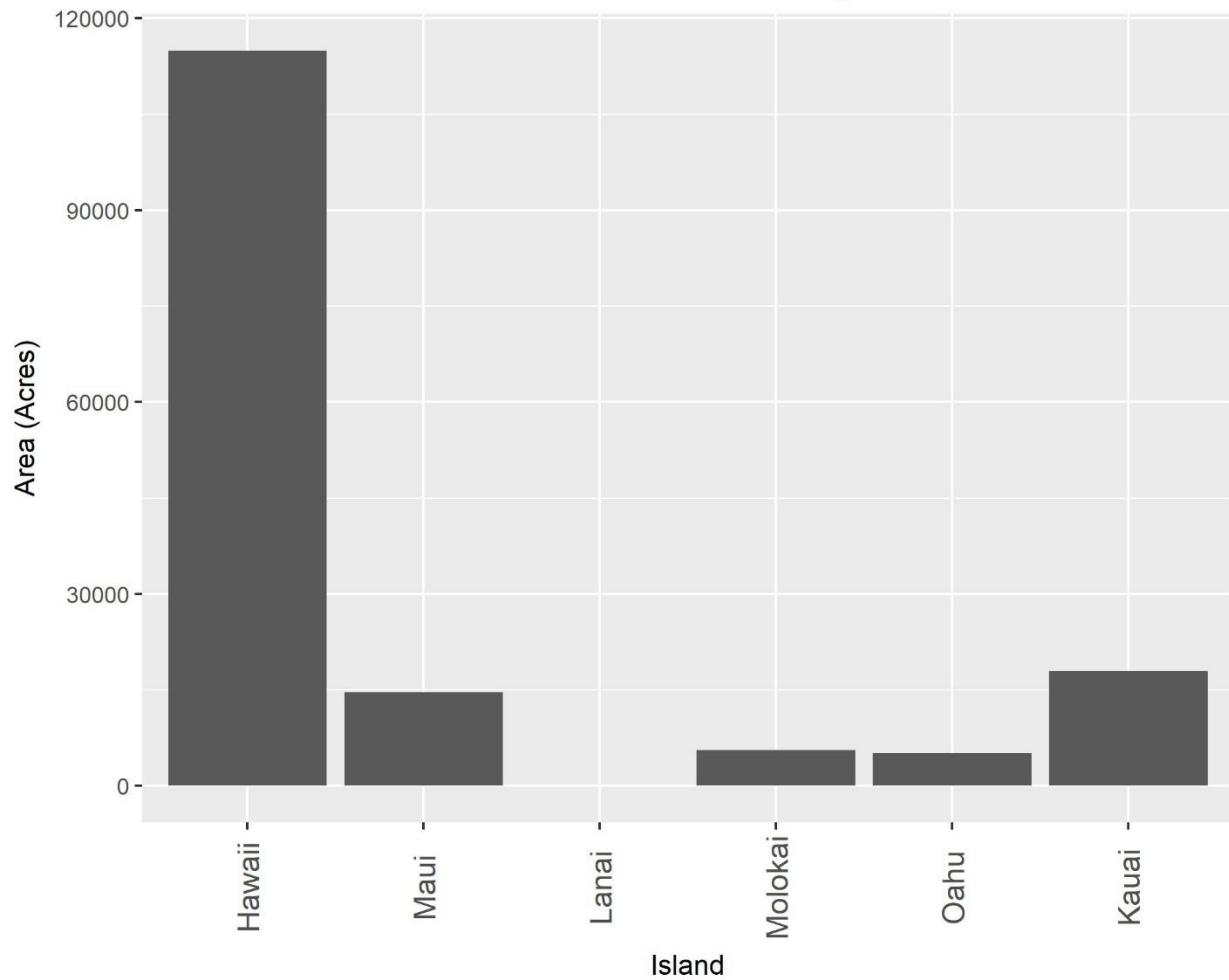
No Data Area Summary



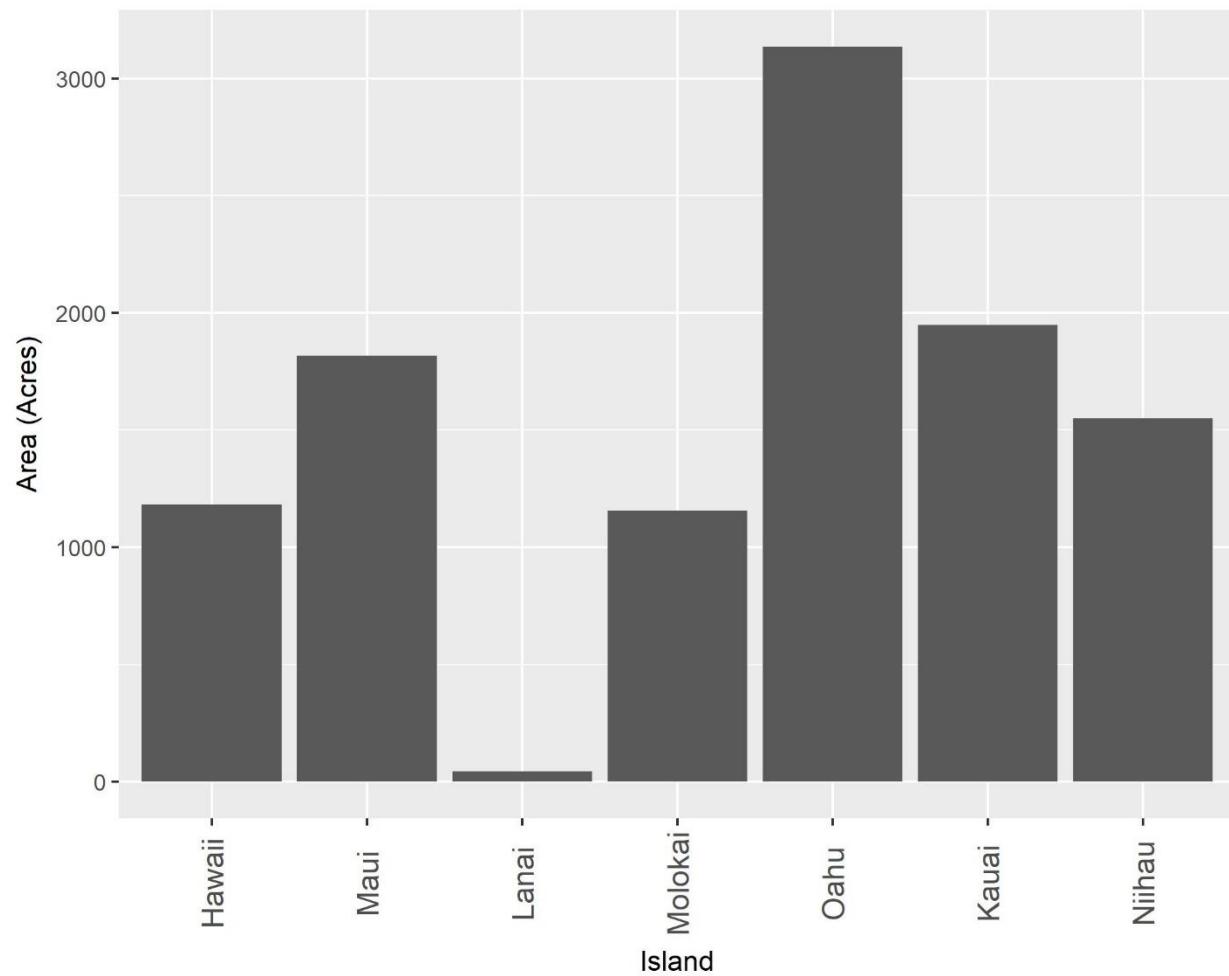
Wet Forest Area Summary



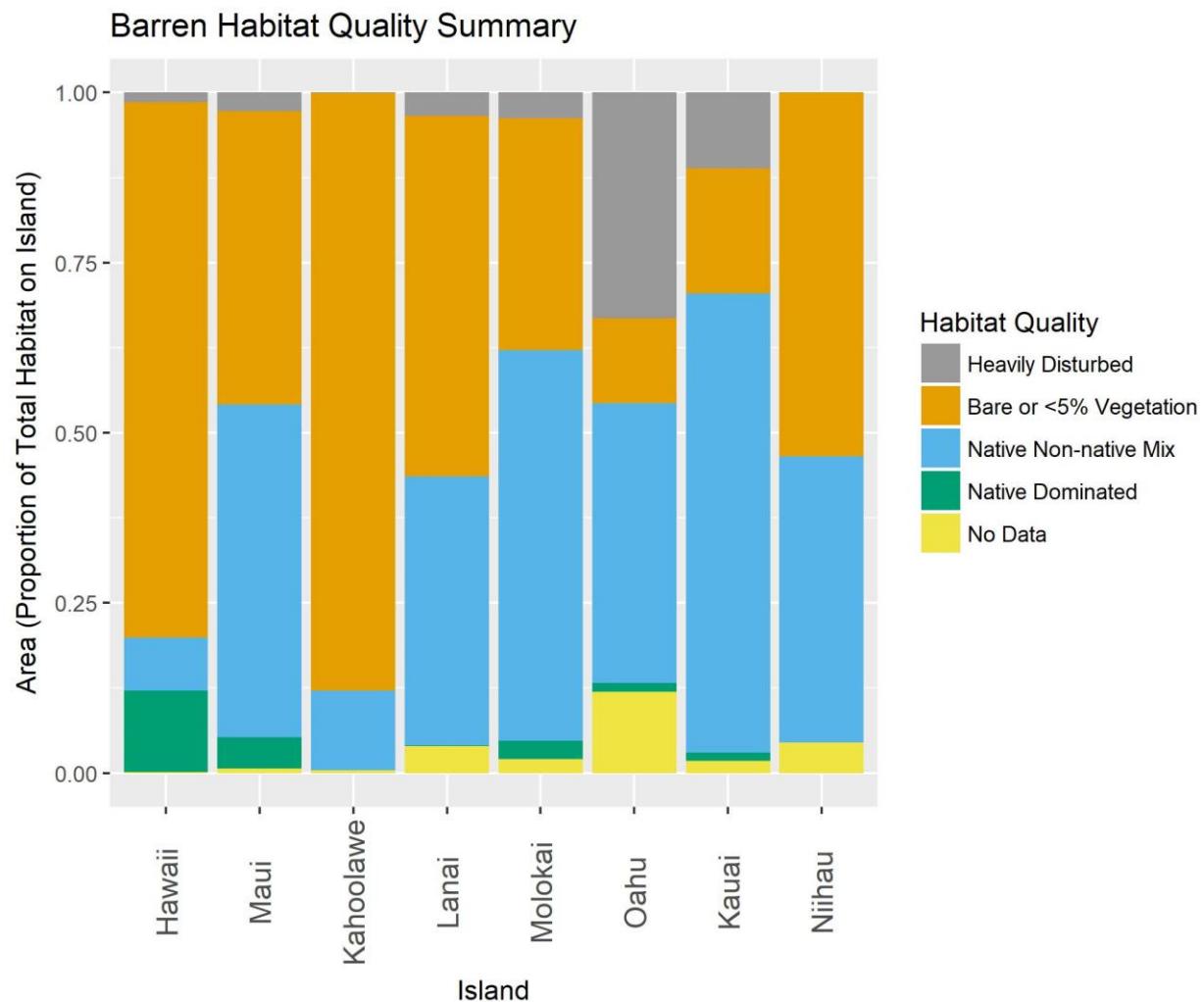
Wet Grasslands and Shrublands Area Summary



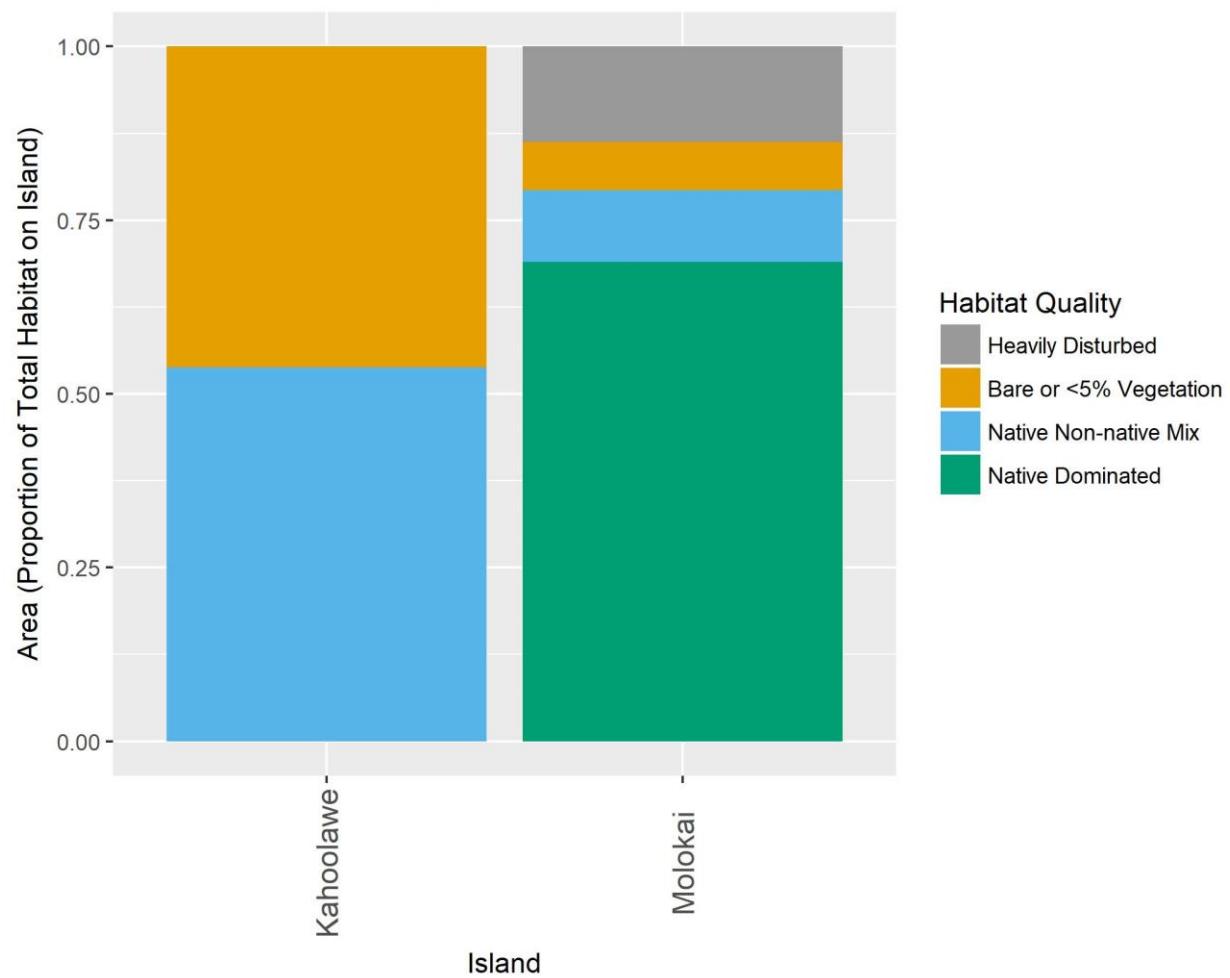
Wetland Area Summary



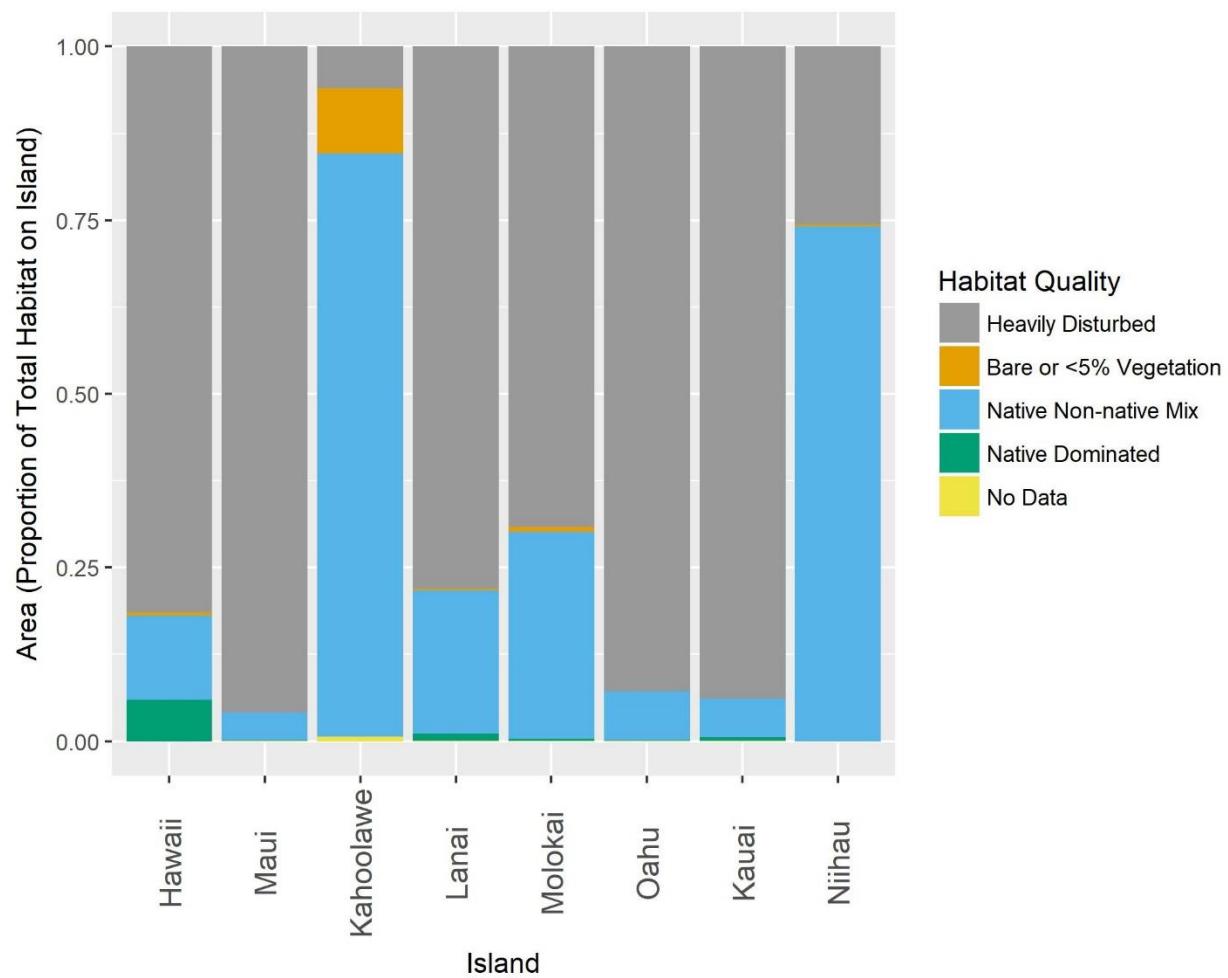
Habitat Quality



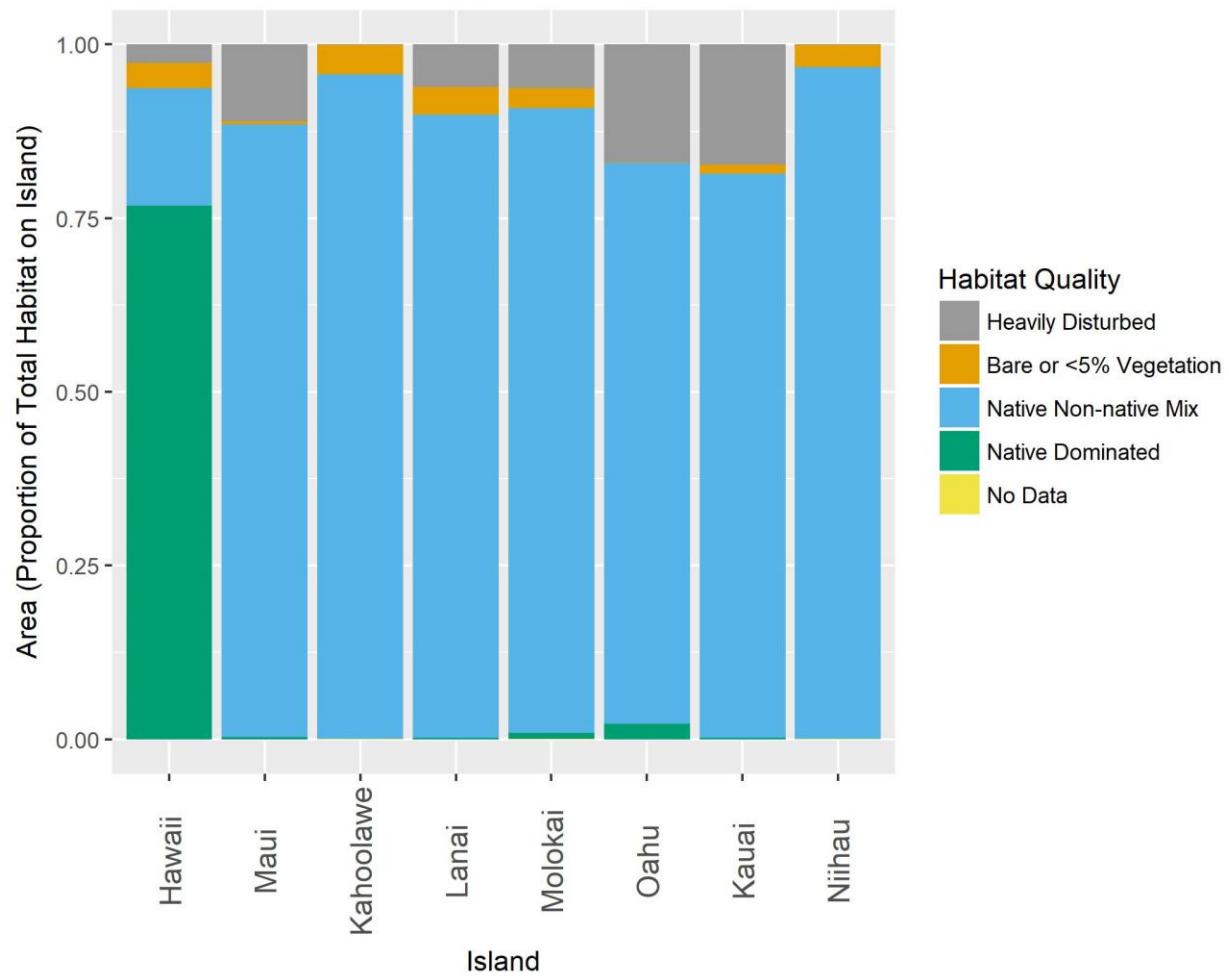
Coastal Habitat Quality Summary



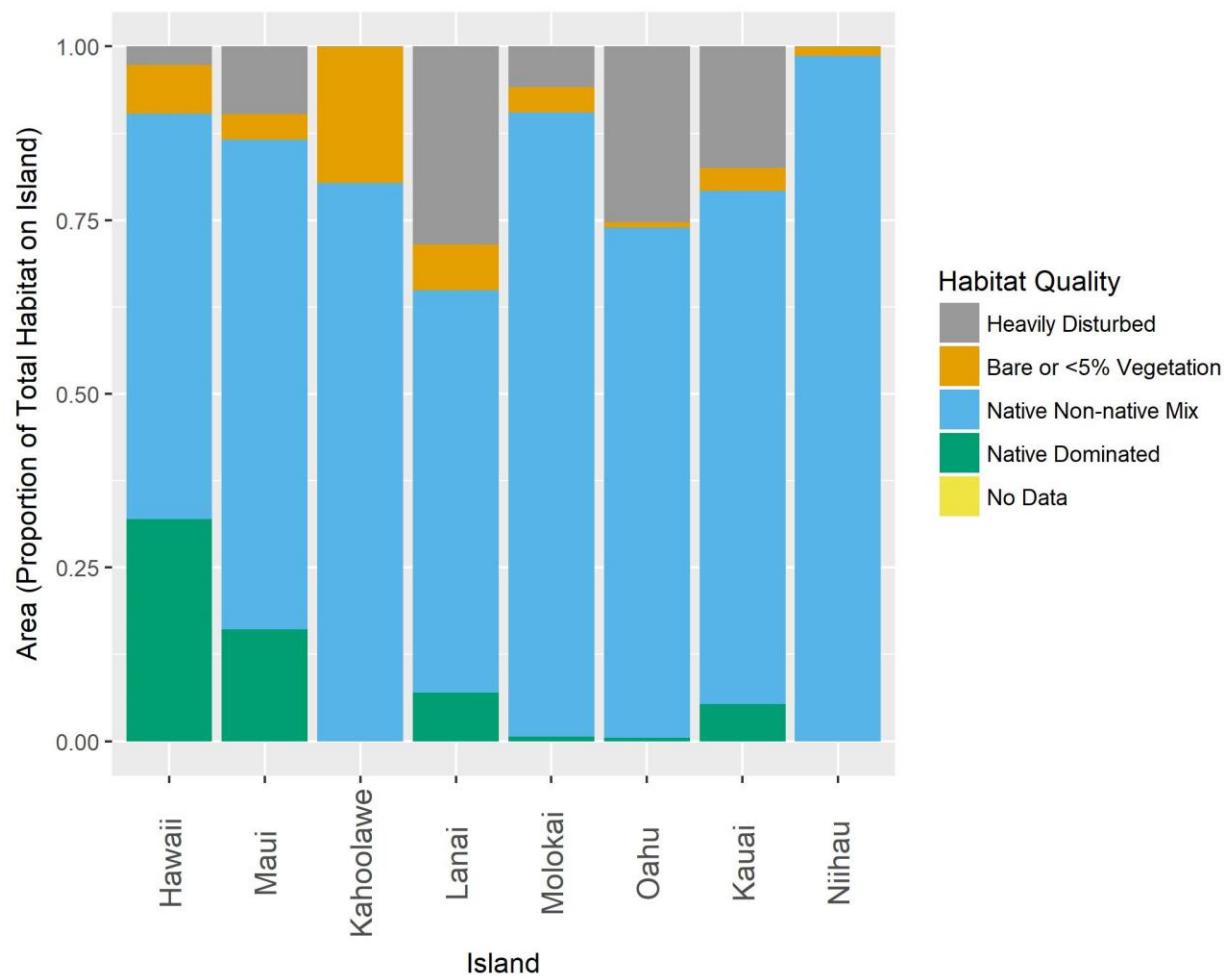
Developed Habitat Quality Summary



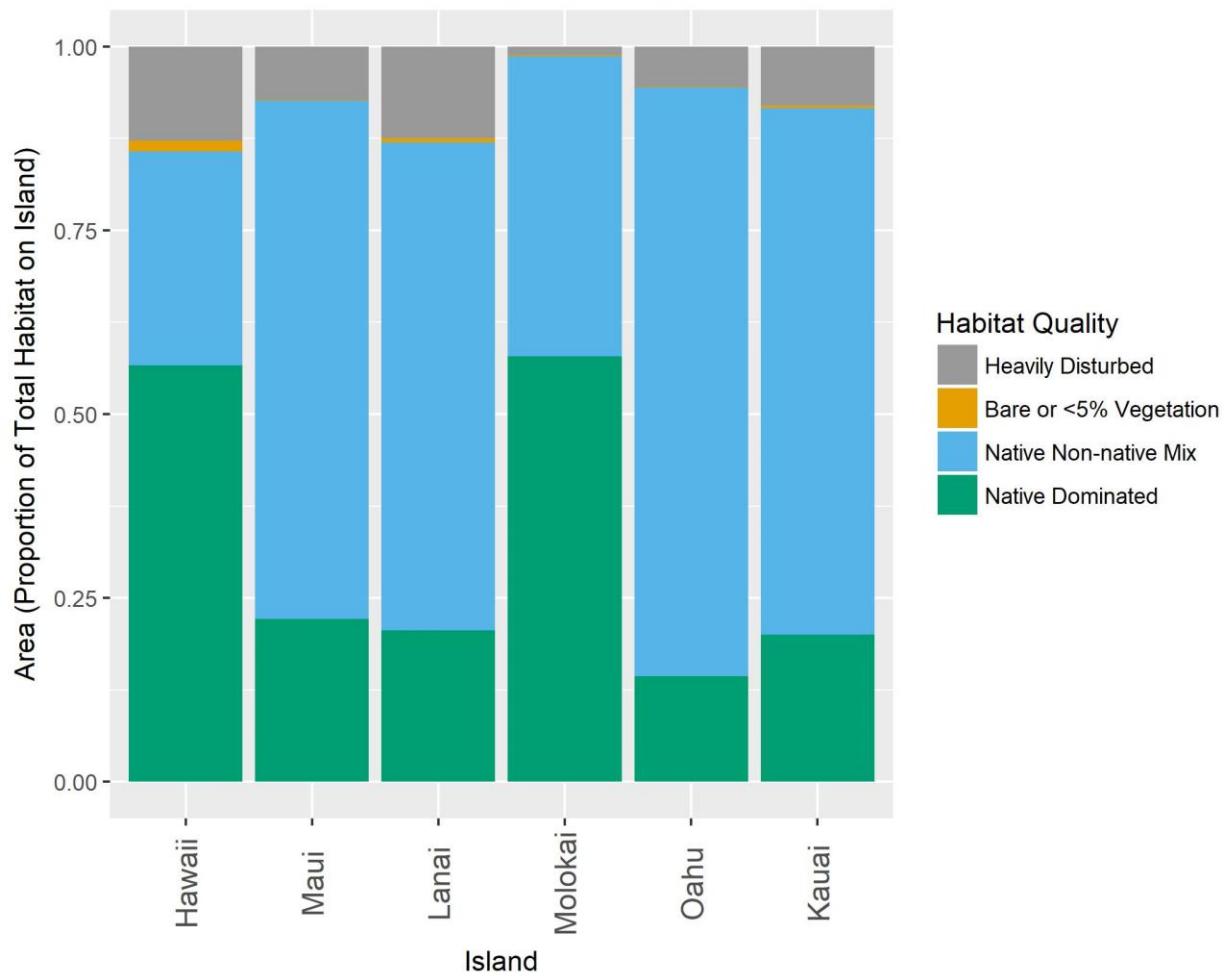
Dry Forest Habitat Quality Summary



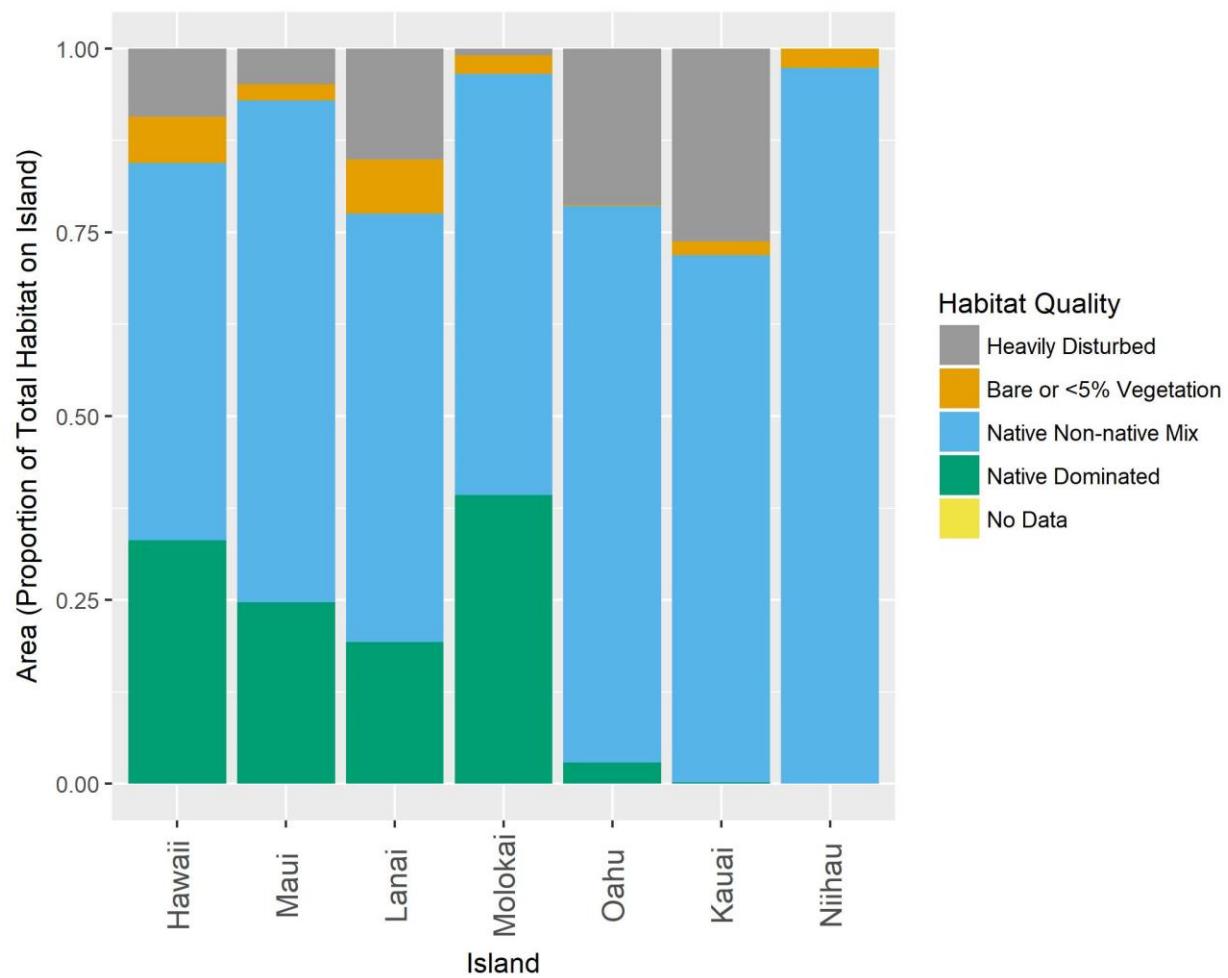
Dry Grasslands and Shrublands Habitat Quality Summary



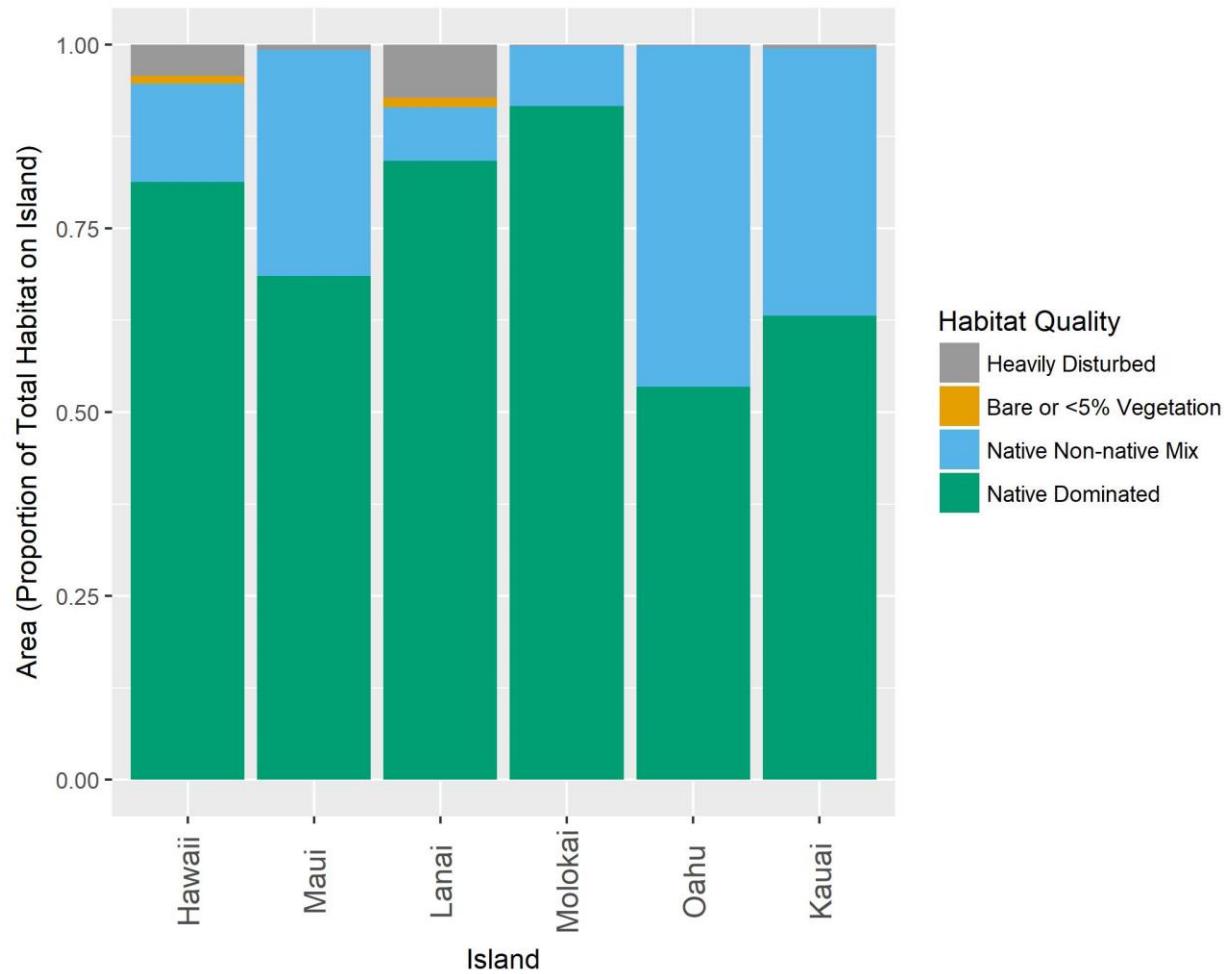
Mesic Forest Habitat Quality Summary



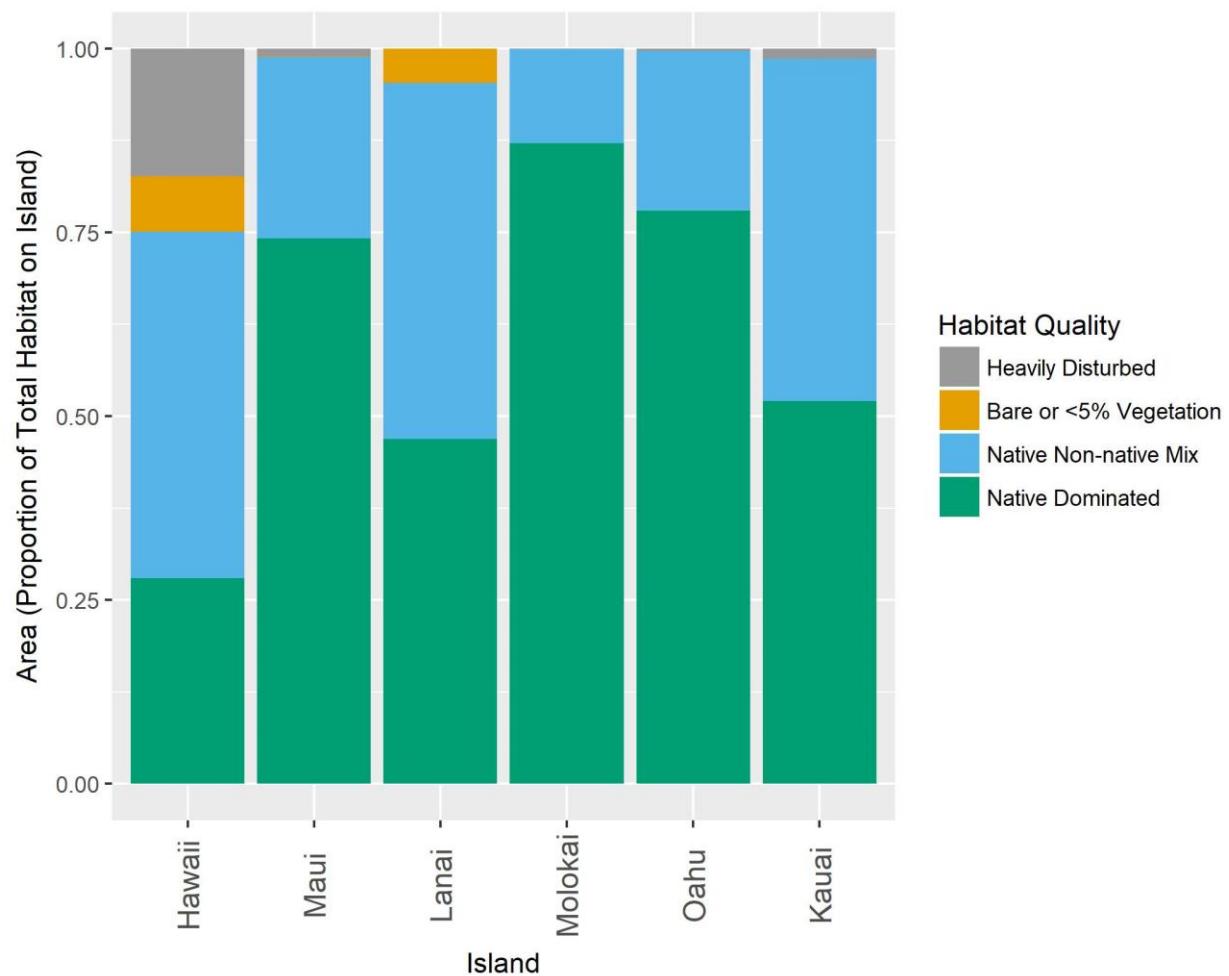
Mesic Grasslands and Shrublands Habitat Quality Summary



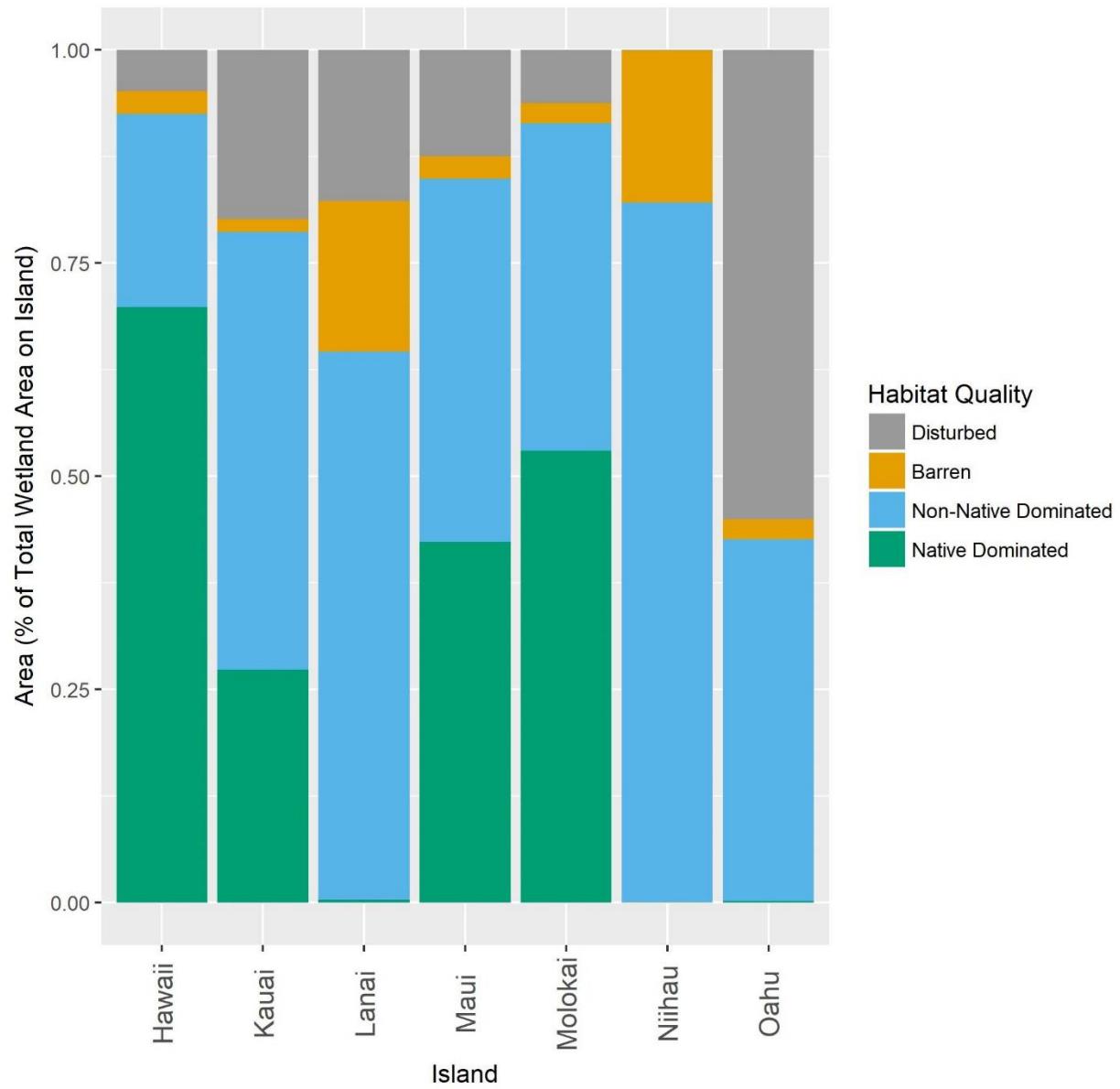
Wet Forest Habitat Quality Summary



Wet Grasslands and Shrublands Habitat Quality Summary

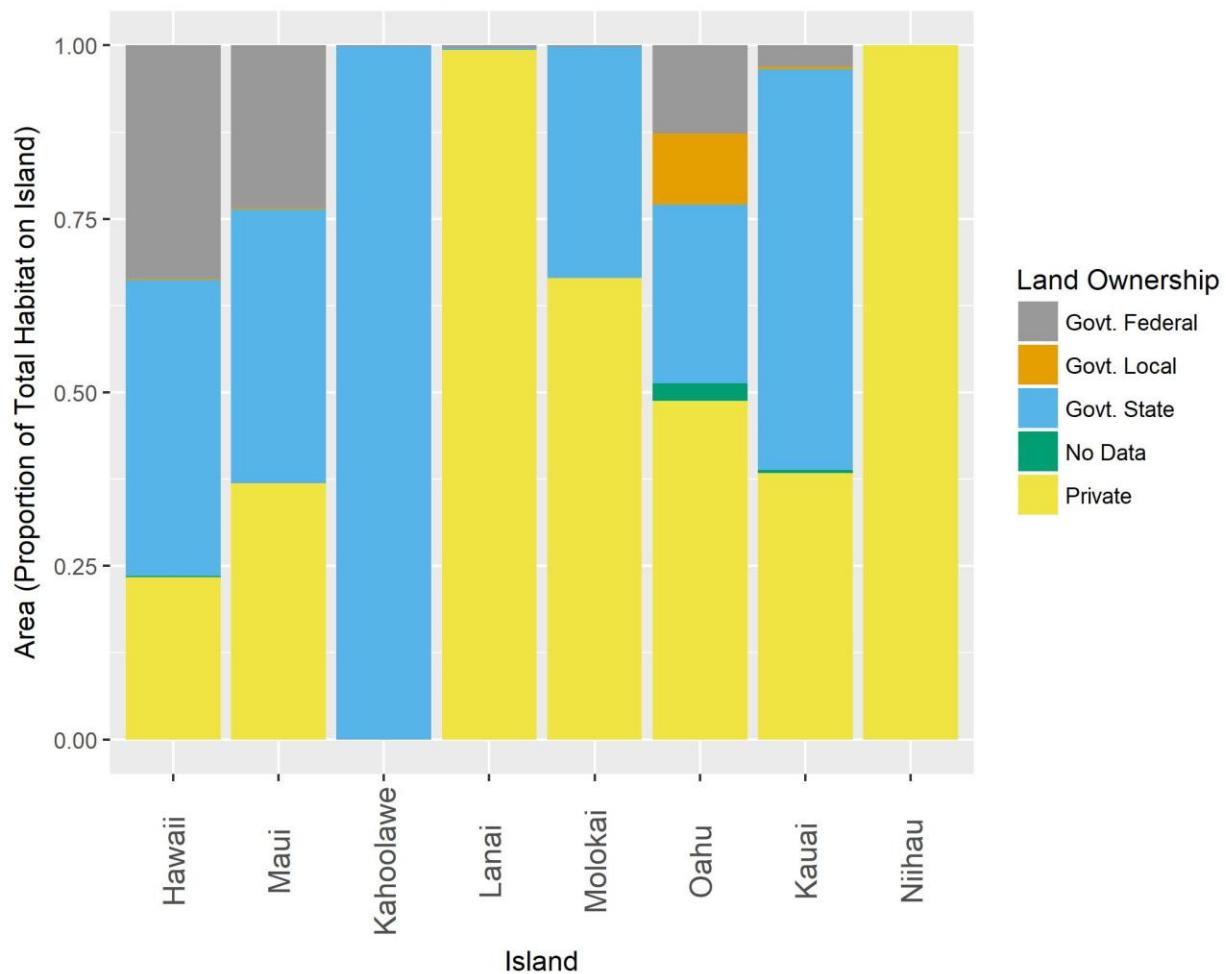


Wetlands Habitat Quality Summary

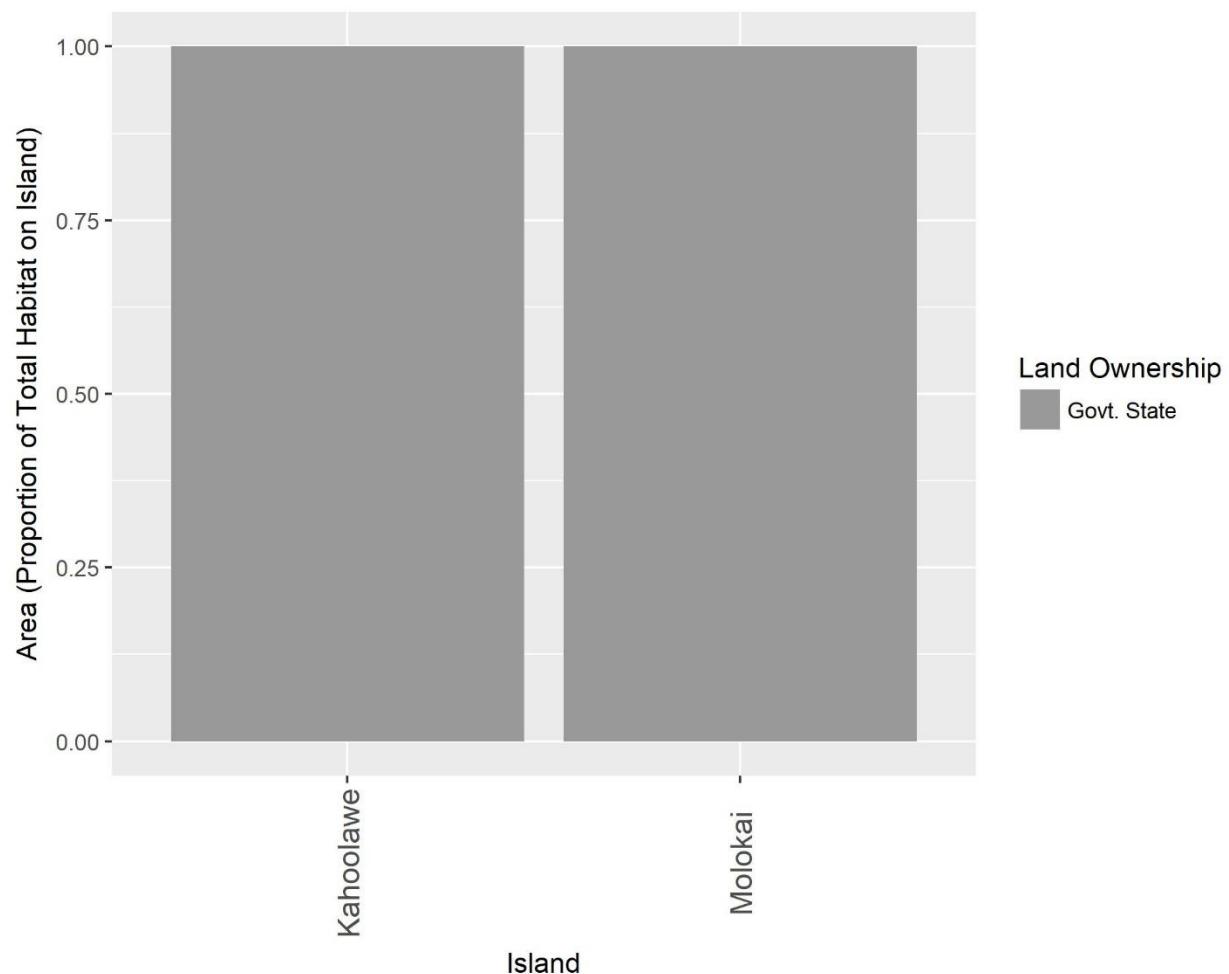


Land Ownership

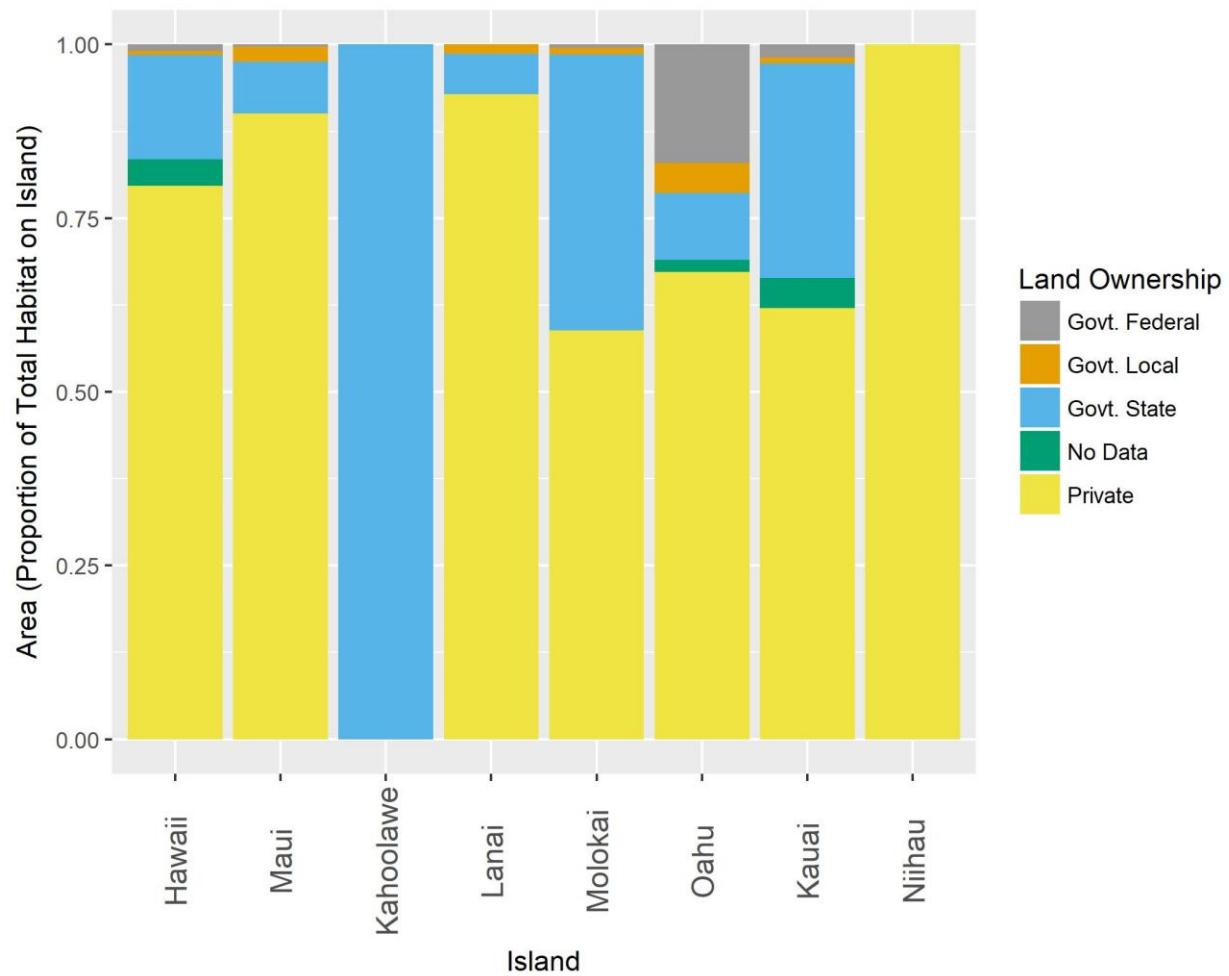
Barren Land Ownership Summary



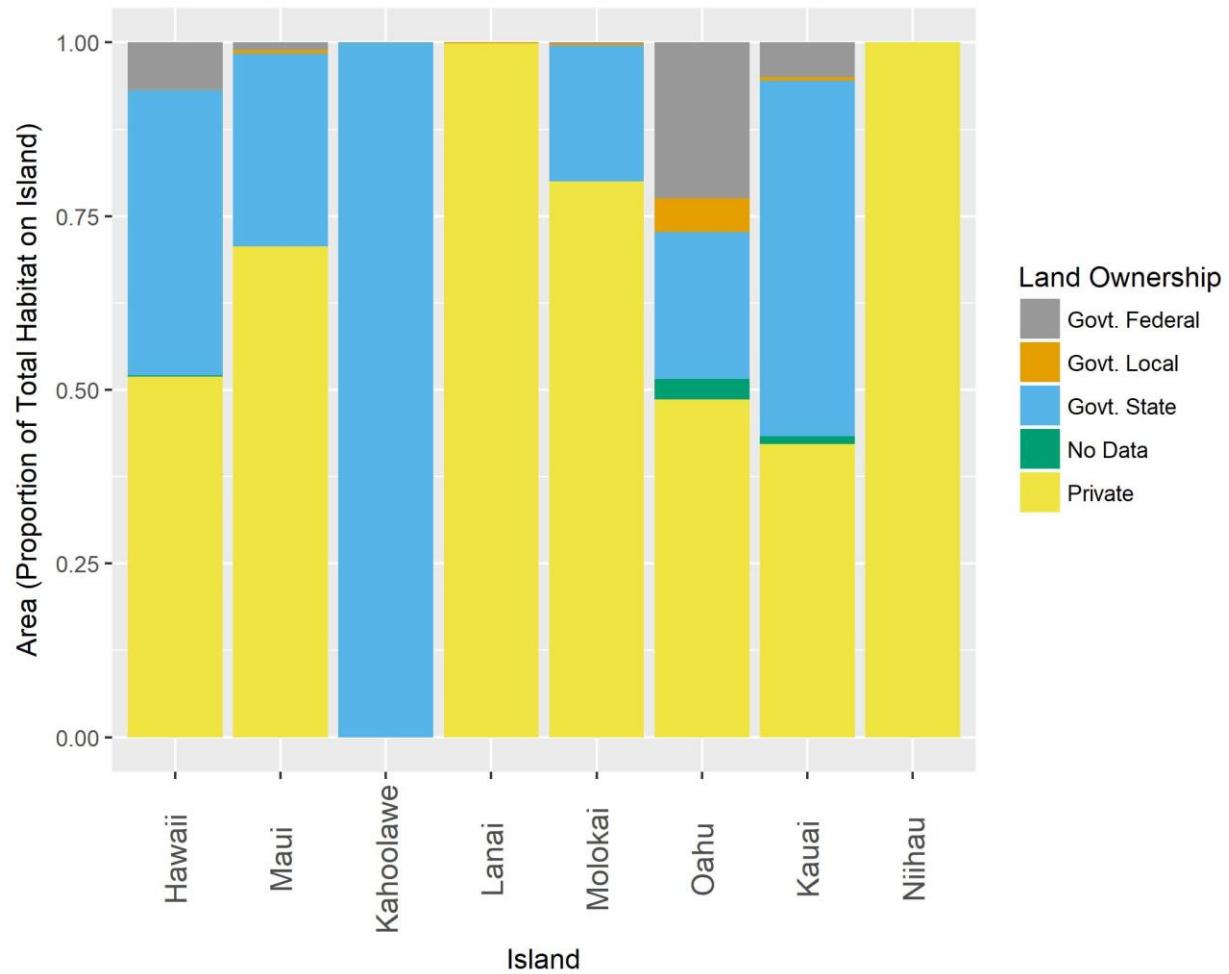
Coastal Land Ownership Summary



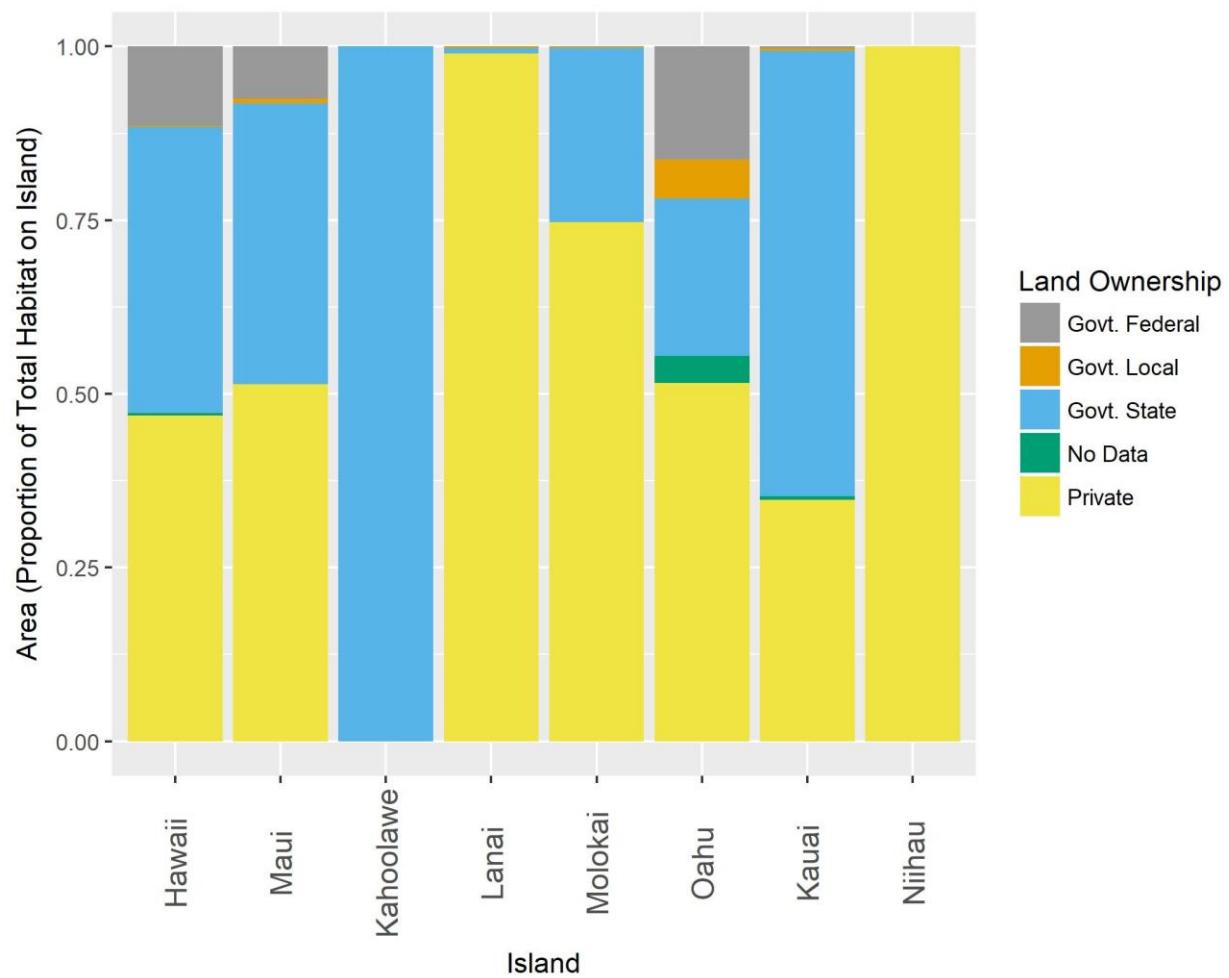
Developed Land Ownership Summary



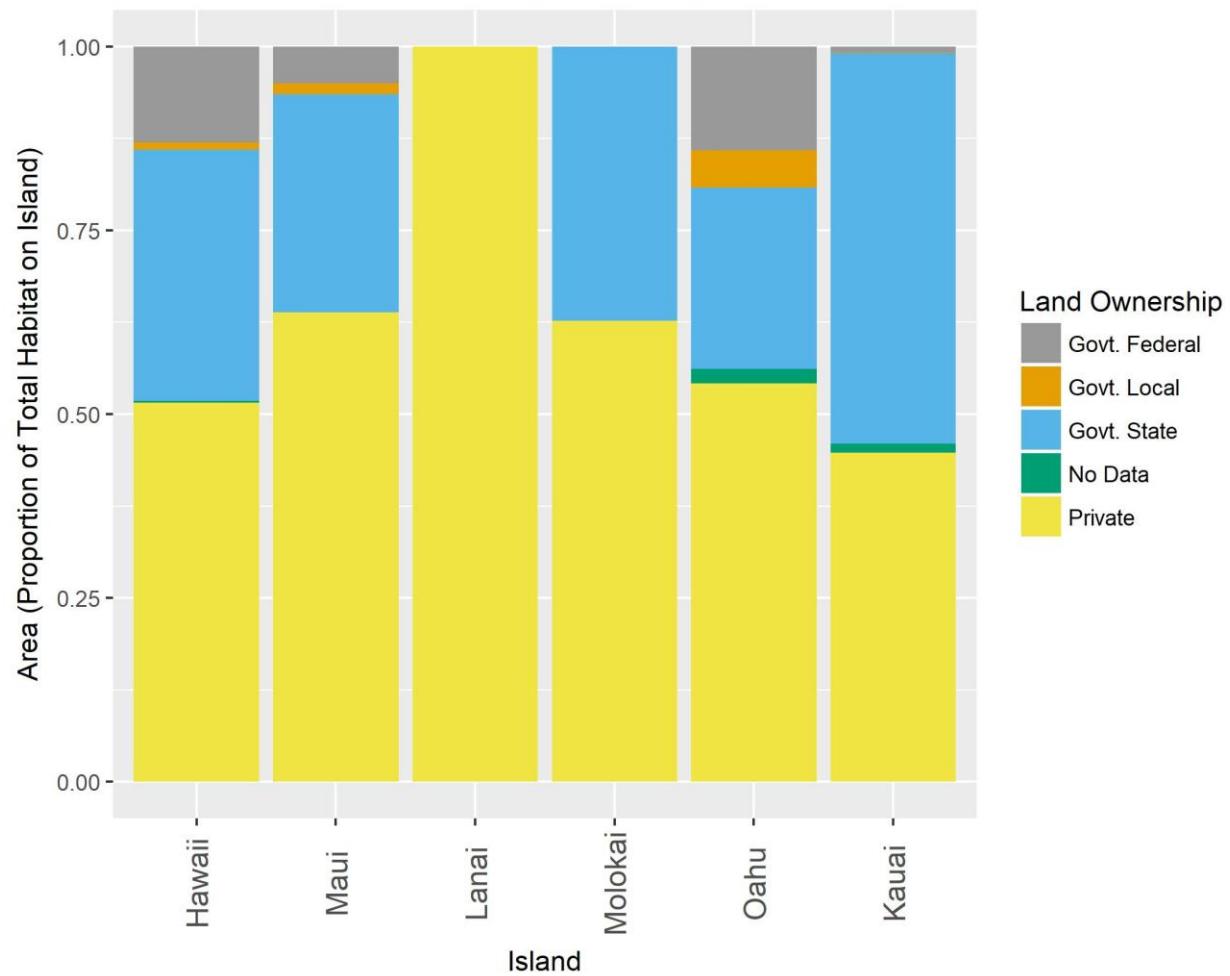
Dry Forest Land Ownership Summary



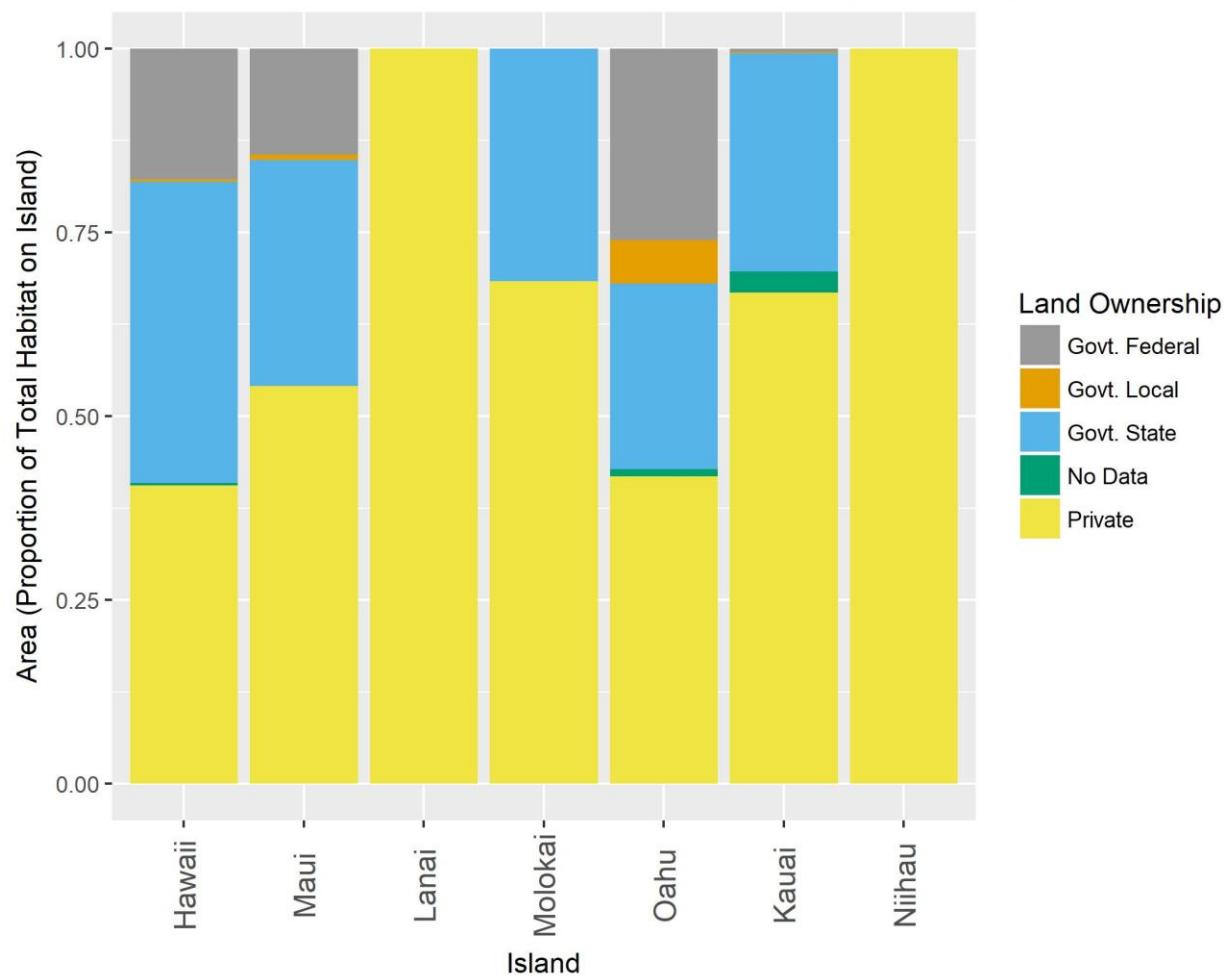
Dry Grasslands and Shrublands Land Ownership Summary



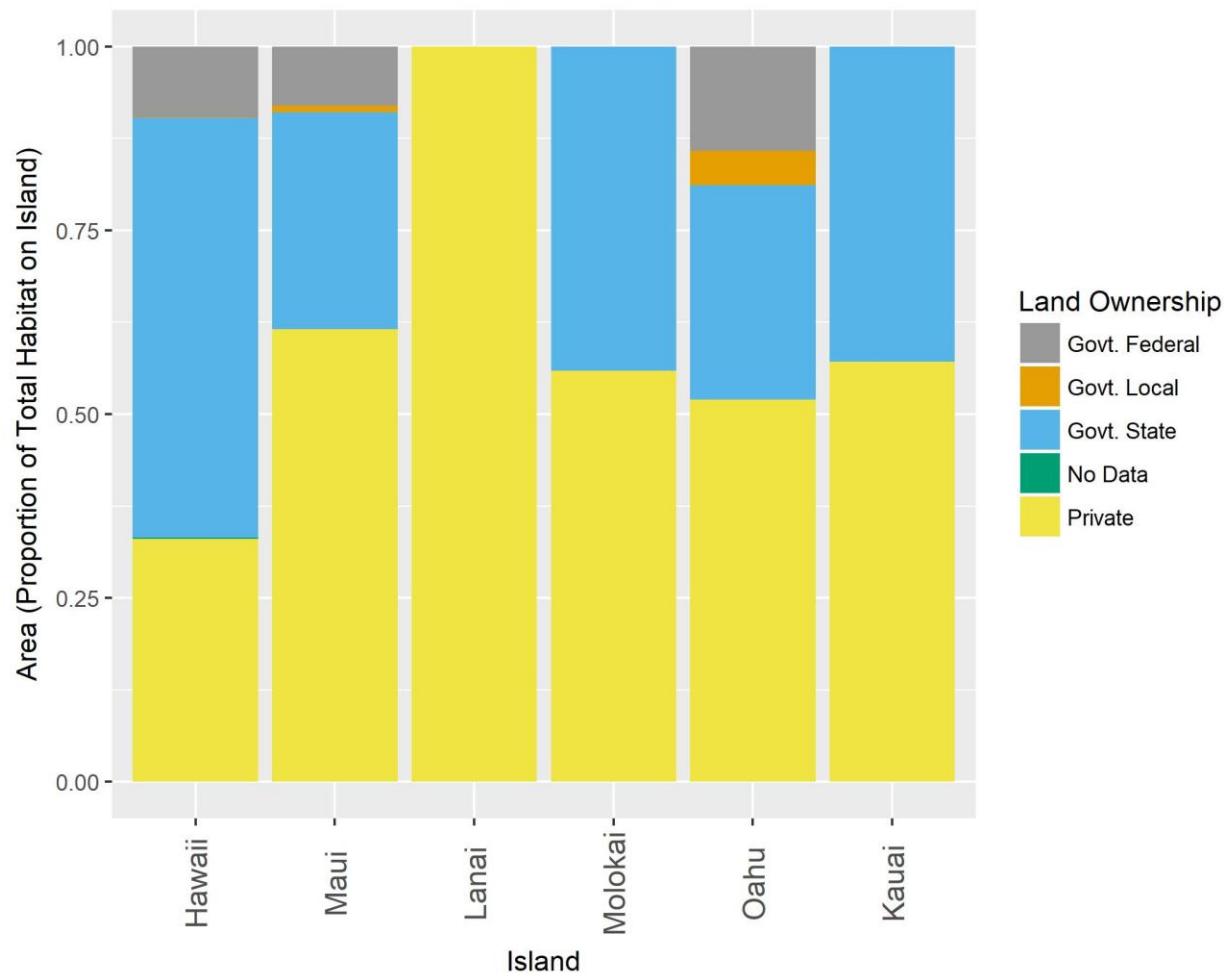
Mesic Forest Land Ownership Summary



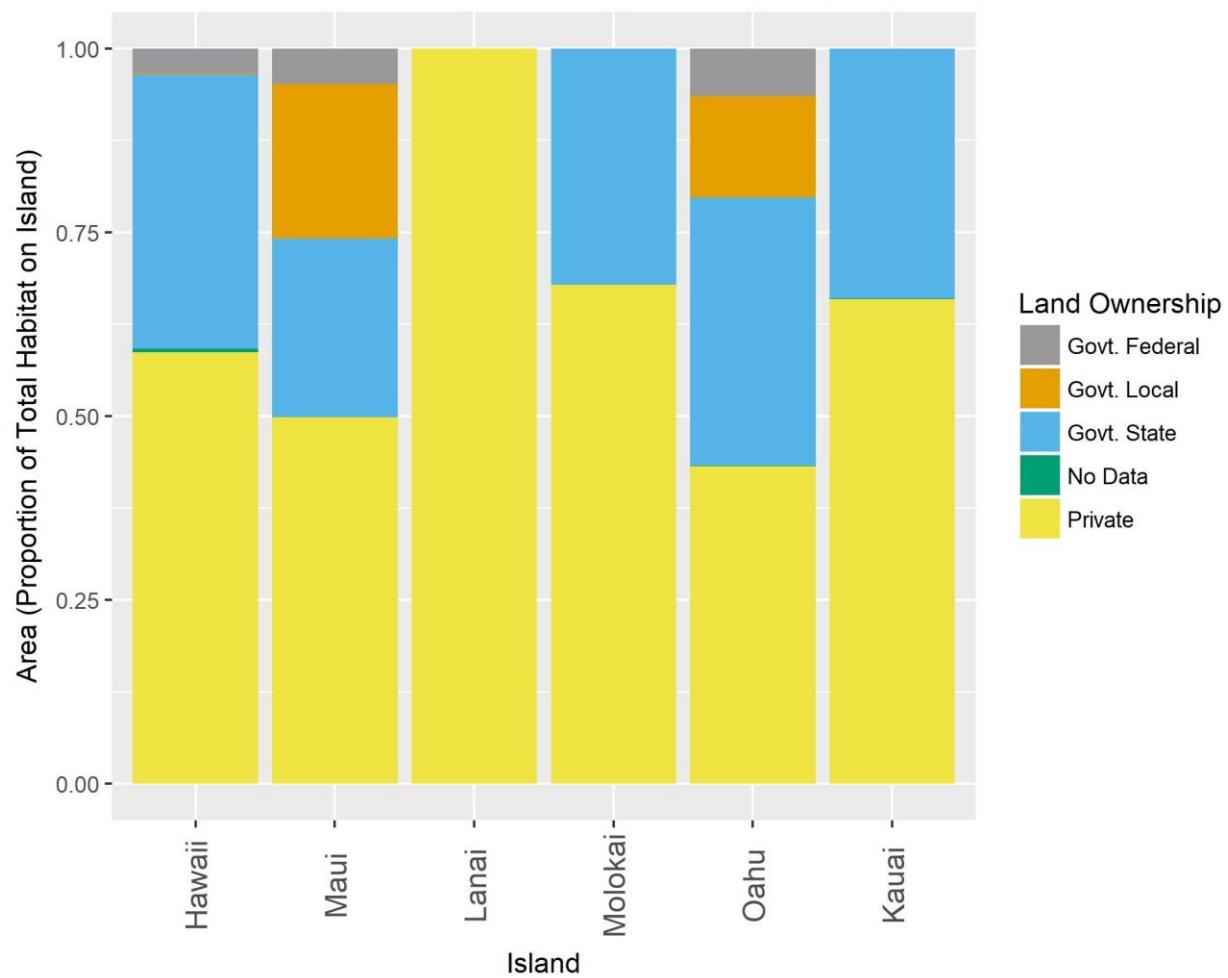
Mesic Grasslands and Shrublands Land Ownership Summary



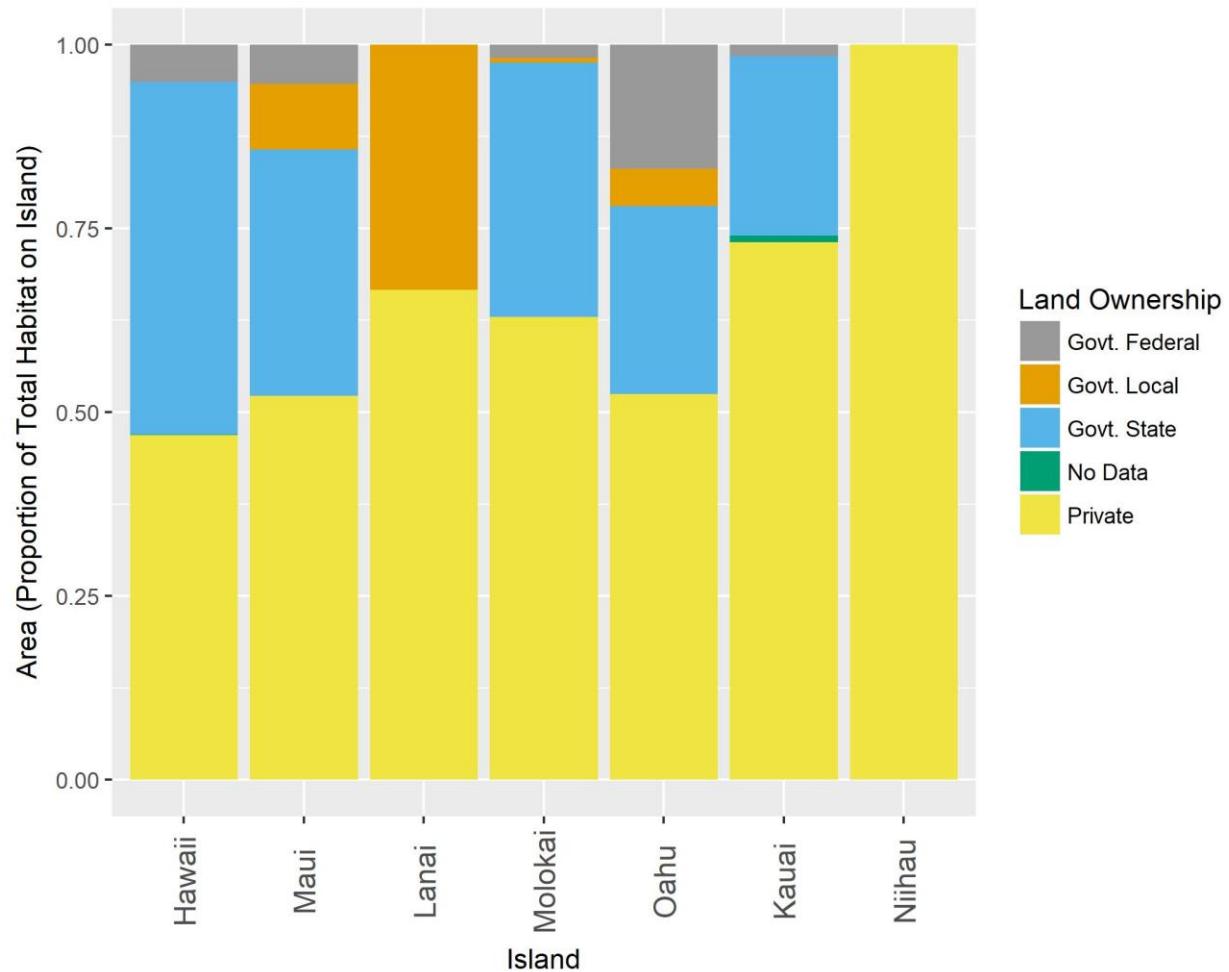
Wet Forest Land Ownership Summary



Wet Grasslands and Shrublands Land Ownership Summary

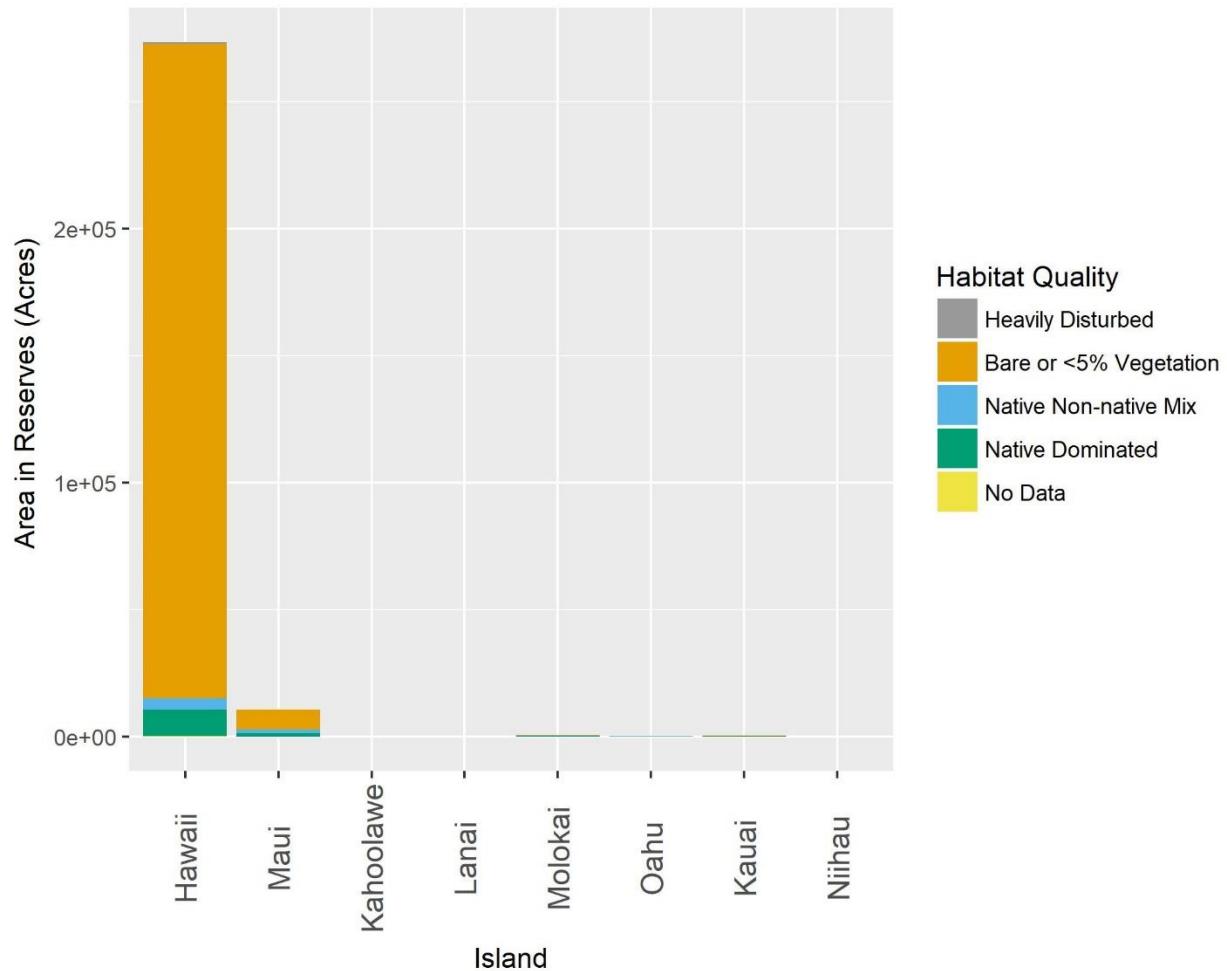


Wetland Land Ownership Summary

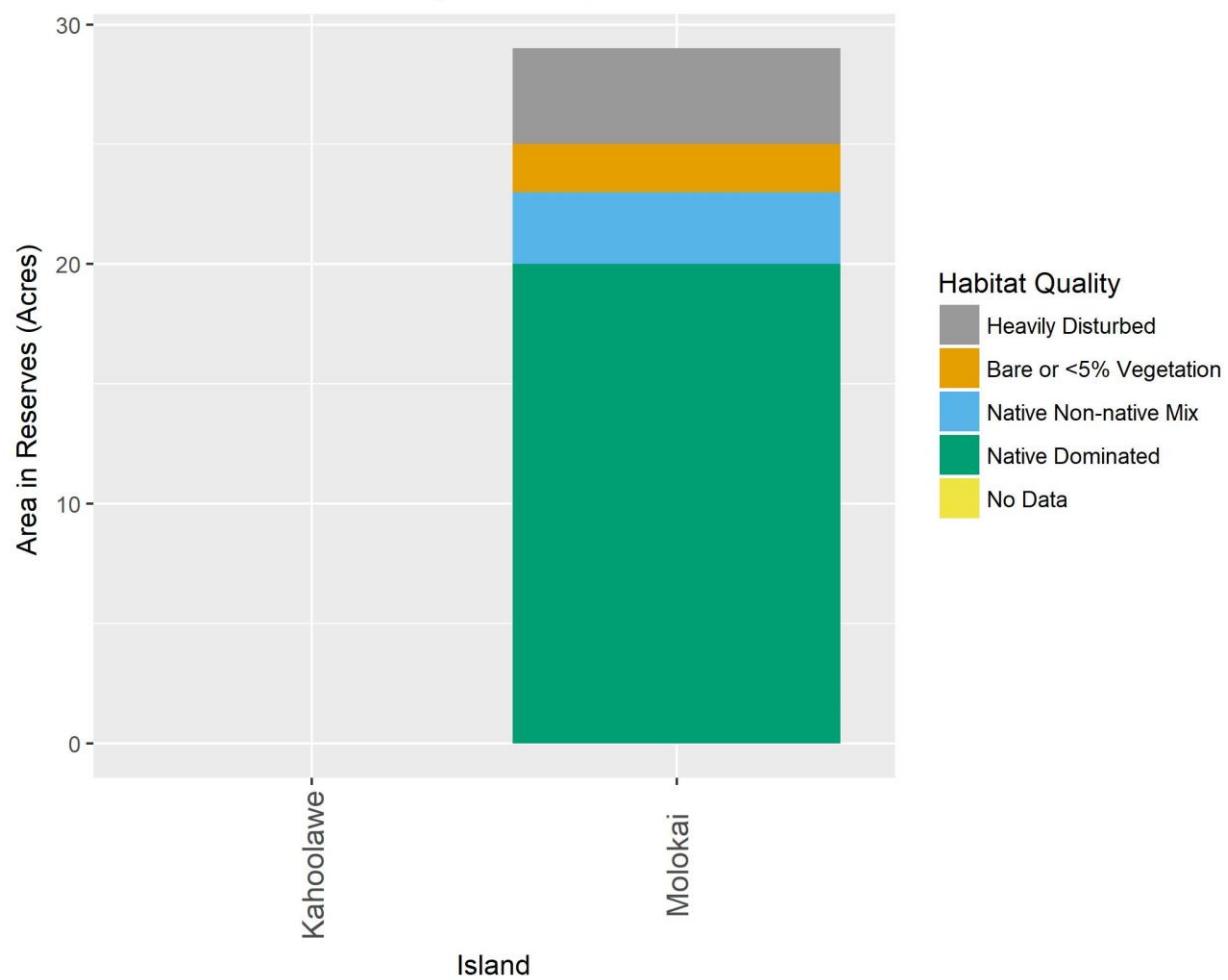


Reserve Status

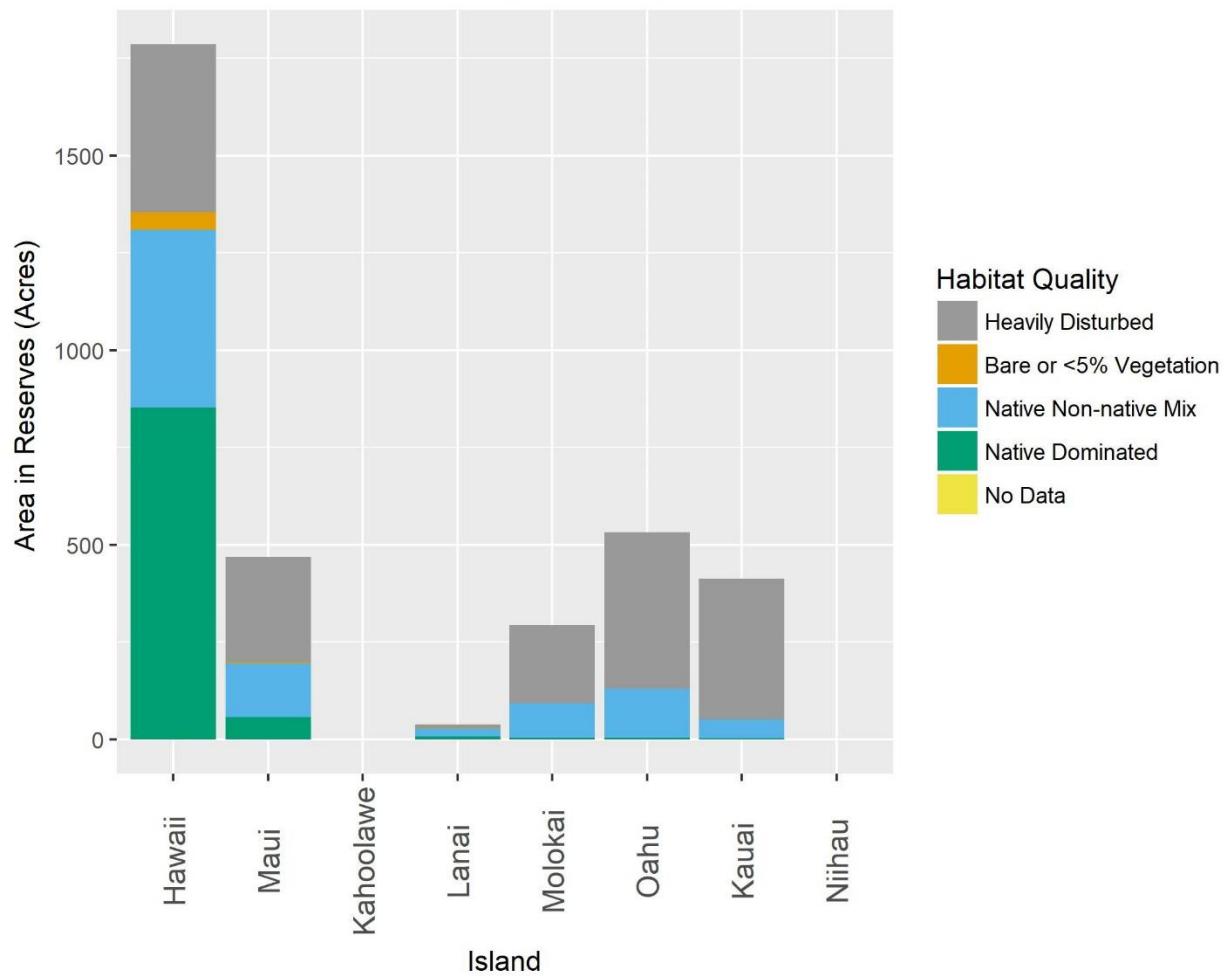
Barren Reserve Quality Summary



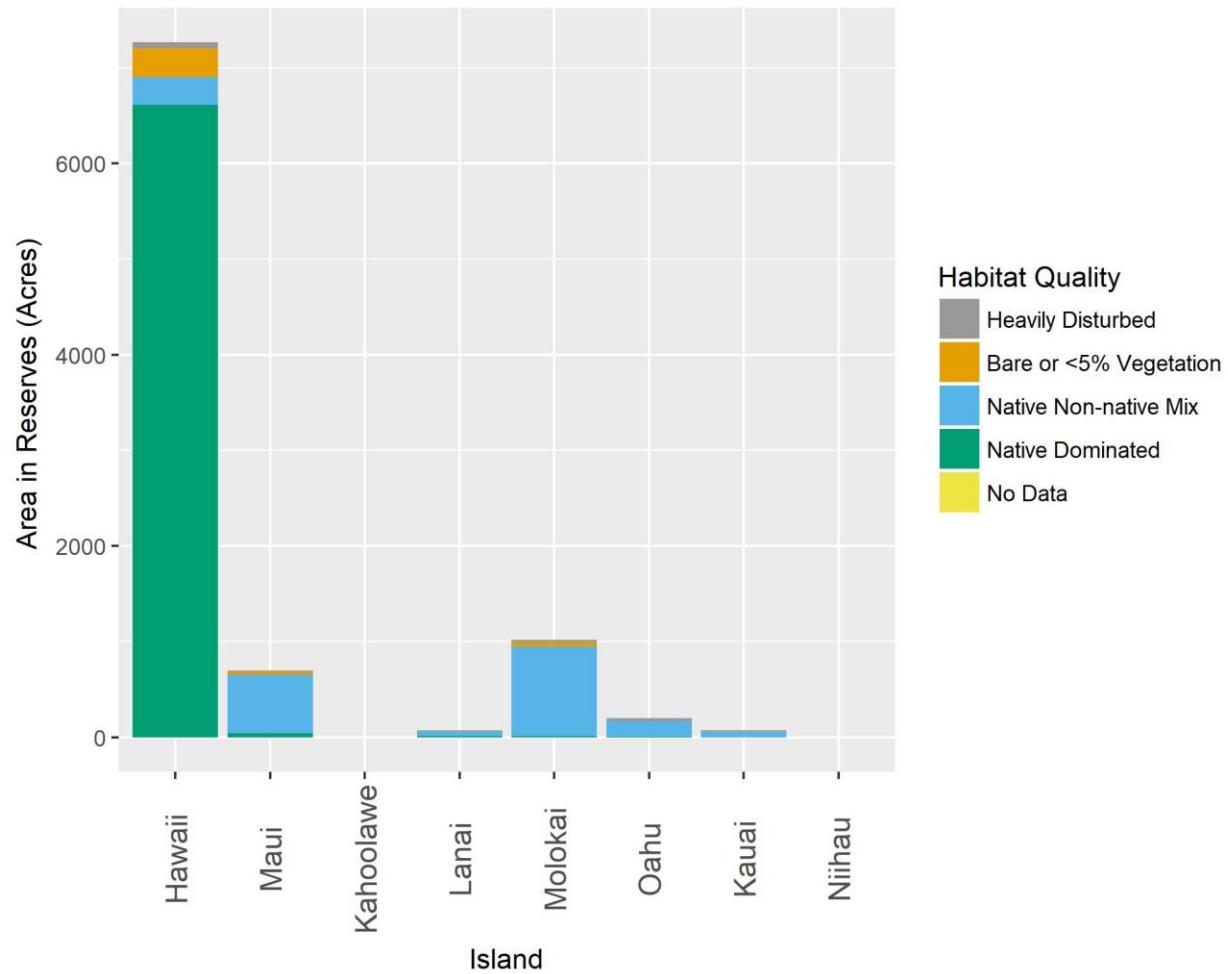
Coastal Reserve Quality Summary



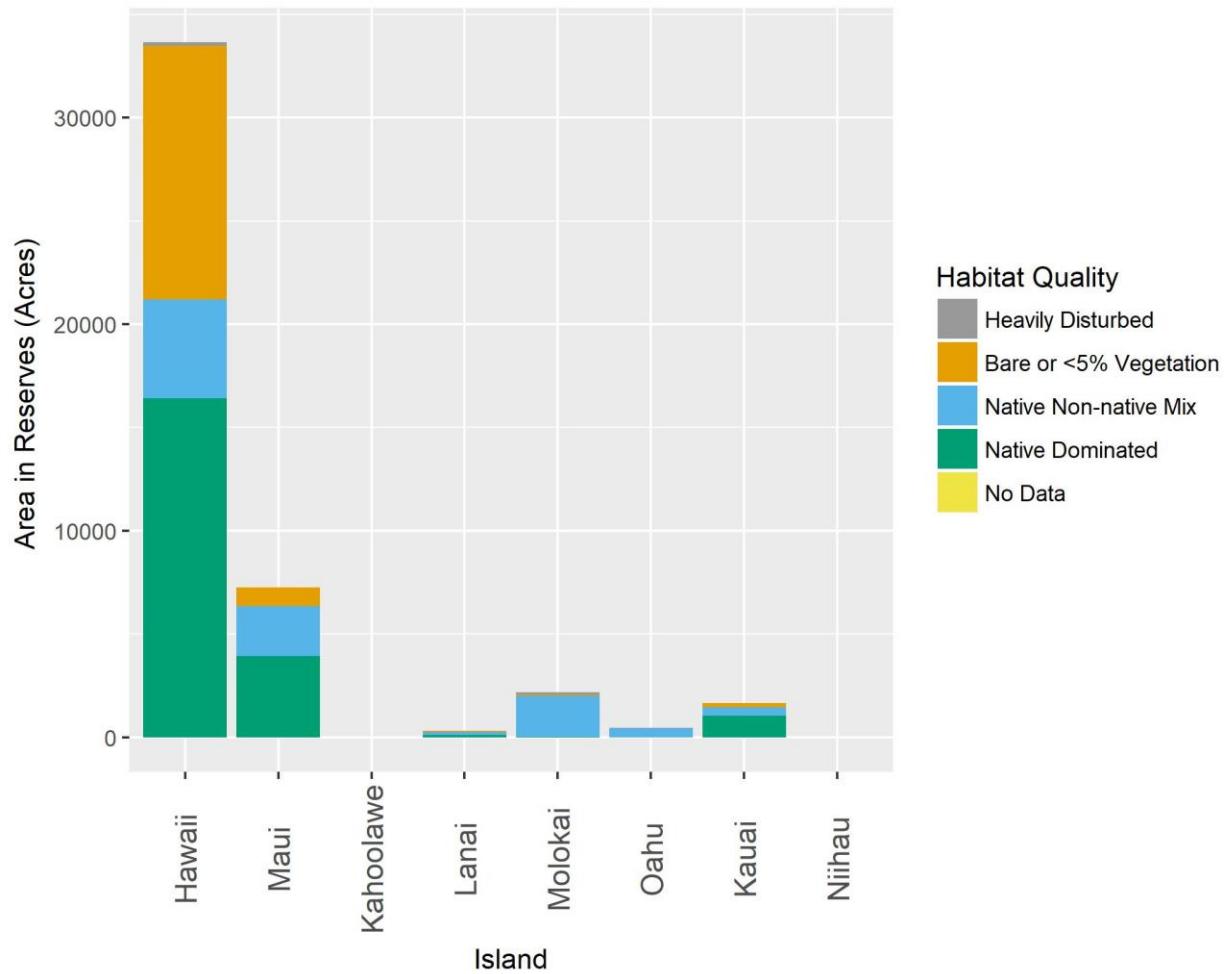
Developed Reserve Quality Summary



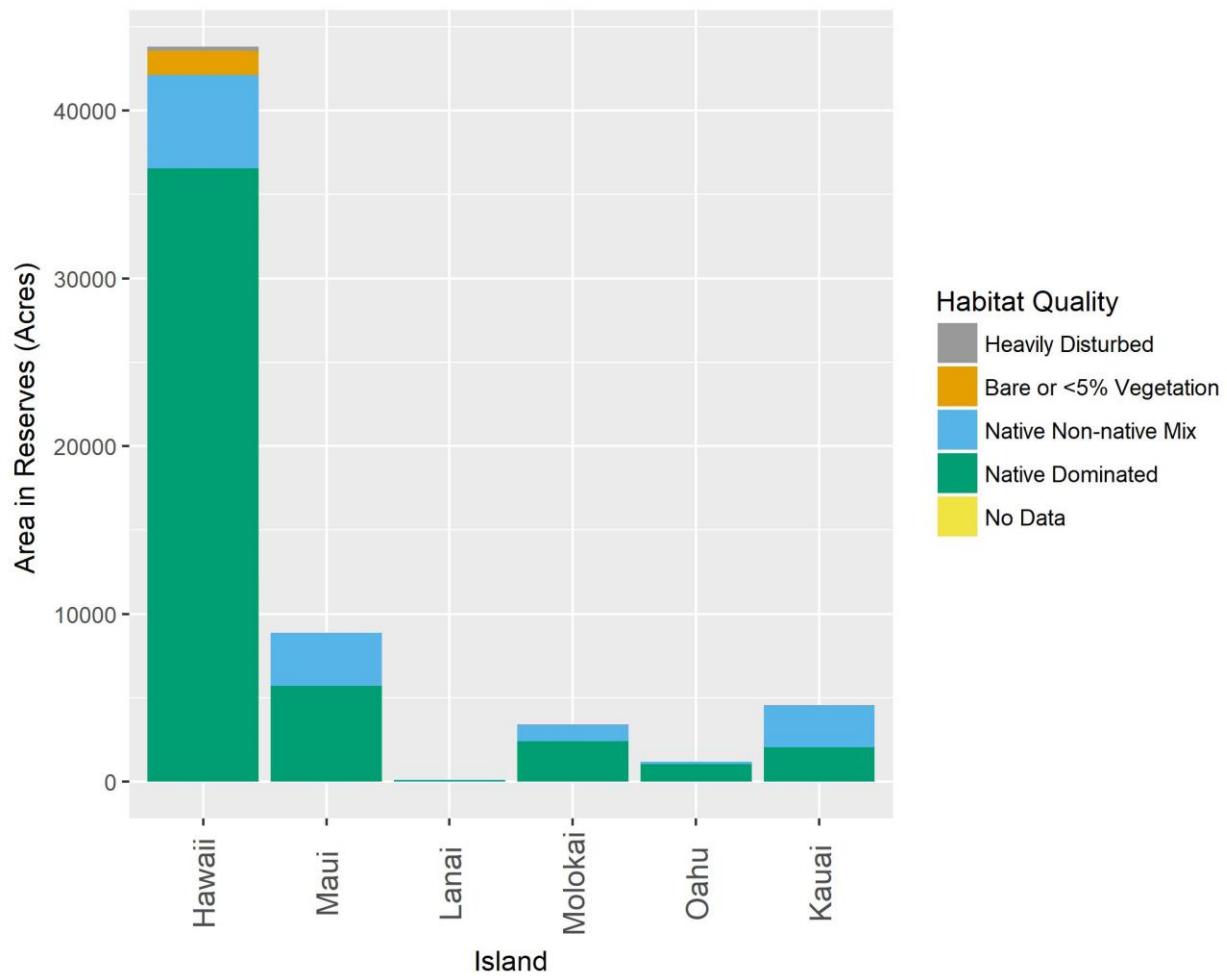
Dry Forest Reserve Quality Summary



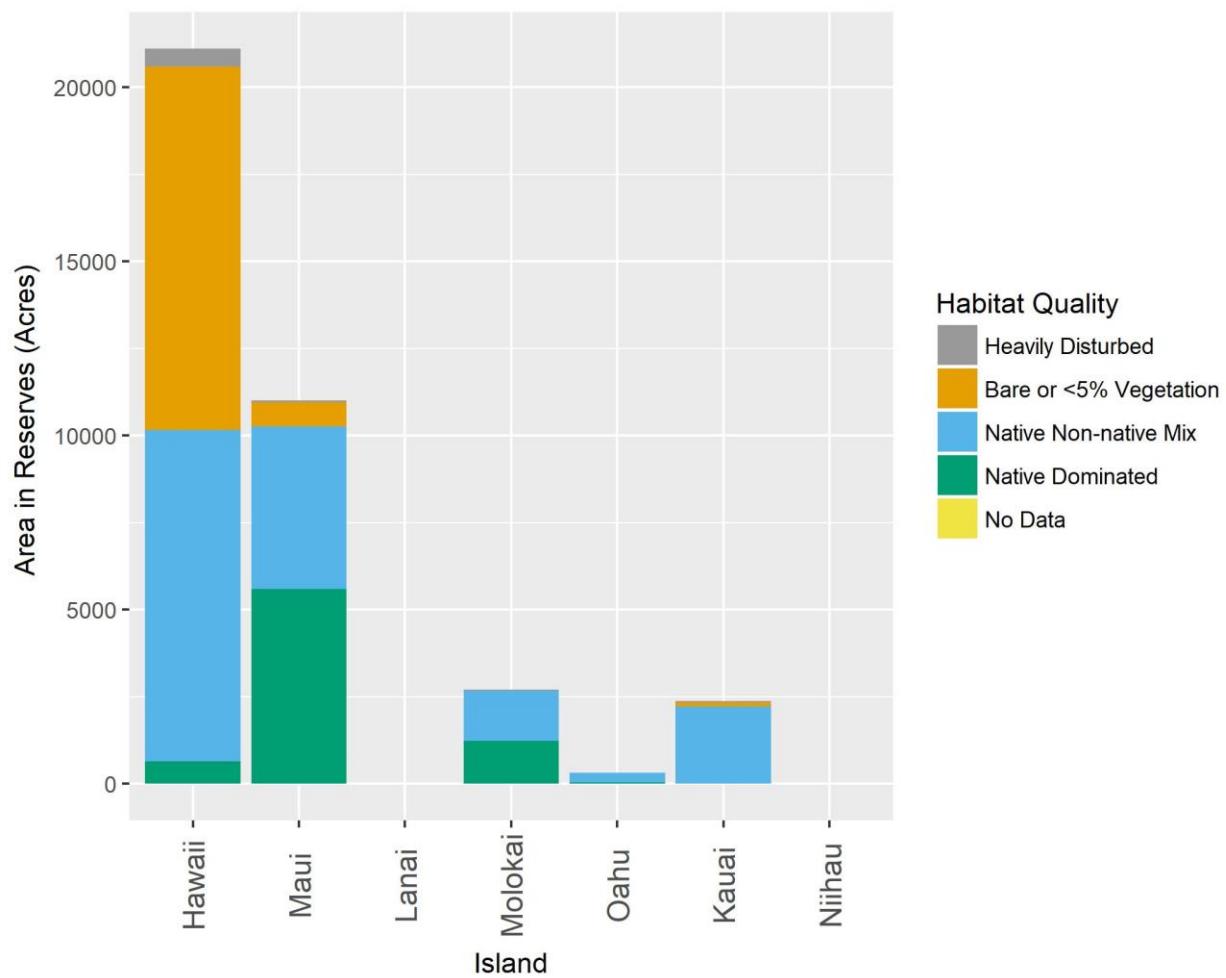
Dry Grasslands and Shrublands Reserve Quality Summary



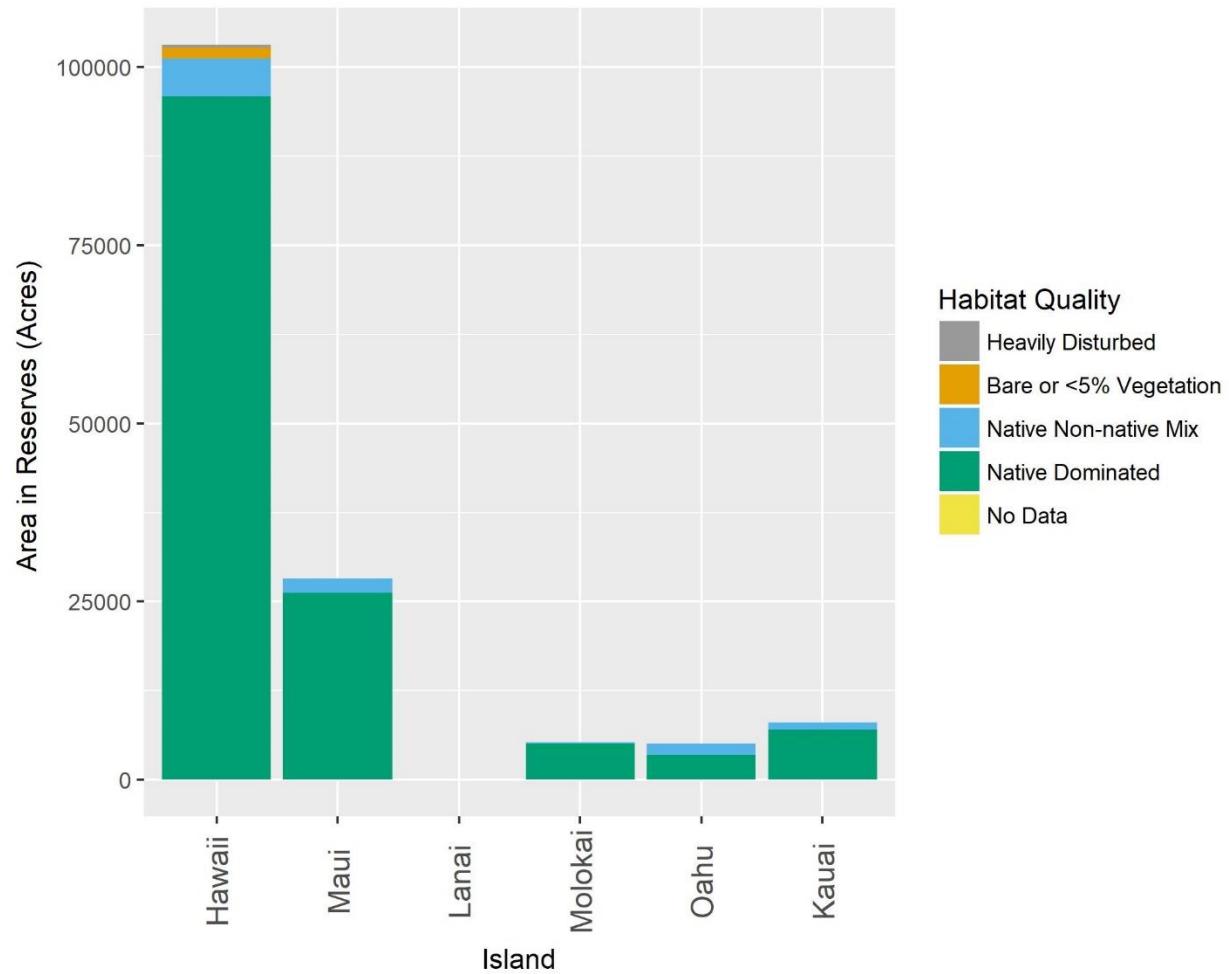
Mesic Forest Reserve Quality Summary



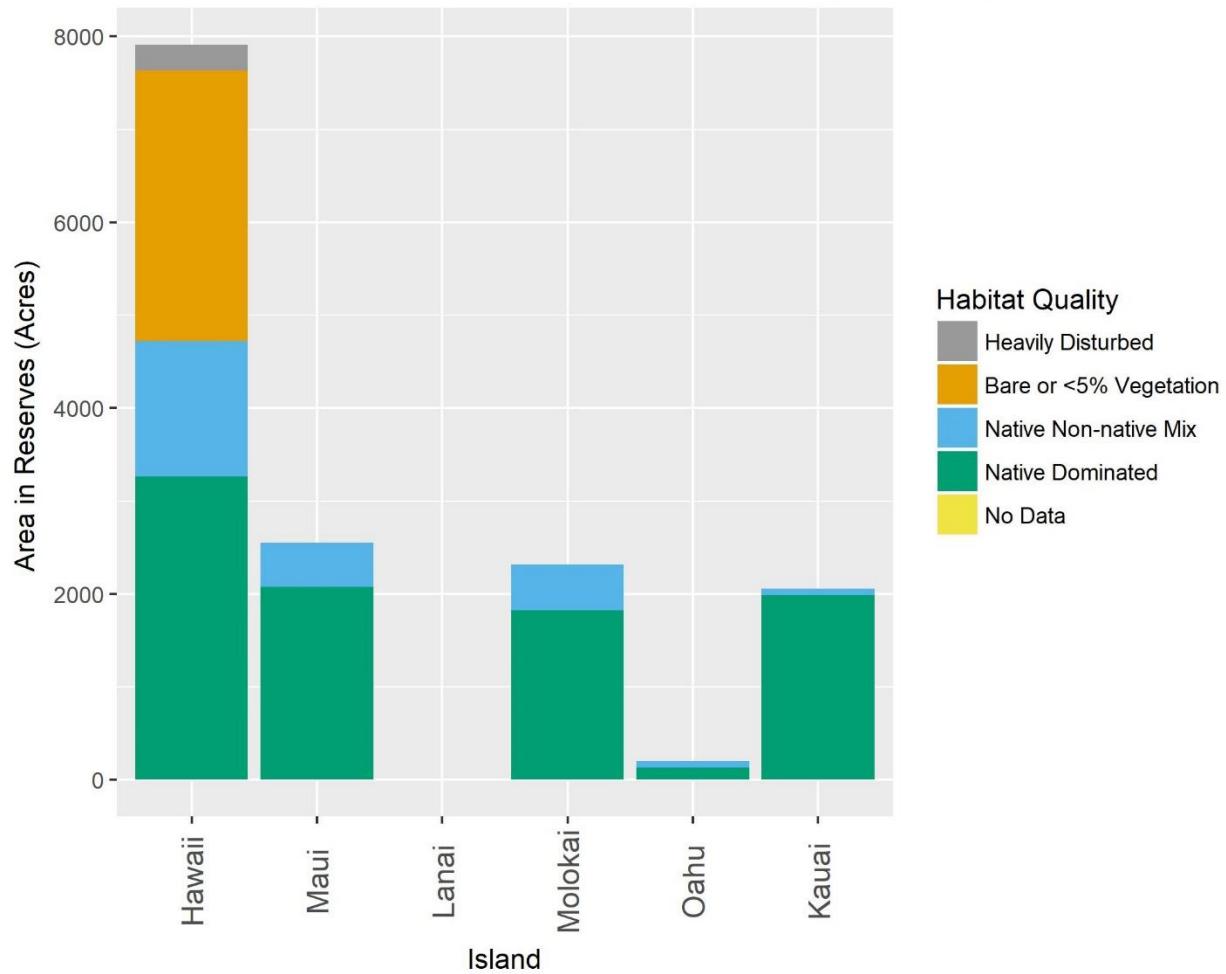
Mesic Grasslands and Shrublands Reserve Quality Summary



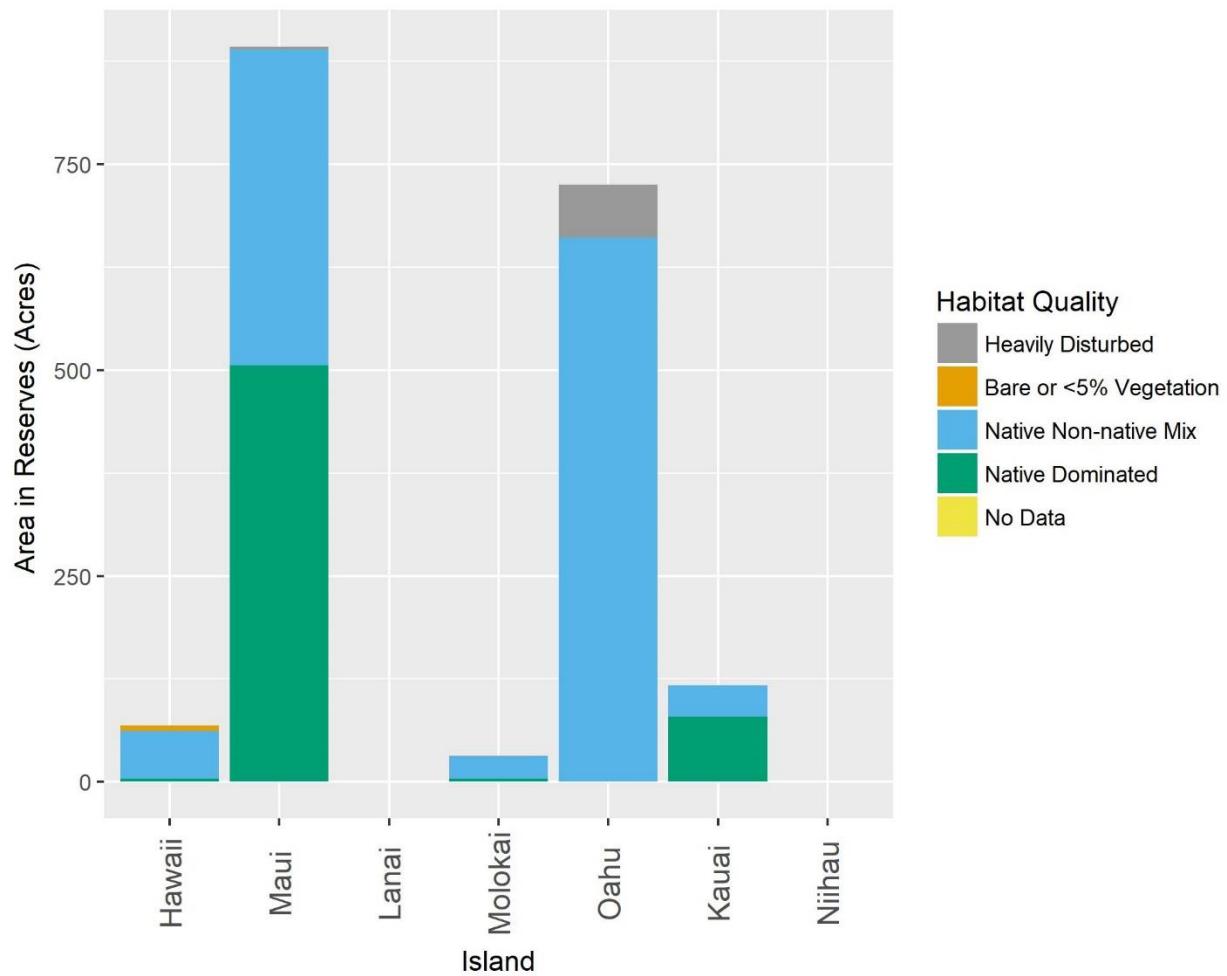
Wet Forest Reserve Quality Summary



Wet Grasslands and Shrublands Reserve Quality Summary

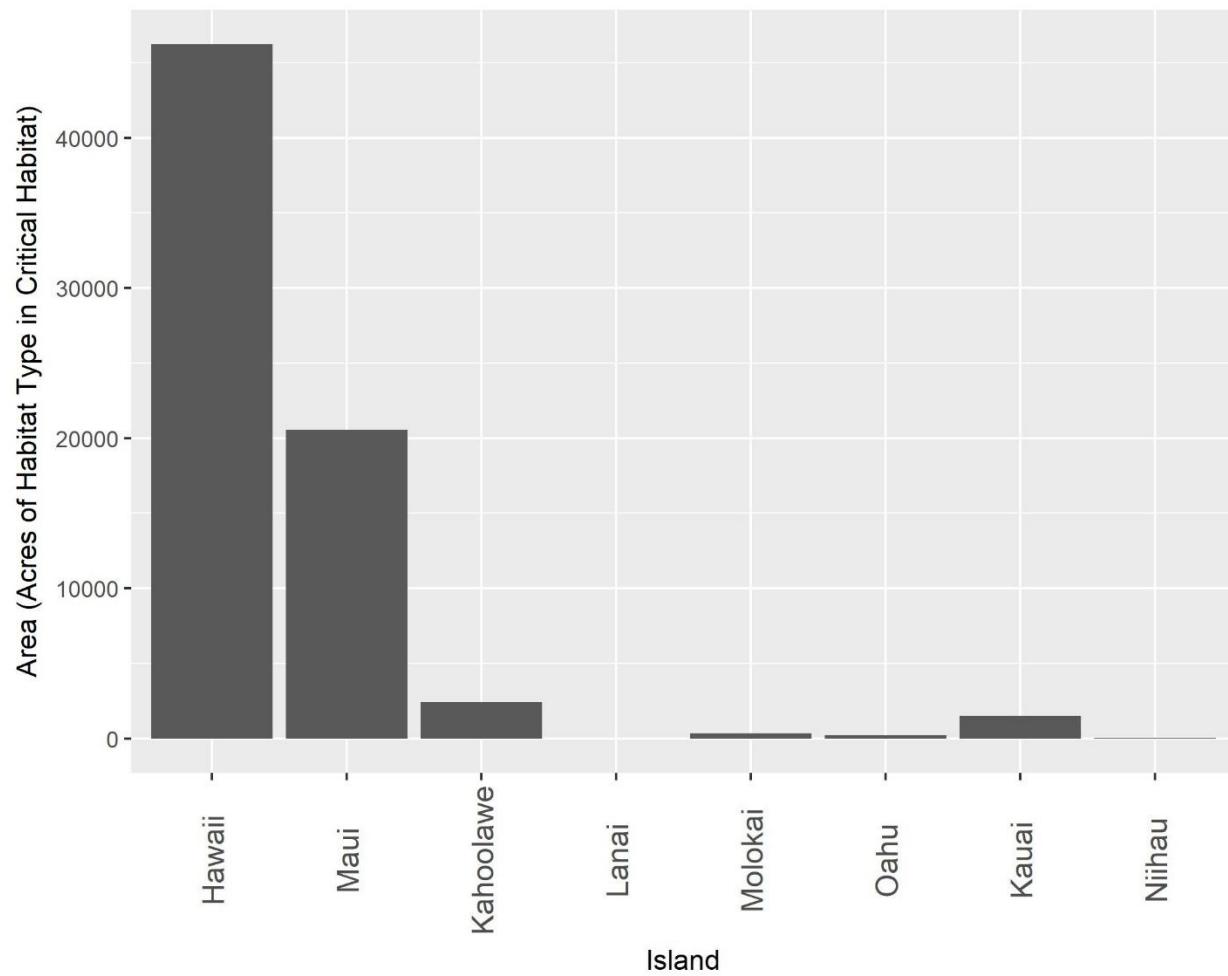


Wetland Reserve Quality Summary

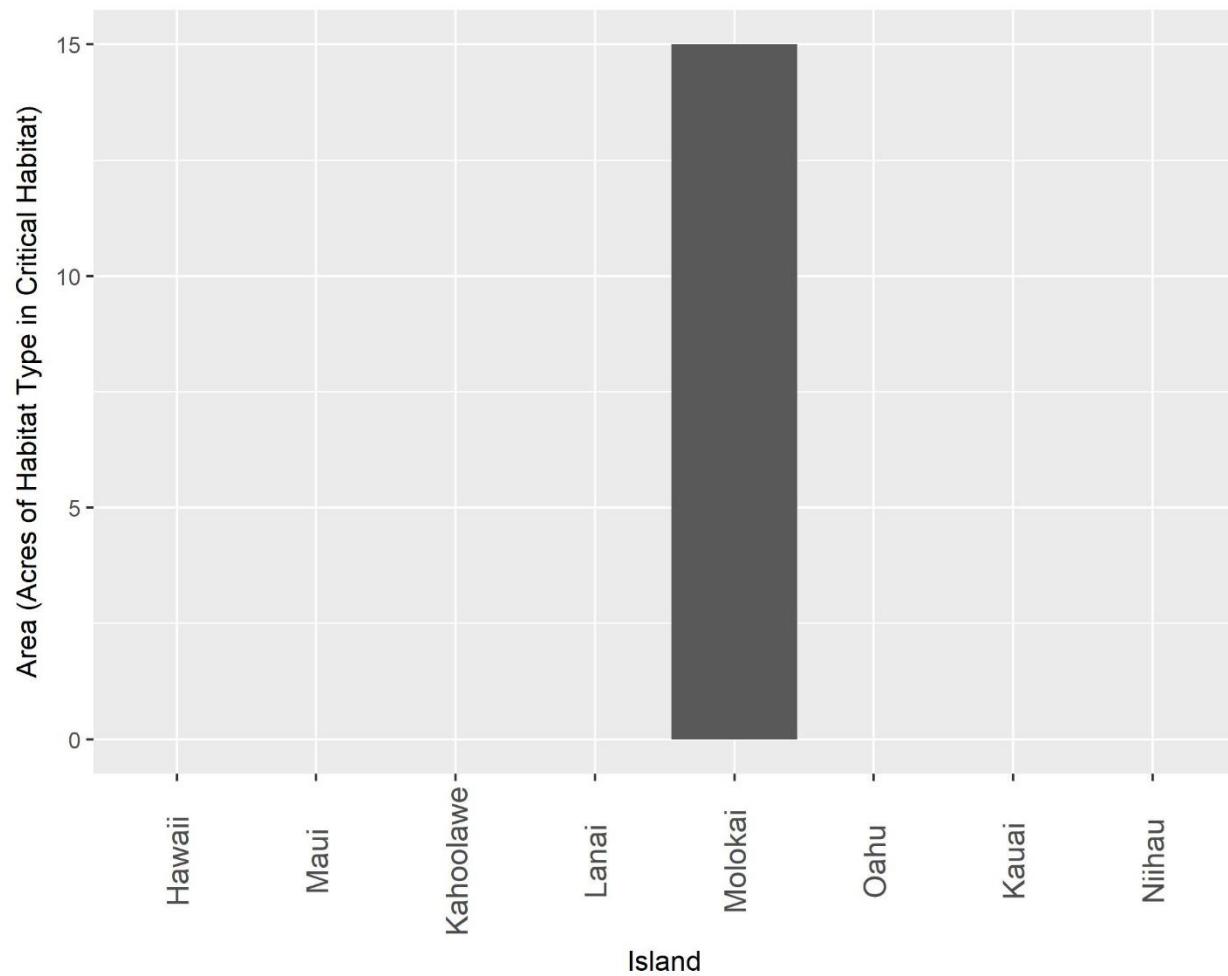


Critical Habitat

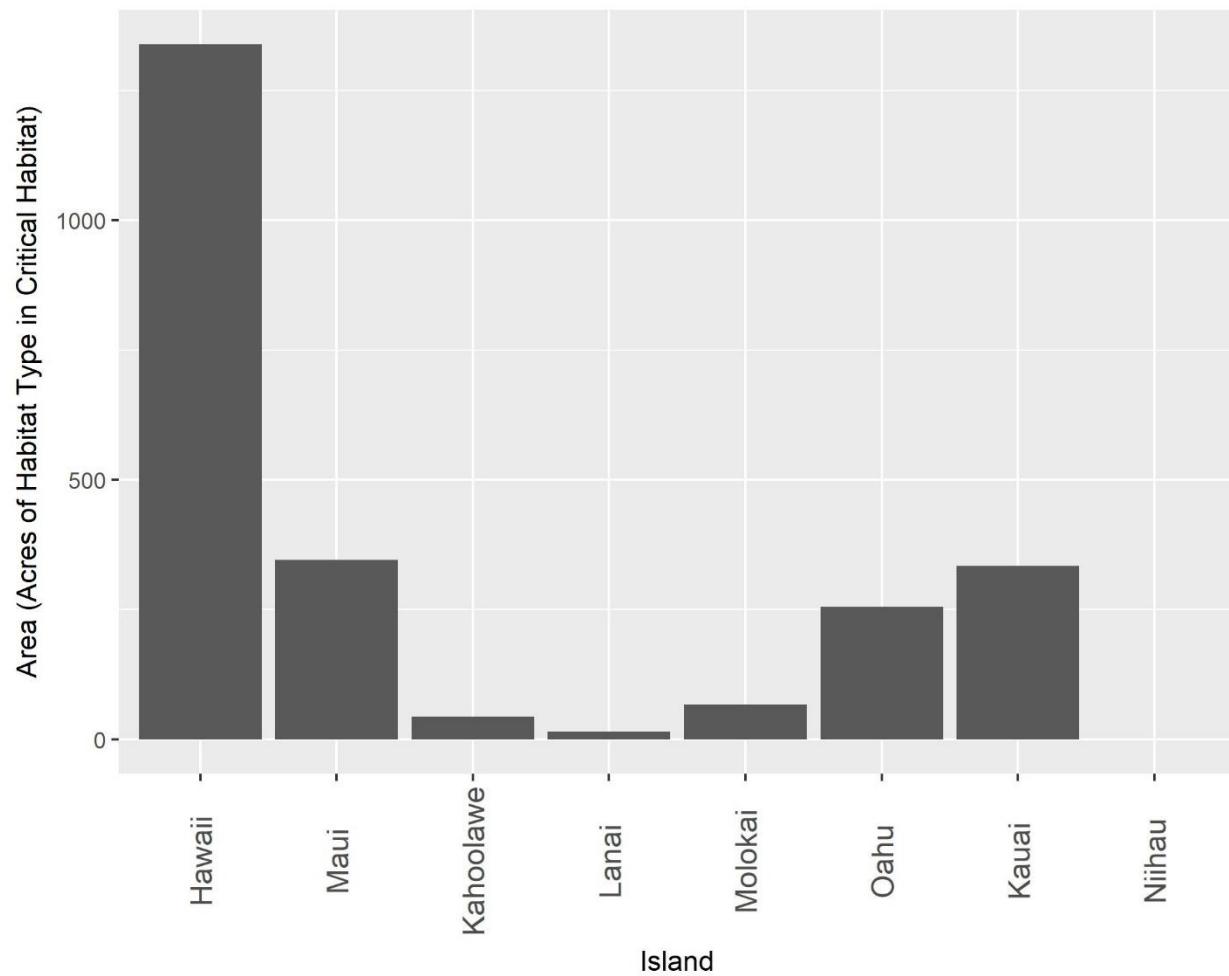
Barren Critical Habitat Summary



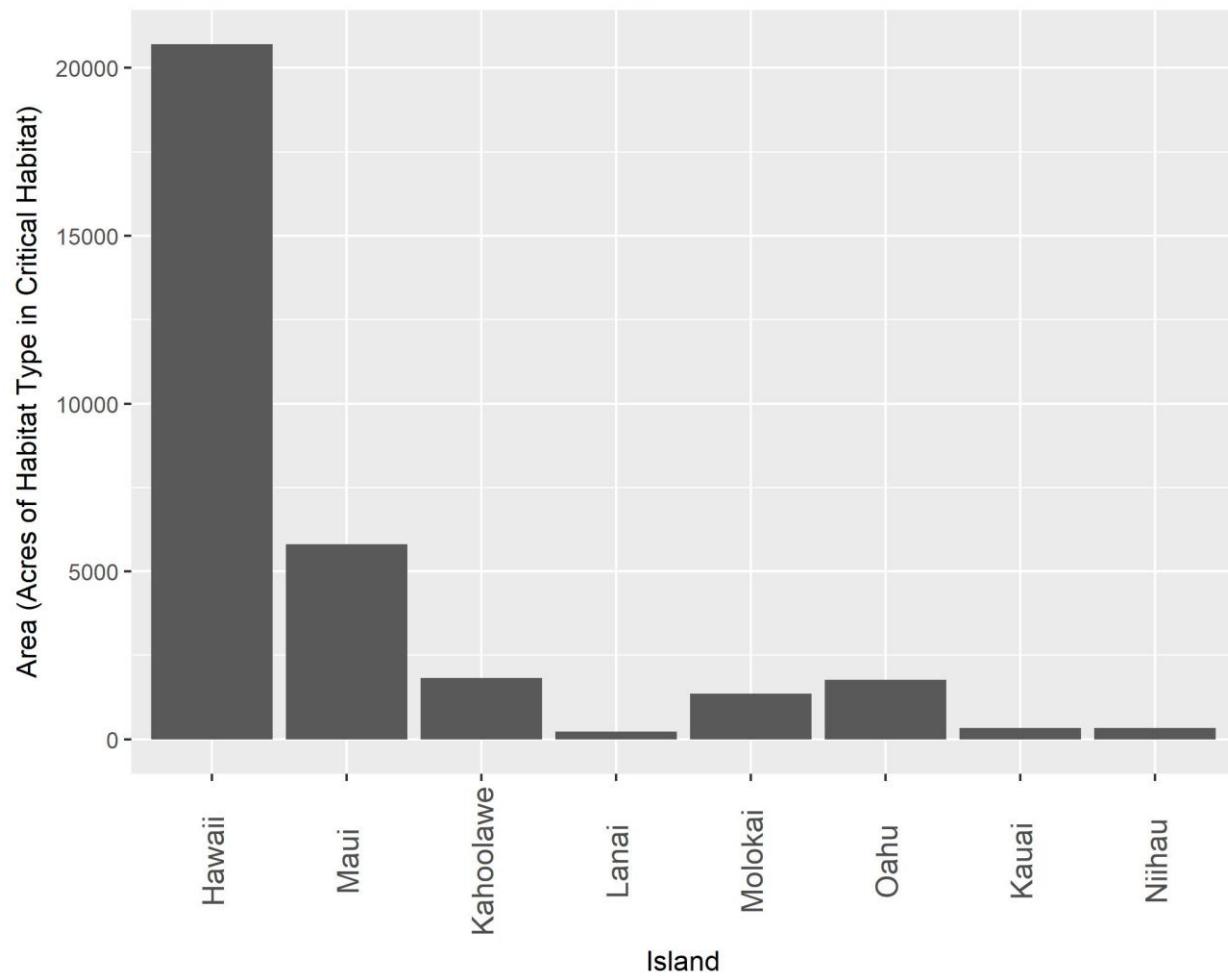
Coastal Critical Habitat Summary



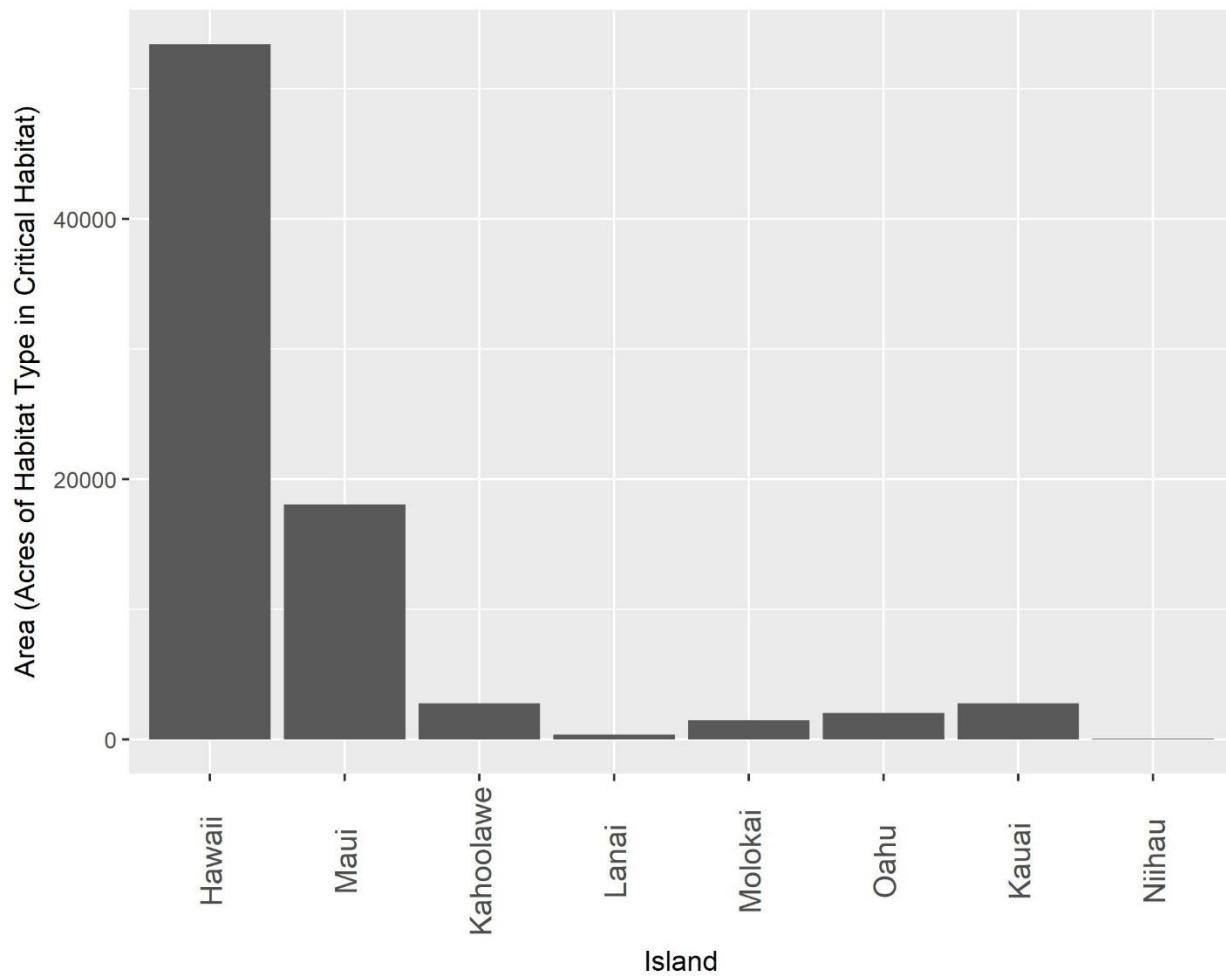
Developed Critical Habitat Summary



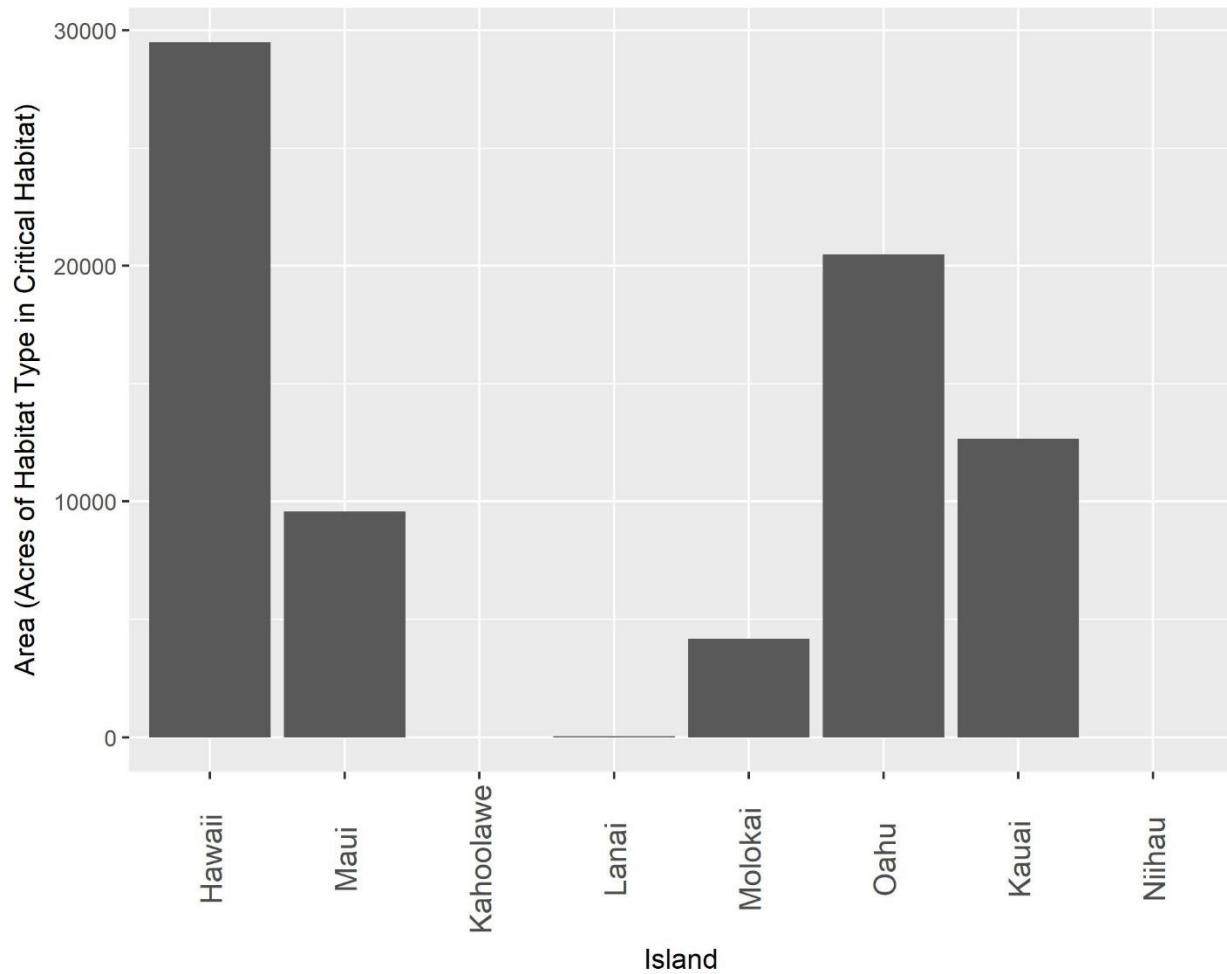
Dry Forest Critical Habitat Summary



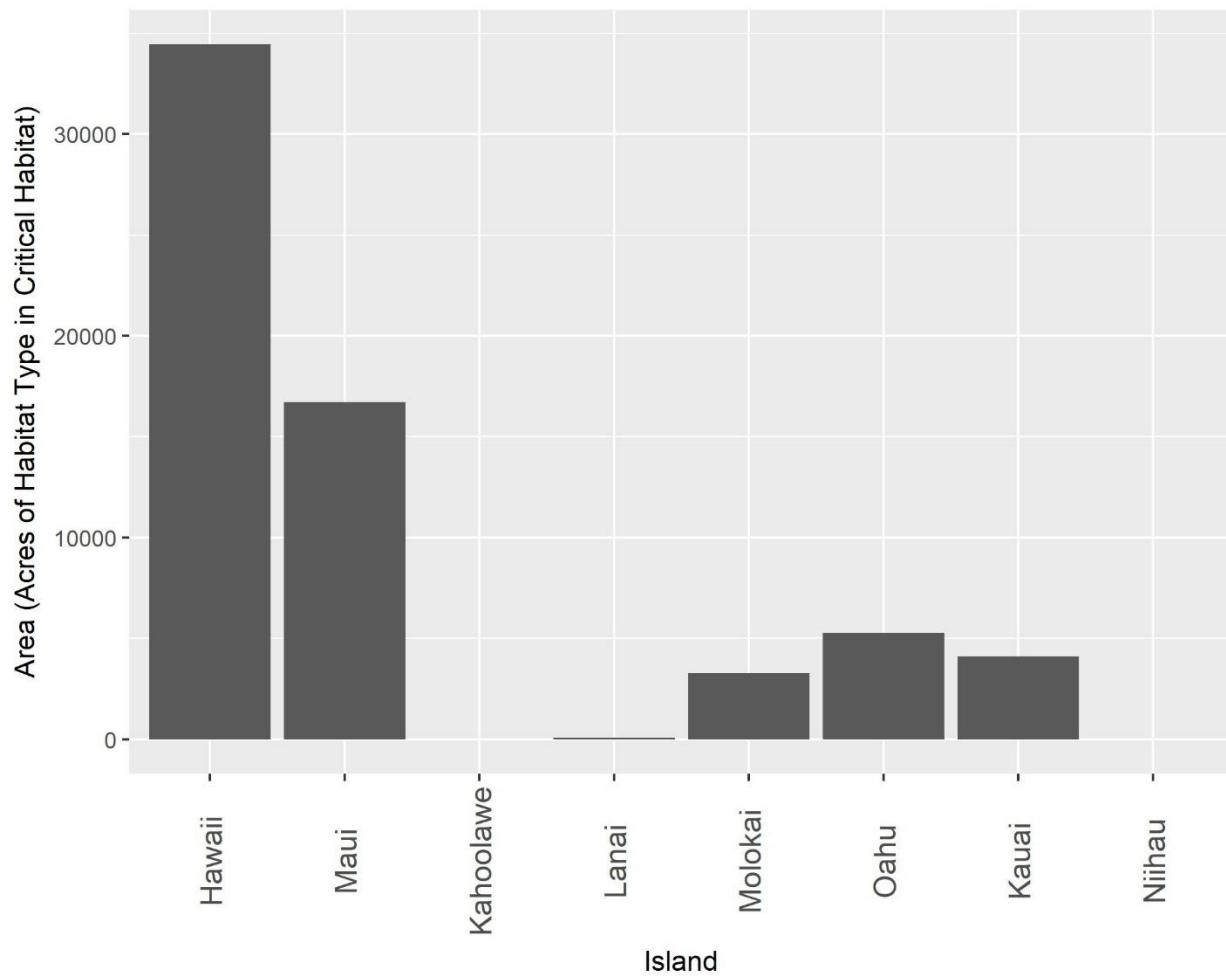
Dry Grasslands and Shrublands Critical Habitat Summary



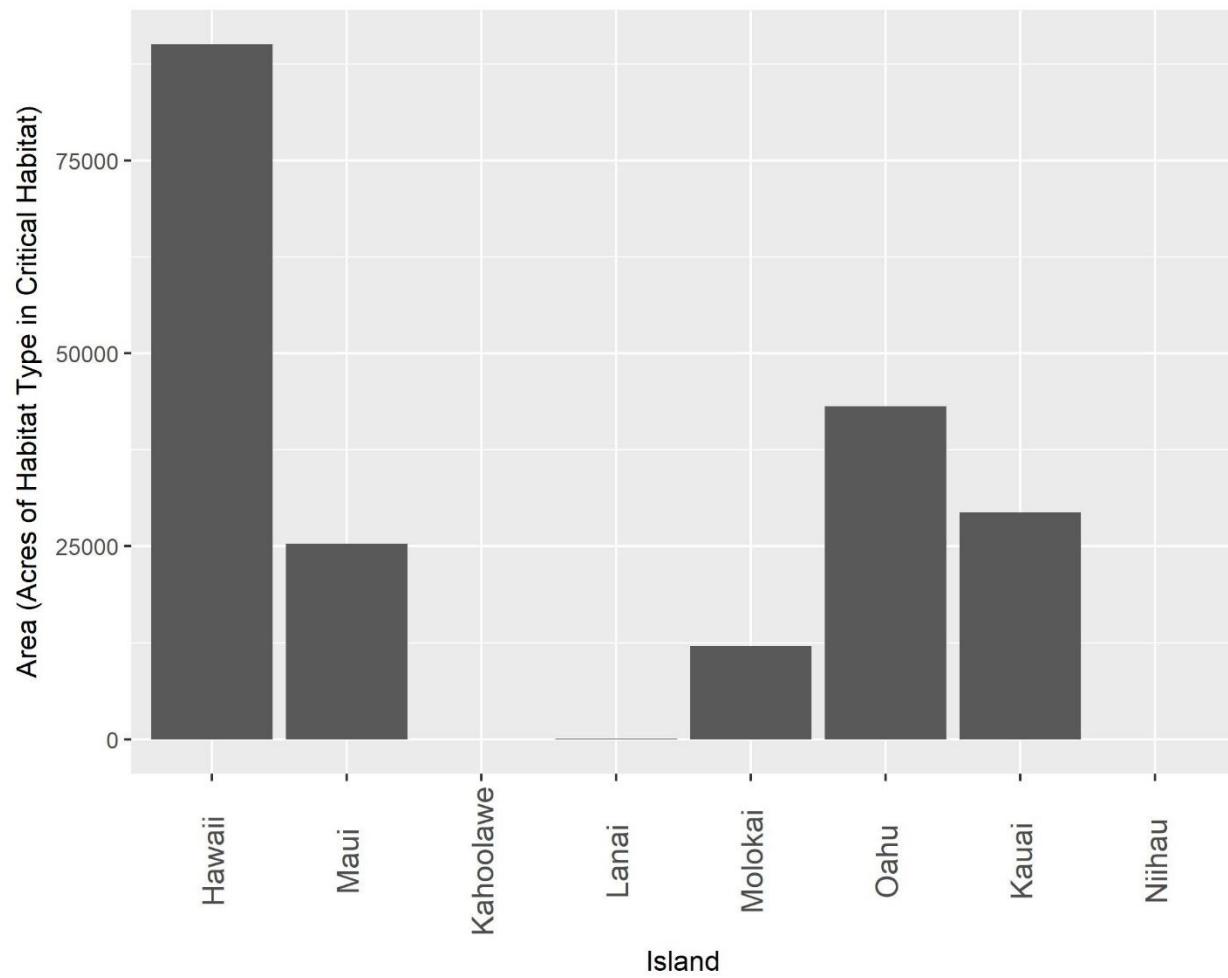
Mesic Forest Critical Habitat Summary



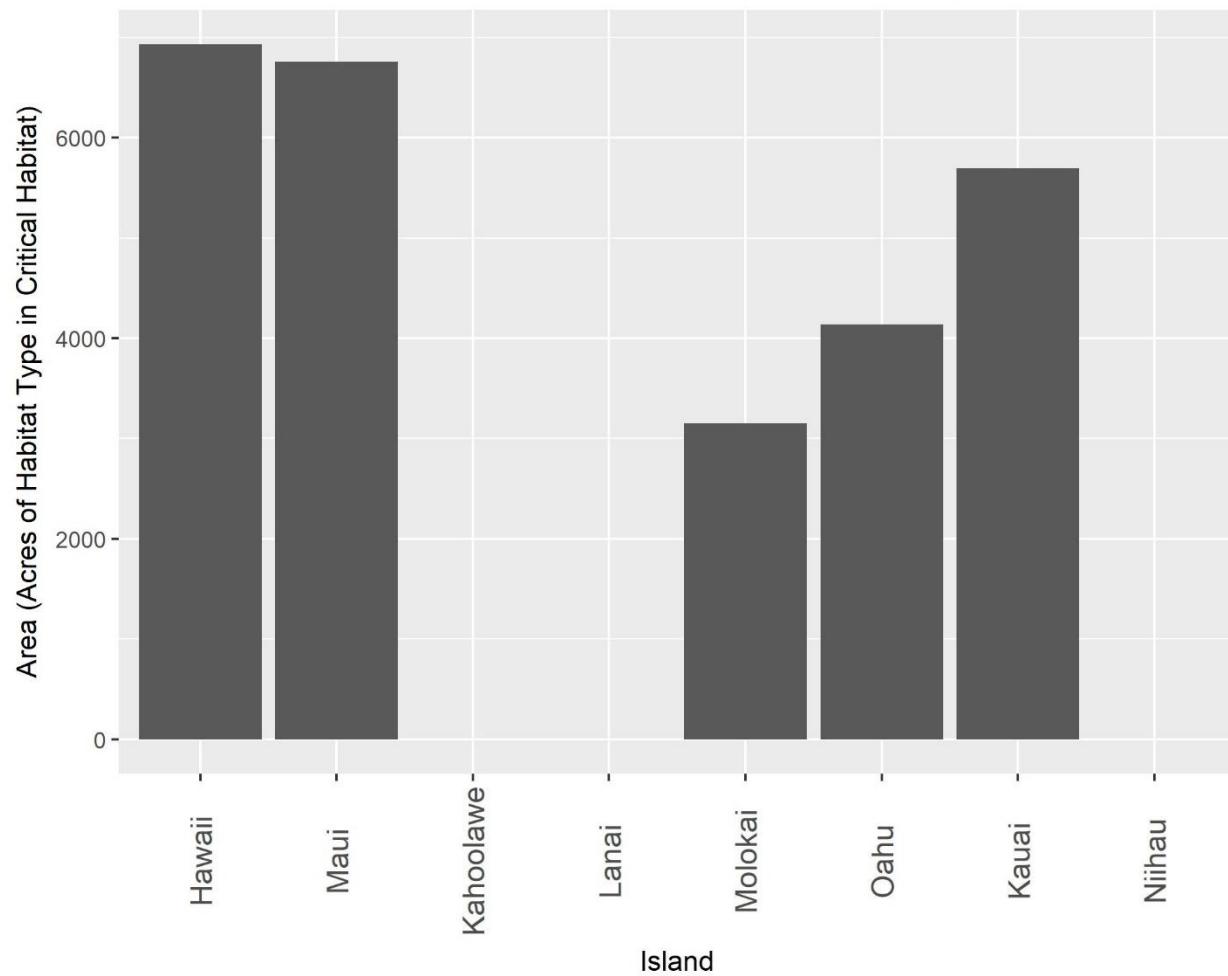
Mesic Grasslands and Shrublands Critical Habitat Summary



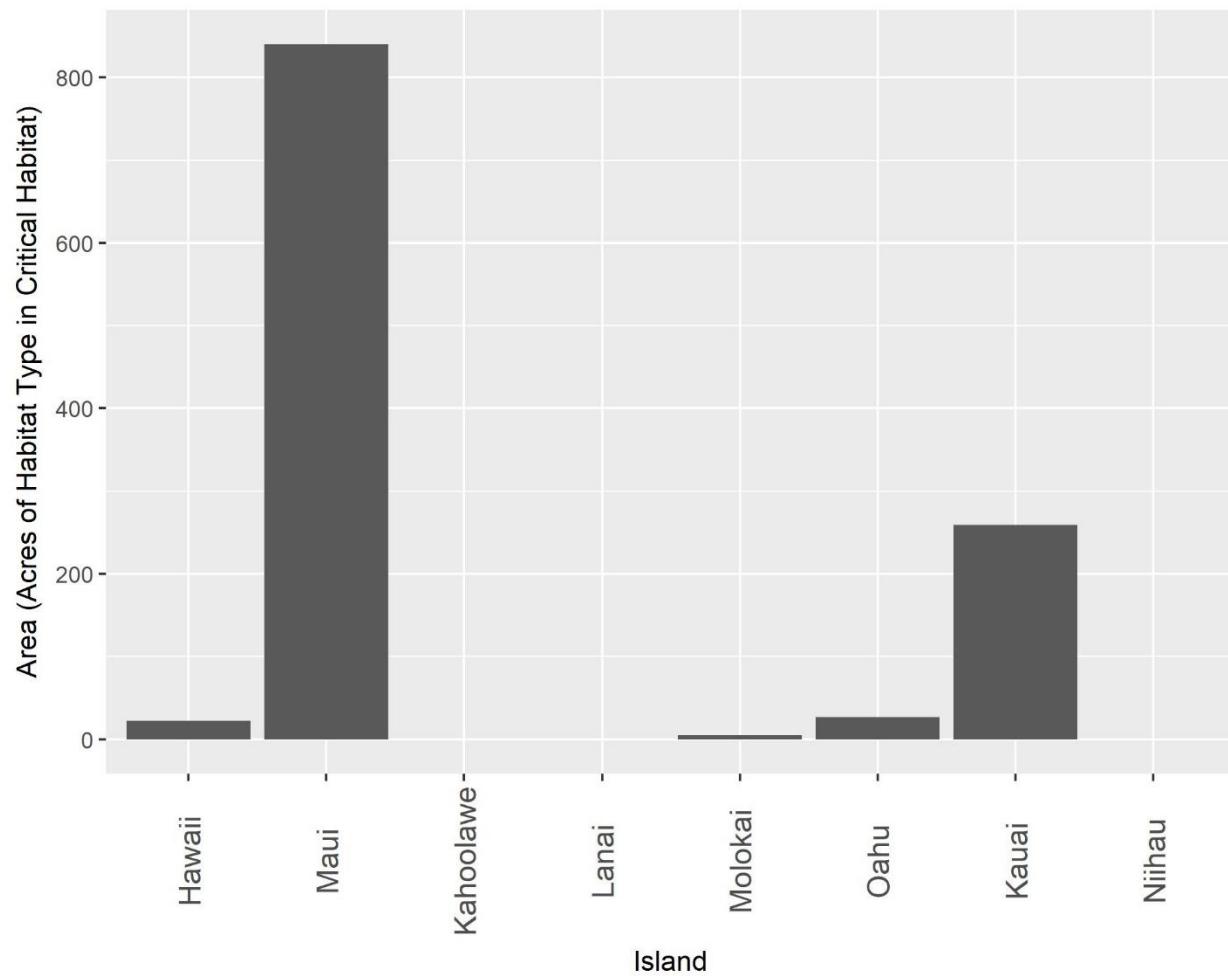
Wet Forest Critical Habitat Summary



Wet Grasslands and Shrublands Critical Habitat Summary



Wetland Critical Habitat Summary



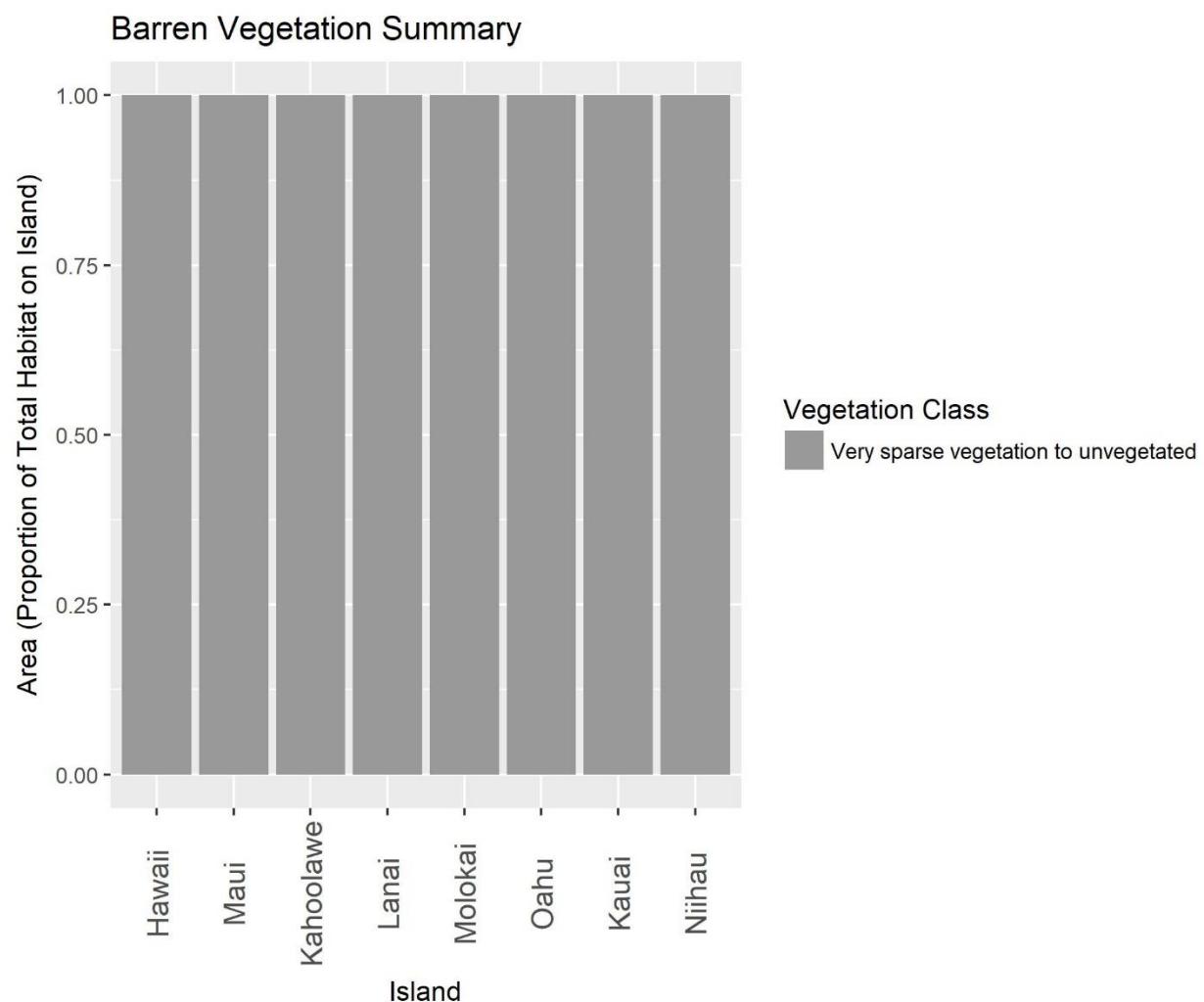
Pre-Human Contact Habitat

Vegetation Community	Island	Area (Acres of Habitat Before Human Contact)	Area (Square Miles of Habitat Before Human Contact)	Area (% of Total Island Area)
Coastal Dry Shrubland & Grassland	Kahoolawe	860	1	3
Dry Cliff	Kahoolawe	1210	2	4
Lowland Dry Forest & Shrubland	Kahoolawe	16812	26	59
Lowland Dry Shrubland & Grassland	Kahoolawe	8747	14	31
Lowland Mesic Forest & Shrubland	Kahoolawe	931	1	3
Coastal Dry Shrubland & Grassland	Niihau	6760	11	15
Dry Cliff	Niihau	1015	2	2
Lowland Dry Forest & Shrubland	Niihau	18720	29	40
Lowland Dry Shrubland & Grassland	Niihau	13046	20	28
Lowland Mesic Forest & Shrubland	Niihau	5087	8	11
Wetland	Niihau	1684	3	4
Dry Cliff	Lanai	4957	8	5
Lowland Dry Forest & Shrubland	Lanai	33756	53	37
Lowland Dry Shrubland & Grassland	Lanai	41205	64	46
Lowland Mesic Forest & Shrubland	Lanai	8366	13	9
Lowland Wet Forest & Shrubland	Lanai	973	2	1
Montane Wet Forest & Shrubland	Lanai	283	<1	<1
Wet Cliff	Lanai	750	1	1
Coastal Dry Shrubland & Grassland	Molokai	3232	5	2
Coastal Mesic Forest & Shrubland	Molokai	725	1	<1
Dry Cliff	Molokai	1289	2	1
Isle	Molokai	26	<1	<1
Lowland Dry Forest & Shrubland	Molokai	56805	89	34
Lowland Dry Shrubland & Grassland	Molokai	55349	86	33

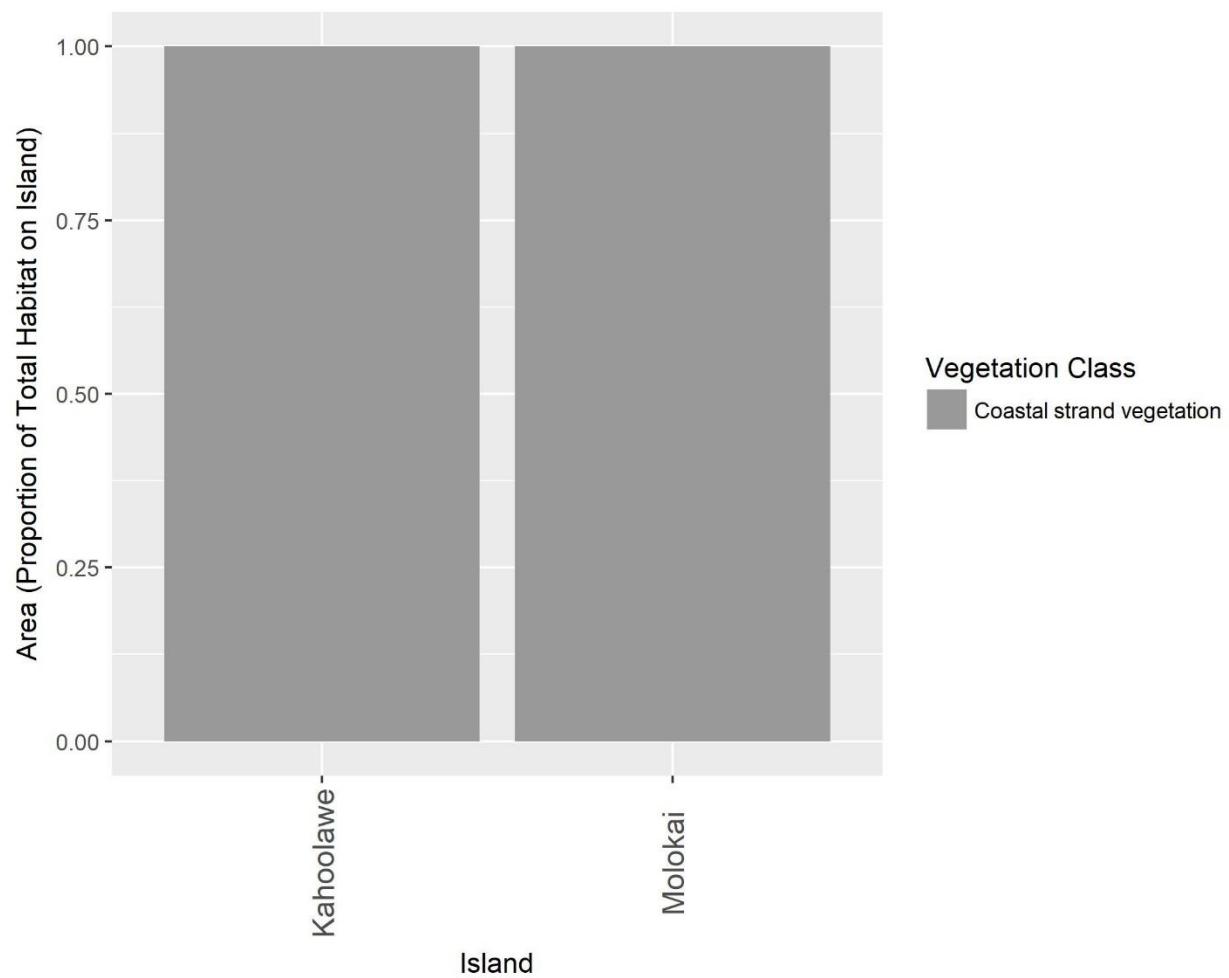
Lowland Mesic Forest & Shrubland	Molokai	16733	26	10
Lowland Wet Forest & Shrubland	Molokai	16293	25	10
Montane Mesic Forest & Shrubland	Molokai	1816	3	1
Montane Wet Forest & Shrubland	Molokai	8688	14	5
Wet Cliff	Molokai	5882	9	4
Dry Cliff	Kauai	14274	22	4
Lowland Dry Forest & Shrubland	Kauai	59355	93	17
Lowland Dry Shrubland & Grassland	Kauai	10626	17	3
Lowland Mesic Forest & Shrubland	Kauai	126665	198	36
Lowland Wet Forest & Shrubland	Kauai	94779	148	27
Montane Mesic Forest & Shrubland	Kauai	8168	13	2
Montane Wet Forest & Shrubland	Kauai	24593	38	7
Wet Cliff	Kauai	13519	21	4
Wetland	Kauai	3035	5	1
Dry Cliff	Oahu	7961	12	2
Lowland Dry Forest & Shrubland	Oahu	122502	191	32
Lowland Dry Shrubland & Grassland	Oahu	39660	62	10
Lowland Mesic Forest & Shrubland	Oahu	125860	197	33
Lowland Wet Forest & Shrubland	Oahu	63552	99	17
Montane Wet Forest & Shrubland	Oahu	790	1	<1
Open Water	Oahu	95	<1	<1
Wet Cliff	Oahu	7230	11	2
Wetland	Oahu	12712	20	3
Alpine Desert	Maui	2143	3	<1
Dry Cliff	Maui	9110	14	2
Isle	Maui	<1	<1	<1
Lowland Dry Forest & Shrubland	Maui	113112	177	24
Lowland Dry Shrubland & Grassland	Maui	51408	80	11
Lowland Mesic Forest & Shrubland	Maui	80711	126	17
Lowland Wet Forest & Shrubland	Maui	87564	137	19
Montane Dry Forest & Shrubland	Maui	508	1	<1
Montane Mesic Forest & Shrubland	Maui	37528	59	8
Montane Wet Forest & Shrubland	Maui	34008	53	7

Subalpine Dry Shrubland & Grassland	Maui	31455	49	7
Wet Cliff	Maui	14820	23	3
Wetland	Maui	954	1	<1
Alpine Communities	Hawaii	126075	197	5
Dry Cliff	Hawaii	3205	5	<1
Lowland Dry Forest & Shrubland	Hawaii	434571	679	17
Lowland Dry Shrubland & Grassland	Hawaii	103347	161	4
Lowland Mesic Forest & Shrubland	Hawaii	169002	264	7
Lowland Wet Forest & Shrubland	Hawaii	562935	880	22
Montane Dry Forest & Shrubland	Hawaii	413126	646	16
Montane Mesic Forest & Shrubland	Hawaii	153205	239	6
Montane Wet Forest & Shrubland	Hawaii	231931	362	9
Subalpine Dry Forest & Shrubland	Hawaii	378446	591	15
Wet Cliff	Hawaii	8509	13	<1

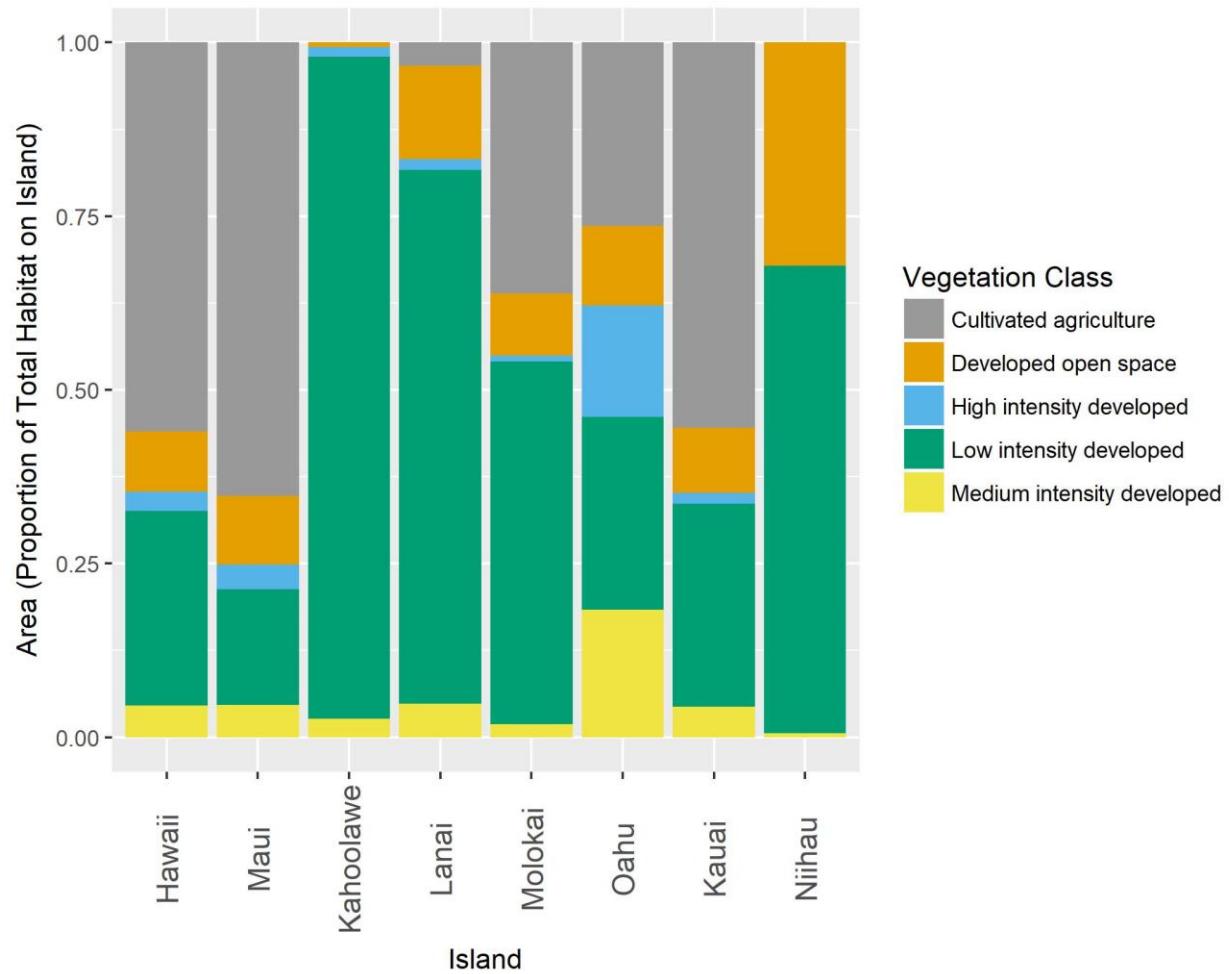
Vegetation Type



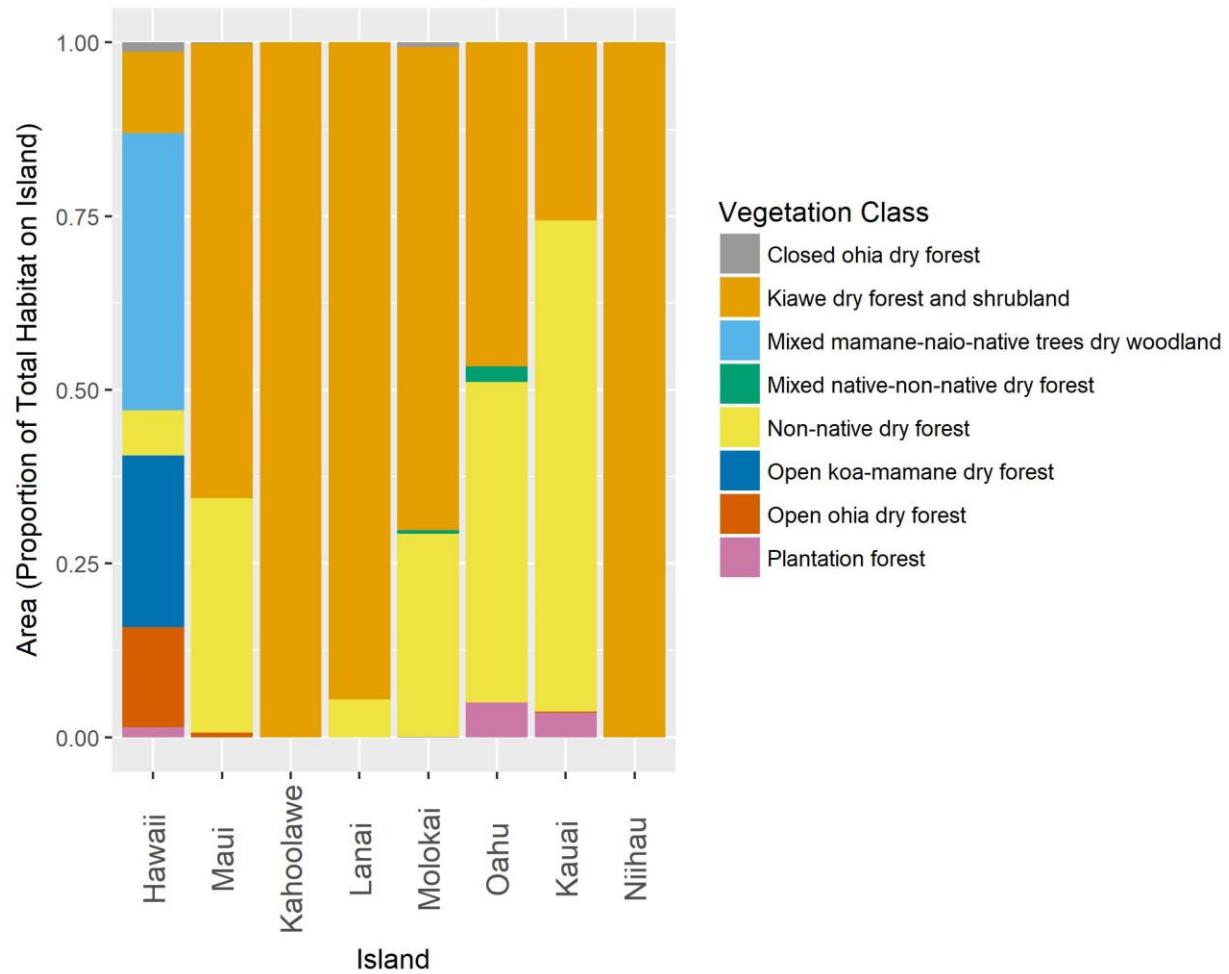
Coastal Vegetation Summary



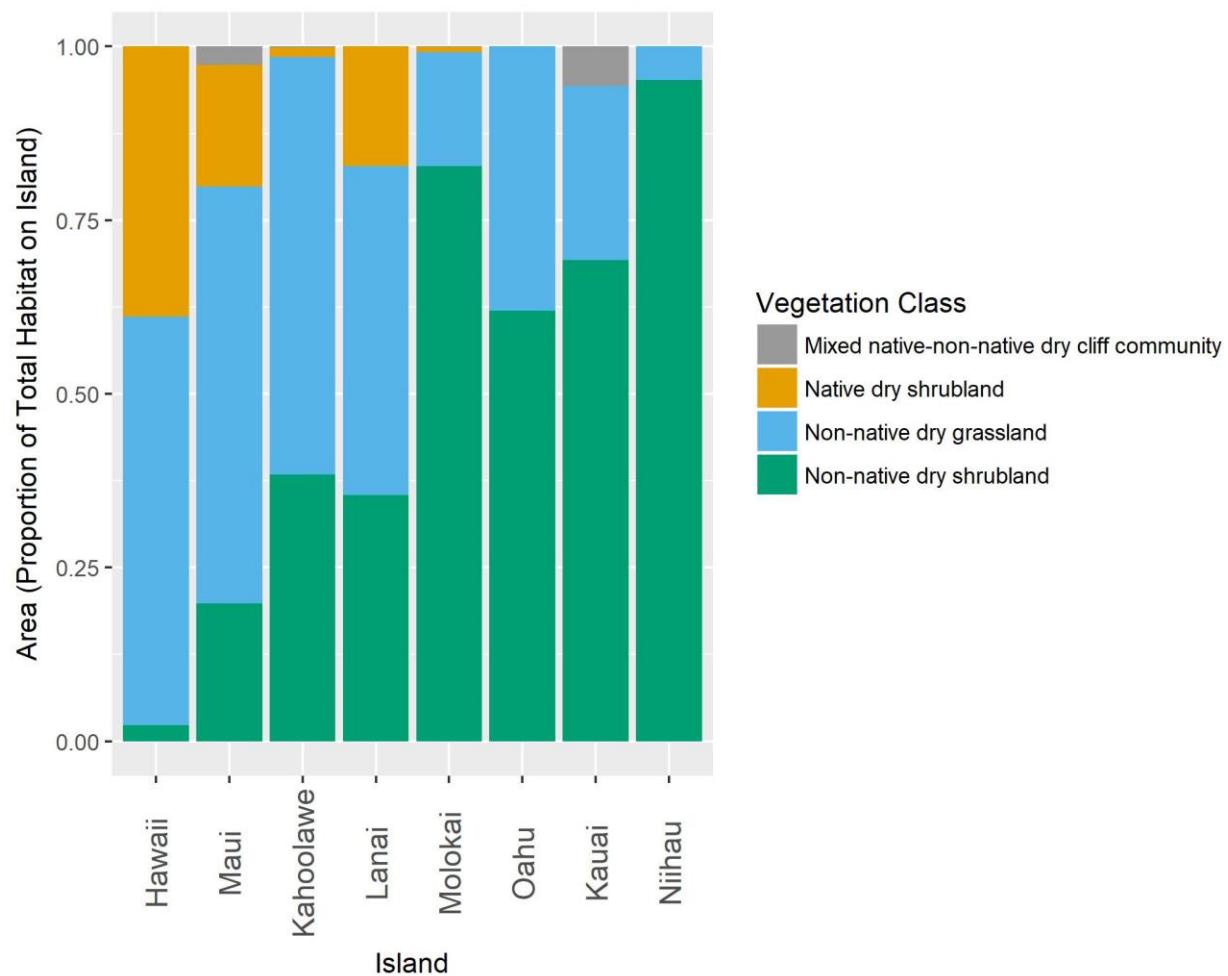
Developed Vegetation Summary



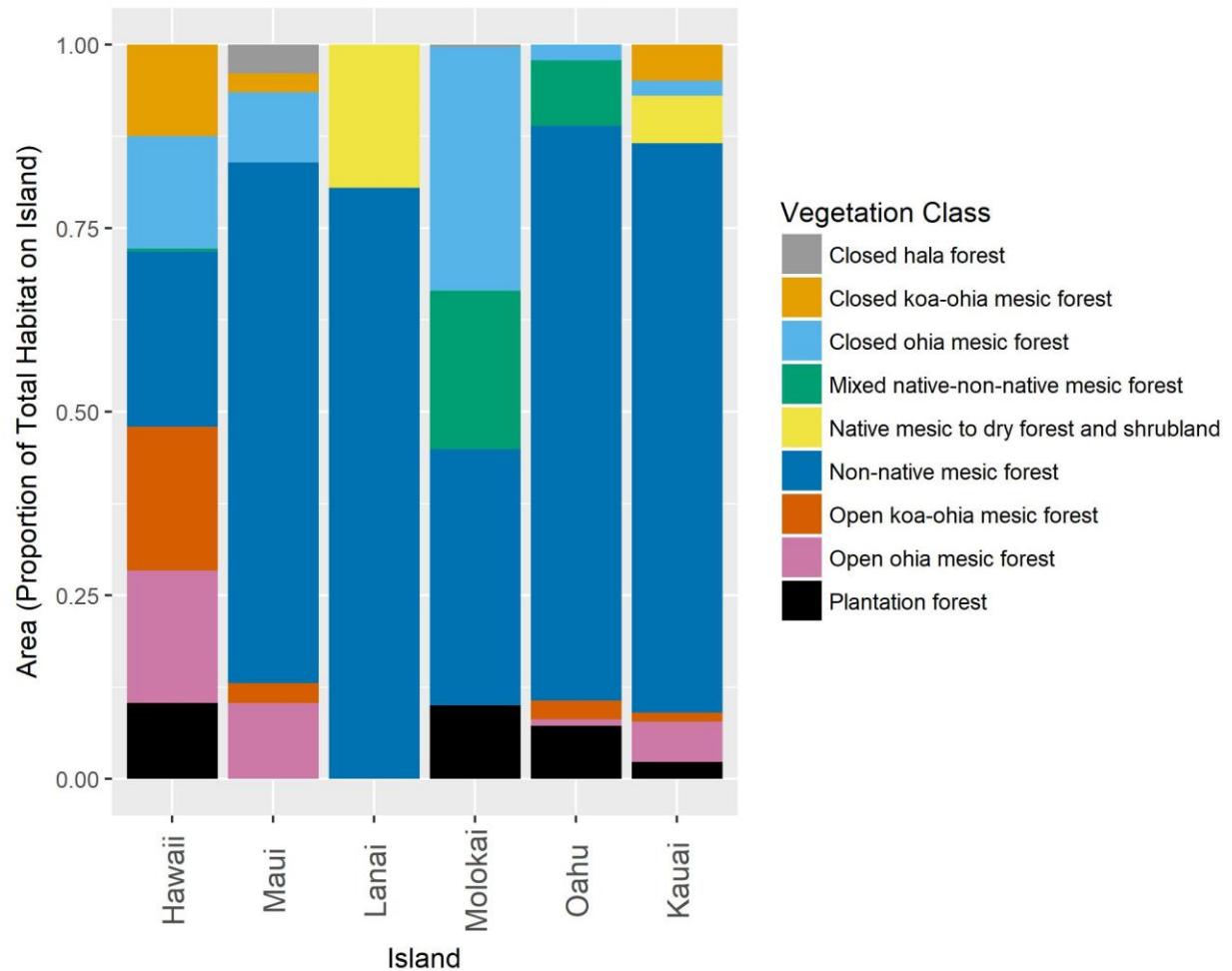
Dry Forest Vegetation Summary



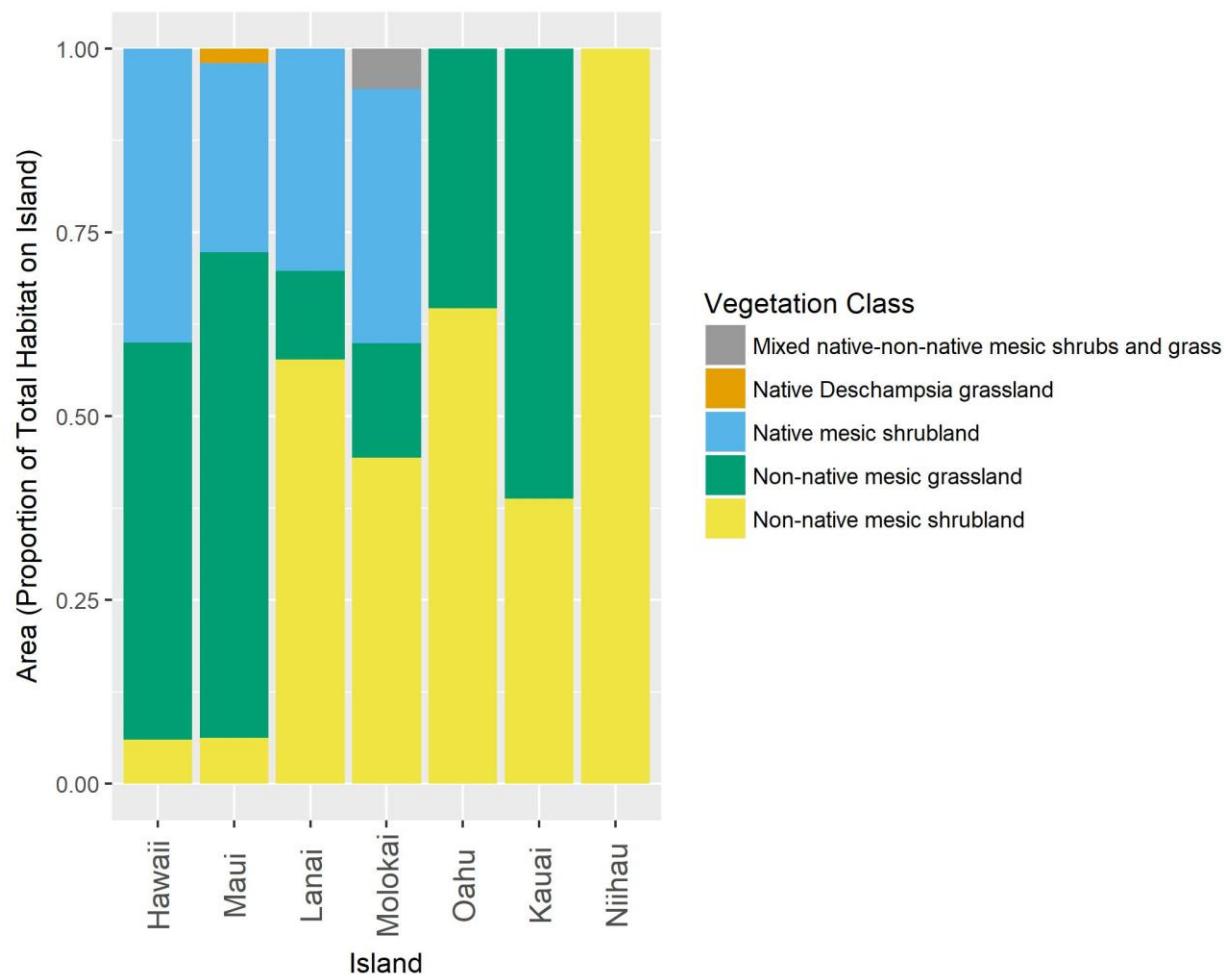
Dry Grasslands and Shrublands Vegetation Summary



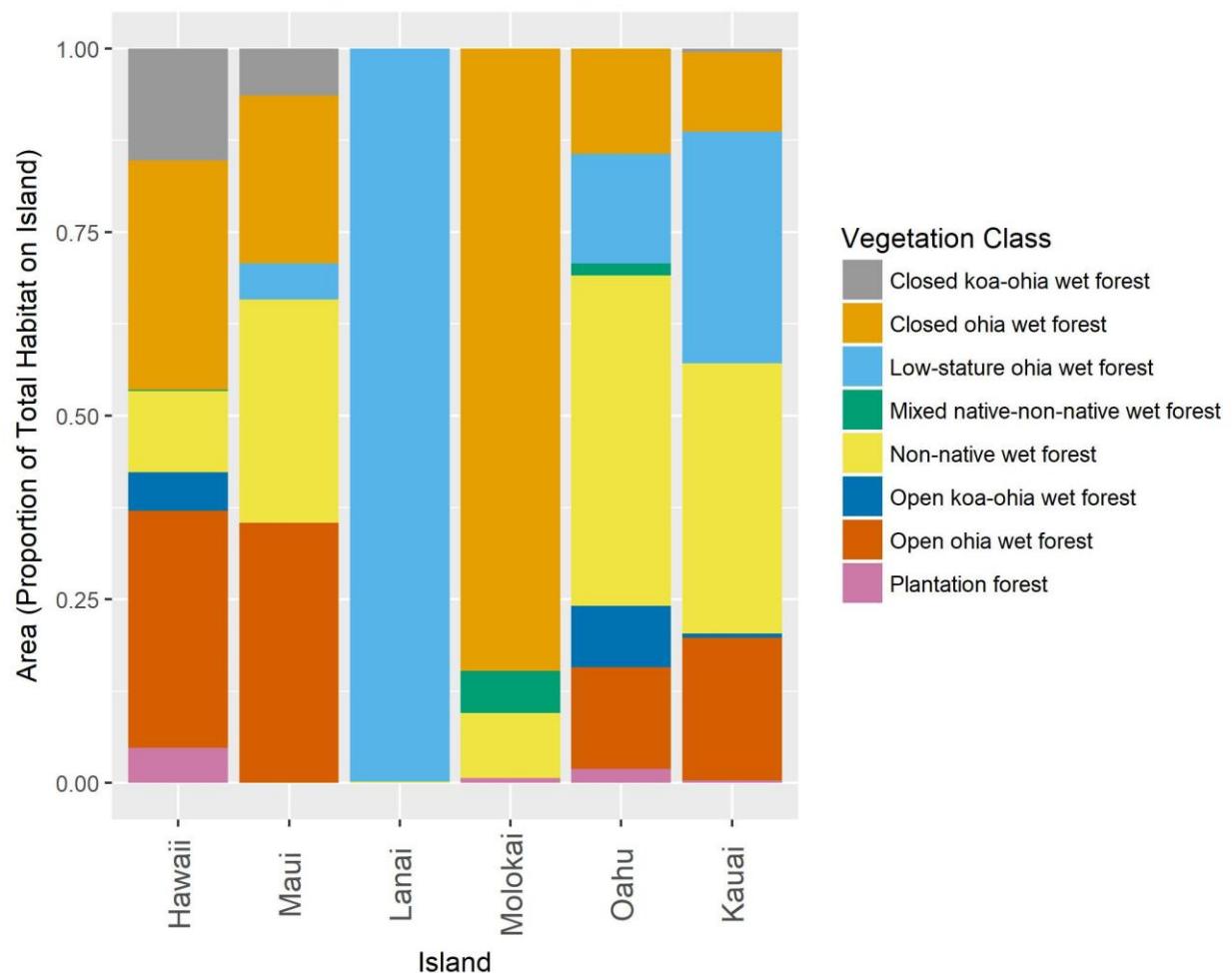
Mesic Forest Vegetation Summary



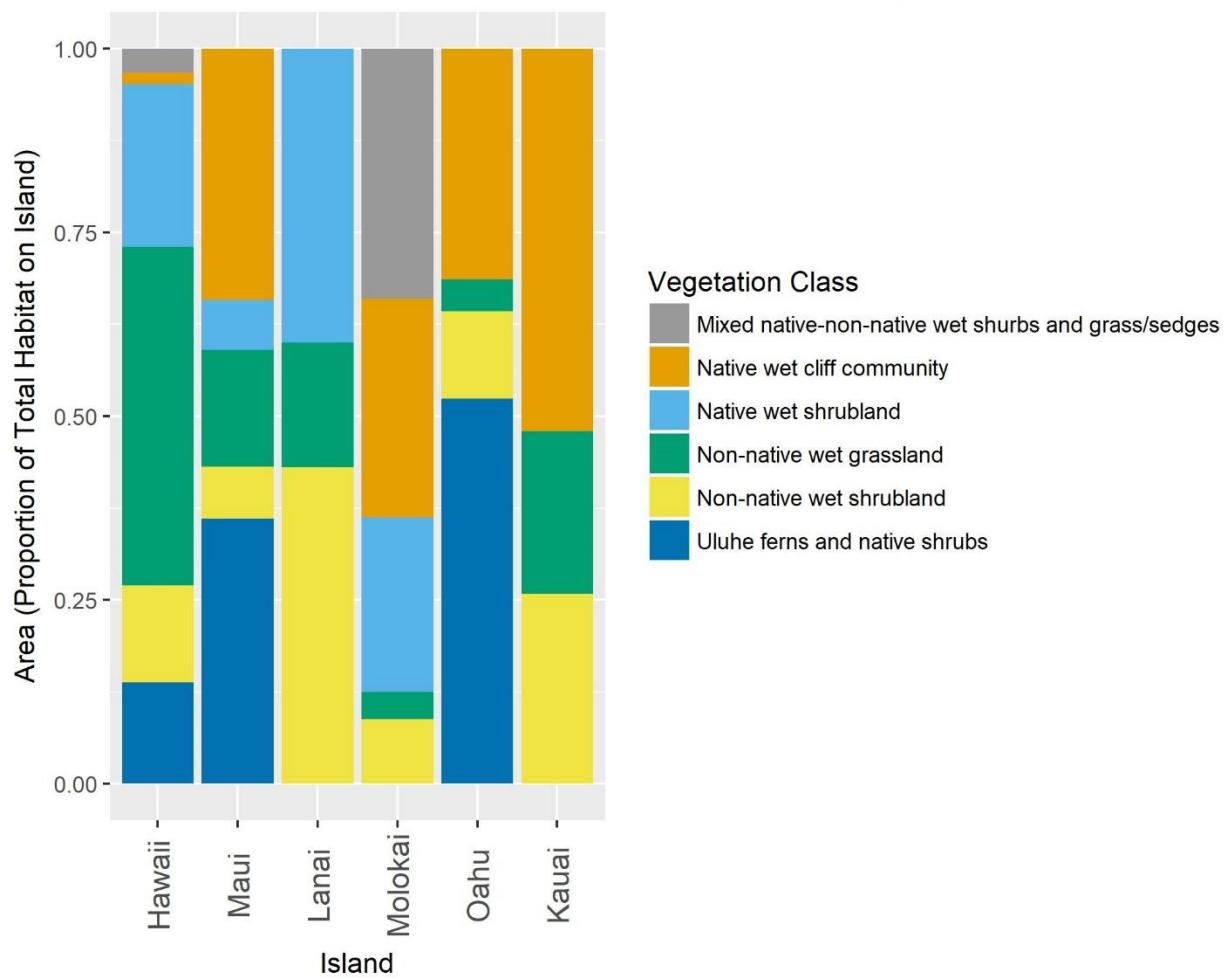
Mesic Grasslands and Shrublands Vegetation Summary



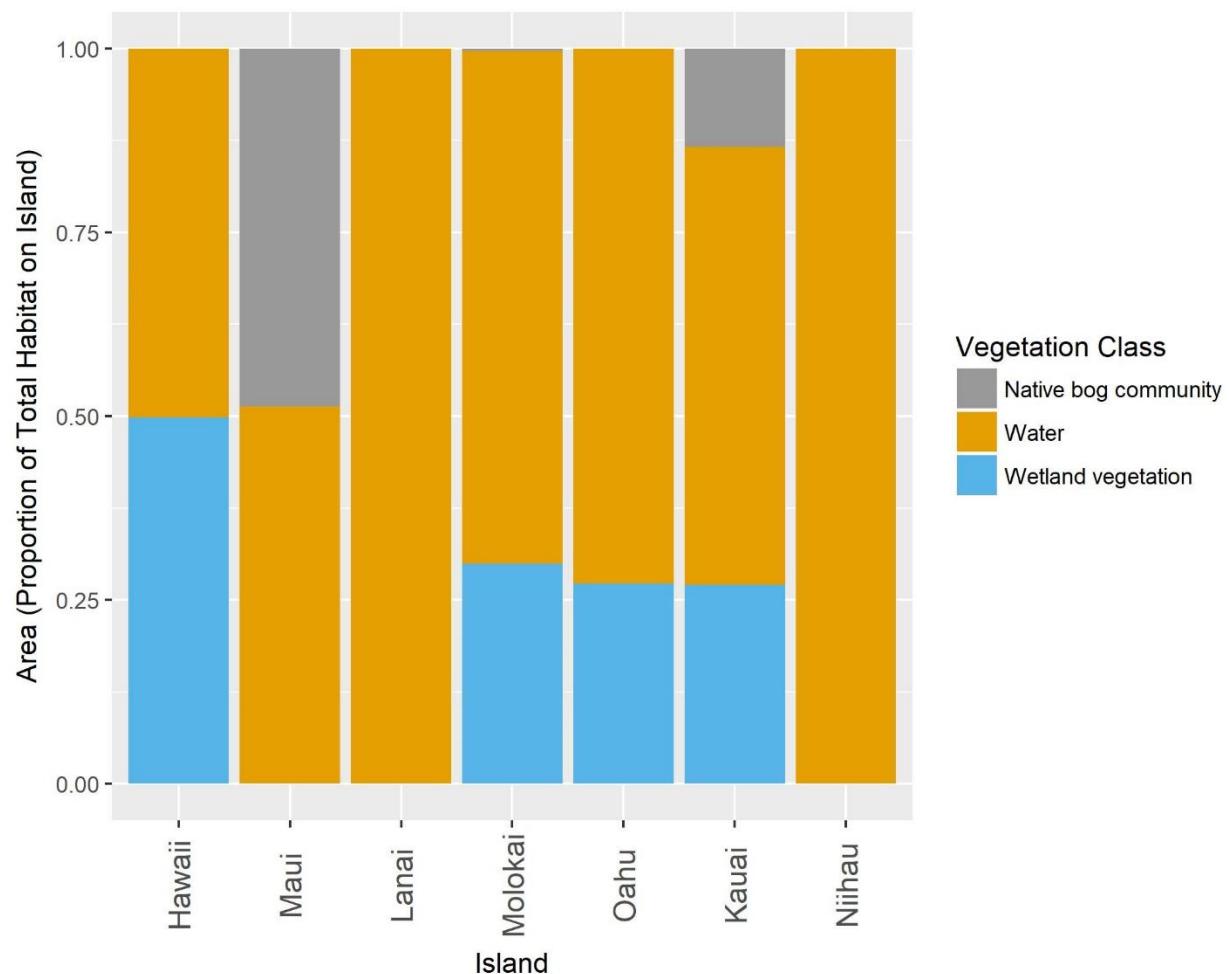
Wet Forest Vegetation Summary



Wet Grasslands and Shrublands Vegetation Summary

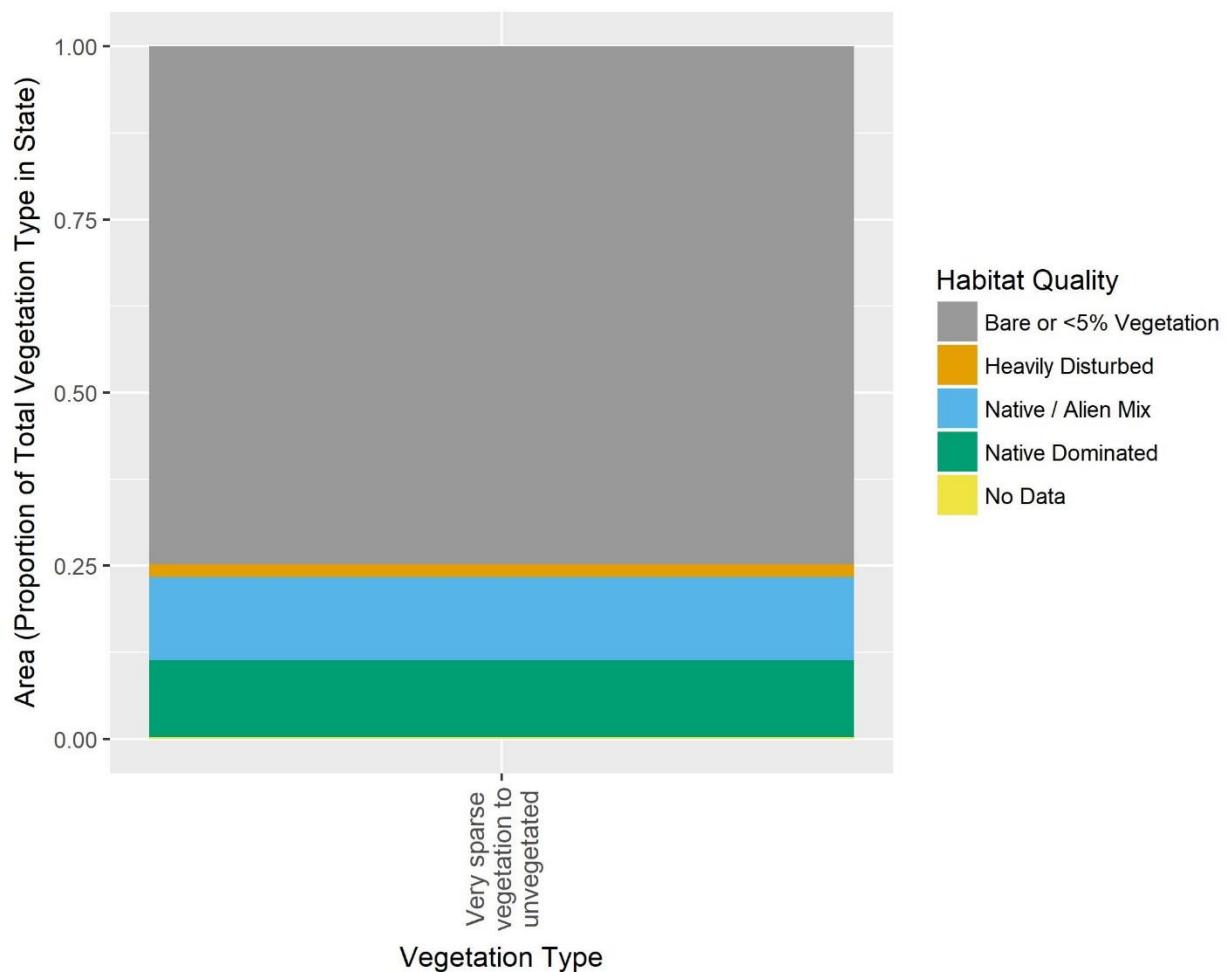


Wetland Vegetation Summary

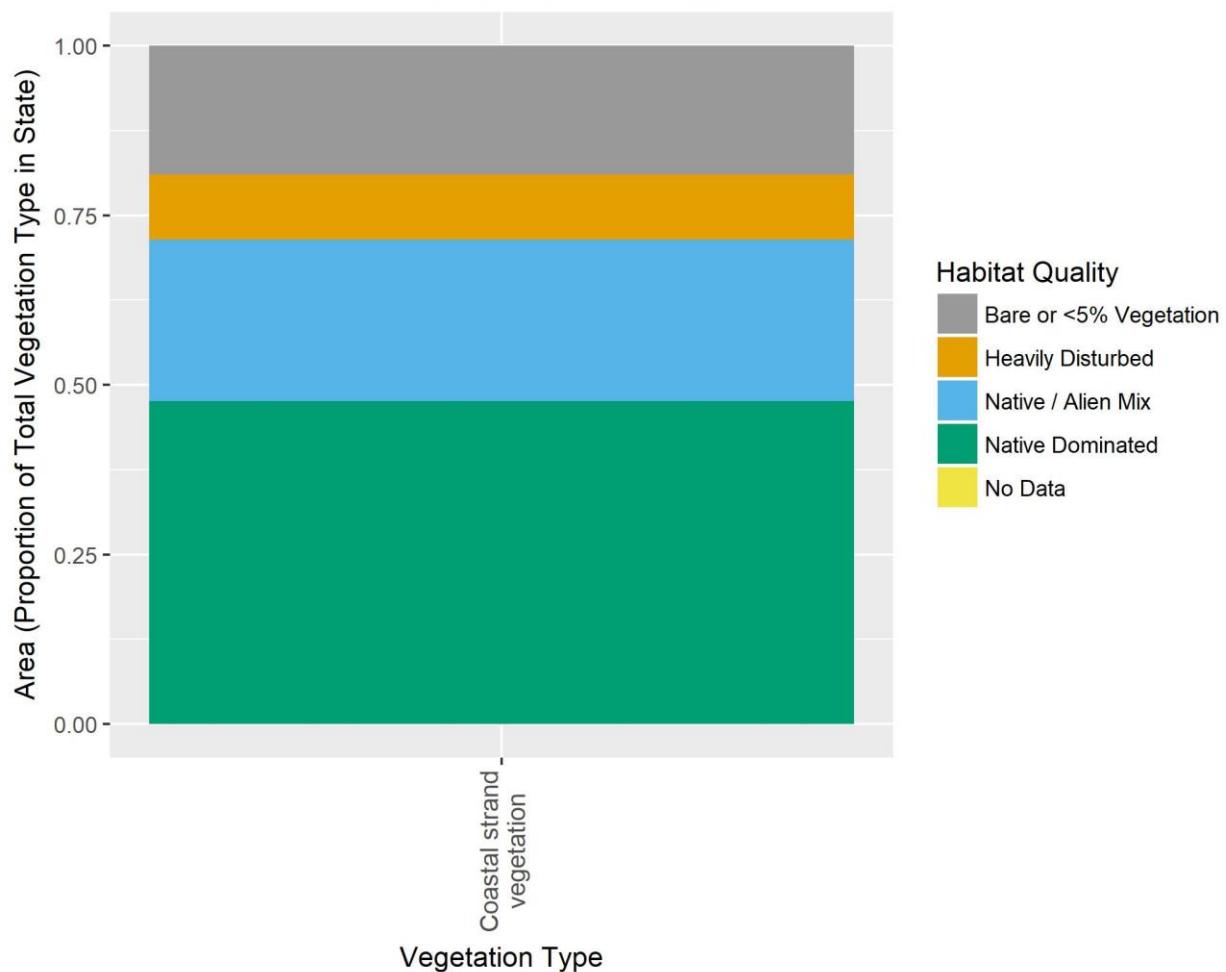


Vegetation Quality

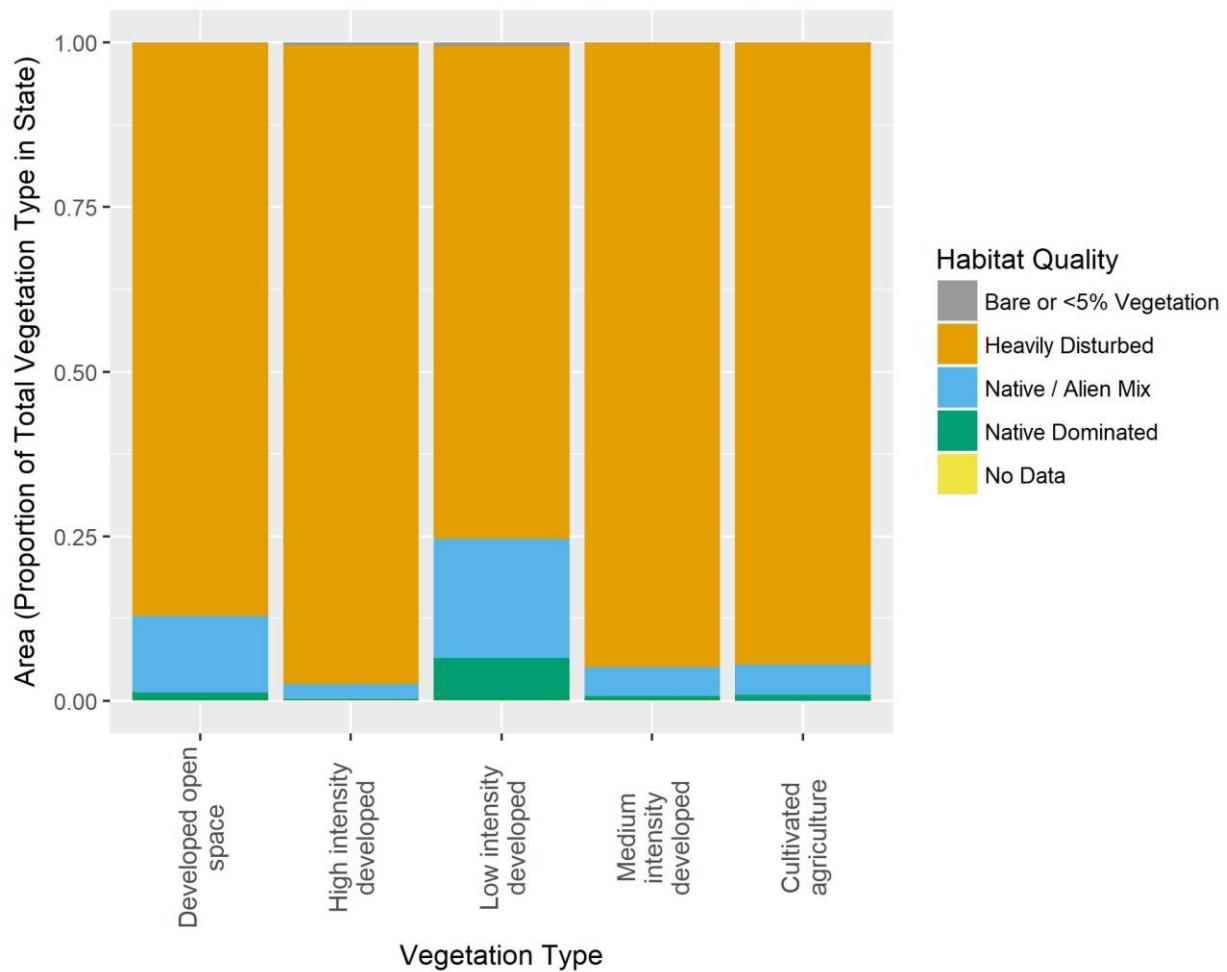
Barren Habitat Quality by Vegetation Type



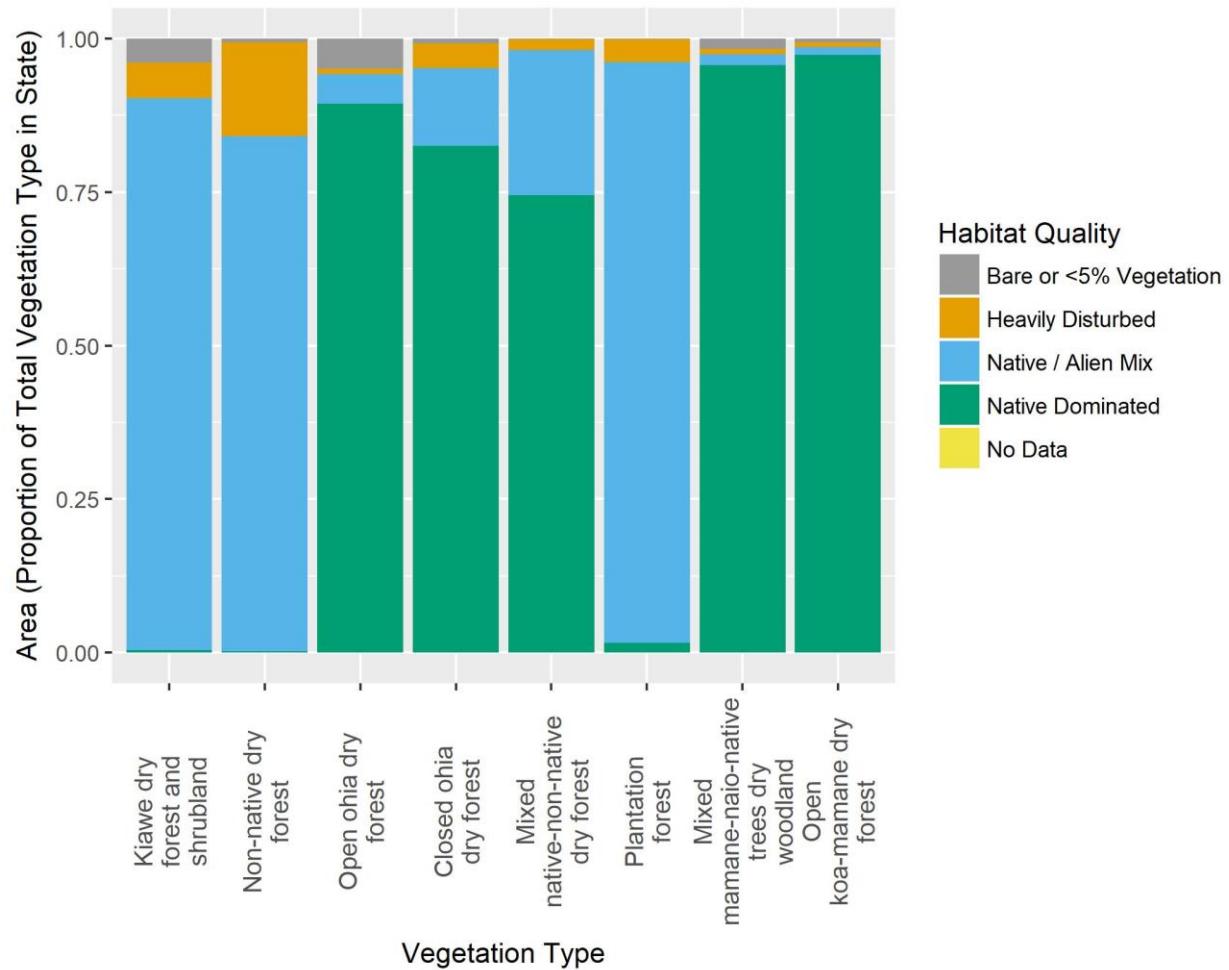
Coastal Habitat Quality by Vegetation Type



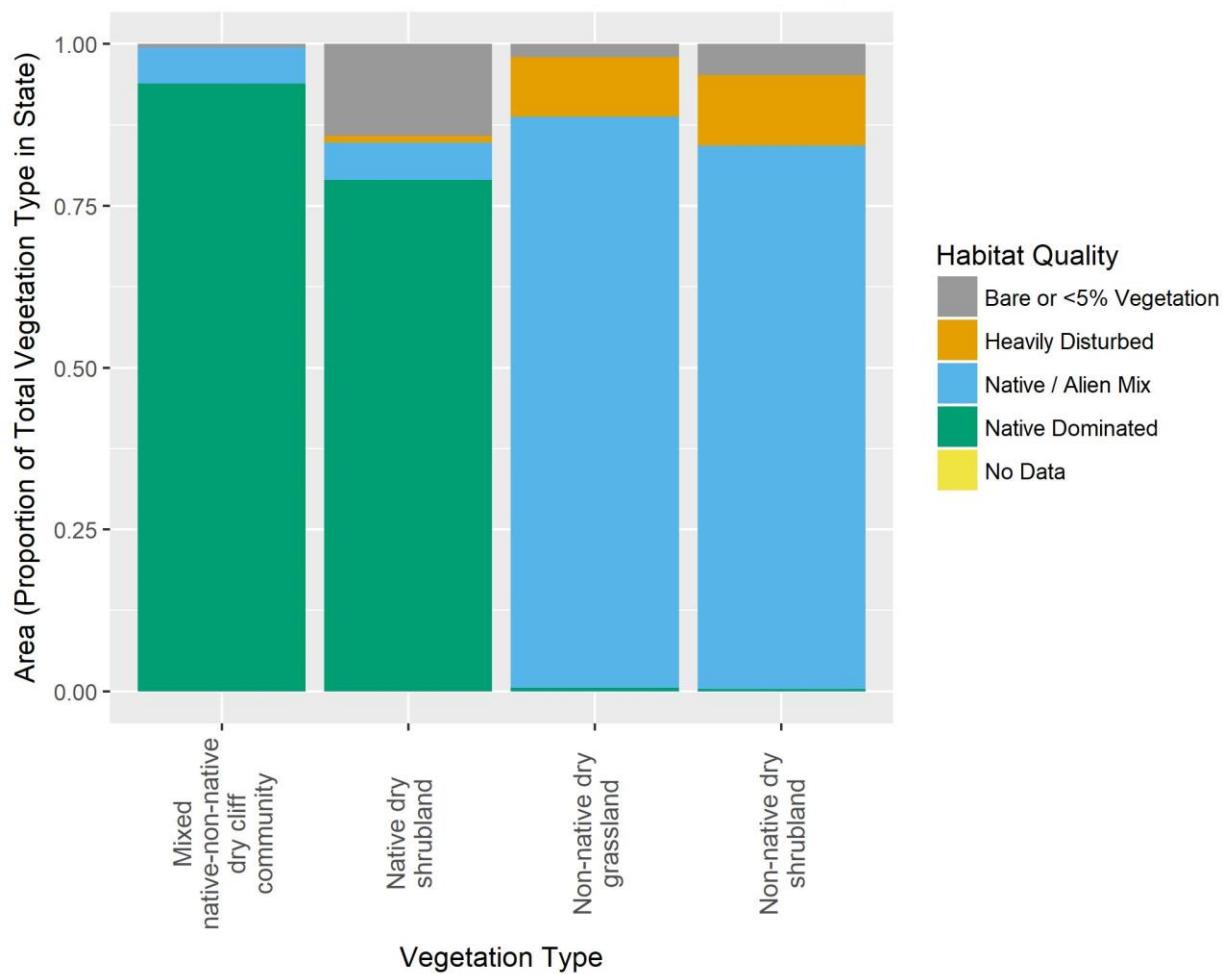
Developed Habitat Quality by Vegetation Type



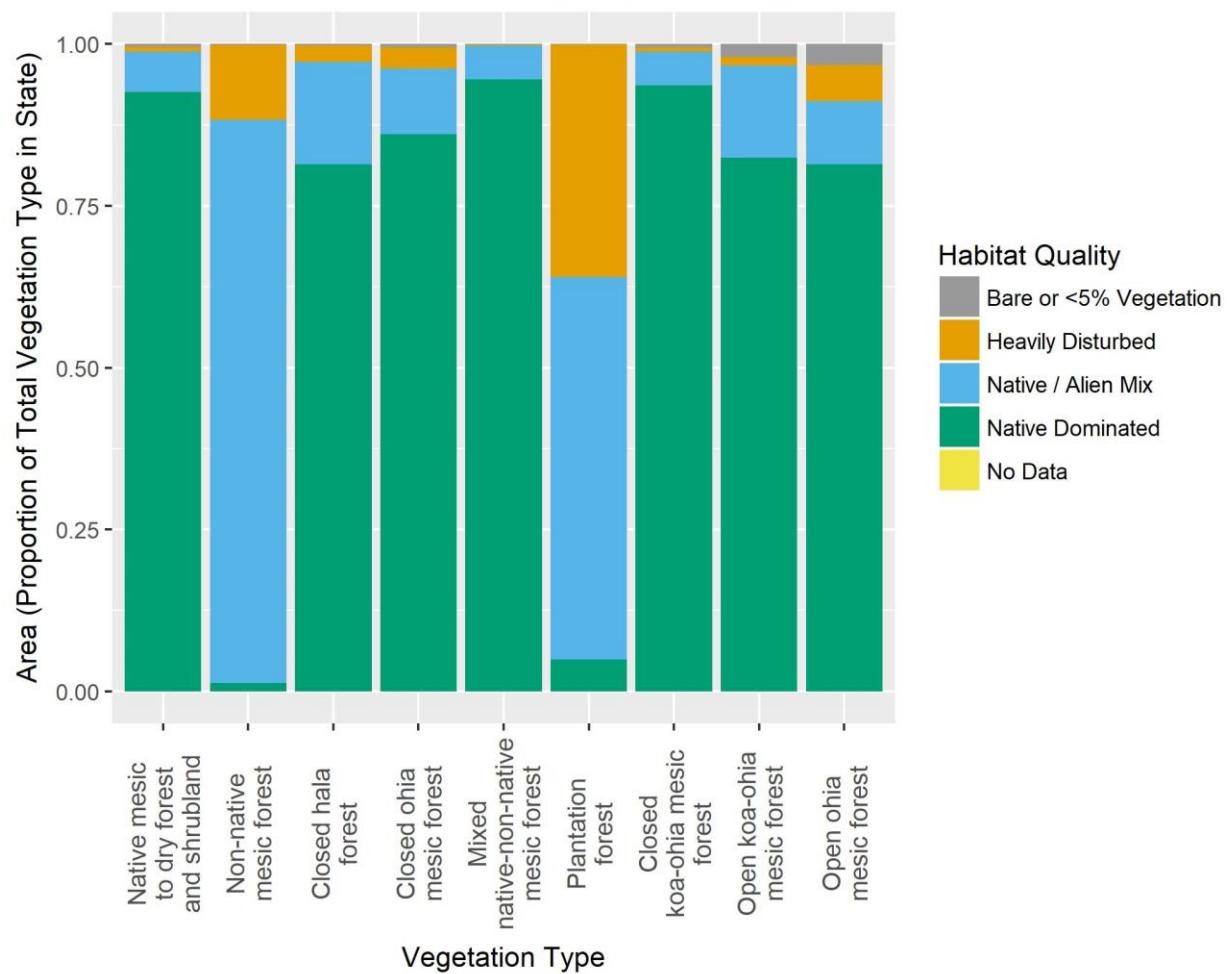
Dry Forest Habitat Quality by Vegetation Type



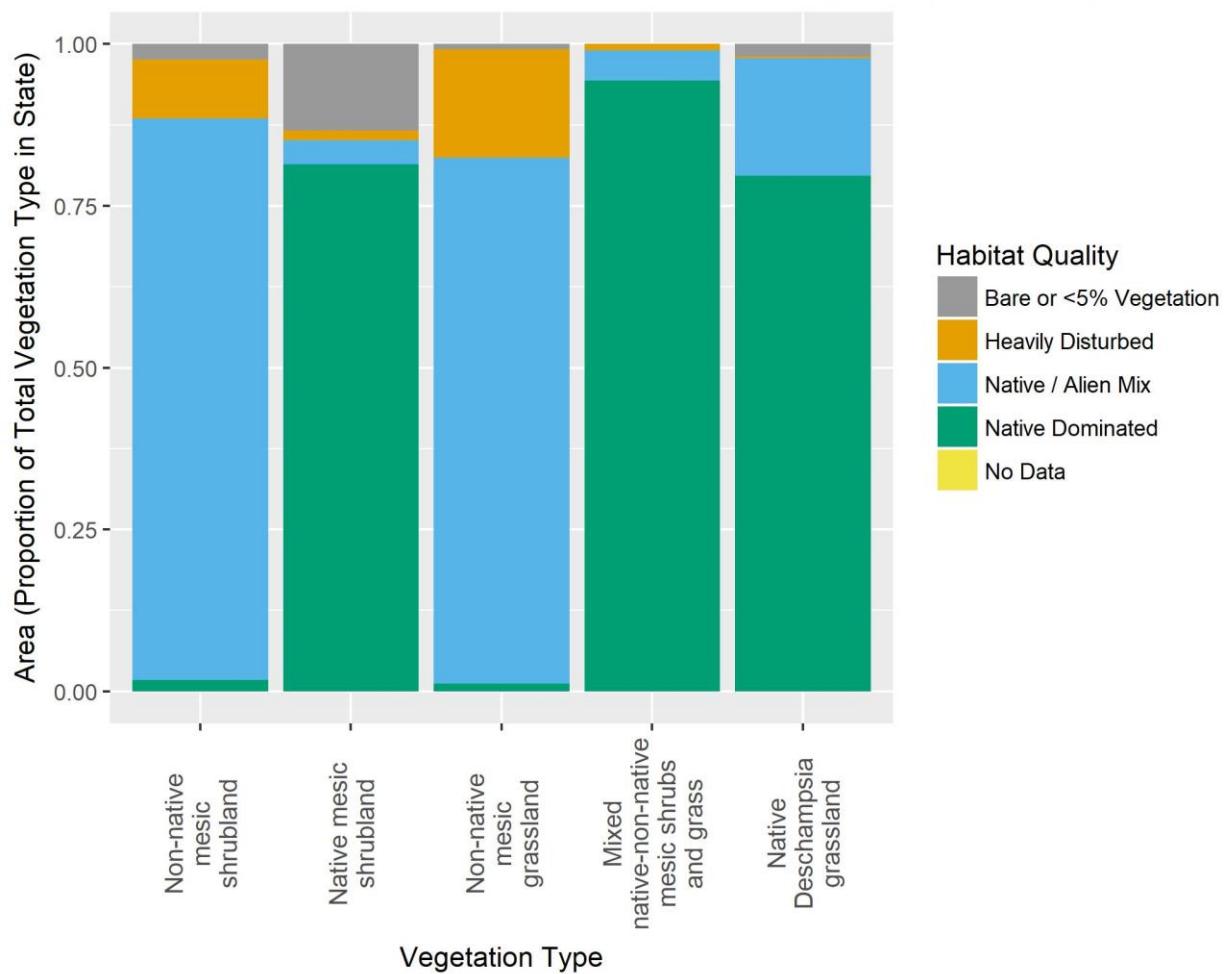
Dry Grasslands and Shrublands Habitat Quality by Vegetation Type



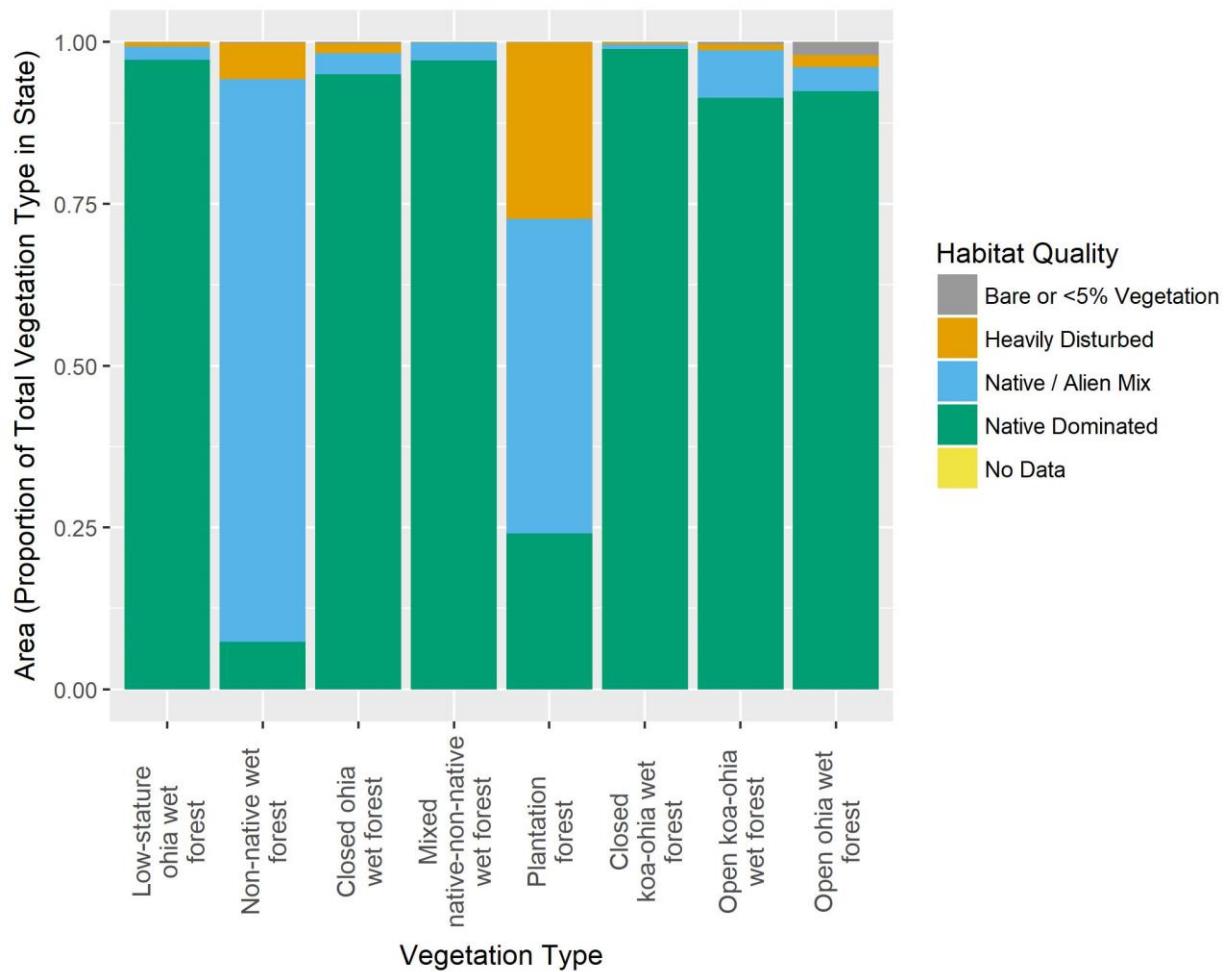
Mesic Forest Habitat Quality by Vegetation Type



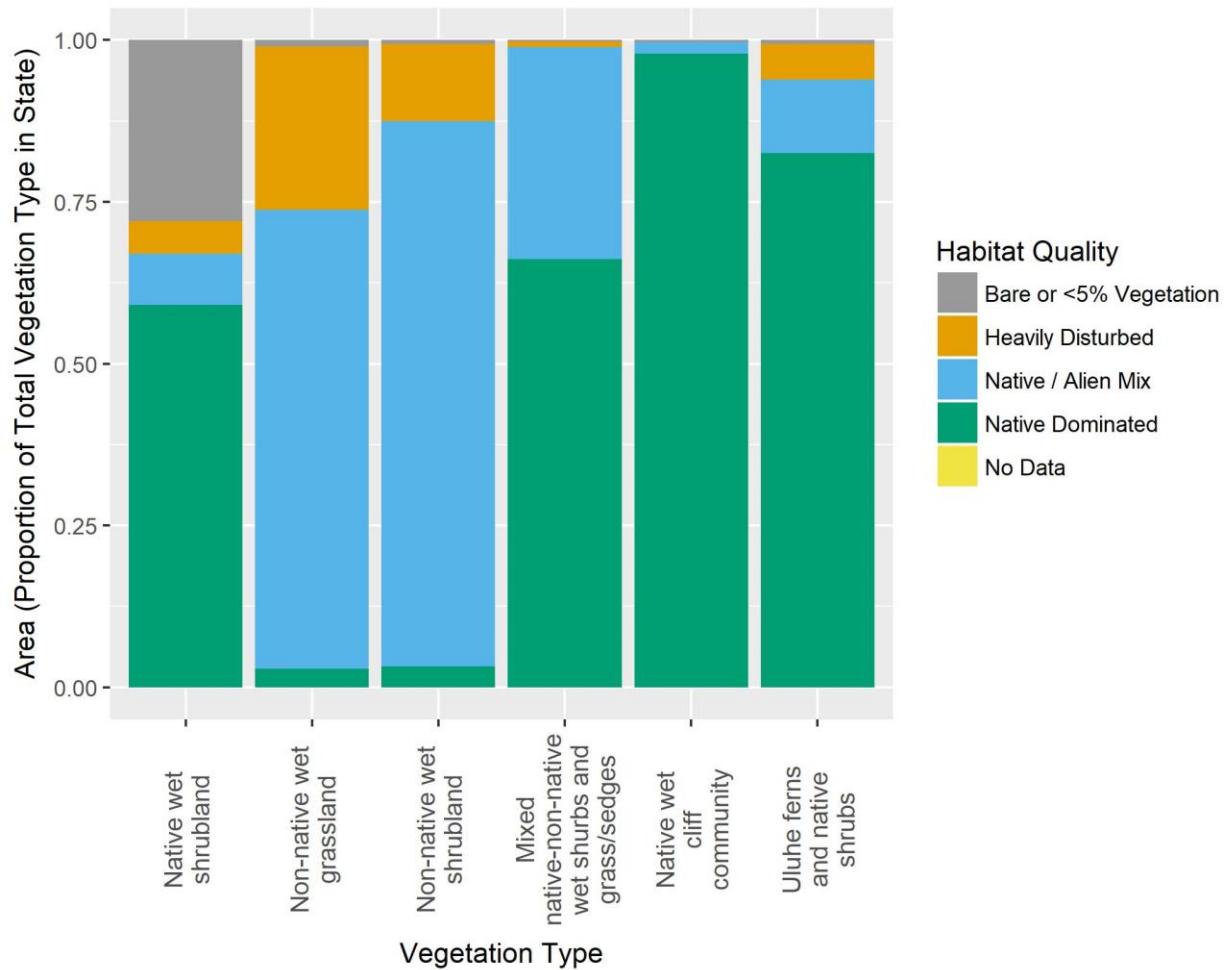
Mesic Grasslands and Shrublands Habitat Quality by Vegetation Type



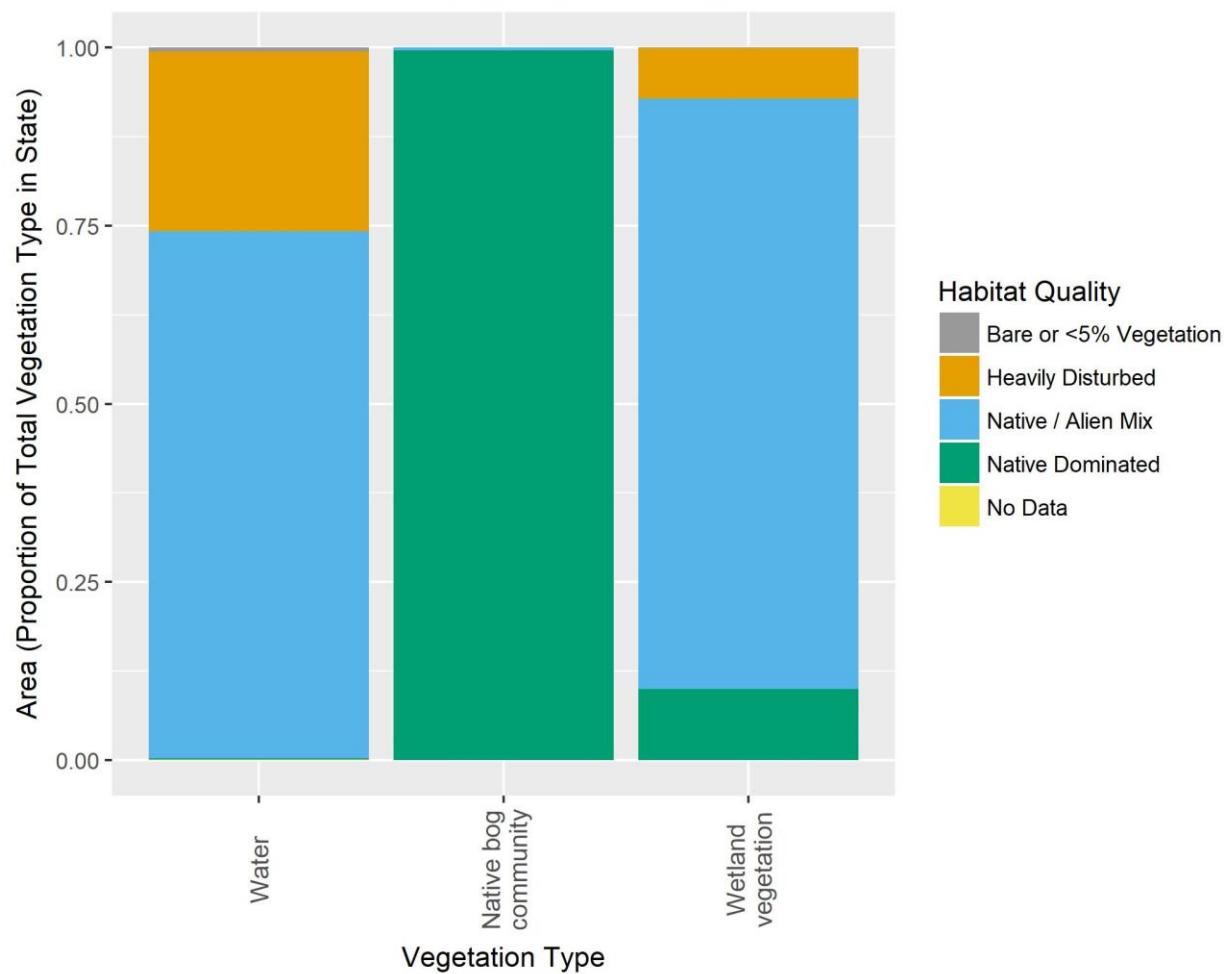
Wet Forest Habitat Quality by Vegetation Type



Wet Grasslands and Shrublands Habitat Quality by Vegetation Type



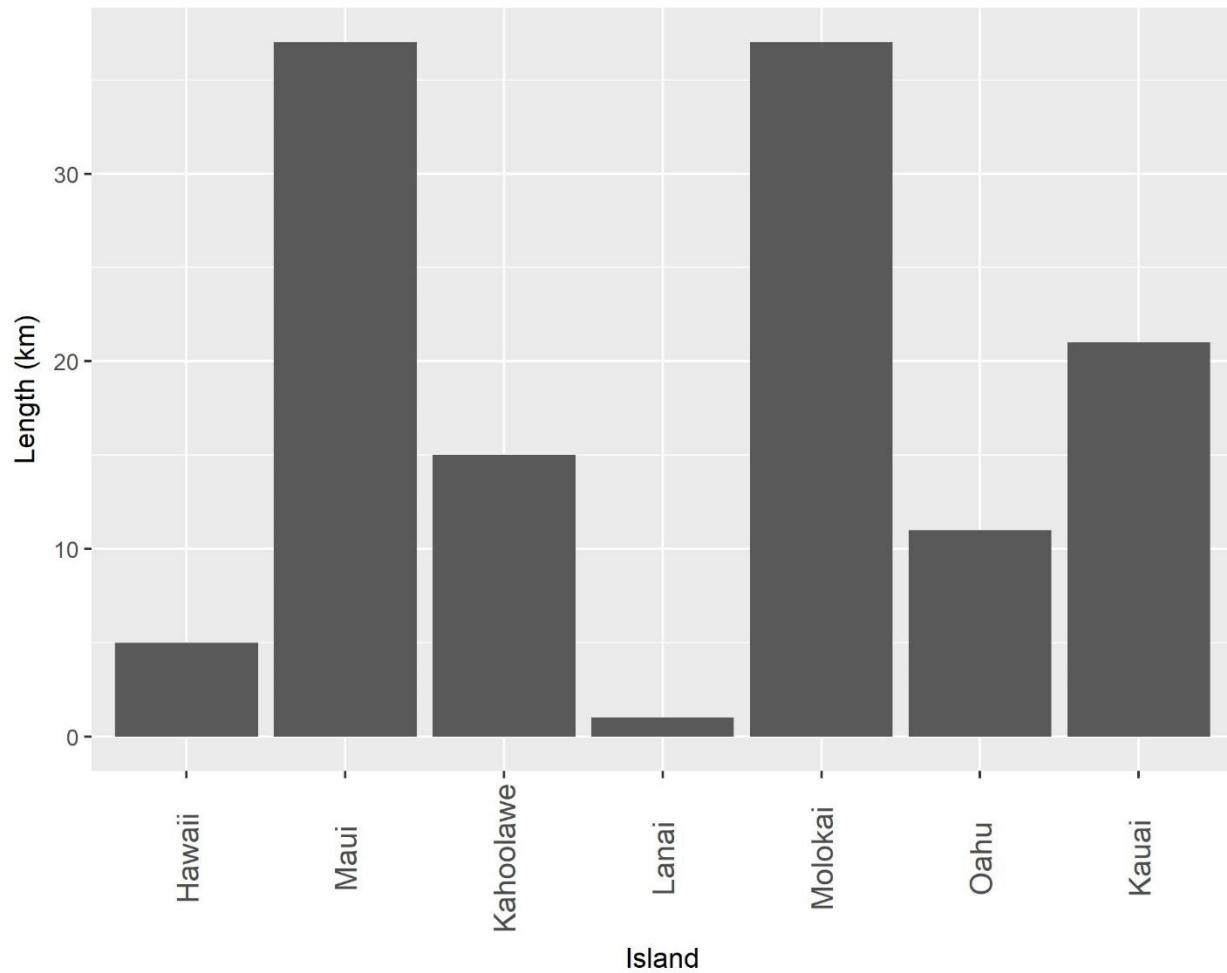
Wetland Habitat Quality by Vegetation Type



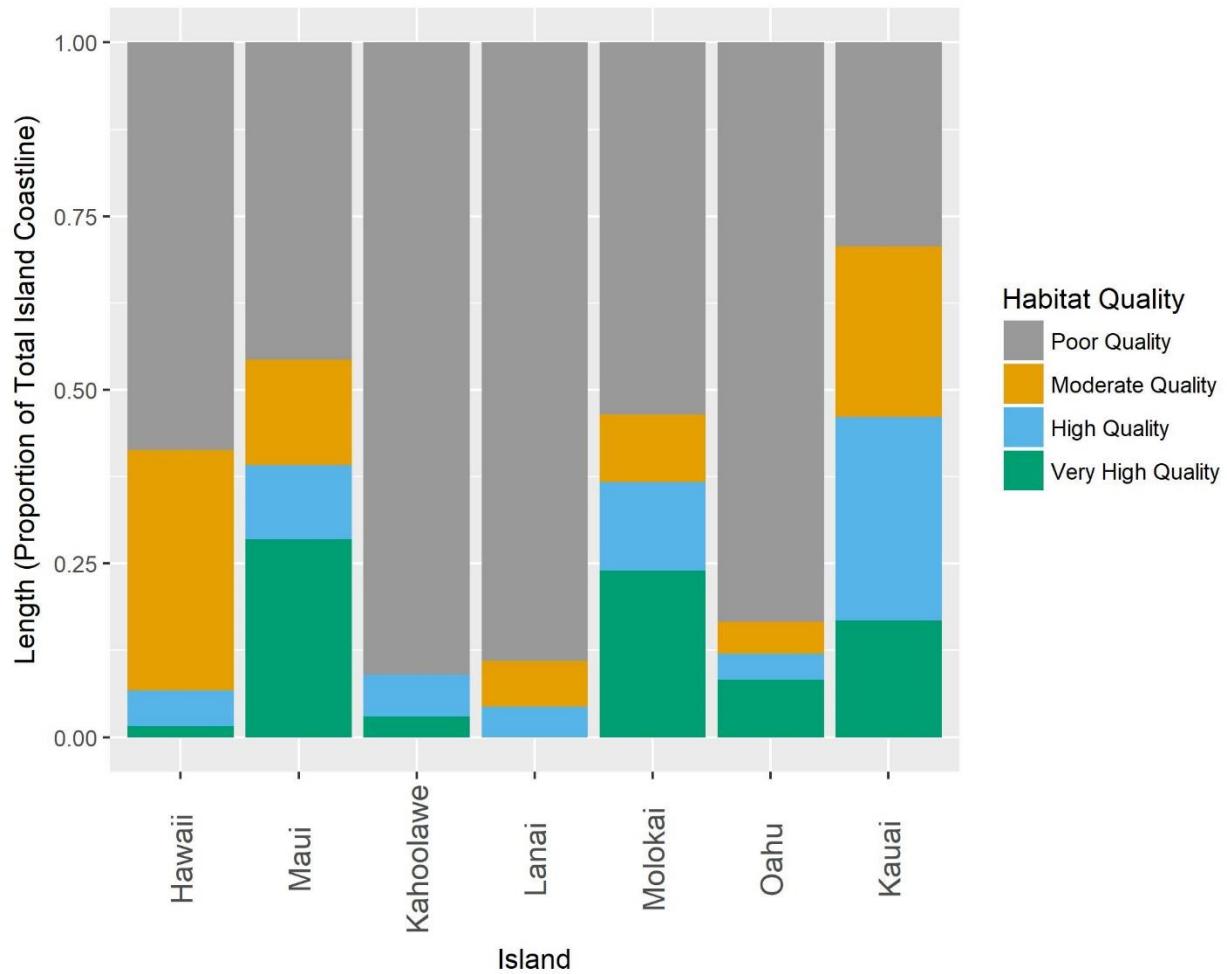
Habitats Better Characterized in Other Layers

The following pages show the assessments for coastal, wetland, and stream habitats based on the layers described above. In most cases, these differ significantly from the Carbon Assessment Layer analysis above, and the following should be considered as more accurate than the Carbon Assessment layer analyses for these habitat types. Both streams and coastal habitats were linear features in these data sets, so the summaries vary from the area-based data.

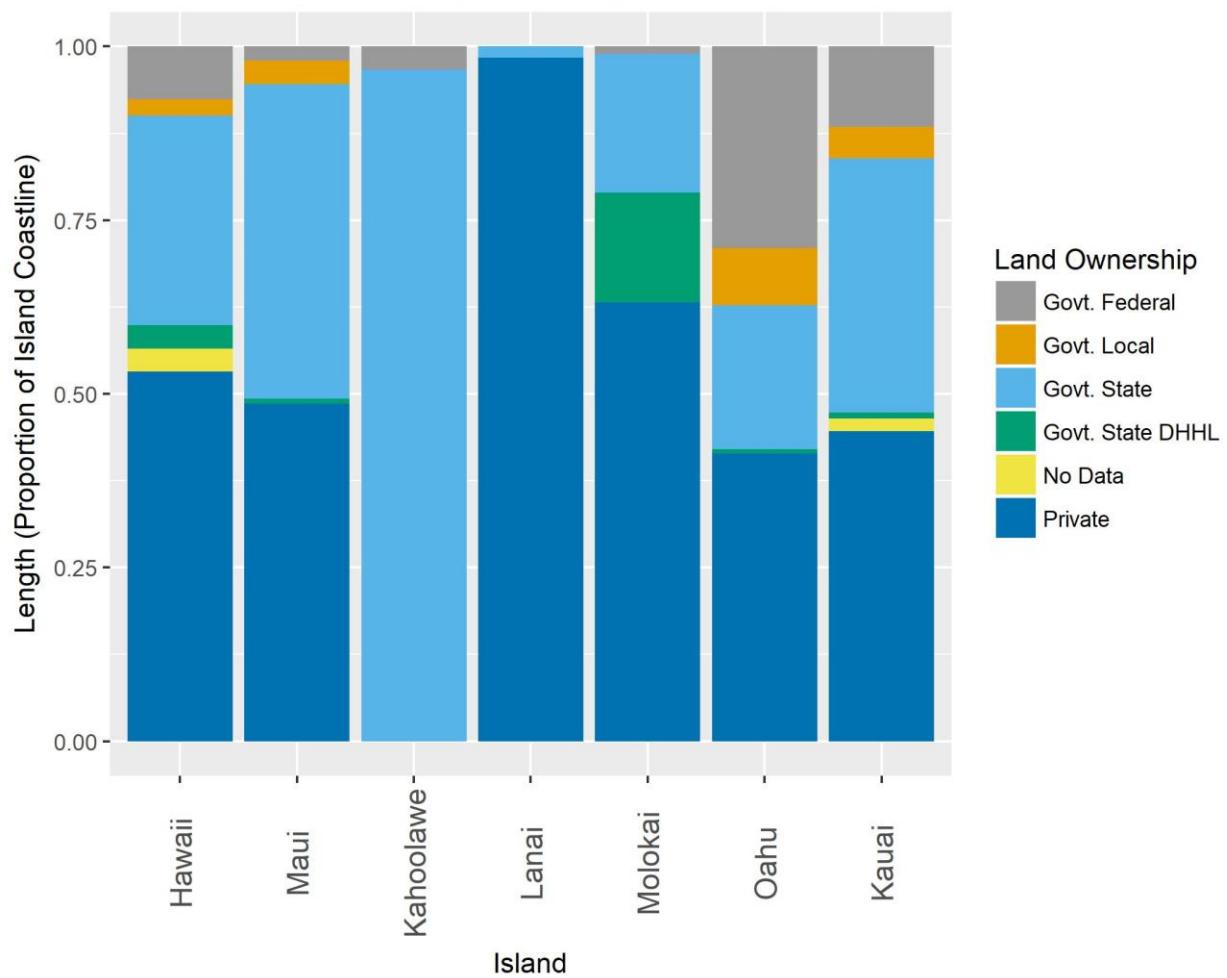
Coastal Critical Habitat Summary



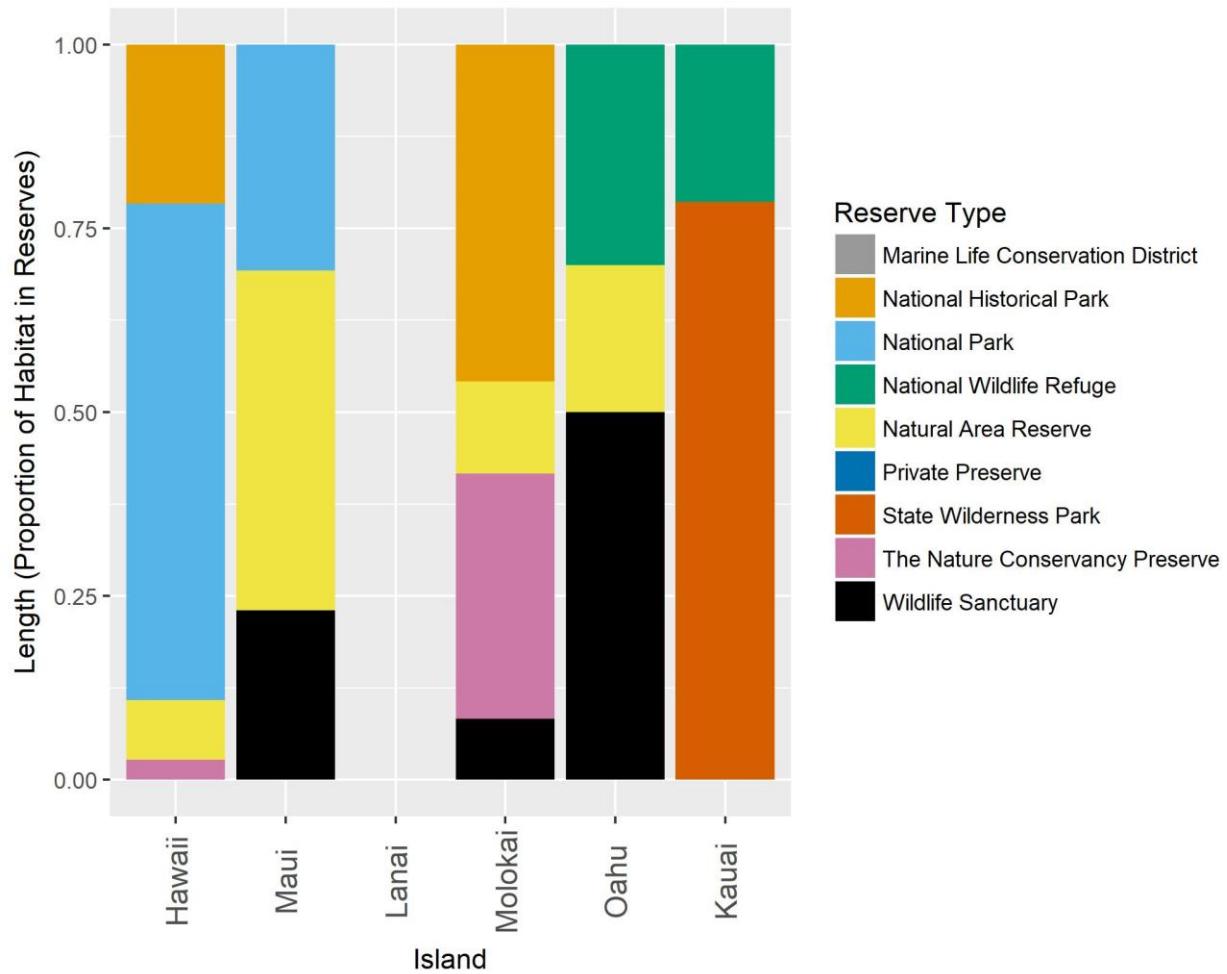
Coastal Habitat Quality Summary



Coastal Land Ownership Summary

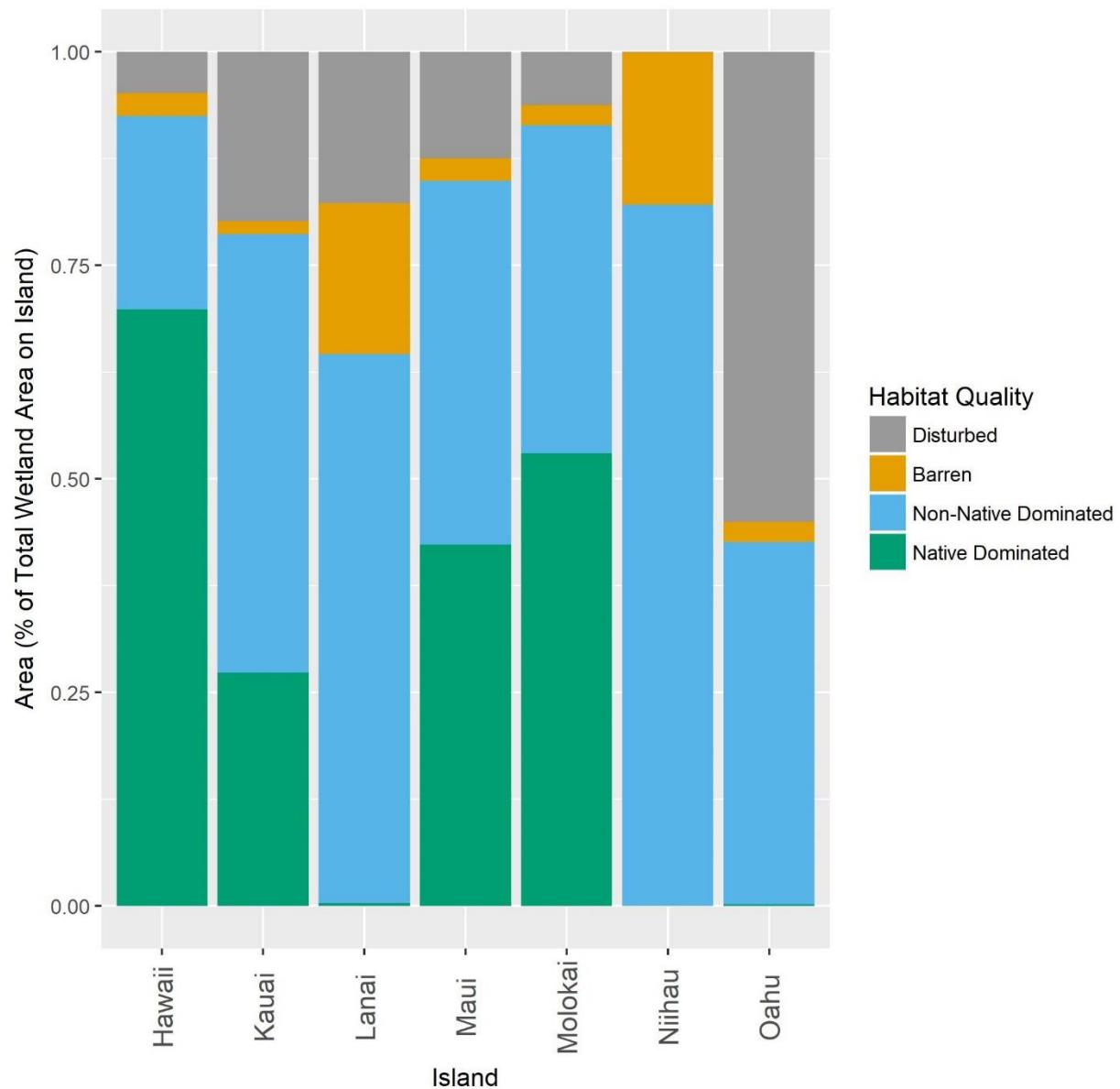


Coastal Reserve Type Summary

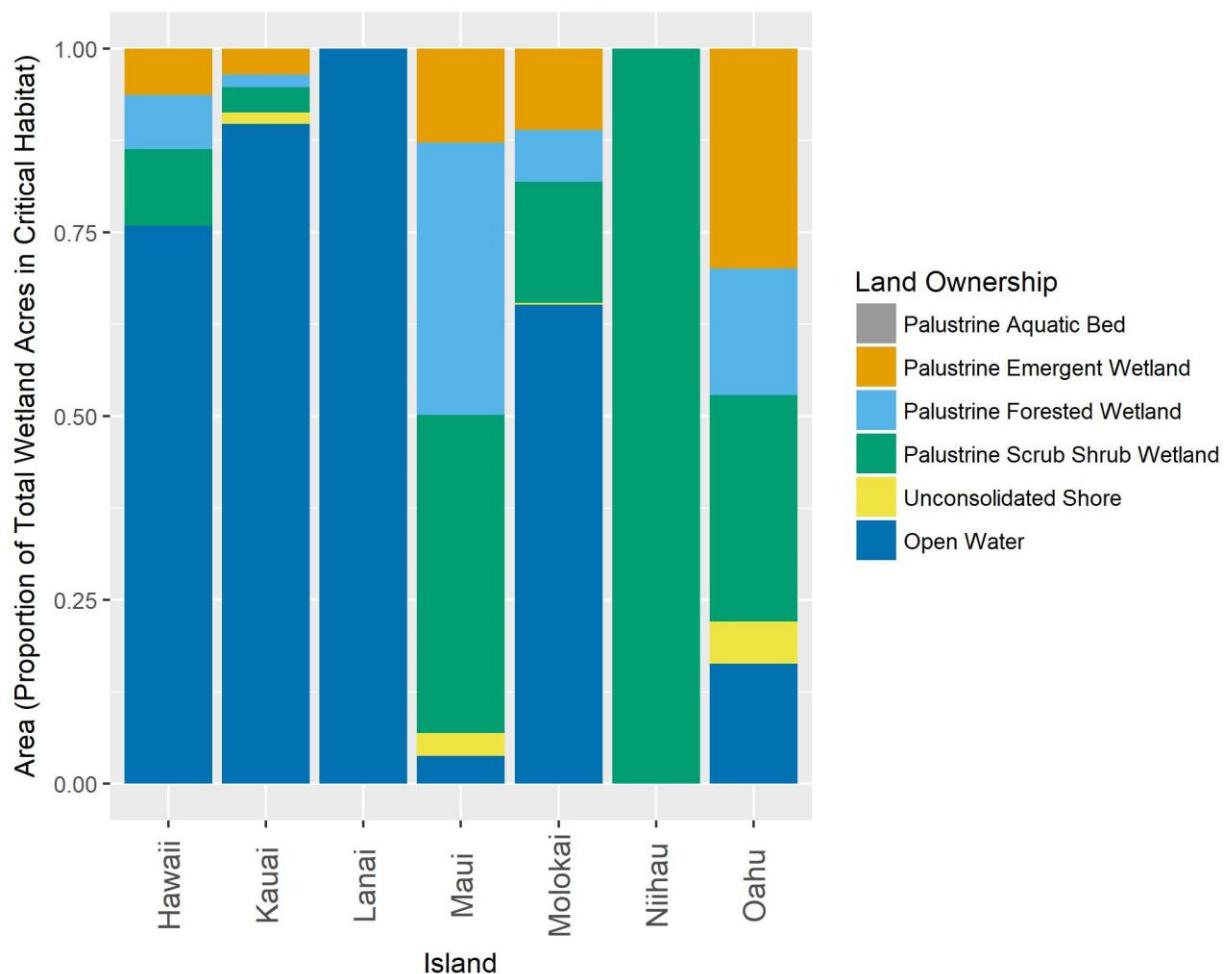


Wetlands

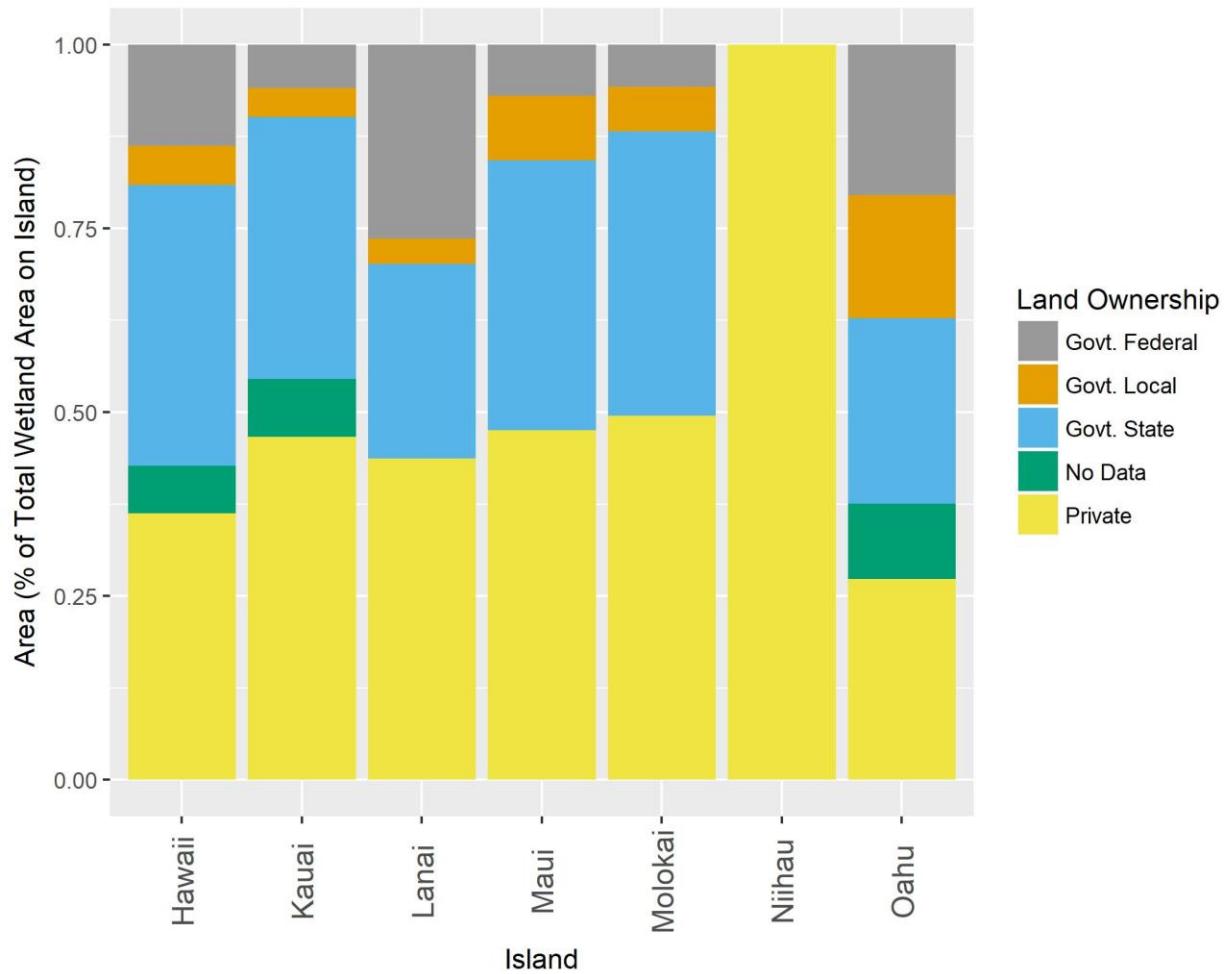
Wetlands Habitat Quality Summary



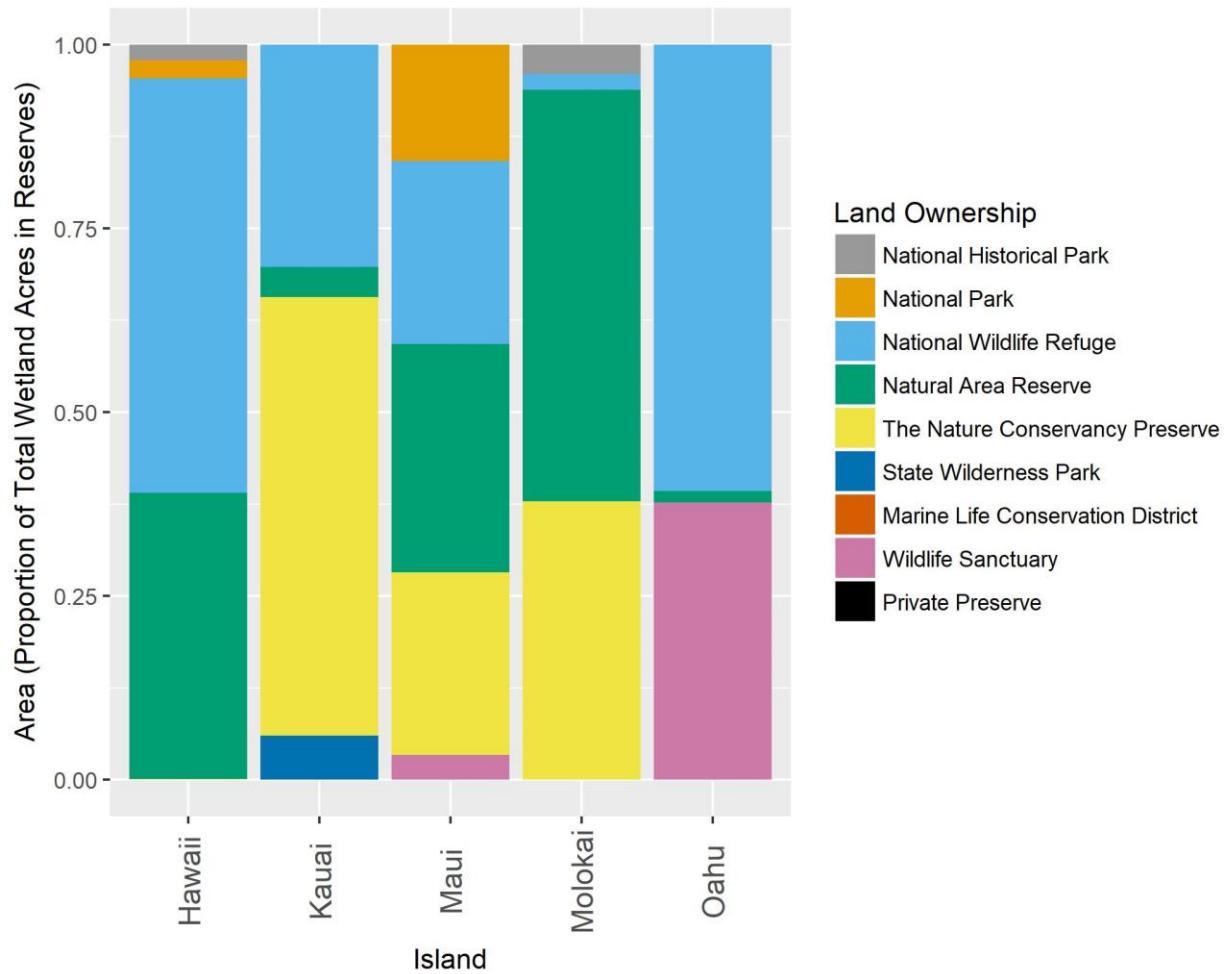
Wetland Critical Habitat Summary



Wetland Land Ownership Summary



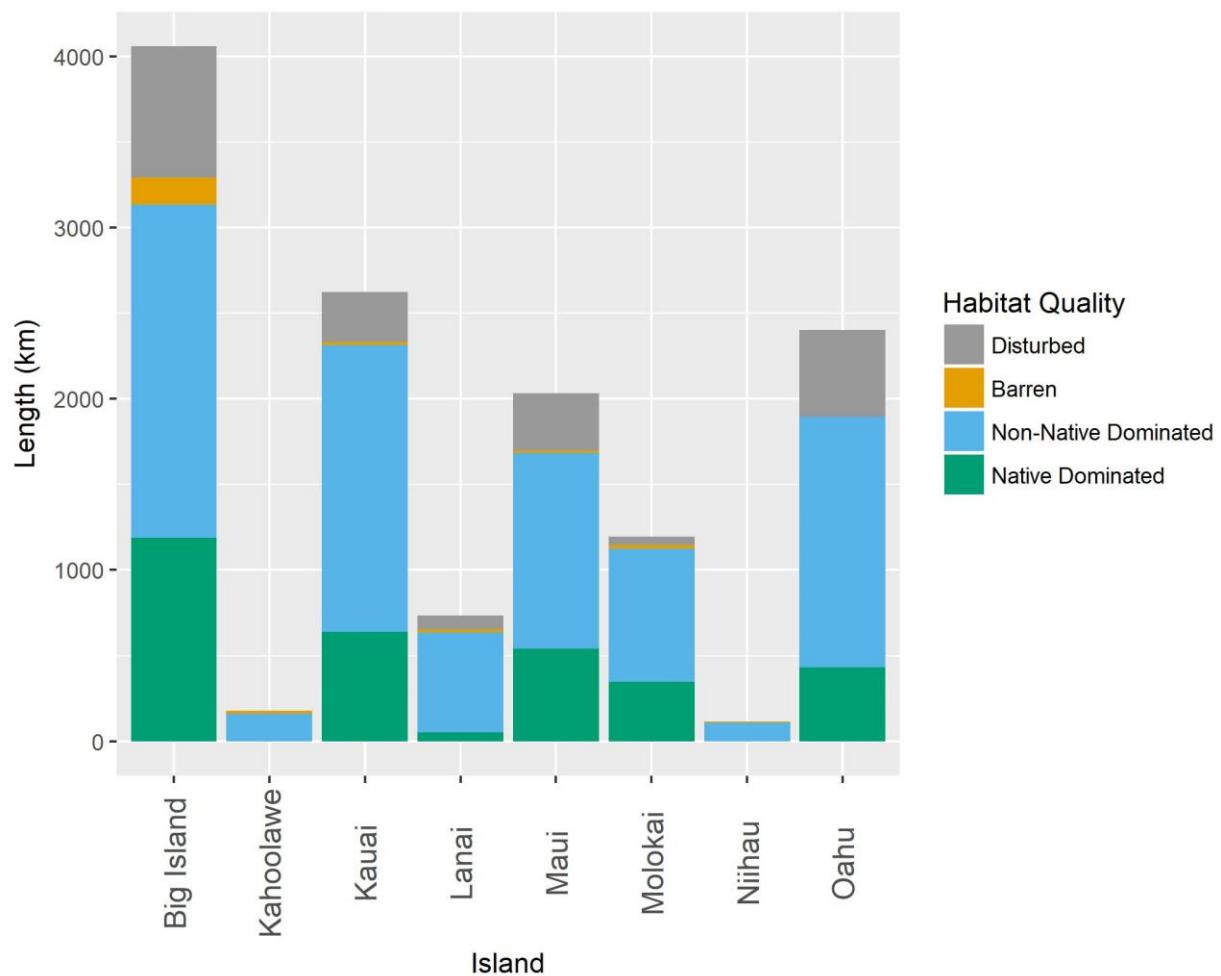
Wetland Reserve Status Summary



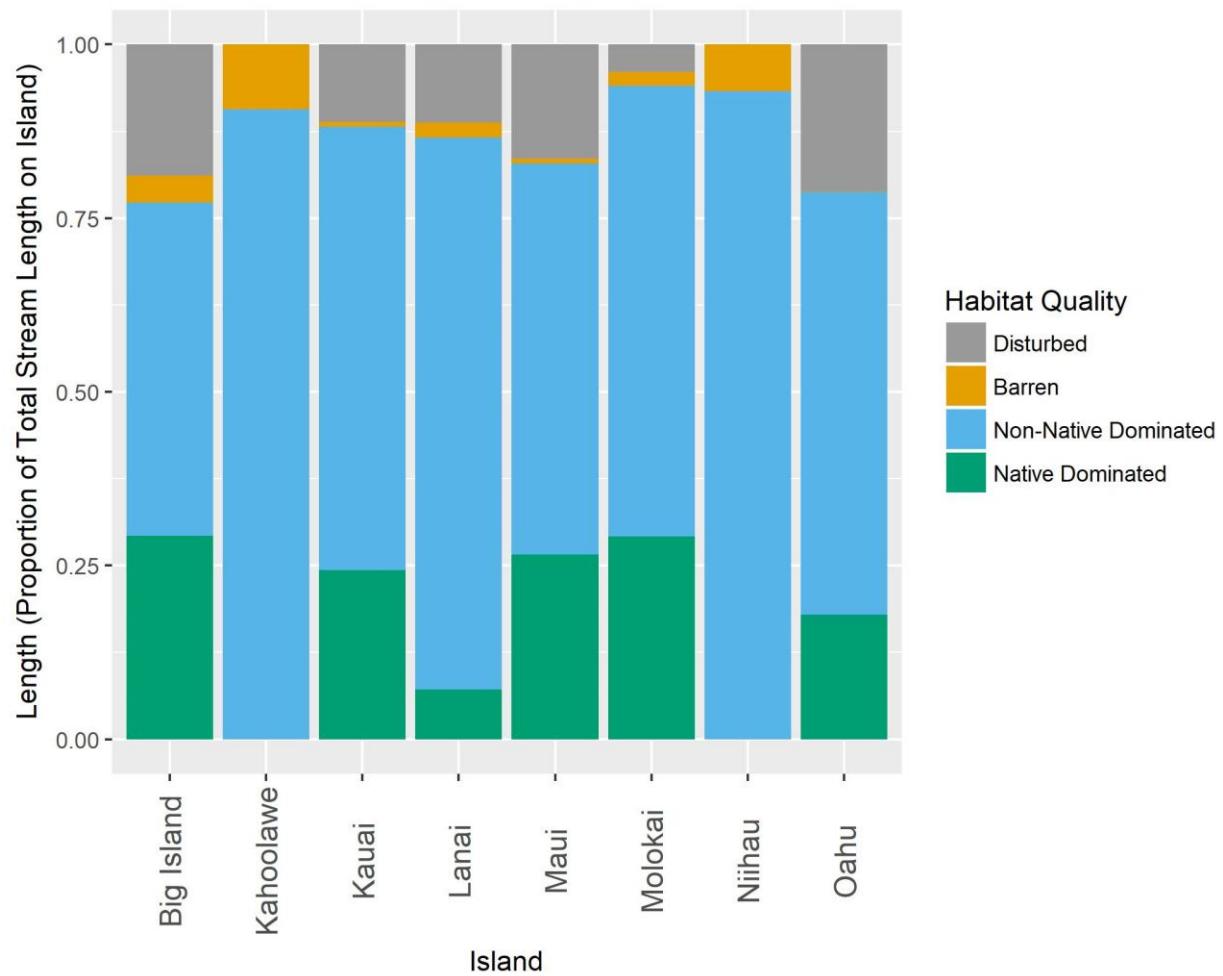
Streams

Stream summaries are reported as both length and percent of total because lengths are relatively equal across islands.

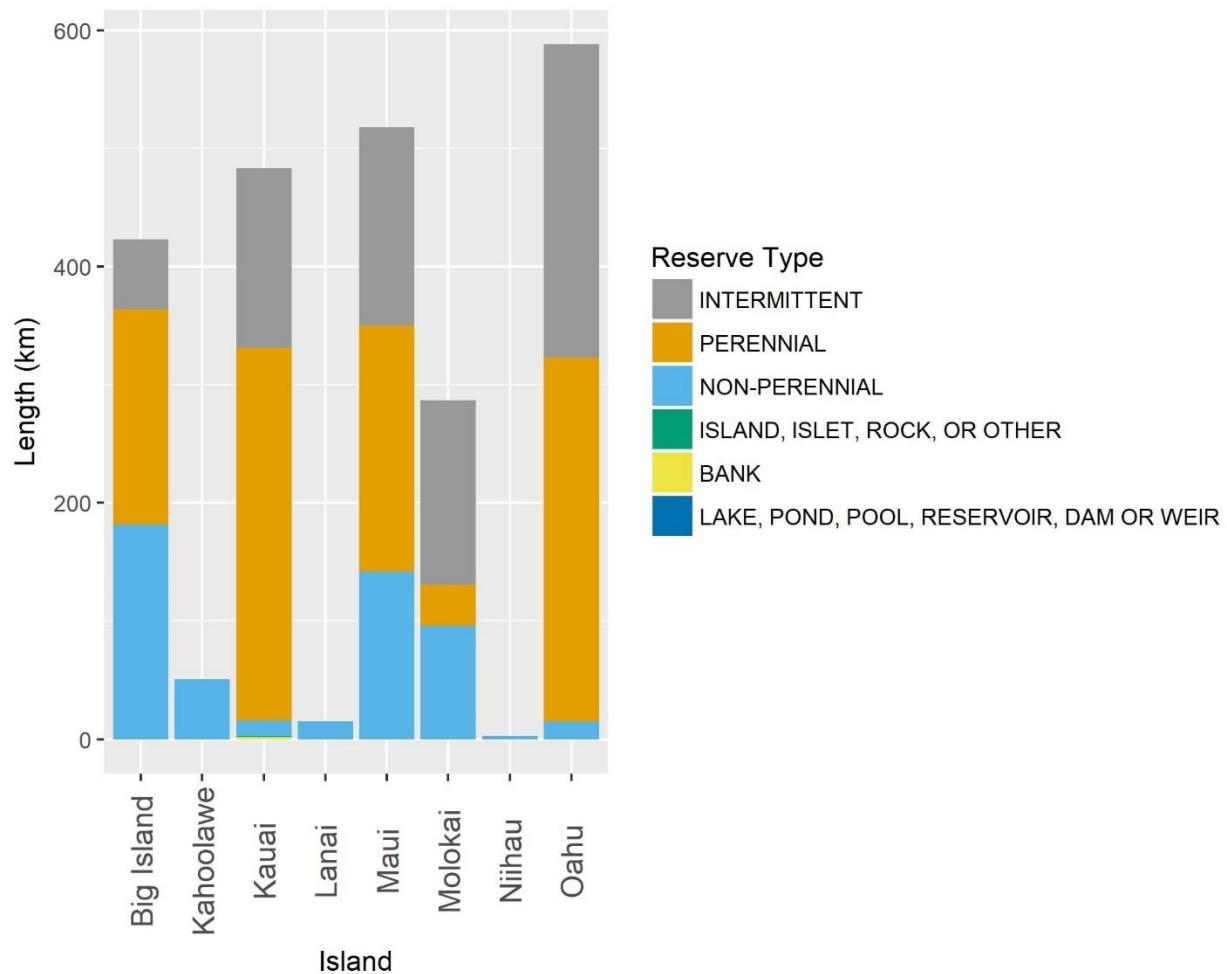
Stream Habitat Quality Summary

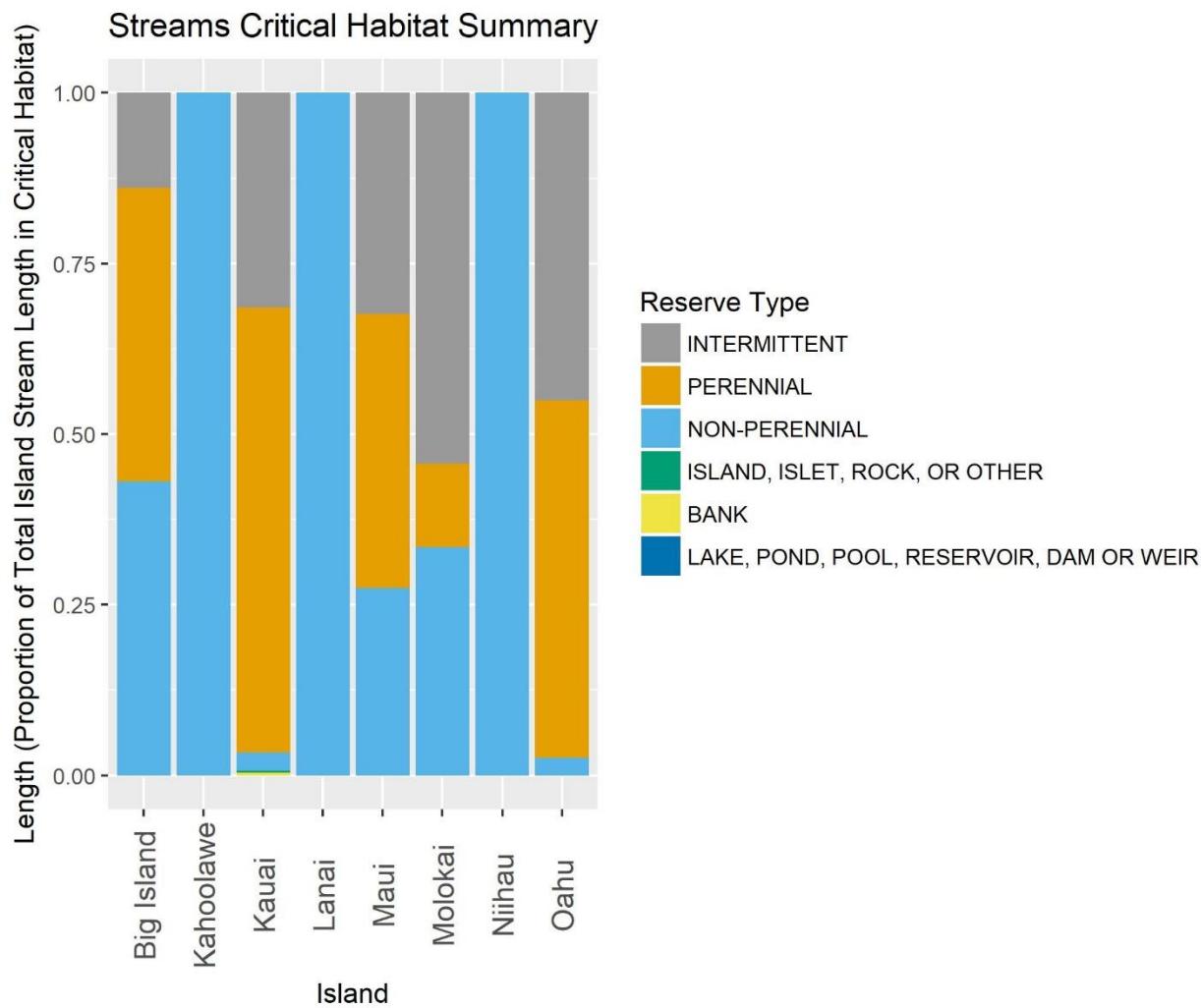


Stream Habitat Quality Summary

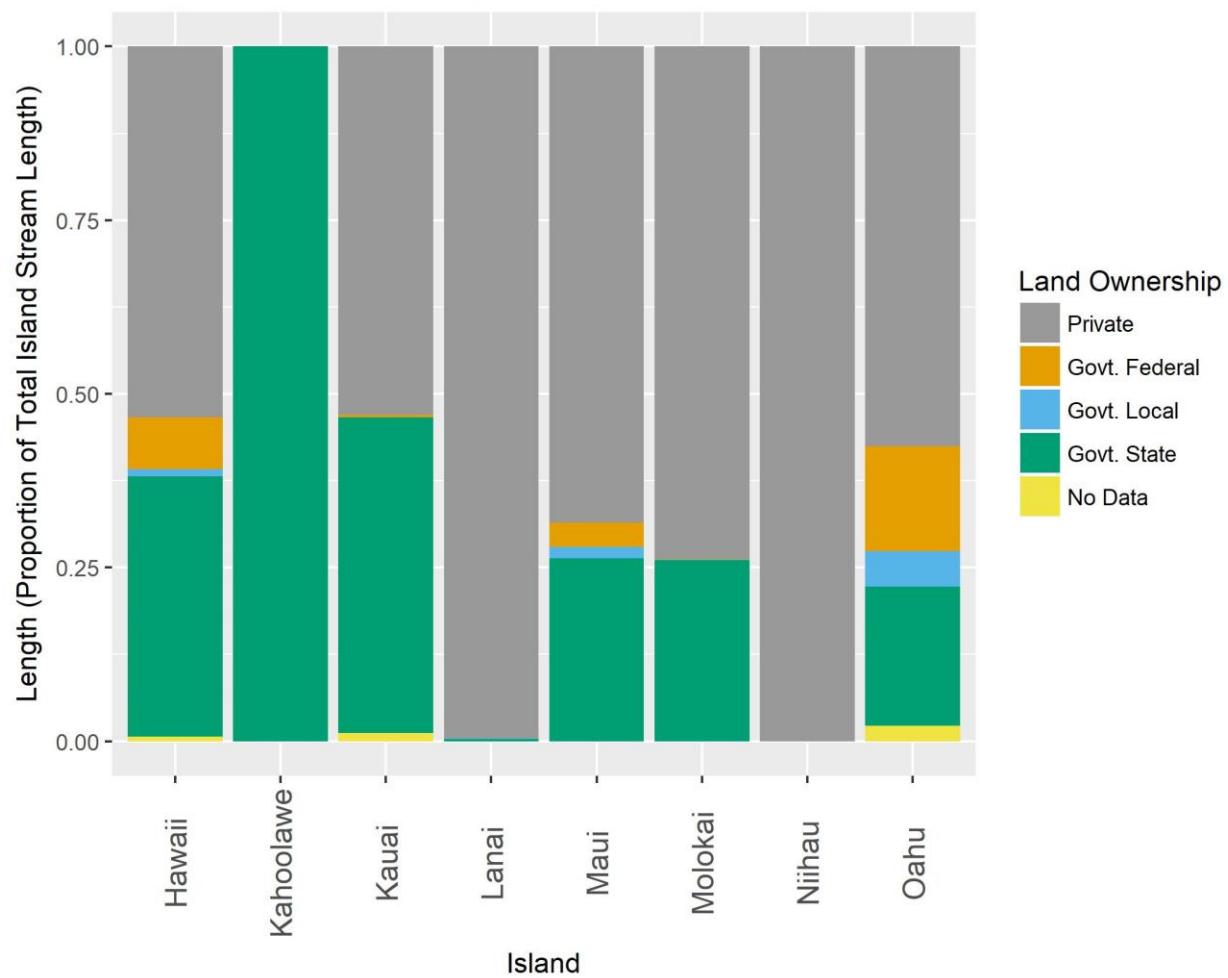


Streams Critical Habitat Summary

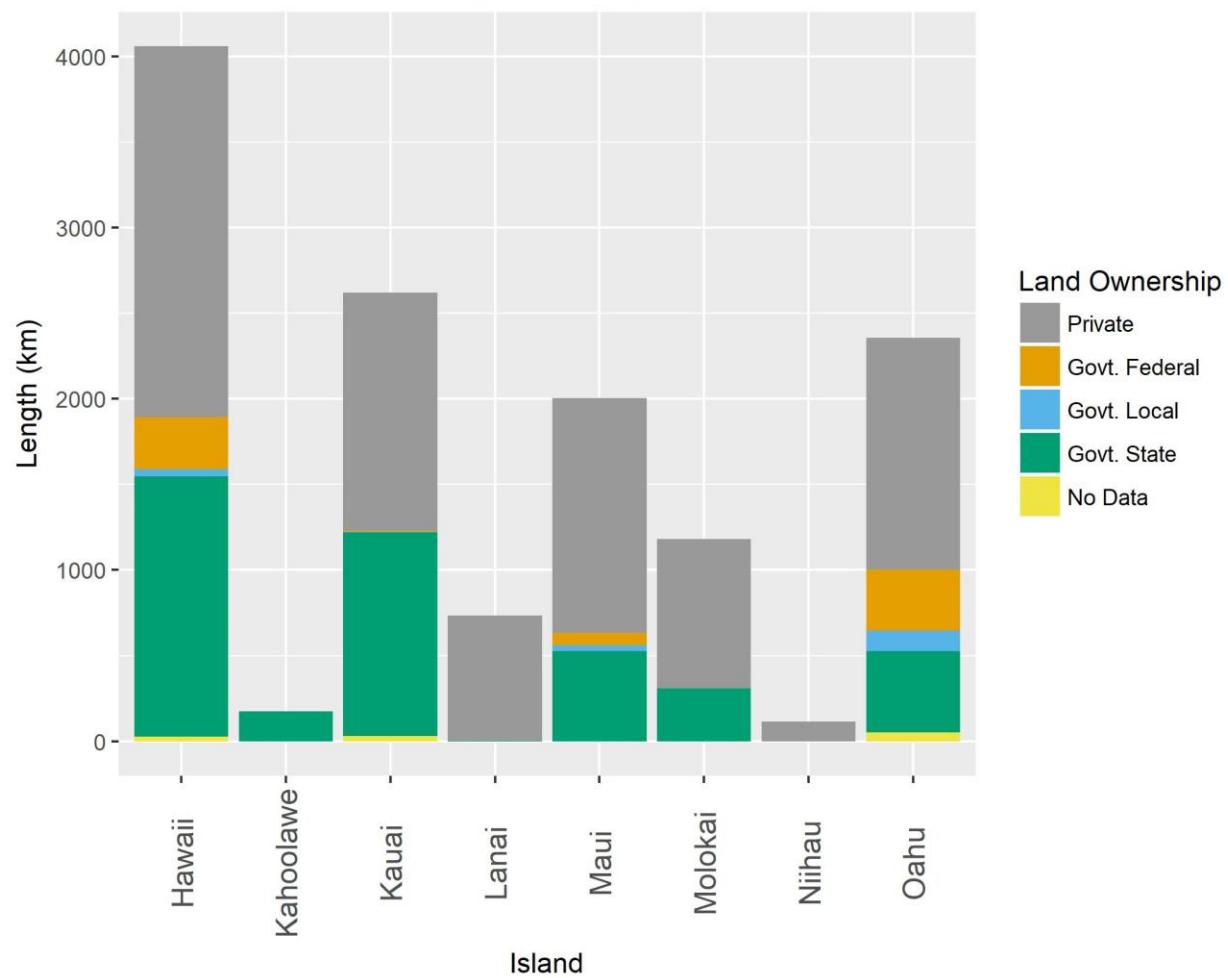




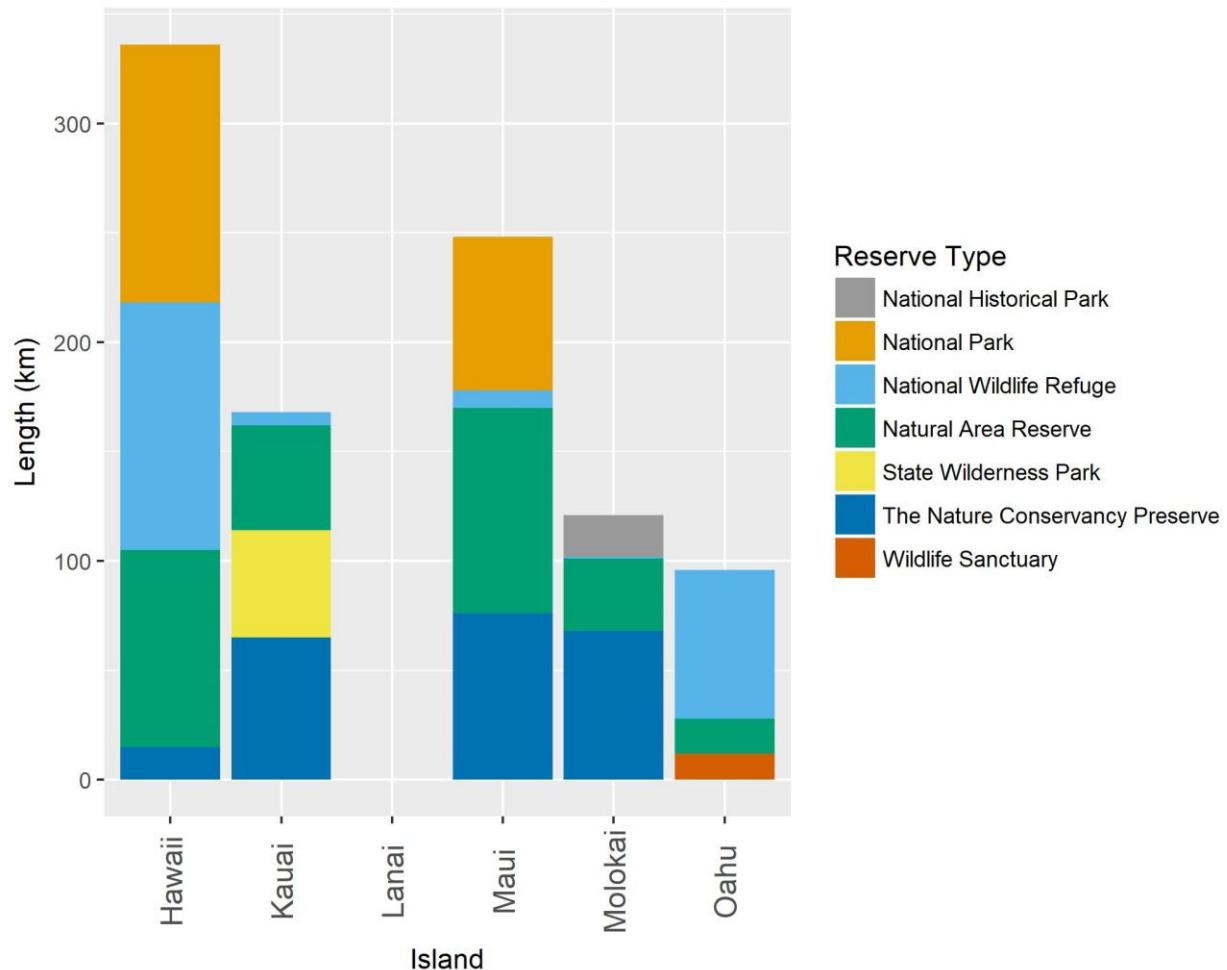
Streams Land Ownership Summary



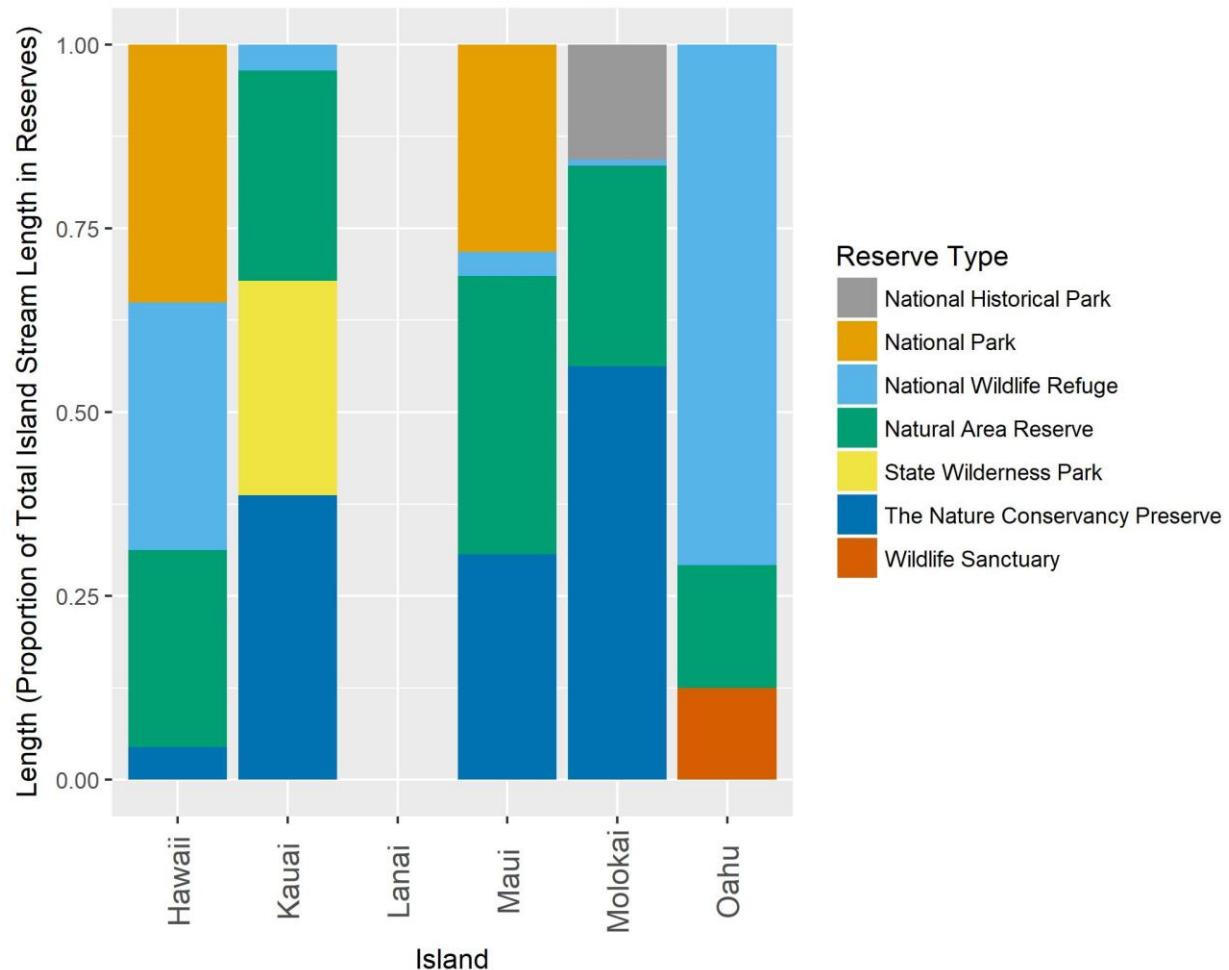
Streams Land Ownership Summary



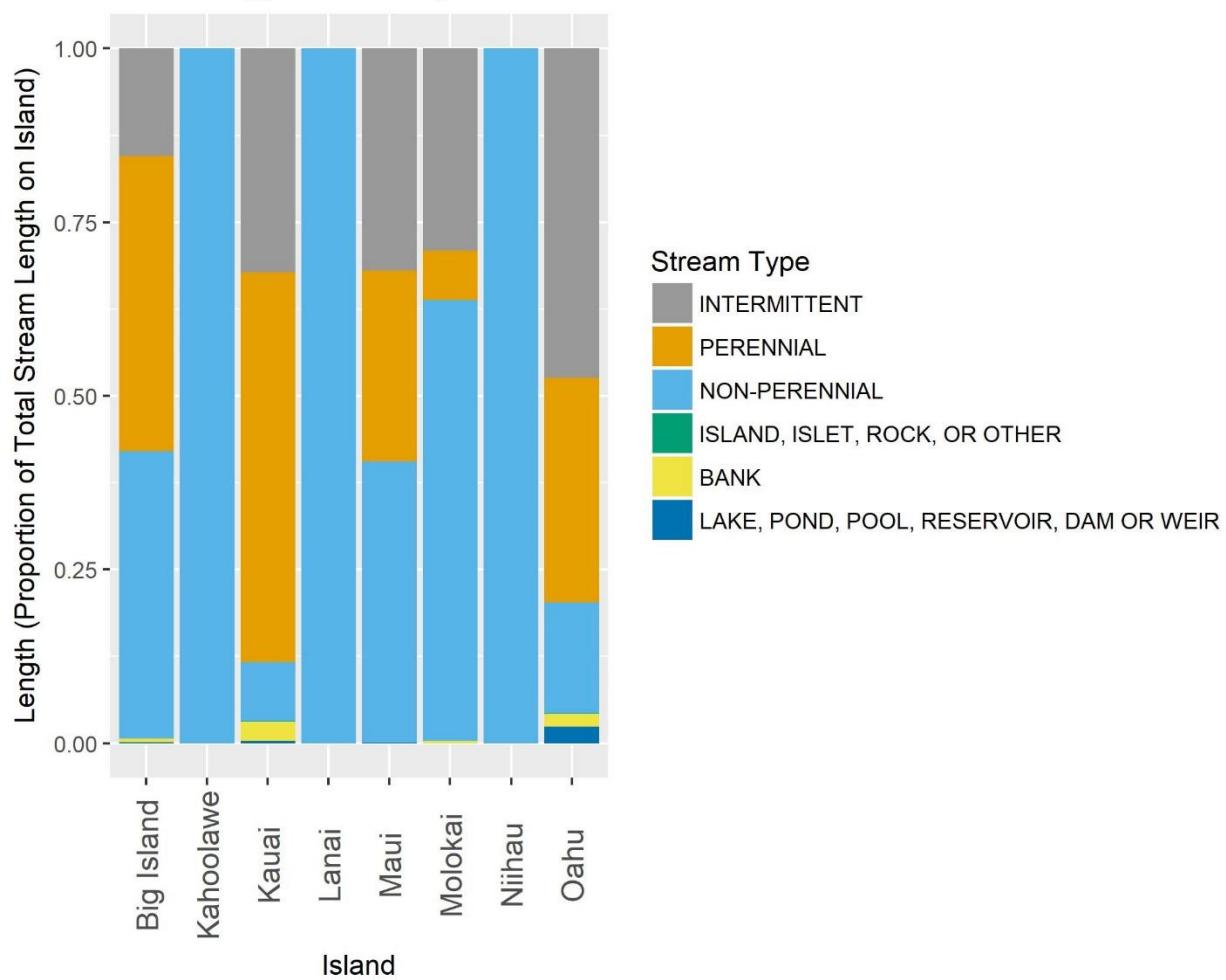
Streams Reserve Type Summary



Streams Reserve Type Summary



Stream Type Summary



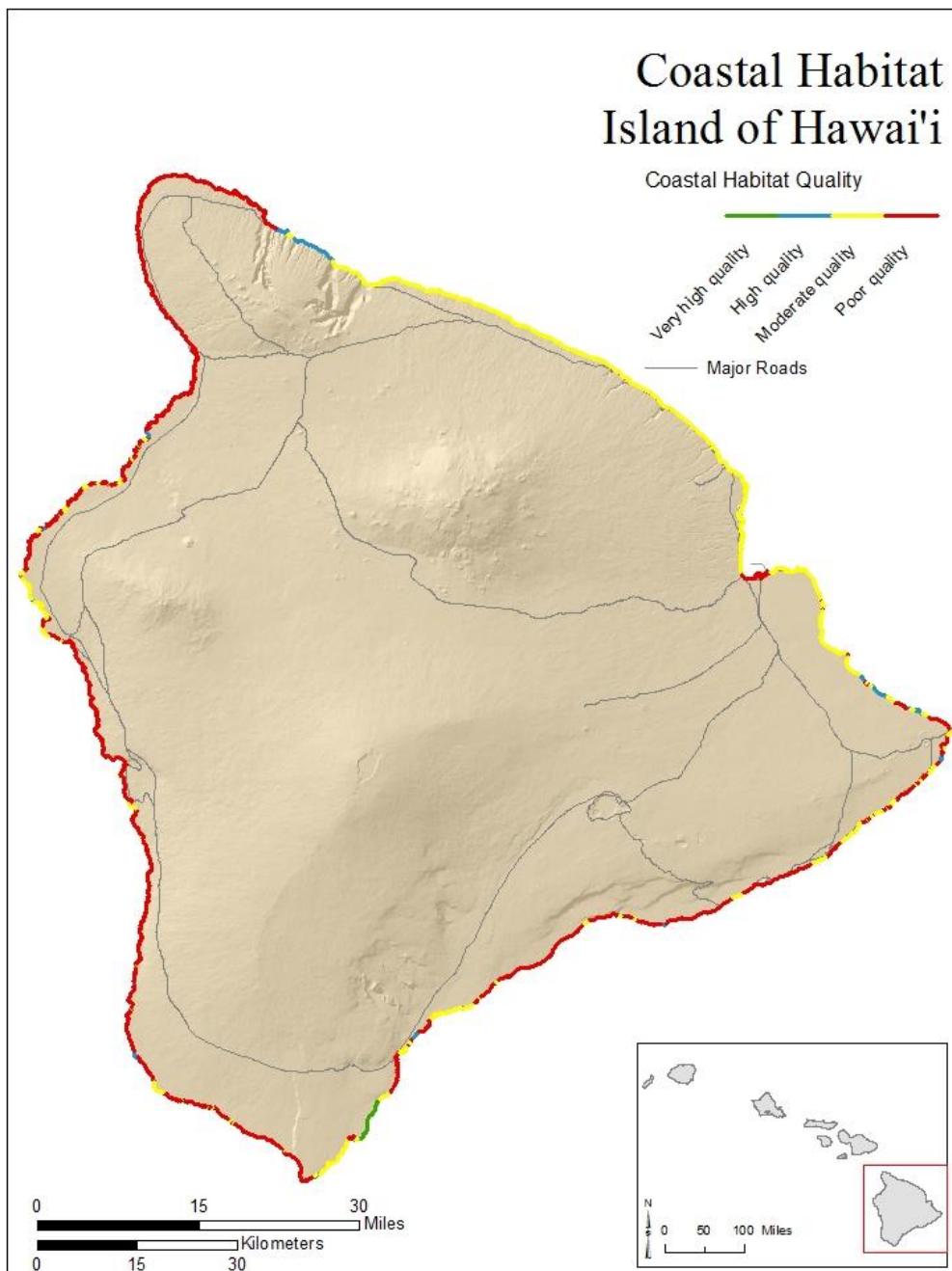
References

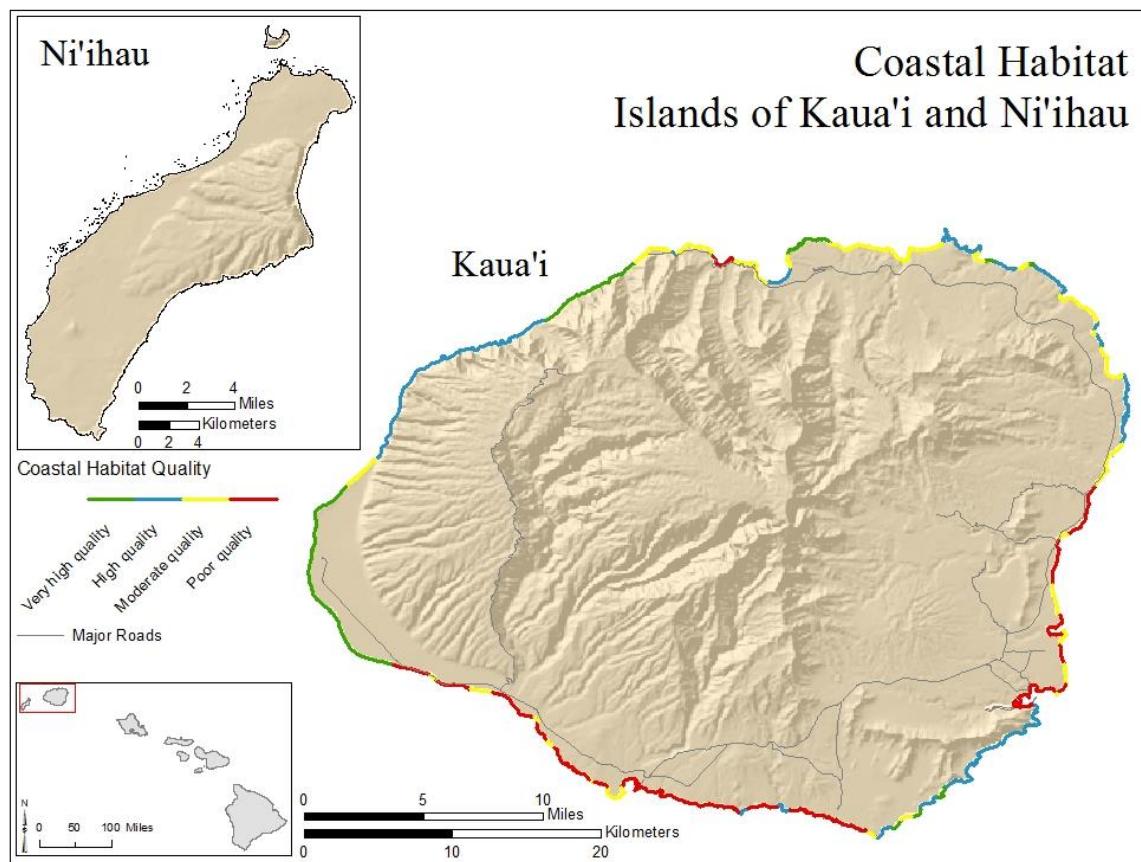
- Jacobi, J.D., Price, J.P., Fortini, L.B., Gon III, S.M., and Berkowitz, Paul, 2017, Hawaii Land Cover and Habitat Status: U.S. Geological Survey data release. Accessed 1 August 2018 at <https://doi.org/10.5066/F7DB80B9>.
- LANDFIRE. 2011. LANDFIRE 2001 and 2008 Refresh, Geographic Report: Hawaii. U.S. Department of Agriculture and U.S. Department of the Interior. Accessed 16 February 2018 at https://www.landfire.gov/lf_methods.php.
- LANDFIRE. 2014. Existing Vegetation Type Layer, LANDFIRE 1.4.0, U.S. Department of the Interior, Geological Survey. Accessed 16 February 2018 at <http://landfire.cr.usgs.gov/viewer/>.
- National Oceanic and Atmospheric Administration, Office for Coastal Management. Coastal Change Analysis Program (C-CAP) 2011 Regional Land Cover, High Resolution Maps for Hawaii. Charleston, SC: NOAA Office for Coastal Management. Accessed 1 August 2018 at www.coast.noaa.gov/ccapftp.
- Pratt L.C. & S.M. Gon III. 1998. Terrestrial Ecosystems. *in*: Juvik S. & J. Juvik., eds. *Atlas of Hawai'i, 3rd Edition*. University of Hawai'i Press.
- Price, J., and J. D. Jacobi. 2012. Moisture zones for the main Hawaiian Islands. U.S. Department of Interior, Geological Survey. Accessed 16 February 2018 at <https://www.sciencebase.gov/catalog/item/57a902e8e4b05e859bdf3c83>.
- Price, J.P., J.D. Jacobi, S.M. Gon III, D. Matsuwaki, L. Mehrhoff, W. Wagner, M. Lucas, and B. Rowe. 2012. Mapping plant species ranges in the Hawaiian Islands—Developing a methodology and associated GIS layers: U.S. Geological Survey Open-File Report 2012–1192, 34 p., 1 appendix (species table), and 1,158 maps. Accessed 1 August 2018 at <http://pubs.usgs.gov/of/2012/1192/>.
- Rollins, M.G. 2009. LANDFIRE: a nationally consistent vegetation, wildland fire, and fuel assessment. International Journal of Wildland Fire 18:235–249.
- Selmants, P.C., Giardina, C.P., Jacobi, J.D., and Zhu, Zhiliang, eds., 2017, Baseline and projected future carbon storage and carbon fluxes in ecosystems of Hawai'i: U.S. Geological Survey Professional Paper 1834, 134 p., Accessed 1 August 2018 at <https://doi.org/10.3133/pp1834>.
- Statewide GIS Program. 2013. Streams. Office of Planning and Department of Aquatic Resources, Division of Land and Natural Resources, State of Hawaii. Accessed 16 February 2018 at <http://files.hawaii.gov/dbedt/op/gis/data/darstreams.shp.zip>.
- The Nature Conservancy. 1998. Native Vegetation Zones of the Hawaiian Islands before Human Occupation. Accessed 1 August 2018 at http://www.hawaiiecoregionplan.info/HI_Before.jpg.

Appendix A. Habitat Maps

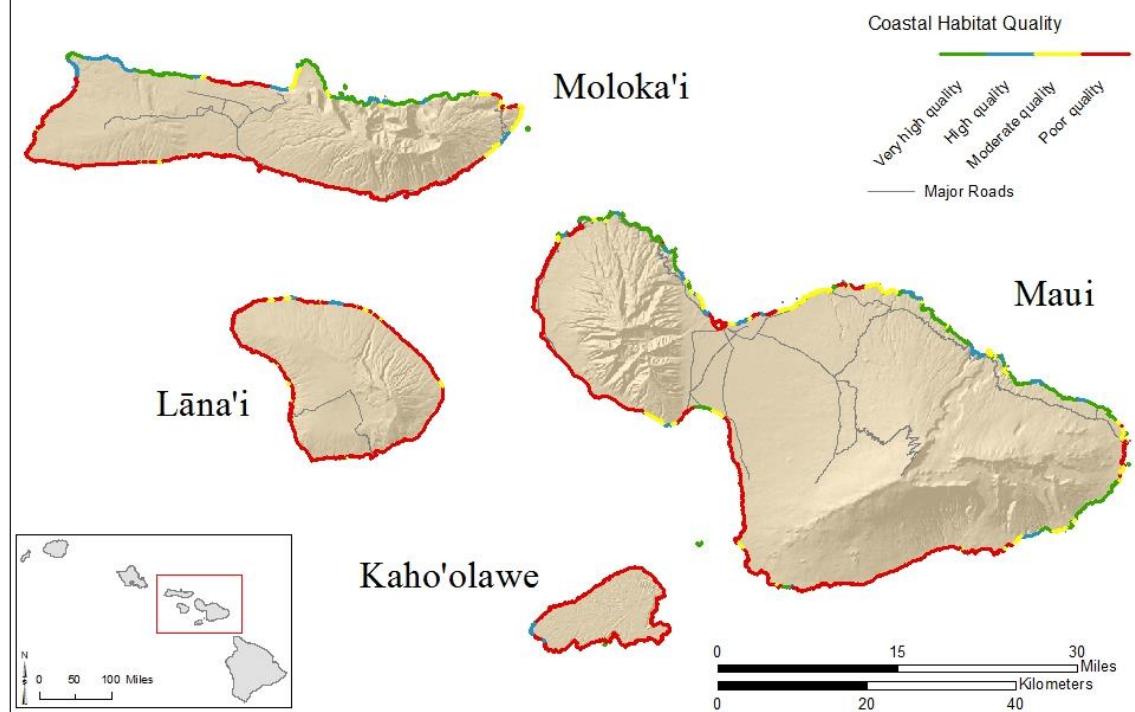
Hawaii Maps

Coastal Habitats

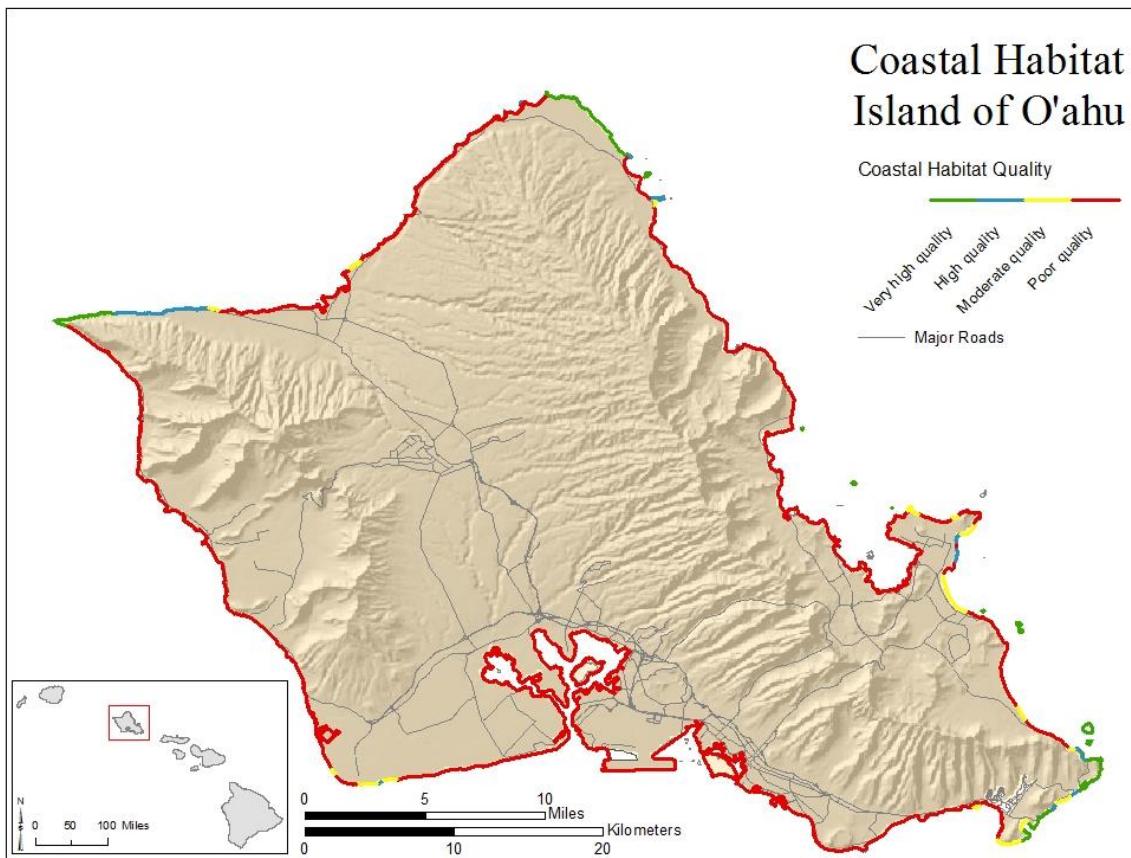




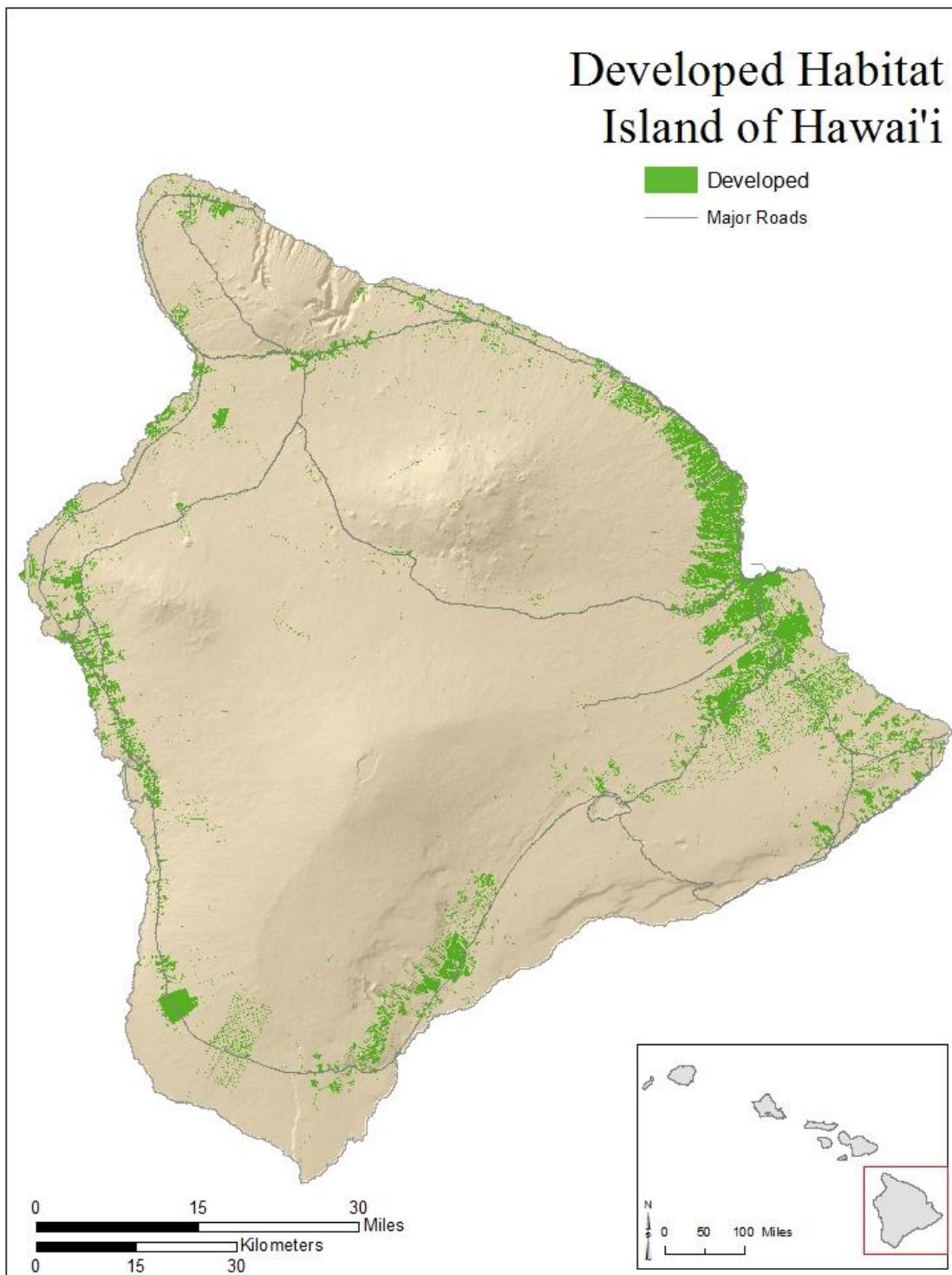
Coastal Habitat, Islands of Moloka'i, Lāna'i, Maui and Kaho'olawe

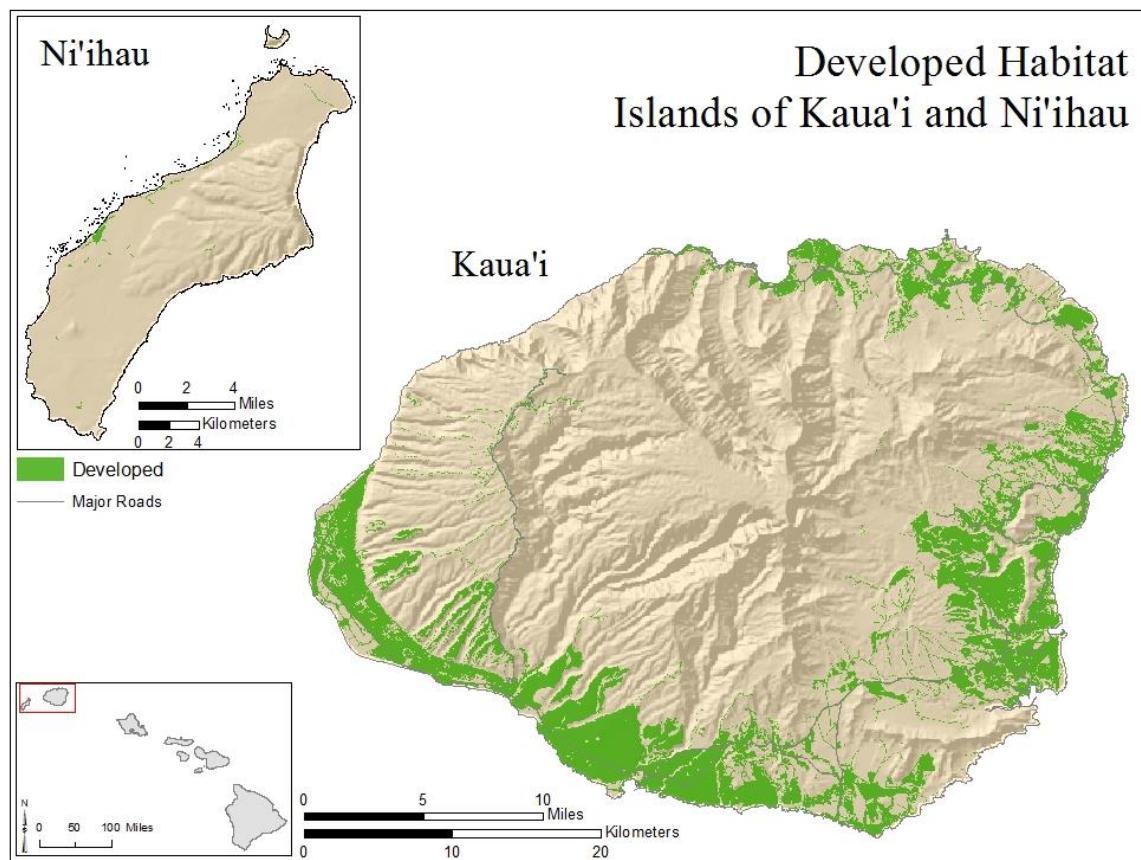


Coastal Habitat Island of O'ahu

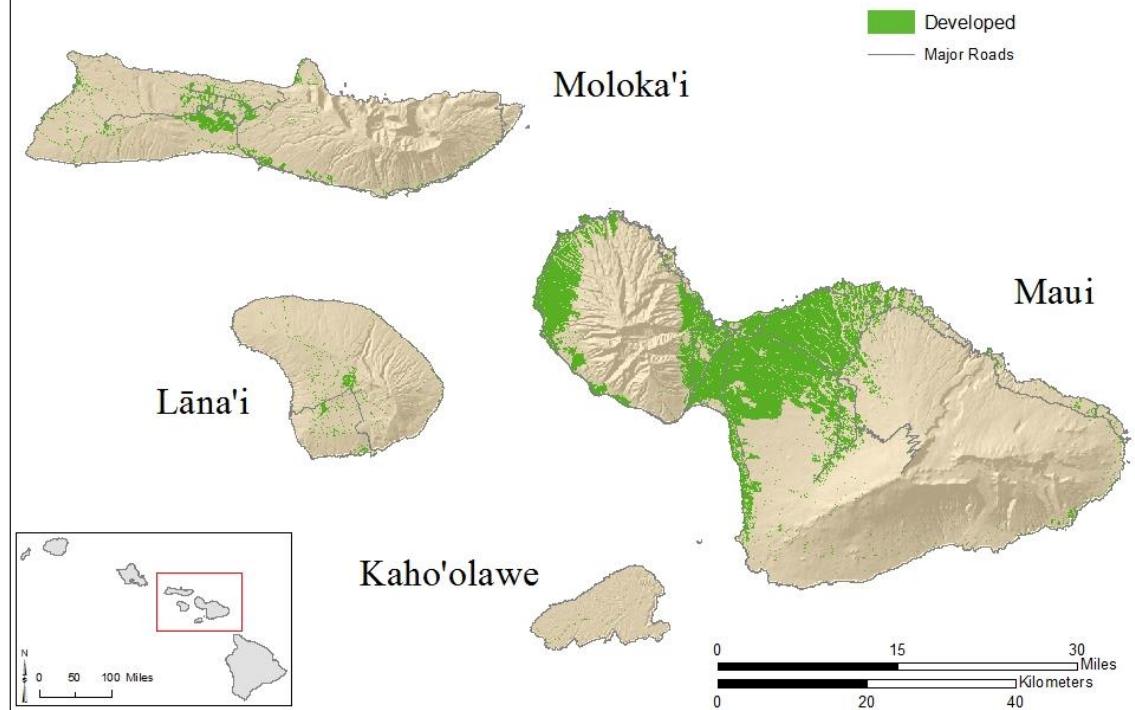


Developed Habitats—Pre-contact extent is not shown due to absence of habitat pre-contact



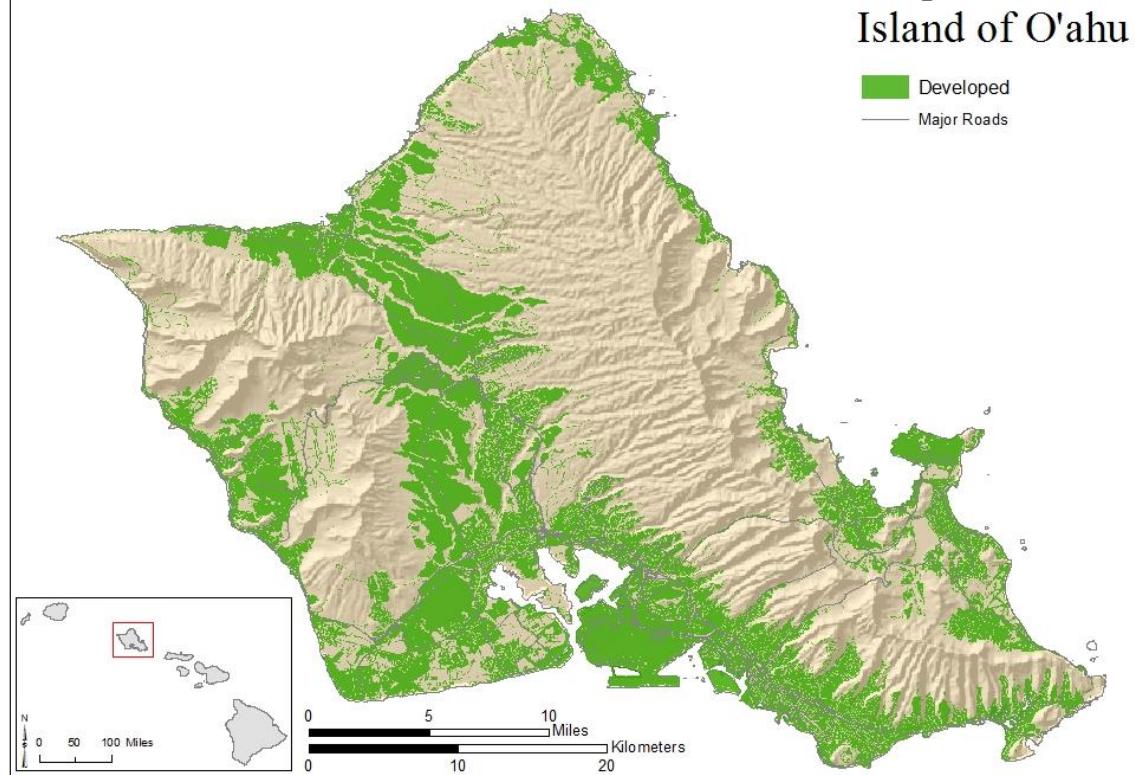


Developed Habitat, Islands of Moloka'i, Lāna'i, Maui and Kaho'olawe

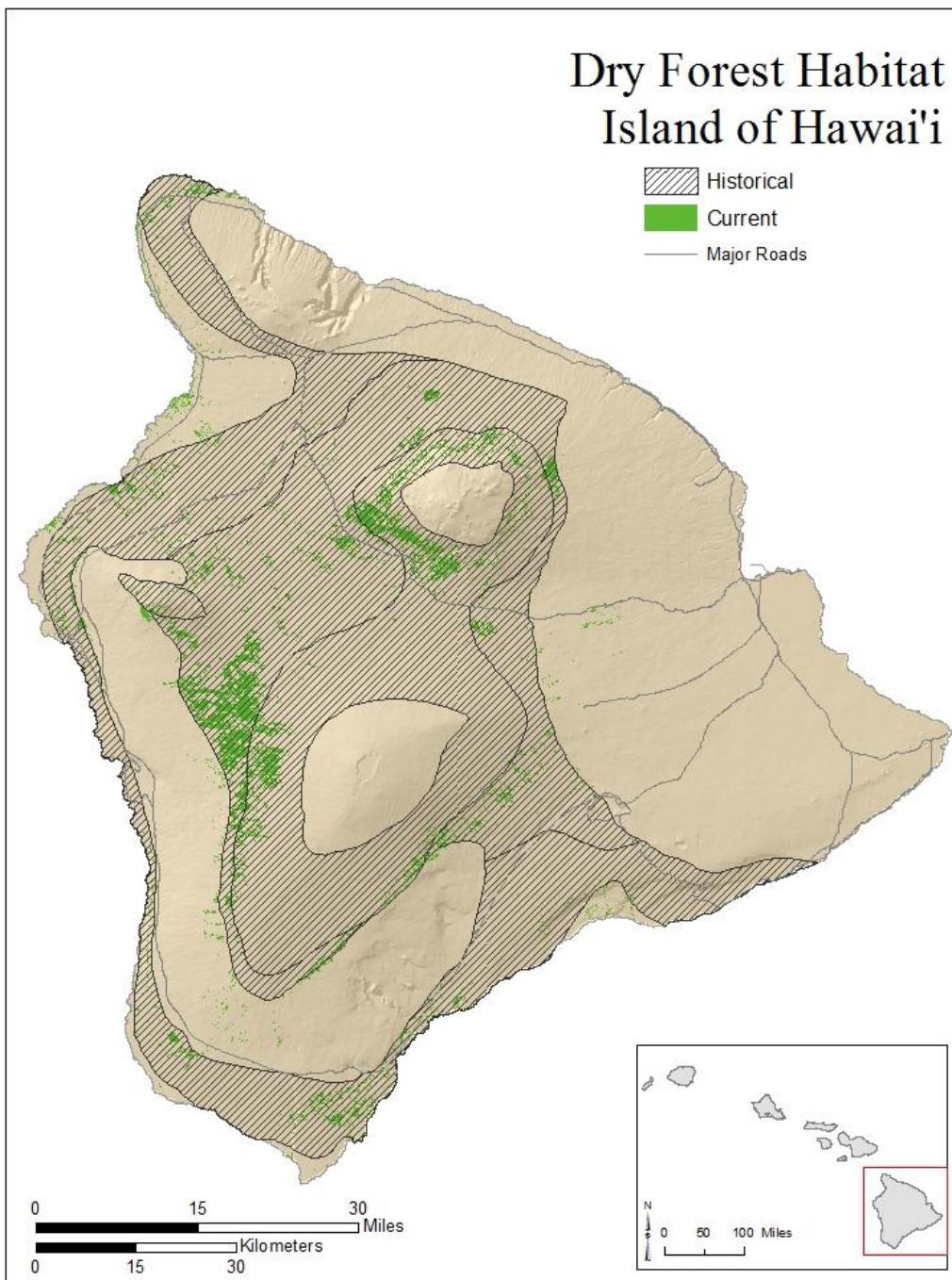


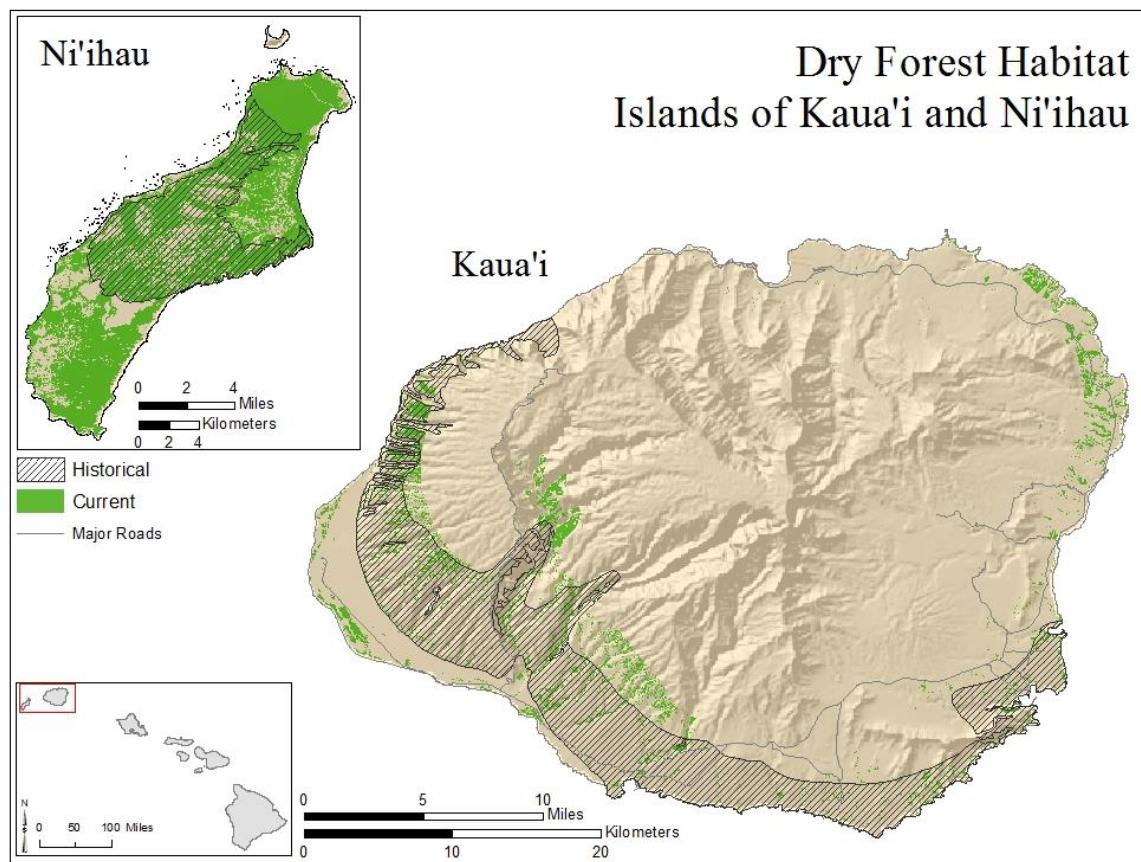
Developed Habitat Island of O'ahu

Developed
Major Roads

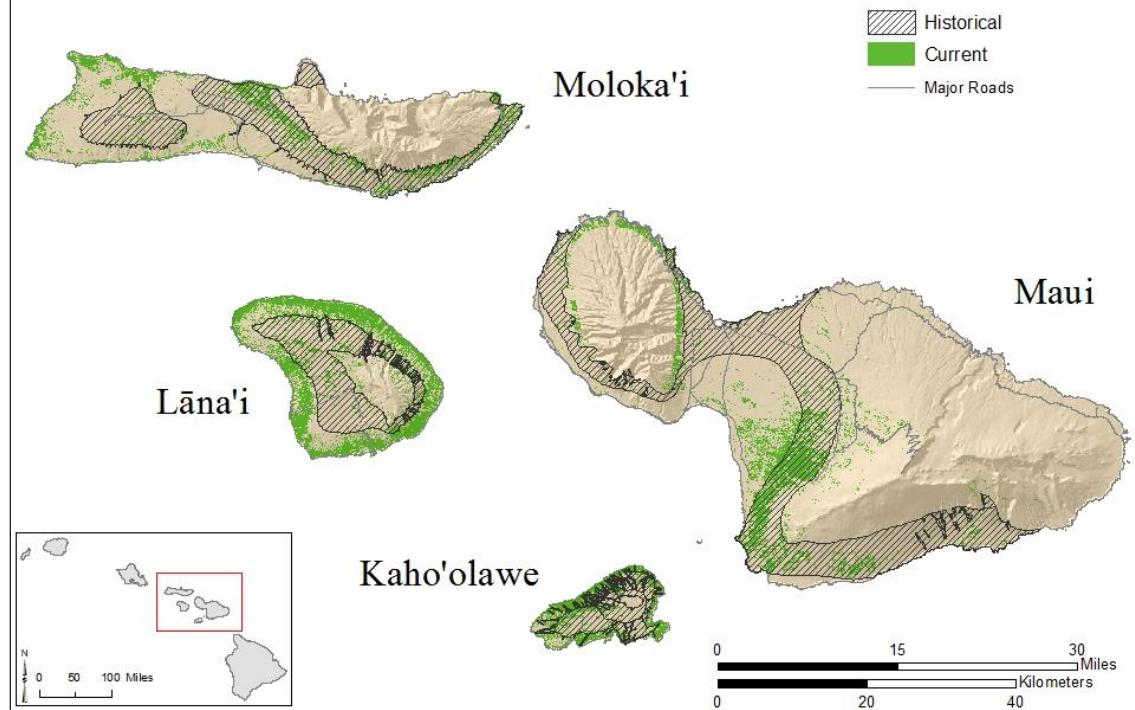


Dry Forest Habitats with Historic Habitat Area

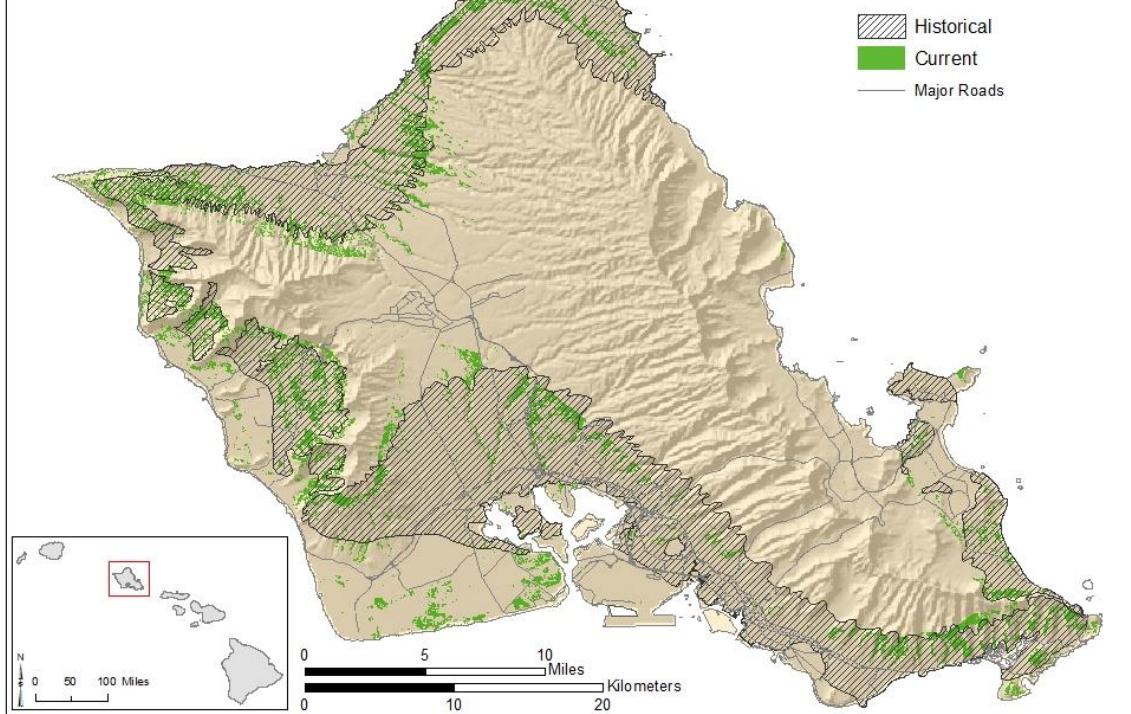




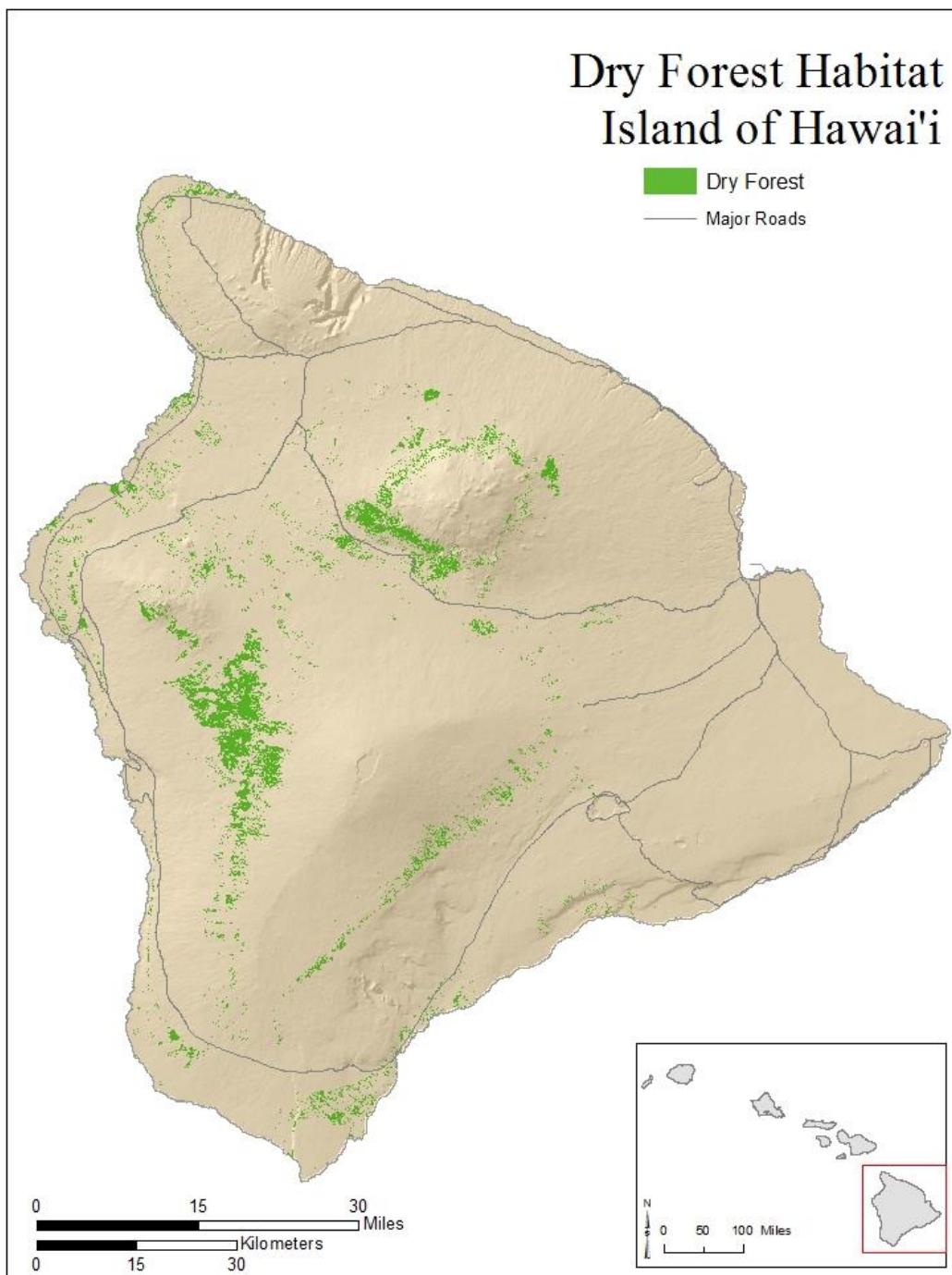
Dry Forest Habitat, Islands of Moloka'i, Lāna'i, Maui and Kaho'olawe

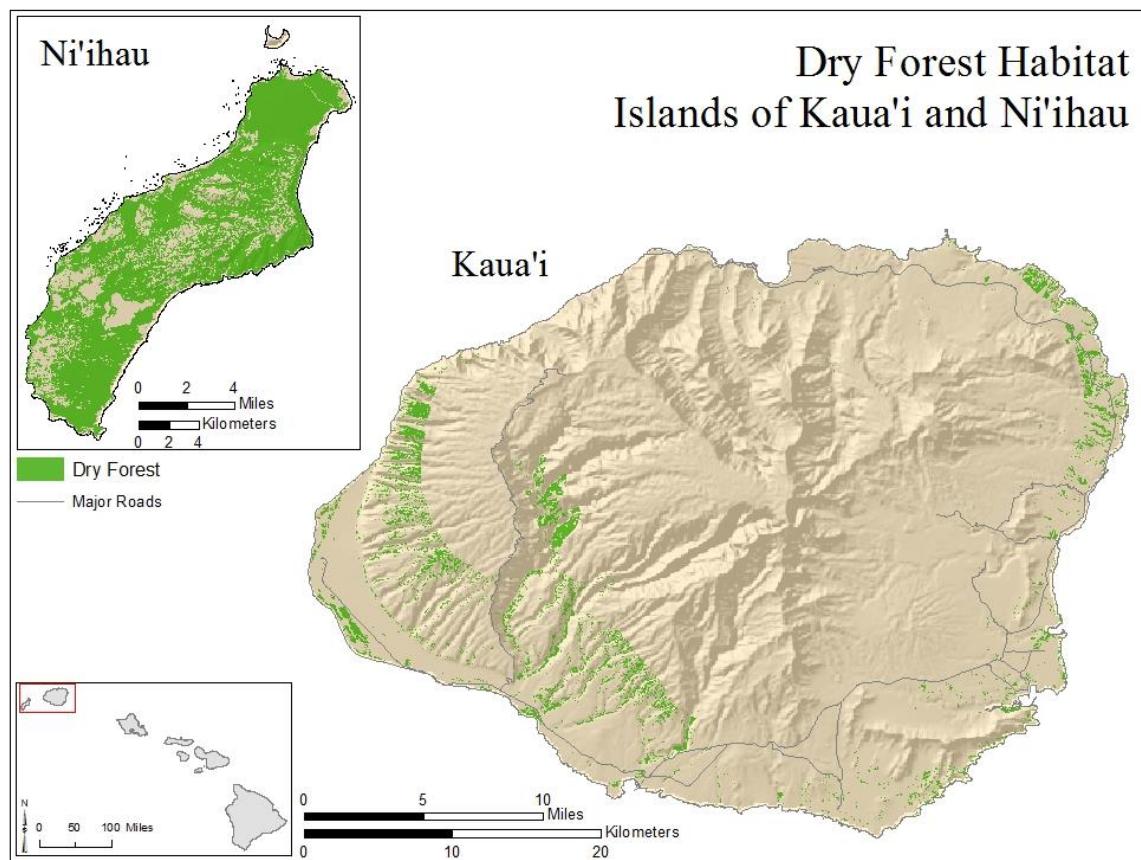


Dry Forest Habitat Island of O'ahu

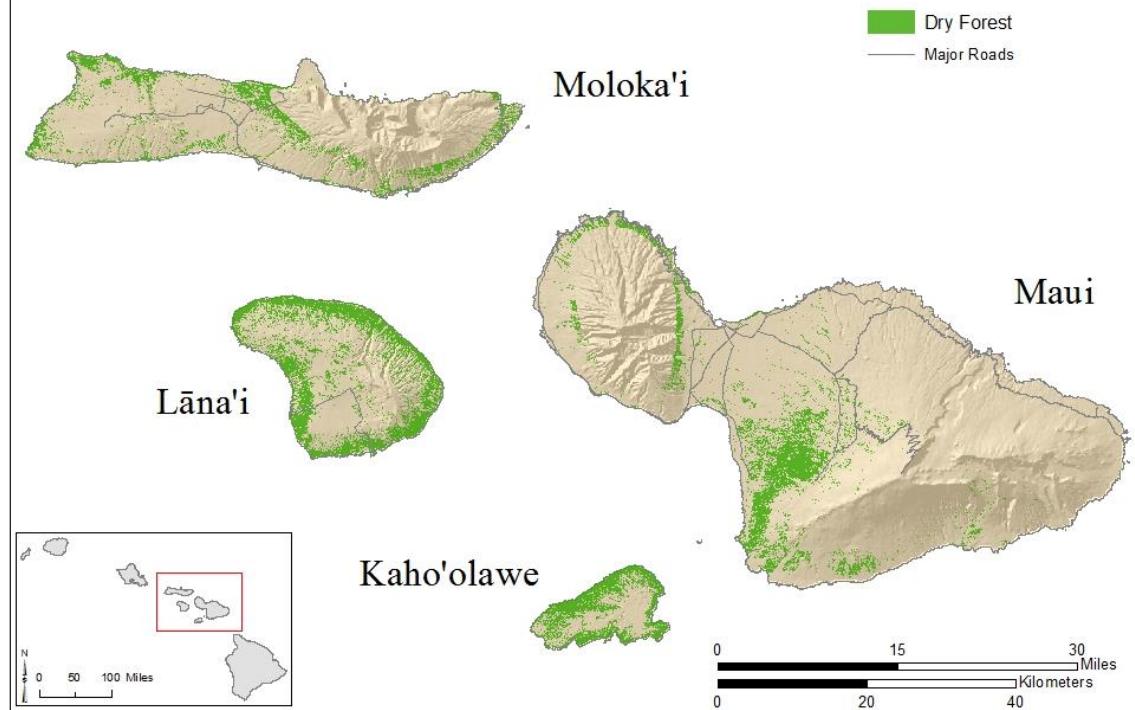


Without Historic Habitat Area



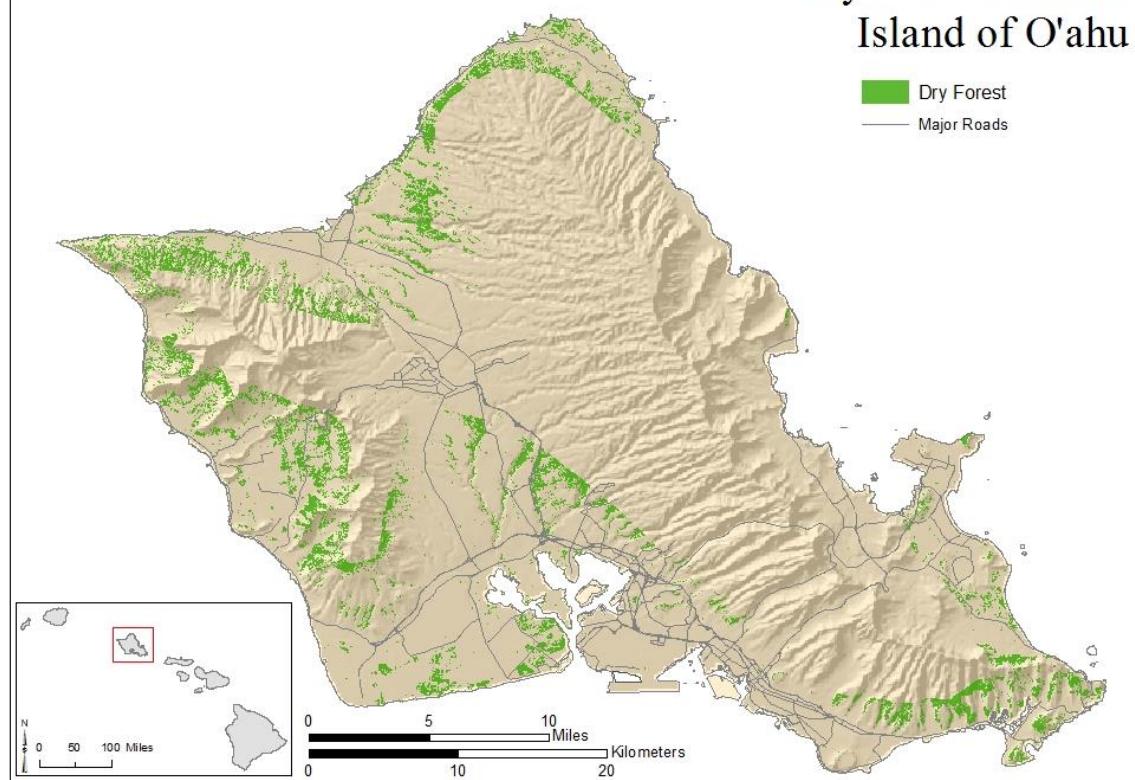


Dry Forest Habitat, Islands of Moloka'i, Lāna'i, Maui and Kaho'olawe

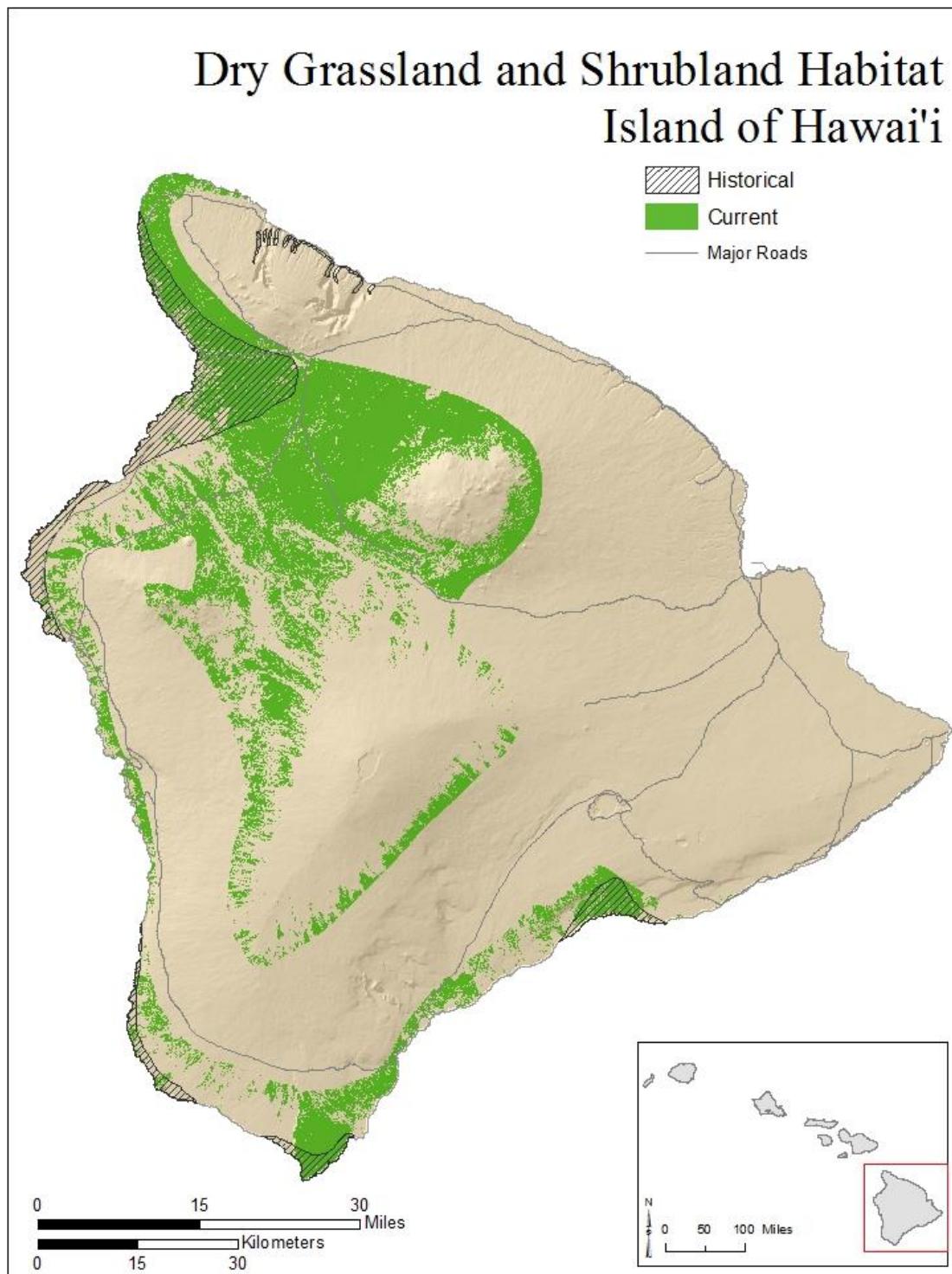


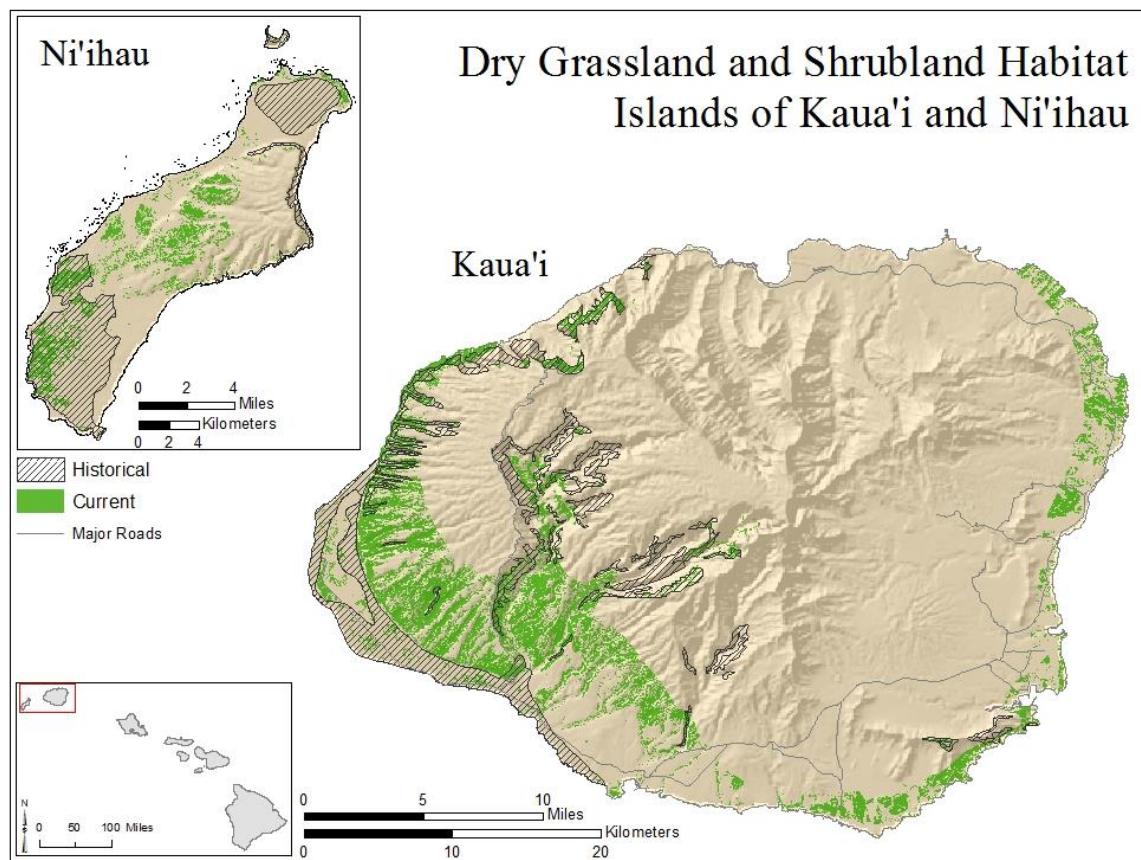
Dry Forest Habitat Island of O'ahu

Dry Forest
Major Roads

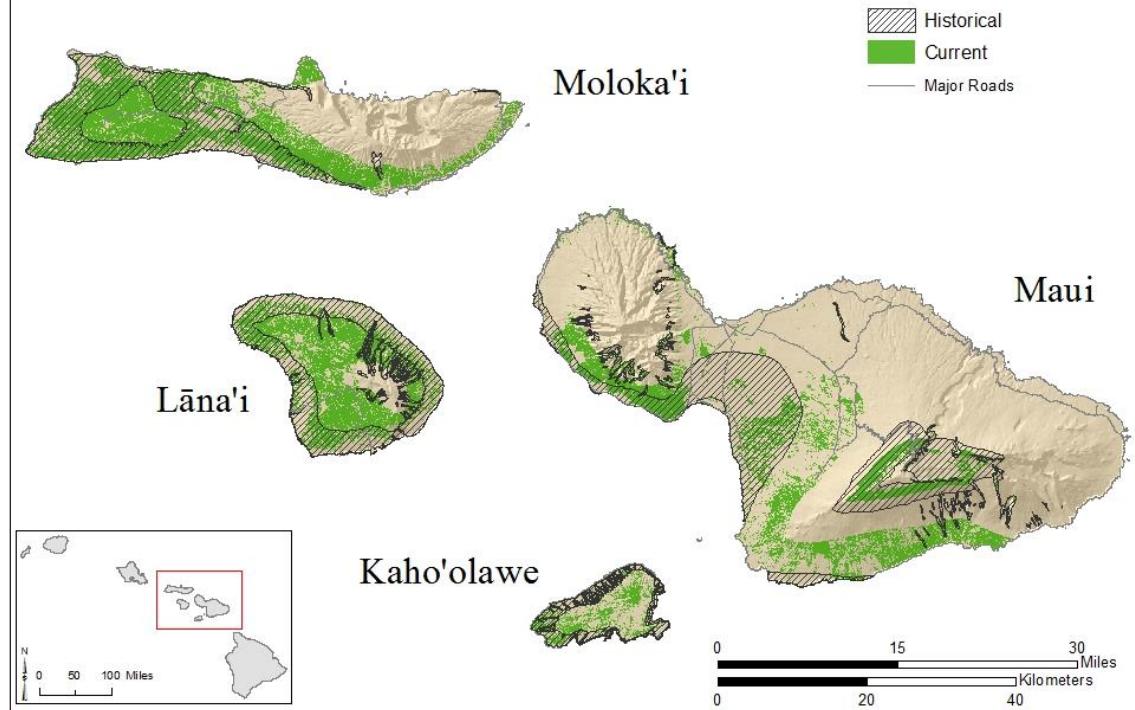


Dry Grassland and Shrubland with historic habitat area

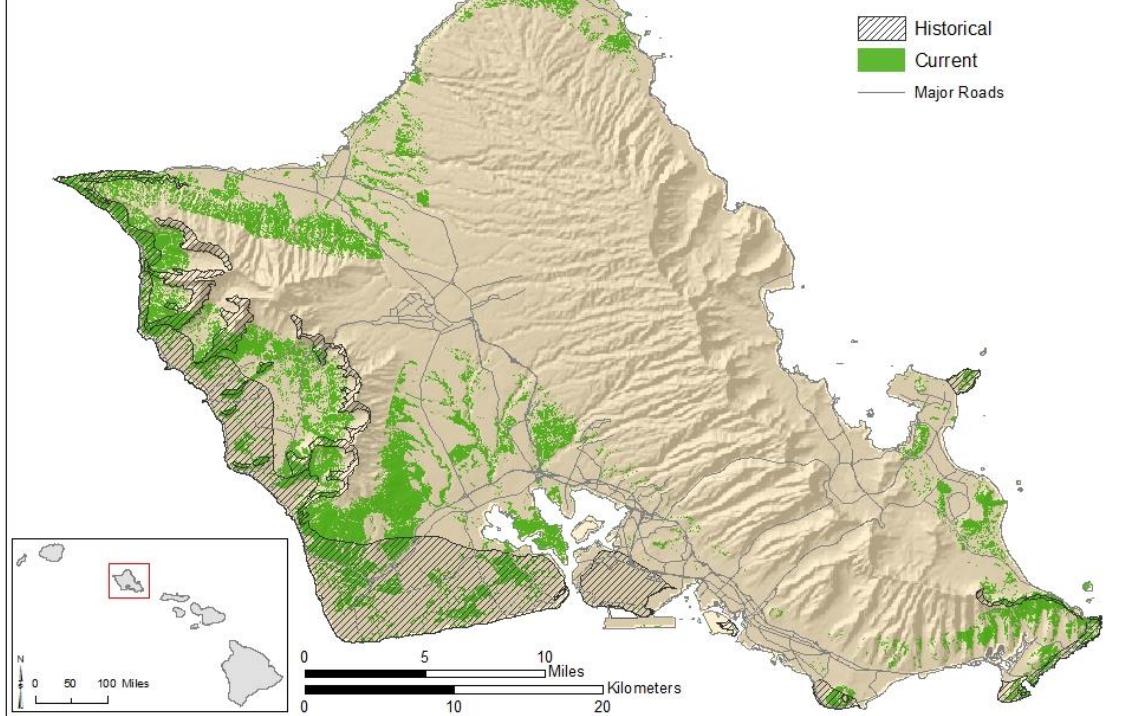




Dry Grassland and Shrubland Habitat, Islands of Moloka'i, Lāna'i, Maui and Kaho'olawe



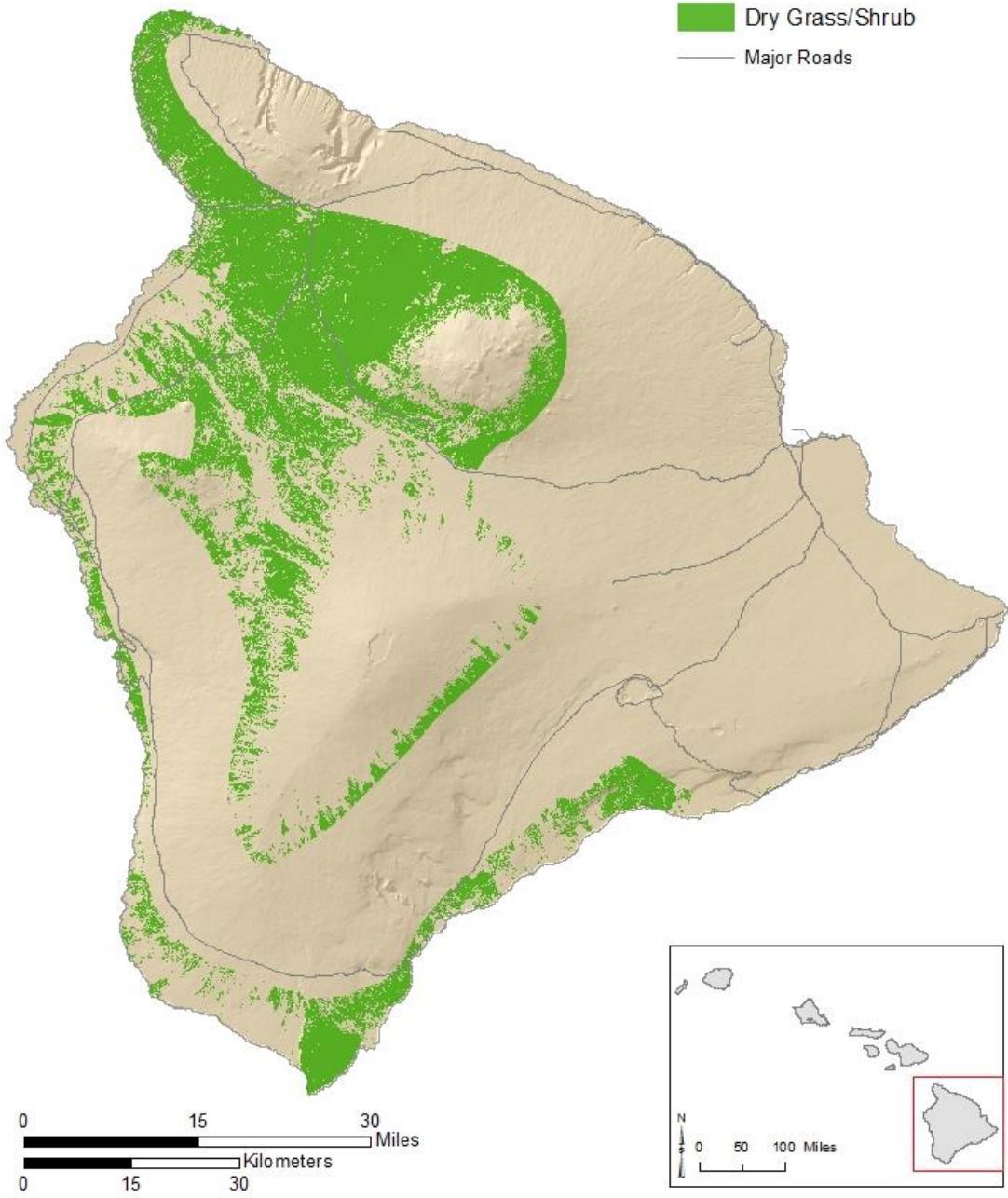
Dry Grassland and Shrubland Habitat Island of O'ahu

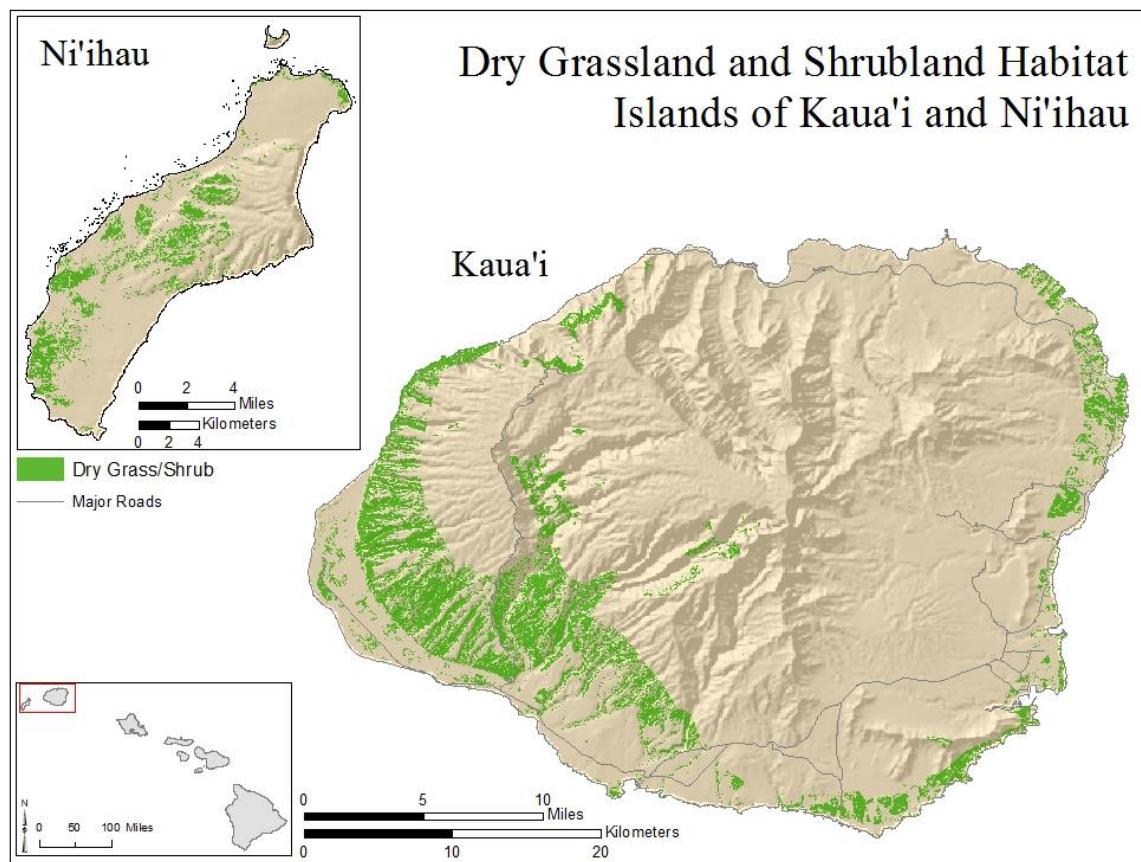


Without historic habitat area

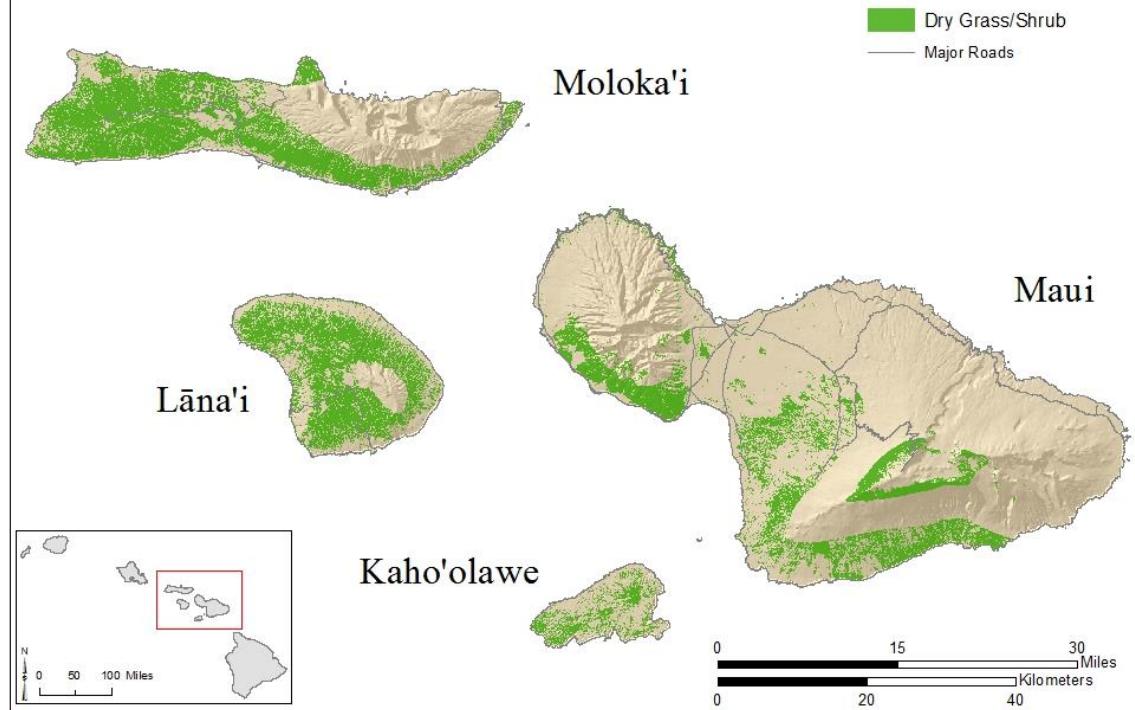
Dry Grassland and Shrubland Habitat Island of Hawai'i

Dry Grass/Shrub
Major Roads

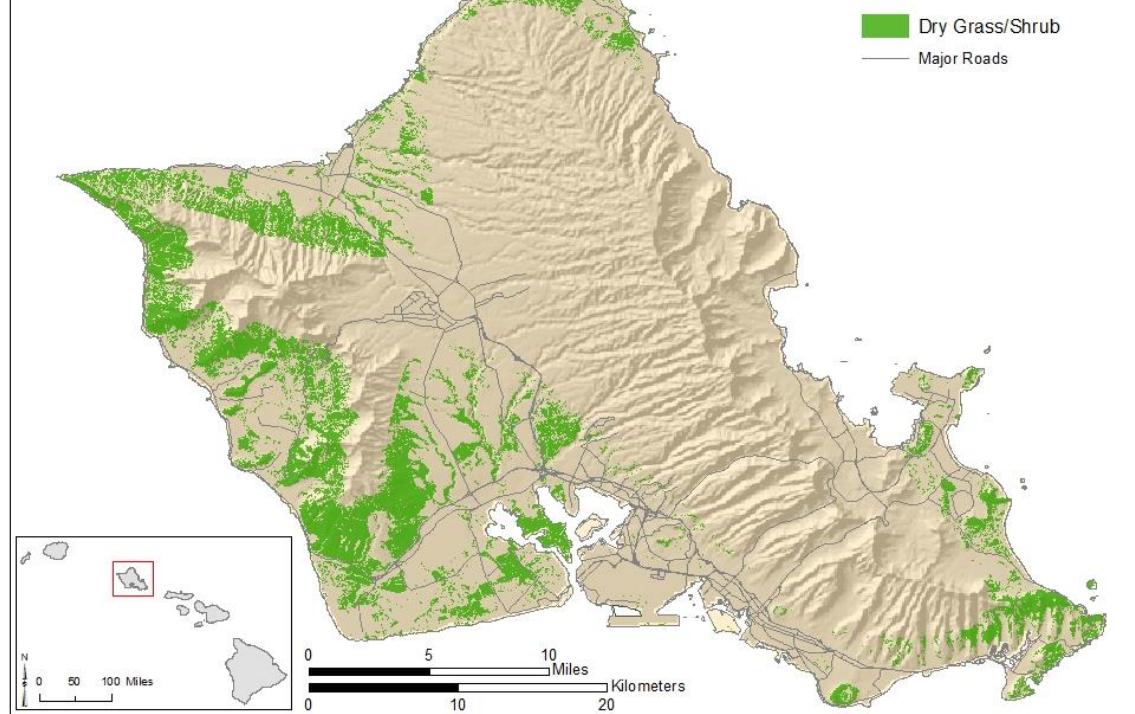




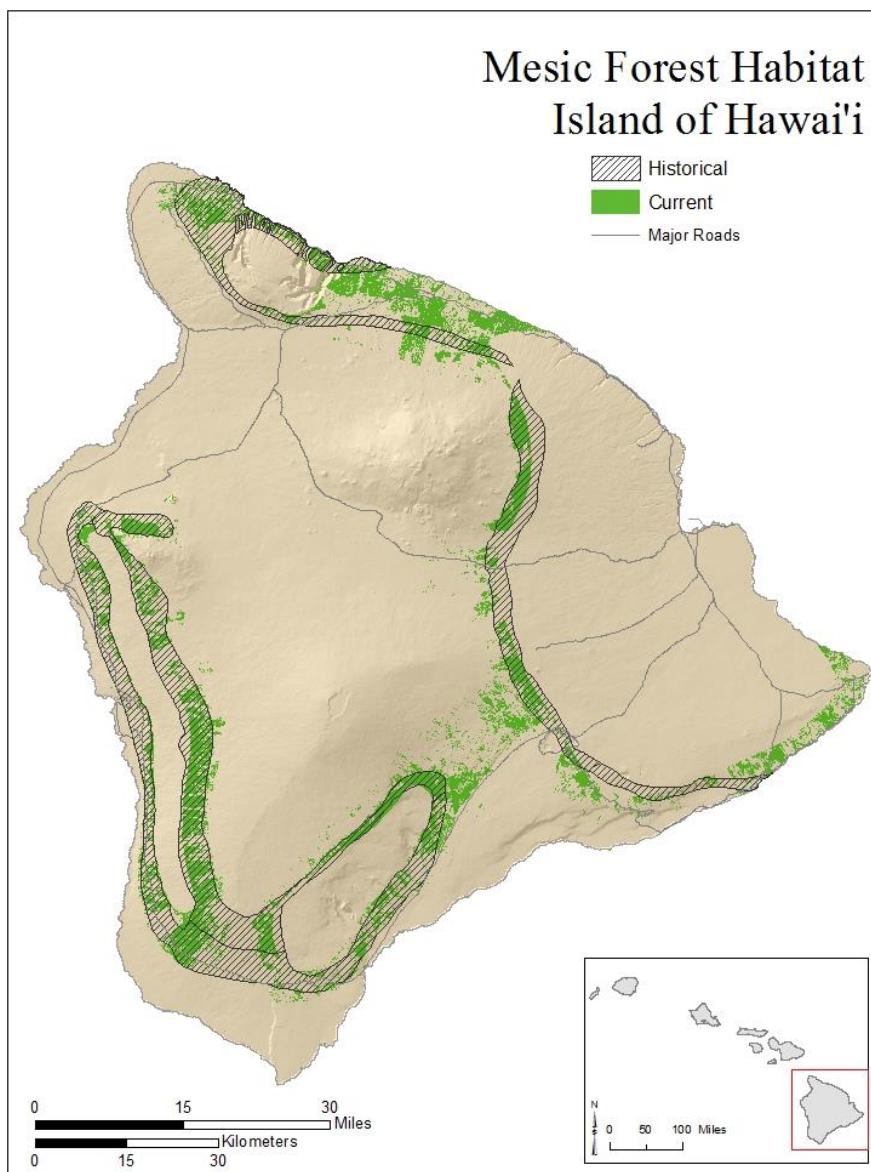
Dry Grassland and Shrubland Habitat, Islands of Moloka'i, Lāna'i, Maui and Kaho'olawe

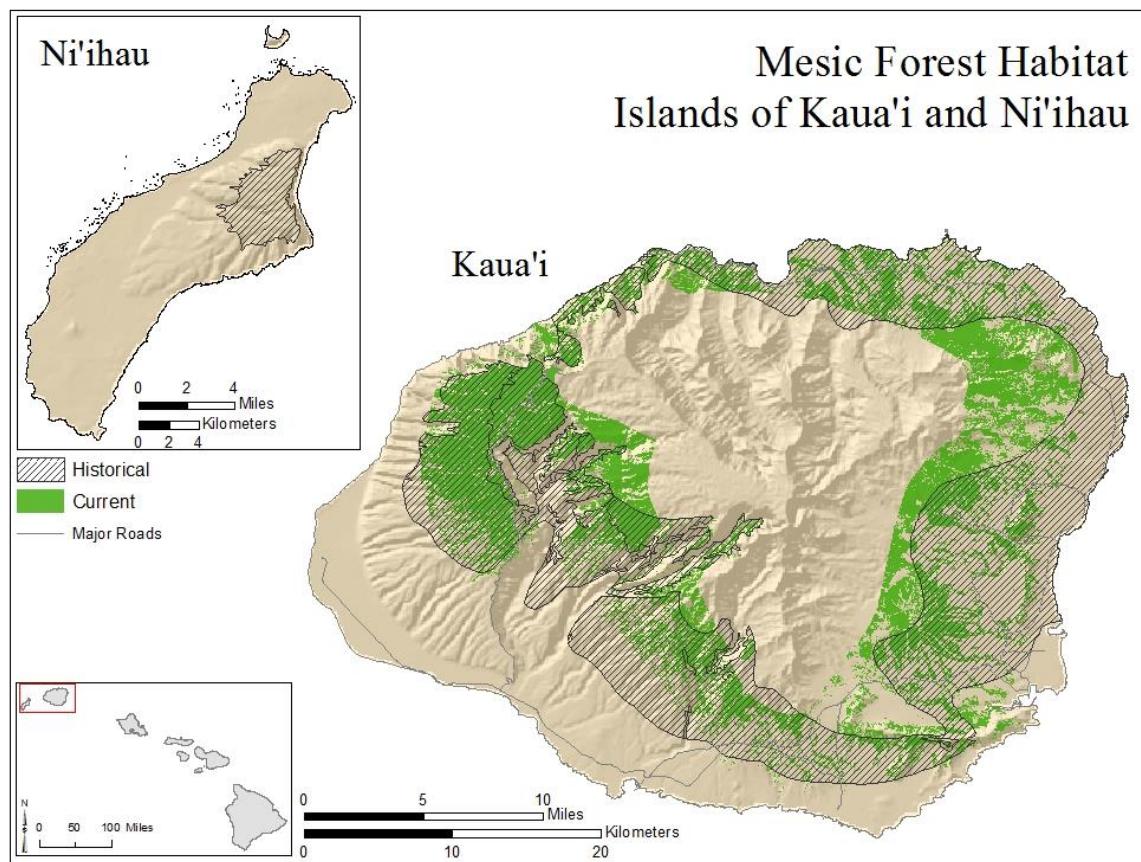


Dry Grassland and Shrubland Habitat Island of O'ahu

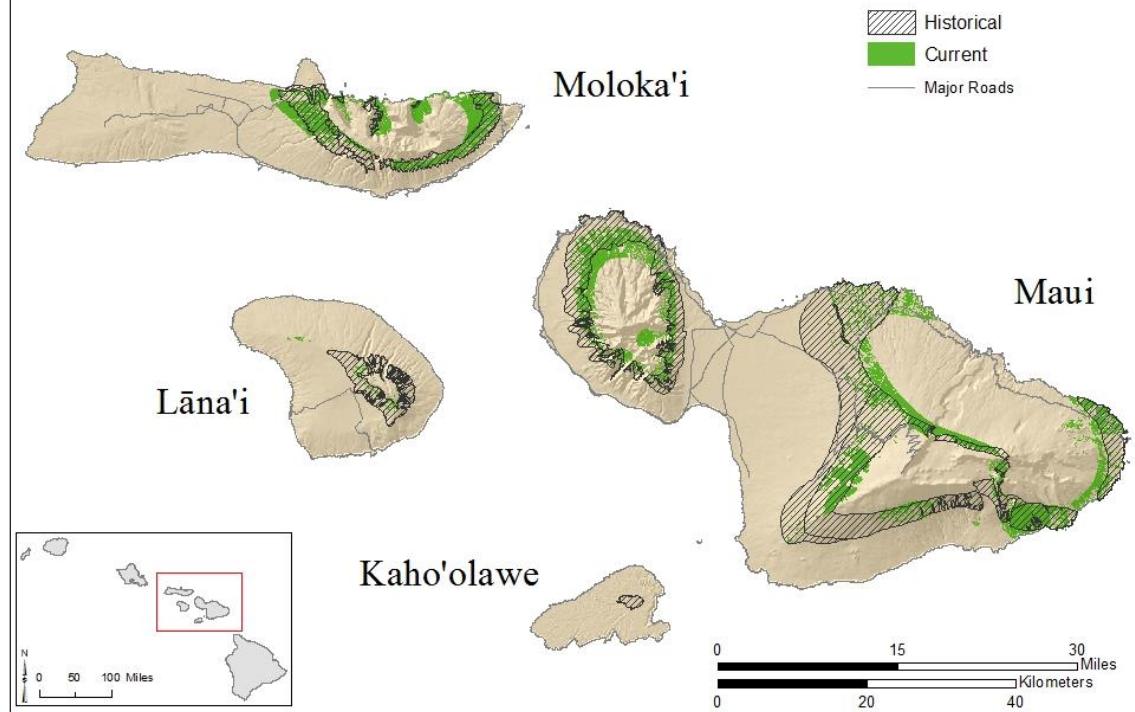


Mesic Forest with Historic Habitat Area

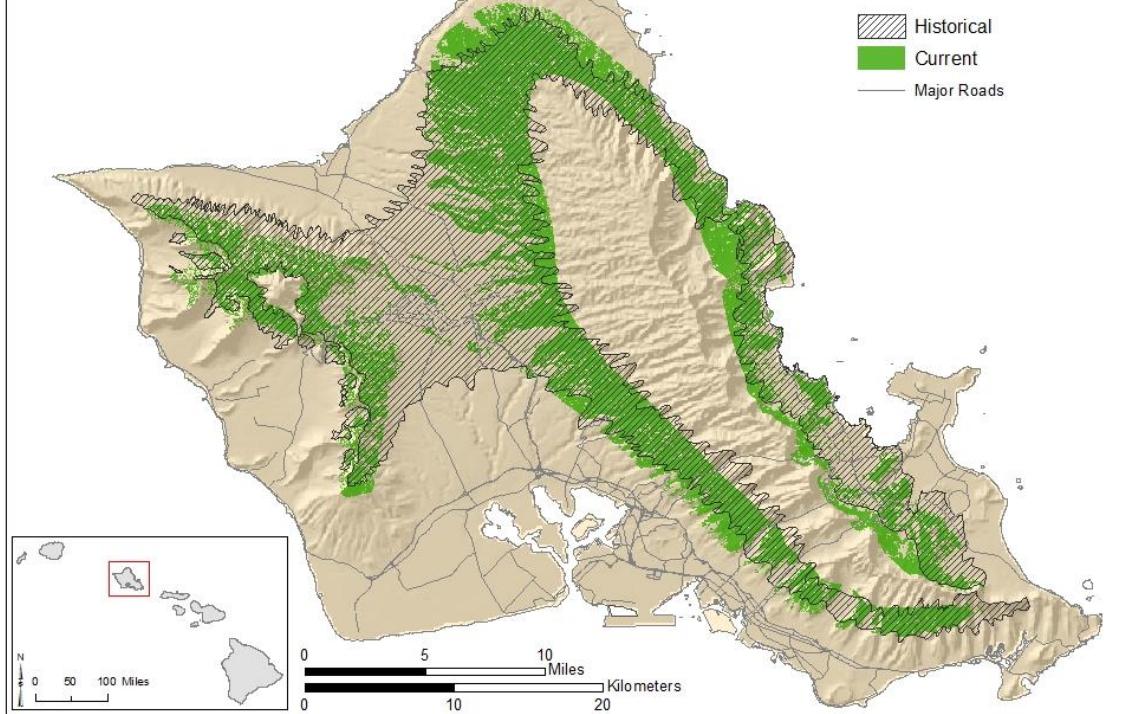




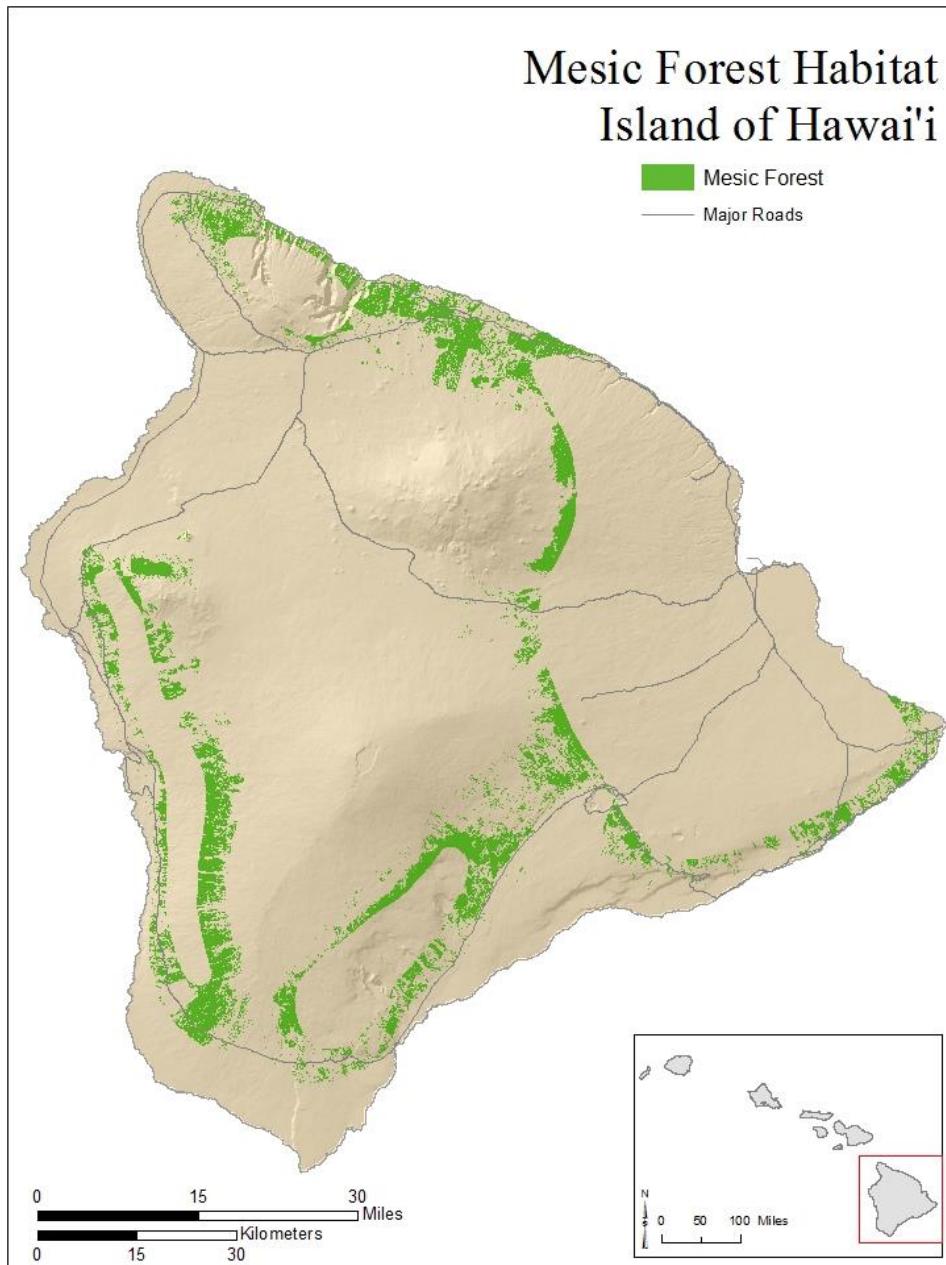
Mesic Forest Habitat, Islands of Moloka'i, Lāna'i, Maui and Kaho'olawe

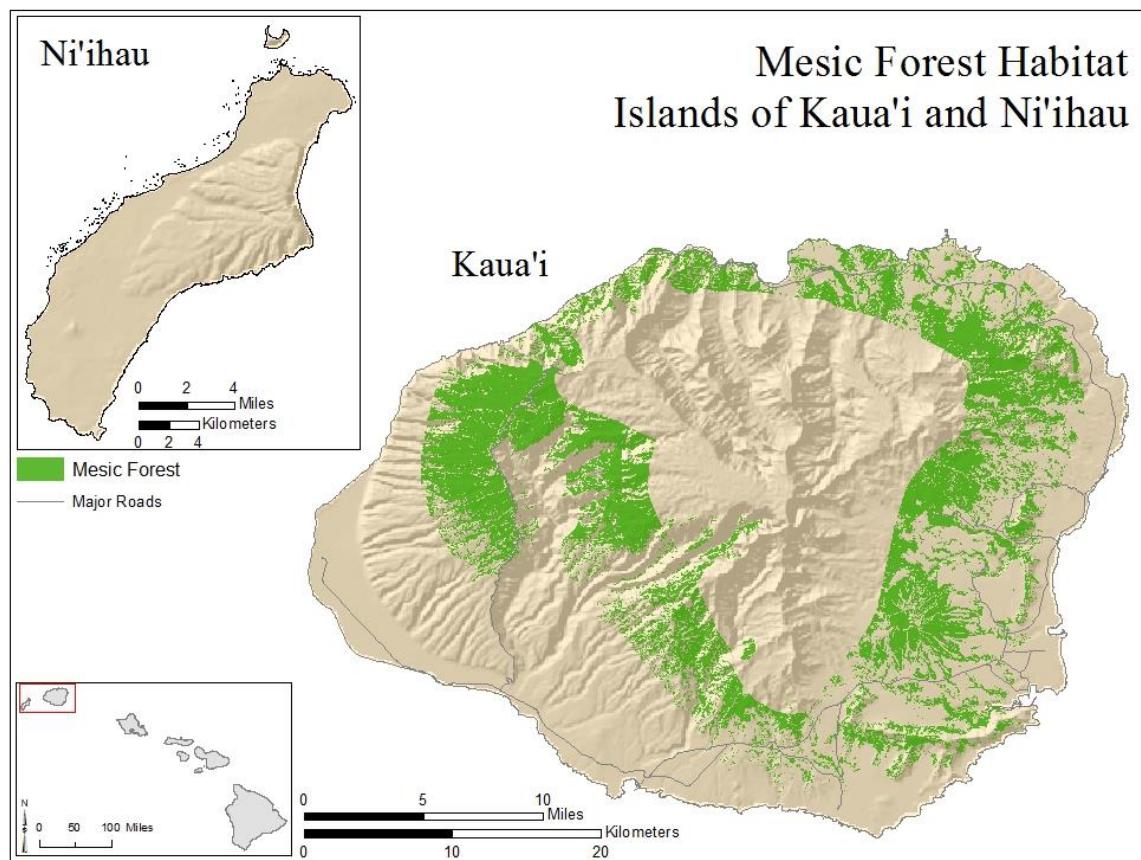


Mesic Forest Habitat Island of O'ahu

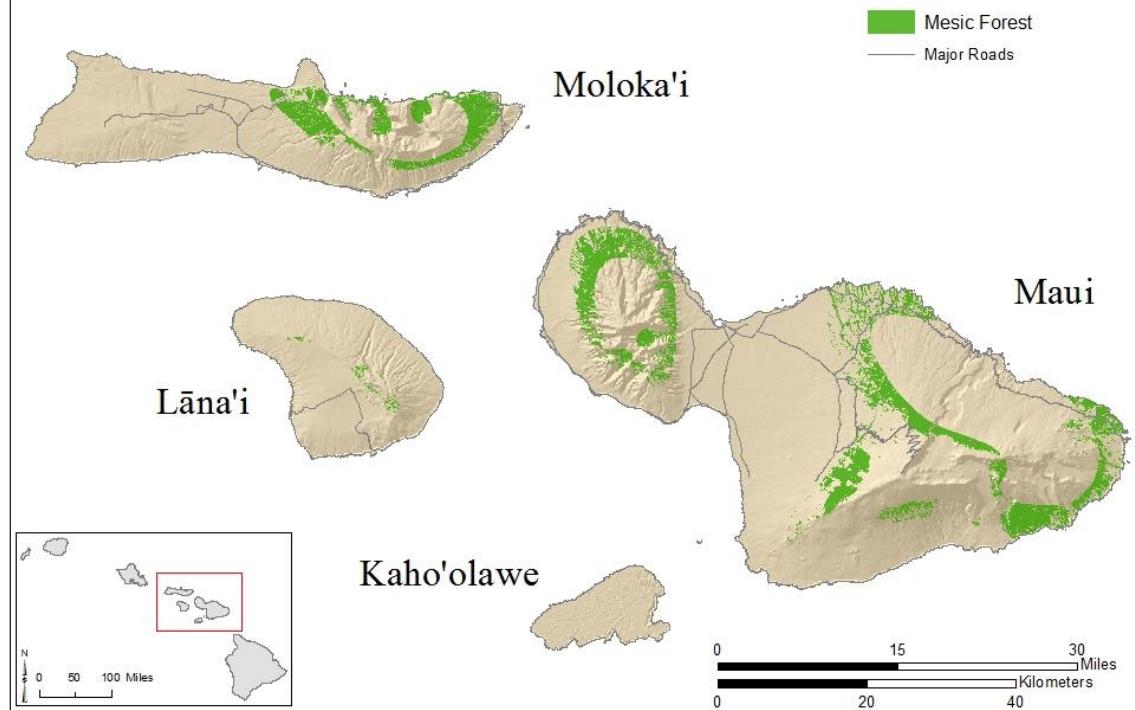


Without Historic Habitat Area



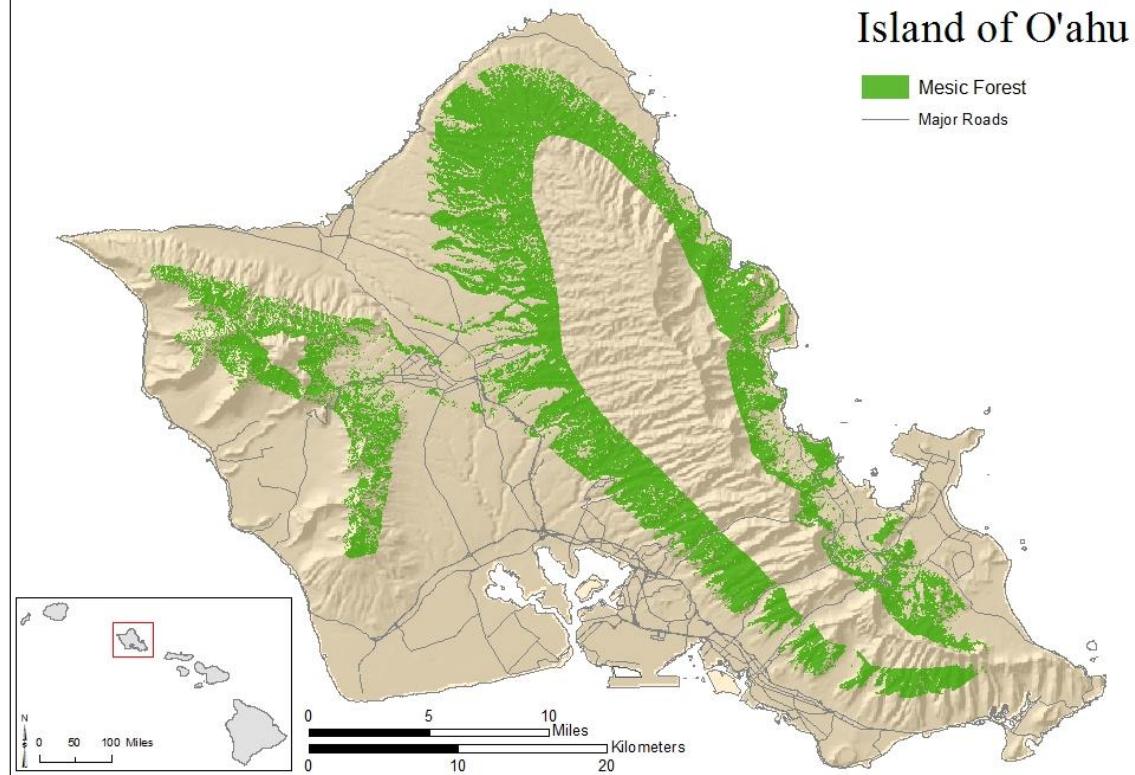


Mesic Forest Habitat, Islands of Moloka'i, Lāna'i, Maui and Kaho'olawe



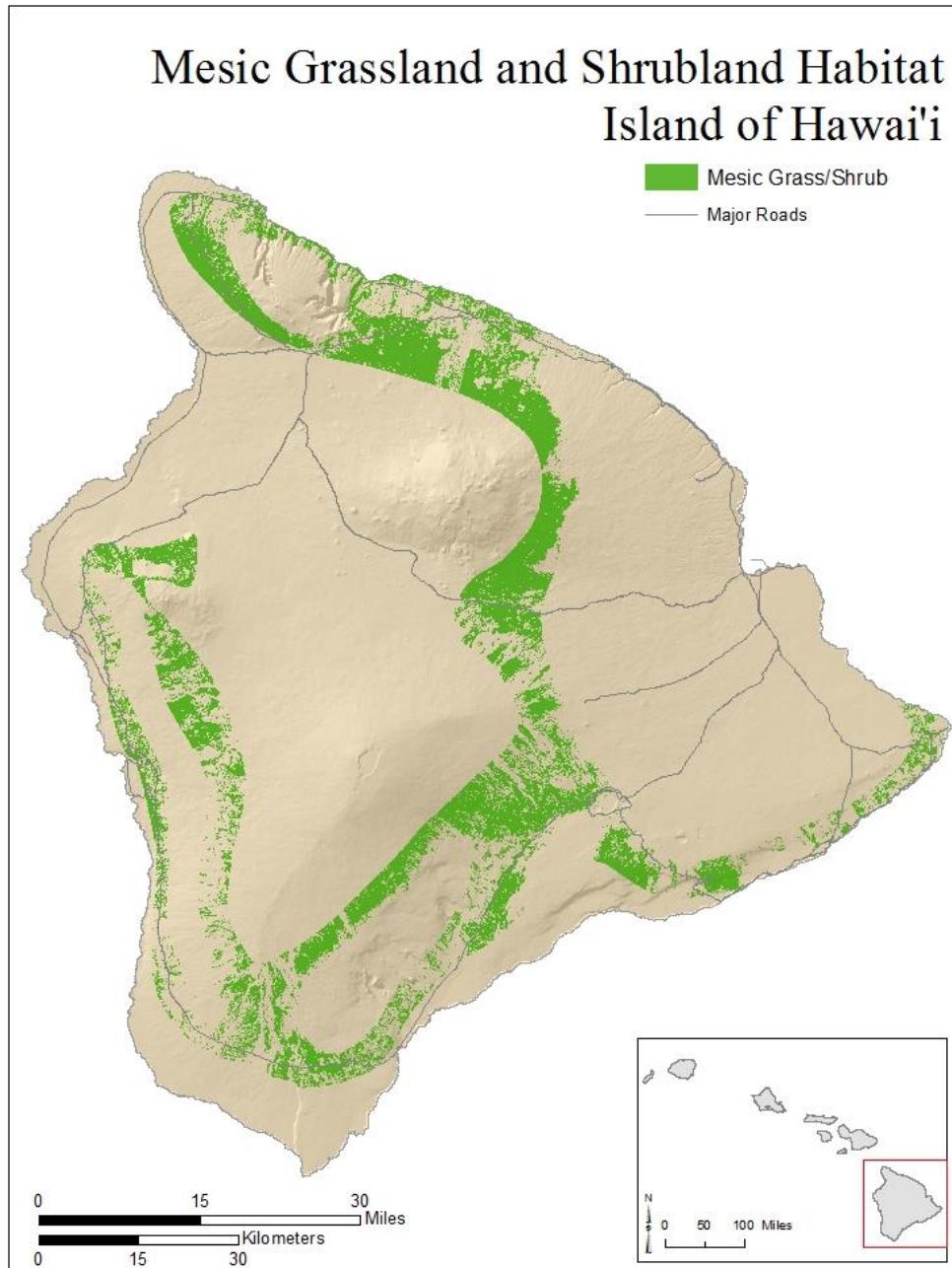
Mesic Forest Habitat Island of O'ahu

 Mesic Forest
 Major Roads



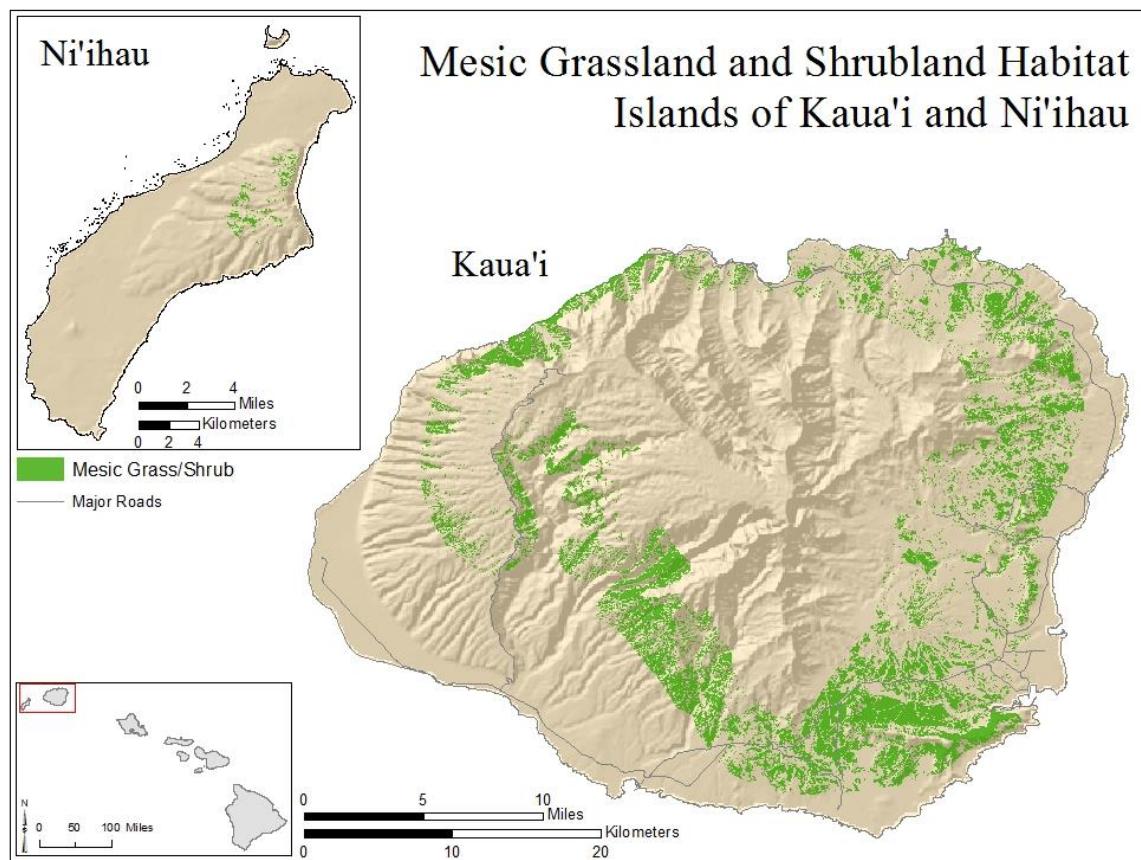
Mesic Grassland and Shrubland

This habitat did not exist before human contact, so pre-contact extent is not shown

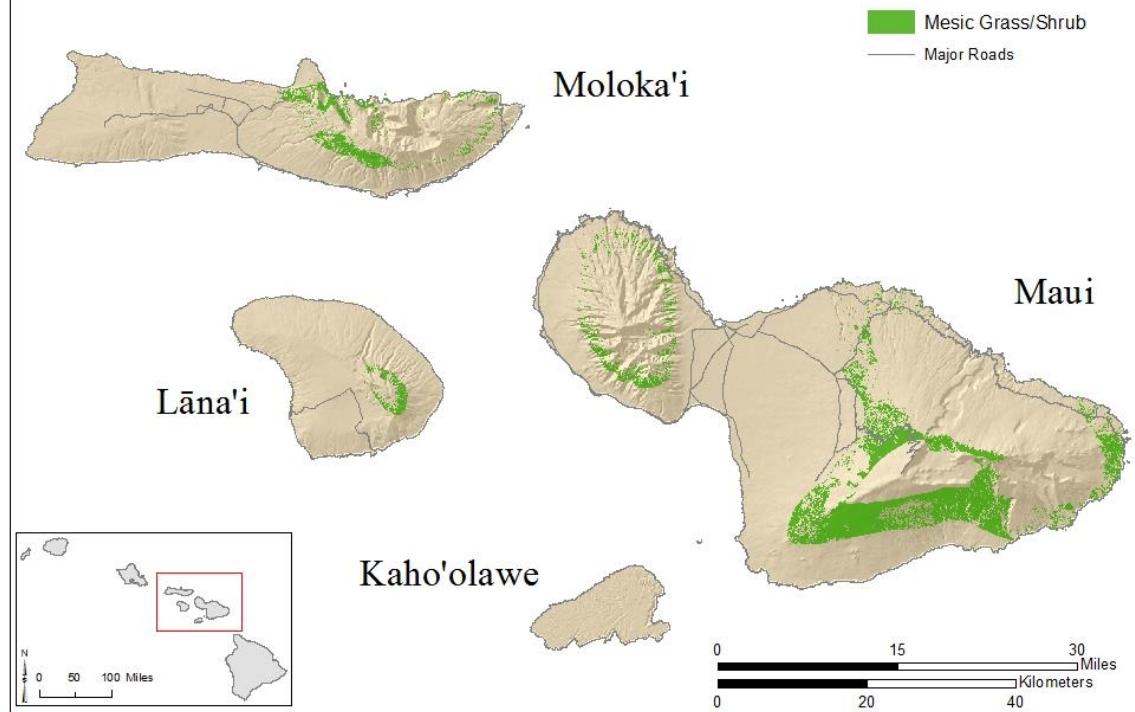


more human

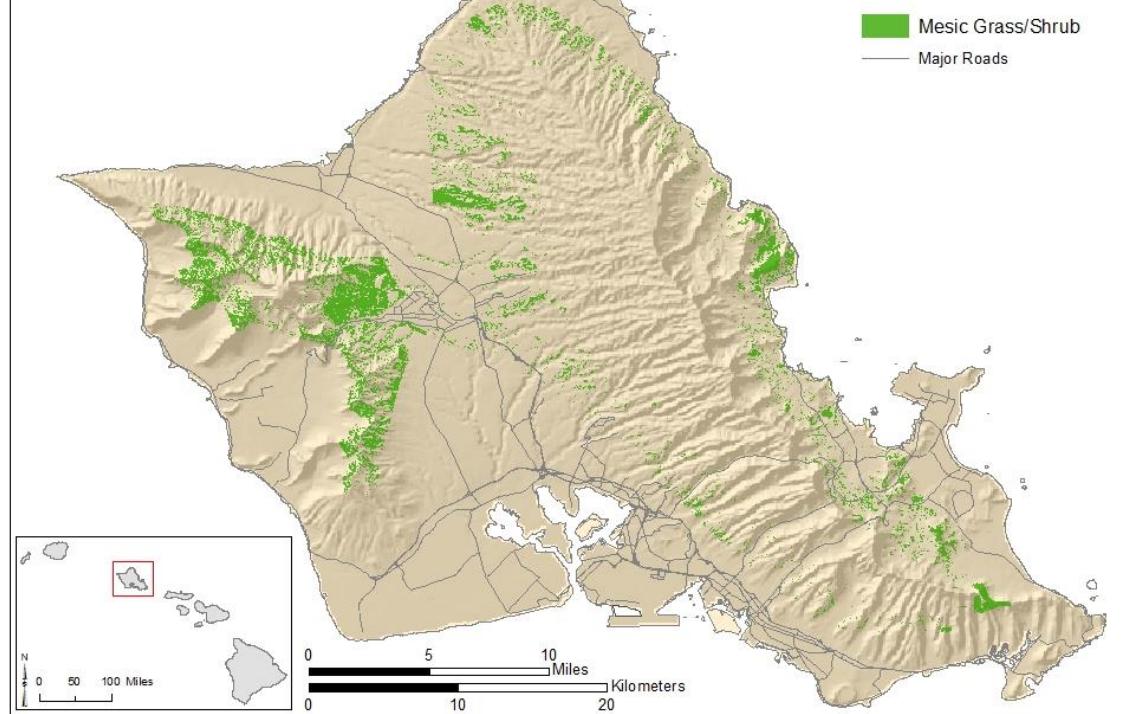
contact, so pre-contact extent is not shown



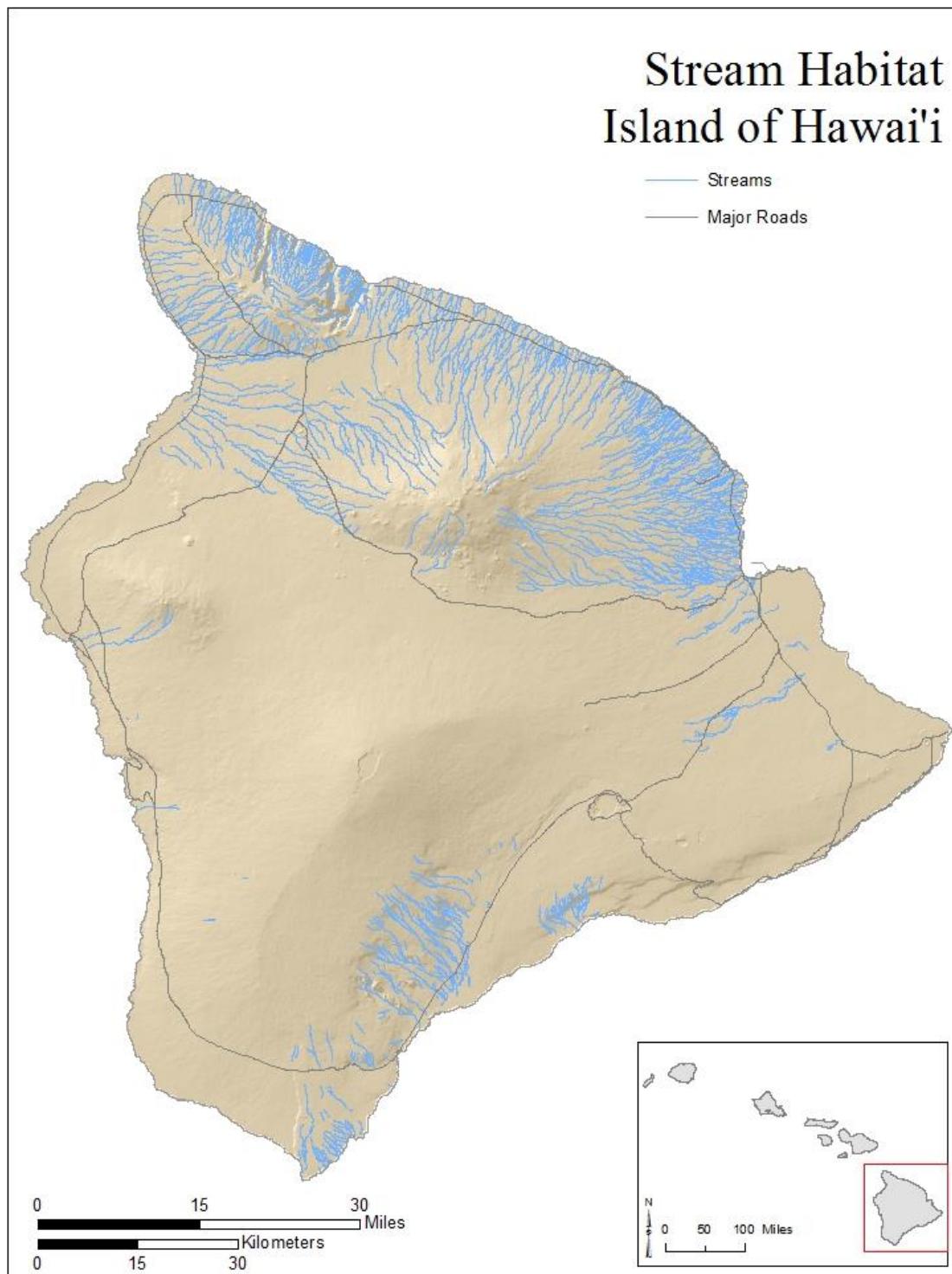
Mesic Grassland and Shrubland Habitat, Islands of Moloka'i, Lāna'i, Maui and Kaho'olawe

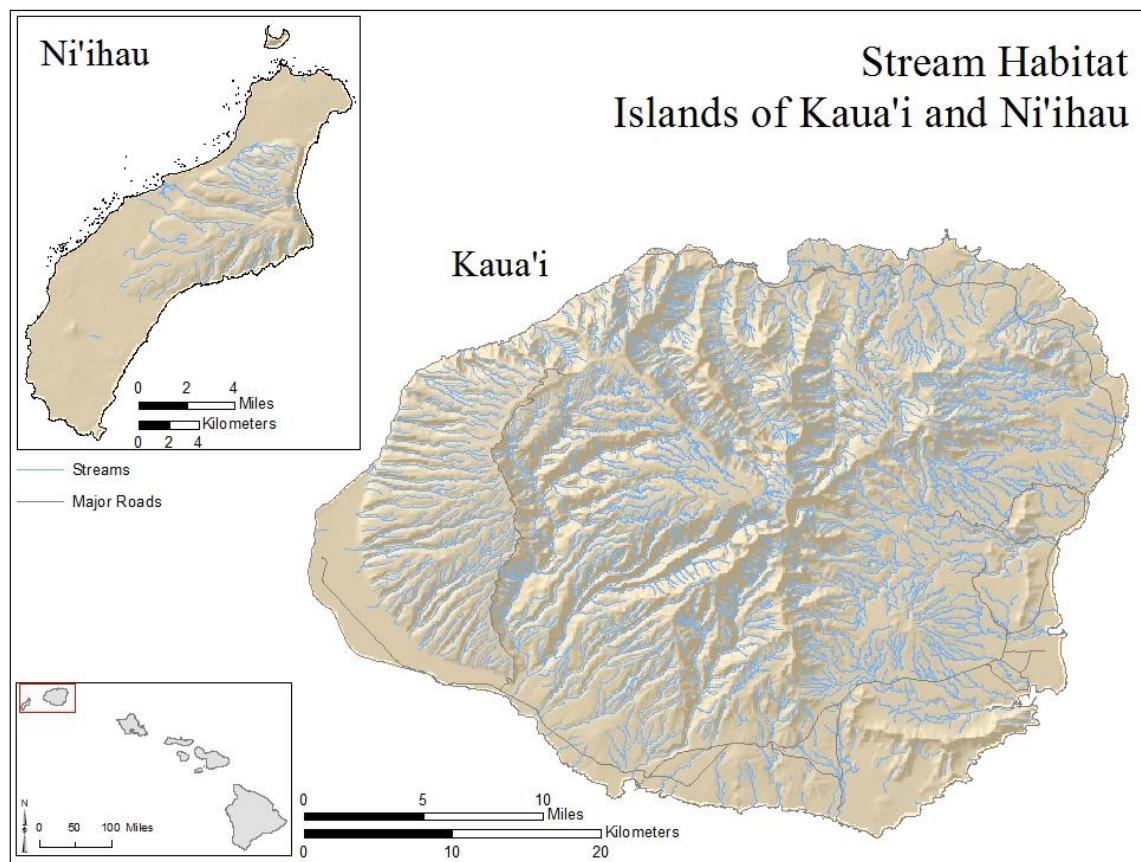


Mesic Grassland and Shrubland Habitat Island of O'ahu

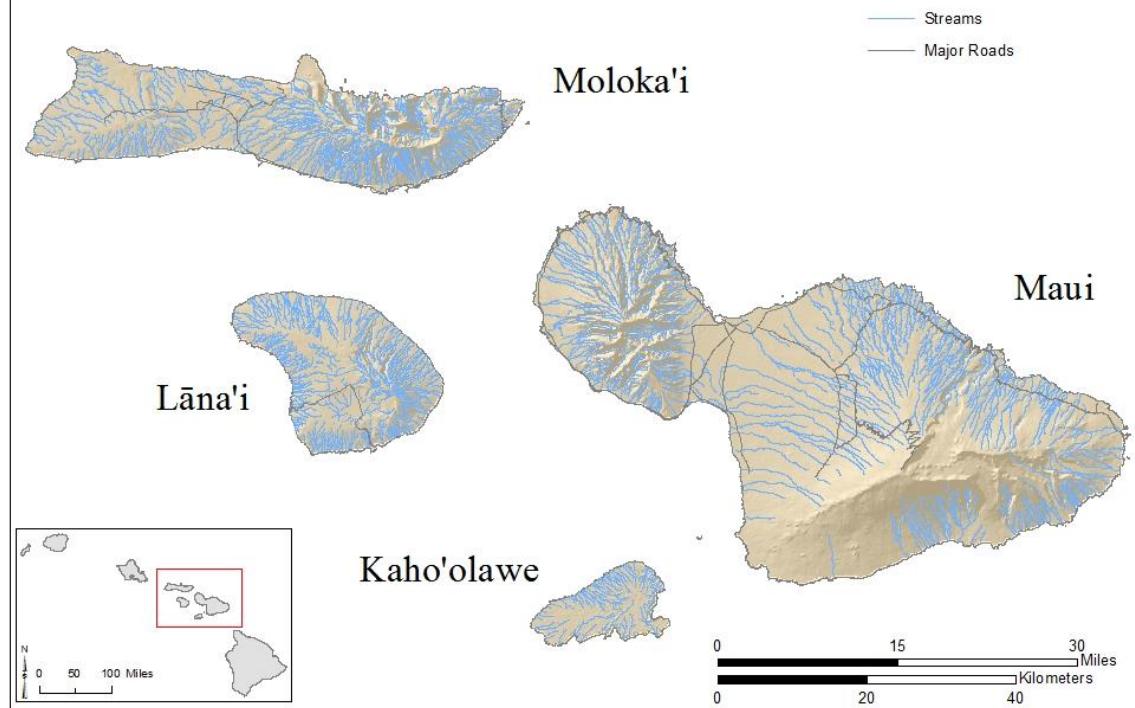


Streams



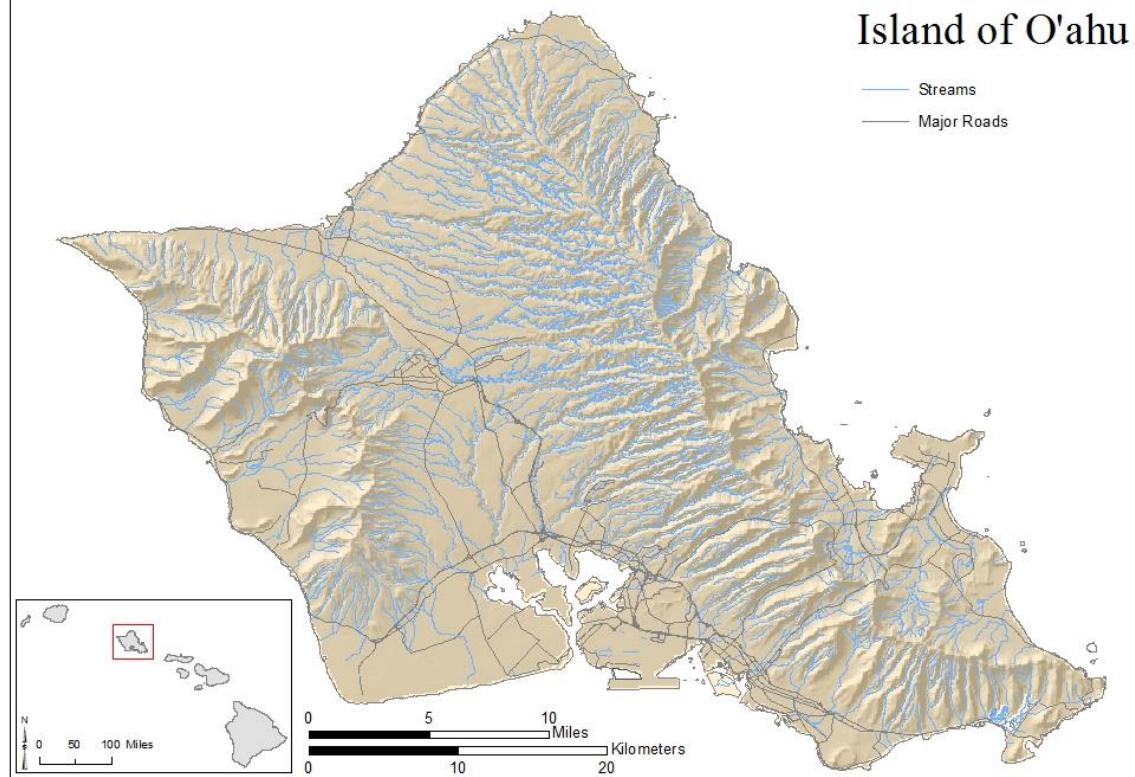


Stream Habitat, Islands of Moloka'i, Lāna'i, Maui and Kaho'olawe

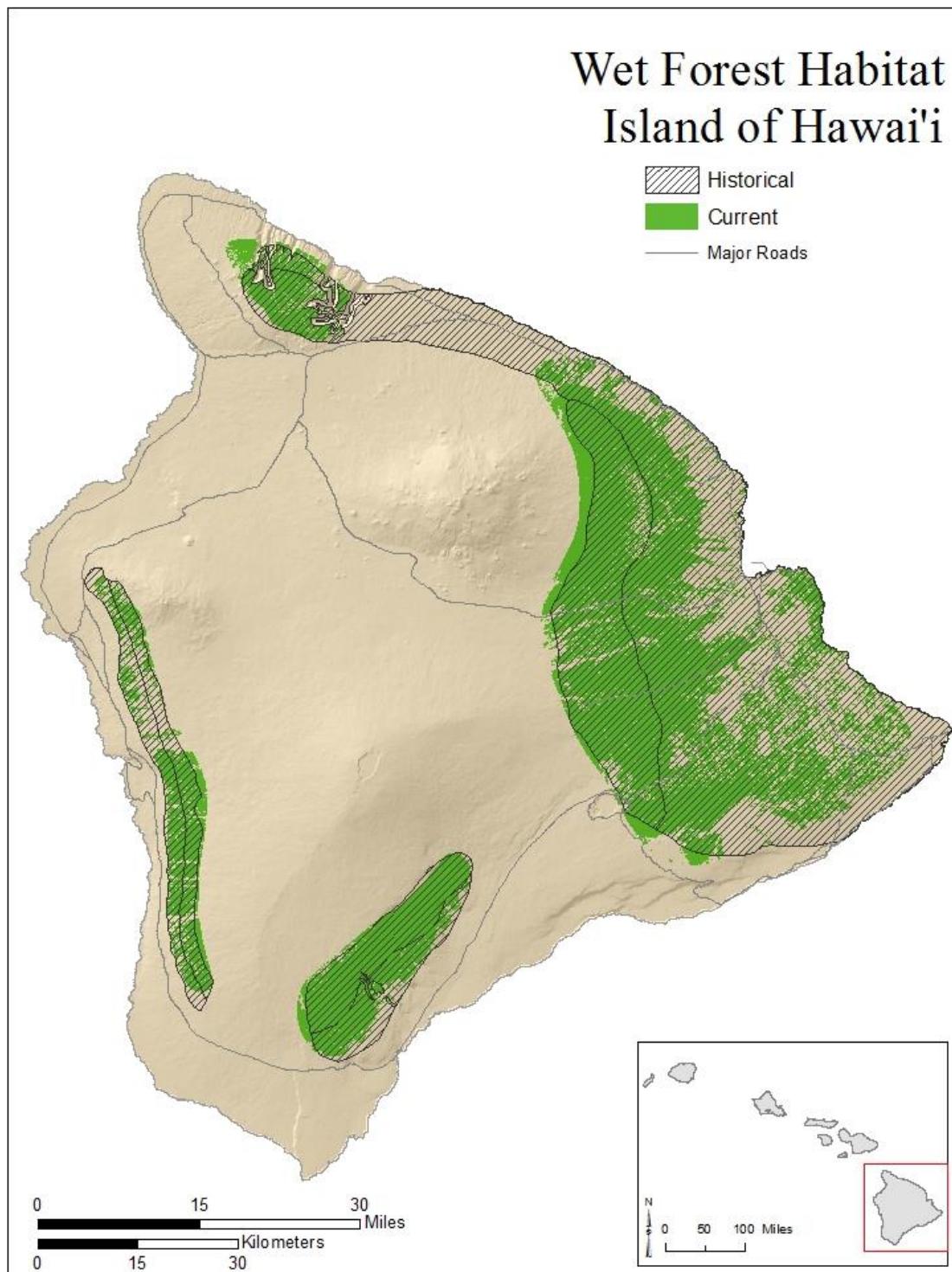


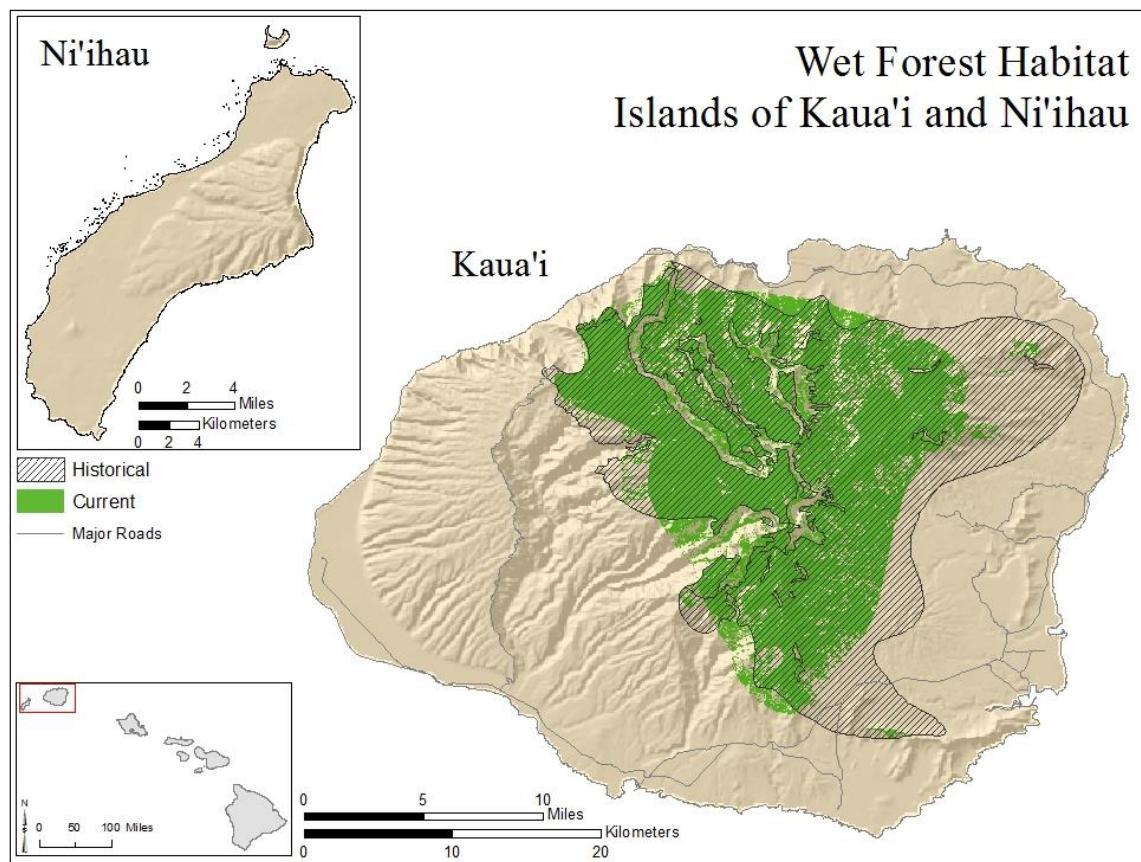
Stream Habitat Island of O'ahu

Streams
Major Roads

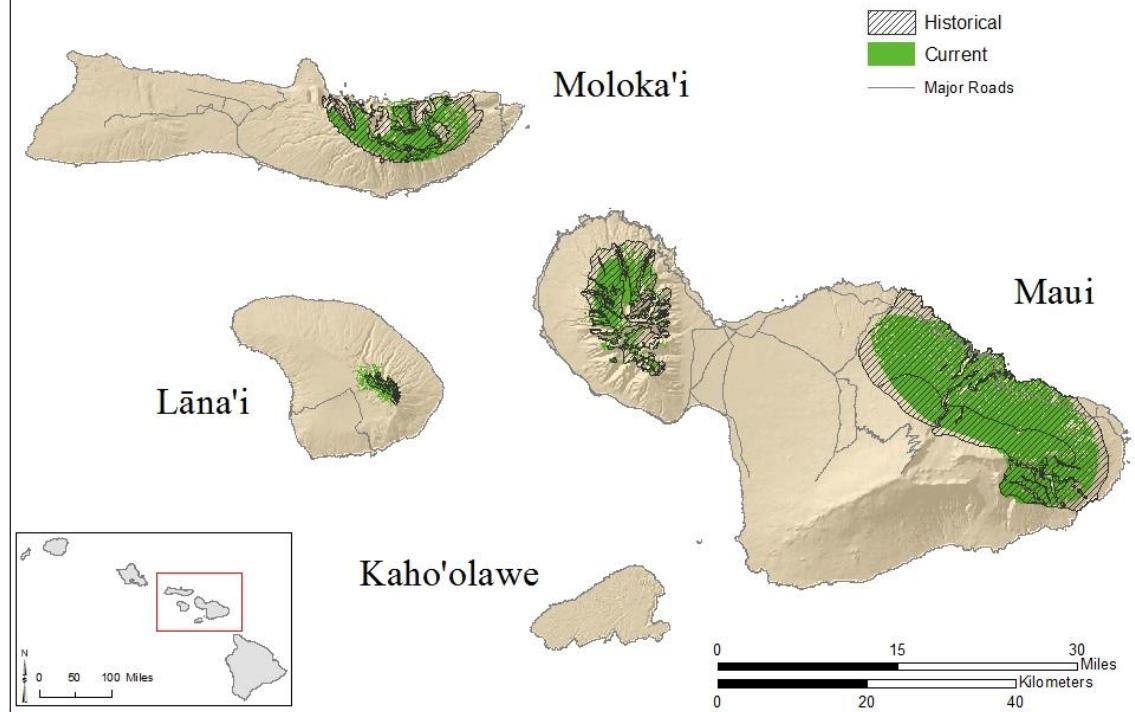


Wet Forests with Historic Habitat Area



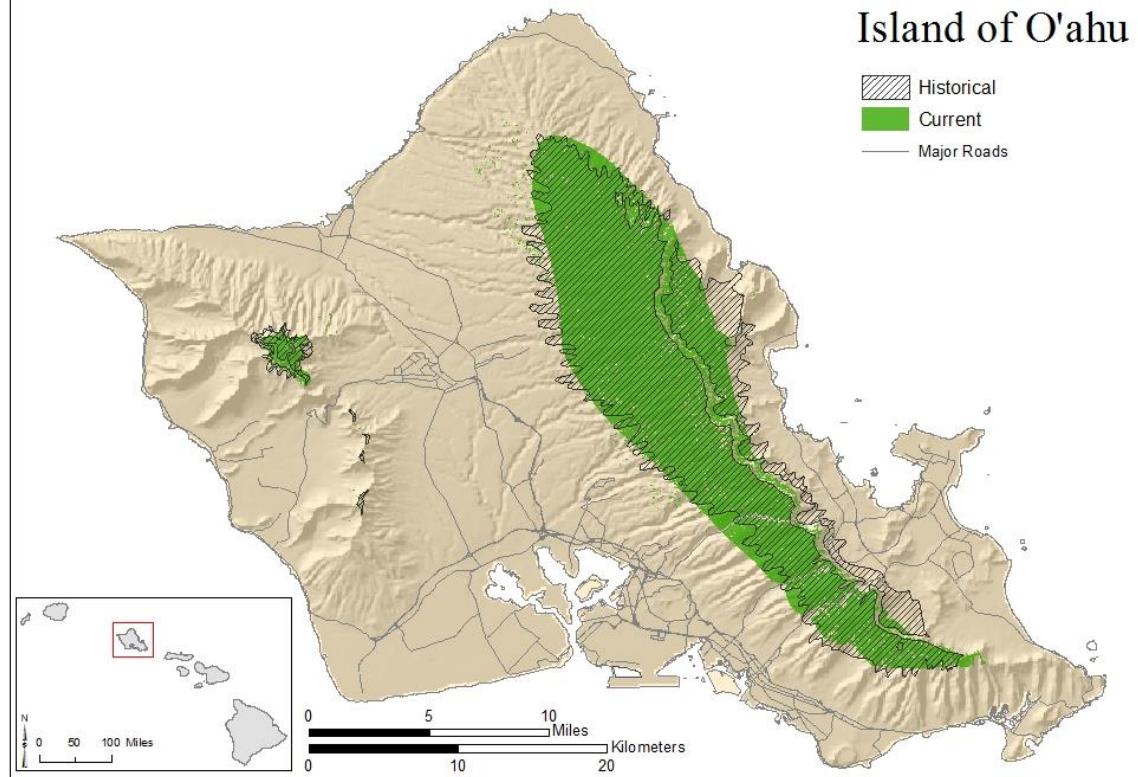


Wet Forest Habitat, Islands of Moloka'i, Lāna'i, Maui and Kaho'olawe

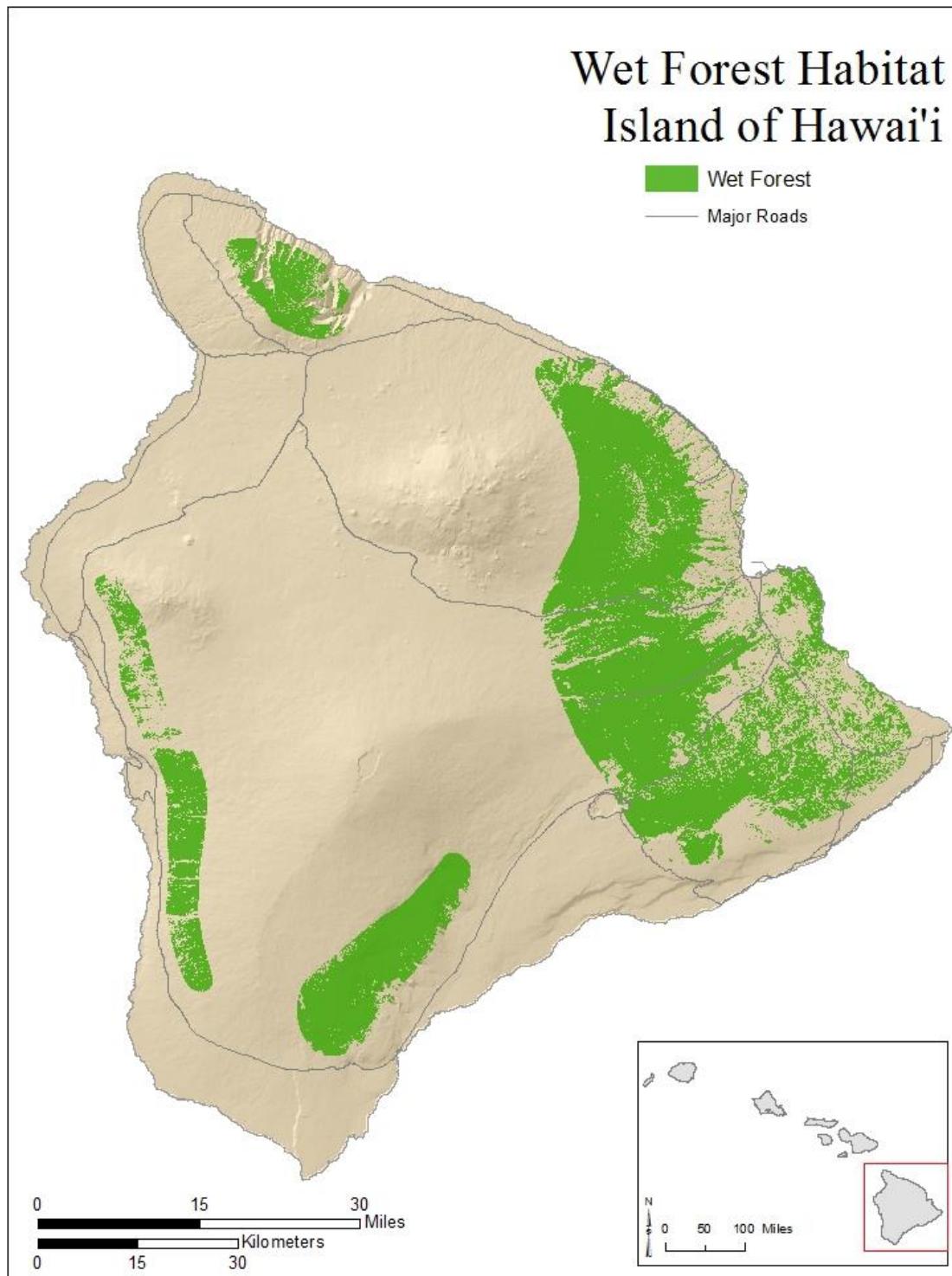


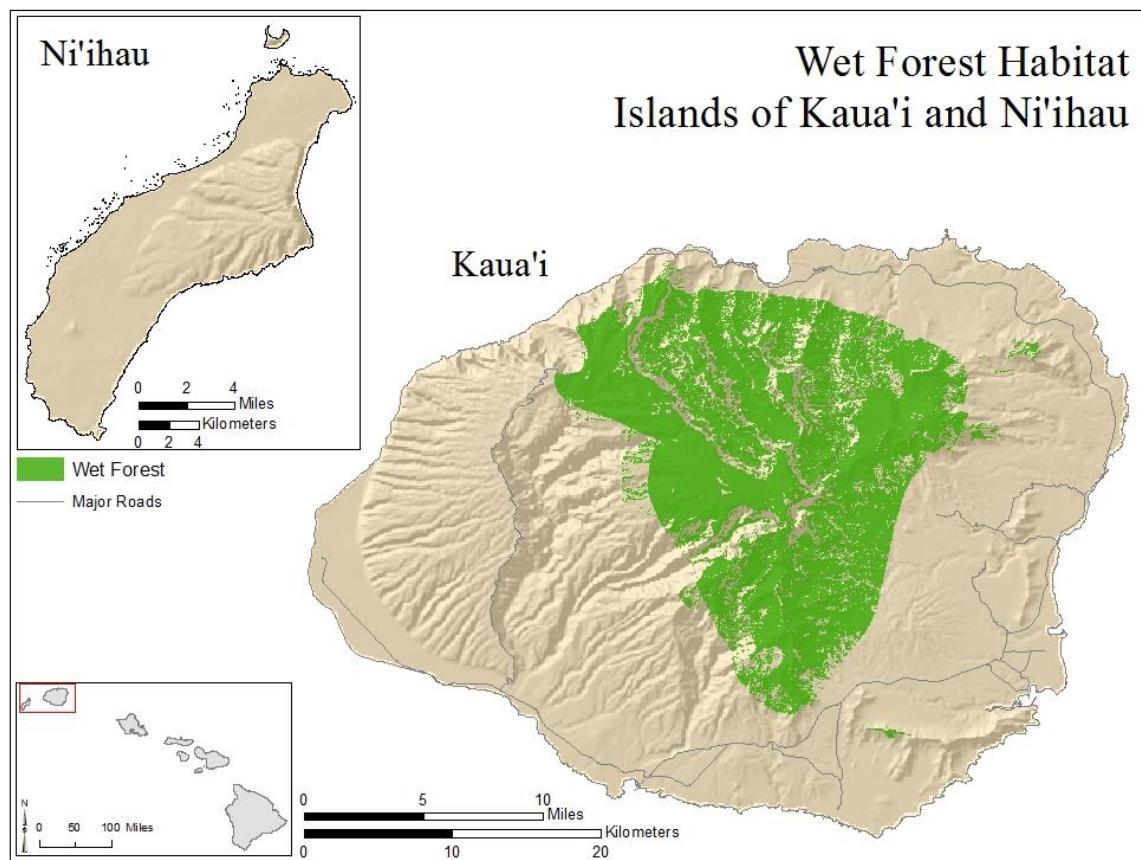
Wet Forest Habitat Island of O'ahu

Historical
Current
Major Roads

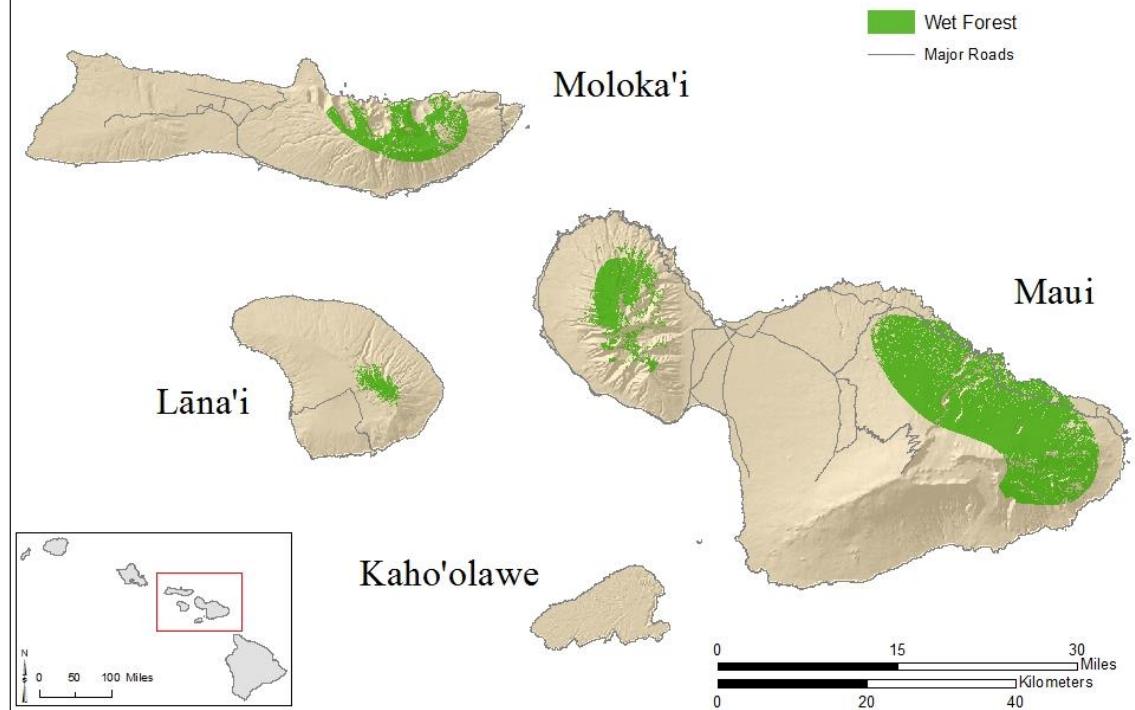


Without Historic Habitat Area



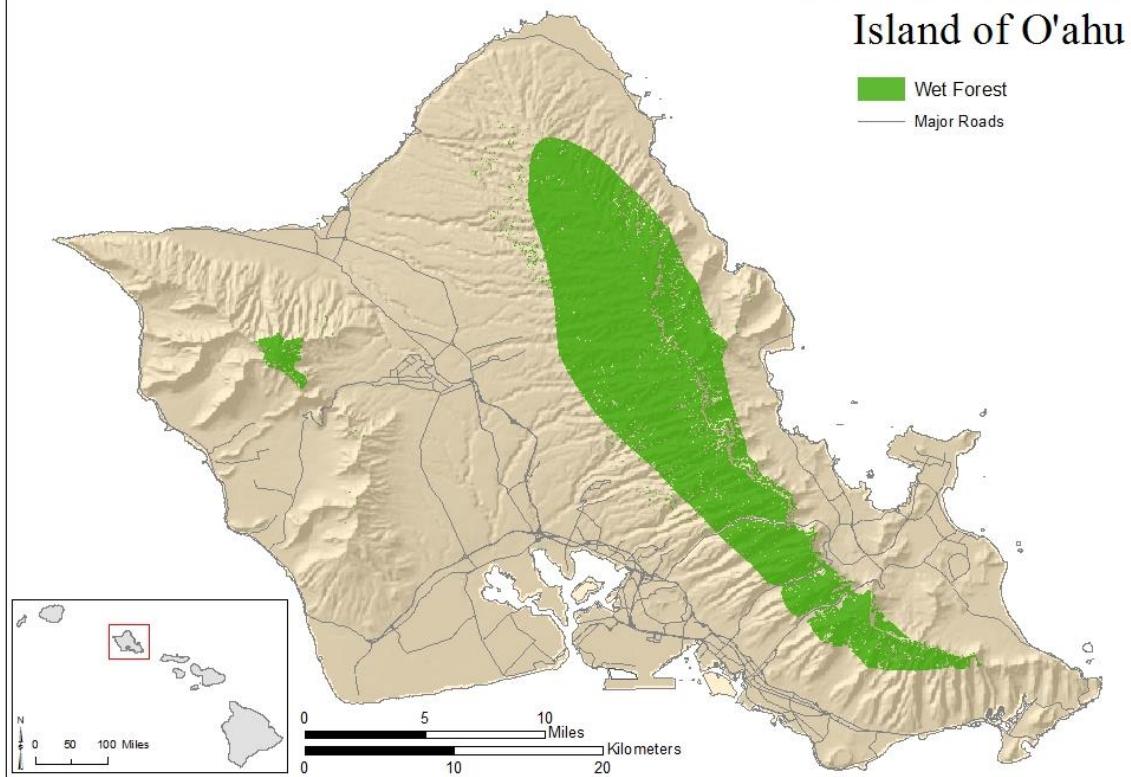


Wet Forest Habitat, Islands of Moloka'i, Lāna'i, Maui and Kaho'olawe

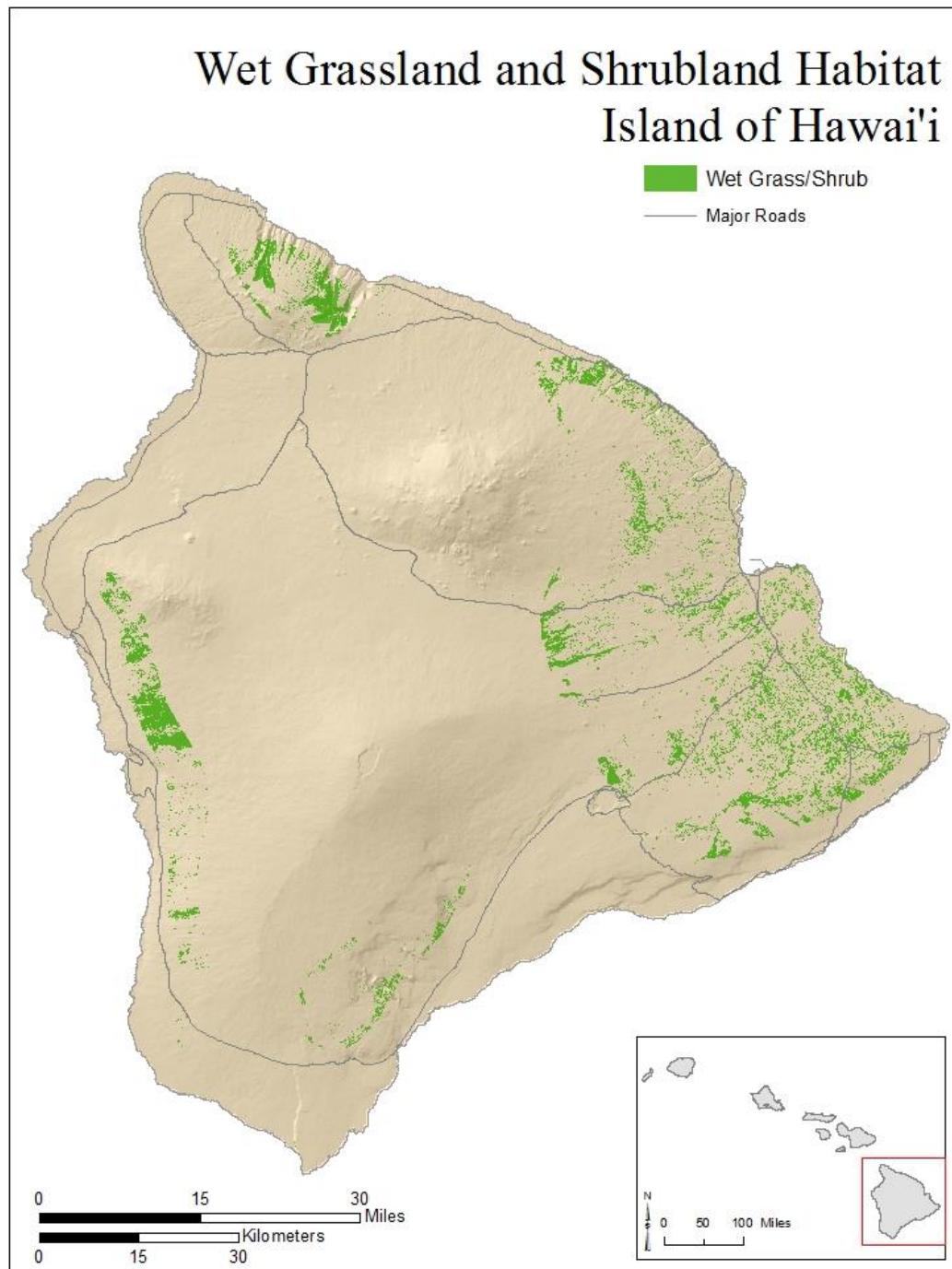


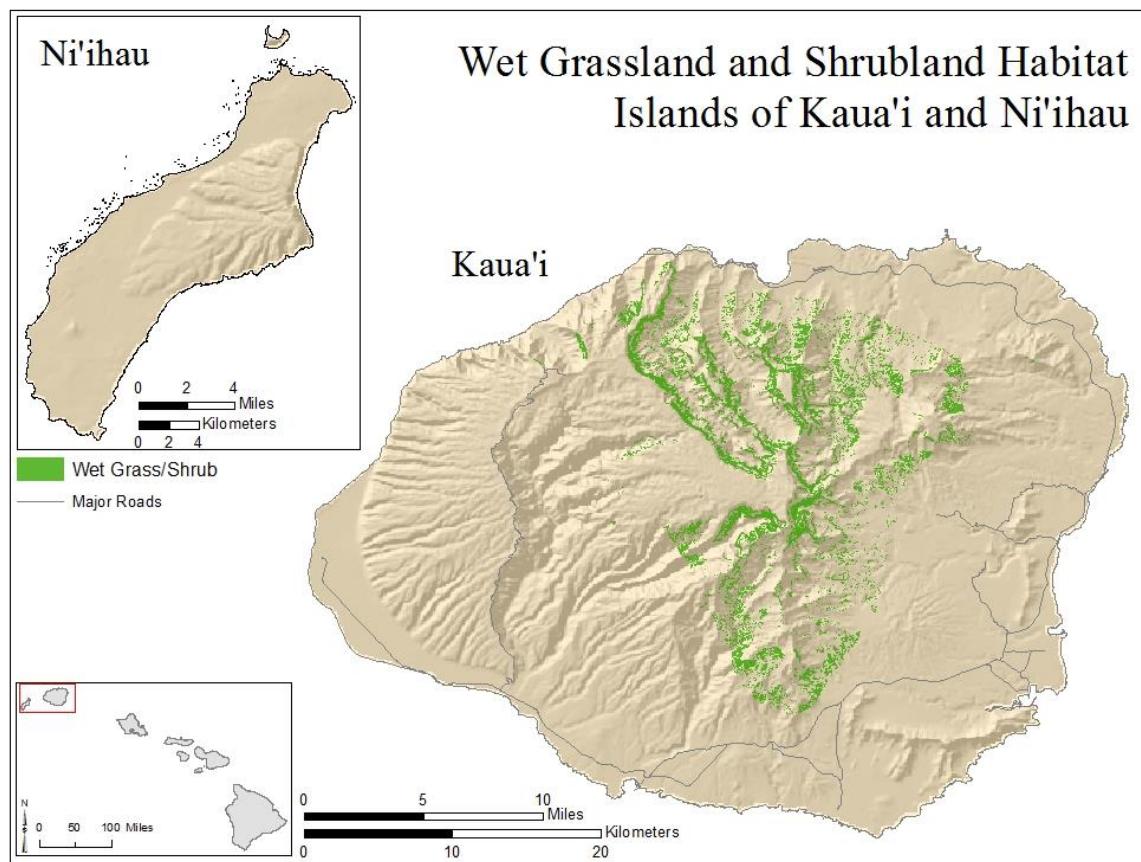
Wet Forest Habitat Island of O'ahu

Wet Forest
Major Roads

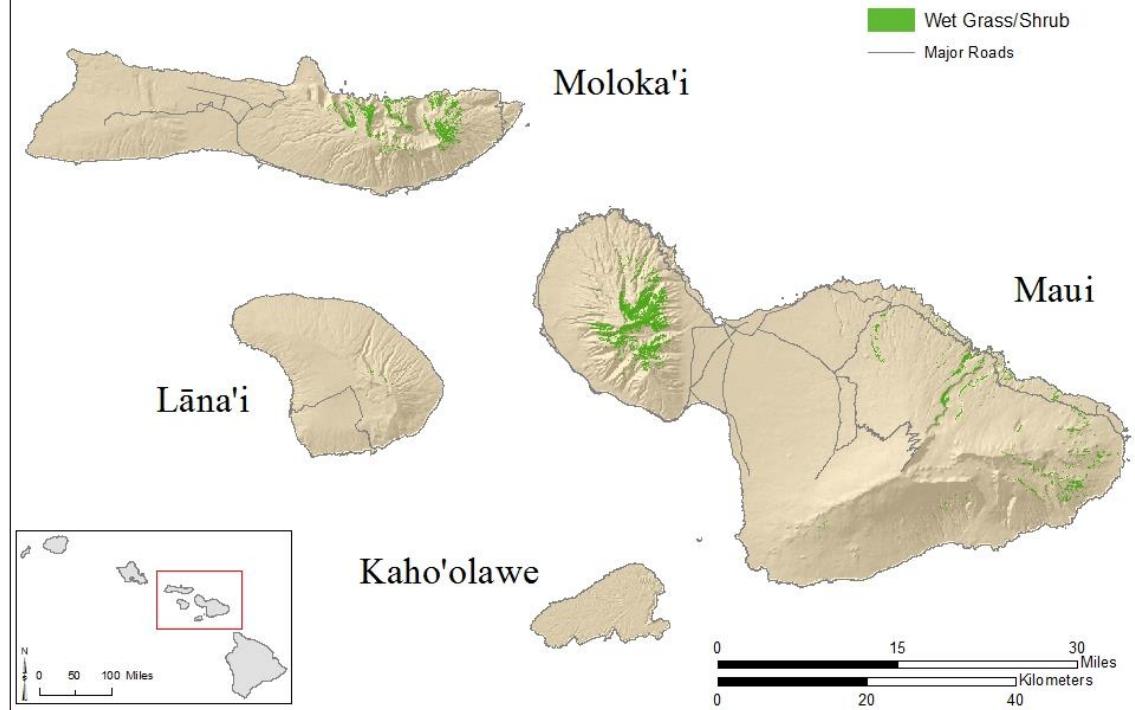


Wet Grassland and Shrubland—Pre-contact extent is not shown due to absence of habitat

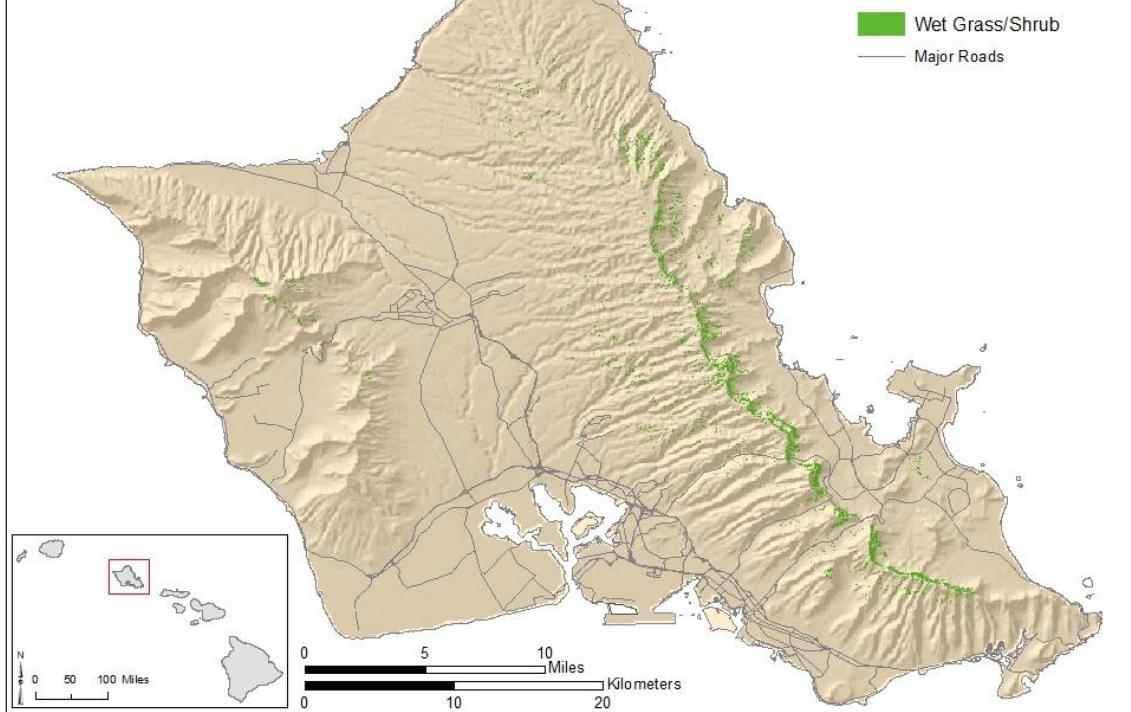




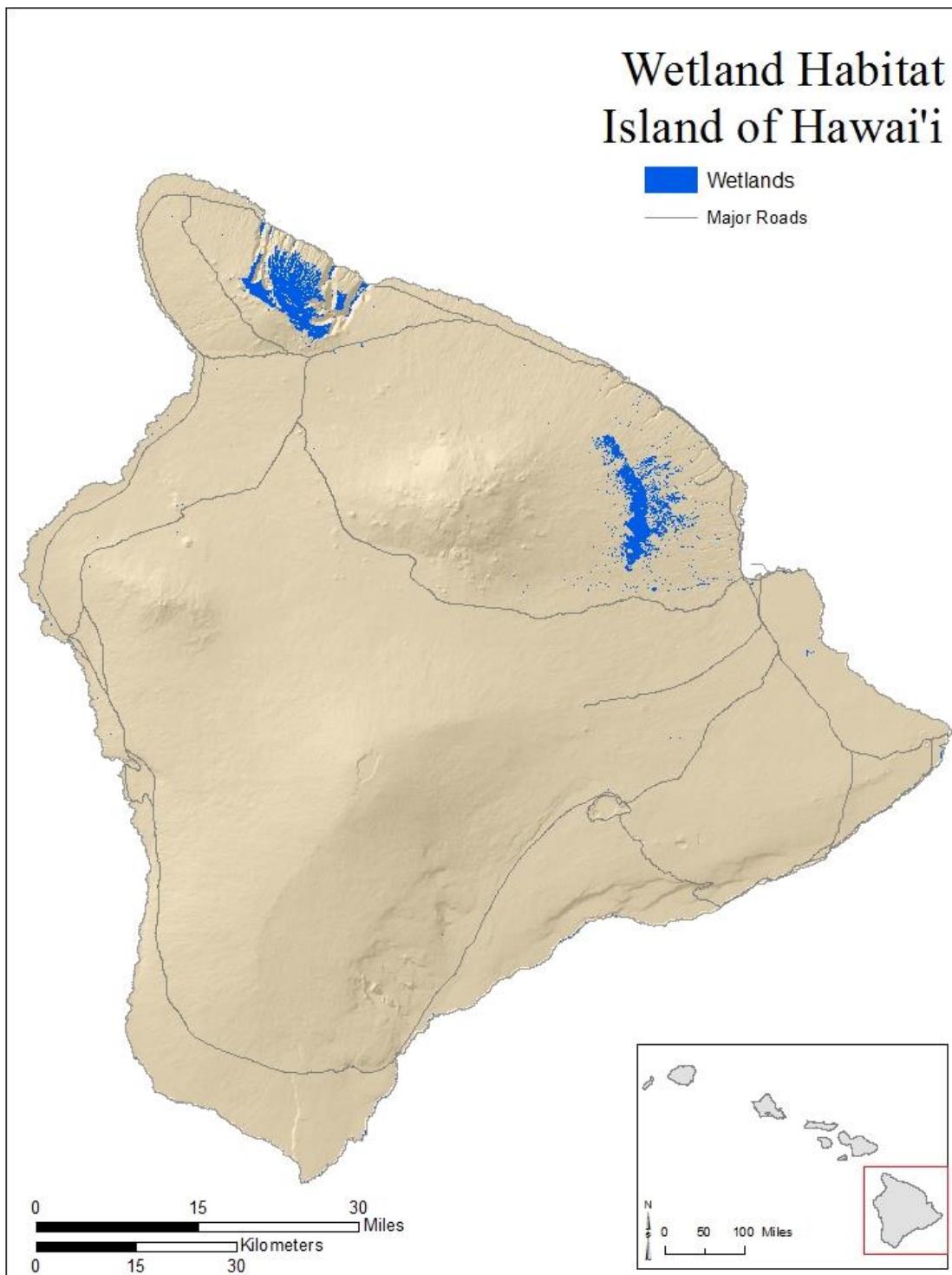
Wet Grassland and Shrubland Habitat, Islands of Moloka'i, Lāna'i, Maui and Kaho'olawe

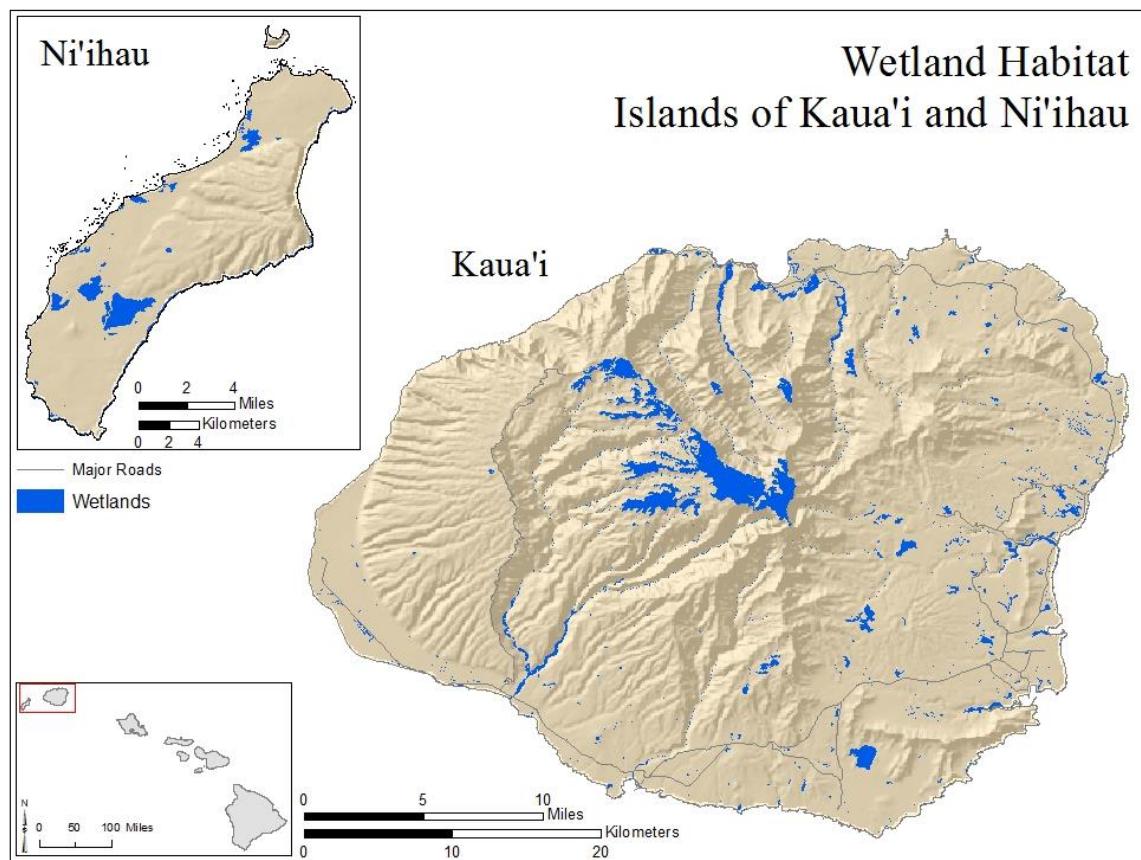


Wet Grassland and Shrubland Habitat Island of O'ahu

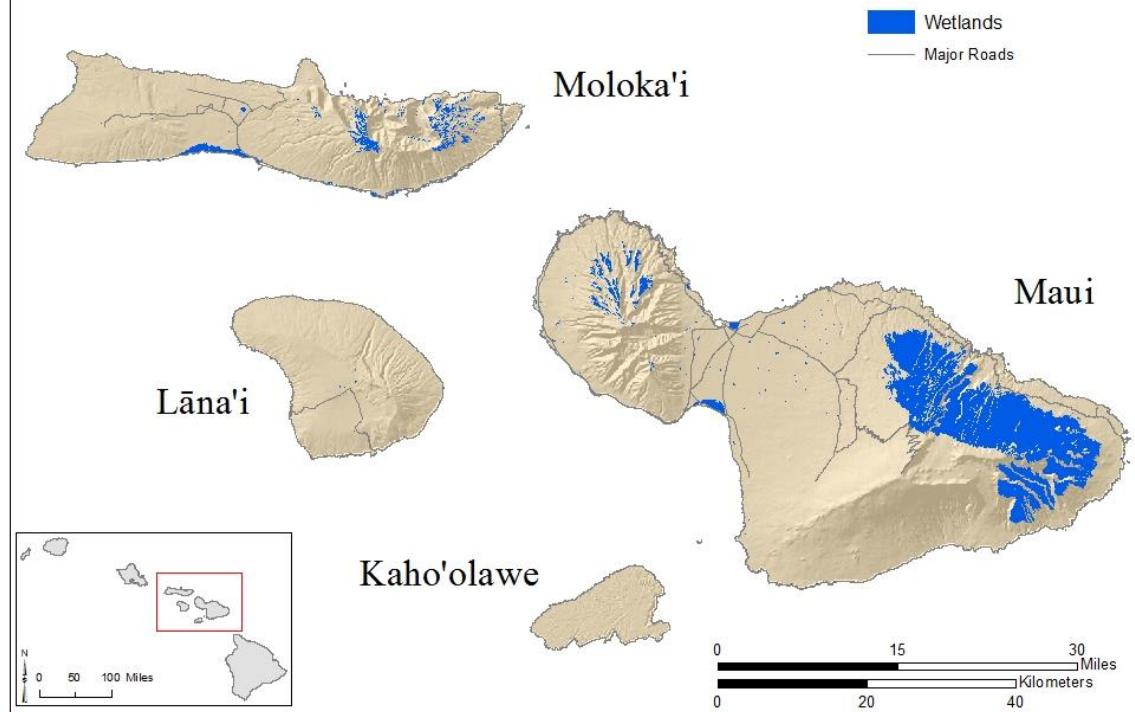


Wetlands



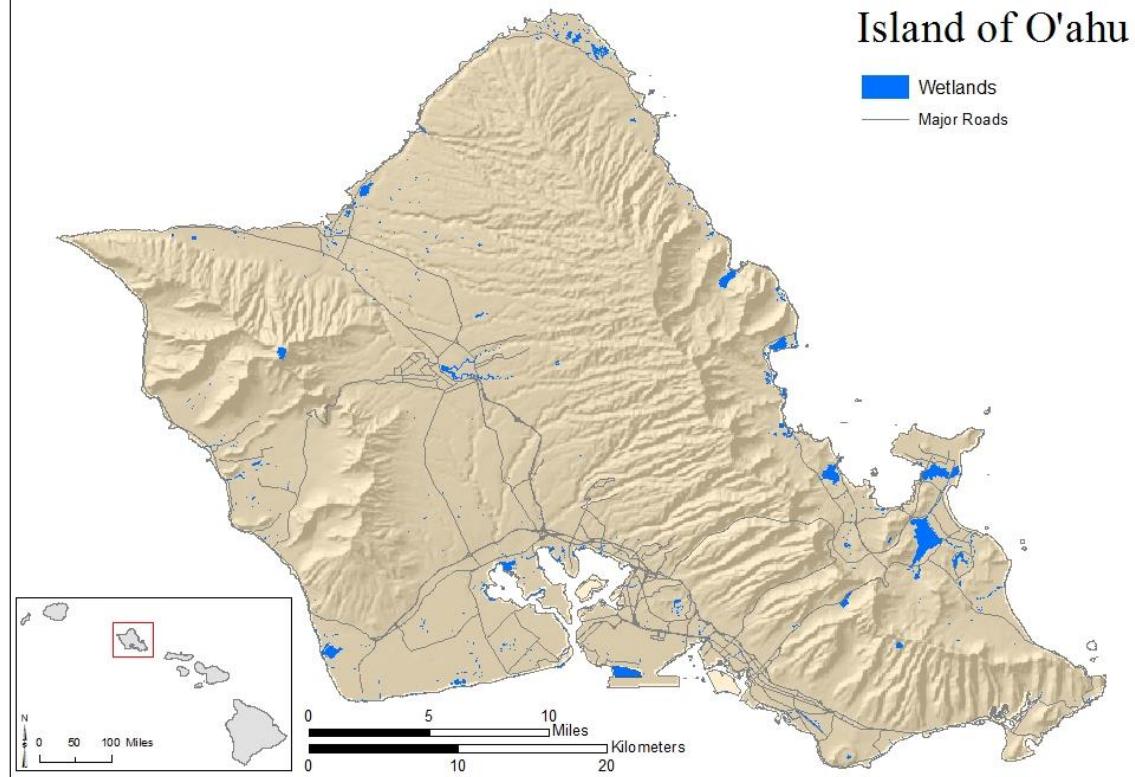


Wetland Habitat, Islands of Moloka'i, Lāna'i, Maui and Kaho'olawe



Wetland Habitat Island of O'ahu

■ Wetlands
— Major Roads



Appendix B. Simple Habitat Area Tables

Barren

Habitat	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Barren	Kahoolawe	5890	21	<1
Barren	Niihau	3718	8	<1
Barren	Lanai	1671	2	<1
Barren	Molokai	4393	3	<1
Barren	Kauai	20921	6	1
Barren	Oahu	1792	<1	<1
Barren	Maui	37949	8	1
Barren	Hawaii	695549	27	17

Coastal from USGS Coastal Vegetation Assessment

Coastal geospatial feature is a line feature, not a polygon feature, so the length summary would simply summarize the length of each islands coastline. This summary is not provided.

Coastal from USGS Carbon Assessment Layers

Habitat	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Coastal	Kahoolawe	13	<1	<1
Coastal	Molokai	28	<1	<1

Developed

Habitat	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Developed	Kahoolawe	149	1	<1
Developed	Niihau	332	1	<1
Developed	Lanai	3339	4	<1
Developed	Molokai	10418	6	<1
Developed	Kauai	63726	18	2
Developed	Oahu	122313	33	3
Developed	Maui	99478	22	2
Developed	Hawaii	172922	7	4

Dry Forest

Habitat	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Dry Forest	Kahoolawe	13657	48	<1
Dry Forest	Niihau	32624	71	1
Dry Forest	Lanai	31610	35	1
Dry Forest	Molokai	21281	13	1

Dry Forest	Kauai	11734	3	<1
Dry Forest	Oahu	25161	7	1
Dry Forest	Maui	35087	8	1
Dry Forest	Hawaii	92516	4	2

Dry Grassland and Shrubland

Habitat	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Dry Grasslands and Shrublands	Kahoolawe	8611	30	<1
Dry Grasslands and Shrublands	Niihau	6948	15	<1
Dry Grasslands and Shrublands	Lanai	46839	52	1
Dry Grasslands and Shrublands	Molokai	74744	46	2
Dry Grasslands and Shrublands	Kauai	33951	10	1
Dry Grasslands and Shrublands	Oahu	51029	14	1
Dry Grasslands and Shrublands	Maui	66058	14	2
Dry Grasslands and Shrublands	Hawaii	462042	18	11

Mesic Forest

Habitat	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Mesic Forest	Lanai	952	1	<1
Mesic Forest	Molokai	20052	12	<1
Mesic Forest	Kauai	74124	21	2
Mesic Forest	Oahu	80344	22	2
Mesic Forest	Maui	56363	12	1
Mesic Forest	Hawaii	203305	8	5

Mesic Grassland and Shrubland

Habitat	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Mesic Grasslands and Shrublands	Niihau	689	1	<1
Mesic Grasslands and Shrublands	Lanai	2198	2	<1
Mesic Grasslands and Shrublands	Molokai	9022	5	<1

Mesic Grasslands and Shrublands	Kauai	45416	13	1
Mesic Grasslands and Shrublands	Oahu	21043	6	1
Mesic Grasslands and Shrublands	Maui	54244	12	1
Mesic Grasslands and Shrublands	Hawaii	325322	13	8

Streams from State DAR Layers

Island	Island Stream Length (km)
Big Island	4059
Kahoolawe	177
Kauai	2624
Lanai	735
Maui	2033
Molokai	1194
Niihau	116
Oahu	2404

Wet Forest

Habitat	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Wet Forest	Lanai	3190	4	<1
Wet Forest	Molokai	17434	11	<1
Wet Forest	Kauai	85022	24	2
Wet Forest	Oahu	60916	16	1
Wet Forest	Maui	94246	20	2
Wet Forest	Hawaii	516109	20	13

Wet Grassland and Shrubland

Habitat	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Wet Grasslands and Shrublands	Lanai	64	<1	<1
Wet Grasslands and Shrublands	Molokai	5627	3	<1
Wet Grasslands and Shrublands	Kauai	17923	5	<1
Wet Grasslands and Shrublands	Oahu	5074	1	<1
Wet Grasslands and Shrublands	Maui	14643	3	<1

Wet Grasslands and Shrublands	Hawaii	114971	4	3
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Wetlands from NOAA Layers

Island	Acres of Wetlands on Island
Hawaii	15791
Kauai	8297
Lanai	213
Maui	6106
Molokai	4814
Niihau	1533
Oahu	3218

Wetlands from USGS Layers

Habitat	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Wetland	Niihau	1549	3	<1
Wetland	Lanai	45	<1	<1
Wetland	Molokai	1156	1	<1
Wetland	Kauai	1948	1	<1
Wetland	Oahu	3136	1	<1
Wetland	Maui	1818	<1	<1
Wetland	Hawaii	1182	<1	<1

Appendix C. Habitat Quality Tables

Barren

Habitat	Habitat Quality	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Barren	Bare or <5% Vegetation	Govt. Federal	Kahoolawe	6	<1	<1
Barren	Native Non-native Mix	Govt. Federal	Kahoolawe	1	<1	<1
Barren	No Data	Govt. Federal	Kahoolawe	1	<1	<1
Barren	Heavily Disturbed	Govt. State	Kahoolawe	2	<1	<1
Barren	Bare or <5% Vegetation	Govt. State	Kahoolawe	5169	18	<1
Barren	Native Non-native Mix	Govt. State	Kahoolawe	691	2	<1
Barren	No Data	Govt. State	Kahoolawe	21	<1	<1
Barren	Bare or <5% Vegetation	Private	Niihau	1988	4	<1
Barren	Native Non-native Mix	Private	Niihau	1564	3	<1
Barren	No Data	Private	Niihau	166	<1	<1
Barren	Bare or <5% Vegetation	Govt. Federal	Lanai	4	<1	<1
Barren	Native Non-native Mix	Govt. Federal	Lanai	1	<1	<1
Barren	No Data	Govt. Federal	Lanai	1	<1	<1
Barren	Bare or <5% Vegetation	Govt. Local	Lanai	1	<1	<1
Barren	Native Non-native Mix	Govt. Local	Lanai	<1	<1	<1
Barren	Heavily Disturbed	Govt. State	Lanai	1	<1	<1
Barren	Bare or <5% Vegetation	Govt. State	Lanai	1	<1	<1
Barren	Native Non-native Mix	Govt. State	Lanai	1	<1	<1
Barren	No Data	Govt. State	Lanai	2	<1	<1
Barren	Heavily Disturbed	Private	Lanai	57	<1	<1
Barren	Bare or <5% Vegetation	Private	Lanai	878	1	<1
Barren	Native Non-native Mix	Private	Lanai	659	1	<1
Barren	Native Dominated	Private	Lanai	2	<1	<1
Barren	No Data	Private	Lanai	63	<1	<1
Barren	Heavily Disturbed	Govt. Federal	Molokai	<1	<1	<1
Barren	Bare or <5% Vegetation	Govt. Federal	Molokai	6	<1	<1

Barren	Native Non-native Mix	Govt. Federal	Molokai	2	<1	<1
Barren	No Data	Govt. Federal	Molokai	1	<1	<1
Barren	Heavily Disturbed	Govt. Local	Molokai	<1	<1	<1
Barren	No Data	Govt. Local	Molokai	<1	<1	<1
Barren	Heavily Disturbed	Govt. State	Molokai	52	<1	<1
Barren	Bare or <5% Vegetation	Govt. State	Molokai	433	<1	<1
Barren	Native Non-native Mix	Govt. State	Molokai	890	1	<1
Barren	Native Dominated	Govt. State	Molokai	54	<1	<1
Barren	No Data	Govt. State	Molokai	34	<1	<1
Barren	Heavily Disturbed	Private	Molokai	113	<1	<1
Barren	Bare or <5% Vegetation	Private	Molokai	1060	1	<1
Barren	Native Non-native Mix	Private	Molokai	1627	1	<1
Barren	Native Dominated	Private	Molokai	64	<1	<1
Barren	No Data	Private	Molokai	56	<1	<1
Barren	Heavily Disturbed	Govt. Federal	Kauai	195	<1	<1
Barren	Bare or <5% Vegetation	Govt. Federal	Kauai	185	<1	<1
Barren	Native Non-native Mix	Govt. Federal	Kauai	178	<1	<1
Barren	No Data	Govt. Federal	Kauai	89	<1	<1
Barren	Heavily Disturbed	Govt. Local	Kauai	19	<1	<1
Barren	Bare or <5% Vegetation	Govt. Local	Kauai	13	<1	<1
Barren	Native Non-native Mix	Govt. Local	Kauai	28	<1	<1
Barren	No Data	Govt. Local	Kauai	3	<1	<1
Barren	Heavily Disturbed	Govt. State	Kauai	514	<1	<1
Barren	Bare or <5% Vegetation	Govt. State	Kauai	2623	1	<1
Barren	Native Non-native Mix	Govt. State	Kauai	8697	2	<1

Barren	Native Dominated	Govt. State	Kauai	125	<1	<1
Barren	No Data	Govt. State	Kauai	133	<1	<1
Barren	Heavily Disturbed	No Data	Kauai	38	<1	<1
Barren	Bare or <5% Vegetation	No Data	Kauai	1	<1	<1
Barren	Native Non-native Mix	No Data	Kauai	38	<1	<1
Barren	Native Dominated	No Data	Kauai	<1	<1	<1
Barren	No Data	No Data	Kauai	7	<1	<1
Barren	Heavily Disturbed	Private	Kauai	1576	<1	<1
Barren	Bare or <5% Vegetation	Private	Kauai	1015	<1	<1
Barren	Native Non-native Mix	Private	Kauai	5169	1	<1
Barren	Native Dominated	Private	Kauai	134	<1	<1
Barren	No Data	Private	Kauai	140	<1	<1
Barren	Heavily Disturbed	Govt. Federal	Oahu	44	<1	<1
Barren	Bare or <5% Vegetation	Govt. Federal	Oahu	53	<1	<1
Barren	Native Non-native Mix	Govt. Federal	Oahu	119	<1	<1
Barren	Native Dominated	Govt. Federal	Oahu	2	<1	<1
Barren	No Data	Govt. Federal	Oahu	9	<1	<1
Barren	Heavily Disturbed	Govt. Local	Oahu	53	<1	<1
Barren	Bare or <5% Vegetation	Govt. Local	Oahu	22	<1	<1
Barren	Native Non-native Mix	Govt. Local	Oahu	82	<1	<1
Barren	Native Dominated	Govt. Local	Oahu	2	<1	<1
Barren	No Data	Govt. Local	Oahu	23	<1	<1
Barren	Heavily Disturbed	Govt. State	Oahu	54	<1	<1
Barren	Bare or <5% Vegetation	Govt. State	Oahu	80	<1	<1
Barren	Native Non-native Mix	Govt. State	Oahu	220	<1	<1

Barren	Native Dominated	Govt. State	Oahu	8	<1	<1
Barren	No Data	Govt. State	Oahu	99	<1	<1
Barren	Heavily Disturbed	No Data	Oahu	32	<1	<1
Barren	Bare or <5% Vegetation	No Data	Oahu	4	<1	<1
Barren	Native Non-native Mix	No Data	Oahu	9	<1	<1
Barren	No Data	No Data	Oahu	1	<1	<1
Barren	Heavily Disturbed	Private	Oahu	410	<1	<1
Barren	Bare or <5% Vegetation	Private	Oahu	65	<1	<1
Barren	Native Non-native Mix	Private	Oahu	306	<1	<1
Barren	Native Dominated	Private	Oahu	10	<1	<1
Barren	No Data	Private	Oahu	82	<1	<1
Barren	Heavily Disturbed	Govt. Federal	Maui	31	<1	<1
Barren	Bare or <5% Vegetation	Govt. Federal	Maui	6741	1	<1
Barren	Native Non-native Mix	Govt. Federal	Maui	1015	<1	<1
Barren	Native Dominated	Govt. Federal	Maui	1096	<1	<1
Barren	No Data	Govt. Federal	Maui	7	<1	<1
Barren	Heavily Disturbed	Govt. Local	Maui	25	<1	<1
Barren	Bare or <5% Vegetation	Govt. Local	Maui	6	<1	<1
Barren	Native Non-native Mix	Govt. Local	Maui	49	<1	<1
Barren	Native Dominated	Govt. Local	Maui	1	<1	<1
Barren	No Data	Govt. Local	Maui	9	<1	<1
Barren	Heavily Disturbed	Govt. State	Maui	143	<1	<1
Barren	Bare or <5% Vegetation	Govt. State	Maui	7800	2	<1
Barren	Native Non-native Mix	Govt. State	Maui	6558	1	<1
Barren	Native Dominated	Govt. State	Maui	292	<1	<1

Barren	No Data	Govt. State	Maui	154	<1	<1
Barren	Heavily Disturbed	No Data	Maui	1	<1	<1
Barren	Native Non-native Mix	No Data	Maui	1	<1	<1
Barren	No Data	No Data	Maui	<1	<1	<1
Barren	Heavily Disturbed	Private	Maui	846	<1	<1
Barren	Bare or <5% Vegetation	Private	Maui	1792	<1	<1
Barren	Native Non-native Mix	Private	Maui	10949	2	<1
Barren	Native Dominated	Private	Maui	337	<1	<1
Barren	No Data	Private	Maui	96	<1	<1
Barren	Heavily Disturbed	Govt. Federal	Hawaii	400	<1	<1
Barren	Bare or <5% Vegetation	Govt. Federal	Hawaii	223649	9	5
Barren	Native Non-native Mix	Govt. Federal	Hawaii	2564	<1	<1
Barren	Native Dominated	Govt. Federal	Hawaii	7209	<1	<1
Barren	No Data	Govt. Federal	Hawaii	50	<1	<1
Barren	Heavily Disturbed	Govt. Local	Hawaii	105	<1	<1
Barren	Bare or <5% Vegetation	Govt. Local	Hawaii	415	<1	<1
Barren	Native Non-native Mix	Govt. Local	Hawaii	316	<1	<1
Barren	Native Dominated	Govt. Local	Hawaii	17	<1	<1
Barren	No Data	Govt. Local	Hawaii	15	<1	<1
Barren	Heavily Disturbed	Govt. State	Hawaii	2595	<1	<1
Barren	Bare or <5% Vegetation	Govt. State	Hawaii	222909	9	5
Barren	Native Non-native Mix	Govt. State	Hawaii	22948	1	1
Barren	Native Dominated	Govt. State	Hawaii	48355	2	1
Barren	No Data	Govt. State	Hawaii	384	<1	<1
Barren	Heavily Disturbed	No Data	Hawaii	497	<1	<1

Barren	Bare or <5% Vegetation	No Data	Hawaii	486	<1	<1
Barren	Native Non-native Mix	No Data	Hawaii	253	<1	<1
Barren	Native Dominated	No Data	Hawaii	22	<1	<1
Barren	No Data	No Data	Hawaii	17	<1	<1
Barren	Heavily Disturbed	Private	Hawaii	6555	<1	<1
Barren	Bare or <5% Vegetation	Private	Hawaii	99717	4	2
Barren	Native Non-native Mix	Private	Hawaii	27635	1	1
Barren	Native Dominated	Private	Hawaii	28023	1	1
Barren	No Data	Private	Hawaii	412	<1	<1

Coastal from USGS Coastal Vegetation Assessment

Habitat Quality	Island	Coastline Length (km)	Length (% of State Coastline)	Length (% of Island Coastline)
High Quality	Kahoolawe	4	<1	6
Poor Quality	Kahoolawe	61	3	92
Very High Quality	Kahoolawe	2	<1	3
High Quality	Lanai	4	<1	4
Moderate Quality	Lanai	6	<1	7
Poor Quality	Lanai	81	5	90
High Quality	Kauai	56	3	29
Moderate Quality	Kauai	47	3	25
Poor Quality	Kauai	56	3	29
Very High Quality	Kauai	32	2	17
High Quality	Molokai	25	1	13
Moderate Quality	Molokai	19	1	10
Poor Quality	Molokai	105	6	54
Very High Quality	Molokai	47	3	24
High Quality	Maui	31	2	11
Moderate Quality	Maui	44	2	15

Poor Quality	Maui	133	7	46
Very High Quality	Maui	83	5	28
High Quality	Oahu	14	1	4
Moderate Quality	Oahu	17	1	5
Poor Quality	Oahu	312	18	83
Very High Quality	Oahu	31	2	8
High Quality	Hawaii	29	2	5
Moderate Quality	Hawaii	196	11	35
Poor Quality	Hawaii	332	19	59
Very High Quality	Hawaii	9	1	2

Coastal from USGS Carbon Assessment Layers

Habitat	Habitat Quality	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Coastal	Bare or <5% Vegetation	Govt. State	Kahoolawe	6	<1	<1
Coastal	Native Non-native Mix	Govt. State	Kahoolawe	7	<1	<1
Coastal	No Data	Govt. State	Kahoolawe	<1	<1	<1
Coastal	Heavily Disturbed	Govt. State	Molokai	4	<1	<1
Coastal	Bare or <5% Vegetation	Govt. State	Molokai	2	<1	<1
Coastal	Native Non-native Mix	Govt. State	Molokai	3	<1	<1
Coastal	Native Dominated	Govt. State	Molokai	20	<1	<1

Developed

Habitat	Habitat Quality	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Developed	Heavily Disturbed	Govt. State	Kahoolawe	9	<1	<1
Developed	Bare or <5% Vegetation	Govt. State	Kahoolawe	14	<1	<1

Developed	Native Non-native Mix	Govt. State	Kahoolawe	125	<1	<1
Developed	No Data	Govt. State	Kahoolawe	1	<1	<1
Developed	Heavily Disturbed	Private	Niihau	85	<1	<1
Developed	Bare or <5% Vegetation	Private	Niihau	1	<1	<1
Developed	Native Non-native Mix	Private	Niihau	246	1	<1
Developed	No Data	Private	Niihau	<1	<1	<1
Developed	Heavily Disturbed	Govt. Federal	Lanai	<1	<1	<1
Developed	Heavily Disturbed	Govt. Local	Lanai	39	<1	<1
Developed	Bare or <5% Vegetation	Govt. Local	Lanai	<1	<1	<1
Developed	Native Non-native Mix	Govt. Local	Lanai	6	<1	<1
Developed	Native Dominated	Govt. Local	Lanai	1	<1	<1
Developed	Heavily Disturbed	Govt. State	Lanai	190	<1	<1
Developed	Native Non-native Mix	Govt. State	Lanai	1	<1	<1
Developed	No Data	Govt. State	Lanai	<1	<1	<1
Developed	Heavily Disturbed	Private	Lanai	2375	3	<1
Developed	Bare or <5% Vegetation	Private	Lanai	8	<1	<1
Developed	Native Non-native Mix	Private	Lanai	682	1	<1
Developed	Native Dominated	Private	Lanai	34	<1	<1
Developed	No Data	Private	Lanai	1	<1	<1
Developed	Heavily Disturbed	Govt. Federal	Molokai	45	<1	<1

Developed	Bare or <5% Vegetation	Govt. Federal	Molokai	<1	<1	<1
Developed	Native Non-native Mix	Govt. Federal	Molokai	8	<1	<1
Developed	No Data	Govt. Federal	Molokai	<1	<1	<1
Developed	Heavily Disturbed	Govt. Local	Molokai	93	<1	<1
Developed	Native Non-native Mix	Govt. Local	Molokai	4	<1	<1
Developed	No Data	Govt. Local	Molokai	<1	<1	<1
Developed	Heavily Disturbed	Govt. State	Molokai	2996	2	<1
Developed	Bare or <5% Vegetation	Govt. State	Molokai	7	<1	<1
Developed	Native Non-native Mix	Govt. State	Molokai	1113	1	<1
Developed	Native Dominated	Govt. State	Molokai	21	<1	<1
Developed	No Data	Govt. State	Molokai	2	<1	<1
Developed	Heavily Disturbed	Private	Molokai	4074	2	<1
Developed	Bare or <5% Vegetation	Private	Molokai	64	<1	<1
Developed	Native Non-native Mix	Private	Molokai	1980	1	<1
Developed	Native Dominated	Private	Molokai	10	<1	<1
Developed	No Data	Private	Molokai	1	<1	<1
Developed	Heavily Disturbed	Govt. Federal	Kauai	1110	<1	<1
Developed	Bare or <5% Vegetation	Govt. Federal	Kauai	1	<1	<1
Developed	Native Non-native Mix	Govt. Federal	Kauai	100	<1	<1
Developed	No Data	Govt. Federal	Kauai	<1	<1	<1

Developed	Heavily Disturbed	Govt. Local	Kauai	487	<1	<1
Developed	Bare or <5% Vegetation	Govt. Local	Kauai	<1	<1	<1
Developed	Native Non-native Mix	Govt. Local	Kauai	30	<1	<1
Developed	No Data	Govt. Local	Kauai	1	<1	<1
Developed	Heavily Disturbed	Govt. State	Kauai	18211	5	<1
Developed	Bare or <5% Vegetation	Govt. State	Kauai	7	<1	<1
Developed	Native Non-native Mix	Govt. State	Kauai	1108	<1	<1
Developed	Native Dominated	Govt. State	Kauai	334	<1	<1
Developed	No Data	Govt. State	Kauai	4	<1	<1
Developed	Heavily Disturbed	No Data	Kauai	2570	1	<1
Developed	Bare or <5% Vegetation	No Data	Kauai	<1	<1	<1
Developed	Native Non-native Mix	No Data	Kauai	187	<1	<1
Developed	Native Dominated	No Data	Kauai	7	<1	<1
Developed	No Data	No Data	Kauai	1	<1	<1
Developed	Heavily Disturbed	Private	Kauai	37430	11	1
Developed	Bare or <5% Vegetation	Private	Kauai	3	<1	<1
Developed	Native Non-native Mix	Private	Kauai	2119	1	<1
Developed	Native Dominated	Private	Kauai	2	<1	<1
Developed	No Data	Private	Kauai	16	<1	<1
Developed	Heavily Disturbed	Govt. Federal	Oahu	18554	5	<1

Developed	Bare or <5% Vegetation	Govt. Federal	Oahu	2	<1	<1
Developed	Native Non-native Mix	Govt. Federal	Oahu	2318	1	<1
Developed	Native Dominated	Govt. Federal	Oahu	4	<1	<1
Developed	No Data	Govt. Federal	Oahu	12	<1	<1
Developed	Heavily Disturbed	Govt. Local	Oahu	4639	1	<1
Developed	Bare or <5% Vegetation	Govt. Local	Oahu	1	<1	<1
Developed	Native Non-native Mix	Govt. Local	Oahu	669	<1	<1
Developed	Native Dominated	Govt. Local	Oahu	3	<1	<1
Developed	No Data	Govt. Local	Oahu	1	<1	<1
Developed	Heavily Disturbed	Govt. State	Oahu	10326	3	<1
Developed	Bare or <5% Vegetation	Govt. State	Oahu	4	<1	<1
Developed	Native Non-native Mix	Govt. State	Oahu	1299	<1	<1
Developed	Native Dominated	Govt. State	Oahu	20	<1	<1
Developed	No Data	Govt. State	Oahu	32	<1	<1
Developed	Heavily Disturbed	No Data	Oahu	2126	1	<1
Developed	Bare or <5% Vegetation	No Data	Oahu	<1	<1	<1
Developed	Native Non-native Mix	No Data	Oahu	80	<1	<1
Developed	No Data	No Data	Oahu	1	<1	<1
Developed	Heavily Disturbed	Private	Oahu	77920	21	2
Developed	Bare or <5% Vegetation	Private	Oahu	4	<1	<1

Developed	Native Non-native Mix	Private	Oahu	4245	1	<1
Developed	Native Dominated	Private	Oahu	7	<1	<1
Developed	No Data	Private	Oahu	48	<1	<1
Developed	Heavily Disturbed	Govt. Federal	Maui	240	<1	<1
Developed	Bare or <5% Vegetation	Govt. Federal	Maui	2	<1	<1
Developed	Native Non-native Mix	Govt. Federal	Maui	15	<1	<1
Developed	Native Dominated	Govt. Federal	Maui	47	<1	<1
Developed	No Data	Govt. Federal	Maui	<1	<1	<1
Developed	Heavily Disturbed	Govt. Local	Maui	2127	<1	<1
Developed	Bare or <5% Vegetation	Govt. Local	Maui	1	<1	<1
Developed	Native Non-native Mix	Govt. Local	Maui	58	<1	<1
Developed	Native Dominated	Govt. Local	Maui	<1	<1	<1
Developed	No Data	Govt. Local	Maui	1	<1	<1
Developed	Heavily Disturbed	Govt. State	Maui	6746	1	<1
Developed	Bare or <5% Vegetation	Govt. State	Maui	15	<1	<1
Developed	Native Non-native Mix	Govt. State	Maui	578	<1	<1
Developed	Native Dominated	Govt. State	Maui	59	<1	<1
Developed	No Data	Govt. State	Maui	8	<1	<1
Developed	Heavily Disturbed	No Data	Maui	6	<1	<1
Developed	Native Non-native Mix	No Data	Maui	4	<1	<1
Developed	No Data	No Data	Maui	<1	<1	<1

Developed	Heavily Disturbed	Private	Maui	86235	19	2
Developed	Bare or <5% Vegetation	Private	Maui	15	<1	<1
Developed	Native Non-native Mix	Private	Maui	3253	1	<1
Developed	Native Dominated	Private	Maui	63	<1	<1
Developed	No Data	Private	Maui	5	<1	<1
Developed	Heavily Disturbed	Govt. Federal	Hawaii	446	<1	<1
Developed	Bare or <5% Vegetation	Govt. Federal	Hawaii	36	<1	<1
Developed	Native Non-native Mix	Govt. Federal	Hawaii	402	<1	<1
Developed	Native Dominated	Govt. Federal	Hawaii	764	<1	<1
Developed	No Data	Govt. Federal	Hawaii	<1	<1	<1
Developed	Heavily Disturbed	Govt. Local	Hawaii	746	<1	<1
Developed	Bare or <5% Vegetation	Govt. Local	Hawaii	3	<1	<1
Developed	Native Non-native Mix	Govt. Local	Hawaii	167	<1	<1
Developed	Native Dominated	Govt. Local	Hawaii	22	<1	<1
Developed	No Data	Govt. Local	Hawaii	1	<1	<1
Developed	Heavily Disturbed	Govt. State	Hawaii	17450	1	<1
Developed	Bare or <5% Vegetation	Govt. State	Hawaii	239	<1	<1
Developed	Native Non-native Mix	Govt. State	Hawaii	5813	<1	<1
Developed	Native Dominated	Govt. State	Hawaii	2460	<1	<1
Developed	No Data	Govt. State	Hawaii	8	<1	<1
Developed	Heavily Disturbed	No Data	Hawaii	5755	<1	<1

Developed	Bare or <5% Vegetation	No Data	Hawaii	83	<1	<1
Developed	Native Non-native Mix	No Data	Hawaii	655	<1	<1
Developed	Native Dominated	No Data	Hawaii	142	<1	<1
Developed	No Data	No Data	Hawaii	1	<1	<1
Developed	Heavily Disturbed	Private	Hawaii	116521	5	3
Developed	Bare or <5% Vegetation	Private	Hawaii	332	<1	<1
Developed	Native Non-native Mix	Private	Hawaii	13934	1	<1
Developed	Native Dominated	Private	Hawaii	6933	<1	<1
Developed	No Data	Private	Hawaii	7	<1	<1

Dry Forest

Habitat	Habitat Quality	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Dry Forest	Bare or <5% Vegetation	Govt. Federal	Kahoolawe	7	<1	<1
Dry Forest	Native Non-native Mix	Govt. Federal	Kahoolawe	5	<1	<1
Dry Forest	Heavily Disturbed	Govt. State	Kahoolawe	9	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. State	Kahoolawe	577	2	<1
Dry Forest	Native Non-native Mix	Govt. State	Kahoolawe	13051	46	<1
Dry Forest	No Data	Govt. State	Kahoolawe	9	<1	<1
Dry Forest	Heavily Disturbed	Private	Niihau	4	<1	<1
Dry Forest	Bare or <5% Vegetation	Private	Niihau	1052	2	<1
Dry Forest	Native Non-native Mix	Private	Niihau	31563	69	1
Dry Forest	No Data	Private	Niihau	5	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. Federal	Lanai	<1	<1	<1

Dry Forest	Native Non-native Mix	Govt. Federal	Lanai	1	<1	<1
Dry Forest	Heavily Disturbed	Govt. Local	Lanai	4	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. Local	Lanai	6	<1	<1
Dry Forest	Native Non-native Mix	Govt. Local	Lanai	20	<1	<1
Dry Forest	Heavily Disturbed	Govt. State	Lanai	22	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. State	Lanai	<1	<1	<1
Dry Forest	Native Non-native Mix	Govt. State	Lanai	3	<1	<1
Dry Forest	Heavily Disturbed	Private	Lanai	1907	2	<1
Dry Forest	Bare or <5% Vegetation	Private	Lanai	1268	1	<1
Dry Forest	Native Non-native Mix	Private	Lanai	28295	31	1
Dry Forest	Native Dominated	Private	Lanai	82	<1	<1
Dry Forest	No Data	Private	Lanai	2	<1	<1
Dry Forest	Heavily Disturbed	Govt. Federal	Molokai	3	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. Federal	Molokai	2	<1	<1
Dry Forest	Native Non-native Mix	Govt. Federal	Molokai	42	<1	<1
Dry Forest	No Data	Govt. Federal	Molokai	<1	<1	<1
Dry Forest	Heavily Disturbed	Govt. Local	Molokai	11	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. Local	Molokai	1	<1	<1
Dry Forest	Native Non-native Mix	Govt. Local	Molokai	39	<1	<1
Dry Forest	Heavily Disturbed	Govt. State	Molokai	303	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. State	Molokai	95	<1	<1
Dry Forest	Native Non-native Mix	Govt. State	Molokai	3719	2	<1
Dry Forest	Native Dominated	Govt. State	Molokai	34	<1	<1

Dry Forest	No Data	Govt. State	Moloka'i	1	<1	<1
Dry Forest	Heavily Disturbed	Private	Moloka'i	1031	1	<1
Dry Forest	Bare or <5% Vegetation	Private	Moloka'i	499	<1	<1
Dry Forest	Native Non-native Mix	Private	Moloka'i	15339	9	<1
Dry Forest	Native Dominated	Private	Moloka'i	159	<1	<1
Dry Forest	No Data	Private	Moloka'i	2	<1	<1
Dry Forest	Heavily Disturbed	Govt. Federal	Kauai	159	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. Federal	Kauai	8	<1	<1
Dry Forest	Native Non-native Mix	Govt. Federal	Kauai	423	<1	<1
Dry Forest	Heavily Disturbed	Govt. Local	Kauai	31	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. Local	Kauai	2	<1	<1
Dry Forest	Native Non-native Mix	Govt. Local	Kauai	26	<1	<1
Dry Forest	Heavily Disturbed	Govt. State	Kauai	576	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. State	Kauai	100	<1	<1
Dry Forest	Native Non-native Mix	Govt. State	Kauai	5304	1	<1
Dry Forest	Native Dominated	Govt. State	Kauai	23	<1	<1
Dry Forest	No Data	Govt. State	Kauai	<1	<1	<1
Dry Forest	Heavily Disturbed	No Data	Kauai	38	<1	<1
Dry Forest	Bare or <5% Vegetation	No Data	Kauai	<1	<1	<1
Dry Forest	Native Non-native Mix	No Data	Kauai	88	<1	<1
Dry Forest	Native Dominated	No Data	Kauai	<1	<1	<1
Dry Forest	No Data	No Data	Kauai	<1	<1	<1
Dry Forest	Heavily Disturbed	Private	Kauai	1225	<1	<1

Dry Forest	Bare or <5% Vegetation	Private	Kauai	42	<1	<1
Dry Forest	Native Non-native Mix	Private	Kauai	3687	1	<1
Dry Forest	No Data	Private	Kauai	1	<1	<1
Dry Forest	Heavily Disturbed	Govt. Federal	Oahu	639	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. Federal	Oahu	6	<1	<1
Dry Forest	Native Non-native Mix	Govt. Federal	Oahu	4970	1	<1
Dry Forest	Native Dominated	Govt. Federal	Oahu	33	<1	<1
Dry Forest	No Data	Govt. Federal	Oahu	<1	<1	<1
Dry Forest	Heavily Disturbed	Govt. Local	Oahu	156	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. Local	Oahu	1	<1	<1
Dry Forest	Native Non-native Mix	Govt. Local	Oahu	982	<1	<1
Dry Forest	Native Dominated	Govt. Local	Oahu	74	<1	<1
Dry Forest	No Data	Govt. Local	Oahu	<1	<1	<1
Dry Forest	Heavily Disturbed	Govt. State	Oahu	285	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. State	Oahu	14	<1	<1
Dry Forest	Native Non-native Mix	Govt. State	Oahu	4706	1	<1
Dry Forest	Native Dominated	Govt. State	Oahu	326	<1	<1
Dry Forest	No Data	Govt. State	Oahu	<1	<1	<1
Dry Forest	Heavily Disturbed	No Data	Oahu	121	<1	<1
Dry Forest	Bare or <5% Vegetation	No Data	Oahu	2	<1	<1
Dry Forest	Native Non-native Mix	No Data	Oahu	598	<1	<1
Dry Forest	Native Dominated	No Data	Oahu	5	<1	<1
Dry Forest	No Data	No Data	Oahu	<1	<1	<1

Dry Forest	Heavily Disturbed	Private	Oahu	3059	1	<1
Dry Forest	Bare or <5% Vegetation	Private	Oahu	7	<1	<1
Dry Forest	Native Non-native Mix	Private	Oahu	9061	2	<1
Dry Forest	Native Dominated	Private	Oahu	114	<1	<1
Dry Forest	No Data	Private	Oahu	<1	<1	<1
Dry Forest	Heavily Disturbed	Govt. Federal	Maui	4	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. Federal	Maui	17	<1	<1
Dry Forest	Native Non-native Mix	Govt. Federal	Maui	319	<1	<1
Dry Forest	Native Dominated	Govt. Federal	Maui	38	<1	<1
Dry Forest	Heavily Disturbed	Govt. Local	Maui	73	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. Local	Maui	1	<1	<1
Dry Forest	Native Non-native Mix	Govt. Local	Maui	103	<1	<1
Dry Forest	No Data	Govt. Local	Maui	<1	<1	<1
Dry Forest	Heavily Disturbed	Govt. State	Maui	510	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. State	Maui	104	<1	<1
Dry Forest	Native Non-native Mix	Govt. State	Maui	9102	2	<1
Dry Forest	Native Dominated	Govt. State	Maui	35	<1	<1
Dry Forest	No Data	Govt. State	Maui	1	<1	<1
Dry Forest	Heavily Disturbed	No Data	Maui	<1	<1	<1
Dry Forest	Native Non-native Mix	No Data	Maui	6	<1	<1
Dry Forest	Heavily Disturbed	Private	Maui	3287	1	<1
Dry Forest	Bare or <5% Vegetation	Private	Maui	41	<1	<1
Dry Forest	Native Non-native Mix	Private	Maui	21416	5	1

Dry Forest	Native Dominated	Private	Maui	29	<1	<1
Dry Forest	No Data	Private	Maui	<1	<1	<1
Dry Forest	Heavily Disturbed	Govt. Federal	Hawaii	79	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. Federal	Hawaii	259	<1	<1
Dry Forest	Native Non-native Mix	Govt. Federal	Hawaii	516	<1	<1
Dry Forest	Native Dominated	Govt. Federal	Hawaii	5335	<1	<1
Dry Forest	No Data	Govt. Federal	Hawaii	<1	<1	<1
Dry Forest	Heavily Disturbed	Govt. Local	Hawaii	22	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. Local	Hawaii	28	<1	<1
Dry Forest	Native Non-native Mix	Govt. Local	Hawaii	80	<1	<1
Dry Forest	Native Dominated	Govt. Local	Hawaii	26	<1	<1
Dry Forest	No Data	Govt. Local	Hawaii	<1	<1	<1
Dry Forest	Heavily Disturbed	Govt. State	Hawaii	537	<1	<1
Dry Forest	Bare or <5% Vegetation	Govt. State	Hawaii	2004	<1	<1
Dry Forest	Native Non-native Mix	Govt. State	Hawaii	5524	<1	<1
Dry Forest	Native Dominated	Govt. State	Hawaii	29916	1	1
Dry Forest	No Data	Govt. State	Hawaii	4	<1	<1
Dry Forest	Heavily Disturbed	No Data	Hawaii	88	<1	<1
Dry Forest	Bare or <5% Vegetation	No Data	Hawaii	4	<1	<1
Dry Forest	Native Non-native Mix	No Data	Hawaii	83	<1	<1
Dry Forest	Native Dominated	No Data	Hawaii	2	<1	<1
Dry Forest	No Data	No Data	Hawaii	<1	<1	<1
Dry Forest	Heavily Disturbed	Private	Hawaii	1719	<1	<1

Dry Forest	Bare or <5% Vegetation	Private	Hawaii	1114	<1	<1
Dry Forest	Native Non-native Mix	Private	Hawaii	9427	<1	<1
Dry Forest	Native Dominated	Private	Hawaii	35744	1	1
Dry Forest	No Data	Private	Hawaii	5	<1	<1

Dry Grassland and Shrubland

Habitat	Habitat Quality	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. State	Kahoolawe	4	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Kahoolawe	1686	6	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. State	Kahoolawe	6921	24	<1
Dry Grasslands and Shrublands	No Data	Govt. State	Kahoolawe	<1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Private	Niihau	2	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Private	Niihau	90	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Private	Niihau	6856	15	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. Local	Lanai	115	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. Local	Lanai	<1	<1	<1
Dry Grasslands and Shrublands	Native Dominated	Govt. Local	Lanai	1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. State	Lanai	361	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. State	Lanai	1	<1	<1
Dry Grasslands and Shrublands	No Data	Govt. State	Lanai	<1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Private	Lanai	12874	14	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Private	Lanai	3080	3	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Private	Lanai	27147	30	1

Dry Grasslands and Shrublands	Native Dominated	Private	Lanai	3259	4	<1
Dry Grasslands and Shrublands	No Data	Private	Lanai	1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. Federal	Molokai	6	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Federal	Molokai	<1	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. Federal	Molokai	35	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. Local	Molokai	8	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Local	Molokai	1	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. Local	Molokai	93	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. State	Molokai	1200	1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Molokai	385	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. State	Molokai	17070	10	<1
Dry Grasslands and Shrublands	Native Dominated	Govt. State	Molokai	98	<1	<1
Dry Grasslands and Shrublands	No Data	Govt. State	Molokai	<1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Private	Molokai	3164	2	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Private	Molokai	2320	1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Private	Molokai	49945	30	1
Dry Grasslands and Shrublands	Native Dominated	Private	Molokai	420	<1	<1
Dry Grasslands and Shrublands	No Data	Private	Molokai	<1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. Federal	Kauai	55	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Federal	Kauai	3	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. Federal	Kauai	47	<1	<1
Dry Grasslands and Shrublands	No Data	Govt. Federal	Kauai	<1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. Local	Kauai	63	<1	<1

Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Local	Kauai	4	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. Local	Kauai	45	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. State	Kauai	2738	1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Kauai	917	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. State	Kauai	16929	5	<1
Dry Grasslands and Shrublands	Native Dominated	Govt. State	Kauai	1184	<1	<1
Dry Grasslands and Shrublands	No Data	Govt. State	Kauai	2	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	No Data	Kauai	124	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	No Data	Kauai	<1	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	No Data	Kauai	40	<1	<1
Dry Grasslands and Shrublands	No Data	No Data	Kauai	<1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Private	Kauai	2967	1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Private	Kauai	183	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Private	Kauai	8020	2	<1
Dry Grasslands and Shrublands	Native Dominated	Private	Kauai	629	<1	<1
Dry Grasslands and Shrublands	No Data	Private	Kauai	<1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. Federal	Oahu	1813	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Federal	Oahu	31	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. Federal	Oahu	6470	2	<1
Dry Grasslands and Shrublands	Native Dominated	Govt. Federal	Oahu	8	<1	<1
Dry Grasslands and Shrublands	No Data	Govt. Federal	Oahu	<1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. Local	Oahu	693	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Local	Oahu	47	<1	<1

Dry Grasslands and Shrublands	Native Non-native Mix	Govt. Local	Oahu	2099	1	<1
Dry Grasslands and Shrublands	Native Dominated	Govt. Local	Oahu	7	<1	<1
Dry Grasslands and Shrublands	No Data	Govt. Local	Oahu	1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. State	Oahu	1122	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Oahu	92	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. State	Oahu	10141	3	<1
Dry Grasslands and Shrublands	Native Dominated	Govt. State	Oahu	207	<1	<1
Dry Grasslands and Shrublands	No Data	Govt. State	Oahu	2	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	No Data	Oahu	400	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	No Data	Oahu	6	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	No Data	Oahu	1590	<1	<1
Dry Grasslands and Shrublands	Native Dominated	No Data	Oahu	1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Private	Oahu	8887	2	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Private	Oahu	206	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Private	Oahu	17173	5	<1
Dry Grasslands and Shrublands	Native Dominated	Private	Oahu	32	<1	<1
Dry Grasslands and Shrublands	No Data	Private	Oahu	1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. Federal	Maui	17	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Federal	Maui	597	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. Federal	Maui	1511	<1	<1
Dry Grasslands and Shrublands	Native Dominated	Govt. Federal	Maui	2854	1	<1
Dry Grasslands and Shrublands	No Data	Govt. Federal	Maui	<1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. Local	Maui	231	<1	<1

Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Local	Maui	6	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. Local	Maui	186	<1	<1
Dry Grasslands and Shrublands	Native Dominated	Govt. Local	Maui	33	<1	<1
Dry Grasslands and Shrublands	No Data	Govt. Local	Maui	<1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. State	Maui	631	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Maui	1324	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. State	Maui	19269	4	<1
Dry Grasslands and Shrublands	Native Dominated	Govt. State	Maui	5473	1	<1
Dry Grasslands and Shrublands	No Data	Govt. State	Maui	1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	No Data	Maui	1	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	No Data	Maui	4	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Private	Maui	5579	1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Private	Maui	473	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Private	Maui	25617	6	1
Dry Grasslands and Shrublands	Native Dominated	Private	Maui	2249	<1	<1
Dry Grasslands and Shrublands	No Data	Private	Maui	1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. Federal	Hawaii	448	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Federal	Hawaii	12004	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. Federal	Hawaii	24143	1	1
Dry Grasslands and Shrublands	Native Dominated	Govt. Federal	Hawaii	16092	1	<1
Dry Grasslands and Shrublands	No Data	Govt. Federal	Hawaii	<1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. Local	Hawaii	32	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Local	Hawaii	9	<1	<1

Dry Grasslands and Shrublands	Native Non-native Mix	Govt. Local	Hawaii	732	<1	<1
Dry Grasslands and Shrublands	Native Dominated	Govt. Local	Hawaii	5	<1	<1
Dry Grasslands and Shrublands	No Data	Govt. Local	Hawaii	<1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Govt. State	Hawaii	3489	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Hawaii	13216	1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Govt. State	Hawaii	84300	3	2
Dry Grasslands and Shrublands	Native Dominated	Govt. State	Hawaii	89528	3	2
Dry Grasslands and Shrublands	No Data	Govt. State	Hawaii	1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	No Data	Hawaii	465	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	No Data	Hawaii	6	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	No Data	Hawaii	918	<1	<1
Dry Grasslands and Shrublands	Native Dominated	No Data	Hawaii	13	<1	<1
Dry Grasslands and Shrublands	No Data	No Data	Hawaii	<1	<1	<1
Dry Grasslands and Shrublands	Heavily Disturbed	Private	Hawaii	7630	<1	<1
Dry Grasslands and Shrublands	Bare or <5% Vegetation	Private	Hawaii	7356	<1	<1
Dry Grasslands and Shrublands	Native Non-native Mix	Private	Hawaii	159656	6	4
Dry Grasslands and Shrublands	Native Dominated	Private	Hawaii	41998	2	1
Dry Grasslands and Shrublands	No Data	Private	Hawaii	1	<1	<1

Mesic Forest

Habitat	Habitat Quality	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Mesic Forest	Heavily Disturbed	Private	Lanai	119	<1	<1
Mesic Forest	Bare or <5% Vegetation	Private	Lanai	5	<1	<1
Mesic Forest	Native Non-native Mix	Private	Lanai	631	1	<1

Mesic Forest	Native Dominated	Private	Lanai	196	<1	<1
Mesic Forest	Native Non-native Mix	Govt. Local	Molo kai	6	<1	<1
Mesic Forest	Heavily Disturbed	Govt. State	Molo kai	79	<1	<1
Mesic Forest	Bare or <5% Vegetation	Govt. State	Molo kai	1	<1	<1
Mesic Forest	Native Non-native Mix	Govt. State	Molo kai	3369	2	<1
Mesic Forest	Native Dominated	Govt. State	Molo kai	4027	2	<1
Mesic Forest	Heavily Disturbed	Private	Molo kai	160	<1	<1
Mesic Forest	Bare or <5% Vegetation	Private	Molo kai	19	<1	<1
Mesic Forest	Native Non-native Mix	Private	Molo kai	4821	3	<1
Mesic Forest	Native Dominated	Private	Molo kai	7570	5	<1
Mesic Forest	No Data	Private	Molo kai	<1	<1	<1
Mesic Forest	Heavily Disturbed	Govt. Federal	Kauai	18	<1	<1
Mesic Forest	Bare or <5% Vegetation	Govt. Federal	Kauai	1	<1	<1
Mesic Forest	Native Non-native Mix	Govt. Federal	Kauai	576	<1	<1
Mesic Forest	Heavily Disturbed	Govt. Local	Kauai	16	<1	<1
Mesic Forest	Bare or <5% Vegetation	Govt. Local	Kauai	<1	<1	<1
Mesic Forest	Native Non-native Mix	Govt. Local	Kauai	45	<1	<1
Mesic Forest	Heavily Disturbed	Govt. State	Kauai	1765	<1	<1
Mesic Forest	Bare or <5% Vegetation	Govt. State	Kauai	176	<1	<1
Mesic Forest	Native Non-native Mix	Govt. State	Kauai	25767	7	1
Mesic Forest	Native Dominated	Govt. State	Kauai	11692	3	<1
Mesic Forest	No Data	Govt. State	Kauai	<1	<1	<1
Mesic Forest	Heavily Disturbed	No Data	Kauai	125	<1	<1

Mesic Forest	Bare or <5% Vegetation	No Data	Kauai	1	<1	<1
Mesic Forest	Native Non-native Mix	No Data	Kauai	765	<1	<1
Mesic Forest	Native Dominated	No Data	Kauai	1	<1	<1
Mesic Forest	Heavily Disturbed	Private	Kauai	4071	1	<1
Mesic Forest	Bare or <5% Vegetation	Private	Kauai	38	<1	<1
Mesic Forest	Native Non-native Mix	Private	Kauai	25928	7	1
Mesic Forest	Native Dominated	Private	Kauai	3137	1	<1
Mesic Forest	No Data	Private	Kauai	<1	<1	<1
Mesic Forest	Heavily Disturbed	Govt. Federal	Oahu	756	<1	<1
Mesic Forest	Bare or <5% Vegetation	Govt. Federal	Oahu	<1	<1	<1
Mesic Forest	Native Non-native Mix	Govt. Federal	Oahu	9174	2	<1
Mesic Forest	Native Dominated	Govt. Federal	Oahu	1377	<1	<1
Mesic Forest	Heavily Disturbed	Govt. Local	Oahu	79	<1	<1
Mesic Forest	Bare or <5% Vegetation	Govt. Local	Oahu	<1	<1	<1
Mesic Forest	Native Non-native Mix	Govt. Local	Oahu	3200	1	<1
Mesic Forest	Native Dominated	Govt. Local	Oahu	817	<1	<1
Mesic Forest	Heavily Disturbed	Govt. State	Oahu	268	<1	<1
Mesic Forest	Bare or <5% Vegetation	Govt. State	Oahu	11	<1	<1
Mesic Forest	Native Non-native Mix	Govt. State	Oahu	15043	4	<1
Mesic Forest	Native Dominated	Govt. State	Oahu	4531	1	<1
Mesic Forest	Heavily Disturbed	No Data	Oahu	172	<1	<1
Mesic Forest	Native Non-native Mix	No Data	Oahu	1362	<1	<1
Mesic Forest	Native Dominated	No Data	Oahu	3	<1	<1

Mesic Forest	Heavily Disturbed	Private	Oahu	3166	1	<1
Mesic Forest	Bare or <5% Vegetation	Private	Oahu	18	<1	<1
Mesic Forest	Native Non-native Mix	Private	Oahu	35538	10	1
Mesic Forest	Native Dominated	Private	Oahu	4830	1	<1
Mesic Forest	Heavily Disturbed	Govt. Federal	Maui	18	<1	<1
Mesic Forest	Bare or <5% Vegetation	Govt. Federal	Maui	2	<1	<1
Mesic Forest	Native Non-native Mix	Govt. Federal	Maui	1411	<1	<1
Mesic Forest	Native Dominated	Govt. Federal	Maui	1399	<1	<1
Mesic Forest	Heavily Disturbed	Govt. Local	Maui	27	<1	<1
Mesic Forest	Bare or <5% Vegetation	Govt. Local	Maui	<1	<1	<1
Mesic Forest	Native Non-native Mix	Govt. Local	Maui	714	<1	<1
Mesic Forest	Native Dominated	Govt. Local	Maui	79	<1	<1
Mesic Forest	Heavily Disturbed	Govt. State	Maui	273	<1	<1
Mesic Forest	Bare or <5% Vegetation	Govt. State	Maui	29	<1	<1
Mesic Forest	Native Non-native Mix	Govt. State	Maui	11847	3	<1
Mesic Forest	Native Dominated	Govt. State	Maui	4587	1	<1
Mesic Forest	No Data	Govt. State	Maui	<1	<1	<1
Mesic Forest	Native Non-native Mix	No Data	Maui	9	<1	<1
Mesic Forest	Heavily Disturbed	Private	Maui	3797	1	<1
Mesic Forest	Bare or <5% Vegetation	Private	Maui	12	<1	<1
Mesic Forest	Native Non-native Mix	Private	Maui	25759	6	1
Mesic Forest	Native Dominated	Private	Maui	6399	1	<1
Mesic Forest	No Data	Private	Maui	<1	<1	<1

Mesic Forest	Heavily Disturbed	Govt. Federal	Hawa ii	252	<1	<1
Mesic Forest	Bare or <5% Vegetation	Govt. Federal	Hawa ii	915	<1	<1
Mesic Forest	Native Non-native Mix	Govt. Federal	Hawa ii	5022	<1	<1
Mesic Forest	Native Dominated	Govt. Federal	Hawa ii	20275	1	<1
Mesic Forest	Heavily Disturbed	Govt. Local	Hawa ii	1759	<1	<1
Mesic Forest	Bare or <5% Vegetation	Govt. Local	Hawa ii	3	<1	<1
Mesic Forest	Native Non-native Mix	Govt. Local	Hawa ii	349	<1	<1
Mesic Forest	Native Dominated	Govt. Local	Hawa ii	26	<1	<1
Mesic Forest	Heavily Disturbed	Govt. State	Hawa ii	1604	<1	<1
Mesic Forest	Bare or <5% Vegetation	Govt. State	Hawa ii	612	<1	<1
Mesic Forest	Native Non-native Mix	Govt. State	Hawa ii	17388	1	<1
Mesic Forest	Native Dominated	Govt. State	Hawa ii	49748	2	1
Mesic Forest	No Data	Govt. State	Hawa ii	<1	<1	<1
Mesic Forest	Heavily Disturbed	No Data	Hawa ii	356	<1	<1
Mesic Forest	Bare or <5% Vegetation	No Data	Hawa ii	4	<1	<1
Mesic Forest	Native Non-native Mix	No Data	Hawa ii	174	<1	<1
Mesic Forest	Native Dominated	No Data	Hawa ii	80	<1	<1
Mesic Forest	Heavily Disturbed	Private	Hawa ii	22056	1	1
Mesic Forest	Bare or <5% Vegetation	Private	Hawa ii	1445	<1	<1
Mesic Forest	Native Non-native Mix	Private	Hawa ii	36237	1	1
Mesic Forest	Native Dominated	Private	Hawa ii	44998	2	1
Mesic Forest	No Data	Private	Hawa ii	<1	<1	<1

Mesic Grassland and Shrubland

Habitat	Habitat Quality	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Private	Niihau	18	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Private	Niihau	671	1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Private	Lanai	332	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Private	Lanai	162	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Private	Lanai	1281	1	<1
Mesic Grasslands and Shrublands	Native Dominated	Private	Lanai	423	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Govt. State	Molokai	17	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Molokai	3	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Govt. State	Molokai	1855	1	<1
Mesic Grasslands and Shrublands	Native Dominated	Govt. State	Molokai	983	1	<1
Mesic Grasslands and Shrublands	No Data	Govt. State	Molokai	<1	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Private	Molokai	66	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Private	Molokai	229	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Private	Molokai	3311	2	<1
Mesic Grasslands and Shrublands	Native Dominated	Private	Molokai	2560	2	<1
Mesic Grasslands and Shrublands	No Data	Private	Molokai	<1	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Govt. Federal	Kauai	16	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Federal	Kauai	7	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Govt. Federal	Kauai	220	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Govt. Local	Kauai	24	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Local	Kauai	<1	<1	<1

Mesic Grasslands and Shrublands	Native Non-native Mix	Govt. Local	Kauai	32	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Govt. State	Kauai	1246	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Kauai	730	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Govt. State	Kauai	11450	3	<1
Mesic Grasslands and Shrublands	Native Dominated	Govt. State	Kauai	41	<1	<1
Mesic Grasslands and Shrublands	No Data	Govt. State	Kauai	2	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	No Data	Kauai	114	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	No Data	Kauai	1	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	No Data	Kauai	1198	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Private	Kauai	10518	3	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Private	Kauai	102	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Private	Kauai	19680	6	<1
Mesic Grasslands and Shrublands	Native Dominated	Private	Kauai	36	<1	<1
Mesic Grasslands and Shrublands	No Data	Private	Kauai	<1	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Govt. Federal	Oahu	1830	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Federal	Oahu	4	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Govt. Federal	Oahu	3566	1	<1
Mesic Grasslands and Shrublands	Native Dominated	Govt. Federal	Oahu	93	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Govt. Local	Oahu	89	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Local	Oahu	1	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Govt. Local	Oahu	1107	<1	<1
Mesic Grasslands and Shrublands	Native Dominated	Govt. Local	Oahu	40	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Govt. State	Oahu	138	<1	<1

Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Oah u	25	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Govt. State	Oah u	4777	1	<1
Mesic Grasslands and Shrublands	Native Dominated	Govt. State	Oah u	365	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	No Data	Oah u	32	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	No Data	Oah u	181	<1	<1
Mesic Grasslands and Shrublands	Native Dominated	No Data	Oah u	<1	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Private	Oah u	2378	1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Private	Oah u	14	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Private	Oah u	6286	2	<1
Mesic Grasslands and Shrublands	Native Dominated	Private	Oah u	116	<1	<1
Mesic Grasslands and Shrublands	No Data	Private	Oah u	<1	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Govt. Federal	Mau i	54	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Federal	Mau i	652	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Govt. Federal	Mau i	3265	1	<1
Mesic Grasslands and Shrublands	Native Dominated	Govt. Federal	Mau i	3879	1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Govt. Local	Mau i	5	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Local	Mau i	1	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Govt. Local	Mau i	371	<1	<1
Mesic Grasslands and Shrublands	Native Dominated	Govt. Local	Mau i	16	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Govt. State	Mau i	105	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Mau i	362	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Govt. State	Mau i	11649	3	<1
Mesic Grasslands and Shrublands	Native Dominated	Govt. State	Mau i	4518	1	<1

Mesic Grasslands and Shrublands	Native Non-native Mix	No Data	Mau i	1	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Private	Mau i	2453	1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Private	Mau i	183	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Private	Mau i	21764	5	1
Mesic Grasslands and Shrublands	Native Dominated	Private	Mau i	4965	1	<1
Mesic Grasslands and Shrublands	No Data	Private	Mau i	<1	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Govt. Federal	Haw aii	456	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Federal	Haw aii	9005	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Govt. Federal	Haw aii	8542	<1	<1
Mesic Grasslands and Shrublands	Native Dominated	Govt. Federal	Haw aii	39807	2	1
Mesic Grasslands and Shrublands	Heavily Disturbed	Govt. Local	Haw aii	1150	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Local	Haw aii	2	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Govt. Local	Haw aii	59	<1	<1
Mesic Grasslands and Shrublands	Native Dominated	Govt. Local	Haw aii	32	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	Govt. State	Haw aii	4347	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Haw aii	6959	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Govt. State	Haw aii	79409	3	2
Mesic Grasslands and Shrublands	Native Dominated	Govt. State	Haw aii	42400	2	1
Mesic Grasslands and Shrublands	No Data	Govt. State	Haw aii	<1	<1	<1
Mesic Grasslands and Shrublands	Heavily Disturbed	No Data	Haw aii	645	<1	<1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	No Data	Haw aii	58	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	No Data	Haw aii	312	<1	<1
Mesic Grasslands and Shrublands	Native Dominated	No Data	Haw aii	63	<1	<1

Mesic Grasslands and Shrublands	Heavily Disturbed	Private	Haw aii	23501	1	1
Mesic Grasslands and Shrublands	Bare or <5% Vegetation	Private	Haw aii	4593	<1	<1
Mesic Grasslands and Shrublands	Native Non-native Mix	Private	Haw aii	78657	3	2
Mesic Grasslands and Shrublands	Native Dominated	Private	Haw aii	25325	1	1
Mesic Grasslands and Shrublands	No Data	Private	Haw aii	<1	<1	<1

Streams from State DAR Layers

Island	Stream Type	Total Stream Length on Island (km)	Length Barren (km)	Length Disturbed (km)	Length Native Dominated (km)	Length Non-Native Dominated (km)
Niihau	NON-PERENNIAL	116.2	7.8	<1	<1	108.5
Kahoolawe	NON-PERENNIAL	176.5	16.4	<1	<1	160.1
Lanai	NON-PERENNIAL	734.6	15.9	82.4	52.6	583.8
Molokai	INTERMITTENT	1194.5	2.4	4.3	214.4	125.5
Molokai	PERENNIAL	1194.5	<1	<1	61.6	22.7
Molokai	NON-PERENNIAL	1194.5	20.9	42	70.2	624.8
Molokai	BANK	1194.5	<1	<1	2.3	1.7
Molokai	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR	1194.5	<1	<1	<1	<1
Maui	INTERMITTENT	2032.6	1.1	97.1	204.4	347.2
Maui	PERENNIAL	2032.6	1	28.9	276.6	251.4
Maui	NON-PERENNIAL	2032.6	10.7	208.8	59.6	544.6
Maui	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR	2032.6	<1	<1	<1	<1
Oahu	INTERMITTENT	2403.5	<1	194.5	161.1	783.1
Oahu	PERENNIAL	2403.5	<1	115.6	260.1	400.6
Oahu	NON-PERENNIAL	2403.5	1.7	143.8	9.7	228.6

Oahu	ISLAND, ISLET, ROCK, OR OTHER	2403.5	<1	2.1	<1		1.1
Oahu	BANK	2403.5	<1	25.2	<1		18.5
Oahu	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR	2403.5	<1	25.5	<1		30.9
Kauai	INTERMITTENT	2623.9	10.4	63.6	184		587.3
Kauai	PERENNIAL	2623.9	4.5	141.3	441.7		884.6
Kauai	NON-PERENNIAL	2623.9	3.3	66.3	12.7		141.9
Kauai	ISLAND, ISLET, ROCK, OR OTHER	2623.9	<1	<1	<1		1.5
Kauai	BANK	2623.9	<1	17	<1		55.7
Kauai	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR	2623.9	<1	3.4	<1		4.1
Big Island	INTERMITTENT	4058.5	24.8	156.8	163.9		282.4
Big Island	PERENNIAL	4058.5	3.1	339.6	683.9		697.1
Big Island	NON-PERENNIAL	4058.5	130	262.9	329.8		957.5
Big Island	ISLAND, ISLET, ROCK, OR OTHER	4058.5	<1	<1	<1		<1
Big Island	BANK	4058.5	<1	3.8	11.2		7.7
Big Island	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR	4058.5	<1	3	<1		<1

Wet Forest

Habitat	Habitat Quality	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Wet Forest	Heavily Disturbed	Private	Lanai	230	<1	<1
Wet Forest	Bare or <5% Vegetation	Private	Lanai	42	<1	<1
Wet Forest	Native Non-native Mix	Private	Lanai	232	<1	<1

Wet Forest	Native Dominated	Private	Lanai	2686	3	<1
Wet Forest	Heavily Disturbed	Govt. State	Molokai	7	<1	<1
Wet Forest	Bare or <5% Vegetation	Govt. State	Molokai	1	<1	<1
Wet Forest	Native Non-native Mix	Govt. State	Molokai	488	<1	<1
Wet Forest	Native Dominated	Govt. State	Molokai	7190	4	<1
Wet Forest	Heavily Disturbed	Private	Molokai	30	<1	<1
Wet Forest	Native Non-native Mix	Private	Molokai	941	1	<1
Wet Forest	Native Dominated	Private	Molokai	8776	5	<1
Wet Forest	Native Non-native Mix	Govt. Federal	Kauai	7	<1	<1
Wet Forest	Heavily Disturbed	Govt. Local	Kauai	1	<1	<1
Wet Forest	Native Non-native Mix	Govt. Local	Kauai	<1	<1	<1
Wet Forest	Heavily Disturbed	Govt. State	Kauai	73	<1	<1
Wet Forest	Bare or <5% Vegetation	Govt. State	Kauai	1	<1	<1
Wet Forest	Native Non-native Mix	Govt. State	Kauai	12522	4	<1
Wet Forest	Native Dominated	Govt. State	Kauai	23856	7	1
Wet Forest	Heavily Disturbed	No Data	Kauai	<1	<1	<1
Wet Forest	Native Non-native Mix	No Data	Kauai	19	<1	<1
Wet Forest	Native Dominated	No Data	Kauai	<1	<1	<1
Wet Forest	Heavily Disturbed	Private	Kauai	365	<1	<1
Wet Forest	Bare or <5% Vegetation	Private	Kauai	5	<1	<1
Wet Forest	Native Non-native Mix	Private	Kauai	18337	5	<1
Wet Forest	Native Dominated	Private	Kauai	29835	8	1
Wet Forest	Heavily Disturbed	Govt. Federal	Oahu	1	<1	<1

Wet Forest	Native Non-native Mix	Govt. Federal	Oahu	3220	1	<1
Wet Forest	Native Dominated	Govt. Federal	Oahu	5418	1	<1
Wet Forest	Heavily Disturbed	Govt. Local	Oahu	9	<1	<1
Wet Forest	Native Non-native Mix	Govt. Local	Oahu	1549	<1	<1
Wet Forest	Native Dominated	Govt. Local	Oahu	1299	<1	<1
Wet Forest	Heavily Disturbed	Govt. State	Oahu	43	<1	<1
Wet Forest	Native Non-native Mix	Govt. State	Oahu	9008	2	<1
Wet Forest	Native Dominated	Govt. State	Oahu	8726	2	<1
Wet Forest	Heavily Disturbed	No Data	Oahu	1	<1	<1
Wet Forest	Native Non-native Mix	No Data	Oahu	1	<1	<1
Wet Forest	Heavily Disturbed	Private	Oahu	41	<1	<1
Wet Forest	Native Non-native Mix	Private	Oahu	14504	4	<1
Wet Forest	Native Dominated	Private	Oahu	17095	5	<1
Wet Forest	Heavily Disturbed	Govt. Federal	Maui	1	<1	<1
Wet Forest	Native Non-native Mix	Govt. Federal	Maui	1011	<1	<1
Wet Forest	Native Dominated	Govt. Federal	Maui	6601	1	<1
Wet Forest	Native Non-native Mix	Govt. Local	Maui	340	<1	<1
Wet Forest	Native Dominated	Govt. Local	Maui	501	<1	<1
Wet Forest	Heavily Disturbed	Govt. State	Maui	125	<1	<1
Wet Forest	Bare or <5% Vegetation	Govt. State	Maui	1	<1	<1
Wet Forest	Native Non-native Mix	Govt. State	Maui	8482	2	<1
Wet Forest	Native Dominated	Govt. State	Maui	19198	4	<1
Wet Forest	No Data	Govt. State	Maui	<1	<1	<1

Wet Forest	Heavily Disturbed	Private	Maui	564	<1	<1
Wet Forest	Bare or <5% Vegetation	Private	Maui	6	<1	<1
Wet Forest	Native Non-native Mix	Private	Maui	19104	4	<1
Wet Forest	Native Dominated	Private	Maui	38312	8	1
Wet Forest	No Data	Private	Maui	<1	<1	<1
Wet Forest	Heavily Disturbed	Govt. Federal	Hawaii	209	<1	<1
Wet Forest	Bare or <5% Vegetation	Govt. Federal	Hawaii	726	<1	<1
Wet Forest	Native Non-native Mix	Govt. Federal	Hawaii	2837	<1	<1
Wet Forest	Native Dominated	Govt. Federal	Hawaii	45867	2	1
Wet Forest	Heavily Disturbed	Govt. Local	Hawaii	175	<1	<1
Wet Forest	Bare or <5% Vegetation	Govt. Local	Hawaii	1	<1	<1
Wet Forest	Native Non-native Mix	Govt. Local	Hawaii	137	<1	<1
Wet Forest	Native Dominated	Govt. Local	Hawaii	31	<1	<1
Wet Forest	Heavily Disturbed	Govt. State	Hawaii	3298	<1	<1
Wet Forest	Bare or <5% Vegetation	Govt. State	Hawaii	3651	<1	<1
Wet Forest	Native Non-native Mix	Govt. State	Hawaii	31234	1	1
Wet Forest	Native Dominated	Govt. State	Hawaii	256509	10	6
Wet Forest	No Data	Govt. State	Hawaii	<1	<1	<1
Wet Forest	Heavily Disturbed	No Data	Hawaii	454	<1	<1
Wet Forest	Bare or <5% Vegetation	No Data	Hawaii	3	<1	<1
Wet Forest	Native Non-native Mix	No Data	Hawaii	316	<1	<1
Wet Forest	Native Dominated	No Data	Hawaii	308	<1	<1
Wet Forest	Heavily Disturbed	Private	Hawaii	17915	1	<1

Wet Forest	Bare or <5% Vegetation	Private	Hawaii	1059	<1	<1
Wet Forest	Native Non-native Mix	Private	Hawaii	34541	1	1
Wet Forest	Native Dominated	Private	Hawaii	116836	5	3
Wet Forest	No Data	Private	Hawaii	<1	<1	<1

Wet Grassland and Shrubland

Habitat	Habitat Quality	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Wet Grasslands and Shrublands	Bare or <5% Vegetation	Private	Lanai	3	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Private	Lanai	31	<1	<1
Wet Grasslands and Shrublands	Native Dominated	Private	Lanai	30	<1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	Govt. State	Molokai	1	<1	<1
Wet Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Molokai	1	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Govt. State	Molokai	191	<1	<1
Wet Grasslands and Shrublands	Native Dominated	Govt. State	Molokai	1615	1	<1
Wet Grasslands and Shrublands	No Data	Govt. State	Molokai	<1	<1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	Private	Molokai	3	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Private	Molokai	531	<1	<1
Wet Grasslands and Shrublands	Native Dominated	Private	Molokai	3285	2	<1
Wet Grasslands and Shrublands	Heavily Disturbed	Govt. Local	Kauai	<1	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Govt. Local	Kauai	<1	<1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	Govt. State	Kauai	5	<1	<1
Wet Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Kauai	1	<1	<1

Wet Grasslands and Shrublands	Native Non-native Mix	Govt. State	Kauai	3110	1	<1
Wet Grasslands and Shrublands	Native Dominated	Govt. State	Kauai	2988	1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	No Data	Kauai	<1	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	No Data	Kauai	2	<1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	Private	Kauai	248	<1	<1
Wet Grasslands and Shrublands	Bare or <5% Vegetation	Private	Kauai	4	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Private	Kauai	5224	1	<1
Wet Grasslands and Shrublands	Native Dominated	Private	Kauai	6342	2	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Govt. Federal	Oahu	63	<1	<1
Wet Grasslands and Shrublands	Native Dominated	Govt. Federal	Oahu	265	<1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	Govt. Local	Oahu	1	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Govt. Local	Oahu	115	<1	<1
Wet Grasslands and Shrublands	Native Dominated	Govt. Local	Oahu	583	<1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	Govt. State	Oahu	5	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Govt. State	Oahu	498	<1	<1
Wet Grasslands and Shrublands	Native Dominated	Govt. State	Oahu	1349	<1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	No Data	Oahu	1	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	No Data	Oahu	1	<1	<1
Wet Grasslands and Shrublands	Native Dominated	No Data	Oahu	2	<1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	Private	Oahu	12	<1	<1
Wet Grasslands and Shrublands	Bare or <5% Vegetation	Private	Oahu	<1	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Private	Oahu	423	<1	<1
Wet Grasslands and Shrublands	Native Dominated	Private	Oahu	1757	<1	<1

Wet Grasslands and Shrublands	Heavily Disturbed	Govt. Federal	Mau i	<1	<1	<1
Wet Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Federal	Mau i	1	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Govt. Federal	Mau i	198	<1	<1
Wet Grasslands and Shrublands	Native Dominated	Govt. Federal	Mau i	517	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Govt. Local	Mau i	238	<1	<1
Wet Grasslands and Shrublands	Native Dominated	Govt. Local	Mau i	2832	1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	Govt. State	Mau i	14	<1	<1
Wet Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Mau i	4	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Govt. State	Mau i	1129	<1	<1
Wet Grasslands and Shrublands	Native Dominated	Govt. State	Mau i	2412	1	<1
Wet Grasslands and Shrublands	No Data	Govt. State	Mau i	<1	<1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	Private	Mau i	148	<1	<1
Wet Grasslands and Shrublands	Bare or <5% Vegetation	Private	Mau i	3	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Private	Mau i	2046	<1	<1
Wet Grasslands and Shrublands	Native Dominated	Private	Mau i	5101	1	<1
Wet Grasslands and Shrublands	No Data	Private	Mau i	<1	<1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	Govt. Federal	Haw aii	48	<1	<1
Wet Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Federal	Haw aii	1300	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Govt. Federal	Haw aii	433	<1	<1
Wet Grasslands and Shrublands	Native Dominated	Govt. Federal	Haw aii	2089	<1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	Govt. Local	Haw aii	175	<1	<1
Wet Grasslands and Shrublands	Bare or <5% Vegetation	Govt. Local	Haw aii	1	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Govt. Local	Haw aii	66	<1	<1

Wet Grasslands and Shrublands	Native Dominated	Govt. Local	Haw aii	4	<1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	Govt. State	Haw aii	5085	<1	<1
Wet Grasslands and Shrublands	Bare or <5% Vegetation	Govt. State	Haw aii	6410	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Govt. State	Haw aii	16635	1	<1
Wet Grasslands and Shrublands	Native Dominated	Govt. State	Haw aii	14679	1	<1
Wet Grasslands and Shrublands	No Data	Govt. State	Haw aii	<1	<1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	No Data	Haw aii	383	<1	<1
Wet Grasslands and Shrublands	Bare or <5% Vegetation	No Data	Haw aii	8	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	No Data	Haw aii	148	<1	<1
Wet Grasslands and Shrublands	Native Dominated	No Data	Haw aii	55	<1	<1
Wet Grasslands and Shrublands	Heavily Disturbed	Private	Haw aii	14304	1	<1
Wet Grasslands and Shrublands	Bare or <5% Vegetation	Private	Haw aii	981	<1	<1
Wet Grasslands and Shrublands	Native Non-native Mix	Private	Haw aii	36842	1	1
Wet Grasslands and Shrublands	Native Dominated	Private	Haw aii	15325	1	<1
Wet Grasslands and Shrublands	No Data	Private	Haw aii	<1	<1	<1

Wetlands from NOAA Layers

Isla nd	Wetland Type	Total Wetland Area on Island (Acres)	Area Barren (Acres)	Area Disturbed (Acres)	Area Native Dominated (Acres)	Area Non-Native Dominated (Acres)
Lan ai	Palustrine Aquatic Bed	213	<1	2.5	<1	<1
Lan ai	Palustrine Emergent Wetland	213	<1	1.5	<1	<1
Lan ai	Unconsolidated Shore	213	21.8	<1	<1	29.1

Lan ai	Open Water	213	15.7	33.5	<1	107.3
Nii hau	Palustrine Emergent Wetland	1533	1	<1	<1	80.6
Nii hau	Palustrine Forested Wetland	1533	<1	<1	<1	77
Nii hau	Palustrine Scrub/Shrub Wetland	1533	<1	<1	<1	71.6
Nii hau	Unconsolidate d Shore	1533	34.5	<1	<1	794.6
Nii hau	Water	1533	237	<1	<1	231
Oa hu	Estuarine Emergent Wetland	3218	<1	45.6	<1	47.4
Oa hu	Estuarine Forested Wetland	3218	<1	91.1	<1	91.1
Oa hu	Palustrine Aquatic Bed	3218	<1	<1	<1	4.6
Oa hu	Palustrine Emergent Wetland	3218	<1	210.5	<1	215.9
Oa hu	Palustrine Forested Wetland	3218	<1	45.3	<1	67.9
Oa hu	Unconsolidate d Shore	3218	42.1	122.1	<1	99.5
Oa hu	Open Water	3218	33.8	1125.9	4.1	650.2
Oa hu	Palustrine Scrub Shrub Wetland	3218	<1	64.3	<1	160.1
Oa hu	Estuarine Scrub Shrub Wetland	3218	<1	60.7	<1	23.7
Mo lok ai	Estuarine Emergent Wetland	4814	22	24.2	<1	328
Mo lok ai	Estuarine Forested Wetland	4814	<1	23.7	<1	260.6

Mo	Palustrine Aquatic Bed	4814	<1	<1	<1	<1
Mo	Palustrine Emergent Wetland	4814	<1	8.4	335.3	57.1
Mo	Palustrine Forested Wetland	4814	2.6	64.6	952.3	249.9
Mo	Unconsolidated Shore	4814	34.6	9.7	3.3	63
Mo	Open Water	4814	51.1	146.8	118.6	304.3
Mo	Palustrine Scrub Shrub Wetland	4814	<1	15.1	1138.7	228.1
Mo	Estuarine Scrub Shrub Wetland	4814	1.4	6.9	<1	355.4
Ma	Palustrine Emergent Wetland	6106	5.1	80.3	162.2	299.8
Ma	Palustrine Forested Wetland	6106	<1	62.1	950	1008.4
Ma	Unconsolidated Shore	6106	34.8	132.6	<1	230.1
Ma	Open Water	6106	120.2	463.9	27.1	431.9
Ma	Palustrine Scrub Shrub Wetland	6106	<1	24.4	1441.1	627.3
Kau	Estuarine Emergent Wetland	8297	1.3	1.1	<1	32.4
Kau	Estuarine Forested Wetland	8297	<1	1.9	<1	56.6
Kau	Estuarine Scrub/Shrub Wetland	8297	<1	<1	<1	4
Kau	Palustrine Aquatic Bed	8297	<1	3.1	<1	<1

Kauai	Palustrine Emergent Wetland	8297	<1	460	501.6	530.1
Kauai	Palustrine Forested Wetland	8297	<1	322.2	1381	1375.1
Kauai	Palustrine Scrub/Shrub Wetland	8297	<1	138.3	130.9	481.7
Kauai	Unconsolidated Shore	8297	64.9	80.1	1.4	111.5
Kauai	Water	8297	58.9	634.9	241.2	1653.2
Ha wai i	Estuarine Emergent Wetland	15791	2.8	5.3	<1	20.1
Ha wai i	Estuarine Forested Wetland	15791	<1	10.6	<1	<1
Ha wai i	Estuarine Scrub/Shrub Wetland	15791	<1	<1	<1	<1
Ha wai i	Palustrine Aquatic Bed	15791	<1	1	<1	<1
Ha wai i	Palustrine Emergent Wetland	15791	1.7	122.7	1427.3	488.7
Ha wai i	Palustrine Forested Wetland	15791	<1	72.9	4849.2	888.7
Ha wai i	Palustrine Scrub/Shrub Wetland	15791	<1	37.8	3567.8	974.4
Ha wai i	Unconsolidated Shore	15791	<1	1.6	<1	27.9
Ha wai i	Water	15791	418.4	510.1	1158.4	1167.1

Wetlands from NWI Layers

Island	Wetland Type	Data set	Total Wetland Area on Island (Acres)	Summary Variable	Area (Acres)	Area (% of Wetland Area on Island)
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Kah oola we	Estuarine and Marine Wetland	USF WS - NWI	136	Estuarine and Marine Wetland	132	97
Lana i	Estuarine and Marine Wetland	USF WS - NWI	276	Estuarine and Marine Wetland	168	61
Niih au	Estuarine and Marine Wetland	USF WS - NWI	2317	Estuarine and Marine Wetland	173	7
Mol okai	Estuarine and Marine Wetland	USF WS - NWI	7871	Estuarine and Marine Wetland	1166	15
Oah u	Estuarine and Marine Wetland	USF WS - NWI	8530	Estuarine and Marine Wetland	3037	36
Kau ai	Estuarine and Marine Wetland	USF WS - NWI	21318	Estuarine and Marine Wetland	1393	7
Haw aii	Estuarine and Marine Wetland	USF WS - NWI	58024	Estuarine and Marine Wetland	1230	2
Mau i	Estuarine and Marine Wetland	USF WS - NWI	62306	Estuarine and Marine Wetland	618	1
Lana i	Freshwater Emergent Wetland	USF WS - NWI	276	Freshwater Emergent Wetland	58	21
Niih au	Freshwater Emergent Wetland	USF WS - NWI	2317	Freshwater Emergent Wetland	163	7
Mol okai	Freshwater Emergent Wetland	USF WS - NWI	7871	Freshwater Emergent Wetland	726	9
Oah u	Freshwater Emergent Wetland	USF WS - NWI	8530	Freshwater Emergent Wetland	1987	23
Kau ai	Freshwater Emergent Wetland	USF WS - NWI	21318	Freshwater Emergent Wetland	9862	46
Haw aii	Freshwater Emergent Wetland	USF WS - NWI	58024	Freshwater Emergent Wetland	904	2
Mau i	Freshwater Emergent Wetland	USF WS - NWI	62306	Freshwater Emergent Wetland	898	1

Kah oola we	Freshwater Forested and Scrub Shrub Wetland	USF WS - NWI	136	Freshwater Forested and Scrub Shrub Wetland	4	3
Lana i	Freshwater Forested and Scrub Shrub Wetland	USF WS - NWI	276	Freshwater Forested and Scrub Shrub Wetland	47	17
Niih au	Freshwater Forested and Scrub Shrub Wetland	USF WS - NWI	2317	Freshwater Forested and Scrub Shrub Wetland	93	4
Mol okai	Freshwater Forested and Scrub Shrub Wetland	USF WS - NWI	7871	Freshwater Forested and Scrub Shrub Wetland	5863	74
Oah u	Freshwater Forested and Scrub Shrub Wetland	USF WS - NWI	8530	Freshwater Forested and Scrub Shrub Wetland	2440	29
Kau ai	Freshwater Forested and Scrub Shrub Wetland	USF WS - NWI	21318	Freshwater Forested and Scrub Shrub Wetland	8758	41
Haw aii	Freshwater Forested and Scrub Shrub Wetland	USF WS - NWI	58024	Freshwater Forested and Scrub Shrub Wetland	4905 2	85
Mau i	Freshwater Forested and Scrub Shrub Wetland	USF WS - NWI	62306	Freshwater Forested and Scrub Shrub Wetland	6000 6	96
Lana i	Open Water	USF WS - NWI	276	Open Water	4	1
Niih au	Open Water	USF WS - NWI	2317	Open Water	1887	81
Mol okai	Open Water	USF WS - NWI	7871	Open Water	116	1
Oah u	Open Water	USF WS - NWI	8530	Open Water	1066	12
Kau ai	Open Water	USF WS - NWI	21318	Open Water	1304	6
Haw aii	Open Water	USF WS - NWI	58024	Open Water	400	1
Mau i	Open Water	USF WS - NWI	62306	Open Water	785	1

Wetlands from USGS Layers

Habit at	Habitat Quality	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Wetland	Heavily Disturbed	Private	Niihau	<1	<1	<1
Wetland	Bare or <5% Vegetation	Private	Niihau	5	<1	<1
Wetland	Native Non-native Mix	Private	Niihau	1544	3	<1
Wetland	Heavily Disturbed	Govt. Local	Lanai	15	<1	<1
Wetland	Heavily Disturbed	Private	Lanai	23	<1	<1
Wetland	Bare or <5% Vegetation	Private	Lanai	<1	<1	<1
Wetland	Native Non-native Mix	Private	Lanai	7	<1	<1
Wetland	Native Dominated	Private	Lanai	<1	<1	<1
Wetland	No Data	Private	Lanai	<1	<1	<1
Wetland	Heavily Disturbed	Govt. Federal	Molokai	<1	<1	<1
Wetland	Native Non-native Mix	Govt. Federal	Molokai	20	<1	<1
Wetland	Heavily Disturbed	Govt. Local	Molokai	4	<1	<1
Wetland	Bare or <5% Vegetation	Govt. Local	Molokai	<1	<1	<1
Wetland	Native Non-native Mix	Govt. Local	Molokai	4	<1	<1
Wetland	No Data	Govt. Local	Molokai	<1	<1	<1
Wetland	Heavily Disturbed	Govt. State	Molokai	120	<1	<1
Wetland	Bare or <5% Vegetation	Govt. State	Molokai	4	<1	<1
Wetland	Native Non-native Mix	Govt. State	Molokai	273	<1	<1
Wetland	Native Dominated	Govt. State	Molokai	<1	<1	<1
Wetland	No Data	Govt. State	Molokai	2	<1	<1
Wetland	Heavily Disturbed	Private	Molokai	51	<1	<1

Wetland	Bare or <5% Vegetation	Private	Molo kai	6	<1	<1
Wetland	Native Non-native Mix	Private	Molo kai	663	<1	<1
Wetland	Native Dominated	Private	Molo kai	5	<1	<1
Wetland	No Data	Private	Molo kai	4	<1	<1
Wetland	Heavily Disturbed	Govt. Federal	Kauai	<1	<1	<1
Wetland	Native Non-native Mix	Govt. Federal	Kauai	30	<1	<1
Wetland	Heavily Disturbed	Govt. Local	Kauai	<1	<1	<1
Wetland	Bare or <5% Vegetation	Govt. Local	Kauai	<1	<1	<1
Wetland	Heavily Disturbed	Govt. State	Kauai	109	<1	<1
Wetland	Bare or <5% Vegetation	Govt. State	Kauai	2	<1	<1
Wetland	Native Non-native Mix	Govt. State	Kauai	185	<1	<1
Wetland	Native Dominated	Govt. State	Kauai	179	<1	<1
Wetland	No Data	Govt. State	Kauai	<1	<1	<1
Wetland	Heavily Disturbed	No Data	Kauai	3	<1	<1
Wetland	Native Non-native Mix	No Data	Kauai	15	<1	<1
Wetland	Heavily Disturbed	Private	Kauai	268	<1	<1
Wetland	Bare or <5% Vegetation	Private	Kauai	<1	<1	<1
Wetland	Native Non-native Mix	Private	Kauai	1074	<1	<1
Wetland	Native Dominated	Private	Kauai	79	<1	<1
Wetland	No Data	Private	Kauai	1	<1	<1
Wetland	Heavily Disturbed	Govt. Federal	Oahu	80	<1	<1
Wetland	Bare or <5% Vegetation	Govt. Federal	Oahu	<1	<1	<1
Wetland	Native Non-native Mix	Govt. Federal	Oahu	451	<1	<1

Wetland	Native Dominated	Govt. Federal	Oahu	<1	<1	<1
Wetland	No Data	Govt. Federal	Oahu	<1	<1	<1
Wetland	Heavily Disturbed	Govt. Local	Oahu	68	<1	<1
Wetland	Bare or <5% Vegetation	Govt. Local	Oahu	<1	<1	<1
Wetland	Native Non-native Mix	Govt. Local	Oahu	88	<1	<1
Wetland	Native Dominated	Govt. Local	Oahu	1	<1	<1
Wetland	No Data	Govt. Local	Oahu	<1	<1	<1
Wetland	Heavily Disturbed	Govt. State	Oahu	52	<1	<1
Wetland	Bare or <5% Vegetation	Govt. State	Oahu	2	<1	<1
Wetland	Native Non-native Mix	Govt. State	Oahu	747	<1	<1
Wetland	Native Dominated	Govt. State	Oahu	<1	<1	<1
Wetland	No Data	Govt. State	Oahu	<1	<1	<1
Wetland	Heavily Disturbed	No Data	Oahu	2	<1	<1
Wetland	Native Non-native Mix	No Data	Oahu	<1	<1	<1
Wetland	Heavily Disturbed	Private	Oahu	607	<1	<1
Wetland	Bare or <5% Vegetation	Private	Oahu	1	<1	<1
Wetland	Native Non-native Mix	Private	Oahu	1035	<1	<1
Wetland	No Data	Private	Oahu	1	<1	<1
Wetland	Native Non-native Mix	Govt. Federal	Maui	1	<1	<1
Wetland	Native Dominated	Govt. Federal	Maui	96	<1	<1
Wetland	Heavily Disturbed	Govt. Local	Maui	16	<1	<1
Wetland	Native Non-native Mix	Govt. Local	Maui	<1	<1	<1
Wetland	Native Dominated	Govt. Local	Maui	146	<1	<1

Wetland	Heavily Disturbed	Govt. State	Maui	17	<1	<1
Wetland	Native Non-native Mix	Govt. State	Maui	130	<1	<1
Wetland	Native Dominated	Govt. State	Maui	463	<1	<1
Wetland	Heavily Disturbed	Private	Maui	354	<1	<1
Wetland	Bare or <5% Vegetation	Private	Maui	9	<1	<1
Wetland	Native Non-native Mix	Private	Maui	408	<1	<1
Wetland	Native Dominated	Private	Maui	178	<1	<1
Wetland	Heavily Disturbed	Govt. Federal	Hawaii	<1	<1	<1
Wetland	Bare or <5% Vegetation	Govt. Federal	Hawaii	4	<1	<1
Wetland	Native Non-native Mix	Govt. Federal	Hawaii	55	<1	<1
Wetland	Native Dominated	Govt. Federal	Hawaii	1	<1	<1
Wetland	No Data	Govt. Federal	Hawaii	<1	<1	<1
Wetland	Heavily Disturbed	Govt. Local	Hawaii	<1	<1	<1
Wetland	Native Non-native Mix	Govt. Local	Hawaii	<1	<1	<1
Wetland	Heavily Disturbed	Govt. State	Hawaii	72	<1	<1
Wetland	Bare or <5% Vegetation	Govt. State	Hawaii	6	<1	<1
Wetland	Native Non-native Mix	Govt. State	Hawaii	252	<1	<1
Wetland	Native Dominated	Govt. State	Hawaii	237	<1	<1
Wetland	No Data	Govt. State	Hawaii	<1	<1	<1
Wetland	Heavily Disturbed	No Data	Hawaii	1	<1	<1
Wetland	Native Non-native Mix	No Data	Hawaii	<1	<1	<1
Wetland	Heavily Disturbed	Private	Hawaii	150	<1	<1
Wetland	Bare or <5% Vegetation	Private	Hawaii	11	<1	<1

Wetland	Native Non-native Mix	Private	Hawaiian	390	<1	<1
Wetland	Native Dominated	Private	Hawaiian	3	<1	<1
Wetland	No Data	Private	Hawaiian	<1	<1	<1

Appendix D. Land Ownership Tables

Barren

Habitat	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Barren	Govt. Federal	Kahoolawe	7	<1	<1
Barren	Govt. State	Kahoolawe	5883	21	<1
Barren	Private	Niihau	3718	8	<1
Barren	Govt. Federal	Lanai	6	<1	<1
Barren	Govt. Local	Lanai	1	<1	<1
Barren	Govt. State	Lanai	4	<1	<1
Barren	Private	Lanai	1660	2	<1
Barren	Govt. Federal	Molokai	10	<1	<1
Barren	Govt. Local	Molokai	1	<1	<1
Barren	Govt. State	Molokai	1462	1	<1
Barren	Private	Molokai	2920	2	<1
Barren	Govt. Federal	Kauai	648	<1	<1
Barren	Govt. Local	Kauai	63	<1	<1
Barren	Govt. State	Kauai	12092	3	<1
Barren	No Data	Kauai	85	<1	<1
Barren	Private	Kauai	8033	2	<1
Barren	Govt. Federal	Oahu	228	<1	<1
Barren	Govt. Local	Oahu	183	<1	<1
Barren	Govt. State	Oahu	461	<1	<1
Barren	No Data	Oahu	46	<1	<1
Barren	Private	Oahu	874	<1	<1
Barren	Govt. Federal	Maui	8891	2	<1
Barren	Govt. Local	Maui	90	<1	<1
Barren	Govt. State	Maui	14947	3	<1
Barren	No Data	Maui	2	<1	<1
Barren	Private	Maui	14020	3	<1
Barren	Govt. Federal	Hawaii	233873	9	6
Barren	Govt. Local	Hawaii	867	<1	<1
Barren	Govt. State	Hawaii	297191	12	7
Barren	No Data	Hawaii	1275	<1	<1
Barren	Private	Hawaii	162343	6	4

Coastal from USGS Coastal Vegetation Assessment

Land Ownership	Island	Coastline Length (km)	Length (% of State Coastline)	Length (% of Island Coastline)
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Govt. Federal	Kahoolawe	1	<1	2
Govt. State	Kahoolawe	29	2	44
Govt. Federal	Lanai	0	<1	<1
Govt. State	Lanai	1	<1	1
Private	Lanai	61	3	68
Govt. Federal	Kauai	13	1	7
Govt. Local	Kauai	5	<1	3
Govt. State	Kauai	41	2	22
Govt. State	Kauai	1	<1	1
DHHL				
No Data	Kauai	2	<1	1
Private	Kauai	50	3	26
Govt. Federal	Molokai	1	<1	1
Govt. Local	Molokai	0	<1	<1
Govt. State	Molokai	19	1	10
Govt. State	Molokai	15	1	8
DHHL				
Private	Molokai	60	3	31
Govt. Federal	Maui	3	<1	1
Govt. Local	Maui	5	<1	2
Govt. State	Maui	67	4	23
Govt. State	Maui	1	<1	<1
DHHL				
No Data	Maui	0	<1	<1
Private	Maui	72	4	25
Govt. Federal	Oahu	49	3	13
Govt. Local	Oahu	14	1	4
Govt. State	Oahu	35	2	9
Govt. State	Oahu	1	<1	<1
DHHL				
No Data	Oahu	0	<1	<1
Private	Oahu	70	4	19
Govt. Federal	Hawaii	32	2	6
Govt. Local	Hawaii	10	1	2
Govt. State	Hawaii	127	7	22
Govt. State	Hawaii	14	1	2
DHHL				
No Data	Hawaii	14	1	2
Private	Hawaii	224	13	40

Coastal from USGS Carbon Assessment Layers

Habitat	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Coastal	Govt. State	Kahoolawe	13	<1	<1
Coastal	Govt. State	Molokai	28	<1	<1

Developed

Habitat	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Developed	Govt. State	Kahoolawe	149	1	<1
Developed	Private	Niihau	332	1	<1
Developed	Govt. Federal	Lanai	<1	<1	<1
Developed	Govt. Local	Lanai	46	<1	<1
Developed	Govt. State	Lanai	192	<1	<1
Developed	Private	Lanai	3100	3	<1
Developed	Govt. Federal	Molokai	53	<1	<1
Developed	Govt. Local	Molokai	97	<1	<1
Developed	Govt. State	Molokai	4139	3	<1
Developed	Private	Molokai	6129	4	<1
Developed	Govt. Federal	Kauai	1211	<1	<1
Developed	Govt. Local	Kauai	518	<1	<1
Developed	Govt. State	Kauai	19664	6	<1
Developed	No Data	Kauai	2764	1	<1
Developed	Private	Kauai	39569	11	1
Developed	Govt. Federal	Oahu	20889	6	1
Developed	Govt. Local	Oahu	5312	1	<1

Developed	Govt. State	Oahu	11680	3	<1	
Developed	No Data	Oahu	2207	1	<1	
Developed	Private	Oahu	82224	22		2
Developed	Govt. Federal	Maui	304	<1	<1	
Developed	Govt. Local	Maui	2187	<1	<1	
Developed	Govt. State	Maui	7407	2	<1	
Developed	No Data	Maui	10	<1	<1	
Developed	Private	Maui	89571	19		2
Developed	Govt. Federal	Hawaii	1649	<1	<1	
Developed	Govt. Local	Hawaii	939	<1	<1	
Developed	Govt. State	Hawaii	25971	1		1
Developed	No Data	Hawaii	6636	<1	<1	
Developed	Private	Hawaii	137728	5		3

Dry Forest

Habitat	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)	
Dry Forest	Govt. Federal	Kahoolawe	11	<1	<1	
Dry Forest	Govt. State	Kahoolawe	13646	48	<1	
Dry Forest	Private	Niihau	32624	71		1
Dry Forest	Govt. Federal	Lanai	1	<1	<1	
Dry Forest	Govt. Local	Lanai	31	<1	<1	
Dry Forest	Govt. State	Lanai	25	<1	<1	
Dry Forest	Private	Lanai	31554	35		1
Dry Forest	Govt. Federal	Molokai	47	<1	<1	

Dry Forest	Govt. Local	Molokai	51	<1	<1
Dry Forest	Govt. State	Molokai	4152	3	<1
Dry Forest	Private	Molokai	17030	10	<1
Dry Forest	Govt. Federal	Kauai	590	<1	<1
Dry Forest	Govt. Local	Kauai	59	<1	<1
Dry Forest	Govt. State	Kauai	6003	2	<1
Dry Forest	No Data	Kauai	127	<1	<1
Dry Forest	Private	Kauai	4955	1	<1
Dry Forest	Govt. Federal	Oahu	5649	2	<1
Dry Forest	Govt. Local	Oahu	1213	<1	<1
Dry Forest	Govt. State	Oahu	5331	1	<1
Dry Forest	No Data	Oahu	726	<1	<1
Dry Forest	Private	Oahu	12242	3	<1
Dry Forest	Govt. Federal	Maui	378	<1	<1
Dry Forest	Govt. Local	Maui	178	<1	<1
Dry Forest	Govt. State	Maui	9752	2	<1
Dry Forest	No Data	Maui	6	<1	<1
Dry Forest	Private	Maui	24774	5	1
Dry Forest	Govt. Federal	Hawaii	6189	<1	<1
Dry Forest	Govt. Local	Hawaii	156	<1	<1
Dry Forest	Govt. State	Hawaii	37984	1	1
Dry Forest	No Data	Hawaii	178	<1	<1
Dry Forest	Private	Hawaii	48009	2	1

Dry Grassland and Shrubland

Habitat	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Dry Grasslands and Shrublands	Govt. State	Kahoolawe	8611	30	<1
Dry Grasslands and Shrublands	Private	Niihau	6948	15	<1
Dry Grasslands and Shrublands	Govt. Local	Lanai	116	<1	<1
Dry Grasslands and Shrublands	Govt. State	Lanai	362	<1	<1
Dry Grasslands and Shrublands	Private	Lanai	46361	51	1
Dry Grasslands and Shrublands	Govt. Federal	Molokai	41	<1	<1
Dry Grasslands and Shrublands	Govt. Local	Molokai	101	<1	<1
Dry Grasslands and Shrublands	Govt. State	Molokai	18753	11	<1
Dry Grasslands and Shrublands	Private	Molokai	55849	34	1
Dry Grasslands and Shrublands	Govt. Federal	Kauai	106	<1	<1
Dry Grasslands and Shrublands	Govt. Local	Kauai	112	<1	<1
Dry Grasslands and Shrublands	Govt. State	Kauai	21770	6	1
Dry Grasslands and Shrublands	No Data	Kauai	164	<1	<1
Dry Grasslands and Shrublands	Private	Kauai	11799	3	<1
Dry Grasslands and Shrublands	Govt. Federal	Oahu	8322	2	<1
Dry Grasslands and Shrublands	Govt. Local	Oahu	2848	1	<1
Dry Grasslands and Shrublands	Govt. State	Oahu	11564	3	<1
Dry Grasslands and Shrublands	No Data	Oahu	1996	1	<1
Dry Grasslands and Shrublands	Private	Oahu	26299	7	1
Dry Grasslands and Shrublands	Govt. Federal	Maui	4980	1	<1
Dry Grasslands and Shrublands	Govt. Local	Maui	457	<1	<1
Dry Grasslands and Shrublands	Govt. State	Maui	26698	6	1

Dry Grasslands and Shrublands	No Data	Maui	5	<1	<1
Dry Grasslands and Shrublands	Private	Maui	33918	7	1
Dry Grasslands and Shrublands	Govt. Federal	Hawaii	52688	2	1
Dry Grasslands and Shrublands	Govt. Local	Hawaii	778	<1	<1
Dry Grasslands and Shrublands	Govt. State	Hawaii	190534	7	5
Dry Grasslands and Shrublands	No Data	Hawaii	1402	<1	<1
Dry Grasslands and Shrublands	Private	Hawaii	216641	8	5

Mesic Forest

Habitat	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Mesic Forest	Private	Lanai	952	1	<1
Mesic Forest	Govt. Local	Molokai	6	<1	<1
Mesic Forest	Govt. State	Molokai	7476	5	<1
Mesic Forest	Private	Molokai	12570	8	<1
Mesic Forest	Govt. Federal	Kauai	595	<1	<1
Mesic Forest	Govt. Local	Kauai	61	<1	<1
Mesic Forest	Govt. State	Kauai	39401	11	1
Mesic Forest	No Data	Kauai	893	<1	<1
Mesic Forest	Private	Kauai	33175	9	1
Mesic Forest	Govt. Federal	Oahu	11307	3	<1
Mesic Forest	Govt. Local	Oahu	4096	1	<1
Mesic Forest	Govt. State	Oahu	19853	5	<1
Mesic Forest	No Data	Oahu	1537	<1	<1
Mesic Forest	Private	Oahu	43552	12	1

Mesic Forest	Govt. Federal	Maui	2829	1	<1
Mesic Forest	Govt. Local	Maui	821	<1	<1
Mesic Forest	Govt. State	Maui	16736	4	<1
Mesic Forest	No Data	Maui	9	<1	<1
Mesic Forest	Private	Maui	35968	8	1
Mesic Forest	Govt. Federal	Hawaii	26464	1	1
Mesic Forest	Govt. Local	Hawaii	2137	<1	<1
Mesic Forest	Govt. State	Hawaii	69354	3	2
Mesic Forest	No Data	Hawaii	614	<1	<1
Mesic Forest	Private	Hawaii	104736	4	3

Mesic Grassland and Shrubland

Habitat	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Mesic Grasslands and Shrublands	Private	Niihau	689	1	<1
Mesic Grasslands and Shrublands	Private	Lanai	2198	2	<1
Mesic Grasslands and Shrublands	Govt. State	Molokai	2857	2	<1
Mesic Grasslands and Shrublands	Private	Molokai	6166	4	<1
Mesic Grasslands and Shrublands	Govt. Federal	Kauai	243	<1	<1
Mesic Grasslands and Shrublands	Govt. Local	Kauai	56	<1	<1
Mesic Grasslands and Shrublands	Govt. State	Kauai	13468	4	<1
Mesic Grasslands and Shrublands	No Data	Kauai	1313	<1	<1
Mesic Grasslands and Shrublands	Private	Kauai	30336	9	1
Mesic Grasslands and Shrublands	Govt. Federal	Oahu	5493	1	<1
Mesic Grasslands and Shrublands	Govt. Local	Oahu	1237	<1	<1

Mesic Grasslands and Shrublands	Govt. State	Oahu	5306	1	<1
Mesic Grasslands and Shrublands	No Data	Oahu	213	<1	<1
Mesic Grasslands and Shrublands	Private	Oahu	8794	2	<1
Mesic Grasslands and Shrublands	Govt. Federal	Maui	7850	2	<1
Mesic Grasslands and Shrublands	Govt. Local	Maui	394	<1	<1
Mesic Grasslands and Shrublands	Govt. State	Maui	16634	4	<1
Mesic Grasslands and Shrublands	No Data	Maui	1	<1	<1
Mesic Grasslands and Shrublands	Private	Maui	29364	6	1
Mesic Grasslands and Shrublands	Govt. Federal	Hawai i	57810	2	1
Mesic Grasslands and Shrublands	Govt. Local	Hawai i	1245	<1	<1
Mesic Grasslands and Shrublands	Govt. State	Hawai i	133115	5	3
Mesic Grasslands and Shrublands	No Data	Hawai i	1077	<1	<1
Mesic Grasslands and Shrublands	Private	Hawai i	132076	5	3

Streams from State DAR Layers

Land Ownership	Island	Total Stream Length on Island (km)	Stream Length in Land Ownership Category (km)	Length (% of Total State Stream Length)	Length (% of Total Island Stream Length)
Private	Niihau	116	116	1	100
Govt. Federal	Kahoolawe	177	<1	<1	<1
Govt. State	Kahoolawe	177	176	1	100
Govt. Local	Lanai	735	1	<1	<1
Govt. State	Lanai	735	2	<1	<1
Govt. State	Lanai	735	<1	<1	<1

Private	Lana i	735	730	5	99
Govt. Federal	Mol okai	1194	1	<1	<1
Govt. Local	Mol okai	1194	1	<1	<1
Govt. State	Mol okai	1194	167	1	14
Govt. State	Mol okai	1194	141	1	12
Private	Mol okai	1194	870	7	73
Govt. Federal	Mau i	2033	70	1	3
Govt. Local	Mau i	2033	33	<1	2
Govt. State	Mau i	2033	480	4	24
Govt. State	Mau i	2033	48	<1	2
No Data	Mau i	2033	<1	<1	<1
Private	Mau i	2033	1375	10	68
Govt. Federal	Oah u	2404	354	3	15
Govt. Local	Oah u	2404	121	1	5
Govt. State	Oah u	2404	448	3	19
Govt. State	Oah u	2404	25	<1	1
No Data	Oah u	2404	52	<1	2
Private	Oah u	2404	1357	10	56
Govt. Federal	Kaua i	2624	7	<1	<1
Govt. Local	Kaua i	2624	2	<1	<1
Govt. State	Kaua i	2624	1040	8	40
Govt. State	Kaua i	2624	151	1	6
No Data	Kaua i	2624	30	<1	1

Private	Kaua'i	2624	1391	10	53
Govt. Federal	Hawaii	4059	303	2	7
Govt. Local	Hawaii	4059	43	<1	1
Govt. State	Hawaii	4059	1206	9	30
Govt. State	Hawaii	4059	312	2	8
No Data	Hawaii	4059	28	<1	1
Private	Hawaii	4059	2166	16	53

Wet Forest

Habitat	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Wet Forest	Private	Lanai	3190	4	<1
Wet Forest	Govt. State	Molokai	7687	5	<1
Wet Forest	Private	Molokai	9747	6	<1
Wet Forest	Govt. Federal	Kauai	7	<1	<1
Wet Forest	Govt. Local	Kauai	1	<1	<1
Wet Forest	Govt. State	Kauai	36453	10	1
Wet Forest	No Data	Kauai	19	<1	<1
Wet Forest	Private	Kauai	48542	14	1
Wet Forest	Govt. Federal	Oahu	8640	2	<1
Wet Forest	Govt. Local	Oahu	2857	1	<1
Wet Forest	Govt. State	Oahu	17777	5	<1
Wet Forest	No Data	Oahu	1	<1	<1
Wet Forest	Private	Oahu	31640	9	1
Wet Forest	Govt. Federal	Maui	7613	2	<1

Wet Forest	Govt. Local	Maui	841	<1	<1
Wet Forest	Govt. State	Maui	27805	6	1
Wet Forest	Private	Maui	57986	13	1
Wet Forest	Govt. Federal	Hawaii	49639	2	1
Wet Forest	Govt. Local	Hawaii	344	<1	<1
Wet Forest	Govt. State	Hawaii	294693	11	7
Wet Forest	No Data	Hawaii	1081	<1	<1
Wet Forest	Private	Hawaii	170352	7	4

Wet Grassland and Shrubland

Habitat	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Wet Grasslands and Shrublands	Private	Lanai	64	<1	<1
Wet Grasslands and Shrublands	Govt. State	Molo kai	1808	1	<1
Wet Grasslands and Shrublands	Private	Molo kai	3819	2	<1
Wet Grasslands and Shrublands	Govt. Local	Kauai	1	<1	<1
Wet Grasslands and Shrublands	Govt. State	Kauai	6103	2	<1
Wet Grasslands and Shrublands	No Data	Kauai	2	<1	<1
Wet Grasslands and Shrublands	Private	Kauai	11817	3	<1
Wet Grasslands and Shrublands	Govt. Federal	Oahu	328	<1	<1
Wet Grasslands and Shrublands	Govt. Local	Oahu	699	<1	<1
Wet Grasslands and Shrublands	Govt. State	Oahu	1851	<1	<1
Wet Grasslands and Shrublands	No Data	Oahu	4	<1	<1
Wet Grasslands and Shrublands	Private	Oahu	2192	1	<1
Wet Grasslands and Shrublands	Govt. Federal	Maui	716	<1	<1

Wet Grasslands and Shrublands	Govt. Local	Maui	3070	1	<1
Wet Grasslands and Shrublands	Govt. State	Maui	3560	1	<1
Wet Grasslands and Shrublands	Private	Maui	7298	2	<1
Wet Grasslands and Shrublands	Govt. Federal	Hawai'i	3870	<1	<1
Wet Grasslands and Shrublands	Govt. Local	Hawai'i	246	<1	<1
Wet Grasslands and Shrublands	Govt. State	Hawai'i	42809	2	1
Wet Grasslands and Shrublands	No Data	Hawai'i	594	<1	<1
Wet Grasslands and Shrublands	Private	Hawai'i	67453	3	2

Wetlands from NOAA Layers

Island	Wetland Type	Total Wetland Area on Island (Acres)	Land Ownership	Area (Acres)	Area (% of Wetland Area on Island)
Lanai	Open Water	213	Govt. Federal	122	57
Oahu	Estuarine Emergent Wetland	3218	Govt. Federal	51	2
Oahu	Estuarine Forested Wetland	3218	Govt. Federal	96	3
Oahu	Palustrine Aquatic Bed	3218	Govt. Federal	1	<1
Oahu	Palustrine Emergent Wetland	3218	Govt. Federal	133	4
Oahu	Palustrine Forested Wetland	3218	Govt. Federal	9	<1
Oahu	Unconsolidated Shore	3218	Govt. Federal	70	2
Oahu	Open Water	3218	Govt. Federal	1047	33
Oahu	Palustrine Scrub Shrub Wetland	3218	Govt. Federal	30	1
Oahu	Estuarine Scrub Shrub Wetland	3218	Govt. Federal	36	1
Molokai	Palustrine Emergent Wetland	4814	Govt. Federal	9	<1
Molokai	Palustrine Forested Wetland	4814	Govt. Federal	12	<1
Molokai	Unconsolidated Shore	4814	Govt. Federal	1	<1
Molokai	Open Water	4814	Govt. Federal	427	9
Molokai	Palustrine Scrub Shrub Wetland	4814	Govt. Federal	1	<1
Maui	Palustrine Emergent Wetland	6106	Govt. Federal	24	<1
Maui	Palustrine Forested Wetland	6106	Govt. Federal	140	2
Maui	Unconsolidated Shore	6106	Govt. Federal	2	<1
Maui	Open Water	6106	Govt. Federal	346	6
Maui	Palustrine Scrub Shrub Wetland	6106	Govt. Federal	132	2
Kauai	Estuarine Emergent Wetland	8297	Govt. Federal	32	<1

Kauai	Estuarine Forested Wetland	8297	Govt. Federal	56	1
Kauai	Estuarine Scrub/Shrub Wetland	8297	Govt. Federal	4	<1
Kauai	Palustrine Emergent Wetland	8297	Govt. Federal	13	<1
Kauai	Palustrine Forested Wetland	8297	Govt. Federal	174	2
Kauai	Palustrine Scrub/Shrub Wetland	8297	Govt. Federal	<1	<1
Kauai	Unconsolidated Shore	8297	Govt. Federal	53	1
Kauai	Water	8297	Govt. Federal	449	5
Hawaii	Estuarine Emergent Wetland	15791	Govt. Federal	15	<1
Hawaii	Palustrine Emergent Wetland	15791	Govt. Federal	232	1
Hawaii	Palustrine Forested Wetland	15791	Govt. Federal	1029	7
Hawaii	Palustrine Scrub/Shrub Wetland	15791	Govt. Federal	784	5
Hawaii	Unconsolidated Shore	15791	Govt. Federal	<1	<1
Hawaii	Water	15791	Govt. Federal	1651	10
Lanai	Open Water	213	Govt. Local	16	8
Oahu	Estuarine Emergent Wetland	3218	Govt. Local	23	1
Oahu	Estuarine Forested Wetland	3218	Govt. Local	74	2
Oahu	Palustrine Emergent Wetland	3218	Govt. Local	62	2
Oahu	Palustrine Forested Wetland	3218	Govt. Local	31	1
Oahu	Unconsolidated Shore	3218	Govt. Local	82	3
Oahu	Open Water	3218	Govt. Local	886	28
Oahu	Palustrine Scrub Shrub Wetland	3218	Govt. Local	15	<1
Oahu	Estuarine Scrub Shrub Wetland	3218	Govt. Local	32	1
Molokai	Estuarine Emergent Wetland	4814	Govt. Local	19	<1
Molokai	Estuarine Forested Wetland	4814	Govt. Local	21	<1
Molokai	Unconsolidated Shore	4814	Govt. Local	1	<1
Molokai	Open Water	4814	Govt. Local	430	9
Molokai	Estuarine Scrub Shrub Wetland	4814	Govt. Local	2	<1
Maui	Palustrine Emergent Wetland	6106	Govt. Local	70	1
Maui	Palustrine Forested Wetland	6106	Govt. Local	21	<1
Maui	Unconsolidated Shore	6106	Govt. Local	26	<1
Maui	Open Water	6106	Govt. Local	582	10
Maui	Palustrine Scrub Shrub Wetland	6106	Govt. Local	112	2
Kauai	Palustrine Emergent Wetland	8297	Govt. Local	4	<1
Kauai	Palustrine Forested Wetland	8297	Govt. Local	21	<1
Kauai	Palustrine Scrub/Shrub Wetland	8297	Govt. Local	1	<1
Kauai	Unconsolidated Shore	8297	Govt. Local	21	<1
Kauai	Water	8297	Govt. Local	463	6
Hawaii	Estuarine Emergent Wetland	15791	Govt. Local	1	<1
Hawaii	Estuarine Forested Wetland	15791	Govt. Local	1	<1
Hawaii	Estuarine Scrub/Shrub Wetland	15791	Govt. Local	<1	<1
Hawaii	Palustrine Aquatic Bed	15791	Govt. Local	1	<1

Hawaii	Water	15791	Govt. Local	1438	9
Lanai	Open Water	213	Govt. State	122	57
Oahu	Estuarine Emergent Wetland	3218	Govt. State	20	1
Oahu	Estuarine Forested Wetland	3218	Govt. State	24	1
Oahu	Palustrine Aquatic Bed	3218	Govt. State	3	<1
Oahu	Palustrine Emergent Wetland	3218	Govt. State	105	3
Oahu	Palustrine Forested Wetland	3218	Govt. State	13	<1
Oahu	Unconsolidated Shore	3218	Govt. State	109	3
Oahu	Open Water	3218	Govt. State	1483	46
Oahu	Palustrine Scrub Shrub Wetland	3218	Govt. State	47	1
Oahu	Estuarine Scrub Shrub Wetland	3218	Govt. State	12	<1
Molokai	Estuarine Emergent Wetland	4814	Govt. State	270	6
Molokai	Estuarine Forested Wetland	4814	Govt. State	98	2
Molokai	Palustrine Emergent Wetland	4814	Govt. State	38	1
Molokai	Palustrine Forested Wetland	4814	Govt. State	912	19
Molokai	Unconsolidated Shore	4814	Govt. State	16	<1
Molokai	Open Water	4814	Govt. State	971	20
Molokai	Palustrine Scrub Shrub Wetland	4814	Govt. State	534	11
Molokai	Estuarine Scrub Shrub Wetland	4814	Govt. State	189	4
Maui	Palustrine Emergent Wetland	6106	Govt. State	223	4
Maui	Palustrine Forested Wetland	6106	Govt. State	1219	20
Maui	Unconsolidated Shore	6106	Govt. State	93	2
Maui	Open Water	6106	Govt. State	986	16
Maui	Palustrine Scrub Shrub Wetland	6106	Govt. State	861	14
Kauai	Estuarine Emergent Wetland	8297	Govt. State	3	<1
Kauai	Estuarine Forested Wetland	8297	Govt. State	21	<1
Kauai	Palustrine Aquatic Bed	8297	Govt. State	3	<1
Kauai	Palustrine Emergent Wetland	8297	Govt. State	615	7
Kauai	Palustrine Forested Wetland	8297	Govt. State	1959	24
Kauai	Palustrine Scrub/Shrub Wetland	8297	Govt. State	388	5
Kauai	Unconsolidated Shore	8297	Govt. State	132	2
Kauai	Water	8297	Govt. State	1556	19
Hawaii	Estuarine Emergent Wetland	15791	Govt. State	8	<1
Hawaii	Palustrine Aquatic Bed	15791	Govt. State	<1	<1
Hawaii	Palustrine Emergent Wetland	15791	Govt. State	953	6
Hawaii	Palustrine Forested Wetland	15791	Govt. State	3537	22
Hawaii	Palustrine Scrub/Shrub Wetland	15791	Govt. State	1862	12
Hawaii	Unconsolidated Shore	15791	Govt. State	28	<1
Hawaii	Water	15791	Govt. State	3935	25
Oahu	Estuarine Emergent Wetland	3218	No Data	<1	<1
Oahu	Estuarine Forested Wetland	3218	No Data	28	1

Oahu	Palustrine Forested Wetland	3218	No Data	12	<1
Oahu	Unconsolidated Shore	3218	No Data	1	<1
Oahu	Open Water	3218	No Data	680	21
Oahu	Palustrine Scrub Shrub Wetland	3218	No Data	3	<1
Oahu	Estuarine Scrub Shrub Wetland	3218	No Data	12	<1
Kauai	Palustrine Emergent Wetland	8297	No Data	144	2
Kauai	Palustrine Forested Wetland	8297	No Data	273	3
Kauai	Palustrine Scrub/Shrub Wetland	8297	No Data	19	<1
Kauai	Unconsolidated Shore	8297	No Data	27	<1
Kauai	Water	8297	No Data	565	7
Hawaii	Estuarine Emergent Wetland	15791	No Data	2	<1
Hawaii	Estuarine Forested Wetland	15791	No Data	<1	<1
Hawaii	Palustrine Emergent Wetland	15791	No Data	10	<1
Hawaii	Palustrine Forested Wetland	15791	No Data	33	<1
Hawaii	Palustrine Scrub/Shrub Wetland	15791	No Data	8	<1
Hawaii	Water	15791	No Data	1686	11
Lanai	Palustrine Aquatic Bed	213	Private	2	1
Lanai	Palustrine Emergent Wetland	213	Private	2	1
Lanai	Unconsolidated Shore	213	Private	50	23
Lanai	Open Water	213	Private	148	69
Niihau	Palustrine Emergent Wetland	1533	Private	82	5
Niihau	Palustrine Forested Wetland	1533	Private	77	5
Niihau	Palustrine Scrub/Shrub Wetland	1533	Private	72	5
Niihau	Unconsolidated Shore	1533	Private	833	54
Niihau	Water	1533	Private	468	31
Oahu	Estuarine Emergent Wetland	3218	Private	6	<1
Oahu	Estuarine Forested Wetland	3218	Private	70	2
Oahu	Palustrine Aquatic Bed	3218	Private	<1	<1
Oahu	Palustrine Emergent Wetland	3218	Private	213	7
Oahu	Palustrine Forested Wetland	3218	Private	86	3
Oahu	Unconsolidated Shore	3218	Private	125	4
Oahu	Open Water	3218	Private	1293	40
Oahu	Palustrine Scrub Shrub Wetland	3218	Private	151	5
Oahu	Estuarine Scrub Shrub Wetland	3218	Private	22	1
Molokai	Estuarine Emergent Wetland	4814	Private	144	3
Molokai	Estuarine Forested Wetland	4814	Private	188	4
Molokai	Palustrine Aquatic Bed	4814	Private	<1	<1
Molokai	Palustrine Emergent Wetland	4814	Private	367	8
Molokai	Palustrine Forested Wetland	4814	Private	1035	21
Molokai	Unconsolidated Shore	4814	Private	84	2
Molokai	Open Water	4814	Private	512	11

Molokai	Palustrine Scrub Shrub Wetland	4814	Private	1273	26
Molokai	Estuarine Scrub Shrub Wetland	4814	Private	265	6
Maui	Palustrine Emergent Wetland	6106	Private	365	6
Maui	Palustrine Forested Wetland	6106	Private	1511	25
Maui	Unconsolidated Shore	6106	Private	345	6
Maui	Open Water	6106	Private	973	16
Maui	Palustrine Scrub Shrub Wetland	6106	Private	1186	19
Kauai	Estuarine Emergent Wetland	8297	Private	4	<1
Kauai	Estuarine Forested Wetland	8297	Private	56	1
Kauai	Palustrine Aquatic Bed	8297	Private	<1	<1
Kauai	Palustrine Emergent Wetland	8297	Private	1279	15
Kauai	Palustrine Forested Wetland	8297	Private	2261	27
Kauai	Palustrine Scrub/Shrub Wetland	8297	Private	416	5
Kauai	Unconsolidated Shore	8297	Private	106	1
Kauai	Water	8297	Private	2001	24
Hawaii	Estuarine Emergent Wetland	15791	Private	8	<1
Hawaii	Estuarine Forested Wetland	15791	Private	11	<1
Hawaii	Estuarine Scrub/Shrub Wetland	15791	Private	<1	<1
Hawaii	Palustrine Aquatic Bed	15791	Private	<1	<1
Hawaii	Palustrine Emergent Wetland	15791	Private	1176	7
Hawaii	Palustrine Forested Wetland	15791	Private	3466	22
Hawaii	Palustrine Scrub/Shrub Wetland	15791	Private	2377	15
Hawaii	Unconsolidated Shore	15791	Private	17	<1
Hawaii	Water	15791	Private	2727	17

Wetlands from USGS Layers

Habitat	Land Ownership	Island	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Wetland	Private	Niihau	1549	3	<1
Wetland	Govt. Local	Lanai	15	<1	<1
Wetland	Private	Lanai	30	<1	<1
Wetland	Govt. Federal	Molokai	21	<1	<1
Wetland	Govt. Local	Molokai	8	<1	<1
Wetland	Govt. State	Molokai	399	<1	<1
Wetland	Private	Molokai	728	<1	<1
Wetland	Govt. Federal	Kauai	30	<1	<1
Wetland	Govt. Local	Kauai	<1	<1	<1
Wetland	Govt. State	Kauai	476	<1	<1
Wetland	No Data	Kauai	18	<1	<1

Wetland	Private	Kauai	1423	<1	<1
Wetland	Govt. Federal	Oahu	531	<1	<1
Wetland	Govt. Local	Oahu	157	<1	<1
Wetland	Govt. State	Oahu	802	<1	<1
Wetland	No Data	Oahu	2	<1	<1
Wetland	Private	Oahu	1644	<1	<1
Wetland	Govt. Federal	Maui	97	<1	<1
Wetland	Govt. Local	Maui	162	<1	<1
Wetland	Govt. State	Maui	610	<1	<1
Wetland	Private	Maui	949	<1	<1
Wetland	Govt. Federal	Hawaii	60	<1	<1
Wetland	Govt. Local	Hawaii	<1	<1	<1
Wetland	Govt. State	Hawaii	567	<1	<1
Wetland	No Data	Hawaii	1	<1	<1
Wetland	Private	Hawaii	554	<1	<1

Appendix E. Reserve Status Tables

Barren

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Kahoolawe	Barren	Heavily Disturbed	<1	28387	<1	<1
Kahoolawe	Barren	Bare or <5% Vegetation	<1	28387	<1	<1
Kahoolawe	Barren	Native Non-native Mix	<1	28387	<1	<1
Kahoolawe	Barren	No Data	<1	28387	<1	<1
Niihau	Barren	Bare or <5% Vegetation	<1	45907	<1	<1
Niihau	Barren	Native Non-native Mix	<1	45907	<1	<1
Niihau	Barren	No Data	<1	45907	<1	<1
Lanai	Barren	Heavily Disturbed	<1	90058	<1	<1
Lanai	Barren	Bare or <5% Vegetation	17	90058	<1	<1
Lanai	Barren	Native Non-native Mix	1	90058	<1	<1
Lanai	Barren	Native Dominated	<1	90058	<1	<1
Lanai	Barren	No Data	<1	90058	<1	<1
Molokai	Barren	Heavily Disturbed	10	164266	<1	<1
Molokai	Barren	Bare or <5% Vegetation	298	164266	<1	<1
Molokai	Barren	Native Non-native Mix	205	164266	<1	<1
Molokai	Barren	Native Dominated	76	164266	<1	<1
Molokai	Barren	No Data	26	164266	<1	<1
Kauai	Barren	Heavily Disturbed	1	354833	<1	<1
Kauai	Barren	Bare or <5% Vegetation	103	354833	<1	<1
Kauai	Barren	Native Non-native Mix	202	354833	<1	<1
Kauai	Barren	Native Dominated	40	354833	<1	<1
Kauai	Barren	No Data	20	354833	<1	<1
Oahu	Barren	Heavily Disturbed	1	371259	<1	<1
Oahu	Barren	Bare or <5% Vegetation	45	371259	<1	<1
Oahu	Barren	Native Non-native Mix	61	371259	<1	<1
Oahu	Barren	Native Dominated	6	371259	<1	<1
Oahu	Barren	No Data	8	371259	<1	<1
Maui	Barren	Heavily Disturbed	56	460028	<1	<1
Maui	Barren	Bare or <5% Vegetation	7897	460028	2	<1
Maui	Barren	Native Non-native Mix	1413	460028	<1	<1
Maui	Barren	Native Dominated	1275	460028	<1	<1
Maui	Barren	No Data	29	460028	<1	<1
Hawaii	Barren	Heavily Disturbed	612	2584205	<1	<1
Hawaii	Barren	Bare or <5% Vegetation	257739	2584205	10	6
Hawaii	Barren	Native Non-native Mix	4466	2584205	<1	<1
Hawaii	Barren	Native Dominated	10594	2584205	<1	<1

Hawaii	Barren	No Data		67	2584205	<1	<1
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Coastal from USGS Coastal Vegetation Assessment

Reserve Type	Island	Coastline Length in Reserve (km)	Length (% of State Coastline)	Length (% of Island Coastline)
Wildlife Sanctuary	Lanai	0	<1	<1
National Wildlife Refuge	Kauai	3	<1	2
Natural Area Reserve	Kauai	0	<1	<1
State Wilderness Park	Kauai	11	1	6
Wildlife Sanctuary	Kauai	0	<1	<1
National Historical Park	Molokai	11	1	6
National Wildlife Refuge	Molokai	0	<1	<1
Natural Area Reserve	Molokai	3	<1	2
The Nature Conservancy Preserve	Molokai	8	<1	4
Wildlife Sanctuary	Molokai	2	<1	1
Marine Life Conservation District	Maui	0	<1	<1
National Park	Maui	4	<1	1
Natural Area Reserve	Maui	6	<1	2
Wildlife Sanctuary	Maui	3	<1	1
National Wildlife Refuge	Oahu	3	<1	1
Natural Area Reserve	Oahu	2	<1	1
Private Preserve	Oahu	0	<1	<1
Wildlife Sanctuary	Oahu	5	<1	1
National Historical Park	Hawaii	8	<1	1
National Park	Hawaii	25	1	4
Natural Area Reserve	Hawaii	3	<1	1
The Nature Conservancy Preserve	Hawaii	1	<1	<1
Wildlife Sanctuary	Hawaii	0	<1	<1

Coastal from USGS Carbon Assessment Layers

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Kahoolawe	Coastal	Bare or <5% Vegetation	<1	28387	<1	<1

Kahoolawe	Coastal	Native Non-native Mix	<1	28387	<1	<1
Kahoolawe	Coastal	No Data	<1	28387	<1	<1
Molokai	Coastal	Heavily Disturbed	4	164266	<1	<1
Molokai	Coastal	Bare or <5% Vegetation	2	164266	<1	<1
Molokai	Coastal	Native Non-native Mix	3	164266	<1	<1
Molokai	Coastal	Native Dominated	20	164266	<1	<1

Developed

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Kahoolawe	Developed	Heavily Disturbed	<1	28387	<1	<1
Kahoolawe	Developed	Bare or <5% Vegetation	<1	28387	<1	<1
Kahoolawe	Developed	Native Non-native Mix	<1	28387	<1	<1
Kahoolawe	Developed	No Data	<1	28387	<1	<1
Niihau	Developed	Heavily Disturbed	<1	45907	<1	<1
Niihau	Developed	Bare or <5% Vegetation	<1	45907	<1	<1
Niihau	Developed	Native Non-native Mix	<1	45907	<1	<1
Niihau	Developed	No Data	<1	45907	<1	<1
Lanai	Developed	Heavily Disturbed	9	90058	<1	<1
Lanai	Developed	Bare or <5% Vegetation	1	90058	<1	<1
Lanai	Developed	Native Non-native Mix	21	90058	<1	<1
Lanai	Developed	Native Dominated	7	90058	<1	<1
Lanai	Developed	No Data	<1	90058	<1	<1
Molokai	Developed	Heavily Disturbed	200	164266	<1	<1
Molokai	Developed	Bare or <5% Vegetation	<1	164266	<1	<1
Molokai	Developed	Native Non-native Mix	89	164266	<1	<1
Molokai	Developed	Native Dominated	4	164266	<1	<1
Molokai	Developed	No Data	<1	164266	<1	<1
Kauai	Developed	Heavily Disturbed	362	354833	<1	<1

Kauai	Developed	Bare or <5% Vegetation	<1	354833	<1	<1
Kauai	Developed	Native Non-native Mix	48	354833	<1	<1
Kauai	Developed	Native Dominated	2	354833	<1	<1
Kauai	Developed	No Data	<1	354833	<1	<1
Oahu	Developed	Heavily Disturbed	403	371259	<1	<1
Oahu	Developed	Bare or <5% Vegetation	<1	371259	<1	<1
Oahu	Developed	Native Non-native Mix	125	371259	<1	<1
Oahu	Developed	Native Dominated	4	371259	<1	<1
Oahu	Developed	No Data	<1	371259	<1	<1
Maui	Developed	Heavily Disturbed	271	460028	<1	<1
Maui	Developed	Bare or <5% Vegetation	4	460028	<1	<1
Maui	Developed	Native Non-native Mix	138	460028	<1	<1
Maui	Developed	Native Dominated	56	460028	<1	<1
Maui	Developed	No Data	<1	460028	<1	<1
Hawaii	Developed	Heavily Disturbed	431	2584205	<1	<1
Hawaii	Developed	Bare or <5% Vegetation	45	2584205	<1	<1
Hawaii	Developed	Native Non-native Mix	457	2584205	<1	<1
Hawaii	Developed	Native Dominated	852	2584205	<1	<1
Hawaii	Developed	No Data	<1	2584205	<1	<1

Dry Forest

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Kahoolawe	Dry Forest	Heavily Disturbed	<1	28387	<1	<1
Kahoolawe	Dry Forest	Bare or <5% Vegetation	<1	28387	<1	<1
Kahoolawe	Dry Forest	Native Non-native Mix	<1	28387	<1	<1
Kahoolawe	Dry Forest	No Data	<1	28387	<1	<1
Niihau	Dry Forest	Heavily Disturbed	<1	45907	<1	<1

Niihau	Dry Forest	Bare or <5% Vegetation	<1	45907	<1	<1
Niihau	Dry Forest	Native Non-native Mix	<1	45907	<1	<1
Niihau	Dry Forest	No Data	<1	45907	<1	<1
Lanai	Dry Forest	Heavily Disturbed	1	90058	<1	<1
Lanai	Dry Forest	Bare or <5% Vegetation	7	90058	<1	<1
Lanai	Dry Forest	Native Non-native Mix	56	90058	<1	<1
Lanai	Dry Forest	Native Dominated	8	90058	<1	<1
Lanai	Dry Forest	No Data	<1	90058	<1	<1
Molokai	Dry Forest	Heavily Disturbed	22	164266	<1	<1
Molokai	Dry Forest	Bare or <5% Vegetation	49	164266	<1	<1
Molokai	Dry Forest	Native Non-native Mix	934	164266	1	<1
Molokai	Dry Forest	Native Dominated	13	164266	<1	<1
Molokai	Dry Forest	No Data	<1	164266	<1	<1
Kauai	Dry Forest	Heavily Disturbed	4	354833	<1	<1
Kauai	Dry Forest	Bare or <5% Vegetation	8	354833	<1	<1
Kauai	Dry Forest	Native Non-native Mix	62	354833	<1	<1
Kauai	Dry Forest	Native Dominated	<1	354833	<1	<1
Kauai	Dry Forest	No Data	<1	354833	<1	<1
Oahu	Dry Forest	Heavily Disturbed	35	371259	<1	<1
Oahu	Dry Forest	Bare or <5% Vegetation	<1	371259	<1	<1
Oahu	Dry Forest	Native Non-native Mix	164	371259	<1	<1
Oahu	Dry Forest	Native Dominated	1	371259	<1	<1
Oahu	Dry Forest	No Data	<1	371259	<1	<1

Maui	Dry Forest	Heavily Disturbed	10	460028	<1	<1
Maui	Dry Forest	Bare or <5% Vegetation	30	460028	<1	<1
Maui	Dry Forest	Native Non-native Mix	617	460028	<1	<1
Maui	Dry Forest	Native Dominated	39	460028	<1	<1
Maui	Dry Forest	No Data	<1	460028	<1	<1
Hawaii	Dry Forest	Heavily Disturbed	63	2584205	<1	<1
Hawaii	Dry Forest	Bare or <5% Vegetation	300	2584205	<1	<1
Hawaii	Dry Forest	Native Non-native Mix	292	2584205	<1	<1
Hawaii	Dry Forest	Native Dominated	6611	2584205	<1	<1
Hawaii	Dry Forest	No Data	<1	2584205	<1	<1

Dry Grassland and Shrubland

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Kahoolawe	Dry Grasslands and Shrublands	Heavily Disturbed	<1	28387	<1	<1
Kahoolawe	Dry Grasslands and Shrublands	Bare or <5% Vegetation	<1	28387	<1	<1
Kahoolawe	Dry Grasslands and Shrublands	Native Non-native Mix	<1	28387	<1	<1
Kahoolawe	Dry Grasslands and Shrublands	No Data	<1	28387	<1	<1
Niihau	Dry Grasslands and Shrublands	Heavily Disturbed	<1	45907	<1	<1
Niihau	Dry Grasslands and Shrublands	Bare or <5% Vegetation	<1	45907	<1	<1
Niihau	Dry Grasslands and Shrublands	Native Non-native Mix	<1	45907	<1	<1
Lanai	Dry Grasslands and Shrublands	Heavily Disturbed	3	90058	<1	<1
Lanai	Dry Grasslands and Shrublands	Bare or <5% Vegetation	54	90058	<1	<1

Lanai	Dry Grasslands and Shrublands	Native Non-native Mix	166	90058	<1	<1
Lanai	Dry Grasslands and Shrublands	Native Dominated	97	90058	<1	<1
Lanai	Dry Grasslands and Shrublands	No Data	<1	90058	<1	<1
Molokai	Dry Grasslands and Shrublands	Heavily Disturbed	125	164266	<1	<1
Molokai	Dry Grasslands and Shrublands	Bare or <5% Vegetation	62	164266	<1	<1
Molokai	Dry Grasslands and Shrublands	Native Non-native Mix	1981	164266	1	<1
Molokai	Dry Grasslands and Shrublands	Native Dominated	21	164266	<1	<1
Molokai	Dry Grasslands and Shrublands	No Data	<1	164266	<1	<1
Kauai	Dry Grasslands and Shrublands	Heavily Disturbed	<1	354833	<1	<1
Kauai	Dry Grasslands and Shrublands	Bare or <5% Vegetation	193	354833	<1	<1
Kauai	Dry Grasslands and Shrublands	Native Non-native Mix	418	354833	<1	<1
Kauai	Dry Grasslands and Shrublands	Native Dominated	1039	354833	<1	<1
Kauai	Dry Grasslands and Shrublands	No Data	<1	354833	<1	<1
Oahu	Dry Grasslands and Shrublands	Heavily Disturbed	40	371259	<1	<1
Oahu	Dry Grasslands and Shrublands	Bare or <5% Vegetation	10	371259	<1	<1
Oahu	Dry Grasslands and Shrublands	Native Non-native Mix	416	371259	<1	<1
Oahu	Dry Grasslands and Shrublands	Native Dominated	1	371259	<1	<1
Oahu	Dry Grasslands and Shrublands	No Data	<1	371259	<1	<1
Maui	Dry Grasslands and Shrublands	Heavily Disturbed	18	460028	<1	<1
Maui	Dry Grasslands and Shrublands	Bare or <5% Vegetation	900	460028	<1	<1
Maui	Dry Grasslands and Shrublands	Native Non-native Mix	2419	460028	1	<1
Maui	Dry Grasslands and Shrublands	Native Dominated	3929	460028	1	<1
Maui	Dry Grasslands and Shrublands	No Data	<1	460028	<1	<1

Hawaii	Dry Grasslands and Shrublands	Heavily Disturbed	173	2584205	<1	<1
Hawaii	Dry Grasslands and Shrublands	Bare or <5% Vegetation	12276	2584205	<1	<1
Hawaii	Dry Grasslands and Shrublands	Native Non-native Mix	4786	2584205	<1	<1
Hawaii	Dry Grasslands and Shrublands	Native Dominated	16406	2584205	1	<1
Hawaii	Dry Grasslands and Shrublands	No Data	<1	2584205	<1	<1

Mesic Forest

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Lanai	Mesic Forest	Heavily Disturbed	3	90058	<1	<1
Lanai	Mesic Forest	Bare or <5% Vegetation	1	90058	<1	<1
Lanai	Mesic Forest	Native Non-native Mix	27	90058	<1	<1
Lanai	Mesic Forest	Native Dominated	91	90058	<1	<1
Molokai	Mesic Forest	Heavily Disturbed	19	164266	<1	<1
Molokai	Mesic Forest	Bare or <5% Vegetation	2	164266	<1	<1
Molokai	Mesic Forest	Native Non-native Mix	957	164266	1	<1
Molokai	Mesic Forest	Native Dominated	2428	164266	1	<1
Molokai	Mesic Forest	No Data	<1	164266	<1	<1
Kauai	Mesic Forest	Heavily Disturbed	28	354833	<1	<1
Kauai	Mesic Forest	Bare or <5% Vegetation	14	354833	<1	<1
Kauai	Mesic Forest	Native Non-native Mix	2471	354833	1	<1
Kauai	Mesic Forest	Native Dominated	2061	354833	1	<1
Kauai	Mesic Forest	No Data	<1	354833	<1	<1

Oahu	Mesic Forest	Heavily Disturbed	<1	371259	<1	<1
Oahu	Mesic Forest	Bare or <5% Vegetation	<1	371259	<1	<1
Oahu	Mesic Forest	Native Non-native Mix	148	371259	<1	<1
Oahu	Mesic Forest	Native Dominated	1042	371259	<1	<1
Maui	Mesic Forest	Heavily Disturbed	24	460028	<1	<1
Maui	Mesic Forest	Bare or <5% Vegetation	5	460028	<1	<1
Maui	Mesic Forest	Native Non-native Mix	3156	460028	1	<1
Maui	Mesic Forest	Native Dominated	5708	460028	1	<1
Maui	Mesic Forest	No Data	<1	460028	<1	<1
Hawaii	Mesic Forest	Heavily Disturbed	276	2584205	<1	<1
Hawaii	Mesic Forest	Bare or <5% Vegetation	1435	2584205	<1	<1
Hawaii	Mesic Forest	Native Non-native Mix	5547	2584205	<1	<1
Hawaii	Mesic Forest	Native Dominated	36554	2584205	1	1
Hawaii	Mesic Forest	No Data	<1	2584205	<1	<1

Mesic Grassland and Shrubland

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Niihau	Mesic Grasslands and Shrublands	Bare or <5% Vegetation	<1	45907	<1	<1
Niihau	Mesic Grasslands and Shrublands	Native Non-native Mix	<1	45907	<1	<1
Lanai	Mesic Grasslands and Shrublands	Heavily Disturbed	<1	90058	<1	<1
Lanai	Mesic Grasslands and Shrublands	Bare or <5% Vegetation	<1	90058	<1	<1
Lanai	Mesic Grasslands and Shrublands	Native Non-native Mix	<1	90058	<1	<1

Lanai	Mesic Grasslands and Shrublands	Native Dominated	<1	90058	<1	<1
Molokai	Mesic Grasslands and Shrublands	Heavily Disturbed	27	164266	<1	<1
Molokai	Mesic Grasslands and Shrublands	Bare or <5% Vegetation	10	164266	<1	<1
Molokai	Mesic Grasslands and Shrublands	Native Non-native Mix	1433	164266	1	<1
Molokai	Mesic Grasslands and Shrublands	Native Dominated	1232	164266	1	<1
Molokai	Mesic Grasslands and Shrublands	No Data	<1	164266	<1	<1
Kauai	Mesic Grasslands and Shrublands	Heavily Disturbed	35	354833	<1	<1
Kauai	Mesic Grasslands and Shrublands	Bare or <5% Vegetation	122	354833	<1	<1
Kauai	Mesic Grasslands and Shrublands	Native Non-native Mix	2201	354833	1	<1
Kauai	Mesic Grasslands and Shrublands	Native Dominated	10	354833	<1	<1
Kauai	Mesic Grasslands and Shrublands	No Data	1	354833	<1	<1
Oahu	Mesic Grasslands and Shrublands	Heavily Disturbed	<1	371259	<1	<1
Oahu	Mesic Grasslands and Shrublands	Bare or <5% Vegetation	<1	371259	<1	<1
Oahu	Mesic Grasslands and Shrublands	Native Non-native Mix	282	371259	<1	<1
Oahu	Mesic Grasslands and Shrublands	Native Dominated	39	371259	<1	<1
Oahu	Mesic Grasslands and Shrublands	No Data	<1	371259	<1	<1
Maui	Mesic Grasslands and Shrublands	Heavily Disturbed	55	460028	<1	<1
Maui	Mesic Grasslands and Shrublands	Bare or <5% Vegetation	694	460028	<1	<1
Maui	Mesic Grasslands and Shrublands	Native Non-native Mix	4669	460028	1	<1
Maui	Mesic Grasslands and Shrublands	Native Dominated	5590	460028	1	<1
Maui	Mesic Grasslands and Shrublands	No Data	<1	460028	<1	<1
Hawaii	Mesic Grasslands and Shrublands	Heavily Disturbed	518	2584205	<1	<1
Hawaii	Mesic Grasslands and Shrublands	Bare or <5% Vegetation	10433	2584205	<1	<1

Hawaii	Mesic Grasslands and Shrublands	Native Non-native Mix	9507	2584205	<1	<1
Hawaii	Mesic Grasslands and Shrublands	Native Dominated	653	2584205	<1	<1
Hawaii	Mesic Grasslands and Shrublands	No Data	<1	2584205	<1	<1

Streams from State DAR Layers

Reserve Type	Island	Total Stream Length on Island (km)	Stream Length in Reserve (km)	Length (% of Total State Stream Length)	Length (% of Total Island Stream Length)
The Nature Conservancy Preserve	Lanai	735	<1	<1	<1
National Historical Park	Molokai	1194	19	<1	2
National Wildlife Refuge	Molokai	1194	1	<1	<1
Natural Area Reserve	Molokai	1194	33	<1	3
The Nature Conservancy Preserve	Molokai	1194	68	1	6
National Park	Maui	2033	70	1	3
National Wildlife Refuge	Maui	2033	8	<1	<1
Natural Area Reserve	Maui	2033	94	1	5
The Nature Conservancy Preserve	Maui	2033	76	1	4
National Wildlife Refuge	Oahu	2404	68	1	3
Natural Area Reserve	Oahu	2404	16	<1	1
Wildlife Sanctuary	Oahu	2404	12	<1	<1
National Wildlife Refuge	Kauai	2624	6	<1	<1
Natural Area Reserve	Kauai	2624	48	<1	2
State Wilderness Park	Kauai	2624	49	<1	2
The Nature Conservancy Preserve	Kauai	2624	65	<1	2
National Historical Park	Hawaii	4059	<1	<1	<1
National Park	Hawaii	4059	118	1	3
National Wildlife Refuge	Hawaii	4059	113	1	3
Natural Area Reserve	Hawaii	4059	90	1	2
The Nature Conservancy Preserve	Hawaii	4059	15	<1	<1

Wet Forest

Wet Grassland and Shrubland

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Lanai	Wet Grasslands and Shrublands	Bare or <5% Vegetation	<1	90058	<1	<1
Lanai	Wet Grasslands and Shrublands	Native Non-native Mix	<1	90058	<1	<1
Lanai	Wet Grasslands and Shrublands	Native Dominated	<1	90058	<1	<1
Molokai	Wet Grasslands and Shrublands	Heavily Disturbed	2	164266	<1	<1
Molokai	Wet Grasslands and Shrublands	Bare or <5% Vegetation	1	164266	<1	<1
Molokai	Wet Grasslands and Shrublands	Native Non-native Mix	493	164266	<1	<1
Molokai	Wet Grasslands and Shrublands	Native Dominated	1822	164266	1	<1
Molokai	Wet Grasslands and Shrublands	No Data	<1	164266	<1	<1
Kauai	Wet Grasslands and Shrublands	Heavily Disturbed	<1	354833	<1	<1
Kauai	Wet Grasslands and Shrublands	Bare or <5% Vegetation	1	354833	<1	<1
Kauai	Wet Grasslands and Shrublands	Native Non-native Mix	72	354833	<1	<1
Kauai	Wet Grasslands and Shrublands	Native Dominated	1983	354833	1	<1
Oahu	Wet Grasslands and Shrublands	Heavily Disturbed	<1	371259	<1	<1
Oahu	Wet Grasslands and Shrublands	Bare or <5% Vegetation	<1	371259	<1	<1
Oahu	Wet Grasslands and Shrublands	Native Non-native Mix	67	371259	<1	<1
Oahu	Wet Grasslands and Shrublands	Native Dominated	134	371259	<1	<1
Maui	Wet Grasslands and Shrublands	Heavily Disturbed	<1	460028	<1	<1
Maui	Wet Grasslands and Shrublands	Bare or <5% Vegetation	1	460028	<1	<1
Maui	Wet Grasslands and Shrublands	Native Non-native Mix	469	460028	<1	<1
Maui	Wet Grasslands and Shrublands	Native Dominated	2078	460028	<1	<1

Maui	Wet Grasslands and Shrublands	No Data	<1	460028	<1	<1
Hawaii	Wet Grasslands and Shrublands	Heavily Disturbed	279	2584205	<1	<1
Hawaii	Wet Grasslands and Shrublands	Bare or <5% Vegetation	2912	2584205	<1	<1
Hawaii	Wet Grasslands and Shrublands	Native Non-native Mix	1459	2584205	<1	<1
Hawaii	Wet Grasslands and Shrublands	Native Dominated	3263	2584205	<1	<1
Hawaii	Wet Grasslands and Shrublands	No Data	<1	2584205	<1	<1

Wetlands from NOAA Layers

Island	Wetland Type	Reserve Type	Total Wetland Area on Island (Acres)	Area (Acres)	Area (% of Wetland Area on Island)
Oahu	Estuarine Emergent Wetland	National Wildlife Refuge	3218	7	<1
Oahu	Palustrine Emergent Wetland	National Wildlife Refuge	3218	90	3
Oahu	Palustrine Forested Wetland	National Wildlife Refuge	3218	1	<1
Oahu	Unconsolidated Shore	National Wildlife Refuge	3218	7	<1
Oahu	Estuarine Forested Wetland	National Wildlife Refuge	3218	1	<1
Oahu	Open Water	National Wildlife Refuge	3218	80	2
Oahu	Palustrine Scrub Shrub Wetland	National Wildlife Refuge	3218	10	<1
Oahu	Estuarine Scrub Shrub Wetland	National Wildlife Refuge	3218	2	<1
Oahu	Palustrine Forested Wetland	Natural Area Reserve	3218	<1	<1
Oahu	Open Water	Natural Area Reserve	3218	5	<1
Oahu	Estuarine Emergent Wetland	Wildlife Sanctuary	3218	8	<1
Oahu	Palustrine Emergent Wetland	Wildlife Sanctuary	3218	38	1
Oahu	Palustrine Forested Wetland	Wildlife Sanctuary	3218	<1	<1
Oahu	Unconsolidated Shore	Wildlife Sanctuary	3218	22	1
Oahu	Estuarine Forested Wetland	Wildlife Sanctuary	3218	4	<1
Oahu	Open Water	Wildlife Sanctuary	3218	24	1
Oahu	Palustrine Scrub Shrub Wetland	Wildlife Sanctuary	3218	24	1
Oahu	Estuarine Scrub Shrub Wetland	Wildlife Sanctuary	3218	<1	<1

Oahu	Palustrine Aquatic Bed	Wildlife Sanctuary	3218	3	<1
Oahu	Open Water	Private Preserve	3218	<1	<1
Molokai	Palustrine Emergent Wetland	National Historical Park	4814	2	<1
Molokai	Palustrine Forested Wetland	National Historical Park	4814	<1	<1
Molokai	Unconsolidated Shore	National Historical Park	4814	2	<1
Molokai	Open Water	National Historical Park	4814	37	1
Molokai	Palustrine Scrub Shrub Wetland	National Historical Park	4814	<1	<1
Molokai	Palustrine Emergent Wetland	National Wildlife Refuge	4814	9	<1
Molokai	Palustrine Forested Wetland	National Wildlife Refuge	4814	11	<1
Molokai	Unconsolidated Shore	National Wildlife Refuge	4814	1	<1
Molokai	Open Water	National Wildlife Refuge	4814	<1	<1
Molokai	Palustrine Scrub Shrub Wetland	National Wildlife Refuge	4814	1	<1
Molokai	Palustrine Emergent Wetland	Natural Area Reserve	4814	2	<1
Molokai	Palustrine Forested Wetland	Natural Area Reserve	4814	552	11
Molokai	Open Water	Natural Area Reserve	4814	12	<1
Molokai	Palustrine Scrub Shrub Wetland	Natural Area Reserve	4814	8	<1
Molokai	Palustrine Emergent Wetland	The Nature Conservancy Preserve	4814	6	<1
Molokai	Palustrine Forested Wetland	The Nature Conservancy Preserve	4814	263	5
Molokai	Unconsolidated Shore	The Nature Conservancy Preserve	4814	2	<1
Molokai	Open Water	The Nature Conservancy Preserve	4814	45	1
Molokai	Palustrine Scrub Shrub Wetland	The Nature Conservancy Preserve	4814	72	1
Maui	Palustrine Emergent Wetland	National Park	6106	23	<1
Maui	Palustrine Forested Wetland	National Park	6106	139	2
Maui	Unconsolidated Shore	National Park	6106	<1	<1
Maui	Open Water	National Park	6106	13	<1
Maui	Palustrine Scrub Shrub Wetland	National Park	6106	131	2
Maui	Palustrine Emergent Wetland	National Wildlife Refuge	6106	99	2
Maui	Palustrine Forested Wetland	National Wildlife Refuge	6106	32	1
Maui	Unconsolidated Shore	National Wildlife Refuge	6106	184	3
Maui	Open Water	National Wildlife Refuge	6106	31	1

Maui	Palustrine Scrub Shrub Wetland	National Wildlife Refuge	6106	136	2
Maui	Palustrine Emergent Wetland	Natural Area Reserve	6106	64	1
Maui	Palustrine Forested Wetland	Natural Area Reserve	6106	160	3
Maui	Open Water	Natural Area Reserve	6106	26	<1
Maui	Palustrine Scrub Shrub Wetland	Natural Area Reserve	6106	351	6
Maui	Palustrine Emergent Wetland	The Nature Conservancy Preserve	6106	55	1
Maui	Palustrine Forested Wetland	The Nature Conservancy Preserve	6106	161	3
Maui	Palustrine Scrub Shrub Wetland	The Nature Conservancy Preserve	6106	263	4
Maui	Open Water	Marine Life Conservation District	6106	<1	<1
Maui	Palustrine Emergent Wetland	Wildlife Sanctuary	6106	35	1
Maui	Palustrine Forested Wetland	Wildlife Sanctuary	6106	8	<1
Maui	Unconsolidated Shore	Wildlife Sanctuary	6106	6	<1
Maui	Open Water	Wildlife Sanctuary	6106	5	<1
Maui	Palustrine Scrub Shrub Wetland	Wildlife Sanctuary	6106	12	<1
Kauai	Estuarine Emergent Wetland	National Wildlife Refuge	8297	32	<1
Kauai	Palustrine Emergent Wetland	National Wildlife Refuge	8297	7	<1
Kauai	Palustrine Forested Wetland	National Wildlife Refuge	8297	96	1
Kauai	Palustrine Scrub/Shrub Wetland	National Wildlife Refuge	8297	<1	<1
Kauai	Unconsolidated Shore	National Wildlife Refuge	8297	19	<1
Kauai	Water	National Wildlife Refuge	8297	47	1
Kauai	Estuarine Forested Wetland	National Wildlife Refuge	8297	21	<1
Kauai	Estuarine Scrub/Shrub Wetland	National Wildlife Refuge	8297	4	<1
Kauai	Palustrine Emergent Wetland	Natural Area Reserve	8297	16	<1
Kauai	Palustrine Forested Wetland	Natural Area Reserve	8297	2	<1
Kauai	Palustrine Scrub/Shrub Wetland	Natural Area Reserve	8297	4	<1
Kauai	Unconsolidated Shore	Natural Area Reserve	8297	<1	<1
Kauai	Water	Natural Area Reserve	8297	9	<1
Kauai	Palustrine Emergent Wetland	The Nature Conservancy Preserve	8297	244	3

Kauai	Palustrine Forested Wetland	The Nature Conservancy Preserve	8297	120	1
Kauai	Palustrine Scrub/Shrub Wetland	The Nature Conservancy Preserve	8297	39	<1
Kauai	Water	The Nature Conservancy Preserve	8297	43	1
Kauai	Unconsolidated Shore	State Wilderness Park	8297	5	<1
Kauai	Water	State Wilderness Park	8297	40	<1
Hawaii	Estuarine Emergent Wetland	National Historical Park	15791	15	<1
Hawaii	Water	National Historical Park	15791	43	<1
Hawaii	Palustrine Emergent Wetland	National Park	15791	3	<1
Hawaii	Water	National Park	15791	64	<1
Hawaii	Palustrine Emergent Wetland	National Wildlife Refuge	15791	220	1
Hawaii	Palustrine Forested Wetland	National Wildlife Refuge	15791	545	3
Hawaii	Palustrine Scrub/Shrub Wetland	National Wildlife Refuge	15791	661	4
Hawaii	Unconsolidated Shore	National Wildlife Refuge	15791	<1	<1
Hawaii	Water	National Wildlife Refuge	15791	95	1
Hawaii	Palustrine Emergent Wetland	Natural Area Reserve	15791	183	1
Hawaii	Palustrine Forested Wetland	Natural Area Reserve	15791	408	3
Hawaii	Palustrine Scrub/Shrub Wetland	Natural Area Reserve	15791	362	2
Hawaii	Water	Natural Area Reserve	15791	99	1
Hawaii	Water	The Nature Conservancy Preserve	15791	3	<1

Wetlands from USGS Layers

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Niihau	Wetland	Heavily Disturbed	<1	45907	<1	<1
Niihau	Wetland	Bare or <5% Vegetation	<1	45907	<1	<1
Niihau	Wetland	Native Non-native Mix	<1	45907	<1	<1
Lanai	Wetland	Heavily Disturbed	<1	90058	<1	<1

Lanai	Wetland	Bare or <5% Vegetation	<1	90058	<1	<1
Lanai	Wetland	Native Non-native Mix	<1	90058	<1	<1
Lanai	Wetland	Native Dominated	<1	90058	<1	<1
Lanai	Wetland	No Data	<1	90058	<1	<1
Molokai	Wetland	Heavily Disturbed	1	164266	<1	<1
Molokai	Wetland	Bare or <5% Vegetation	<1	164266	<1	<1
Molokai	Wetland	Native Non-native Mix	27	164266	<1	<1
Molokai	Wetland	Native Dominated	4	164266	<1	<1
Molokai	Wetland	No Data	<1	164266	<1	<1
Kauai	Wetland	Heavily Disturbed	<1	354833	<1	<1
Kauai	Wetland	Bare or <5% Vegetation	<1	354833	<1	<1
Kauai	Wetland	Native Non-native Mix	38	354833	<1	<1
Kauai	Wetland	Native Dominated	79	354833	<1	<1
Kauai	Wetland	No Data	<1	354833	<1	<1
Oahu	Wetland	Heavily Disturbed	64	371259	<1	<1
Oahu	Wetland	Bare or <5% Vegetation	<1	371259	<1	<1
Oahu	Wetland	Native Non-native Mix	661	371259	<1	<1
Oahu	Wetland	Native Dominated	<1	371259	<1	<1
Oahu	Wetland	No Data	<1	371259	<1	<1
Maui	Wetland	Heavily Disturbed	4	460028	<1	<1
Maui	Wetland	Bare or <5% Vegetation	<1	460028	<1	<1
Maui	Wetland	Native Non-native Mix	383	460028	<1	<1
Maui	Wetland	Native Dominated	506	460028	<1	<1
Hawaii	Wetland	Heavily Disturbed	<1	2584205	<1	<1
Hawaii	Wetland	Bare or <5% Vegetation	6	2584205	<1	<1
Hawaii	Wetland	Native Non-native Mix	58	2584205	<1	<1
Hawaii	Wetland	Native Dominated	4	2584205	<1	<1
Hawaii	Wetland	No Data	<1	2584205	<1	<1

Appendix F. Critical Habitat Tables

Barren

Island	Habitat	Total Island Area (Acres)	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Kahoolawe	Barren	28387	2436	9	<1
Niihau	Barren	45907	7	<1	<1
Lanai	Barren	90058	5	<1	<1
Molokai	Barren	164266	339	<1	<1
Kauai	Barren	354833	1512	<1	<1
Oahu	Barren	371259	213	<1	<1
Maui	Barren	460028	20539	4	1
Hawaii	Barren	2584205	46220	2	1

Coastal from USGS Coastal Vegetation Assessment

Island	Length of Coastline Designated Critical Habitat (km)	Length (% of State Coastline)	Length (% of Island Coastline)
Kahoolawe	15	1	23
Lanai	1	<1	1
Kauai	21	1	11
Molokai	37	2	19
Maui	37	2	13
Oahu	11	1	3
Hawaii	5	<1	1

Coastal from USGS Carbon Assessment Layers

Island	Habitat	Total Island Area (Acres)	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Kahoolawe	Coastal	28387	<1	<1	<1
Niihau	Coastal	45907	<1	<1	<1
Lanai	Coastal	90058	<1	<1	<1
Molokai	Coastal	164266	15	<1	<1
Kauai	Coastal	354833	<1	<1	<1
Oahu	Coastal	371259	<1	<1	<1

Maui	Coastal	460028	<1	<1	<1
Hawaii	Coastal	2584205	<1	<1	<1

Developed

Island	Habitat	Total Island Area (Acres)	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Kahoolawe	Developed	28387	44	<1	<1
Niihau	Developed	45907	<1	<1	<1
Lanai	Developed	90058	15	<1	<1
Molokai	Developed	164266	67	<1	<1
Kauai	Developed	354833	334	<1	<1
Oahu	Developed	371259	255	<1	<1
Maui	Developed	460028	346	<1	<1
Hawaii	Developed	2584205	1339	<1	<1

Dry Forest

Island	Habitat	Total Island Area (Acres)	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Kahoolawe	Dry Forest	28387	1819	6	<1
Niihau	Dry Forest	45907	341	1	<1
Lanai	Dry Forest	90058	225	<1	<1
Molokai	Dry Forest	164266	1366	1	<1
Kauai	Dry Forest	354833	339	<1	<1
Oahu	Dry Forest	371259	1764	<1	<1
Maui	Dry Forest	460028	5809	1	<1
Hawaii	Dry Forest	2584205	20702	1	1

Dry Grassland and Shrubland

Island	Habitat	Total Island	Area (Acres)	Area (% of Island)	Area (% of State

		Area (Acres)			of Hawaii)
Kahoolawe	Dry Grasslands and Shrublands	28387	2743	10	<1
Niihau	Dry Grasslands and Shrublands	45907	7	<1	<1
Lanai	Dry Grasslands and Shrublands	90058	339	<1	<1
Molokai	Dry Grasslands and Shrublands	164266	1475	1	<1
Kauai	Dry Grasslands and Shrublands	354833	2777	1	<1
Oahu	Dry Grasslands and Shrublands	371259	2002	1	<1
Maui	Dry Grasslands and Shrublands	460028	18063	4	<1
Hawaii	Dry Grasslands and Shrublands	2584205	53408	2	1

Mesic Forest

Island	Habitat	Total Island Area (Acres)	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Kahoolawe	Mesic Forest	28387	<1	<1	<1
Niihau	Mesic Forest	45907	<1	<1	<1
Lanai	Mesic Forest	90058	52	<1	<1
Molokai	Mesic Forest	164266	4176	3	<1
Kauai	Mesic Forest	354833	12676	4	<1
Oahu	Mesic Forest	371259	20487	6	<1
Maui	Mesic Forest	460028	9585	2	<1
Hawaii	Mesic Forest	2584205	29484	1	1

Mesic Grassland and Shrubland

Island	Habitat	Total Island	Area (Acres)	Area (% of Island)	Area (% of State)

		Area (Acres)			of Hawaii)
Kahoolawe	Mesic Grasslands and Shrublands	28387	<1	<1	<1
Niihau	Mesic Grasslands and Shrublands	45907	<1	<1	<1
Lanai	Mesic Grasslands and Shrublands	90058	79	<1	<1
Molokai	Mesic Grasslands and Shrublands	164266	3284	2	<1
Kauai	Mesic Grasslands and Shrublands	354833	4119	1	<1
Oahu	Mesic Grasslands and Shrublands	371259	5261	1	<1
Maui	Mesic Grasslands and Shrublands	460028	16714	4	<1
Hawaii	Mesic Grasslands and Shrublands	2584205	34441	1	1

Streams from State DAR Layers

Island	Stream Type	Total Stream Length on Island (km)	Length of Stream Designated Critical Habitat (km)	Length (% of Total State Stream Length)	Length (% of Total Island Stream Length)
Niihau	NON-PERENNIAL	116	3	<1	3
Kahoolawe	NON-PERENNIAL	177	51	<1	29
Lanai	NON-PERENNIAL	735	15	<1	2
Molokai	INTERMITTENT	1194	156	1	13
Molokai	NON-PERENNIAL	1194	96	1	8
Molokai	PERENNIAL	1194	35	<1	3
Molokai	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR	1194	<1	<1	<1
Maui	INTERMITTENT	2033	168	1	8
Maui	NON-PERENNIAL	2033	142	1	7
Maui	PERENNIAL	2033	208	2	10
Maui	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR	2033	<1	<1	<1
Oahu	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR	2404	<1	<1	<1
Oahu	INTERMITTENT	2404	265	2	11
Oahu	LAKE, POND, POOL, RESERVOIR, DAM OR WEIR	2404	<1	<1	<1

Oahu	NON-PERENNIAL	2404	15	<1	1
Oahu	PERENNIAL	2404	308	2	13
Kauai	BANK	2624	2	<1	<1
Kauai	INTERMITTENT	2624	152	1	6
Kauai	NON-PERENNIAL	2624	13	<1	<1
Kauai	PERENNIAL	2624	315	2	12
Kauai	ISLAND, ISLET, ROCK, OR OTHER	2624	1	<1	<1
Big Island	INTERMITTENT	4059	59	<1	1
Big Island	BANK	4059	<1	<1	<1
Big Island	NON-PERENNIAL	4059	182	1	4
Big Island	PERENNIAL	4059	182	1	4

Wet Forest

Island	Habitat	Total Island Area (Acres)	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Kahoolawe	Wet Forest	28387	<1	<1	<1
Niihau	Wet Forest	45907	<1	<1	<1
Lanai	Wet Forest	90058	67	<1	<1
Molokai	Wet Forest	164266	12071	7	<1
Kauai	Wet Forest	354833	29422	8	1
Oahu	Wet Forest	371259	43126	12	1
Maui	Wet Forest	460028	25382	6	1
Hawaii	Wet Forest	2584205	90038	3	2

Wet Grassland and Shrubland

Island	Habitat	Total Island Area (Acres)	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Kahoolawe	Wet Grasslands and Shrublands	28387	<1	<1	<1
Niihau	Wet Grasslands and Shrublands	45907	<1	<1	<1

Lanai	Wet Grasslands and Shrublands	90058	<1	<1	<1
Molokai	Wet Grasslands and Shrublands	164266	3153	2	<1
Kauai	Wet Grasslands and Shrublands	354833	5698	2	<1
Oahu	Wet Grasslands and Shrublands	371259	4139	1	<1
Maui	Wet Grasslands and Shrublands	460028	6758	1	<1
Hawaii	Wet Grasslands and Shrublands	2584205	6931	<1	<1

Wetlands from NOAA Layers

Island	Wetland Type	Total Wetland Area on Island (Acres)	Area (Acres)	Area (% of Wetland Area on Island)
Lanai	Open Water	213	2	1
Niihau	Palustrine Scrub Shrub Wetland	1533	2	0
Oahu	Palustrine Emergent Wetland	3218	68	2
Oahu	Palustrine Forested Wetland	3218	39	1
Oahu	Unconsolidated Shore	3218	13	0
Oahu	Open Water	3218	37	1
Oahu	Palustrine Scrub Shrub Wetland	3218	70	2
Molokai	Palustrine Emergent Wetland	4814	521	11
Molokai	Palustrine Forested Wetland	4814	329	7
Molokai	Unconsolidated Shore	4814	12	0
Molokai	Open Water	4814	3059	64
Molokai	Palustrine Scrub Shrub Wetland	4814	775	16
Maui	Palustrine Emergent Wetland	6106	334	5
Maui	Palustrine Forested Wetland	6106	968	16
Maui	Unconsolidated Shore	6106	82	1
Maui	Open Water	6106	99	2
Maui	Palustrine Scrub Shrub Wetland	6106	1129	18
Kauai	Palustrine Emergent Wetland	8297	179	2
Kauai	Palustrine Forested Wetland	8297	89	1
Kauai	Palustrine Scrub Shrub Wetland	8297	174	2

Kauai	Unconsolidated Shore	8297	77	1
Kauai	Open Water	8297	4550	55
Hawaii	Palustrine Aquatic Bed	15791	1	0
Hawaii	Palustrine Emergent Wetland	15791	251	2
Hawaii	Palustrine Forested Wetland	15791	297	2
Hawaii	Palustrine Scrub Shrub Wetland	15791	416	3
Hawaii	Unconsolidated Shore	15791	0	0
Hawaii	Open Water	15791	3040	19

Wetlands from USGS Layers

Island	Habitat	Total Island Area (Acres)	Area (Acres)	Area (% of Island)	Area (% of State of Hawaii)
Kahoolawe	Wetland	28387	<1	<1	<1
Niihau	Wetland	45907	<1	<1	<1
Lanai	Wetland	90058	<1	<1	<1
Molokai	Wetland	164266	5	<1	<1
Kauai	Wetland	354833	259	<1	<1
Oahu	Wetland	371259	27	<1	<1
Maui	Wetland	460028	840	<1	<1
Hawaii	Wetland	2584205	22	<1	<1

Appendix G. Vegetation Quality Tables

Barren

Coastal from USGS Coastal Vegetation Assessment

Reserve Type	Island	Coastline Length in Reserve (km)	Length (% of State Coastline)	Length (% of Island Coastline)
Wildlife Sanctuary	Lanai	0	<1	<1
National Wildlife Refuge	Kauai	3	<1	2
Natural Area Reserve	Kauai	0	<1	<1
State Wilderness Park	Kauai	11	1	6
Wildlife Sanctuary	Kauai	0	<1	<1
National Historical Park	Molokai	11	1	6
National Wildlife Refuge	Molokai	0	<1	<1
Natural Area Reserve	Molokai	3	<1	2
The Nature Conservancy Preserve	Molokai	8	<1	4
Wildlife Sanctuary	Molokai	2	<1	1
Marine Life Conservation District	Maui	0	<1	<1
National Park	Maui	4	<1	1
Natural Area Reserve	Maui	6	<1	2
Wildlife Sanctuary	Maui	3	<1	1
National Wildlife Refuge	Oahu	3	<1	1
Natural Area Reserve	Oahu	2	<1	1
Private Preserve	Oahu	0	<1	<1
Wildlife Sanctuary	Oahu	5	<1	1
National Historical Park	Hawaii	8	<1	1
National Park	Hawaii	25	1	4
Natural Area Reserve	Hawaii	3	<1	1
The Nature Conservancy Preserve	Hawaii	1	<1	<1
Wildlife Sanctuary	Hawaii	0	<1	<1

Coastal from USGS Carbon Assessment Layers

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Kahoolawe	Coastal	Bare or <5% Vegetation	<1	28387	<1	<1

Kahoolawe	Coastal	Native Non-native Mix	<1		28387	<1	<1
Kahoolawe	Coastal	No Data	<1		28387	<1	<1
Molokai	Coastal	Heavily Disturbed	4		164266	<1	<1
Molokai	Coastal	Bare or <5% Vegetation	2		164266	<1	<1
Molokai	Coastal	Native Non-native Mix	3		164266	<1	<1
Molokai	Coastal	Native Dominated	20		164266	<1	<1

Developed

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Kahoolawe	Developed	Heavily Disturbed	<1	28387	<1	<1
Kahoolawe	Developed	Bare or <5% Vegetation	<1	28387	<1	<1
Kahoolawe	Developed	Native Non-native Mix	<1	28387	<1	<1
Kahoolawe	Developed	No Data	<1	28387	<1	<1
Niihau	Developed	Heavily Disturbed	<1	45907	<1	<1
Niihau	Developed	Bare or <5% Vegetation	<1	45907	<1	<1
Niihau	Developed	Native Non-native Mix	<1	45907	<1	<1
Niihau	Developed	No Data	<1	45907	<1	<1
Lanai	Developed	Heavily Disturbed	9	90058	<1	<1
Lanai	Developed	Bare or <5% Vegetation	1	90058	<1	<1
Lanai	Developed	Native Non-native Mix	21	90058	<1	<1
Lanai	Developed	Native Dominated	7	90058	<1	<1
Lanai	Developed	No Data	<1	90058	<1	<1
Molokai	Developed	Heavily Disturbed	200	164266	<1	<1
Molokai	Developed	Bare or <5% Vegetation	<1	164266	<1	<1
Molokai	Developed	Native Non-native Mix	89	164266	<1	<1

Molokai	Developed	Native Dominated	4	164266	<1	<1
Molokai	Developed	No Data	<1	164266	<1	<1
Kauai	Developed	Heavily Disturbed	362	354833	<1	<1
Kauai	Developed	Bare or <5% Vegetation	<1	354833	<1	<1
Kauai	Developed	Native Non-native Mix	48	354833	<1	<1
Kauai	Developed	Native Dominated	2	354833	<1	<1
Kauai	Developed	No Data	<1	354833	<1	<1
Oahu	Developed	Heavily Disturbed	403	371259	<1	<1
Oahu	Developed	Bare or <5% Vegetation	<1	371259	<1	<1
Oahu	Developed	Native Non-native Mix	125	371259	<1	<1
Oahu	Developed	Native Dominated	4	371259	<1	<1
Oahu	Developed	No Data	<1	371259	<1	<1
Maui	Developed	Heavily Disturbed	271	460028	<1	<1
Maui	Developed	Bare or <5% Vegetation	4	460028	<1	<1
Maui	Developed	Native Non-native Mix	138	460028	<1	<1
Maui	Developed	Native Dominated	56	460028	<1	<1
Maui	Developed	No Data	<1	460028	<1	<1
Hawaii	Developed	Heavily Disturbed	431	2584205	<1	<1
Hawaii	Developed	Bare or <5% Vegetation	45	2584205	<1	<1
Hawaii	Developed	Native Non-native Mix	457	2584205	<1	<1
Hawaii	Developed	Native Dominated	852	2584205	<1	<1
Hawaii	Developed	No Data	<1	2584205	<1	<1

Dry Forest

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Kahoolawe	Dry Forest	Heavily Disturbed	<1	28387	<1	<1
Kahoolawe	Dry Forest	Bare or <5% Vegetation	<1	28387	<1	<1
Kahoolawe	Dry Forest	Native Non-native Mix	<1	28387	<1	<1

Kahoolawe	Dry Forest	No Data	<1	28387	<1	<1
Niihau	Dry Forest	Heavily Disturbed	<1	45907	<1	<1
Niihau	Dry Forest	Bare or <5% Vegetation	<1	45907	<1	<1
Niihau	Dry Forest	Native Non-native Mix	<1	45907	<1	<1
Niihau	Dry Forest	No Data	<1	45907	<1	<1
Lanai	Dry Forest	Heavily Disturbed	1	90058	<1	<1
Lanai	Dry Forest	Bare or <5% Vegetation	7	90058	<1	<1
Lanai	Dry Forest	Native Non-native Mix	56	90058	<1	<1
Lanai	Dry Forest	Native Dominated	8	90058	<1	<1
Lanai	Dry Forest	No Data	<1	90058	<1	<1
Molokai	Dry Forest	Heavily Disturbed	22	164266	<1	<1
Molokai	Dry Forest	Bare or <5% Vegetation	49	164266	<1	<1
Molokai	Dry Forest	Native Non-native Mix	934	164266	1	<1
Molokai	Dry Forest	Native Dominated	13	164266	<1	<1
Molokai	Dry Forest	No Data	<1	164266	<1	<1
Kauai	Dry Forest	Heavily Disturbed	4	354833	<1	<1
Kauai	Dry Forest	Bare or <5% Vegetation	8	354833	<1	<1
Kauai	Dry Forest	Native Non-native Mix	62	354833	<1	<1
Kauai	Dry Forest	Native Dominated	<1	354833	<1	<1
Kauai	Dry Forest	No Data	<1	354833	<1	<1
Oahu	Dry Forest	Heavily Disturbed	35	371259	<1	<1
Oahu	Dry Forest	Bare or <5% Vegetation	<1	371259	<1	<1
Oahu	Dry Forest	Native Non-native Mix	164	371259	<1	<1

Oahu	Dry Forest	Native Dominated	1	371259	<1	<1
Oahu	Dry Forest	No Data	<1	371259	<1	<1
Maui	Dry Forest	Heavily Disturbed	10	460028	<1	<1
Maui	Dry Forest	Bare or <5% Vegetation	30	460028	<1	<1
Maui	Dry Forest	Native Non-native Mix	617	460028	<1	<1
Maui	Dry Forest	Native Dominated	39	460028	<1	<1
Maui	Dry Forest	No Data	<1	460028	<1	<1
Hawaii	Dry Forest	Heavily Disturbed	63	2584205	<1	<1
Hawaii	Dry Forest	Bare or <5% Vegetation	300	2584205	<1	<1
Hawaii	Dry Forest	Native Non-native Mix	292	2584205	<1	<1
Hawaii	Dry Forest	Native Dominated	6611	2584205	<1	<1
Hawaii	Dry Forest	No Data	<1	2584205	<1	<1

Dry Grassland and Shrubland

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Kahoolawe	Dry Grasslands and Shrublands	Heavily Disturbed	<1	28387	<1	<1
Kahoolawe	Dry Grasslands and Shrublands	Bare or <5% Vegetation	<1	28387	<1	<1
Kahoolawe	Dry Grasslands and Shrublands	Native Non-native Mix	<1	28387	<1	<1
Kahoolawe	Dry Grasslands and Shrublands	No Data	<1	28387	<1	<1
Niihau	Dry Grasslands and Shrublands	Heavily Disturbed	<1	45907	<1	<1
Niihau	Dry Grasslands and Shrublands	Bare or <5% Vegetation	<1	45907	<1	<1
Niihau	Dry Grasslands and Shrublands	Native Non-native Mix	<1	45907	<1	<1

Lanai	Dry Grasslands and Shrublands	Heavily Disturbed	3	90058	<1	<1
Lanai	Dry Grasslands and Shrublands	Bare or <5% Vegetation	54	90058	<1	<1
Lanai	Dry Grasslands and Shrublands	Native Non-native Mix	166	90058	<1	<1
Lanai	Dry Grasslands and Shrublands	Native Dominated	97	90058	<1	<1
Lanai	Dry Grasslands and Shrublands	No Data	<1	90058	<1	<1
Molokai	Dry Grasslands and Shrublands	Heavily Disturbed	125	164266	<1	<1
Molokai	Dry Grasslands and Shrublands	Bare or <5% Vegetation	62	164266	<1	<1
Molokai	Dry Grasslands and Shrublands	Native Non-native Mix	1981	164266	1	<1
Molokai	Dry Grasslands and Shrublands	Native Dominated	21	164266	<1	<1
Molokai	Dry Grasslands and Shrublands	No Data	<1	164266	<1	<1
Kauai	Dry Grasslands and Shrublands	Heavily Disturbed	<1	354833	<1	<1
Kauai	Dry Grasslands and Shrublands	Bare or <5% Vegetation	193	354833	<1	<1
Kauai	Dry Grasslands and Shrublands	Native Non-native Mix	418	354833	<1	<1
Kauai	Dry Grasslands and Shrublands	Native Dominated	1039	354833	<1	<1
Kauai	Dry Grasslands and Shrublands	No Data	<1	354833	<1	<1
Oahu	Dry Grasslands and Shrublands	Heavily Disturbed	40	371259	<1	<1
Oahu	Dry Grasslands and Shrublands	Bare or <5% Vegetation	10	371259	<1	<1
Oahu	Dry Grasslands and Shrublands	Native Non-native Mix	416	371259	<1	<1
Oahu	Dry Grasslands and Shrublands	Native Dominated	1	371259	<1	<1
Oahu	Dry Grasslands and Shrublands	No Data	<1	371259	<1	<1
Maui	Dry Grasslands and Shrublands	Heavily Disturbed	18	460028	<1	<1
Maui	Dry Grasslands and Shrublands	Bare or <5% Vegetation	900	460028	<1	<1
Maui	Dry Grasslands and Shrublands	Native Non-native Mix	2419	460028	1	<1

Maui	Dry Grasslands and Shrublands	Native Dominated	3929	460028	1	<1
Maui	Dry Grasslands and Shrublands	No Data	<1	460028	<1	<1
Hawaii	Dry Grasslands and Shrublands	Heavily Disturbed	173	2584205	<1	<1
Hawaii	Dry Grasslands and Shrublands	Bare or <5% Vegetation	12276	2584205	<1	<1
Hawaii	Dry Grasslands and Shrublands	Native Non-native Mix	4786	2584205	<1	<1
Hawaii	Dry Grasslands and Shrublands	Native Dominated	16406	2584205	1	<1
Hawaii	Dry Grasslands and Shrublands	No Data	<1	2584205	<1	<1

Mesic Forest

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Lanai	Mesic Forest	Heavily Disturbed	3	90058	<1	<1
Lanai	Mesic Forest	Bare or <5% Vegetation	1	90058	<1	<1
Lanai	Mesic Forest	Native Non-native Mix	27	90058	<1	<1
Lanai	Mesic Forest	Native Dominated	91	90058	<1	<1
Molokai	Mesic Forest	Heavily Disturbed	19	164266	<1	<1
Molokai	Mesic Forest	Bare or <5% Vegetation	2	164266	<1	<1
Molokai	Mesic Forest	Native Non-native Mix	957	164266	1	<1
Molokai	Mesic Forest	Native Dominated	2428	164266	1	<1
Molokai	Mesic Forest	No Data	<1	164266	<1	<1
Kauai	Mesic Forest	Heavily Disturbed	28	354833	<1	<1
Kauai	Mesic Forest	Bare or <5% Vegetation	14	354833	<1	<1
Kauai	Mesic Forest	Native Non-native Mix	2471	354833	1	<1

Kauai	Mesic Forest	Native Dominated	2061	354833	1	<1
Kauai	Mesic Forest	No Data	<1	354833	<1	<1
Oahu	Mesic Forest	Heavily Disturbed	<1	371259	<1	<1
Oahu	Mesic Forest	Bare or <5% Vegetation	<1	371259	<1	<1
Oahu	Mesic Forest	Native Non-native Mix	148	371259	<1	<1
Oahu	Mesic Forest	Native Dominated	1042	371259	<1	<1
Maui	Mesic Forest	Heavily Disturbed	24	460028	<1	<1
Maui	Mesic Forest	Bare or <5% Vegetation	5	460028	<1	<1
Maui	Mesic Forest	Native Non-native Mix	3156	460028	1	<1
Maui	Mesic Forest	Native Dominated	5708	460028	1	<1
Maui	Mesic Forest	No Data	<1	460028	<1	<1
Hawaii	Mesic Forest	Heavily Disturbed	276	2584205	<1	<1
Hawaii	Mesic Forest	Bare or <5% Vegetation	1435	2584205	<1	<1
Hawaii	Mesic Forest	Native Non-native Mix	5547	2584205	<1	<1
Hawaii	Mesic Forest	Native Dominated	36554	2584205	1	1
Hawaii	Mesic Forest	No Data	<1	2584205	<1	<1

Mesic Grassland and Shrubland

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Niihau	Mesic Grasslands and Shrublands	Bare or <5% Vegetation	<1	45907	<1	<1
Niihau	Mesic Grasslands and Shrublands	Native Non-native Mix	<1	45907	<1	<1
Lanai	Mesic Grasslands and Shrublands	Heavily Disturbed	<1	90058	<1	<1

Lanai	Mesic Grasslands and Shrublands	Bare or <5% Vegetation	<1	90058	<1	<1
Lanai	Mesic Grasslands and Shrublands	Native Non-native Mix	<1	90058	<1	<1
Lanai	Mesic Grasslands and Shrublands	Native Dominated	<1	90058	<1	<1
Molokai	Mesic Grasslands and Shrublands	Heavily Disturbed	27	164266	<1	<1
Molokai	Mesic Grasslands and Shrublands	Bare or <5% Vegetation	10	164266	<1	<1
Molokai	Mesic Grasslands and Shrublands	Native Non-native Mix	1433	164266	1	<1
Molokai	Mesic Grasslands and Shrublands	Native Dominated	1232	164266	1	<1
Molokai	Mesic Grasslands and Shrublands	No Data	<1	164266	<1	<1
Kauai	Mesic Grasslands and Shrublands	Heavily Disturbed	35	354833	<1	<1
Kauai	Mesic Grasslands and Shrublands	Bare or <5% Vegetation	122	354833	<1	<1
Kauai	Mesic Grasslands and Shrublands	Native Non-native Mix	2201	354833	1	<1
Kauai	Mesic Grasslands and Shrublands	Native Dominated	10	354833	<1	<1
Kauai	Mesic Grasslands and Shrublands	No Data	1	354833	<1	<1
Oahu	Mesic Grasslands and Shrublands	Heavily Disturbed	<1	371259	<1	<1
Oahu	Mesic Grasslands and Shrublands	Bare or <5% Vegetation	<1	371259	<1	<1
Oahu	Mesic Grasslands and Shrublands	Native Non-native Mix	282	371259	<1	<1
Oahu	Mesic Grasslands and Shrublands	Native Dominated	39	371259	<1	<1
Oahu	Mesic Grasslands and Shrublands	No Data	<1	371259	<1	<1
Maui	Mesic Grasslands and Shrublands	Heavily Disturbed	55	460028	<1	<1
Maui	Mesic Grasslands and Shrublands	Bare or <5% Vegetation	694	460028	<1	<1
Maui	Mesic Grasslands and Shrublands	Native Non-native Mix	4669	460028	1	<1
Maui	Mesic Grasslands and Shrublands	Native Dominated	5590	460028	1	<1
Maui	Mesic Grasslands and Shrublands	No Data	<1	460028	<1	<1

Hawaii	Mesic Grasslands and Shrublands	Heavily Disturbed	518	2584205	<1	<1
Hawaii	Mesic Grasslands and Shrublands	Bare or <5% Vegetation	10433	2584205	<1	<1
Hawaii	Mesic Grasslands and Shrublands	Native Non-native Mix	9507	2584205	<1	<1
Hawaii	Mesic Grasslands and Shrublands	Native Dominated	653	2584205	<1	<1
Hawaii	Mesic Grasslands and Shrublands	No Data	<1	2584205	<1	<1

Streams from State DAR Layers

Reserve Type	Island	Total Stream Length on Island (km)	Stream Length in Reserve (km)	Length (% of Total State Stream Length)	Length (% of Total Island Stream Length)
The Nature Conservancy Preserve	Lanai	735	<1	<1	<1
National Historical Park	Molokai	1194	19	<1	2
National Wildlife Refuge	Molokai	1194	1	<1	<1
Natural Area Reserve	Molokai	1194	33	<1	3
The Nature Conservancy Preserve	Molokai	1194	68	1	6
National Park	Maui	2033	70	1	3
National Wildlife Refuge	Maui	2033	8	<1	<1
Natural Area Reserve	Maui	2033	94	1	5
The Nature Conservancy Preserve	Maui	2033	76	1	4
National Wildlife Refuge	Oahu	2404	68	1	3
Natural Area Reserve	Oahu	2404	16	<1	1
Wildlife Sanctuary	Oahu	2404	12	<1	<1
National Wildlife Refuge	Kauai	2624	6	<1	<1
Natural Area Reserve	Kauai	2624	48	<1	2
State Wilderness Park	Kauai	2624	49	<1	2
The Nature Conservancy Preserve	Kauai	2624	65	<1	2
National Historical Park	Hawaii	4059	<1	<1	<1
National Park	Hawaii	4059	118	1	3
National Wildlife Refuge	Hawaii	4059	113	1	3
Natural Area Reserve	Hawaii	4059	90	1	2
The Nature Conservancy Preserve	Hawaii	4059	15	<1	<1

Wet Forest

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Lanai	Wet Forest	Heavily Disturbed	<1	90058	<1	<1
Lanai	Wet Forest	Bare or <5% Vegetation	<1	90058	<1	<1
Lanai	Wet Forest	Native Non-native Mix	<1	90058	<1	<1
Lanai	Wet Forest	Native Dominated	<1	90058	<1	<1
Molokai	Wet Forest	Heavily Disturbed	16	164266	<1	<1
Molokai	Wet Forest	Bare or <5% Vegetation	1	164266	<1	<1
Molokai	Wet Forest	Native Non-native Mix	215	164266	<1	<1
Molokai	Wet Forest	Native Dominated	5066	164266	3	<1
Kauai	Wet Forest	Heavily Disturbed	<1	354833	<1	<1
Kauai	Wet Forest	Bare or <5% Vegetation	1	354833	<1	<1
Kauai	Wet Forest	Native Non-native Mix	984	354833	<1	<1
Kauai	Wet Forest	Native Dominated	7042	354833	2	<1
Oahu	Wet Forest	Heavily Disturbed	<1	371259	<1	<1
Oahu	Wet Forest	Native Non-native Mix	1542	371259	<1	<1
Oahu	Wet Forest	Native Dominated	3512	371259	1	<1
Maui	Wet Forest	Heavily Disturbed	2	460028	<1	<1
Maui	Wet Forest	Bare or <5% Vegetation	1	460028	<1	<1
Maui	Wet Forest	Native Non-native Mix	1988	460028	<1	<1
Maui	Wet Forest	Native Dominated	26257	460028	6	1

Maui	Wet Forest	No Data	<1	460028	<1	<1
Hawaii	Wet Forest	Heavily Disturbed	434	2584205	<1	<1
Hawaii	Wet Forest	Bare or <5% Vegetation	1565	2584205	<1	<1
Hawaii	Wet Forest	Native Non-native Mix	5299	2584205	<1	<1
Hawaii	Wet Forest	Native Dominated	95855	2584205	4	2
Hawaii	Wet Forest	No Data	<1	2584205	<1	<1

Wet Grassland and Shrubland

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Lanai	Wet Grasslands and Shrublands	Bare or <5% Vegetation	<1	90058	<1	<1
Lanai	Wet Grasslands and Shrublands	Native Non-native Mix	<1	90058	<1	<1
Lanai	Wet Grasslands and Shrublands	Native Dominated	<1	90058	<1	<1
Molokai	Wet Grasslands and Shrublands	Heavily Disturbed	2	164266	<1	<1
Molokai	Wet Grasslands and Shrublands	Bare or <5% Vegetation	1	164266	<1	<1
Molokai	Wet Grasslands and Shrublands	Native Non-native Mix	493	164266	<1	<1
Molokai	Wet Grasslands and Shrublands	Native Dominated	1822	164266	1	<1
Molokai	Wet Grasslands and Shrublands	No Data	<1	164266	<1	<1
Kauai	Wet Grasslands and Shrublands	Heavily Disturbed	<1	354833	<1	<1
Kauai	Wet Grasslands and Shrublands	Bare or <5% Vegetation	1	354833	<1	<1
Kauai	Wet Grasslands and Shrublands	Native Non-native Mix	72	354833	<1	<1
Kauai	Wet Grasslands and Shrublands	Native Dominated	1983	354833	1	<1
Oahu	Wet Grasslands and Shrublands	Heavily Disturbed	<1	371259	<1	<1

Oahu	Wet Grasslands and Shrublands	Bare or <5% Vegetation	<1	371259	<1	<1
Oahu	Wet Grasslands and Shrublands	Native Non-native Mix	67	371259	<1	<1
Oahu	Wet Grasslands and Shrublands	Native Dominated	134	371259	<1	<1
Maui	Wet Grasslands and Shrublands	Heavily Disturbed	<1	460028	<1	<1
Maui	Wet Grasslands and Shrublands	Bare or <5% Vegetation	1	460028	<1	<1
Maui	Wet Grasslands and Shrublands	Native Non-native Mix	469	460028	<1	<1
Maui	Wet Grasslands and Shrublands	Native Dominated	2078	460028	<1	<1
Maui	Wet Grasslands and Shrublands	No Data	<1	460028	<1	<1
Hawaii	Wet Grasslands and Shrublands	Heavily Disturbed	279	2584205	<1	<1
Hawaii	Wet Grasslands and Shrublands	Bare or <5% Vegetation	2912	2584205	<1	<1
Hawaii	Wet Grasslands and Shrublands	Native Non-native Mix	1459	2584205	<1	<1
Hawaii	Wet Grasslands and Shrublands	Native Dominated	3263	2584205	<1	<1
Hawaii	Wet Grasslands and Shrublands	No Data	<1	2584205	<1	<1

Wetlands from NOAA Layers

Island	Wetland Type	Reserve Type	Total Wetland Area on Island (Acres)	Area (Acres)	Area (% of Wetland Area on Island)
Oahu	Estuarine Emergent Wetland	National Wildlife Refuge	3218	7	<1
Oahu	Palustrine Emergent Wetland	National Wildlife Refuge	3218	90	3
Oahu	Palustrine Forested Wetland	National Wildlife Refuge	3218	1	<1
Oahu	Unconsolidated Shore	National Wildlife Refuge	3218	7	<1
Oahu	Estuarine Forested Wetland	National Wildlife Refuge	3218	1	<1
Oahu	Open Water	National Wildlife Refuge	3218	80	2
Oahu	Palustrine Scrub Shrub Wetland	National Wildlife Refuge	3218	10	<1
Oahu	Estuarine Scrub Shrub Wetland	National Wildlife Refuge	3218	2	<1

Oahu	Palustrine Forested Wetland	Natural Area Reserve	3218	<1	<1
Oahu	Open Water	Natural Area Reserve	3218	5	<1
Oahu	Estuarine Emergent Wetland	Wildlife Sanctuary	3218	8	<1
Oahu	Palustrine Emergent Wetland	Wildlife Sanctuary	3218	38	1
Oahu	Palustrine Forested Wetland	Wildlife Sanctuary	3218	<1	<1
Oahu	Unconsolidated Shore	Wildlife Sanctuary	3218	22	1
Oahu	Estuarine Forested Wetland	Wildlife Sanctuary	3218	4	<1
Oahu	Open Water	Wildlife Sanctuary	3218	24	1
Oahu	Palustrine Scrub Shrub Wetland	Wildlife Sanctuary	3218	24	1
Oahu	Estuarine Scrub Shrub Wetland	Wildlife Sanctuary	3218	<1	<1
Oahu	Palustrine Aquatic Bed	Wildlife Sanctuary	3218	3	<1
Oahu	Open Water	Private Preserve	3218	<1	<1
Molokai	Palustrine Emergent Wetland	National Historical Park	4814	2	<1
Molokai	Palustrine Forested Wetland	National Historical Park	4814	<1	<1
Molokai	Unconsolidated Shore	National Historical Park	4814	2	<1
Molokai	Open Water	National Historical Park	4814	37	1
Molokai	Palustrine Scrub Shrub Wetland	National Historical Park	4814	<1	<1
Molokai	Palustrine Emergent Wetland	National Wildlife Refuge	4814	9	<1
Molokai	Palustrine Forested Wetland	National Wildlife Refuge	4814	11	<1
Molokai	Unconsolidated Shore	National Wildlife Refuge	4814	1	<1
Molokai	Open Water	National Wildlife Refuge	4814	<1	<1
Molokai	Palustrine Scrub Shrub Wetland	National Wildlife Refuge	4814	1	<1
Molokai	Palustrine Emergent Wetland	Natural Area Reserve	4814	2	<1
Molokai	Palustrine Forested Wetland	Natural Area Reserve	4814	552	11
Molokai	Open Water	Natural Area Reserve	4814	12	<1
Molokai	Palustrine Scrub Shrub Wetland	Natural Area Reserve	4814	8	<1
Molokai	Palustrine Emergent Wetland	The Nature Conservancy Preserve	4814	6	<1
Molokai	Palustrine Forested Wetland	The Nature Conservancy Preserve	4814	263	5
Molokai	Unconsolidated Shore	The Nature Conservancy Preserve	4814	2	<1
Molokai	Open Water	The Nature Conservancy Preserve	4814	45	1

Molokai	Palustrine Scrub Shrub Wetland	The Nature Conservancy Preserve	4814	72	1
Maui	Palustrine Emergent Wetland	National Park	6106	23	<1
Maui	Palustrine Forested Wetland	National Park	6106	139	2
Maui	Unconsolidated Shore	National Park	6106	<1	<1
Maui	Open Water	National Park	6106	13	<1
Maui	Palustrine Scrub Shrub Wetland	National Park	6106	131	2
Maui	Palustrine Emergent Wetland	National Wildlife Refuge	6106	99	2
Maui	Palustrine Forested Wetland	National Wildlife Refuge	6106	32	1
Maui	Unconsolidated Shore	National Wildlife Refuge	6106	184	3
Maui	Open Water	National Wildlife Refuge	6106	31	1
Maui	Palustrine Scrub Shrub Wetland	National Wildlife Refuge	6106	136	2
Maui	Palustrine Emergent Wetland	Natural Area Reserve	6106	64	1
Maui	Palustrine Forested Wetland	Natural Area Reserve	6106	160	3
Maui	Open Water	Natural Area Reserve	6106	26	<1
Maui	Palustrine Scrub Shrub Wetland	Natural Area Reserve	6106	351	6
Maui	Palustrine Emergent Wetland	The Nature Conservancy Preserve	6106	55	1
Maui	Palustrine Forested Wetland	The Nature Conservancy Preserve	6106	161	3
Maui	Palustrine Scrub Shrub Wetland	The Nature Conservancy Preserve	6106	263	4
Maui	Open Water	Marine Life Conservation District	6106	<1	<1
Maui	Palustrine Emergent Wetland	Wildlife Sanctuary	6106	35	1
Maui	Palustrine Forested Wetland	Wildlife Sanctuary	6106	8	<1
Maui	Unconsolidated Shore	Wildlife Sanctuary	6106	6	<1
Maui	Open Water	Wildlife Sanctuary	6106	5	<1
Maui	Palustrine Scrub Shrub Wetland	Wildlife Sanctuary	6106	12	<1
Kauai	Estuarine Emergent Wetland	National Wildlife Refuge	8297	32	<1
Kauai	Palustrine Emergent Wetland	National Wildlife Refuge	8297	7	<1
Kauai	Palustrine Forested Wetland	National Wildlife Refuge	8297	96	1
Kauai	Palustrine Scrub/Shrub Wetland	National Wildlife Refuge	8297	<1	<1
Kauai	Unconsolidated Shore	National Wildlife Refuge	8297	19	<1

Kauai	Water	National Wildlife Refuge	8297	47	1
Kauai	Estuarine Forested Wetland	National Wildlife Refuge	8297	21	<1
Kauai	Estuarine Scrub/Shrub Wetland	National Wildlife Refuge	8297	4	<1
Kauai	Palustrine Emergent Wetland	Natural Area Reserve	8297	16	<1
Kauai	Palustrine Forested Wetland	Natural Area Reserve	8297	2	<1
Kauai	Palustrine Scrub/Shrub Wetland	Natural Area Reserve	8297	4	<1
Kauai	Unconsolidated Shore	Natural Area Reserve	8297	<1	<1
Kauai	Water	Natural Area Reserve	8297	9	<1
Kauai	Palustrine Emergent Wetland	The Nature Conservancy Preserve	8297	244	3
Kauai	Palustrine Forested Wetland	The Nature Conservancy Preserve	8297	120	1
Kauai	Palustrine Scrub/Shrub Wetland	The Nature Conservancy Preserve	8297	39	<1
Kauai	Water	The Nature Conservancy Preserve	8297	43	1
Kauai	Unconsolidated Shore	State Wilderness Park	8297	5	<1
Kauai	Water	State Wilderness Park	8297	40	<1
Hawaii	Estuarine Emergent Wetland	National Historical Park	15791	15	<1
Hawaii	Water	National Historical Park	15791	43	<1
Hawaii	Palustrine Emergent Wetland	National Park	15791	3	<1
Hawaii	Water	National Park	15791	64	<1
Hawaii	Palustrine Emergent Wetland	National Wildlife Refuge	15791	220	1
Hawaii	Palustrine Forested Wetland	National Wildlife Refuge	15791	545	3
Hawaii	Palustrine Scrub/Shrub Wetland	National Wildlife Refuge	15791	661	4
Hawaii	Unconsolidated Shore	National Wildlife Refuge	15791	<1	<1
Hawaii	Water	National Wildlife Refuge	15791	95	1
Hawaii	Palustrine Emergent Wetland	Natural Area Reserve	15791	183	1
Hawaii	Palustrine Forested Wetland	Natural Area Reserve	15791	408	3
Hawaii	Palustrine Scrub/Shrub Wetland	Natural Area Reserve	15791	362	2
Hawaii	Water	Natural Area Reserve	15791	99	1
Hawaii	Water	The Nature Conservancy Preserve	15791	3	<1

Wetlands from NWI Layers

Island	Wetland Type	Dataset	Total Wetland Area on Island (Acres)	Summary Variable	Area (Acres)	Area (% of Wetland Area on Island	acres
Maui	Estuarine and Marine Wetland	USFWS - NWI	62306	Marine Life Conservation District	2	2.42	<1
Molokai	Estuarine and Marine Wetland	USFWS - NWI	7871	National Historical Park	15	15.38	<1
Molokai	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	7871	National Historical Park	4	3.64	<1
Molokai	Open Water	USFWS - NWI	7871	National Historical Park	3	3.26	<1
Hawaii	Estuarine and Marine Wetland	USFWS - NWI	58024	National Historical Park	19	19.4	<1
Hawaii	Estuarine and Marine Wetland	USFWS - NWI	58024	National Park	67	66.73	<1
Hawaii	Freshwater Emergent Wetland	USFWS - NWI	58024	National Park	5	5.09	<1
Hawaii	Open Water	USFWS - NWI	58024	National Park	4	3.59	<1
Maui	Estuarine and Marine Wetland	USFWS - NWI	62306	National Park	4	4.05	<1
Maui	Freshwater Emergent Wetland	USFWS - NWI	62306	National Park	59	59.28	<1
Maui	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	62306	National Park	5869	5868.78	9
Maui	Open Water	USFWS - NWI	62306	National Park	4	3.75	<1
Molokai	Freshwater Emergent Wetland	USFWS - NWI	7871	National Wildlife Refuge	16	15.85	<1
Molokai	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	7871	National Wildlife Refuge	10	9.94	<1
Oahu	Estuarine and Marine Wetland	USFWS - NWI	8530	National Wildlife Refuge	20	19.92	<1
Oahu	Freshwater Emergent Wetland	USFWS - NWI	8530	National Wildlife Refuge	210	210.15	2
Oahu	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	8530	National Wildlife Refuge	26	25.89	<1
Oahu	Open Water	USFWS - NWI	8530	National Wildlife Refuge	161	160.57	2
Kauai	Estuarine and Marine Wetland	USFWS - NWI	21318	National Wildlife Refuge	62	61.92	<1
Kauai	Freshwater Emergent Wetland	USFWS - NWI	21318	National Wildlife Refuge	297	296.72	1

Kauai	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	21318	National Wildlife Refuge	30	29.7	<1
Kauai	Open Water	USFWS - NWI	21318	National Wildlife Refuge	0	0.49	<1
Hawaii	Freshwater Emergent Wetland	USFWS - NWI	58024	National Wildlife Refuge	5	4.99	<1
Hawaii	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	58024	National Wildlife Refuge	14112	14112.16	24
Hawaii	Open Water	USFWS - NWI	58024	National Wildlife Refuge	15	14.57	<1
Maui	Estuarine and Marine Wetland	USFWS - NWI	62306	National Wildlife Refuge	0	0.12	<1
Maui	Freshwater Emergent Wetland	USFWS - NWI	62306	National Wildlife Refuge	177	176.62	<1
Maui	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	62306	National Wildlife Refuge	196	196.37	<1
Maui	Open Water	USFWS - NWI	62306	National Wildlife Refuge	262	262.36	<1
Molokai	Estuarine and Marine Wetland	USFWS - NWI	7871	Natural Area Reserve	5	4.71	<1
Molokai	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	7871	Natural Area Reserve	715	715.21	9
Oahu	Estuarine and Marine Wetland	USFWS - NWI	8530	Natural Area Reserve	10	10.18	<1
Oahu	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	8530	Natural Area Reserve	48	47.53	1
Kauai	Estuarine and Marine Wetland	USFWS - NWI	21318	Natural Area Reserve	0	0.35	<1
Kauai	Freshwater Emergent Wetland	USFWS - NWI	21318	Natural Area Reserve	11	10.86	<1
Kauai	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	21318	Natural Area Reserve	192	192.44	1
Hawaii	Estuarine and Marine Wetland	USFWS - NWI	58024	Natural Area Reserve	4	4.44	<1
Hawaii	Freshwater Emergent Wetland	USFWS - NWI	58024	Natural Area Reserve	34	34.42	<1
Hawaii	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	58024	Natural Area Reserve	6433	6432.76	11
Hawaii	Open Water	USFWS - NWI	58024	Natural Area Reserve	4	4.06	<1
Maui	Estuarine and Marine Wetland	USFWS - NWI	62306	Natural Area Reserve	12	12.24	<1
Maui	Freshwater Emergent Wetland	USFWS - NWI	62306	Natural Area Reserve	121	120.73	<1
Maui	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	62306	Natural Area Reserve	7997	7996.54	13

Maui	Open Water	USFWS - NWI	62306	Natural Area Reserve	0	0.29	<1
Oahu	Estuarine and Marine Wetland	USFWS - NWI	8530	Private Preserve	0	0	<1
Kauai	Estuarine and Marine Wetland	USFWS - NWI	21318	State Wilderness Park	23	23.4	<1
Molokai	Estuarine and Marine Wetland	USFWS - NWI	7871	The Nature Conservancy Preserve	11	11.33	<1
Molokai	Freshwater Emergent Wetland	USFWS - NWI	7871	The Nature Conservancy Preserve	7	6.83	<1
Molokai	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	7871	The Nature Conservancy Preserve	843	842.9	11
Kauai	Freshwater Emergent Wetland	USFWS - NWI	21318	The Nature Conservancy Preserve	22	21.86	<1
Kauai	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	21318	The Nature Conservancy Preserve	1140	1140.26	5
Hawaii	Estuarine and Marine Wetland	USFWS - NWI	58024	The Nature Conservancy Preserve	2	1.53	<1
Hawaii	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	58024	The Nature Conservancy Preserve	2	1.71	<1
Hawaii	Open Water	USFWS - NWI	58024	The Nature Conservancy Preserve	2	2.32	<1
Maui	Freshwater Emergent Wetland	USFWS - NWI	62306	The Nature Conservancy Preserve	30	29.94	<1
Maui	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	62306	The Nature Conservancy Preserve	5852	5851.87	9
Lanai	Estuarine and Marine Wetland	USFWS - NWI	276	Wildlife Sanctuary	1	0.62	<1
Niihau	Estuarine and Marine Wetland	USFWS - NWI	2317	Wildlife Sanctuary	6	5.75	<1
Molokai	Estuarine and Marine Wetland	USFWS - NWI	7871	Wildlife Sanctuary	3	2.86	<1
Oahu	Estuarine and Marine Wetland	USFWS - NWI	8530	Wildlife Sanctuary	53	53.37	1
Oahu	Freshwater Emergent Wetland	USFWS - NWI	8530	Wildlife Sanctuary	609	608.55	7

Oahu	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	8530	Wildlife Sanctuary	2	1.54	<1
Oahu	Open Water	USFWS - NWI	8530	Wildlife Sanctuary	45	44.86	1
Kauai	Estuarine and Marine Wetland	USFWS - NWI	21318	Wildlife Sanctuary	3	2.79	<1
Hawaii	Estuarine and Marine Wetland	USFWS - NWI	58024	Wildlife Sanctuary	1	0.74	<1
Maui	Estuarine and Marine Wetland	USFWS - NWI	62306	Wildlife Sanctuary	3	3.31	<1
Maui	Freshwater Emergent Wetland	USFWS - NWI	62306	Wildlife Sanctuary	40	39.73	<1
Maui	Freshwater Forested and Scrub Shrub Wetland	USFWS - NWI	62306	Wildlife Sanctuary	35	34.59	<1
Maui	Open Water	USFWS - NWI	62306	Wildlife Sanctuary	63	63.18	<1

Wetlands from USGS Layers

Island	Habitat	Habitat Quality	Area in Reserves (Acres)	Island Area (Acres)	Reserve Area (% of Island)	Reserve Area (% of State of Hawaii)
Niihau	Wetland	Heavily Disturbed	<1	45907	<1	<1
Niihau	Wetland	Bare or <5% Vegetation	<1	45907	<1	<1
Niihau	Wetland	Native Non-native Mix	<1	45907	<1	<1
Lanai	Wetland	Heavily Disturbed	<1	90058	<1	<1
Lanai	Wetland	Bare or <5% Vegetation	<1	90058	<1	<1
Lanai	Wetland	Native Non-native Mix	<1	90058	<1	<1
Lanai	Wetland	Native Dominated	<1	90058	<1	<1
Lanai	Wetland	No Data	<1	90058	<1	<1
Molokai	Wetland	Heavily Disturbed	1	164266	<1	<1
Molokai	Wetland	Bare or <5% Vegetation	<1	164266	<1	<1
Molokai	Wetland	Native Non-native Mix	27	164266	<1	<1
Molokai	Wetland	Native Dominated	4	164266	<1	<1
Molokai	Wetland	No Data	<1	164266	<1	<1
Kauai	Wetland	Heavily Disturbed	<1	354833	<1	<1
Kauai	Wetland	Bare or <5% Vegetation	<1	354833	<1	<1
Kauai	Wetland	Native Non-native Mix	38	354833	<1	<1
Kauai	Wetland	Native Dominated	79	354833	<1	<1
Kauai	Wetland	No Data	<1	354833	<1	<1
Oahu	Wetland	Heavily Disturbed	64	371259	<1	<1

Oahu	Wetland	Bare or <5% Vegetation	<1	371259	<1	<1
Oahu	Wetland	Native Non-native Mix	661	371259	<1	<1
Oahu	Wetland	Native Dominated	<1	371259	<1	<1
Oahu	Wetland	No Data	<1	371259	<1	<1
Maui	Wetland	Heavily Disturbed	4	460028	<1	<1
Maui	Wetland	Bare or <5% Vegetation	<1	460028	<1	<1
Maui	Wetland	Native Non-native Mix	383	460028	<1	<1
Maui	Wetland	Native Dominated	506	460028	<1	<1
Hawaii	Wetland	Heavily Disturbed	<1	2584205	<1	<1
Hawaii	Wetland	Bare or <5% Vegetation	6	2584205	<1	<1
Hawaii	Wetland	Native Non-native Mix	58	2584205	<1	<1
Hawaii	Wetland	Native Dominated	4	2584205	<1	<1
Hawaii	Wetland	No Data	<1	2584205	<1	<1

Appendix H. Hawaii Wetlands Code

#Mari K Reeves

#18_05_30_SummarizeWetlandHabitatsForHSAs

#This code will intersect the NWI and NOAA polygon layers with Land Ownership, Habitat Quality, Reserve Areas and Critical Habitats

#and generate summary tables and figures for the biologists doing the Habitat Status Assessment Reports.

#The NOAA layer was a polygon file that I generated from the rasters for the wetlands project, but this stupid file was corrupted and

#all the gridcode values were assigned to the wrong habitat and I don't understand why the raster to polygon function does this

#sometimes, but I'm tired enough of the problem I am going back to the base rasters with this code.
ARRGH!

```
rm(list = ls()) #remove all past worksheet variables
```

```
set.seed(333)
```

```
# Read in Base Packages -----
```

```
pckg <- c("dplyr", "tidyR", "RColorBrewer", "ggplot2",
  "parallel", "gdalUtils", "rgdal", "rgeos",
  "spatial", "sp", "raster", "maptools", "spatialEco",
  "SpatialPack", "spatstat", "microbenchmark", "devtools",
  "snowfall", "tictoc")
```

```
# READING IN PACKAGES
```

```
for(i in 1:length(pckg)){
```

```

if (!pckg[i] %in% installed.packages() == T) {
  install.packages(pckg[i], repos = "http://cran.us.r-project.org",
    dependencies = T)
  print(pckg[i])
  do.call("library", list(pckg[i]))
} else{
  print(pckg[i])
  do.call("library", list(pckg[i]))
}
}

#Define Directories
#BaseDir <- "J:/PIOGIS12/APPS/SH_CC/Mari/HSAs/"
BaseDir<- "C:/Users/marieeves/Documents/HSAs/"
WorkingDir<-paste0(BaseDir, "HabitatStatusAssessmentsR/Hawaii")
SHADir<-paste0(BaseDir, "SHADataFiles/")
ConservationDir<-paste0(WorkingDir, "/ShapeFiles4R" )
OutDir<-paste0(ConservationDir, "/CoastalWetlandsStreamsOut")
WetDir<-paste0(OutDir, "/StreamsWetlandsCoastal")
CCAPDir<-paste0(ConservationDir, "/NOAACCAPRasters/noaa_ccap_rasters")
CCAPOut<-paste0(ConservationDir, "/NOAACCAPRasters")
ReportOut<-paste0(BaseDir, "/HSAResorts/18_06_14_WetlandsFiguresTables")
setwd(ReportOut)

#Set CRS for session
BigIslandCRS<- "+proj=utm +zone=5 +ellps=GRS80 +towgs84=0,0,0,-0,-0,-0,0 +units=m +no_defs"
OtherIslandCRS<- "+proj=utm +zone=4 +ellps=GRS80 +towgs84=0,0,0,-0,-0,0 +units=m +no_defs"
sysCRS<- "+proj=utm +zone=4 +datum=NAD83 +units=m +no_defs +ellps=GRS80 +towgs84=0,0,0"
#colorblind friendly palatte:

```

```

cbPalette <- c("#999999", "#E69F00", "#56B4E9", "#009E73", "#F0E442", "#0072B2", "#D55E00",
"#CC79A7", "#000000")

#Bring in files and transform them into the sysCRS - send them to a new folder - only need to run this
once, so commented it out

neededshps<-list.files(CCPOut, pattern = ".shp$")

#habitatsplit<-function(hab){

for (myshp in neededshps){

  #get rid of the shp extension

  lyr <- sub(".shp$", "", myshp)#This gets rid of the .shp extension in the list of files

  b<-readOGR(dsn = CCPOut, layer = lyr)#read in the shpfile

  print(proj4string(b))#check CRS

  #transform it to the sysCRS

  g<-spTransform(b, CRS(sysCRS))

  print(proj4string(g))#recheck the spatial projections

  #send it back out to a different file

  #clip it to the coastline

  outname<-paste0("18_06_11_sysCRS",lyr)

  writeOGR(g, dsn = OutDir, layer = outname, driver="ESRI Shapefile", overwrite_layer = T)

}

#Bring these files back in for intersection operations.

list.files(OutDir, pattern = ".shp")

own<-readOGR(dsn = OutDir, layer = "18_05_24_sysCRS18_05_03_DissolveOwnerIsland")

owndata<-own@data

ownBuffer<-gBuffer(own, byid=TRUE, width=0)#fix most gisValid errors

```

```

reserves<-readOGR(dsn = OutDir, layer = "18_05_24_sysCRSReserves")

crithab<-readOGR(dsn = OutDir, layer = "CriticalHabitatsysCRSOnePoly")
crithabdata<-crithab@data

#clean up the reserve layer to delete reserves we don't think are important from a conservation
perspective

types2keep<-c ("Marine Life Conservation District", "National Historical Park",
                 "National Park", "National Wildlife Refuge", "Natural Area Reserve",
                 "Private Preserve", "State Wilderness Park", "The Nature Conservancy Preserve",
                 "Wildlife Sanctuary")

myreserves<-reserves[reserves$Type_Defin %in% types2keep,]

myreservedata<-myreserves@data

habqual<-
raster("C:/Users/marieeves/Documents/HSAs/SHADataFiles/CarbonAssessment2017VegLayers/CAH_H
abStatus/CAH_HabStatus.tif")

#write functions to intersect the streams, wetlands, and streams with reserves, critical habitat, and land
ownership, calculate and

#plot length in each status. I think I may just need to treat each of these guys separately and not do this
in a loop. Because the

#incoming datasets are so different. Bleh.

#
#
#~~~~~
```

```

# Write a function to bring in each CCAP raster and summarize acres in each gridcode in the most recent
layer

#This took forever and needed to do queries and convert to polygons for calcs in ArcGIS

# CCAPFiles<-list.files(CCAPDir, '\\.img$', full.names=T)

#
# noaaDesc<-read.csv(paste0(WetDir, "/18_05_28_HSA_NOAA2KEEPPDROP.csv"))

# noaaDrop<-noaaDesc[noaaDesc$KEEP_DROP == "DROP",]

# noaaKeep<-noaaDesc[noaaDesc$KEEP_DROP == "KEEP",]

#
# noaaDesc$value<-noaaDesc$NOAA_CAT

#
#

# for(filez in CCAPFiles){

# z<-stack(filez)

# print(proj4string(z))#check the projection

# myres<-res(z)#get the resolution of z (m2 per pixel) for count to area conversion

# sqmperpixel<-myres[1]*myres[2]#assign m2 per pixel to a variable so we can use it for math

#

# y<-freq(z)#count pixels in each value category

# y<-data.frame(y)#turn in into a data frame

# names(y)<-c("value", "count")#give the columns names

#

# y$aream2<-y$count*sqmperpixel #convert counts to areas

# y$acres<-y$aream2*0.0002471

# names(y)<-c("Value", "pixel_count", "aream2", "acres")

#

# #bring in the NOAA crosswalk and join the values to the areas

# j<-merge(y, noaaDesc, by = "Value")

```

```

# #save this table to double check areas

# jname<-
sub("C:/Users/marieees/Domains/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/NOAACCRasters/noaa_ccap_rasters/hi_","", filez)

# jname<-sub("_20*.*img", "CCAP.csv", jname)

# write.csv(j, file=jname)

# #Filter to keep only the wetlands

# noaawet<-j[j$Value %in% noaaKeep$NOAA_CAT,]

# noaawet$island<-sub("CCAP.csv", "", jname)

# summaryname<-sub("CCAP.csv", "CCAP_summary.csv", jname)

# write.csv(noaawet, file = summaryname)

# 

# }

# 

# 

# 

# wetlandsummaries<-list.files(CCPOut, pattern = "summary.csv", full.names = T)

# 

# wetsummaries<-lapply(wetlandsummaries, read.csv, header = T)

# 

# 

# wetlandsummarynohawaii<-do.call(rbind, wetsummaries)

# names(wetlandsummarynohawaii)

# w.summary<-wetlandsummarynohawaii[,c( "pixel_count","acres","NOAA_CAT","DESCRIPTION",
#"island" )]

# w.summary$sqmi<-w.summary$acres*0.001563

# 

# sum(w.summary$sqmi)

# levels(w.summary$DESCRIPTION)

#

```

```

# wet.no.openwater<-w.summary[w.summary$DESCRIPTION != "open water – hopefully all of these are
wetlands" ,]

# wetarea<-sum(wet.no.openwater$sqmi)

# mycells<-z %in% noaaKeep$NOAA_CAT

# plot(mycells)

# wet <- mask(z, mycells, maskvalue=0, updatevalue=NA)

# plot(wet)

# #the next line of code takes an unbelievably long time and tons of memory ugkh and then totally
# doesn't work

# q<-rasterToPolygons(wet, n=4, na.rm=TRUE, digits=12, dissolve=TRUE)

# plot(q)

# writeOGR(q, dsn = CCAPOut, layer = "niihauwetlands", driver="ESRI Shapefile", overwrite_layer = T)

#



#~~~~~
~~~~~
~~~~~


#bring in nwi and see if they map onto each other

nwi<-readOGR(dsn = WetDir, layer = "18_05_24_sysCRSHI_Wetlands" )

nwidata<-nwi@data

nwilut<-data.frame(table(nwidata$WETLAND_TY))

write.csv(nwilut, file = "nwi2keep.csv")

```

```

#drop the Rivers and the Estuarine and Marine Deepwater, retaining all other categories for this
analysis.

#oops, I did this in Excel by habit. could have should have done it here...oh well. Missed opportunity
nwikeepdrop<-read.csv(paste0(OutDir, "/nwi2keep.csv"))

nwiKeep<-nwikeepdrop[nwikeepdrop$KEEP_DROP == "KEEP",]

#Filter to keep only the wetlands I want
nwiwet<-nwi[nwi@data$WETLAND_TY %in% nwiKeep$WETLAND_TY,]

#check if that worked
nwiwetdata<-nwiwet@data

write.csv(nwiwetdata, file = "18_05_30_nwiwet.csv")

#Calculate Areas and make an area statewide variable to use

nwiwet$Area_m<-gArea(nwiwet, byid = T)
nwiwetlandstotalarea<-gArea(nwiwet) #65,075,6448
nwiwetdata<-nwiwet@data

#Add in Island to table
#bring in a coastlines shape for an over statement...
list.files(ConservationDir)

```

```

coast<-readOGR(dsn = ConservationDir, layer = "state_coast")

#transform it into the sysCRS

print(proj4string(coast))#check CRS

#transform it to the sysCRS

coast<-spTransform(coast, CRS(sysCRS))

print(proj4string(coast))#recheck the spatial projections

#send it back out to a different file

writeOGR(coast, dsn = OutDir, layer = "coastsysCRS", driver="ESRI Shapefile", overwrite_layer = T)

#run intersection to assign island names to wetland tables.

#Keep only islands of interest...The 2500m buffer makes it so smaller islands are included with Mains

#Get rid of Lehua and other islands we don't want to avoid double counting

levels(coast$Label)

islands2keep<-c( "Big Island" , "Kahoolawe" , "Kauai" , "Lanai" , "Maui" , "Molokai" , "Niihau" , "Oahu"   )

coast<-coast[coast$Label %in% islands2keep,]

coastdata<-coast@data

#change name Big Island to Hawaii

coast$island<-sub("Big Island", "Hawaii", coast$Label)

#~~~~~
~~~~~
~~~~~

wetplaces<-list.files(OutDir, pattern = "18_06_11_sysCRS*.*.shp")

#Write a loop to bring in each island file

```

```

for (wet in wetplaces){

  #get rid of the shp extension
  lyr <- sub(".shp$", "", wet)#This gets rid of the .shp extension in the list of files
  b<-readOGR(dsn = OutDir, layer = lyr)#read in the shpfile


  #clip it to the coastline and #Assign an island name to the datafile
  clip <- raster::intersect(b, coast)
  plot(clip)

  plot(coast, col = "red", add = T)

  #compute wetland areas by island
  clip$aream2<-gArea(clip, byid = T)
  clip<-clip[,c(2,3 ,13, 14)]
  names(clip@data)<-c("gridcode", "wetlandtype", "island", "Area_m")
  clipdata<-clip@data
  outname<-paste0(lyr, "coastlineclipped.shp")
  writeOGR(clip, dsn = OutDir, layer = outname, driver="ESRI Shapefile", overwrite_layer = T)
}

```

#intersect it with land ownership and write data to file

```

tic()

typeownno<-try(raster::intersect(clip, ownBuffer))

if(class(typeownno) %in% c('NULL', 'try-error')){

  next

}else{
  typeownno$newarea_m<-gArea(typeownno, byid = T)
  typeownno$keyinfo<-typeownno$BigstOwner
  typeownnodata<-typeownno@data
  ownname<-paste0(lyr, "own.csv")
  write.csv(typeownnodata, file = ownname)
}

```

```

toc()
}

}

for (wetter in wetplaces){
  #get rid of the shp extension
  lyr <- sub(".shp$", "", wetter)#This gets rid of the .shp extension in the list of files
  b<-readOGR(dsn = OutDir, layer = lyr)#read in the shpfile

  #clip it to the coastline and #Assign an island name to the datafile
  clip <- raster::intersect(b, coast)

  tic()
  intersectresno<-try(raster::intersect(clip, myreserves))
  if(class(intersectresno) %in% c('NULL', 'try-error')){
    next
  }else{
    intersectresno$newarea_m<-gArea(intersectresno, byid = T)
    intersectresnodata<-intersectresno@data
    intersectresno$keyinfo<-intersectresno$Type_Defin
    resname<-paste0(lyr, "reserves.csv")
    write.csv(intersectresnodata, file = resname)
  }
  toc()
}

}

```

```

for (wettest in wetplaces){

  #get rid of the shp extension

  lyr<- sub(".shp$", "", wettest)#This gets rid of the .shp extension in the list of files

  b<-readOGR(dsn = OutDir, layer = lyr)#read in the shpfile


  #clip it to the coastline and #Assign an island name to the datafile

  clip <- raster::intersect(b, coast)

  # #intersect it with critical habitat

  #

  tic()

  intersectchno<-try(raster::intersect(clip, crithab))

  if(class(intersectchno) %in% c('NULL', 'try-error')){

    next

  }else{

    intersectchno$newarea_m<-gArea(intersectchno, byid = T)

    intersectchnodata<-intersectchno@data

    intersectchno$keyinfo<-"Designated as Critical Habitat"

    chname<-paste0(lyr, "ch.csv")

    write.csv(intersectchnodata, file = chname)

    toc()

  }

}

```

```

for (wetwipe in wetplaces[6]){
  #get rid of the shp extension
  lyr<- sub(".shp$", "", wetwipe)#This gets rid of the .shp extension in the list of files
  b<-readOGR(dsn = OutDir, layer = lyr)#read in the shpfile

  #clip it to the coastline and #Assign an island name to the datafile
  clip <- raster::intersect(b, coast)

  #intersect it with habitat quality and write data to file

  tic()
  intersectqualno<-raster::extract(habqual, clip )

  toc()

  noaaqualintersect<-intersectqualno

  # # Get class counts for each polygon
  noaa.counts <- lapply(noaaqualintersect,table)
  #

  # # Calculate class percentages for each polygon
  noaa.pct <- lapply(noaa.counts, FUN=function(x){ x / sum(x) } )

  #

  # # Create a data.frame where missing classes are NA

  class.df2<-plyr::ldply(noaa.pct, rbind)

  # # Replace NA's with 0 and add names
  class.df2[is.na(class.df2)] <- 0

```

```

names(class.df2) <- paste("class", names(class.df2), sep = "")

# # Add back to polygon data
clip$aream2 <- gArea(clip, byid = T)
clipdata <- clip@data
clipdata <- cbind(clipdata, class.df2)
head(clipdata)
qualname <- paste0(lyr, "qual.csv")
write.csv(clipdata, file = qualname)

}

#end of looper
#~~~~~Merge Critical Habitat Data into one
file~~~~~

#Start the figure and tables

#~~~~~Merge Critical Habitat Data into one
file~~~~~

list.files(CCPOut)

CHTables <- list.files(paste0(CCPOut, "/CritHabTables"), full.names = T)

chin <- lapply(CHTables, read.csv, header = F)

```

```

crithabpolydata<-do.call(rbind, chin)

crithaball<-crithabpolydata[,c(3,4,14,18)]

names(crithaball)<-c("gridcode","Class_Name","island","newarea_m")

#population[order(population$age),]
crithaball<-crithaball[order(crithaball$Class_Name),]

#remove those old title rows
ch<-crithaball[crithaball$island != "island",]

#~~~~~Merge Ownership Data into one file

OwnTables<-list.files(paste0(CCPOut, "/OwnershipTables"), full.names = T)

owin<-lapply(OwnTables, read.csv, header = T)

ownpolydata<-do.call(rbind, owin)

#~~~~~Merge Reserve Data into one file

ReserveTables<-list.files(paste0(CCPOut, "/Reserves"), full.names = T)

resin<-lapply(ReserveTables, read.csv, header = T)

respolydata<-do.call(rbind, resin)

```

```

#~~~~~Merge Habitat Quality Data

QualTables<-list.files(paste0(CCPOut, "/HabQualTables"), full.names = T)

#the columns ended up with the same names this time, but in the wrong order, so the solution we just
did last time (removing the header row

#on import, would be a disaster, because it would mix up the results of the different classes. )

#Write a loop to reorder the columns

for (csv in QualTables){

  a<-read.csv(csv, header = T)

  col_order <- c("X","Id","gridcode","Class_Name" , "OBJECTID","AREA","PERIMETER","Shape_Leng"
,"Shape_Area" , "Island",
           "Label","Acres","Area_KM_2" , "island","aream2","class1","class2" , "class3" , "class4" )

  a<-a[,col_order]

  write.csv(a, file = csv)

}

QualTables<-list.files(paste0(CCPOut, "/HabQualTables"), full.names = T)

qualin<-lapply(QualTables, read.csv, header = T)

qualpolydata<-do.call(rbind, qualin)

```

```

#~~~~~Merge the clipped Shapefiles into a statewide file

noaclippedDir<-
"C:/Users/marieeves/Documents/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/CoastalWetlandsStreamsOut/CoastlineClippedFiles"

noacliplist<-list.files(noaclippedDir, pattern = ".shp.shp",
                        full.names = T)

noaget <- lapply(noacliplist, readOGR)

BestNOAAEWetlandFileEver<-Reduce(union, noaget)

plot(BestNOAAEWetlandFileEver)

writeOGR(BestNOAAEWetlandFileEver, dsn = OutDir, layer = "18_06_12_BestNOAAEWetlandFileEver",
         driver="ESRI Shapefile", overwrite_layer = T)

noawet<-BestNOAAEWetlandFileEver

#Calculate Areas and make an area statewide variable to use

noawet$Area_m<-gArea(noawet, byid = T)

noawetdata<-noawet@data

noawetlandstotalarea<-gArea(noawet)# 161,763,248 meters

nwiwet$Area_m<-gArea(nwiwet, byid = T)

nwiwetlandstotalarea<-gArea(nwiwet) #65,075,6448

nwiwetdata<-nwiwet@data

#Add in Island to table

```

```

#bring in a coastlines shape for an over statement...
list.files(ConservationDir)
coast<-readOGR(dsn = ConservationDir, layer = "Coastline2500m")

#transform it into the sysCRS

print(proj4string(coast))#check CRS
#transform it to the sysCRS
coast<-spTransform(coast, CRS(sysCRS))
print(proj4string(coast))#recheck the spatial projections
#send it back out to a different file
writeOGR(coast, dsn = OutDir, layer = "coast2500sysCRS", driver="ESRI Shapefile", overwrite_layer = T)
#run intersection to assign island names to wetland tables.

#Keep only islands of interest...The 2500m buffer makes it so smaller islands are included with Mains

#Get rid of Lehua and other islands we don't want to avoid double counting
#
# levels(coast$Label)
# islands2keep<-c( "Big Island", "Kahoolawe", "Kauai", "Lanai", "Maui", "Molokai", "Niihau", "Oahu" )
# coast<-coast[coast$Label %in% islands2keep,]
# coastdata<-coast@data
# #change name Big Island to Hawaii
# coast$island<-sub("Big Island", "Hawaii", coast$Label)
#
# nwiisland<-raster::intersect(nwiwet, coast )
# plot(nwiisland)
# nwiislanddata<-nwiisland@data

```

```

#
# noaaisland<-raster::intersect(noaawet, coast)
# noaaislanddata<-noaaisland@data
# #calculate Island Areas within main tables
# nwiwetlandareas<-aggregate(nwiisland$Area_m, by = list(nwiisland$island), FUN = sum)
# names(nwiisland@data)
# names(nwiwetlandareas)<-c("island", "wetlandareaonisland")
# nwiwetter<-merge(nwiisland, nwiwetlandareas)
#
# #Fix names of scrub shrub to join with forested and get rid of dash
# nwiwetter$WetlandType<-sub("Freshwater Forested/Shrub Wetland", "Freshwater Forested and
Scrub Shrub Wetland", nwiwetter$WETLAND_TY)
#
# nwiwetter$WetlandType<-sub("Lake", "Open Water", nwiwetter$WetlandType)
# nwiwetter$WetlandType<-sub("Freshwater Pond", "Open Water", nwiwetter$WetlandType)
#
# levels(as.factor(nwiwetter$WetlandType))
#
# #create a column for nwi to use later
# nwiwetter$dataset<-"nwi"

```

```
noaawetlandareas<-aggregate(noaawet$Area_m, by = list(noaawet$island), FUN = sum)
```

```

names(noaawet@data)
names(noaawetlandareas)<-c("island", "wetlandareaonisland")
noawetter<-merge(noaawet, noaawetlandareas, by = "island")

```

```
#create a dataset column for noaa to use later
```

```

noaawetter$dataset<-"noaa"

#add gridcode descriptions and call it wetland type to match NWI and edit categories in

# #so that these match across datasets

# levels(nwiwetter$WETLAND_TY)

## Keep Open Water

# noaawetter$WetlandType<-sub("21", "Open Water", noaawetter$gridcode)

## Keep Unconsolidated shore

# noaawetter$WetlandType<-sub("19", "Unconsolidated Shore", noaawetter$WetlandType)

## Lump all estuarine wetlands and estuarine aquatic beds into Estuarine and Marine

## Wetlands category

# noaawetter$WetlandType<-sub("23", "Estuarine and Marine Wetland" , noaawetter$WetlandType)

# noaawetter$WetlandType<-sub("18", "Estuarine and Marine Wetland" , noaawetter$WetlandType)

# noaawetter$WetlandType<-sub("17", "Estuarine and Marine Wetland" , noaawetter$WetlandType)

# noaawetter$WetlandType<-sub("16", "Estuarine and Marine Wetland" , noaawetter$WetlandType)

#
#
##Lump all the following into freshwater Forested and Shrub Scrub Wetlands,
##gridcodes 13, 14, palustrine forested and scrub shrub

#
#
# noaawetter$WetlandType<-sub("13", "Freshwater Forested and Scrub Shrub Wetland" ,
noaawetter$WetlandType)

# noaawetter$WetlandType<-sub("14", "Freshwater Forested and Scrub Shrub Wetland" ,
noaawetter$WetlandType)

#
## Lump palustrine emergent wetlands and palustrine aquatic beds to Freshwater

##Emergent Wetland category

# noaawetter$WetlandType<-sub("15", "Freshwater Emergent Wetland" , noaawetter$WetlandType)

# noaawetter$WetlandType<-sub("22", "Freshwater Emergent Wetland" , noaawetter$WetlandType)

#

```

```

#
# levels(as.factor(noawetter$WetlandType))

#aggregate these guys by variables we're interested in summarizing:
#Wetland Type, island, island area, WetlandType

# agnwi<-aggregate(nwiwetter$Area_m, by = list(nwiwetter$island, nwiwetter$WetlandType,
nwiwetter$dataset, nwiwetter$wetlandareaonisland), FUN = sum)

# names(agnwi)<-c("island", "wetlandtype", "dataset", "wetlandareaonisland", "Area_m")

names(noaawetter)<-c("island","gridcod","WetlandType","Area_m","wetlandareaonisland","dataset" )

agno<-aggregate(noaawetter$Area_m, by = list(noaawetter$island, noaawetter$WetlandType,
noaawetter$dataset, noaawetter$wetlandareaonisland), FUN = sum)

names(agno)<-c("island", "wetlandtype", "dataset", "wetlandareaonisland", "Area_m")

#bind the aggregated files together so I only need to work with one data file for plots and tables

# wetlands<-rbind(agnwi, agno)

# #finally. One dataset that I can facet by dataset

#
# names(wetlands)

# wetlands$acres<-round(wetlands$Area_m*0.0002471, digits = 0)

#
# #convert the wetland area on island column to acres and round it too

# wetlands$WetlandAcresOnIsle<-round(wetlands$wetlandareaonisland*0.0002471, digits = 0)

# #drop the m2 area columns

# wetlands<-wetlands[,c("island","wetlandtype","dataset", "acres","WetlandAcresOnIsle")]

#
# wetlands$propwetlandsisle<-round((wetlands$acres/wetlands$WetlandAcresOnIsle)*100, digits = 0)

# wetlands$dataset<-sub("noaa", "NOAA - CCAP", wetlands$dataset)

```

```

# wetlands$dataset<-sub("nwi", "USFWS - NWI", wetlands$dataset)
#
# #create a few comparison plots for the different datasets
# #acres of wetlands on each island
# str(wetlands)
# wetlands$wetlandtype<-as.factor(wetlands$wetlandtype)
# wetlands$island<-as.factor(wetlands$island)
# wetlands$dataset<-as.factor(wetlands$dataset)
#
# a<-ggplot(wetlands, aes(wetlands$dataset, wetlands$acres, fill = wetlands$wetlandtype))
# datacompare<- a+geom_bar(stat="identity", position = "stack") +
#   labs(fill = "Wetland Type", title = "Wetland Areas by Type - Comparing Datasets", x = "Wetlands Dataset", y = "Area (Acres)")+
#   scale_fill_manual(values=cbPalette)
# ggsave(filename="CompareWetlandAreaTypeData.tif", plot=datacompare, device = "tiff" )
#
#
# b<-ggplot(wetlands, aes(wetlands$island, wetlands$acres, fill = wetlands$dataset))
# wettypecompare<- b+geom_bar(stat="identity", position = "dodge") +
#   labs(fill = "Wetlands Dataset", title = "Wetland Areas by Dataset - Comparing Islands", x = "Island", y = "Area (Acres)")+
#   scale_fill_manual(values=cbPalette)
# ggsave(filename="CompareWetlandDatasetsbyIsland.tif", plot=wettypecompare, device = "tiff" )

save.image("~/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/NOAACCAPRasters/18_06_12_P
ostExtractionDataWetlands.RData")

```

```
#~~~~~Run the Raster to Poly Extractions. these take 26 hours to  
run
```

```
load("~/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/NOAACAPRasters/.RData")  
#summarize the habitat quality data
```

```
ReportOut<-paste0(BaseDir, "/HSAReports/18_06_14_WetlandsFiguresTables")  
setwd(ReportOut)
```

```
#define columns to keep in each layer  
qual<-qualpolydata  
qual<-merge(qual, noawetlandareas, by = "island")  
names(qual)
```

```
qual<-qual[,c("island","wetlandareaonisland", "Class_Name",  
"aream2","class1","class2","class3","class4" ) ]  
names(qual)<-c("island", "wetlandareaonisland","WetlandType", "Area_m",  
"class1","class2","class3","class4")  
w<-qual
```

```
#convert the wetland area on island column to acres and round it too  
w$WetlandAcresOnIsle<-round(w$wetlandareaonisland*0.0002471, digits = 0)  
w$acres<-round(w$Area_m*0.0002471, digits = 2)
```

```
#calculate area proportion of wetlands on island  
w$propwetlandsisle<-round((w$acres/w$WetlandAcresOnIsle)*100, digits = 2)  
#rename the "class" columns and calculate acreages in each category per polygon
```

```

# Class descriptions from the metadata: If Habqual was already distrubed (category = 1),
# then it was NEVER overwritten as bare earth; instead it remained classified as disturbed.

# Lastly, the TIGER roads layer was buffered and converted into a raster of category 1 (distrubed).

# The roads raster was then mosaic'ed on top of Habqual to expand the distrubed class to include roads

# adjacent disturbed areas.This layer has four mapped values: 1 = heavily disturbed areas including
# agriculture and urban developments;

# 2 = mixed native-alien dominated plant communities; 3 = native dominated vegetation;

# and 4 = bare lands or <5% plant cover. References ARIS B.V. 2014, GRID Editor for ArcMap. ARIS
B.V., Netherlands.

```

```
w$AcresDisturbed<-round(w$class1*w$acres, digits = 5)
```

```
w$AcresBarren<-round(w$class4*w$acres, digits = 5)
```

```
w$AcresNative<-round(w$class3*w$acres, digits = 5)
```

```
w$AcresNonNative<-round(w$class2*w$acres, digits = 5)
```

```
#drop the m2 area columns and the "class" columns
```

```
w<-w[,c("island","WetlandType","acres","WetlandAcresOnIsle", "propwetlandsisle", "AcresDisturbed",
"AcresBarren", "AcresNative", "AcresNonNative")]
```

```
#give better names
```

```
names(w)<-c("Island", "Wetland Type", "Area (Acres)", "Total Wetland Area on Island (Acres)", "Area (%
of Wetland Area on Island", "Area Disturbed (Acres)", "Area Barren (Acres)", "Area Native Dominated
(Acres)", "Area Non-Native Dominated (Acres)")
```

```
#save the raw data
```

```
write.csv(w, file = "18_06_12_HabitatQualityWetlandsRaw.csv")
```

```

u<-aggregate(list(w$`Area Barren (Acres)`, w$`Area Disturbed (Acres)`, w$`Area Native Dominated (Acres)`, w$`Area Non-Native Dominated (Acres)`), by = list(w$Island, w$`Wetland Type`, w$`Total Wetland Area on Island (Acres)` ), FUN = sum)

names(u)<-c("Island","Wetland Type","Total Wetland Area on Island (Acres)", "Area Barren (Acres)", "Area Disturbed (Acres)","Area Native Dominated (Acres)", "Area Non-Native Dominated (Acres)")

u$`Area Barren (Acres)`<-round(u$`Area Barren (Acres)` , digits = 1)
u$`Area Native Dominated (Acres)`<-round(u$`Area Native Dominated (Acres)` , digits = 1)
u$`Area Non-Native Dominated (Acres)`<-round(u$`Area Non-Native Dominated (Acres)` , digits = 1)
u$`Area Disturbed (Acres)`<-round(u$`Area Disturbed (Acres)` , digits = 1)

u$propbarren<-round((u$`Area Barren (Acres)` /u$`Total Wetland Area on Island (Acres)` )*100, digits = 1)

u$propnative<-round((u$`Area Native Dominated (Acres)`/u$`Total Wetland Area on Island (Acres)`)*100, digits = 1)

u$propnonnative<-round((u$`Area Non-Native Dominated (Acres)`/u$`Total Wetland Area on Island (Acres)`)*100, digits = 1)

u$propdisturbed<-round((u$`Area Disturbed (Acres)`/u$`Total Wetland Area on Island (Acres)`)*100, digits = 1)

```

```

#rename variables

names(u)<-c("Island","Wetland Type","Total Wetland Area on Island (Acres)", "Area Barren (Acres)", "Area Disturbed (Acres)" , "Area Native Dominated (Acres)", "Area Non-Native Dominated (Acres)", "Barren (% of Wetland Area on Island)" , "Native Dominated (% of Wetland Area on Island)", "Non-Native Dominataed (% of Wetland Area on Island)" , "Disturbed (% of Wetland Area on Island)" )

```

#Create a couple tables while these are numeric to use later

```

areas<-u[,c( "Island","Wetland Type", "Total Wetland Area on Island (Acres)","Area Barren (Acres)"
,"Area Disturbed (Acres)",
"Area Native Dominated (Acres)","Area Non-Native Dominated (Acres)" )]

percentages<-u[,c( "Island","Wetland Type", "Total Wetland Area on Island (Acres)", "Barren (% of
Wetland Area on Island)" ,
"Native Dominated (% of Wetland Area on Island)","Non-Native Dominated (% of Wetland
Area on Island)",
"Disturbed (% of Wetland Area on Island)" )]

arealong<-gather(areas, key = "Descriptor", value = "Acres", 4:7)
arealong$HabitatQuality<-sub("Area ", "", arealong$Descriptor)
arealong$HabitatQuality<-sub("\\"(Acres)", "", arealong$HabitatQuality)
arealong <- within(arealong, rm(Descriptor))

pctlong<-gather(percentages, key = "Descriptor", value = "Percent of Wetland Habitat on Island", 4:7)
pctlong$HabitatQuality<-sub("\\"(% of Wetland Area on Island)", "", pctlong$Descriptor)
pctlong <- within(pctlong, rm(Descriptor))

#reorder Habitat Quality Variables So they Plot in more intuitive colors
str(arealong)
arealong$HabitatQuality<-as.factor(arealong$HabitatQuality)
levels(arealong$HabitatQuality)
arealong$HabitatQuality <- ordered(arealong$HabitatQuality,levels = c("Disturbed ","Barren ","Non-
Native Dominated ","Native Dominated "))
#check this worked
levels(arealong$HabitatQuality)

```

```
#now we can make pretty
```

```
k<-ggplot(arealong, aes(arealong$Island, arealong$Acres , fill = arealong$HabitatQuality))  
pretty1<-k+geom_bar(stat = "identity", position = "fill")+  
  labs(fill = "Habitat Quality", title = "Wetlands Habitat Quality Summary", x = "Island", y = "Area (% of  
Total Wetland Area on Island)" ) +  
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+  
  scale_fill_manual(values=cbPalette)  
  
ggsave(filename= "HabitatQualityWetlandsPlot.jpg", plot=pretty1, device = "jpg" )
```

```
u$`Area Barren (Acres)`[u$`Area Barren (Acres)` <1]<"<1"  
u$`Area Native Dominated (Acres)`[u$`Area Native Dominated (Acres)` <1]<"<1"  
u$`Area Non-Native Dominated (Acres)`[u$`Area Non-Native Dominated (Acres)` <1]<"<1"  
u$`Area Disturbed (Acres)`[u$`Area Disturbed (Acres)` <1]<"<1"  
  
u$`Barren (% of Wetland Area on Island)` [u$`Barren (% of Wetland Area on Island)` <1]<"<1"  
u$`Native Dominated (% of Wetland Area on Island)` [u$`Native Dominated (% of Wetland Area on  
Island)` <1]<"<1"  
u$`Non-Native Dominataed (% of Wetland Area on Island)` [u$`Non-Native Dominataed (% of Wetland  
Area on Island)` <1]<"<1"  
u$`Disturbed (% of Wetland Area on Island)` [u$`Disturbed (% of Wetland Area on Island)` <1]<"<1"
```

```
#write file to drive
```

```
write.csv(u, file = "WetlandHabitatQualitySummary.csv")
```

```

#~~~~~
~~~~~
#Work up the Land Ownership Data

own<-ownpolydata
names(own)
own<-merge(own, noawetlandareas, by = "island")
#make a list of keeper variables for each outfile:

j<-own[,c("island", "wetlandareaonisland", "wetlandtype", "Area_m", "keyinfo")]
names(j)<-c("island", "wetlandareaonisland","WetlandType","newarea_m", "keyinfo")

#reclassify the State DHHL ownership to State
levels(j$keyinfo)
j$keyinfo<-as.character(j$keyinfo)
j$keyinfo[j$keyinfo == "Govt. State DHHL"]<- "Govt. State"
j$keyinfo[j$keyinfo == "No data" ]<- "No Data"
j$keyinfo<-as.factor(j$keyinfo)

#convert the wetland area on island column to acres and round it too
j$WetlandAcresOnIsle<-round(j$wetlandareaonisland*0.0002471, digits = 0)
j$acres<-round(j$newarea_m*0.0002471, digits = 2)

#calculate area proportion of wetlands on island
j$propwetlandsisle<-round((j$acres/j$WetlandAcresOnIsle)*100, digits = 2)
#drop the m2 area columns

```

```

j<-j[,c("island","WetlandType", "keyinfo", "acres","WetlandAcresOnIsle", "propwetlandsisle")]

#give better names

names(j)<-c("Island","Wetland Type","Land Ownership" , "Area (Acres)","Total Wetland Area on Island
(Acres)", "Area (% of Wetland Area on Island)")

write.csv(j, file = "WetlandsLandOwnershipDataRaw.csv")

d<-aggregate(j$`Area (Acres)`, by = list(j$Island, j$`Wetland Type` , j$`Total Wetland Area on Island
(Acres)` , j$`Land Ownership` ), FUN = sum)

names(d)<-c("Island","Wetland Type","Total Wetland Area on Island (Acres)","Land Ownership" , "Area
(Acres)")

#d$acres<-as.numeric(d$`Area (Acres)`)

d$propwetlandsisle<-round((d$`Area (Acres)` /d$`Total Wetland Area on Island (Acres)` )*100, digits =
0)

d$`Area (Acres)`<-round(d$`Area (Acres)`, digits = 0)

names(d)<-c("Island","Wetland Type","Total Wetland Area on Island (Acres)","Land Ownership" , "Area
(Acres)", "Area (% of Wetland Area on Island)")

a<-ggplot(d, aes(d$Island, d$`Area (Acres)` , fill = d$`Land Ownership` ))

pretty<-a+geom_bar(stat = "identity", position = "fill")+
  labs(fill = "Land Ownership", title = "Wetland Land Ownership Summary", x = "Island", y = "Area (% of
  Total Wetland Area on Island)" ) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+

  scale_fill_manual(values=cbPalette)

ggsave(filename= "WetlandsLandOwnershipSummary.jpg", plot=pretty, device = "jpg")

```

```

d$`Area (% of Wetland Area on Island)` [d$`Area (% of Wetland Area on Island)` <1]<"<1"
d$`Area (Acres)`[d$`Area (Acres)`<1]<"<1"

write.csv(d, file = "WetlandsLandOwnershipSummary.csv" )

save.image("~/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/NOAACCAPRasters/18_06_13.RData")

#~~~~~
~~~~~
#Work up Critical Habitat Data

chdata<-merge(ch, noawetlandareas, by = "island")

#make a list of keeper variables for each outfile:
names(chdata)

ch1<-chdata[,c("island", "wetlandareaonisland", "Class_Name" , "newarea_m" )]

names(ch1)<-c("island", "wetlandareaonisland","WetlandType", "newarea_m")

#convert the wetland area on island column to acres and round it too
ch1$WetlandAcresOnIsle<-round(ch1$wetlandareaonisland*0.0002471, digits = 0)
ch1$newarea_m<-as.numeric(ch1$newarea_m)

```

```

ch1$acres<-round(ch1$newarea_m*0.0002471, digits = 2)

#calculate area proportion of wetlands on island
ch1$propwetlandsisle<-round((ch1$acres/ch1$WetlandAcresOnIsle)*100, digits = 2)

#drop the m2 area columns
names(ch1)

ch1<-ch1[,c("island","WetlandType", "acres","WetlandAcresOnIsle", "propwetlandsisle")]

#give better names
names(ch1)<-c("Island", "Wetland Type", "Area (Acres)", "Total Wetland Area on Island (Acres)", "Area (% of Wetland Area on Island)")

write.csv(ch1, file = "WetlandsCriticalHabitatDataRaw.csv")

ch2<-aggregate(ch1$`Area (Acres)`, by = list(ch1$Island, ch1$`Wetland Type`, ch1$`Total Wetland Area on Island (Acres)` ), FUN = sum)

names(ch2)<-c("Island", "Wetland Type", "Total Wetland Area on Island (Acres)", "Area (Acres)")

#ch2$acres<-as.numeric(ch2$`Area (Acres)`)

ch2$propwetlandsisle<-round((ch2$`Area (Acres)` /ch2$`Total Wetland Area on Island (Acres)` )*100, digits = 0)

ch2$`Area (Acres)`<-round(ch2$`Area (Acres)` , digits = 0)

names(ch2)<-c("Island", "Wetland Type", "Total Wetland Area on Island (Acres)", "Area (Acres)", "Area (% of Wetland Area on Island)")

#clean up and reorder variables
#Change "Water" to Open Water
levels(ch2$`Wetland Type`)

ch2$`Wetland Type`<-as.character(ch2$`Wetland Type`)

ch2$`Wetland Type`[ch2$`Wetland Type`== "Water"]<- "Open Water"

```

```

ch2$`Wetland Type`[ch2$`Wetland Type` == "Palustrine Scrub/Shrub Wetland"]<-"Palustrine Scrub
Shrub Wetland"

ch2$`Wetland Type`<-as.factor(ch2$`Wetland Type`)

#Reorder these so open water plots in Blue
ch2$`Wetland Type`<-ordered(ch2$`Wetland Type`, levels = c("Palustrine Aquatic Bed", "Palustrine
Emergent Wetland" , "Palustrine Forested Wetland" ,
"Palustrine Scrub Shrub Wetland", "Unconsolidated Shore", "Open
Water" ))


#check that worked
levels(ch2$`Wetland Type`)

c<-ggplot(ch2, aes(ch2$Island, ch2$`Area (Acres)`, fill = ch2$`Wetland Type` ))

prettych<-c+geom_bar(stat = "identity", position = "fill")+
  labs(fill = "Land Ownership", title = "Wetland Critical Habitat Summary", x = "Island", y = "Area
(Proportion of Total Wetland Acres in Critical Habitat)" ) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+

  scale_fill_manual(values=cbPalette)

ggsave(filename= "WetlandsCriticalHabitatSummary.jpg", plot=prettych, device = "jpg")

ch2$`Area (% of Wetland Area on Island)` [ch2$`Area (% of Wetland Area on Island)` <1]<"<1"
ch2$`Area (Acres)`[ch2$`Area (Acres)`<1]<"<1"

write.csv(ch2, file = "WetlandsCriticalHabitatSummary.csv" )

```

```

save.image("~/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/NOAACAPRasters/18_06_13.RData")

#~~~~~
~~~~~
#Work up Reserve Data

resdata<-respolydata

names(resdata)
resdata<-merge(respolydata, noawetlandareas, by = "island")

#make a list of keeper variables for each outfile:
names(resdata)

res1<-resdata[,c("island" , "wetlandareaonisland", "Class_Name" , "Type_Defin", "newarea_m" )]

names(res1)<-c("island", "wetlandareaonisland","WetlandType", "Reserve Type", "newarea_m")

#convert the wetland area on island column to acres and round it too
res1$WetlandAcresOnIsle<-round(res1$wetlandareaonisland*0.0002471, digits = 0)
res1$newarea_m<-as.numeric(res1$newarea_m)
res1$acres<-round(res1$newarea_m*0.0002471, digits = 2)

#calculate area proportion of wetlands on island

```

```

res1$propwetlandsisle<-round((res1$acres/res1$WetlandAcresOnIsle)*100, digits = 2)

#drop the m2 area columns

names(res1)

res1<-res1[,c("island","WetlandType", "Reserve Type", "acres","WetlandAcresOnIsle",
"propwetlandsisle")]

#give better names

names(res1)<-c("Island","Wetland Type", "Reserve Type", "Area (Acres)","Total Wetland Area on
Island (Acres)", "Area (% of Wetland Area on Island)")

write.csv(res1, file = "WetlandsReserveStatusDataRaw.csv")

res2<-aggregate(res1$`Area (Acres)`, by = list(res1$Island, res1$`Wetland Type`, res1$`Reserve Type`,
res1$`Total Wetland Area on Island (Acres)` ), FUN = sum)

names(res2)<-c("Island","Wetland Type", "Reserve Type", "Total Wetland Area on Island (Acres)","Area
(Acres)")

res2$propwetlandsisle<-round((res2$`Area (Acres)` /res2$`Total Wetland Area on Island (Acres)` *
100, digits = 0)

res2$`Area (Acres)`<-round(res2$`Area (Acres)`, digits = 0)

names(res2)<-c("Island","Wetland Type", "Reserve Type", "Total Wetland Area on Island (Acres)","Area
(Acres)", "Area (% of Wetland Area on Island)")

#clean up and reorder variables

#Change "Water" to Open Water

# levels(res2$`Wetland Type`)

# res2$`Wetland Type`<-as.character(res2$`Wetland Type`)

# res2$`Wetland Type`[res2$`Wetland Type`== "Water"]<- "Open Water"

# res2$`Wetland Type`[res2$`Wetland Type` == "Palustrine Scrub/Shrub Wetland"]<-"Palustrine Scrub
Shrub Wetland"

# res2$`Wetland Type`<-as.factor(res2$`Wetland Type`)

```

```

# #Reorder these so open water plots in Blue
# res2$`Wetland Type`<-ordered(res2$`Wetland Type`, levels = c("Palustrine Aquatic Bed","Palustrine
Emergent Wetland" , "Palustrine Forested Wetland" ,
# "Palustrine Scrub Shrub Wetland" , "Unconsolidated Shore","Open
Water" ))
#
#
# #check that worked
# levels(res2$`Wetland Type`)

res3<-ggplot(res2, aes(res2$Island, res2$`Area (Acres)` , fill = res2$`Reserve Type` ))
prettyres<-res3+geom_bar(stat = "identity", position = "fill")+
  labs(fill = "Land Ownership", title = "Wetland Reserve Status Summary", x = "Island", y = "Area
(Proportion of Total Wetland Acres in Reserves)" ) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+

scale_fill_manual(values=cbPalette)

ggsave(filename= "WetlandsReserveStatusSummary.jpg", plot=prettyres, device = "jpg")

res2$`Area (% of Wetland Area on Island)` [res2$`Area (% of Wetland Area on Island)` <1]<"<1"
res2$`Area (Acres)`[res2$`Area (Acres)`<1]<"<1"

write.csv(res2, file = "WetlandsReserveStatusSummary.csv" )
save.image("~/HSAs/HabitatStatusAssessmentsR/Hawaii/18_06_14_WetlandsWorkspaceFinal.RData")

```

Appendix I. Hawaii Streams Code

#Mari K Reeves

#18_06_14_SummarizeStreamHabitatsForHSAs

#This code will intersect the streams with Land Ownership, Habitat Quality, Reserve Areas and Critical Habitats

#and generate summary tables and figures for the biologists doing the Habitat Status Assessment Reports.

#It's not done yet because I'm figuring out which layer to use for streams.

```
rm(list = ls()) #remove all past worksheet variables
```

```
set.seed(333)
```

```
# Read in Base Packages -----
```

```
pckg <- c("dplyr", "tidyR", "RColorBrewer", "ggplot2",
"parallel", "gdalUtils", "rgdal", "rgeos",
"spatial", "sp", "raster", "maptools", "spatialEco",
"SpatialPack", "spatstat", "microbenchmark", "devtools",
"snowfall", "tictoc")
```

```
# READING IN PACKAGES
```

```
for(i in 1:length(pckg)){
  if ((!pckg[i] %in% installed.packages())==T) {
    install.packages(pckg[i], repos="http://cran.us.r-project.org",
                     dependencies = T)
    print(pckg[i])}
```

```

do.call("library", list(pckg[i]))

}else{

print(pckg[i])

do.call("library", list(pckg[i]))


}

}

#Define Directories

#BaseDir <- "J:/PIOGIS12/APPS/SH_CC/Mari/HSAs/"

BaseDir<-"C:/Users/marieeves/Documents/HSAs/"

WorkingDir<-paste0(BaseDir, "HabitatStatusAssessmentsR/Hawaii")

SHADir<-paste0(BaseDir, "SHADataFiles/")

ConservationDir<-paste0(WorkingDir,"/ShapeFiles4R" )

OutDir<-paste0(ConservationDir, "/CoastalWetlandsStreamsOut")

WetDir<-paste0(OutDir, "/StreamsWetlandsCoastal")

ReportOut<-paste0(BaseDir, "/HSAReports/18_06_14_StreamsFiguresTables")

setwd(ReportOut)

#Set CRS for session

BigIslandCRS<- "+proj=utm +zone=5 +ellps=GRS80 +towgs84=0,0,0,-0,-0,0 +units=m +no_defs"

OtherIslandCRS<- "+proj=utm +zone=4 +ellps=GRS80 +towgs84=0,0,0,-0,-0,0 +units=m +no_defs"

sysCRS<-"+proj=utm +zone=4 +datum=NAD83 +units=m +no_defs +ellps=GRS80 +towgs84=0,0,0"

#Bring in files and transform them into the sysCRS - send them to a new folder - only need to run this
once, so commented it out

#neededshps<-list.files(ConservationDir, pattern = ".shp$")

```

```

# #habitatsplit<-function(hab){

# for (myshp in neededshps){

# #get rid of the shp extension

# lyr <- sub(".shp$", "", myshp)#This gets rid of the .shp extension in the list of files

# b<-readOGR(dsn = ConservationDir, layer = lyr)#read in the shpfile

# print(proj4string(b))#check CRS

# #transform it to the sysCRS

# g<-spTransform(b, CRS(sysCRS))

# print(proj4string(g))#recheck the spatial projections

# #send it back out to a different file

# outname<-paste0("18_05_24_sysCRS",lyr)

# writeOGR(g, dsn = OutDir, layer = outname, driver="ESRI Shapefile", overwrite_layer = T)

# }

```

#Bring these files back in for intersection operations.

```

list.files(OutDir, full.names = T, pattern = ".shp")

own<-readOGR(dsn = OutDir, layer = "18_05_24_sysCRS18_05_03_DissolveOwnerIsland")

owndata<-own@data

ownBuffer<-gBuffer(own, byid=TRUE, width=0)#fix most gisValid errors

```

```
reserves<-readOGR(dsn = OutDir, layer = "18_05_24_sysCRSReserves")
```

```
crithab<-readOGR(dsn = OutDir, layer = "CriticalHabitatsysCRSOnePoly")
```

```
crithabdata<-crithab@data
```

```
#clean up the reserve layer to delete reserves we don't think are important from a conservation perspective
```

```
types2keep<-c( "Marine Life Conservation District", "National Historical Park",
```

```

"National Park", "National Wildlife Refuge", "Natural Area Reserve",
"Private Preserve", "State Wilderness Park", "The Nature Conservancy Preserve",
"Wildlife Sanctuary")

myreserves<-reserves[reserves$Type_Defin %in% types2keep,]

myreservedata<-myreserves@data

#write functions to intersect the streams, wetlands, and streams with reserves, critical habitat, and land
ownership, calculate and

#plot length in each status. I think I may just need to treat each of these guys separately and not do this
in a loop. Because the

#incoming datasets are so different. Bleh.

wetplaces<-list.files(WetDir, pattern = ".shp")

#
#
##wetowners<-function(wet in wetplaces){

# for (wet in wetplaces[1]){

# #get rid of the shp extension

# lyr <- sub(".shp", "", wet)#This gets rid of the .shp extension in the list of files

streams<-readOGR(dsn = WetDir, layer = "18_05_24_sysCRSstate_darstreams")#read in the shpfile

streamsdata<-streams@data

plot(streams)

write.csv(streamsdata, file = "streams.csv")

streams$length_m<-gLength(streams, byid = T)

streamsmeters<-sum(streams$length_m)

streams$length_km<-streams$length_m/1000

```

```

habqual<-
raster("C:/Users/marieeves/Documents/HSAs/SHADataFiles/CarbonAssessment2017VegLayers/CAH_H
abStatus/CAH_HabStatus.jpg")

proj4string(habqual)
proj4string(streams)
plot(habqual)
tic()
streamsqualprice<-raster::extract(habqual, streams)

#make a copy of extracted data to work with:
streamqualqualintersect<-streamsqualprice

## Get class counts for each polygon
stream.counts <- lapply(streamqualqualintersect,table)
#
## Calculate class percentages for each polygon
stream.pct <- lapply(stream.counts, FUN=function(x){ x / sum(x) } )
#
## Create a data.frame where missing classes are NA

class.df<-plyr::ldply(stream.pct, rbind)

## Replace NA's with 0 and add names
class.df[is.na(class.df)] <- 0
names(class.df) <- paste("class", names(class.df),sep="")

## Add back to polygon data
streamdata<-streams@data
streamdata <- cbind(streamdata, class.df)
head(streamdata)

```

```

write.csv(streamdata, file = "streamhabqualraw.csv")

load("~/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/CoastalWetlandsStreamsOut/18_06_06
_StreamWorkspace.RData")

toc()

#create a column in streams for % of stream length on island
islandstreamlength<-aggregate(streams$length_km~streams$IslandName , FUN = sum)
names(streams)
names(islandstreamlength)<-c("IslandName", "IslandStreamLengthkm")
write.csv(islandstreamlength, file = "islandstreamlength.csv")
streams<-merge(streams, islandstreamlength, by = "IslandName")
#check that worked
streamsdata<-streams@data

streamskm<-sum(streams$length_km)

streamstype<-aggregate(streamsdata$length_km, by = list(streamsdata$TYPE,
streamsdata$IslandName, streamsdata$IslandStreamLengthkm), FUN = sum)
names(streamstype)<-c("Stream Type", "Island","Total Stream Length on Island" , "Stream Length
(km)")

streamstype$"Stream Length (km)" <-round(streamstype$"Stream Length (km)" , digits = 0)
streamstype$"Total Stream Length on Island" <-round(streamstype$"Total Stream Length on Island" ,
digits = 0)
streamstype$perctotallength<-round(100*(streamstype$"Stream Length (km)" /streamskm), digits = 0)

```

```
streamstype$percentIslandLength<-round(100*(streamstype$`Stream Length (km)`  
/streamstype$`Total Stream Length on Island` ), digits = 0)
```

```
#Make a figure for streams Stream Type by Island
```

```
#load color blind palette
```

```
cbPalette <- c("#999999", "#E69F00", "#56B4E9", "#009E73", "#FOE442", "#0072B2", "#D55E00",  
"#CC79A7", "#000000")
```

```
#reorder Stream Type Variables So they Plot in more intuitive colors
```

```
#And lump some things
```

```
str(streamstype)
```

```
levels(streamstype$`Stream Type`)
```

```
streamstype$`Stream Type`<-as.character(streamstype$`Stream Type`)
```

```
streamstype$`Stream Type`[streamstype$`Stream Type`== "L. BANK"]<-"BANK"
```

```
streamstype$`Stream Type`[streamstype$`Stream Type`== "LEFT BANK"]<-"BANK"
```

```
streamstype$`Stream Type`[streamstype$`Stream Type`== "RIGHT BANK"]<-"BANK"
```

```
streamstype$`Stream Type`[streamstype$`Stream Type`== "LAKE"]<- "LAKE, POND, POOL, RESERVOIR,  
DAM OR WEIR"
```

```
streamstype$`Stream Type`[streamstype$`Stream Type`== "POND"]<- "LAKE, POND, POOL, RESERVOIR,  
DAM OR WEIR"
```

```
streamstype$`Stream Type`[streamstype$`Stream Type`== "POOL"]<- "LAKE, POND, POOL,  
RESERVOIR, DAM OR WEIR"
```

```
streamstype$`Stream Type`[streamstype$`Stream Type`== "RESERVOIR"]<- "LAKE, POND, POOL,  
RESERVOIR, DAM OR WEIR"
```

```
streamstype$`Stream Type`[streamstype$`Stream Type`== "LAKE OR POND"]<- "LAKE, POND, POOL,  
RESERVOIR, DAM OR WEIR"
```

```
streamstype$`Stream Type`[streamstype$`Stream Type`== "DAM OR WEIR"]<- "LAKE, POND, POOL,  
RESERVOIR, DAM OR WEIR"
```

```

streamstype$`Stream Type`[streamstype$`Stream Type`== "ROCK" ]<- "ISLAND, ISLET, ROCK, OR
OTHER"

streamstype$`Stream Type`[streamstype$`Stream Type`== "ISLAND" ]<- "ISLAND, ISLET, ROCK, OR
OTHER"

streamstype$`Stream Type`[streamstype$`Stream Type`== "MISC" ]<- "ISLAND, ISLET, ROCK, OR
OTHER"

streamstype$`Stream Type`[streamstype$`Stream Type`== "ISLET" ]<- "ISLAND, ISLET, ROCK, OR
OTHER"

streamstype$`Stream Type`<-as.factor(streamstype$`Stream Type`)

levels(streamstype$`Stream Type`)

#sizes <- ordered(sizes, levels = c("small", "medium", "large"))

streamstype$`Stream Type` <- ordered(streamstype$`Stream Type`,levels = c( "INTERMITTENT"
,"PERENNIAL", "NON-PERENNIAL",
"ISLAND, ISLET, ROCK, OR OTHER","BANK",
"LAKE, POND, POOL, RESERVOIR, DAM OR WEIR" ))

#check this worked

levels(streamstype$`Stream Type`)

st1<-ggplot(streamstype, aes(streamstype$Island, streamstype$`Stream Length (km)` , fill =
streamstype$`Stream Type`))

plottitle<-"Stream Type Summary"

prettyst1<-st1+geom_bar(stat = "identity", position = "fill")+

labs(fill = "Stream Type", title = plottitle, x = "Island", y = "Length (Proportion of Total Stream Length
on Island)" ) + 

theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+

scale_fill_manual(values=cbPalette)

ggsave(filename="StreamsTypeSummary.jpg", plot=prettyst1, device = "jpg" )

```

```

streamstype$percentIslandLength[streamstype$percentIslandLength <1]<"<1"
streamstype$perctotallength[streamstype$perctotallength <1]<"<1"

names(streamstype)<-c("Stream Type", "Island" , "Total Stream Length on Island (km)", "Length in
Stream Type (km)" ,
"Length (% of Total Statewide Stream Length)", "Length (% of Total Stream Length on
Island)" )

write.csv(streamstype, file = "streamtypesummary.csv")

#~~~~~Summarize Habitat Quality for Different Stream Lengths Based on
USGS Veg layers~~~~~

#start with streamdata, not streamsdata. confusing I know, sorry. I lack creativity in naming objects
sometimes.

#make a list of these data tables to process

#define columns to keep in each layer
names(streamdata)

#create a column in streams for % of stream length on island

streamdata<-merge(streamdata, islandstreamlength, by = "IslandName")
names(streamdata)

```

```

moneyshot<-c("IslandName", "IslandStreamLengthkm.x" , "TYPE","length_km",
"class1","class2","class3","class4")

w<-streamdata[ ,moneyshot]

# drop unwanted variables

#rename the "class" columns and calculate acreages in each category per polygon

# Class descriptions from the metadata: If Habqual was already distrubed (category = 1),
# then it was NEVER overwritten as bare earth; instead it remained classified as disturbed.

# Lastly, the TIGER roads layer was buffered and converted into a raster of category 1 (distrubed).

# The roads raster was then mosaic'ed on top of Habqual to expand the distrubed class to include
roads

# adjacent disturbed areas.This layer has four mapped values: 1 = heavily disturbed areas including
agriculture and urban developments;

# 2 = mixed native-alien dominated plant communities; 3 = native dominated vegetation;

# and 4 = bare lands or <5% plant cover.ReferencesARIS B.V. 2014, GRID Editor for ArcMap. ARIS
B.V., Netherlands.

w$KmDisturbed<-round(w$class1*w$length_km, digits = 5)
w$KmBarren<-round(w$class4*w$length_km, digits = 5)
w$KmNative<-round(w$class3*w$length_km, digits = 5)
w$KmNonNative<-round(w$class2*w$length_km, digits = 5)

#Drop the proportional class variables and reorganize columns

w<-w[,c( "IslandName", "TYPE" , "length_km" , "IslandStreamLengthkm.x",
"KmDisturbed","KmBarren",
"KmNative","KmNonNative"   )]
```

```

#give better names

names(w)<-c("Island", "Stream Type", "Length (km)", "Total Stream Length on Island (km)", "Length
Disturbed (km)",

"Length Barren (km)", "Length Native Dominated (km)", "Length Non-Native Dominated (km)")

#save the raw data

write.csv(w, file = "StreamHabitatQualityRaw.csv")

#reorder Stream Type Variables So they Plot in more intuitive colors

#And lump some things

str(w)

levels(w$`Stream Type`)

w$`Stream Type`<-as.character(w$`Stream Type`)

w$`Stream Type`[w$`Stream Type`== "L. BANK"]<-"BANK"

w$`Stream Type`[w$`Stream Type`== "LEFT BANK"]<-"BANK"

w$`Stream Type`[w$`Stream Type`== "RIGHT BANK"]<-"BANK"

w$`Stream Type`[w$`Stream Type`== "LAKE"]<- "LAKE, POND, POOL, RESERVOIR, DAM OR WEIR"

w$`Stream Type`[w$`Stream Type`== "POND"]<- "LAKE, POND, POOL, RESERVOIR, DAM OR WEIR"

w$`Stream Type`[w$`Stream Type`== "POOL"]<- "LAKE, POND, POOL, RESERVOIR, DAM OR WEIR"

```

```

w$`Stream Type`[w$`Stream Type`== "RESERVOIR" ]<- "LAKE, POND, POOL, RESERVOIR, DAM OR
WEIR"

w$`Stream Type`[w$`Stream Type`== "LAKE OR POND" ]<- "LAKE, POND, POOL, RESERVOIR, DAM OR
WEIR"

w$`Stream Type`[w$`Stream Type`== "DAM OR WEIR" ]<- "LAKE, POND, POOL, RESERVOIR, DAM OR
WEIR"

w$`Stream Type`[w$`Stream Type`== "ROCK" ]<- "ISLAND, ISLET, ROCK, OR OTHER"
w$`Stream Type`[w$`Stream Type`== "ISLAND" ]<- "ISLAND, ISLET, ROCK, OR OTHER"
w$`Stream Type`[w$`Stream Type`== "MISC" ]<- "ISLAND, ISLET, ROCK, OR OTHER"
w$`Stream Type`[w$`Stream Type`== "ISLET" ]<- "ISLAND, ISLET, ROCK, OR OTHER"

w$`Stream Type`<-as.factor(w$`Stream Type`)
levels(w$`Stream Type`)

#sizes <- ordered(sizes, levels = c("small", "medium", "large"))

w$`Stream Type` <- ordered(w$`Stream Type`,levels = c( "INTERMITTENT", "PERENNIAL", "NON-
PERENNIAL",
"ISLAND, ISLET, ROCK, OR OTHER","BANK",
"LAKE, POND, POOL, RESERVOIR, DAM OR WEIR" ))

#check this worked

levels(w$`Stream Type`)

u<-aggregate(list(w$`Length Barren (km)`, w$`Length Disturbed (km)`, w$`Length Native Dominated
(km)`, w$`Length Non-Native Dominated (km)` ), by = list(w$Island, w$`Stream Type` , w$`Total Stream
Length on Island (km)` ), FUN = sum)

names(u)<-c("Island","Stream Type","Total Stream Length on Island (km)","Length Barren (km)",
"Length Disturbed (km)",
"Length Native Dominated (km)", "Length Non-Native Dominated (km)")


```

```
u$`Total Stream Length on Island (km)`<-round(u$`Total Stream Length on Island (km)`, digits = 1)
```

```
u$`Length Barren (km)` <-round(u$`Length Barren (km)`, digits = 1)
```

```
u$`Length Disturbed (km)` <- round(u$`Length Disturbed (km)`, digits = 1)
```

```
u$`Length Native Dominated (km)` <-round(u$`Length Native Dominated (km)`, digits = 1)
```

```
u$`Length Non-Native Dominated (km)`<-round(u$`Length Non-Native Dominated (km)`, digits = 1)
```

```
u$propbarren<-round((u$`Length Barren (km)` /u$`Total Stream Length on Island (km)` )*100, digits = 1)
```

```
u$propnative<-round((u$`Length Native Dominated (km)` /u$`Total Stream Length on Island (km)` )*100, digits = 1)
```

```
u$propnonnative<-round((u$`Length Non-Native Dominated (km)` /u$`Total Stream Length on Island (km)` )*100, digits = 1)
```

```
u$propdisturbed<-round((u$`Length Disturbed (km)`/u$`Total Stream Length on Island (km)` )*100, digits = 1)
```

```
#rename variables
```

```
names(u)<-c("Island","Stream Type","Total Stream Length on Island (km)",
```

```
"Length Barren (km)","Length Disturbed (km)","Length Native Dominated (km)",
```

```
"Length Non-Native Dominated (km)","Barren (% of Total Stream Length on Island)","Native (% of Total Stream Length on Island)" ,
```

```
"Non-Native (% of Total Stream Length on Island)","Disturbed (% of Total Stream Length on Island)" )
```

```
#Create a couple tables while these are numeric to use later
```

```
lengths<-u[,c( "Island","Stream Type","Total Stream Length on Island (km)",
```

```
"Length Barren (km)","Length Disturbed (km)","Length Native Dominated (km)",
```

```

"Length Non-Native Dominated (km)" )]

percentages<-u[,c( "Island","Stream Type","Total Stream Length on Island",
"Barren (% of Total Stream Length on Island)","Native (% of Total Stream Length on Island)",
"Non-Native (% of Total Stream Length on Island)","Disturbed (% of Total Stream Length on
Island)" )]

lengthlong<-gather(lengths, key = "Descriptor", value = "Length (km)", 4:7)
lengthlong$HabitatQuality<-sub("Length ", "", lengthlong$Descriptor)
lengthlong$HabitatQuality<-sub("\\"(km)", "", lengthlong$HabitatQuality)
lengthlong <- within(lengthlong, rm(Descriptor))

pctlong<-gather(percentages, key = "Descriptor", value = "Percent of Total Stream Length on Island",
4:7)
pctlong$HabitatQuality<-sub("\\"(% of Total Stream Length on Island)", "", pctlong$Descriptor)
pctlong <-within(pctlong, rm(Descriptor))

#reorder Habitat Quality Variables So they Plot in more intuitive colors
str(lengthlong)
lengthlong$HabitatQuality<-as.factor(lengthlong$HabitatQuality)
levels(lengthlong$HabitatQuality)
lengthlong$HabitatQuality <- ordered(lengthlong$HabitatQuality,levels = c("Disturbed ","Barren",
,"Non-Native Dominated ","Native Dominated "))
#check this worked
levels(lengthlong$HabitatQuality)

#now we can make pretty

```

```

st2<-ggplot(lengthlong, aes(lengthlong$Island, lengthlong$`Length (km)` , fill =
lengthlong$HabitatQuality))

prettyst2<-st2+geom_bar(stat = "identity", position = "stack")+
  labs(fill = "Habitat Quality", title = "Stream Habitat Quality Summary", x = "Island", y = "Length (km)" )
+
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+

  scale_fill_manual(values=cbPalette)

ggsave(filename= "StreamHabQualLengths.jpg", plot=prettyst2, device = "jpg" )

prettyst3<-st2+geom_bar(stat = "identity", position = "fill")+
  labs(fill = "Habitat Quality", title = "Stream Habitat Quality Summary", x = "Island", y = "Length
(Proportion of Total Stream Length on Island)" ) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+

  scale_fill_manual(values=cbPalette)

ggsave(filename= "StreamHabQualPercents.jpg", plot=prettyst3, device = "jpg" )

u$`Length Barren (km)` [ u$`Length Barren (km)` <1]<"<1"
u$`Length Disturbed (km)` [ u$`Length Disturbed (km)` <1]<"<1"
u$`Length Native Dominated (km)` [ u$`Length Native Dominated (km)`<1]<"<1"
u$`Length Non-Native Dominated (km)` [u$`Length Non-Native Dominated (km)` <1]<"<1"

u$`Barren (% of Total Stream Length on Island)` [ u$`Barren (% of Total Stream Length on Island)`<1]<
"<1"

```

```
u$`Disturbed (% of Total Stream Length on Island)` [ u$`Disturbed (% of Total Stream Length on Island)` <1]<"<1"  
u$`Native (% of Total Stream Length on Island)` [u$`Native (% of Total Stream Length on Island)` <1]<"<1"
```

```
u$`Non-Native (% of Total Stream Length on Island)` [ u$`Non-Native (% of Total Stream Length on Island)` <1]<"<1"
```

```
#write file to drive
```

```
write.csv(u, file = "StreamHabQualSummary.csv")
```

```
#post extraction pre-processing save
```

```
save.image("~/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/CoastalWetlandsStreamsOut/18  
_06_07_PostIntersectStreamsData.RData")
```

```
#summarize land ownership for streams habitats
```

```

load
("~/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/CoastalWetlandsStreamsOut/18_06_07_StreamWorkspaceEndofCode.RData")

intersect1<-raster::intersect(streams, ownBuffer )

intersect1$length_m<-gLength(intersect1, byid = T)
interdata<-intersect1@data
names(interdata)
streamsownqual<-intersect1[c("BigstOwner", "Island", "IslandStreamLengthkm", "length_m")]
streamsowndata<-streamsownqual@data
streamsowndata$length_km<-streamsowndata$length_m/1000

clowndata<-aggregate(streamsowndata$length_km, by = list(streamsowndata$BigstOwner,
streamsowndata$Island, streamsowndata$IslandStreamLengthkm), FUN = sum)
names(clowndata)<-c("Land Owner", "Island", "IslandLength", "Stream Length (km)")
clowndata$`Stream Length (km)`<-round(clowndata$`Stream Length (km)`, digits = 0)
clowndata$perctotallength<-round(100*(clowndata$`Stream Length (km)`/streamskm), digits = 0)
clowndata$percentIslandLength<-round(100*(clowndata$`Stream Length (km)`/clowndata$`IslandLength`), digits = 0)

names(clowndata)<-c("Land Ownership", "Island", "Total Stream Length on Island (km)", "Stream Length (km)", "Length (% of Total State Stream") ,
"Length (% of Total Island Stream" )

#capitalize "data" in the land ownership column
clowndata$`Land Ownership`<-as.factor(clowndata$`Land Ownership`)

```

```

levels(clowndata$`Land Ownership`)
clowndata$`Land Ownership`<-as.character(clowndata$`Land Ownership`)
clowndata$`Land Ownership`<-sub("No data", "No Data", clowndata$`Land Ownership`)

#change State DHHL to State
clowndata$`Land Ownership`<-sub("Govt. State DHHL", "Govt. State", clowndata$`Land Ownership`)

clowndata$`Land Ownership`<-as.factor(clowndata$`Land Ownership`)
levels(clowndata$`Land Ownership`)

#Make a figure for streams habitat quality by Island

#load color blind palette
cbPalette <- c("#999999", "#E69F00", "#56B4E9", "#009E73", "#F0E442", "#0072B2", "#D55E00",
  "#CC79A7", "#000000")

## ##reorder Land Ownership Variables private plots in grey
# str(clowndata)

# clowndata$`Land Ownership`<-as.factor(clowndata$`Land Ownership`)
# levels(clowndata$`Land Ownership`)

#
# #sizes <- ordered(sizes, levels = c("small", "medium", "large"))

clowndata$`Land Ownership` <- ordered(clowndata$`Land Ownership`,levels = c( "Private","Govt.
Federal","Govt. Local","Govt. State","No Data"))

#check this worked

levels(clowndata$`Land Ownership`)

#
st3<-ggplot(clowndata, aes(clowndata$Island, clowndata$`Stream Length (km)`, fill = clowndata$`Land
Ownership`))

plottitle<-"Streams Land Ownership Summary"
prettyst3<-st3+geom_bar(stat = "identity", position = "fill")+

```

```

  labs(fill = "Land Ownership", title = plottitle, x = "Island", y = "Length (Proportion of Total Island
Stream Length)" ) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+
  scale_fill_manual(values=cbPalette)
  ggsave(filename="streamsLandOwnershipSummary.jpg", plot=prettyst3, device = "jpg" )

prettyst4<-st3+geom_bar(stat = "identity", position = "stack")+
  labs(fill = "Land Ownership", title = plottitle, x = "Island", y = "Length (km)" ) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+
  scale_fill_manual(values=cbPalette)
  ggsave(filename="streamsLandOwnershipSummaryKm.jpg", plot=prettyst4, device = "jpg" )

clowndata$`Total Stream Length on Island (km)`<-round(clowndata$`Total Stream Length on Island
(km)`, digits = 0)
clowndata$`Stream Length (km)` [clowndata$`Stream Length (km)` <1]<"<1"
clowndata$`Length (% of Total Island Stream)` [clowndata$`Length (% of Total Island Stream)` <1]<-
"<1"
clowndata$`Length (% of Total State Stream)`[clowndata$`Length (% of Total State Stream)` <1]<"<1"

#fix a couple name typos

names(clowndata)<- c("Land Ownership","Island","Total Stream Length on Island (km)",
"Stream Length in Land Ownership Category (km)","Length (% of Total State Stream Length)","Length
(% of Total Island Stream Length)" )

write.csv(clowndata, file = "StreamLandOwnershipSummary.csv")

```

```

#~~~~~
~~~~~
#Summarize Reserve Status for streams Habitats

intersect2<-raster::intersect(streams, myreserves)
intersect2$length_m<-gLength(intersect2, byid = T)
inter2data<-intersect2@data

names(inter2data)

streamsreserves<-intersect2[c( "Type_Defin" , "Island" , "IslandStreamLengthkm", "length_m" )]

streamsresdata<-streamsreserves@data
streamsresdata$length_km<-streamsresdata$length_m/1000

creserves<-aggregate(streamsresdata$length_km, by = list(streamsresdata$Type_Defin ,
streamsresdata$Island, streamsresdata$IslandStreamLengthkm), FUN = sum)

names(creserves)<-c("Reserve Type", "Island", "IslandLength", "Stream Length (km)")

creserves$`Stream Length (km)`<-round(creserves$`Stream Length (km)`, digits = 0)
creserves$perctotallength<-round(100*(creserves$`Stream Length (km)`/streamskm), digits = 0)
creserves$percentIslandLength<-round(100*(creserves$`Stream Length (km)`/creserves$`IslandLength` ), digits = 0)

names(creserves)<-c("Reserve Type", "Island", "Total Stream Length on Island (km)", "Stream Length in Reserve (km)",
"Length (% of Total State Stream Length)" ,
"Length (% of Total Island Stream Length)" )

```

```

#Make a figure for streams Reserve Type by Island

# #reorder Reserve Type Variables So they Plot in more intuitive colors
str(creserves)

creserves$`Reserve Type`<-as.factor(creserves$`Reserve Type`)

levels(creserves$`Reserve Type`)

#convert to a character to drop levels we screened out earlier then back to a factor
creserves$`Reserve Type`<-as.character(creserves$`Reserve Type`)

creserves$`Reserve Type`<-as.factor(creserves$`Reserve Type`)

levels(creserves$`Reserve Type`)

#sizes <- ordered(sizes, levels = c("small", "medium", "large"))

# creserves$`Reserve Type` <- ordered(creserves$`Reserve Type`,levels = c("Poor Quality","Moderate
Quality","High Quality","Very High Quality"))

# #check this worked

# levels(creserves$`Reserve Type`)

#
st4<-ggplot(creserves, aes(creserves$Island, creserves$`Stream Length in Reserve (km)`, fill =
creserves$`Reserve Type`))

plottitle<-"Streams Reserve Type Summary"

prettyst5<-st4+geom_bar(stat = "identity", position = "stack")+

labs(fill = "Reserve Type", title = plottitle, x = "Island", y = "Length (km)" ) +  

theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+  

scale_fill_manual(values=cbPalette)

ggsave(filename="streamsReserveTypeSummaryKm.jpg", plot=prettyst5, device = "jpg" )

prettyst6<-st4+geom_bar(stat = "identity", position = "fill")+

labs(fill = "Reserve Type", title = plottitle, x = "Island", y = "Length (Proportion of Total Island Stream
Length in Reserves)" ) +

```

```

theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+  

scale_fill_manual(values=cbPalette)  

ggsave(filename="streamsReserveTypeSummaryPercent.jpg", plot=prettyst6, device = "jpg" )  
  

creserves$`Total Stream Length on Island (km)`<-round(creserves$`Total Stream Length on Island (km)`,  

digits=0)  

creserves$`Total Stream Length on Island (km)`[ creserves$`Total Stream Length on Island (km)` <1]<-
"<1"  

creserves$`Length (% of Total State Stream Length)` [ creserves$`Length (% of Total State Stream  

Length)` <1]<"<1"  

creserves$`Length (% of Total Island Stream Length)` [ creserves$`Length (% of Total Island Stream  

Length)` <1]<"<1"  

creserves$`Stream Length in Reserve (km)` [creserves$`Stream Length in Reserve (km)` <1]<"<1"  
  

write.csv(creserves, file = "StreamReserveStatusSummary.csv")  
  

#~~~~~  

#~~~~~  

#Summarize Critical Habitat for streams Habitats  

intersect3<-raster::intersect(streams, crithab)  

inter3data<-intersect3@data  
  

intersect3$length_m<-gLength(intersect3, byid = T)  

inter3data<-intersect3@data  
  

names(inter3data)  
  

streamsCH<-intersect3[c( "IslandName" , "TYPE" , "IslandStreamLengthkm", "length_m"  )]  


```

```

streamsCHdata<-streamsCH@data

streamsCHdata$length_km<-streamsCHdata$length_m/1000

ch<-aggregate(streamsCHdata$length_km, by = list(streamsCHdata$IslandName, streamsCHdata$TYPE,
streamsCHdata$IslandStreamLengthkm), FUN = sum)

names(ch)<-c("Island", "Stream Type", "IslandLength", "Stream Length (km)")

ch$`Stream Length (km)`<-round(ch$`Stream Length (km)`, digits = 0)

ch$perctotallength<-round(100*(ch$`Stream Length (km)`/streamskm), digits = 0)

ch$percentIslandLength<-round(100*(ch$`Stream Length (km)`/ch$`IslandLength` ), digits = 0)

names(ch)<-c("Island" , "Stream Type" , "Total Stream Length on Island (km)", "Length of Stream
Designated Critical Habitat (km)",
"Length (% of Total State Stream Length)" ,
"Length (% of Total Island Stream Length)" )

#reorder Stream Type Variables So they Plot in more intuitive colors

#And lump some things

str(ch)

levels(ch$`Stream Type`)

ch$`Stream Type`<-as.character(ch$`Stream Type`)

ch$`Stream Type`[ch$`Stream Type`== "L. BANK"]<-"BANK"

ch$`Stream Type`[ch$`Stream Type`== "LEFT BANK"]<-"BANK"

ch$`Stream Type`[ch$`Stream Type`== "RIGHT BANK"]<-"BANK"

ch$`Stream Type`[ch$`Stream Type`== "LAKE"]<- "LAKE, POND, POOL, RESERVOIR, DAM OR WEIR"

```

```

ch$`Stream Type`[ch$`Stream Type`== "POND"]<- "LAKE, POND, POOL, RESERVOIR, DAM OR WEIR"
ch$`Stream Type`[ch$`Stream Type`== "POOL" ]<- "LAKE, POND, POOL, RESERVOIR, DAM OR WEIR"
ch$`Stream Type`[ch$`Stream Type`== "RESERVOIR" ]<- "LAKE, POND, POOL, RESERVOIR, DAM OR WEIR"
ch$`Stream Type`[ch$`Stream Type`== "LAKE OR POND" ]<- "LAKE, POND, POOL, RESERVOIR, DAM OR WEIR"
ch$`Stream Type`[ch$`Stream Type`== "DAM OR WEIR" ]<- "LAKE, POND, POOL, RESERVOIR, DAM OR WEIR"

```

```

ch$`Stream Type`[ch$`Stream Type`== "ROCK" ]<- "ISLAND, ISLET, ROCK, OR OTHER"
ch$`Stream Type`[ch$`Stream Type`== "ISLAND" ]<- "ISLAND, ISLET, ROCK, OR OTHER"
ch$`Stream Type`[ch$`Stream Type`== "MISC" ]<- "ISLAND, ISLET, ROCK, OR OTHER"
ch$`Stream Type`[ch$`Stream Type`== "ISLET" ]<- "ISLAND, ISLET, ROCK, OR OTHER"

```

```
ch$`Stream Type`<-as.factor(ch$`Stream Type`)
```

```
levels(ch$`Stream Type`)
```

```

#sizes <- ordered(sizes, levels = c("small", "medium", "large"))

ch$`Stream Type` <- ordered(ch$`Stream Type`,levels = c( "INTERMITTENT" , "PERENNIAL", "NON-PERENNIAL",
"ISLAND, ISLET, ROCK, OR OTHER","BANK",
"LAKE, POND, POOL, RESERVOIR, DAM OR WEIR" ))

```

```
#check this worked
```

```
levels(w$`Stream Type`)
```

```
#
```

```

st5<-ggplot(ch, aes(ch$Island, ch$`Length of Stream Designated Critical Habitat (km)` , fill = ch$`Stream Type`))
plottitle<-"Streams Critical Habitat Summary"

```

```

prettyst7<-st5+geom_bar(stat = "identity", position = "stack")+
  labs(fill = "Reserve Type", title = plottitle, x = "Island", y = "Length (km)" ) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+ 
  scale_fill_manual(values=cbPalette)
ggsave(filename="streamsCritHabSummarykm.jpg", plot=prettyst7, device = "jpg" )

```

```

prettyst8<-st5+geom_bar(stat = "identity", position = "fill")+
  labs(fill = "Reserve Type", title = plottitle, x = "Island", y = "Length (Proportion of Total Island Stream Length in Critical Habitat)" ) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+ 
  scale_fill_manual(values=cbPalette)
ggsave(filename="streamsCritHabSummaryPercent.jpg", plot=prettyst8, device = "jpg" )

```

ch\$`Total Stream Length on Island (km)`<-round(ch\$`Total Stream Length on Island (km)`, digits = 0)

```

ch$`Total Stream Length on Island (km)`[ ch$`Total Stream Length on Island (km)` <1]<"<1"
ch$`Length (% of Total Island Stream Length)` [ ch$`Length (% of Total Island Stream Length)` <1]<"<1"
ch$`Length (% of Total State Stream Length)` [ ch$`Length (% of Total State Stream Length)` <1]<"<1"
ch$`Length of Stream Designated Critical Habitat (km)`[ch$`Length of Stream Designated Critical
Habitat (km)`<1]<"<1"
write.csv(ch, file = "StreamsCriticalHabitatSummary.csv")

```

save.image("~/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/CoastalWetlandsStreamsOut/18
_06_14_StreamsWorkspaceEndofCode.RData")

Appendix J. Hawaii Coastal Habitats Code

#Mari K Reeves

#18_06_21_SummarizeCoastalHabitatsForHSAs

#This code will intersect the linear features (coastal and streams) and the wetlands, which are poorly represented in the

#Carbon Assessment Landcover layers, intersect them with LandOwnership, Habitat Quality, Reserve Areas and Critical Habitats

#and generate summary tables for the biologists doing the Habitat Status Assessment Reports.

#Bring in layer files for wetlands, coastal veg quality, streams, landownership, and reserve status and put them in the SYSCRS

#Run gIntersection with these layers in sequence to summarize linear measure (m) in each of the following:

#Habitat Quality from Carbon Assessment Rasters

```
rm(list = ls()) #remove all past worksheet variables
```

```
set.seed(333)
```

Read in Base Packages -----

```
pckg <- c("dplyr", "tidyr", "RColorBrewer", "ggplot2",
"parallel", "gdalUtils", "rgdal", "rgeos",
"spatial", "sp", "raster", "maptools", "spatialEco",
"SpatialPack", "spatstat", "microbenchmark", "devtools",
"snowfall", "tictoc")
```

```

# READING IN PACKAGES

for(i in 1:length(pckg)){
  if ((!pckg[i] %in% installed.packages())==T) {
    install.packages(pckg[i], repos="http://cran.us.r-project.org",
                     dependencies = T)
    print(pckg[i])
    do.call("library", list(pckg[i]))
  }else{
    print(pckg[i])
    do.call("library", list(pckg[i]))
  }
}

#Define Directories

#BaseDir <- "J:/PIOGIS12/APPS/SH_CC/Mari/HSAs/"
BaseDir<-"C:/Users/marieeves/Documents/HSAs/"
WorkingDir<-paste0(BaseDir, "HabitatStatusAssessmentsR/Hawaii")
SHADir<-paste0(BaseDir, "SHADataFiles/")
ConservationDir<-paste0(WorkingDir,"/ShapeFiles4R" )
OutDir<-paste0(ConservationDir, "/CoastalWetlandsStreamsOut")
WetDir<-paste0(OutDir, "/StreamsWetlandsCoastal")
ReportOut<-paste0(BaseDir, "/HSAResorts/18_06_21_Coastal")
setwd(ReportOut)

#Set CRS for session

BigIslandCRS<- "+proj=utm +zone=5 +ellps=GRS80 +towgs84=0,0,0,-0,-0,-0,0 +units=m +no_defs"
OtherIslandCRS<- "+proj=utm +zone=4 +ellps=GRS80 +towgs84=0,0,0,-0,-0,0 +units=m +no_defs"
sysCRS<-"+proj=utm +zone=4 +datum=NAD83 +units=m +no_defs +ellps=GRS80 +towgs84=0,0,0"

```

```
#Bring in files and transform them into the sysCRS - send them to a new folder - only need to run this once, so commented it out
```

```
neededshps<-list.files(ConservationDir, pattern = ".shp$")

# #habitatsplit<-function(hab){

# for (myshp in neededshps){

#   #get rid of the shp extension

#   lyr <- sub(".shp$", "", myshp)#This gets rid of the .shp extension in the list of files

#   b<-readOGR(dsn = ConservationDir, layer = lyr)#read in the shpfile

#   print(proj4string(b))#check CRS

#   #transform it to the sysCRS

#   g<-spTransform(b, CRS(sysCRS))

#   print(proj4string(g))#recheck the spatial projections

#   #send it back out to a different file

#   outname<-paste0("18_05_24_sysCRS",lyr)

#   writeOGR(g, dsn = OutDir, layer = outname, driver="ESRI Shapefile", overwrite_layer = T)

# }
```

```
#Bring these files back in for intersection operations.
```

```
list.files(OutDir, full.names = T, pattern = ".shp")

own<-readOGR(dsn = OutDir, layer = "18_05_24_sysCRS18_05_03_DissolveOwnerIsland")

owndata<-own@data

ownBuffer<-gBuffer(own, byid=TRUE, width=0)#fix most gisValid errors
```

```
reserves<-readOGR(dsn = OutDir, layer = "18_05_24_sysCRSReserves")
```

```

crithab<-readOGR(dsn = OutDir, layer = "CriticalHabitatsysCRSOnePoly")
crithabdata<-crithab@data

#clean up the reserve layer to delete reserves we don't think are important from a conservation
perspective

types2keep<-c( "Marine Life Conservation District", "National Historical Park",
             "National Park", "National Wildlife Refuge", "Natural Area Reserve",
             "Private Preserve", "State Wilderness Park","The Nature Conservancy Preserve",
             "Wildlife Sanctuary")

myreserves<-reserves[reserves$Type_Defin %in% types2keep,]

myreservedata<-myreserves@data

#write functions to intersect the streams, wetlands, and coastal with reserves, critical habitat, and land
ownership, calculate and

#plot length in each status. I think I may just need to treat each of these guys separately and not do this
in a loop. Because the

#incoming datasets are so different. Bleh.

# wetplaces<-list.files(WetDir, pattern = ".shp")
#
#
##wetowners<-function(wet in wetplaces){
# for (wet in wetplaces[1]){
#   #get rid of the shp extension
#   lyr <- sub(".shp", "", wet)#This gets rid of the .shp extension in the list of files
coastal<-readOGR(dsn = WetDir, layer = "18_05_24_sysCRSCoastal_Vegetation_Survey_2013-
2015")#read in the shpfile

coastaldata<-coastal@data

plot(coastal)

levels(coastal$Island)

```

```

write.csv(coastaldata, file = "coastal_rawdata.csv")

coastal$length_m<-gLength(coastal, byid = T)
coastalmeters<-sum(coastal$length_m)
coastal$length_km<-coastal$length_m/1000
#Summarize the habitat quality for coastal habitats - rename some things
levels(coastal$Veg_Catego) # "Blue" "Green 1" "Green 2" "Orange" "Purple" "Red" "Yellow"
levels(coastal>Status_Cat) # "Blue - High quality" "Green - Very high quality" "Red - Poor quality"
# "Yellow - Moderate quality"
coastal$qual<-sub("Blue - High quality", "High Quality", coastal>Status_Cat)
coastal$qual<-sub("Green - Very high quality", "Very High Quality", coastal$qual)
coastal$qual<-sub("Red - Poor quality", "Poor Quality", coastal$qual)
coastal$qual<-sub("Yellow - Moderate quality", "Moderate Quality", coastal$qual)
coastaldata<-coastal@data

#create a column in coastal for % of coastline length
islandlength<-aggregate(coastal$length_km~coastal$Island , FUN = sum)
names(coastal)
names(islandlength)<-c("Island", "IslandLengthkm")
coastal<-merge(coastal, islandlength)
#check that worked
coastaldata<-coastal@data

coastalkm<-sum(coastal$length_km)
coastalqual<-aggregate(coastal$length_km, by = list(coastal$qual, coastal$Island,
coastal$IslandLengthkm), FUN = sum)
names(coastalqual)<-c("Habitat Quality", "Island", "IslandLength", "Coastline Length (km)")

```

```

coastalqual$`Coastline Length (km)`<-round(coastalqual$`Coastline Length (km)` , digits = 0)
coastalqual$perctotallength<-round(100*(coastalqual$`Coastline Length (km)`/coastalkm), digits = 0)
coastalqual$percentIslandLength<-round(100*(coastalqual$`Coastline Length (km)`/coastalqual$`IslandLength` ), digits = 0)
coastalqual$percentIslandLength[coastalqual$percentIslandLength <1]<"<1"
coastalqual$perctotallength[coastalqual$perctotallength <1]<"<1"
coastalqual<-coastalqual[,c("Habitat Quality","Island" , "Coastline Length (km)", "perctotallength" ,
"percentIslandLength")]
names(coastalqual)<-c("Habitat Quality","Island" , "Coastline Length (km)" , "Length (% of State
Coastline)" ,
"Length (% of Island Coastline" )
write.csv(coastalqual, file = "CoastalHabitatQuality.csv")

```

```

#Reorder Islands from East to west in figures
levels(coastalqual$Island)
levels(coastalqual$Island)
coastalqual$Island<-as.character(coastalqual$Island)#get rid of pre-lehua factor levels
coastalqual$Island <- ordered(coastalqual$Island ,levels = c( "Hawaii" , "Maui", "Kahoolawe", "Lanai",
"Molokai", "Oahu" , "Kauai" , "Nihihau" ))
coastalqual$Island<-as.factor(coastalqual$Island)
levels(coastalqual$Island)#check that worked

```

```

#load color blind palette
cbPalette <- c("#999999", "#E69F00", "#56B4E9", "#009E73", "#FOE442", "#0072B2", "#D55E00",
"#CC79A7", "#000000")
#Make a figure for coastal habitat quality by Island
#reorder Habitat Quality Variables So they Plot in more intuitive colors
str(coastalqual)

```



```

intersect1$length_m<-gLength(intersect1, byid = T)

interdata<-intersect1@data

names(interdata)

coastalownqual<-intersect1[c( "BigstOwner", "Island.2" , "IslandLengthkm", "length_m"  )]

coastalowndata<-coastalownqual@data

coastalowndata$length_km<-coastalowndata$length_m/1000

clowndata<-aggregate(coastalowndata$length_km, by = list(coastalowndata$BigstOwner,
coastalowndata$Island.2, coastalowndata$IslandLengthkm), FUN = sum)

names(clowndata)<-c("Land Owner", "Island", " IslandLength" , "Coastline Length (km)")

clowndata$`Coastline Length (km)`<-round(clowndata$`Coastline Length (km)`, digits = 0)

clowndata$perctotallength<-round(100*(clowndata$`Coastline Length (km)`/coastalkm), digits = 0)

clowndata$percentIslandLength<-round(100*(clowndata$`Coastline Length (km)`/clowndata$`IslandLength` ), digits = 0)

clowndata$percentIslandLength[clowndata$percentIslandLength <1]<-<"1"

clowndata$perctotallength[clowndata$perctotallength <1]<-<"1"

clowndata<-clowndata[,c("Land Owner", "Island" , "Coastline Length (km)", "perctotallength",
"percentIslandLength")]

names(clowndata)<-c("Land Ownership", "Island" , "Coastline Length (km)", "Length (% of State
Coastline)" ,
"Length (% of Island Coastline" )

#capitalize "data" in the land ownership column

clowndata$`Land Ownership`<-as.character(clowndata$`Land Ownership`)

clowndata$`Land Ownership`<-sub("No data", "No Data", clowndata$`Land Ownership`)

```

```

write.csv(clowndata, file = "CoastalLandOwnership.csv")

#Reorder Islands from East to west in figures

levels(clowndata$Island)

levels(clowndata$Island)

clowndata$Island<-as.character(clowndata$Island)#get rid of pre-lehua factor levels

clowndata$Island <- ordered(clowndata$Island ,levels = c( "Hawaii" , "Maui", "Kahoolawe", "Lanai",
" Molokai", "Oahu" , "Kauai" , "Niihau" ))

clowndata$Island<-as.factor(clowndata$Island)

levels(clowndata$Island)#check that worked

#Make a figure for coastal habitat quality by Island

#load color blind palette

cbPalette <- c("#999999", "#E69F00", "#56B4E9", "#009E73", "#F0E442", "#0072B2", "#D55E00",
"#CC79A7", "#000000")

## ##reorder Land Ownership Variables private plots in grey

# str(clowndata)

# clowndata$`Land Ownership`<-as.factor(clowndata$`Land Ownership`)

# levels(clowndata$`Land Ownership`)

# 

# #sizes <- ordered(sizes, levels = c("small", "medium", "large"))

# clowndata$`Land Ownership` <- ordered(clowndata$`Land Ownership`,levels = c( "Private","Govt.
Federal","Govt. Local","Govt. State","Govt. State DHHL" ,"No Data"))

# #check this worked

# levels(clowndata$`Land Ownership`)

# 

clown<-ggplot(clowndata, aes(clowndata$Island, clowndata$`Coastline Length (km)` , fill =
clowndata$`Land Ownership`))

```

```

plottitle<-"Coastal Land Ownership Summary"
prettyclown<-clown+geom_bar(stat = "identity", position = "fill")+
  labs(fill = "Land Ownership", title = plottitle, x = "Island", y = "Length (Proportion of Island Coastline)" )
+
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+ 
  scale_fill_manual(values=cbPalette)
ggsave(filename="CoastalLandOwnershipSummary.jpg", plot=prettyclown, device = "jpg" )

#~~~~~
~~~~~
#Summarize Reserve Status for Coastal Habitats

intersect2<-raster::intersect(coastal, myreserves)
intersect2$length_m<-gLength(intersect2, byid = T)
inter2data<-intersect2@data

names(inter2data)

coastalreserves<-intersect2[c( "Type_Defin" , "Island.2" , "IslandLengthkm", "length_m"  )]
coastalresdata<-coastalreserves@data
coastalresdata$length_km<-coastalresdata$length_m/1000

creserves<-aggregate(coastalresdata$length_km, by = list(coastalresdata$Type_Defin ,
coastalresdata$Island.2, coastalresdata$IslandLengthkm), FUN = sum)

names(creserves)<-c("Reserve Type", "Island", "IslandLength", "Coastline Length (km)")
creserves$`Coastline Length (km)`<-round(creserves$`Coastline Length (km)`, digits = 0)
creserves$perctotallength<-round(100*(creserves$`Coastline Length (km)`/coastalkm), digits = 0)

```

```

creserves$percentIslandLength<-round(100*(creserves$`Coastline Length (km)`/creserves$`  

IslandLength` ), digits = 0)

creserves<-creserves[,c("Reserve Type","Island" , "Coastline Length (km)", "perctotallength" ,  

"percentIslandLength")]

names(creserves)<-c("Reserve Type","Island" , "Coastline Length in Reserve (km)", "Length (% of State  

Coastline)" ,  

"Length (% of Island Coastline" )

```

#Make a figure for coastal Reserve Type by Island

```

# #reorder Reserve Type Variables So they Plot in more intuitive colors

# str(creserves)

# creserves$`Reserve Type`<-as.factor(creserves$`Reserve Type`)

# levels(creserves$`Reserve Type`)

# 

# #sizes <- ordered(sizes, levels = c("small", "medium", "large"))

# creserves$`Reserve Type` <- ordered(creserves$`Reserve Type`,levels = c("Poor Quality","Moderate  

Quality","High Quality","Very High Quality"))

# #check this worked

# levels(creserves$`Reserve Type`)

```

#Reorder Islands from East to west in figures

```

levels(creserves$Island)

creserves$Island<-as.character(creserves$Island)#get rid of pre-lehua factor levels

creserves$Island <- ordered(creserves$Island ,levels = c( "Hawaii" , "Maui", "Kahoolawe", "Lanai",  

" Molokai", "Oahu" , "Kauai" , "Niihau" ))

creserves$Island<-as.factor(creserves$Island)

```

```

levels(creserves$Island)#check that worked

#
cres<-ggplot(creserves, aes(creserves$Island, creserves$`Coastline Length in Reserve (km)` , fill =
creserves$`Reserve Type`))

plottitle<-"Coastal Reserve Type Summary"

prettycr<-cres+geom_bar(stat = "identity", position = "fill")+
  labs(fill = "Reserve Type", title = plottitle, x = "Island", y = "Length (Proportion of Habitat in Reserves)"
) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+
  scale_fill_manual(values=cbPalette)

ggsave(filename="CoastalReserveTypeSummary.jpg", plot=prettycr, device = "jpg" )

creserves$`Length (% of Island Coastline)` [creserves$`Length (% of Island Coastline)` <1]<"<1"
creserves$`Length (% of State Coastline)` [creserves$`Length (% of State Coastline)` <1]<"<1"
write.csv(creserves, file = "CoastalReserveTypesStatewide.csv")

#~~~~~
~~~~~

#Summarize Critical Habitat for Coastal Habitats

intersect3<-raster::intersect(coastal, crithab)

inter3data<-intersect3@data

intersect3$length_m<-gLength(intersect3, byid = T)

inter3data<-intersect3@data

names(inter3data)

coastalCH<-intersect3[c( "Island" , "IslandLengthkm", "length_m"  )]

coastalCHdata<-coastalCH@data

coastalCHdata$length_km<-coastalCHdata$length_m/1000

```

```

ch<-aggregate(coastalCHdata$length_km, by = list(coastalCHdata$Island,
coastalCHdata$IslandLengthkm), FUN = sum)

names(ch)<-c("Island"," IslandLength" ,"Coastline Length (km)")

ch$`Coastline Length (km)`<-round(ch$`Coastline Length (km)` , digits = 0)

ch$perctotallength<-round(100*(ch$`Coastline Length (km)`/coastalkm), digits = 0)

ch$percentIslandLength<-round(100*(ch$`Coastline Length (km)`/ch$` IslandLength` ), digits = 0)

ch$percentIslandLength[ch$percentIslandLength <1]<-<"1"

ch$perctotallength[ch$perctotallength <1]<-<"1"

ch<-ch[,c("Island" , "Coastline Length (km)" , "perctotallength" ,
"percentIslandLength")]

names(ch)<-c("Island" , "Length of Coastline Designated Critical Habitat (km)" , "Length (% of State
Coastline)" ,
"Length (% of Island Coastline" )

write.csv(ch, file = "CriticalHabitatSummary.csv")

```

```

#Make a figure for coastal Reserve Type by Island

#Reorder Islands from East to west in figures

levels(ch$Island)

levels(ch$Island)

ch$Island<-as.character(ch$Island)#get rid of pre-lehua factor levels

ch$Island <- ordered(ch$Island ,levels = c( "Hawaii" , "Maui", "Kahoolawe", "Lanai", "Molokai",
"Oahu" , "Kauai" , "Niihau" ))

ch$Island<-as.factor(ch$Island)

levels(ch$Island)#check that worked

```

```
# #reorder Reserve Type Variables So they Plot in more intuitive colors
```

```
# str(ch)
```

```

# ch$`Reserve Type`<-as.factor(ch$`Reserve Type`)

# levels(ch$`Reserve Type`)

#
# #sizes <- ordered(sizes, levels = c("small", "medium", "large"))

# ch$`Reserve Type` <- ordered(ch$`Reserve Type`,levels = c("Poor Quality","Moderate Quality","High Quality","Very High Quality"))

# #check this worked

# levels(ch$`Reserve Type`)

#
chplot<-ggplot(ch, aes(ch$Island, ch$`Length of Coastline Designated Critical Habitat (km)`))

plottitle<-"Coastal Critical Habitat Summary"

prettych<-chplot+geom_bar(stat = "identity", position = "stack")+

  labs( title = plottitle, x = "Island", y = "Length (km)" ) + 

  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12)) + 

  scale_fill_manual(values=cbPalette)

ggsave(filename="CoastalCriticalHabitatSummary.jpg", plot=prettych, device = "jpg" )

```

```
save.image("~/HSAs/HSAReports/18_06_21_Coastal/18_06_21_EndOfCodeWorkspace.RData")
```

Appendix K. Code for all Hawaii Carbon Assessment Based Figures and Tables

#Mari K Reeves

#18_06_14_SummarizePIFWO Polygons

#This code takes the most recent USGS 30 m pixel scale land cover assessment and

#lumps it into PIFWO habitat category and summarizes the area of each one

#breaks these down by sub-habitat and summarizes areas of those

#Since it was faster, I also converted the file to polygons in GIS and dissolved those

#polygons by raster value so I can do a spatial extraction to the land cover polygons

#to get summaries below.

```
rm(list = ls()) #remove all past worksheet variables
```

```
set.seed(333)
```

```
# Read in Base Packages -----
```

```
pckg <- c("dplyr", "tidyr", "RColorBrewer", "ggplot2", "curl",
  "RCurl", "parallel", "gdalUtils", "rgdal", "rgeos",
  "spatial", "sp", "raster", "maptools", "spatialEco",
  "SpatialPack", "spatstat", "microbenchmark",
  "snowfall", "stringi", "stringr", "tictoc")
```

```
# READING IN PACKAGES
```

```
for(i in 1:length(pckg)){
  if ((!pckg[i] %in% installed.packages())==T) {
    install.packages(pckg[i], repos="http://cran.us.r-project.org",
      dependencies = T)
  }
}
```

```

print(pckg[i])
do.call("library", list(pckg[i]))

}else{
print(pckg[i])
do.call("library", list(pckg[i]))
}

}

#Define Directories
#BaseDir <- "J:/PIOGIS12/APPS/SH_CC/Mari/HSAs/"
BaseDir<-"C:/Users/marieeves/Documents/HSAs/"
WorkingDir<-paste0(BaseDir, "HabitatStatusAssessmentsR/Hawaii")

SHADir<-paste0(BaseDir, "SHADataFiles/")
LandOwnDir<-paste0(SHADir,"LandOwnership/HawaiiParcels/statewide" )
ConservationDir<-paste0(WorkingDir,"/ShapeFiles4R" )
HabitatDir<-paste0(ConservationDir, "/HabitatPolygons")
HabCatDir<-paste0(SHADir, "HawaiiHabitats/HabCatShapefiles")
IsleHabDir<-paste0(SHADir, "HawaiiHabitats/IslandHabitatFiles")
CoastDir<-paste0(SHADir, "Coastlines")
OutDir<-paste0(WorkingDir, "/Test")
list.files(ConservationDir)
ConsDirOut<-paste0(WorkingDir, "/ConsDirOut")
ReportOut<-paste0(BaseDir, "/HSAResorts/18_06_14_OtherHabitatsFiguresTables")
setwd(ReportOut)

```

```

BigIslandCRS<- "+proj=utm +zone=5 +ellps=GRS80 +towgs84=0,0,0,-0,-0,0 +units=m +no_defs"

OtherIslandCRS<- "+proj=utm +zone=4 +ellps=GRS80 +towgs84=0,0,0,-0,-0,0 +units=m +no_defs"

#I changed this to match the habitat files below...

#sysCRS<-" +proj=utm +zone=4 +ellps=WGS84 +towgs84=0,0,0,-0,-0,0 +units=m +no_defs"

#go online and get the landcover
file:https://www.sciencebase.gov/catalog/item/592dee56e4b092b266efeb6b

# download and unzip
# download.file("https://www.sciencebase.gov/catalog/item/592dee56e4b092b266efeb6b",
#               destfile = "carbon.zip") #this doesn't work yet, because I can't get the right link from GS site

# carbonLC<-raster(paste0(WorkingDir, "/CAH_LandCover.jpg"))

# plot(carbonLC)

#proj4string(carbonLC)# "+proj=utm +zone=4 +datum=NAD83 +units=m +no_defs +ellps=GRS80
#+towgs84=0,0,0"

# #make this into the systemCRS

sysCRS<-" +proj=utm +zone=4 +datum=NAD83 +units=m +no_defs +ellps=GRS80 +towgs84=0,0,0"
#
# #bring in the data table that goes with this file (I had to export this from GIS) and categorize
# the PIFWO habitats, to serve as a crosswalk...This file now has the PIFWO Habitats in it.

#mycarbon<-read.csv(paste0(WorkingDir, "/LandCoverCategoriesCarbonAssessment.csv"))

#make a copy

#carboncopy<-mycarbon

#
# #useful: http://r-spatial.org/spatial/rst/8-rastermanip.html

```

```

#That's why I did the polygon conversion in ArcGIS and am working with the
#files imported below, which are the habitats as polygons and dissolved polygons
#dealing with memory in R was too much for this giant polygon file.
#had to do the spatial overlays in GIS, and am working with a csv file exported from Arc
#After making the carbon assessment rasters into polygons, joining the habitat type and habitat
#quality data together and also to the coastlines layer (to assign an island name, over was taking forever
#in R) then exporting that dataframe with ~1.5 million records from Arc to bring it into R as follows:

```

```

#~~~~~Bring Data file in from Yeti Run ~~~~~
#
list.files(HabitatDir, pattern = ".shp$", full.names = T)
#read in the habitat file and assign a CRS.(exported this as csv in GIS)
#habitats<-readOGR(dsn = HabitatDir, layer = "18_05_22_HabsWithConsArea")
#reservedata<-habitats@data
#write.csv(reservedata, file = paste0(HabitatDir, "/habitatpolyareasReserveAreas.csv"))
#~~~~~Bring in pre-historic conservation
area~~~~~

#These were generated by the nature conservancy, but we don't have reference

prehistoric<-readOGR(dsn = ConservationDir, layer = "state_naturalcom_beforecontact")
plot(prehistoric)

#put it in the sysCRS
prehistoric<- spTransform(prehistoric, CRS(sysCRS))
prehistoric$area_m<-gArea(prehistoric, byid = T)
prehistoricdata<-prehistoric@data

levels(prehistoricdata$COMMUNITY )
prehistoricdata$COMMUNITY<-as.character(prehistoricdata$COMMUNITY)

```

```

prehistoricdata$COMMUNITY[prehistoricdata$COMMUNITY == "isle" ] <- "Isle"
prehistoricdata$COMMUNITY[prehistoricdata$COMMUNITY == "water" ]<- "Open Water"
prehistoricdata$COMMUNITY<-as.factor(prahistoricdata$COMMUNITY)
levels(prahistoricdata$COMMUNITY)

preisl<-aggregate(prahistoricdata$area_m, by = list( prahistoricdata$ISLAND), FUN = sum)
names(preisl)<-c("Isl", "Area_m")
levels(preisl$Isl)
island<-c( "Hawaii", "Kauai", "Kahoolawe", "Lanai", "Maui", "Molokai", "Niihau", "Oahu")
preisl<-cbind(preisl, island)

precom<-prehab<-aggregate(prahistoricdata$area_m, by = list(prahistoricdata$COMMUNITY), FUN =
sum)
names(precom)<-c("Community", "Area_m")

#convert sqmeters to Acres and Sq Miles
precom$acres<-round(precom$Area_m*0.0002471, digits = 0)
precom$sqmi<-round(precom$Area_m*0.0000003861, digits = 0)

#drop area in meters, rename columns and write out to csv
names(precom)
precom<-precom[,c("Community", "acres","sqmi" )]
names(precom)<-c("Vegetation Community", "Area (Acres of Habitat Before Human Contact)", "Area (Square Miles of Habitat Before Human Contact)")

precom$`Area (Square Miles of Habitat Before Human Contact)`[precom$`Area (Square Miles of Habitat Before Human Contact)` <1]<- "<1"
write.csv(precom, file = "EstimatedAreaPrecontactTNCLayers.csv")

```

```

#Bind island names and total area to the file

names(preisl)<-c( "ISLAND" , "TotallIslandArea_m", "island")

names(prehistoricdata)

pre<-merge(prehistoricdata, preisl, by = "ISLAND")



names(pre)

prehab<-aggregate(pre$area_m, by = list(pre$COMMUNITY, pre$island, pre$TotallIslandArea_m), FUN =
sum)

names(prehab)<-c("Community", "Island", "totalarea_m", "communityarea_m")

#convert sqmeters to Acres and Sq Miles

prehab$acres_com<-round(prehab$communityarea_m*0.0002471, digits = 0)

prehab$sqmi_com<-round(prehab$communityarea_m*0.0000003861, digits = 0)






prehab$acres_tot<-round(prehab$totalarea_m*0.0002471, digits = 0)

prehab$sqmi_tot<-round(prehab$totalarea_m*0.0000003861, digits = 0)






prehab$proptotalarea<-round((prehab$acres_com/prehab$acres_tot)*100)






#drop, reorganize, rename, write out

names(prehab)

prehab<-prehab[,c("Community","Island" , "acres_com", "sqmi_com", "proptotalarea" )]

names(prehab)<-c("Vegetation Community", "Island", "Area (Acres of Habitat Before Human Contact)", "Area (Square Miles of Habitat Before Human Contact)", "Area (% of Total Island Area)")






prehab$`Area (Acres of Habitat Before Human Contact)` [prehab$`Area (Acres of Habitat Before Human Contact)` <1]<- "<1"

prehab$`Area (% of Total Island Area)`[prehab$`Area (% of Total Island Area)`<1]<- "<1"

prehab$`Area (Square Miles of Habitat Before Human Contact)`[prehab$`Area (Square Miles of Habitat Before Human Contact)` <1]<- "<1"

```

```

write.csv(prehab, file = "PreContactSummaryByIsland.csv")

#~~~~~
~~~~~

#not done because did it last time, spatial file is huge and takes too much
memory~~~~~

#~~~~~
~~~~~

# proj4string(habitats)<-sysCRS

# habitatcopy<-habitats

habdata<-
read.csv("C:/Users/marieeves/Documents/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/Hab
itPolygons/18_05_22_HabPolyExport.csv" )

#~~~~~
~~~~~

#Reformat the Data to make nice Maps and Tables

#make a copy

habcopy<-habdata

#cut unwanted columns out of habdata and reassign variable names

names(habdata)

#convert conservation area in hectares to acres

habdata$ReserveAcres<-habdata$ConsAreaHA*2.471

habdata<-habdata[,c("PIFWOHAB_1", "PIFWOHAB_2", "Descriptio", "BigstOwner",
                    "Island", "AreaAcres", "ReserveAcres")]

names(habdata)<-c("vegclass", "PIFWO_Habitat", "HabQual", "owner", "island", "AreaAcres",
                  "ReserveAcres")

```

```

#Get rid of Lehua

levels(habdata$island)

islands2keep<-c( "Hawaii", "Kahoolawe", "Kauai", "Lanai", "Maui", "Molokai", "Niihau", "Oahu"    )

habdata<-habdata[habdata$island %in% islands2keep,]

#let's summarize by these, by habitat, then maybe create a summary with simpler (fewer) categories
unique(habdata$PIFWO_Habitat)

habdata$habtype<-habdata$PIFWO_Habitat

#clean up the habitats so they make better names

#Clean up the habitat names to remove slashes and dashes

# habdata$habtype<-sub("-", " ", habdata$habtype)

#habdata$habtype<-sub(" ", "", habdata$habtype)

#habdata$habtype<-sub(" ", "", habdata$habtype)#get rid of where there were double spaces

#add a column converting area to miles

habdata$Area_SqMi<-habdata$AreaAcres*0.001563

#check that areas are right

sum(habdata$Area_SqMi)#interesting, that implies no spatial overlap in polygons!

#also checking this by intersecting the layer with itself in GIS, but this may take another
#20 hours to complete...

ArchipelagoAcres<-sum(habdata$AreaAcres)

#First error, there are polygons with no habitat assignment

#replace with words "No Data"

habdata$habtype<-sub("^ $", "No Data", habdata$habtype)

```

```

habdata$vegclass<-sub("^\s", "No Data", habdata$vegclass)

#replace missing data in hab qual with "No Data"
habdata$HabQual<-sub("^\s", "No Data", habdata$HabQual)

#replace missing data in Land Owner with "No Data"
habdata$owner<-sub("^\s", "No Data", habdata$owner)

#change state dhhl to state in land ownership
habdata$owner
habdata$owner<-sub( "Govt. State DHHL", "Govt. State", habdata$owner)

#rename Non-Forest to ScrubShrub
habdata$habtype<-sub("Non-Forest", "Grasslands and Shrublands", habdata$habtype)

#capitalize "data" in the land ownership column
habdata$owner<-sub("No data", "No Data", habdata$owner)

nohab<-habdata[habdata$habtype == "No Data",]
unclassifiedacres<-sum(nohab$AreaAcres) # 1323.794
#It's only 1300 acres unclassified, this is nothing, out of 4,099,205 ArchipelagoAcres
#so could just drop these for now (or forever) and not worry about them
habdata$habtype<-as.factor(habdata$habtype)

levels(habdata$habtype)
#create a column in habdata for % of Island area
islandareas<-aggregate(habdata$AreaAcres~habdata$Island, FUN = sum)

```

```

names(habdata)
names(islandareas)<-c("island", "IslandAreaAcres")
habdata<-left_join(habdata, islandareas)

#other late in the game data changes

#Reorder islands from East to west in figures - doing this tomorrow, not a priority
levels(habdata$island)
habdata$island<-as.character(habdata$island)#get rid of pre-lehua factor levels
habdata$island<-as.factor(habdata$island)
levels(habdata$island)
habdata$island <- ordered(habdata$island ,levels = c( "Hawaii" , "Maui", "Kahoolawe", "Lanai",
"Molokai", "Oahu" , "Kauai" , "Niihau" ))
levels(habdata$island)#check that worked

# Alien – change to non-native in veg class and habitat quality columns
levels(habdata$HabQual)
habdata$HabQual<-sub("Alien", "Non-native", habdata$HabQual)
habdata$HabQual<-sub("alien", "non-native", habdata$HabQual)
habdata$HabQual<-sub(" /", "", habdata$HabQual)

levels(habdata$vegclass)
habdata$vegclass<-sub("Alien", "Non-native", habdata$vegclass)
habdata$vegclass<-sub("alien", "non-native", habdata$vegclass)

#order these to plot nicely
habdata$HabQual<-as.factor(habdata$HabQual)

```

```

habdata$HabQual <- ordered( habdata$HabQual ,levels = c( "Heavily Disturbed" , "Bare or <5% Vegetation",
                                                               "Native Non-native Mix", "Native Dominated", "No Data" ))

levels(habdata$HabQual)

#Make file size smaller for all the figures and make them into jpgs(global change in code)

#replace tiff with jpg -- check

#replace ".tif" with ".jpg" -- check

#make a list of these habitats to use in function

habitatlist<-unique(habdata$habtype)

#Fix color palette to colorblind friendly:http://www.cookbook-r.com/Graphs/Colors\_\(ggplot2\)/

# The palette with grey:

cbPalette <- c("#999999", "#E69F00", "#56B4E9", "#009E73", "#F0E442", "#0072B2", "#D55E00",
               "#CC79A7", "#000000")

#Plot Vegetation Types by Island

#SimpleVegetationSummary<-function(myhabitat){

for(myhabitat in habitatlist){

  subtable<-habdata[habdata$habtype == myhabitat,]

  summary<-aggregate(subtable$AreaAcres, by = list(subtable$habtype ,
                                                    subtable$vegclass, subtable$owner,
                                                    subtable$island, subtable$IslandAreaAcres), FUN = sum)

  summary$PercentArchArea<-(summary$x /ArchipelagoAcres)*100

  summary$PercentIslandArea<-(summary$x/summary$Group.5)*100

  summary<-summary[,c("Group.1","Group.2","Group.3","Group.4","Group.5","x",
                     "PercentIslandArea" , "PercentArchArea" )]
```

```

names(summary)<-c("Habitat", "Vegetation Class", "Land Ownership", "Island", "Total Island Area
(Acres)", "Area (Acres)",

  "Area (% of Island)", "Area (% of State of Hawaii)")

summary$`Area (Acres)`<-round(summary$`Area (Acres)`, digits = 0)

summary$`Area (% of State of Hawaii)` <-round(summary$`Area (% of State of Hawaii)`, digits = 0)

summary$`Total Island Area (Acres)`<-round(summary$`Total Island Area (Acres)`, digits = 0)

summary$`Area (% of Island)` <-round(summary$`Area (% of Island)`, digits = 0)

}

vc<-ggplot(summary, aes(summary$Island, summary$`Area (Acres)`, fill = summary$`Vegetation Class`))
))

plotname<-paste0(ReportOut, "/Hawaii", myhabitat, "VegetationSummaryPlot.jpg")

plottitle<-paste0(myhabitat, " Vegetation Summary")

prettyvc<-vc+geom_bar(stat = "identity", position = "fill")+

  labs(fill = "Vegetation Class", title = plottitle, x = "Island", y = "Area (Proportion of Total Habitat on
Island)" ) +

  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+

  scale_fill_manual(values=cbPalette)

ggsave(filename=plotname, plot=prettyvc, device = "jpg")

summary$`Area (% of State of Hawaii)`[summary$`Area (% of State of Hawaii)`<1]<"<1"
summary$`Area (Acres)`[summary$`Area (Acres)`<1]<"<1"

#Reorder vegetation categories per Cheryl's email - this is harder than it sounds to cheryl in the loop, so
waiting for now

```

```
#Check Vegetation class table (seems to have assigned the wrong name - add hab qual, drop
vegetation class)
```

```
summary$`Area (% of Island)` [summary$`Area (% of Island)` <1]<-<1"
tablename<-paste0(ReportOut, "/Hawaii", myhabitat, "VegetationTypeTable.csv")
write.csv(summary, file = tablename)

}
```

```
#lapply(habitatlist, SimpleVegetationSummary)
```

```
#~~~~~
~~~~~
#SimpleHabQualSummary<-function(myhabitat){
for(myhabitat in habitatlist){
subtable<-habdata[habdata$habtype == myhabitat,]

summary<-aggregate(subtable$AreaAcres, by = list(subtable$habtype,
                                                 subtable$HabQual, subtable$owner,
                                                 subtable$island, subtable$IslandAreaAcres), FUN = sum)

summary$PercentArchArea<-(summary$x /ArchipelagoAcres)*100
summary$PercentIslandArea<-(summary$x/summary$Group.5)*100

#drop island area and reorganize columns

summary<-summary[,c("Group.1","Group.2","Group.3","Group.4","x",
                    "PercentIslandArea" , "PercentArchArea" )]

names(summary)<-c("Habitat", "Habitat Quality", "Land Ownership", "Island", "Area (Acres)",
                  "Area (% of Island)", "Area (% of State of Hawaii)")

summary$`Area (Acres)`<-round(summary$`Area (Acres)`, digits = 0)
```

```

summary$`Area (Acres)`[summary$`Area (Acres)`<1]<- "<1"
summary$`Area (% of State of Hawaii)`<- round(summary$`Area (% of State of Hawaii)`, digits = 0)
summary$`Area (% of State of Hawaii)`[summary$`Area (% of State of Hawaii)`<1]<- "<1"
summary$`Area (% of Island)` <- round(summary$`Area (% of Island)`, digits = 0)
summary$`Area (% of Island)` [summary$`Area (% of Island)` <1]<- "<1"
tablename<-paste0(ReportOut, "/Hawaii", myhabitat, "QualityTable.csv")
write.csv(summary, file = tablename)

summary$area<-as.numeric(summary$`Area (Acres)`)

a<-ggplot(summary, aes(summary$Island, summary$area, fill = summary$`Habitat Quality` ))
plotname<-paste0(ReportOut, "/Hawaii", myhabitat, "HabitatQualityPlot.jpg")
plottitle<-paste0(myhabitat, " Habitat Quality Summary")
pretty<-a+geom_bar(stat = "identity", position = "fill")+
  labs(fill = "Habitat Quality", title = plottitle, x = "Island", y = "Area (Proportion of Total Habitat on
Island)" ) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+

  scale_fill_manual(values=cbPalette)
ggsave(filename=plotname, plot=pretty, device = "jpg")

}

#lapply(habitatlist, SimpleHabQualSummary)

rm(subtable)
rm(summary)
rm(a)
rm(pretty)
#Make a plot of Land Ownership by island

```

```

SimpleOwnershipSummary<-function(myhabitat){

# for(myhabitat in habitatlist){

subtable<-habdata[habdata$habtype == myhabitat,]

summary<-aggregate(subtable$AreaAcres, by = list(subtable$habtype,
                                                 subtable$owner,
                                                 subtable$island, subtable$IslandAreaAcres), FUN = sum)

summary$PercentArchArea<-(summary$x / ArchipelagoAcres)*100

summary$PercentIslandArea<-(summary$x/summary$Group.4)*100

#drop island area and reorganize columns

summary<-summary[,c("Group.1","Group.2","Group.3","x",
                    "PercentIslandArea" , "PercentArchArea" )]

names(summary)<-c("Habitat", "Land Ownership", "Island", "Area (Acres)",
                  "Area (% of Island)", "Area (% of State of Hawaii)")

summary`Area (Acres)`<-round(summary`Area (Acres)`, digits = 0)
summary`Area (Acres)`[summary`Area (Acres)`<1]<- "<1"
summary`Area (% of State of Hawaii)`<-round(summary`Area (% of State of Hawaii)`, digits = 0)
summary`Area (% of State of Hawaii)`[summary`Area (% of State of Hawaii)`<1]<- "<1"
summary`Area (% of Island)` <-round(summary`Area (% of Island)`, digits = 0)
summary`Area (% of Island)` [summary`Area (% of Island)` <1]<- "<1"
tablename<-paste0(ReportOut, "/Hawaii", myhabitat, "OwnTable.csv")

write.csv(summary, file = tablename)

summary$area<-as.numeric(summary`Area (Acres)`)

a<-ggplot(summary, aes(summary$Island, summary$area, fill = summary`Land Ownership`))

plotname<-paste0(ReportOut, "/Hawaii", myhabitat, "LandOwnershipPlot.jpg")

plottitle<-paste0(myhabitat, " Land Ownership Summary")

pretty<-a+geom_bar(stat = "identity", position = "fill")+

```

```

  labs(fill = "Land Ownership", title = plottitle, x = "Island", y = "Area (Proportion of Total Habitat on
Island)" ) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+  

  scale_fill_manual(values=cbPalette)
  ggsave(filename=plotname, plot=pretty, device = "jpg")
}

}

```

```
lapply(habitatlist, SimpleOwnershipSummary)
```

```
#~~~~~  
~~~~~
```

```
#Make a plot of habitats by island
```

```
SimpleIslandSummary<-function(myhabitat){  

# for(myhabitat in habitatlist){  

  subtable<-habdata[habdata$habtype == myhabitat,]  

  summary<-aggregate(subtable$AreaAcres, by = list(subtable$habtype,  

    subtable$island, subtable$IslandAreaAcres), FUN = sum)  

  summary$PercentIslandArea<-(summary$x/summary$Group.3)*100  

  summary$PercentArchArea<-(summary$x /ArchipelagoAcres)*100  

  #drop island area and reorganize columns  

  summary<-summary[,c("Group.1","Group.2","x",  

    "PercentIslandArea" , "PercentArchArea" )]  

  names(summary)<-c("Habitat", "Island", "Area (Acres)",  

    "Area (% of Island)","Area (% of State of Hawaii)")
```

```

summary$`Area (Acres)`<-round(summary$`Area (Acres)`, digits = 0)
summary$`Area (Acres)`[summary$`Area (Acres)`<1]<"<1"
summary$`Area (% of State of Hawaii)`<-round(summary$`Area (% of State of Hawaii)`, digits = 0)
summary$`Area (% of State of Hawaii)`[summary$`Area (% of State of Hawaii)`<1]<"<1"
summary$`Area (% of Island)` <-round(summary$`Area (% of Island)`, digits = 0)
summary$`Area (% of Island)` [summary$`Area (% of Island)` <1]<"<1"
tablename<-paste0(ReportOut, "/Hawaii", myhabitat, "IslandTable.csv")
write.csv(summary, file = tablename)

summary$area<-as.numeric(summary$`Area (Acres)`)

a<-ggplot(summary, aes(summary$Island, summary$area))

plotname<-paste0(ReportOut, "/Hawaii", myhabitat, "IslandPlot.jpg")

plottitle<-paste0(myhabitat, " Area Summary")

pretty<-a+geom_bar(stat = "identity")+
  labs(title = plottitle, x = "Island", y = "Area (Acres)" ) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+

  scale_fill_manual(values=cbPalette)

ggsave(filename=plotname, plot=pretty, device = "jpg")

}

lapply(habitatlist, SimpleIslandSummary)

#~~~~~Summarize Reserve Status by Habitat Type, HabQual, Veg
Class and Ownership
#~~~~~  

load("~/HSAs/HSAReports/18_06_14_OtherHabitatsFiguresTables/18_06_14_latenight.RData")

# reservedata<-
read.csv("C:/Users/marieees/Documents/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/Hab
itPolygons/habitatpolyareasReserveAreas.csv")

```

```

#check acreages in habdata

rescheck<-aggregate(habdata$ReserveAcres~habdata$island, FUN = sum)
names(rescheck)

rescheck$sqmi<-rescheck$`habdata$ReserveAcres`*0.001563
islandareas$sqmi<-islandareas$IslandAreaAcres*0.001563

#Plot statewide reserve habitat quality

# r1<-ggplot(habdata, aes(habdata$habtype, habdata$ReserveAcres, fill = habdata$HabQual))
# resstatewide<-r1+geom_bar(stat = "identity")+
#   labs(title = "Quality of Reserve Lands Statewide", x = "Habitat Type", y = "Area (Acres)" , fill = "Habitat Quality") +
#   theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+
#   scale_fill_manual(values=cbPalette)
#
# ggsave(filename="StatewideReserveHabitatQuality.jpg", plot=resstatewide, device = "jpg")

#ReserveAreaSummary<-function(myhabitat){

  for (myhabitat in habitatlist ){

    subtable<-habdata[habdata$habtype == myhabitat,]

    summary<-aggregate(subtable$ReserveAcres, by = list(subtable$habtype, subtable$island,
    subtable$HabQual,
    subtable$IslandAreaAcres), FUN = sum)

    summary$PercentIsleArea<-(summary$x/summary$Group.4)*100
    summary$PercentArchArea<-(summary$x /ArchipelagoAcres)*100
  }
}

```

```
names(summary)<-c("Habitat", "Island", "Habitat Quality", "Island Area (Acres)", "Area in Reserves (Acres)",
```

```
"Reserve Area (% of Island)","Reserve Area (% of State of Hawaii)")
```

```
#reorder these to make more sense
```

```
summary<-summary[, c("Island", "Habitat", "Habitat Quality", "Area in Reserves (Acres)", "Island Area (Acres)",
```

```
"Reserve Area (% of Island)","Reserve Area (% of State of Hawaii)" )]
```

```
summary$`Area in Reserves (Acres)`<-round(summary$`Area in Reserves (Acres)`, digits = 0)
```

```
summary$`Island Area (Acres)`<-round(summary$`Island Area (Acres)`, digits = 0)
```

```
summary$`Reserve Area (% of Island)`<-round(summary$`Reserve Area (% of Island)`, digits = 0)
```

```
summary$`Reserve Area (% of State of Hawaii)`<-round(summary$`Reserve Area (% of State of Hawaii)`, digits = 0)
```

```
# summary<-summary[, c("Island", "Habitat", "Habitat Quality", "Area in Reserves (Acres)",
```

```
# "Reserve Area (% of Island)",
```

```
# "Reserve Area (% of State of Hawaii)" )]
```

```
res<-ggplot(summary, aes(summary$Island, summary$`Area in Reserves (Acres)`, fill =  
summary$`Habitat Quality`))
```

```
plotname<-paste0(ReportOut, "/Hawaii", myhabitat, "ReserveQualityPlot.jpg")
```

```
plottitle<-paste0(myhabitat, " Reserve Quality Summary")
```

```
prettyrhythm<-res+geom_bar(stat = "identity", position = "stack")+
```

```
labs(title = plottitle, x = "Island", y = "Area in Reserves (Acres) " , fill = "Habitat Quality") +
```

```
theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+
```

```
scale_fill_manual(values=cbPalette)
```

```

ggsave(filename=plotname, plot=prettyrhythm, device = "jpg")

summary$`Area in Reserves (Acres)`[summary$`Area in Reserves (Acres)` <1]<- "<1"

summary$`Reserve Area (% of Island)`[ summary$`Reserve Area (% of Island)` <1]<- "<1"

summary$`Reserve Area (% of State of Hawaii)`[summary$`Reserve Area (% of State of Hawaii)` <1 ]<- "<1"

tablename<-paste0(ReportOut, "/Hawaii", myhabitat, "ReserveStatusTable.csv")
write.csv(summary, file = tablename)

}

#~~~~~Summarize the Critical Habitat Extraction (run separately and late)
#read in file - fred did this extraction separately because we couldn't run it on yeti

chsimple<-read.csv(paste0(HabitatDir, "/18_06_14_HSA_CH_14Jun2018.csv"))
#recategorize a few variables
names(chsimple)
levels(chsimple$HSA)

```

```

#get rid of lehua

levels(chsimple$Isle)
islands2keep<-c( "Hawaii", "Kahoolawe", "Kauai", "Lanai", "Maui", "Molokai", "Niihau", "Oahu"    )
chsimple<-chsimple[chsimple$Isle %in% islands2keep,]

#Reorder islands from East to west in figures - doing this tomorrow, not a priority
levels(chsimple$Isle)
chsimple$Isle<-as.character(chsimple$Isle)#get rid of pre-lehua factor levels
chsimple$Isle<-as.factor(chsimple$Isle)
levels(chsimple$Isle)
chsimple$Isle <- ordered(chsimple$Isle ,levels = c( "Hawaii" , "Maui", "Kahoolawe", "Lanai",
"Molokai", "Oahu" , "Kauai" , "Niihau" ))
levels(chsimple$Isle)#check that worked

#rename Non-Forest to ScrubShrub
chsimple$HSA<-sub("Non-Forest", "Grasslands and Shrublands", chsimple$HSA)

#convert ha to acres
chsimple$acres<-round(chsimple$Ha*2.471, digits = 2)
chsimple$IslandAreaAcres<-round(as.numeric(chsimple$IslandAreaAcres), digits = 0)

#merge in total island area
levels(chsimple$Isle)
names(islandareas)
names(chsimple)<-c("island" , "HSA", "Ha", "acres")
chsimple<-merge(chsimple, islandareas, by = "island")

```

```

chsimplehablist<-unique(chsimple$HSA)

for(myhabitat in chsimplehablist){

  subtablech<-chsimple[chsimple$HSA == myhabitat,]

  summarych<-aggregate(subtablech$acres , by = list(subtablech$island, subtablech$HSA,
  subtablech$IslandAreaAcres), FUN = sum)

  summarych$PercentIslandArea<-round((summarych$x/summarych$Group.3)*100, digits = 0)
  summarych$percentarchipelagoarea<-round((summarych$x/ArchipelagoAcres)*100, digits = 0)

  names(summarych)<-c("Island", "Habitat", "Total Island Area (Acres)","Area (Acres)",
  "Area (% of Island)", "Area (% of State of Hawaii)")

  summarych$`Area (Acres)`<-round(summarych$`Area (Acres)`, digits = 0)

  chplot<-ggplot(summarych, aes(summarych$Island, summarych$`Area (Acres)` ))
  plotnamech<-paste0(ReportOut, "/Hawaii", myhabitat, "CriticalHabitatSummaryPlot.jpg")

  plottitlech<-paste0(myhabitat, " Critical Habitat Summary")
  prettych<-chplot+geom_bar(stat = "identity", position = "stack")+
  labs(title = plottitlech, x = "Island", y = "Area (Acres of Habitat Type in Critical Habitat)" ) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+

  scale_fill_manual(values=cbPalette)

  ggsave(filename=plotnamech, plot=prettych, device = "jpg")

summarych$`Area (% of State of Hawaii)`[summarych$`Area (% of State of Hawaii)`<1]<"<1"

```

```

summarych$`Area (Acres)`[summarych$`Area (Acres)`<1]<"<1"

#Reorder vegetation categories per Cheryl's email - this is harder than it sounds to cheryl in the loop, so
waiting for now

#Check Vegetation class table (seems to have assigned the wrong name - add hab qual, drop
vegetation class)

summarych$`Area (% of Island)` [summarych$`Area (% of Island)` <1]<"<1"
tablenamech<-paste0(ReportOut, "/Hawaii", myhabitat, "CriticalHabitatSummaryTable.csv")
write.csv(summarych, file = tablenamech)

}

#lapply(habitatlist, SimpleVegetationSummary)

#~~~~~Summarize Vegetation Class
by Habitat Quality

#~~~~~
~~~~~

VegQualSummary<-function(myhabitat){

  #for(myhabitat in habitatlist){

    subtable<-habdata[habdata$habtype == myhabitat,]

    summary<-aggregate(subtable$AreaAcres, by = list(subtable$habtype,
                                                    subtable$HabQual, subtable$vegclass ,
                                                    subtable$island, subtable$IslandAreaAcres), FUN = sum)

    summary$PercentArchArea<-(summary$x /ArchipelagoAcres)*100
}

```

```

summary$PercentIslandArea<-(summary$x/summary$Group.5)*100

#drop island area and reorganize columns

summary<-summary[,c("Group.1","Group.2","Group.3","Group.4","x",
  "PercentIslandArea","PercentArchArea" )]

names(summary)<-c("Habitat", "Habitat Quality", "Vegetation Type", "Island", "Area (Acres)",
  "Area (% of Island)","Area (% of State of Hawaii)")

summary$`Area (Acres)`<-round(summary$`Area (Acres)`, digits = 0)

summary$`Area (% of State of Hawaii)`<-round(summary$`Area (% of State of Hawaii)`, digits = 0)

summary$`Area (% of Island)` <-round(summary$`Area (% of Island)` , digits = 0)

summary$`Area (Acres)`<-as.numeric(summary$`Area (Acres)`)

vq<-ggplot(summary, aes(summary$`Vegetation Type` , summary$`Area (Acres)`, fill =
summary$`Habitat Quality` ))

plotname<-paste0(ReportOut, "/Hawaii", myhabitat, "VegClassQualityPlot.jpg")

plottitle<-paste0(myhabitat, " Habitat Quality by Vegetation Type")

prettyvegqual<-vq+geom_bar(stat = "identity", position = "fill")+
  labs(fill = "Habitat Quality", title = plottitle, x = "Vegetation Type", y = "Area (Proportion of Total
Vegetation Type in State)" ) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=10))+

  scale_fill_manual(values=cbPalette)+

  scale_x_discrete(labels = function(x) lapply(strwrap(x, width = 15, simplify = FALSE), paste,
collapse="\n"), limits=unique(summary$`Vegetation Type` ))

ggsave(filename=plotname, plot=prettyvegqual, device = "jpg")

summary$`Area (Acres)`[summary$`Area (Acres)`<1]<"<1"
summary$`Area (% of State of Hawaii)`[summary$`Area (% of State of Hawaii)`<1]<"<1"
summary$`Area (% of Island)` [summary$`Area (% of Island)` <1]<"<1"

tablename<-paste0(ReportOut, "/Hawaii", myhabitat, "VegQualityTable.csv")

```

```
write.csv(summary, file = tablename)
}

lapply(habitatlist, VegQualSummary)

save.image("~/HSAs/HSAReports/18_06_14_OtherHabitatsFiguresTables/18_06_20_EndofRunData.RDa
ta")
```

Appendix L. Code for Production of Hawaii Maps

```
## Update and Print HSA Habitat Maps ##
```

```
import arcpy, os

hsa = ['Dry Forest', 'Dry Grassland and Shrubland', 'Mesic Forest', 'Mesic Grassland and Shrubland',
'Developed', 'Wetland', 'Wet Forest', 'Wet Grassland and Shrubland', 'Coastal', 'Stream']

for hab in hsa:
    print "Processing "+hab
    temp2 = hab.replace("-","_")
    pFolder = os.path.join(os.getcwd())
    oFolder = pFolder + "\\\" + temp2
    if not os.path.exists(oFolder):
        os.makedirs(oFolder)
    for filename in os.listdir(pFolder):
        fullpath = os.path.join(pFolder, filename)
        if os.path.isfile(fullpath):
            if filename.lower().endswith(".mxd"):
                mxd = arcpy.mapping.MapDocument(fullpath)
                for txt in arcpy.mapping.ListLayoutElements(mxd, "TEXT_ELEMENT"):
                    if txt.text.startswith('Current Habitat'):
                        txt.text = txt.text.replace('Current', hab)
                for df in arcpy.mapping.ListDataFrames(mxd):
                    layers = arcpy.mapping.ListLayers(mxd,"",df)
                    for lyr in layers:
                        if "OwnerDissolvedIn" in lyr.datasetName:
                            if (hab == "Coastal" or hab == "Stream" or hab == "Wetland"):
                                lyr.visible = False
```

```

else:
    lyr.visible = True

if "Grassland" not in hab:
    lyr.definitionQuery = "PIFWOHAB_2 = '{}'".format(hab)
    lyr.name = hab

else:
    if (hab == "Dry Grassland and Shrubland"):

        hab3 = "Dry Non-Forest"

    if (hab == "Mesic Grassland and Shrubland"):

        hab3 = "Mesic Non-Forest"

    if (hab == "Wet Grassland and Shrubland"):

        hab3 = "Wet Non-Forest"

    lyr.definitionQuery = "PIFWOHAB_2 = '{}'".format(hab3)

    hab2 = hab

    lyr.name = hab2.replace("Grassland and Shrubland", "Grass/Shrub")

if "darstreams" in lyr.datasetName:
    if hab == "Stream":
        lyr.visible = True
    else:
        lyr.visible = False

if "Coastal" in lyr.datasetName:
    if hab == "Coastal":
        lyr.visible = True
    else:
        lyr.visible = False

if "sysCRS" in lyr.datasetName:
    if hab == "Wetland":
        lyr.visible = True

```

```

else:
    lyr.visible = False

if "beforecontact" in lyr.datasetName:
    lyr.visible = False

temp = filename.split(".")
jpgOut = oFolder+"/"+temp[0]_+temp[0]+".jpg"
arcpy.mapping.ExportToJPEG(mxd, jpgOut)

del mxd

if (hab != 'Developed' and hab != 'Coastal' and hab != 'Stream' and hab != 'Wetland'):

    mxd = arcpy.mapping.MapDocument(fullpath)

    for txt in arcpy.mapping.ListLayoutElements(mxd, "TEXT_ELEMENT"):

        if txt.text.startswith('Current Habitat'):

            txt.text = txt.text.replace('Current', hab)

    for df in arcpy.mapping.ListDataFrames(mxd):

        layers = arcpy.mapping.ListLayers(mxd,"",df)

        for lyr in layers:

            if "OwnerDissolvedIn" in lyr.datasetName:

                if "Grassland" not in hab:

                    lyr.definitionQuery = "PIFWOHAB_2 = '{}'".format(hab)

                else:

                    if (hab == "Dry Grassland and Shrubland"):

                        hab3 = "Dry Non-Forest"

                    if (hab == "Mesic Grassland and Shrubland"):

                        hab3 = "Mesic Non-Forest"

                    if (hab == "Wet Grassland and Shrubland"):

                        hab3 = "Wet Non-Forest"

                    lyr.definitionQuery = "PIFWOHAB_2 = '{}'".format(hab3)

            lyr.name = "Current"

```

```

if "Coastal" in lyr.datasetName:
    lyr.visible = False

if "beforecontact" in lyr.datasetName:
    lyr.visible = True

if "Grassland" not in hab:
    lyr.definitionQuery = "HSA = '{}'".format(hab)
else:
    if (hab == "Dry Grassland and Shrubland"):
        hab3 = "Dry Non-Forest"

    if (hab == "Mesic Grassland and Shrubland"):
        hab3 = "Mesic Non-Forest"

    if (hab == "Wet Grassland and Shrubland"):
        hab3 = "Wet Non-Forest"

    lyr.definitionQuery = "HSA = '{}'".format(hab3)

lyr.name = "Historical"

temp = filename.split(".")
jpgOut = oFolder+"/"+temp[0]_historical.jpg"
arcpy.mapping.ExportToJPEG(mxd, jpgOut)

del mxd

print "Processing complete."

```

Appendix M. Code to compare NOAA and NWI Wetlands

```
#Mari K Reeves
```

```
#18_05_30_SummarizeWetlandHabitatsForHSAs
```

```
#This code will intersect the NWI and NOAA polygon layers with Land Ownership, Habitat Quality, Reserve Areas and Critical Habitats
```

```
#and generate summary tables and figures for the biologists doing the Habitat Status Assessment Reports.
```

```
#The NOAA layer was a polygon file that I generated from the rasters for the wetlands project
```

```
#I'm not filtering the NWI layer at all for this assessment
```

```
rm(list = ls()) #remove all past worksheet variables
```

```
set.seed(333)
```

```
# Read in Base Packages -----
```

```
pckg <- c("dplyr", "tidyr", "RColorBrewer", "ggplot2",
  "parallel", "gdalUtils", "rgdal", "rgeos",
  "spatial", "sp", "raster", "maptools", "spatialEco",
  "SpatialPack", "spatstat", "microbenchmark", "devtools",
  "snowfall", "tictoc")
```

```
# READING IN PACKAGES
```

```
for(i in 1:length(pckg)){
  if ((!pckg[i] %in% installed.packages())==T) {
```

```

install.packages(pckg[i], repos="http://cran.us.r-project.org",
                 dependencies = T)

print(pckg[i])

do.call("library", list(pckg[i]))

}else{

print(pckg[i])

do.call("library", list(pckg[i]))


}

}

#Define Directories

#BaseDir <- "J:/PIOGIS12/APPS/SH_CC/Mari/HSAs/"

BaseDir<- "C:/Users/marieees/Documents/HSAs/"

WorkingDir<-paste0(BaseDir, "HabitatStatusAssessmentsR/Hawaii")

SHADir<-paste0(BaseDir, "SHADataFiles/")

ConservationDir<-paste0(WorkingDir, "/ShapeFiles4R" )

OutDir<-paste0(ConservationDir, "/CoastalWetlandsStreamsOut")

WetDir<-paste0(OutDir, "/StreamsWetlandsCoastal")

ReportOut<-paste0(BaseDir, "HSAReports/18_06_24_CompNOAANWIWetlands" )

setwd(ReportOut)

#Set CRS for session

BigIslandCRS<- "+proj=utm +zone=5 +ellps=GRS80 +towgs84=0,0,0,-0,-0,0 +units=m +no_defs"

OtherIslandCRS<- "+proj=utm +zone=4 +ellps=GRS80 +towgs84=0,0,0,-0,-0,0 +units=m +no_defs"

sysCRS<-"+proj=utm +zone=4 +datum=NAD83 +units=m +no_defs +ellps=GRS80 +towgs84=0,0,0"

#colorblind friendly palatte:

cbPalette <- c("#999999", "#E69F00", "#56B4E9", "#009E73", "#F0E442", "#0072B2", "#D55E00",
               "#CC79A7", "#000000")

```

```
#Bring in files and transform them into the sysCRS - send them to a new folder - only need to run this once, so commented it out
```

```
#neededshps<-list.files(ConservationDir, pattern = ".shp$")

# #habitatsplit<-function(hab){

# for (myshp in neededshps){

#   #get rid of the shp extension

#   lyr <- sub(".shp$", "", myshp)#This gets rid of the .shp extension in the list of files

#   b<-readOGR(dsn = ConservationDir, layer = lyr)#read in the shpfile

#   print(proj4string(b))#check CRS

#   #transform it to the sysCRS

#   g<-spTransform(b, CRS(sysCRS))

#   print(proj4string(g))#recheck the spatial projections

#   #send it back out to a different file

#   outname<-paste0("18_05_24_sysCRS",lyr)

#   writeOGR(g, dsn = OutDir, layer = outname, driver="ESRI Shapefile", overwrite_layer = T)

# }
```

```
#Bring these files back in for intersection operations.
```

```
list.files(OutDir, full.names = T, pattern = ".shp")

own<-readOGR(dsn = OutDir, layer = "18_05_24_sysCRS18_05_03_DissolveOwnerIsland")

owndata<-own@data

ownBuffer<-gBuffer(own, byid=TRUE, width=0)#fix most gisValid errors
```

```
reserves<-readOGR(dsn = OutDir, layer = "18_05_24_sysCRSReserves")
```

```

crithab<-readOGR(dsn = OutDir, layer = "18_05_24_sysCRSCriticalHabitat")
crithabdata<-crithab@data

#clean up the reserve layer to delete reserves we don't think are important from a conservation
perspective

types2keep<-c( "Marine Life Conservation District", "National Historical Park",
             "National Park", "National Wildlife Refuge", "Natural Area Reserve",
             "Private Preserve", "State Wilderness Park","The Nature Conservancy Preserve",
             "Wildlife Sanctuary")

myreserves<-reserves[reserves$Type_Defin %in% types2keep,]

myreservedata<-myreserves@data

#write functions to intersect the streams, wetlands, and streams with reserves, critical habitat, and land
ownership, calculate and

#plot length in each status. I think I may just need to treat each of these guys separately and not do this
in a loop. Because the

#incoming datasets are so different. Bleh.

```

```

wetplaces<-list.files(WetDir, pattern = ".shp")
#
#
#~~~~~#
#~~~~~#
# Did this earlier...
#
# #read in NOAA Polygons and a csv to say which to keep or drop
#
list.files(OutDir)

```

```

noaa<-readOGR(dsn = OutDir, layer = "18_06_12_BestNOAAEWetlandFileEver")
levels(noaa$wtIndty)
noaa$wtIndty<-as.character(noaa$wtIndty)
noaa$wtIndty<-gsub("Scrub/Shrub", "Scrub Shrub", noaa$wtIndty)
noaa$wtIndty<-as.factor(noaa$wtIndty)

noaadata<-noaa@data
names(noaadata)
noaasummary<-aggregate(noaadata$Area_m, by = list(noaadata$island), FUN = sum)
names(noaasummary)<-c("Island", "aream2")
noaasummary$acres<-round(noaasummary$aream2*0.0002471, digits = 0)
noaasummary$aream2<- NULL
names(noaasummary)<- c("Island", "Acres of Wetlands on Island")
write.csv(noaasummary, file = "noaawetlandacresisland.csv")
writeOGR(noaa, dsn = OutDir, layer = "18_08_01_BestNOAAWetlandFileEver", driver="ESRI Shapefile",
overwrite_layer = T)

#bring in nwi and see if they map onto each other
nwi<-readOGR(dsn = WetDir, layer = "18_05_24_sysCRSHI_Wetlands" )
nwidata<-nwi@data

nwilut<-data.frame(table(nwidata$WETLAND_TY))

levels(nwilut$Var1)

#drop the Rivers and the Estuarine and Marine Deepwater, retaining all other categories for this
analysis.

nwilut$KEEP_DROP<-ifelse(nwilut$Var1 == "Estuarine and Marine Deepwater" | nwilut$Var1 ==
"Riverine" , "DROP", "KEEP")

```

```

nwiKeep<-nwilut[nwilut$KEEP_DROP == "KEEP",]

#Filter to keep only the wetlands I want
nwiwet<-nwi[nwi@data$WETLAND_TY %in% nwiKeep$Var1,]

nwiwet$aream2<-gArea(nwiwet, byid = T)

#check if that worked
nwiwetdata<-nwiwet@data

#there are fewer of them, yes.
plot(nwiwet, col = "red", border = "red")

nwiwet$Shape_Area<-round(nwiwet@data$Shape_Area, digits = 2)
nwiwet$aream2<-round(nwiwet@data$aream2, digits = 2)

writeOGR(nwiwet, dsn = OutDir, layer = "18_08_01_NWI4HSAsNoError", driver="ESRI Shapefile",
overwrite_layer = T)

#The big marine areas are gone
plot(noaa, col = "blue", border = "blue", add = T)

names(nwiwetdata)

save.image("~/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/CoastalWetlandsStreamsOut/18
_06_23NWINOAAWetlandsComp.RData")

write.csv(nwiwetdata, file = "18_06_23_nwiwet.csv")
write.csv(noadata, file = "18_06_23_noawet.csv")

```

```

noaawet<-noaa

#Calculate Areas and make an area statewide variable to use

noaawet$Area_m<-gArea(noaawet, byid = T)

noaawetdata<-noaawet@data

noaawetlandstotalarea<-gArea(noaawet)#161,763,248 meters


nwiwet$Area_m<-gArea(nwiwet, byid = T)

nwiwetlandstotalarea<-gArea(nwiwet) #650,756,448

nwiwetdata<-nwiwet@data


#Add in Island to table

#bring in a coastlines shape for an over statement...

list.files(ConservationDir)

coast<-readOGR(dsn = ConservationDir, layer = "Coastline2500m")




#transform it into the sysCRS

print(proj4string(coast))#check CRS

#transform it to the sysCRS

coast<-spTransform(coast, CRS(sysCRS))

print(proj4string(coast))#recheck the spatial projections

#send it back out to a different file

writeOGR(coast, dsn = OutDir, layer = "coast2500sysCRS", driver="ESRI Shapefile", overwrite_layer = F)

#run intersection to assign island names to wetland tables.


#Keep only islands of interest...The 2500m buffer makes it so smaller islands are included with Mains

```

```
#Get rid of Lehua and other islands we don't want to avoid double counting
```

```
levels(coast$Label)

islands2keep<-c( "Big Island", "Kahoolawe", "Kauai", "Lanai", "Maui", "Molokai", "Niihau", "Oahu"    )

coast<-coast[coast$Label %in% islands2keep,]

coastdata<-coast@data

#change name Big Island to Hawaii

coast$island<-sub("Big Island", "Hawaii", coast$Label)

nwiisland<-raster::intersect(nwiwet, coast )

plot(nwiisland)

nwiislanddata<-nwiisland@data

noaaisland<-raster::intersect(noawet, coast)

noaaislanddata<-noaaisland@data

#calculate Island Areas within main tables

nwiwetlandareas<-aggregate(nwiisland$Area_m, by = list(nwiisland$island), FUN = sum)

names(nwiisland@data)

names(nwiwetlandareas)<-c("island", "wetlandareaonisland")

nwiwetter<-merge(nwiisland, nwiwetlandareas)

#Fix names of scrub shrub to join with forested and get rid of dash

nwiwetter$WetlandType<-sub("Freshwater Forested/Shrub Wetland", "Freshwater Forested and Scrub Shrub Wetland", nwiwetter$WETLAND_TY)

nwiwetter$WetlandType<-sub("Lake", "Open Water", nwiwetter$WetlandType)

nwiwetter$WetlandType<-sub("Freshwater Pond", "Open Water", nwiwetter$WetlandType)
```

```

levels(as.factor(nwiwetter$WetlandType))

#create a column for nwi to use later
nwiwetter$dataset<- "nwi"

noaawetlandareas<-aggregate(noaa@data$Area_m, by = list(noaa@data$Island), FUN = sum)

names(noaa@data)
names(noaawetlandareas)<-c("Island", "wetlandareaonisland")
noaawetter<-merge(noaa@data, noaawetlandareas, by = "Island")

#create a dataset column for noaa to use later
noaawetter$dataset<- "noaa"

#add gridcode descriptions and call it wetland type to match NWI and edit categories in
#so that these match across datasets
levels(nwiwetter$WETLAND_TY)
# Keep Open Water
names(noaawetter)

checkme<-noaawetter@data
levels(noaawetter$wtlndty)
noaawetter$WetlandType<-sub("Water", "Open Water", noaawetter$wtlndty)
# Keep Unconsolidated shore
noaawetter$WetlandType<-sub("19", "Unconsolidated Shore", noaawetter$WetlandType)
# Lump all estuarine wetlands and estuarine aquatic beds into Estuarine and Marine
#Wetlands category
noaawetter$WetlandType<-sub("23", "Estuarine and Marine Wetland", noaawetter$WetlandType)
noaawetter$WetlandType<-sub("18", "Estuarine and Marine Wetland", noaawetter$WetlandType)

```

```
noaawetter$WetlandType<-sub("17", "Estuarine and Marine Wetland" , noaawetter$WetlandType)
noaawetter$WetlandType<-sub("16", "Estuarine and Marine Wetland" , noaawetter$WetlandType)
```

```
#Lump all the following into freshwater Forested and Shrub Scrub Wetlands,
```

```
#gridcodes 13, 14, palustrine forested and scrub shrub
```

```
noaawetter$WetlandType<-sub("13", "Freshwater Forested and Scrub Shrub Wetland" ,
noaawetter$WetlandType)
```

```
noaawetter$WetlandType<-sub("14", "Freshwater Forested and Scrub Shrub Wetland" ,
noaawetter$WetlandType)
```

```
# Lump palustrine emergent wetlands and palustrine aquatic beds to Freshwater
```

```
#Emergent Wetland category
```

```
noaawetter$WetlandType<-sub("15", "Freshwater Emergent Wetland" , noaawetter$WetlandType)
```

```
noaawetter$WetlandType<-sub("22", "Freshwater Emergent Wetland" , noaawetter$WetlandType)
```

```
levels(as.factor(noaawetter$WetlandType))
```

```
#aggregate these guys by variables we're interested in summarizing:
```

```
#Wetland Type, island, island area, WetlandType
```

```
agnwi<-aggregate(nwiwetter$Area_m, by = list(nwiwetter$island, nwiwetter$WetlandType,
nwiwetter$dataset, nwiwetter$wetlandareaonisland), FUN = sum)
```

```
names(agnwi)<-c("island", "wetlandtype", "dataset", "wetlandareaonisland", "Area_m")
```

```
agno<-aggregate(noaawetter$Area_m, by = list(noaawetter$island.2, noaawetter$WetlandType,
noaawetter$dataset, noaawetter$wetlandareaonisland), FUN = sum)
```

```
names(agnwi)<-c("island", "wetlandtype", "dataset", "wetlandareaonisland", "Area_m")  
#bind the aggregated files together so I only need to work with one data file for plots and tables
```

```
wetlands<-rbind(agnwi, agno)
```

```
#finally. One dataset that I can facet
```

```
names(wetlands)
```

```
wetlands$acres<-round(wetlands$Area_m*0.0002471, digits = 0)
```

```
#convert the wetland area on island column to acres and round it too
```

```
wetlands$WetlandAcresOnIsle<-round(wetlands$wetlandareaonisland*0.0002471, digits = 0)
```

```
#drop the m2 area columns
```

```
wetlands<-wetlands[,c("island","wetlandtype","dataset", "acres","WetlandAcresOnIsle")]
```

```
wetlands$propwetlandsisle<-round((wetlands$acres/wetlands$WetlandAcresOnIsle)*100, digits = 0)
```

```
wetlands$dataset<-sub("noaa", "NOAA - CCAP", wetlands$dataset)
```

```
wetlands$dataset<-sub("nwi", "USFWS - NWI", wetlands$dataset)
```

```
#create a few comparison plots for the different datasets
```

```
#acres of wetlands on each island
```

```
str(wetlands)
```

```
wetlands$wetlandtype<-as.factor(wetlands$wetlandtype)
```

```
wetlands$island<-as.factor(wetlands$island)
```

```
wetlands$dataset<-as.factor(wetlands$dataset)
```

```
a<-ggplot(wetlands, aes(wetlands$dataset, wetlands$acres, fill = wetlands$wetlandtype))
```

```
datacompare<- a+geom_bar(stat="identity", position = "stack") +
```

```

labs(fill = "Wetland Type", title = "Wetland Areas by Type - Comparing Datasets", x = "Wetlands
Dataset", y = "Area (Acres)")+
  scale_fill_manual(values=cbPalette)
ggsave(filename="CompareWetlandAreaTypeData.jpg", plot=datacompare, device = "jpg" )

b<-ggplot(wetlands, aes(wetlands$island, wetlands$acres, fill = wetlands$dataset))
wettypecompare<- b+geom_bar(stat="identity", position = "dodge") +
  labs(fill = "Wetlands Dataset", title = "Wetland Areas by Dataset - Comparing Islands", x = "Island", y =
"Area (Acres)")+
  scale_fill_manual(values=cbPalette)
ggsave(filename="CompareWetlandDatasetsbyIsland.jpg", plot=wettypecompare, device = "jpg" )

#~~~~~
~~~~~

#summarize land ownership for wetlands habitats
#Mari K Reeves
#18_05_30_SummarizeWetlandHabitatsForHSAs

#This code will intersect the NWI and NOAA polygon layers with Land Ownership, Habitat Quality,
Reserve Areas and Critical Habitats
#and generate summary tables and figures for the biologists doing the Habitat Status Assessment
Reports.

#The NOAA layer was a polygon file that I generated from the rasters for the wetlands project

#I'm not filtering the NWI layer at all for this assessment

rm(list = ls()) #remove all past worksheet variables

```

```

set.seed(333)

# Read in Base Packages -----
pckg <- c("dplyr", "tidyr", "RColorBrewer", "ggplot2",
        "parallel", "gdalUtils", "rgdal", "rgeos",
        "spatial", "sp", "raster", "maptools", "spatialEco",
        "SpatialPack", "spatstat", "microbenchmark", "devtools",
        "snowfall", "tictoc")

# READING IN PACKAGES
for(i in 1:length(pckg)){
  if ((!pckg[i] %in% installed.packages())==T) {
    install.packages(pckg[i], repos="http://cran.us.r-project.org",
                      dependencies = T)
    print(pckg[i])
    do.call("library", list(pckg[i]))
  }else{
    print(pckg[i])
    do.call("library", list(pckg[i]))
  }
}

#Define Directories
#BaseDir <- "J:/PIOGIS12/APPS/SH_CC/Mari/HSAs/"
BaseDir<-"C:/Users/marieeves/Documents/HSAs/"
WorkingDir<-paste0(BaseDir, "HabitatStatusAssessmentsR/Hawaii")
SHADir<-paste0(BaseDir, "SHADataFiles/")
ConservationDir<-paste0(WorkingDir, "/ShapeFiles4R" )

```

```

OutDir<-paste0(ConservationDir, "/CoastalWetlandsStreamsOut")

WetDir<-paste0(OutDir, "/StreamsWetlandsCoastal")

setwd(OutDir)

#Set CRS for session

BigIslandCRS<- "+proj=utm +zone=5 +ellps=GRS80 +towgs84=0,0,0,-0,-0,0 +units=m +no_defs"

OtherIslandCRS<- "+proj=utm +zone=4 +ellps=GRS80 +towgs84=0,0,0,-0,-0,0 +units=m +no_defs"

sysCRS<-"+proj=utm +zone=4 +datum=NAD83 +units=m +no_defs +ellps=GRS80 +towgs84=0,0,0

#colorblind friendly palatte:

cbPalette <- c("#999999", "#E69F00", "#56B4E9", "#009E73", "#F0E442", "#0072B2", "#D55E00",
  "#CC79A7", "#000000")

#Bring in files and transform them into the sysCRS - send them to a new folder - only need to run this
once, so commented it out

#neededshps<-list.files(ConservationDir, pattern = ".shp$")

# #habitatsplit<-function(hab){

# for (myshp in neededshps){

#   #get rid of the shp extension

#   lyr <- sub(".shp$", "", myshp)#This gets rid of the .shp extension in the list of files

#   b<-readOGR(dsn = ConservationDir, layer = lyr)#read in the shpfile

#   print(proj4string(b))#check CRS

#   #transform it to the sysCRS

#   g<-spTransform(b, CRS(sysCRS))

#   print(proj4string(g))#recheck the spatial projections

#   #send it back out to a different file

#   outname<-paste0("18_05_24_sysCRS",lyr)

#   writeOGR(g, dsn = OutDir, layer = outname, driver="ESRI Shapefile", overwrite_layer = T)
}

```

```

# }

#Bring these files back in for intersection operations.

list.files(OutDir, full.names = T, pattern = ".shp")

own<-readOGR(dsn = OutDir, layer = "18_05_24_sysCRS18_05_03_DissolveOwnerIsland")

owndata<-own@data

ownBuffer<-gBuffer(own, byid=TRUE, width=0)#fix most gisValid errors

reserves<-readOGR(dsn = OutDir, layer = "18_05_24_sysCRSReserves")

crithab<-readOGR(dsn = OutDir, layer = "18_05_24_sysCRSCriticalHabitat")

crithabdata<-crithab@data

#clean up the reserve layer to delete reserves we don't think are important from a conservation
perspective

types2keep<-c( "Marine Life Conservation District", "National Historical Park",
             "National Park", "National Wildlife Refuge", "Natural Area Reserve",
             "Private Preserve", "State Wilderness Park", "The Nature Conservancy Preserve",
             "Wildlife Sanctuary")

myreserves<-reserves[reserves$Type_Defin %in% types2keep,]

myreservedata<-myreserves@data

crithab<-readOGR(dsn = OutDir, layer = "CriticalHabitatsysCRSOnePoly")

crithabdata<-crithab@data

#write functions to intersect the streams, wetlands, and streams with reserves, critical habitat, and land
ownership, calculate and

#plot length in each status. I think I may just need to treat each of these guys separately and not do this
in a loop. Because the

```

```
#incoming datasets are so different. Bleh.
```

```
wetplaces<-list.files(WetDir, pattern = ".shp")
```

```
#
```

```
#
```

```
#~~~~~  
~~~~~
```

```
# Did this earlier...
```

```
#
```

```
# #read in NOAA Polygons and a csv to say which to keep or drop
```

```
#
```

```
list.files(WetDir)
```

```
noaa<-readOGR(dsn = WetDir, layer = "18_06_12_BestNOAAEWetlandFileEver")
```

```
noaaDesc<-read.csv(paste0(WetDir, "/18_05_28_HSA_NOAA2KEEPDROP.csv"))
```

```
noaaDrop<-noaaDesc[noaaDesc$KEEP_DROP == "DROP",]
```

```
noaaKeep<-noaaDesc[noaaDesc$KEEP_DROP == "KEEP",]
```

```
#Filter to keep only the wetlands
```

```
noaawet<-noaa[noaa@data$gridcode %in% noaaKeep$NOAA_CAT,]
```

```
#
```

```
#
```

```
# #reproject the wetland file
```

```
noaawet<-spTransform(noaawet, CRS(sysCRS))
```

```
#save this to file so we can restart R and not bring in the whole NOAA poly file.
```

```
writeOGR(noaawet, dsn = WetDir, layer = "18_05_28_NOAAWetlands", driver="ESRI Shapefile",
overwrite_layer = T)
```

```
list.files(WetDir)
```

```
noaawet<-readOGR(dsn = WetDir, layer = "18_05_28_NOAAWetlands")
```

```
# #check this worked
```

```
plot(noaa)
```

```
#bring in nwi and see if they map onto each other
```

```
nwi<-readOGR(dsn = WetDir, layer = "18_05_24_sysCRSHI_Wetlands" )
```

```
plot(nwi, add = T, col = "red")
```

```
nwidata<-nwi@data
```

```
nwilut<-data.frame(table(nwidata$WETLAND_TY))
```

```
write.csv(nwilut, file = "nwi2keep.csv")
```

```
#drop the Rivers and the Estuarine and Marine Deepwater, retaining all other categories for this analysis.
```

```
#oops, I did this in Excel by habit. could have should have done it here...oh well. Missed opportunity
```

```
nwikeepdrop<-read.csv(paste0(OutDir, "/nwi2keep.csv"))
```

```
nwiKeep<-nwikeepdrop[nwikeepdrop$KEEP_DROP == "KEEP",]
```

```
#Filter to keep only the wetlands I want
```

```

nwiwet<-nwi[nwi@data$WETLAND_TY %in% nwiKeep$WETLAND_TY,]

#check if that worked

nwiwetdata<-nwiwet@data

#there are fewer of them, yes.

plot(nwiwet, col = "red", add = T)

#The big marine areas are gone

plot(noaawet, col = "blue")

noaawetdata<-noaawet@data

load("~/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/CoastalWetlandsStreamsOut/18_05_31
_PostNOAAWetlandsWorkspace.RData")

noaawetdata<-noaawet@data

write.csv(nwiwetdata, file = "18_05_30_nwiwet.csv")

write.csv(noaawetdata, file = "18_05_30_noaawet.csv")

#Calculate Areas and make an area statewide variable to use

noaawet$Area_m<-gArea(noaawet, byid = T)

noaawetdata<-noaawet@data

noaawetlandstotalarea<-gArea(noaawet)#931,240,823 meters

nwiwet$Area_m<-gArea(nwiwet, byid = T)

nwiwetlandstotalarea<-gArea(nwiwet) #65,075,6448

nwiwetdata<-nwiwet@data

```

```

#Add in Island to table

#bring in a coastlines shape for an over statement...

list.files(ConservationDir)

coast<-readOGR(dsn = ConservationDir, layer = "Coastline2500m")



#transform it into the sysCRS

print(proj4string(coast))#check CRS

#transform it to the sysCRS

coast<-spTransform(coast, CRS(sysCRS))

print(proj4string(coast))#recheck the spatial projections

#send it back out to a different file

writeOGR(coast, dsn = OutDir, layer = "coast2500sysCRS", driver="ESRI Shapefile", overwrite_layer = T)

#run intersection to assign island names to wetland tables.

#Keep only islands of interest...The 2500m buffer makes it so smaller islands are included with Mains

#Get rid of Lehua and other islands we don't want to avoid double counting

levels(coast$Label)

islands2keep<-c( "Big Island" , "Kahoolawe" , "Kauai" , "Lanai" , "Maui" , "Molokai" , "Niihau" , "Oahu" )

coast<-coast[coast$Label %in% islands2keep,]

coastdata<-coast@data

#change name Big Island to Hawaii

coast$island<-sub("Big Island", "Hawaii", coast$Label)

nwiisland<-raster::intersect(nwiwet, coast )

```

```

plot(nwiisland)

nwiislanddata<-nwiisland@data


noaaisland<-raster::intersect(noaawet, coast)

noaaislanddata<-noaaisland@data

#calculate Island Areas within main tables

nwiwetlandareas<-aggregate(nwiisland$Area_m, by = list(nwiisland$island), FUN = sum)

names(nwiisland@data)

names(nwiwetlandareas)<-c("island", "wetlandareaonisland")

nwiwetter<-merge(nwiisland, nwiwetlandareas)

#Fix names of scrub shrub to join with forested and get rid of dash

nwiwetter$WetlandType<-sub("Freshwater Forested/Shrub Wetland", "Freshwater Forested and Scrub
Shrub Wetland", nwiwetter$WETLAND_TY)

nwiwetter$WetlandType<-sub("Lake", "Open Water", nwiwetter$WetlandType)

nwiwetter$WetlandType<-sub("Freshwater Pond", "Open Water", nwiwetter$WetlandType)

levels(as.factor(nwiwetter$WetlandType))

#create a column for nwi to use later

nwiwetter$dataset<-"nwi"

noaawetlandareas<-aggregate(noaaisland$Area_m, by = list(noaaisland$island), FUN = sum)

names(noaaisland@data)

names(noaawetlandareas)<-c("island", "wetlandareaonisland")

noaawetter<-merge(noaaisland, noaawetlandareas)

```

```

#create a dataset column for noaa to use later

noaawetter$dataset<-"noaa"

#add gridcode descriptions and call it wetland type to match NWI and edit categories in
#so that these match across datasets

levels(nwiwetter$WETLAND_TY)

# Keep Open Water

noaawetter$WetlandType<-sub("21", "Open Water", noaawetter$gridcode)

# Keep Unconsolidated shore

noaawetter$WetlandType<-sub("19", "Unconsolidated Shore", noaawetter$WetlandType)

# Lump all estuarine wetlands and estuarine aquatic beds into Estuarine and Marine

#Wetlands category

noaawetter$WetlandType<-sub("23", "Estuarine and Marine Wetland" , noaawetter$WetlandType)
noaawetter$WetlandType<-sub("18", "Estuarine and Marine Wetland" , noaawetter$WetlandType)
noaawetter$WetlandType<-sub("17", "Estuarine and Marine Wetland" , noaawetter$WetlandType)
noaawetter$WetlandType<-sub("16", "Estuarine and Marine Wetland" , noaawetter$WetlandType)

#Lump all the following into freshwater Forested and Shrub Scrub Wetlands,
#gridcodes 13, 14, palustrine forested and scrub shrub

noaawetter$WetlandType<-sub("13", "Freshwater Forested and Scrub Shrub Wetland" ,
noaawetter$WetlandType)
noaawetter$WetlandType<-sub("14", "Freshwater Forested and Scrub Shrub Wetland" ,
noaawetter$WetlandType)

# Lump palustrine emergent wetlands and palustrine aquatic beds to Freshwater

#Emergent Wetland category

noaawetter$WetlandType<-sub("15", "Freshwater Emergent Wetland" , noaawetter$WetlandType)

```

```

noaawetter$WetlandType<-sub("22", "Freshwater Emergent Wetland" , noaawetter$WetlandType)

levels(as.factor(noaawetter$WetlandType))

#aggregate these guys by variables we're interested in summarizing:
#Wetland Type, island, island area, WetlandType

agnwi<-aggregate(nwiwetter$Area_m, by = list(nwiwetter$island, nwiwetter$WetlandType,
nwiwetter$dataset, nwiwetter$wetlandareaonisland), FUN = sum)
names(agnwi)<-c("island", "wetlandtype", "dataset", "wetlandareaonisland", "Area_m")
agno<-aggregate(noaawetter$Area_m, by = list(noaawetter$island, noaawetter$WetlandType,
noaawetter$dataset, noaawetter$wetlandareaonisland), FUN = sum)
names(agno)<-c("island", "wetlandtype", "dataset", "wetlandareaonisland", "Area_m")
#bind the aggregated files together so I only need to work with one data file for plots and tables

wetlands<-rbind(agnwi, agno)

#finally. One dataset that I can facet by dataset

names(wetlands)
wetlands$acres<-round(wetlands$Area_m*0.0002471, digits = 0)

#convert the wetland area on island column to acres and round it too
wetlands$WetlandAcresOnIsle<-round(wetlands$wetlandareaonisland*0.0002471, digits = 0)
#drop the m2 area columns
wetlands<-wetlands[,c("island","wetlandtype","dataset", "acres","WetlandAcresOnIsle")]

wetlands$propwetlandsisle<-round((wetlands$acres/wetlands$WetlandAcresOnIsle)*100, digits = 0)

```

```

wetlands$dataset<-sub("noaa", "NOAA - CCAP", wetlands$dataset)
wetlands$dataset<-sub("nwi", "USFWS - NWI", wetlands$dataset)

#create a few comparison plots for the different datasets
#acres of wetlands on each island
str(wetlands)
wetlands$wetlandtype<-as.factor(wetlands$wetlandtype)
wetlands$island<-as.factor(wetlands$island)
wetlands$dataset<-as.factor(wetlands$dataset)

a<-ggplot(wetlands, aes(wetlands$dataset, wetlands$acres, fill = wetlands$wetlandtype))
datacompare<- a+geom_bar(stat="identity", position = "stack") +
  labs(fill = "Wetland Type", title = "Wetland Areas by Type - Comparing Datasets", x = "Wetlands Dataset", y = "Area (Acres)")+
  scale_fill_manual(values=cbPalette)
ggsave(filename="CompareWetlandAreaTypeData.tif", plot=datacompare, device = "tiff" )

b<-ggplot(wetlands, aes(wetlands$island, wetlands$acres, fill = wetlands$dataset))
wettypecompare<- b+geom_bar(stat="identity", position = "dodge") +
  labs(fill = "Wetlands Dataset", title = "Wetland Areas by Dataset - Comparing Islands", x = "Island", y = "Area (Acres)")+
  scale_fill_manual(values=cbPalette)
ggsave(filename="CompareWetlandDatasetsbyIsland.tif", plot=wettypecompare, device = "tiff" )

load("~/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/CoastalWetlandsStreamsOut/18_05_31
_preintersectworkspacewetlands.RData")
#~~~~~
~~~
```

```
#~~~~~Run the Raster to Poly Extractions. these take 26 hours to  
run
```

```
habqual<-  
raster("C:/Users/marieeves/Documents/HSAs/SHADataFiles/CarbonAssessment2017VegLayers/CAH_H  
abStatus/CAH_HabStatus.tif")  
proj4string(habqual)  
proj4string(nwiwetter)  
plot(habqual)  
tic()  
intersectqualni<-raster::extract(habqual, nwiwetter)  
  
toc()
```

```
#make a copy of extracted data to work with:
```

```
nwiqualintersect<-intersectqualni
```

```
# # Get class counts for each polygon  
nwi.counts <- lapply(nwiqualintersect,table)  
#  
# # Calculate class percentages for each polygon  
nwi.pct <- lapply(nwi.counts, FUN=function(x){ x / sum(x) } )  
#  
# # Create a data.frame where missing classes are NA
```

```
class.df<-plyr::ldply(nwi.pct, rbind)
```

```
# # Replace NA's with 0 and add names
```

```
class.df[is.na(class.df)] <- 0
```

```

names(class.df) <- paste("class", names(class.df),sep="")

## Add back to polygon data
nwiwetterdata<-nwiwetter@data
nwiwetterdata <- cbind(nwiwetterdata, class.df)
head(nwiwetterdata)
write.csv(nwiwetterdata, file = "nwihabqualextract.csv")

tic()
intersectqualno<-raster::extract(habqual, noaawetter )

toc()

noaaqualintersect<-intersectqualno

## Get class counts for each polygon
noaa.counts <- lapply(noaaqualintersect,table)
#
## Calculate class percentages for each polygon
noaa.pct <- lapply(noaa.counts, FUN=function(x){ x / sum(x) } )
#
## Create a data.frame where missing classes are NA

class.df2<-plyr::ldply(noaa.pct, rbind)

## Replace NA's with 0 and add names
class.df2[is.na(class.df2)] <- 0
names(class.df2) <- paste("class", names(class.df2),sep="")

```

```

# # Add back to polygon data

noaawetterdata<-noaawetter@data

noaawetterdata <- cbind(noaawetterdata, class.df2)

head(noaawetterdata)

write.csv(noaawetterdata, file = "noaabqualextract.csv")

save.image("~/HSAs/HabitatStatusAssessmentsR/Hawaii/18_06_04_PostExtractWorkspace.RData")

#make a list of these data tables to process

priceextract<-c("nwiwetterdata", "noaawetterdata" )

#define columns to keep in each layer

names(noaawetterdata)

moneyshot<-c("island", "wetlandareaonisland","WetlandType","dataset", "Area_m",
"class1","class2","class3","class4")

for (spendy in priceextract){

  w<-get(spendy)[,moneyshot] #get the file from the global env and keep only the columns in moneyshot

  # drop unwanted variables

  #convert the wetland area on island column to acres and round it too

  w$WetlandAcresOnIsle<-round(w$wetlandareaonisland*0.0002471, digits = 0)

  w$acres<-round(w$Area_m*0.0002471, digits = 2)

  w$dataset<-sub("noaa", "NOAA - CCAP", w$dataset)

  w$dataset<-sub("nwi", "USFWS - NWI", w$dataset)

  #calculate area proportion of wetlands on island

  w$propwetlandsisle<-round((w$acres/w$WetlandAcresOnIsle)*100, digits = 2)
}

```

```
#rename the "class" columns and calculate acreages in each category per polygon  
# Class descriptions from the metadata: If Habqual was already distrubed (category = 1),  
# then it was NEVER overwritten as bare earth; instead it remained classified as disturbed.  
# Lastly, the TIGER roads layer was buffered and converted into a raster of category 1 (distrubed).  
# The roads raster was then mosaic'ed on top of Habqual to expand the distrubed class to include roads  
# adjacent disturbed areas.This layer has four mapped values: 1 = heavily disturbed areas including  
agriculture and urban developments;  
# 2 = mixed native-alien dominated plant communities; 3 = native dominated vegetation;  
# and 4 = bare lands or <5% plant cover.ReferencesARIS B.V. 2014, GRID Editor for ArcMap. ARIS  
B.V., Netherlands.
```

```
w$AcresDisturbed<-round(w$class1*w$acres, digits = 5)  
w$AcresBarren<-round(w$class4*w$acres, digits = 5)  
w$AcresNative<-round(w$class3*w$acres, digits = 5)  
w$AcresNonNative<-round(w$class2*w$acres, digits = 5)
```

```
#drop the m2 area columns and the "class" columns
```

```
w<-w[,c("island","WetlandType","dataset", "acres","WetlandAcresOnIsle", "propwetlandsisle",  
"AcresDisturbed", "AcresBarren", "AcresNative", "AcresNonNative")]
```

```
#give better names
```

```
names(w)<-c("Island","Wetland Type","Dataset", "Area (Acres)","Total Wetland Area on Island (Acres)",  
"Area (% of Wetland Area on Island", "Area Disturbed (Acres)", "Area Barren (Acres)", "Area Native  
Dominated (Acres)", "Area Non-Native Dominated (Acres)")
```

```
#save the raw data
```

```
#write file to drive
```

```

outname2<-sub("wetterdata", "habqualraw.csv", spendy)

write.csv(w, file = outname2)

u<-aggregate(list(w$`Area Barren (Acres)`, w$`Area Disturbed (Acres)`, w$`Area Native Dominated (Acres)`, w$`Area Non-Native Dominated (Acres)`), by = list(w$Island, w$`Wetland Type`,w$Dataset, w$`Total Wetland Area on Island (Acres)` ), FUN = sum)

names(u)<-c("Island","Wetland Type","Dataset","Total Wetland Area on Island (Acres)", "Area Barren (Acres)", "Area Disturbed (Acres)", "Area Native Dominated (Acres)", "Area Non-Native Dominated (Acres)")

u$`Area Barren (Acres)`<-round(u$`Area Barren (Acres)`, digits = 1)

u$`Area Native Dominated (Acres)`<-round(u$`Area Native Dominated (Acres)`, digits = 1)

u$`Area Non-Native Dominated (Acres)`<-round(u$`Area Non-Native Dominated (Acres)`, digits = 1)

u$`Area Disturbed (Acres)`<-round(u$`Area Disturbed (Acres)`, digits = 1)

u$propbarren<-round((u$`Area Barren (Acres)` /u$`Total Wetland Area on Island (Acres)` )*100, digits = 1)

u$propnative<-round((u$`Area Native Dominated (Acres)`/u$`Total Wetland Area on Island (Acres)`)*100, digits = 1)

u$propnonnative<-round((u$`Area Non-Native Dominated (Acres)`/u$`Total Wetland Area on Island (Acres)`)*100, digits = 1)

u$propdisturbed<-round((u$`Area Disturbed (Acres)`/u$`Total Wetland Area on Island (Acres)`)*100, digits = 1)

```

#drop the wetland area on island column

```

u<-u[, c( "Island","Wetland Type","Dataset","Area Barren (Acres)","Area Disturbed (Acres)" ,
"Area Native Dominated (Acres)","Area Non-Native Dominated (Acres)","propbarren" ,
"propnative","propnonnative","propdisturbed")]

```

#rename variables

```

names(u)<-c("Island","Wetland Type","Dataset",

```

```

"Area Barren (Acres)", "Area Disturbed (Acres)" ,  

"Area Native Dominated (Acres)", "Area Non-Native Dominated (Acres)", "Barren (% of Wetland Area on  

Island)" ,  

"Native Dominated (% of Wetland Area on Island)", "Non-Native Dominataed (% of Wetland Area on  

Island)" , "Disturbed (% of Wetland Area on Island)" )

```

#Create a couple tables while these are numeric to use later

```

areas<-u[,c( "Island", "Wetland Type", "Dataset", "Area Barren (Acres)" , "Area Disturbed (Acres)" ,  

"Area Native Dominated (Acres)", "Area Non-Native Dominated (Acres)" )]

```

```

percentages<-u[,c( "Island", "Wetland Type", "Dataset", "Barren (% of Wetland Area on Island)" ,  

"Native Dominated (% of Wetland Area on Island)", "Non-Native Dominataed (% of Wetland  

Area on Island)" ,  

"Disturbed (% of Wetland Area on Island)" )]

```

```

arealong<-gather(areas, key = "Descriptor", value = "Acres", 4:7)  

arealong$HabitatQuality<-sub("Area ", "", arealong$Descriptor)  

arealong$HabitatQuality<-sub("\\"(Acres)", "", arealong$HabitatQuality)  

arealong <- select(arealong, -Descriptor)

```

```

pctlong<-gather(percentages, key = "Descriptor", value = "Percent of Wetland Habitat on Island", 4:7)  

pctlong$HabitatQuality<-sub("\\"(% of Wetland Area on Island)", "", pctlong$Descriptor)  

pctlong <- select(pctlong, -Descriptor)

```

#reorder Habitat Quality Variables So they Plot in more intuitive colors

```

str(arealong)  

arealong$HabitatQuality<-as.factor(arealong$HabitatQuality)  

levels(arealong$HabitatQuality)

```

```
arealong$HabitatQuality <- ordered(arealong$HabitatQuality, levels = c("Disturbed ", "Barren ", "Non-Native Dominated ", "Native Dominated "))
```

```
#check this worked
```

```
levels(arealong$HabitatQuality)
```

```
#now we can make pretty
```

```
k<-ggplot(arealong, aes(arealong$Island, arealong$Acres , fill = arealong$HabitatQuality))
```

```
pretty1<-k+geom_bar(stat = "identity", position = "stack")+
```

```
labs(fill = "Habitat Quality", title = "Wetlands Summary", x = "Island", y = "Area (Acres)" ) +
```

```
theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+
```

```
scale_fill_manual(values=cbPalette)
```

```
plotname1<- sub("wetterdata", "QualPlot.tif", spendy)
```

```
ggsave(filename=plotname1, plot=pretty1, device = "tiff" )
```

```
u$`Area Barren (Acres)`[u$`Area Barren (Acres)` <1]<"<1"
```

```
u$`Area Native Dominated (Acres)`[u$`Area Native Dominated (Acres)` <1]<"<1"
```

```
u$`Area Non-Native Dominated (Acres)`[u$`Area Non-Native Dominated (Acres)` <1]<"<1"
```

```
u$`Area Disturbed (Acres)`[u$`Area Disturbed (Acres)` <1]<"<1"
```

```
u$`Barren (% of Wetland Area on Island)` [u$`Barren (% of Wetland Area on Island)` <1]<"<1"
```

```
u$`Native Dominated (% of Wetland Area on Island)` [u$`Native Dominated (% of Wetland Area on Island)` <1]<"<1"
```

```
u$`Non-Native Dominataed (% of Wetland Area on Island)` [u$`Non-Native Dominataed (% of Wetland Area on Island)` <1]<"<1"
```

```
u$`Disturbed (% of Wetland Area on Island)` [u$`Disturbed (% of Wetland Area on Island)` <1]<"<1"
```

```

#write file to drive

outname<-sub("wetterdata", "habqualsummary.csv", spendy)

write.csv(u, file = outname)

}

#~~~~~Run the Poly to Poly
Intersections~~~~~


#summarize land ownership for wetlands habitats - These take 10 hours to run

typeownni<-raster::intersect(nwiwetter, ownBuffer )

typeownni$newarea_m<-gArea(typeownni, byid = T)

typeownnidata<-typeownni@data

write.csv(intersectownnidata, file = "intersectownnidata.csv")

typeownni$keyinfo<-typeownni$BigstOwner

toc()

tic()

typeownno<-raster::intersect(noaawetter, ownBuffer)

typeownno$newarea_m<-gArea(typeownno, byid = T)

typeownnodata<-typeownno@data

write.csv(intersectownnodata, file = "intersectownnodata.csv")

typeownno$keyinfo<-typeownno$BigstOwner

toc()

tic()

```

```

intersectresni<-raster::intersect(nwiwetter, myreserves)

intersectresni$newarea_m<-gArea(intersectresni, byid = T)

intersectresnidata<-intersectresni@data

write.csv(intersectresnidata, file = "intersectresnidata.csv")

intersectresni$keyinfo<-intersectresni$type_Defin

toc()

tic()

intersectresno<-raster::intersect(noaawetter, myreserves)

intersectresno$newarea_m<-gArea(intersectresno, byid = T)

intersectresnodata<-intersectresno@data

write.csv(intersectresnodata, file = "intersectresnodata.csv")

intersectresno$keyinfo<-intersectresno$type_Defin

toc()

tic()

intersectchni<-raster::intersect(nwiwetter, crithab)

intersectchni$newarea_m<-gArea(intersectchni, byid = T)

intersectchnidata<-intersectchni@data

write.csv(intersectchnidata, file = "intersectchnidata.csv")

intersectchni$keyinfo<-"Designated as Critical Habitat"

toc()

tic()

intersectchno<-raster::intersect(noaawetter, crithab)

intersectchno$newarea_m<-gArea(intersectchno, byid = T)

intersectchnodata<-intersectchno@data

write.csv(intersectchnodata, file = "intersectchnodata.csv")

intersectchno$keyinfo<-"Designated as Critical Habitat"

```

```
toc()
```

```
save.image("~/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/CoastalWetlandsStreamsOut/18_06_01_post_wetland_intersections_workspace.RData")
```

```
#write a function to take in all these extraction files, retain only needed columns, and save them as shpfiles
```

```
#how do I call the things I want to keep here, when some of the variables differ across datasets, and the numbers are not the same either?
```

```
#I think I just have to rename one thing manually...the extracted attribute to "keyinfo"
```

```
#make a list of keeper variables for each outfile:
```

```
keepers<-c("island", "wetlandareaonisland","WetlandType","dataset","newarea_m", "keyinfo" )
```

```
extractions <- c("typeownni", "typeownno", "intersectownni", "intersectownno", "intersectresni", "intersectresno", "intersectchni", "intersectchno")
```

```
for (ex in extractions[1]) {
```

```
  # drop unwanted variables
```

```
  j<-get(ex)[,keepers]
```

```
  #convert the wetland area on island column to acres and round it too
```

```
  j$WetlandAcresOnIsle<-round(j$wetlandareaonisland*0.0002471, digits = 0)
```

```
  j$acres<-round(j$newarea_m*0.0002471, digits = 2)
```

```
  j$dataset<-sub("noaa", "NOAA - CCAP", j$dataset)
```

```
  j$dataset<-sub("nwi", "USFWS - NWI", j$dataset)
```

```
  #calculate area proportion of wetlands on island
```

```
  j$propwetlandsisle<-round((j$acres/j$WetlandAcresOnIsle)*100, digits = 2)
```

```
  #drop the m2 area columns
```

```

j<-j[,c("island","WetlandType","dataset", "keyinfo", "acres","WetlandAcresOnIsle",
"propwetlandsisle")]

#give better names

names(j)<-c("Island","Wetland Type","Dataset","Summary Variable" , "Area (Acres)","Total Wetland
Area on Island (Acres)", "Area (% of Wetland Area on Island)")

jdata<-j@data

d<-aggregate(j$`Area (Acres)`, by = list(j$Island, j$`Wetland Type`,j$Dataset, j$`Total Wetland Area on
Island (Acres)` , j$`Summary Variable` ), FUN = sum)

names(d)<-c("Island","Wetland Type","Dataset","Total Wetland Area on Island (Acres)","Summary
Variable" , "Area (Acres)")

d$acres<-as.numeric(d$`Area (Acres)`)

d$propwetlandsisle<-round((d$`Area (Acres)` /d$`Total Wetland Area on Island (Acres)` )*100, digits =
0)

d$propwetlandsisle[d$propwetlandsisle <1]<-<"1"
d$`Area (Acres)`<-round(d$`Area (Acres)` , digits = 0)
#d$`Area (Acres)`[d$`Area (Acres)`<1]<-<"1"

names(d)<-c("Island","Wetland Type","Dataset","Total Wetland Area on Island (Acres)","Summary
Variable" , "Area (Acres)","Area (% of Wetland Area on Island", "acres")

a<-ggplot(d, aes(d$Island, d$`Area (Acres)` , fill = d$`Summary Variable` ))

pretty<-a+geom_bar(stat = "identity", position = "stack")+
  labs(fill = "Summary Variable", title = "Wetlands Summary", x = "Island", y = "Area (Acres)" ) +
  theme(axis.text.x = element_text(angle=90, vjust=0.5, size=12))+

  scale_fill_manual(values=cbPalette)

outname<-paste0(ex, '_hope')

```

```

outnamecsv<-paste0(OutDir, "/", outname, ".csv")
outnamed<-paste0(OutDir, "/", "varsummary", outname, ".csv")
outnamed<-sub("intersect", "", outnamed)
plotname<-sub(".csv", ".tif", outnamed)
ggsave(filename=plotname, plot=pretty, device = "tiff")
write.csv(d, file = outnamed)
write.csv(jdata, file = outnamecsv)
writeOGR(j, dsn = OutDir, layer = outname , driver="ESRI Shapefile", overwrite_layer = T)

}

```

```

load("~/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/CoastalWetlandsStreamsOut/18_06_01
_post_wetland_intersections_workspace.RData")

```

```

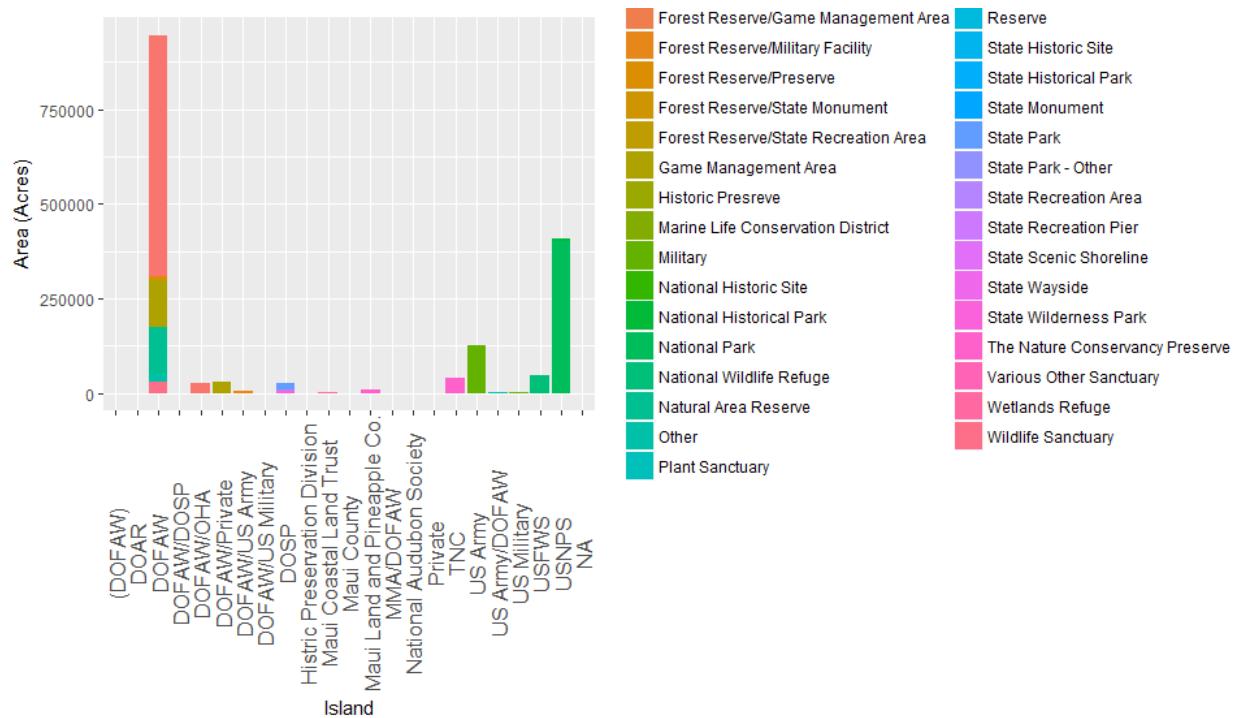
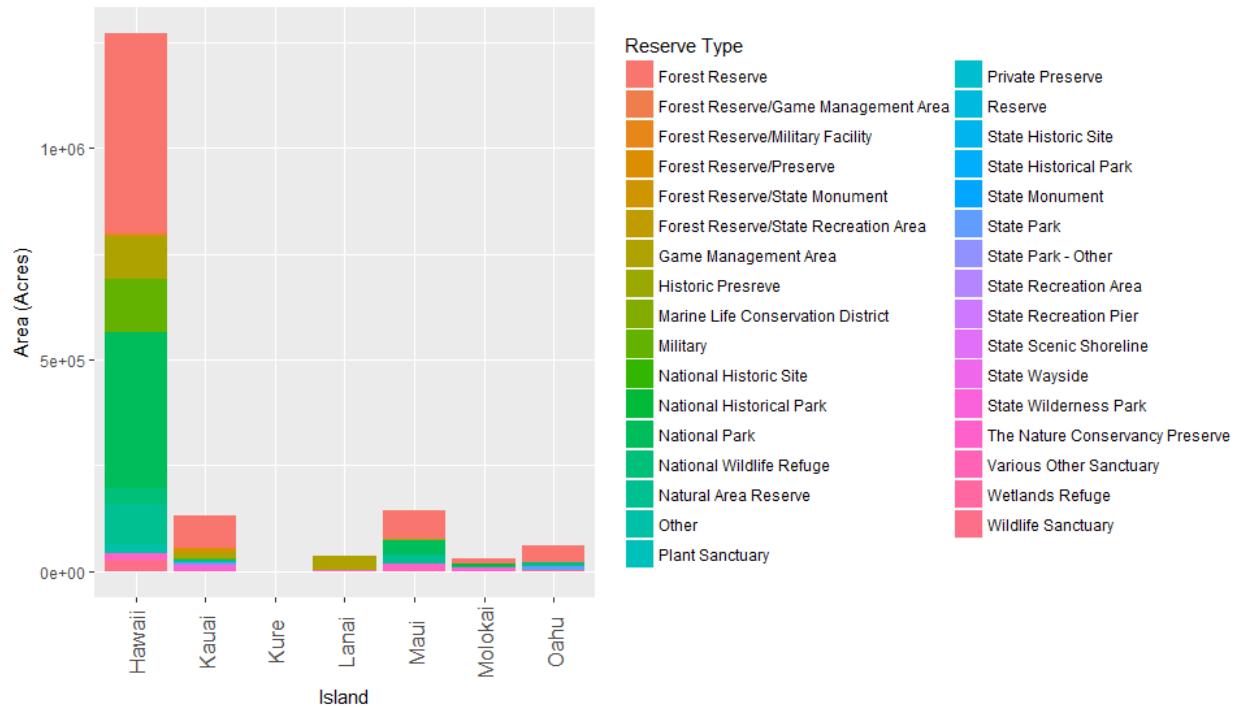
save.image("~/HSAs/HabitatStatusAssessmentsR/Hawaii/ShapeFiles4R/CoastalWetlandsStreamsOut/18
_06_04_EndOfWetlandsProcessingSpace.RData")

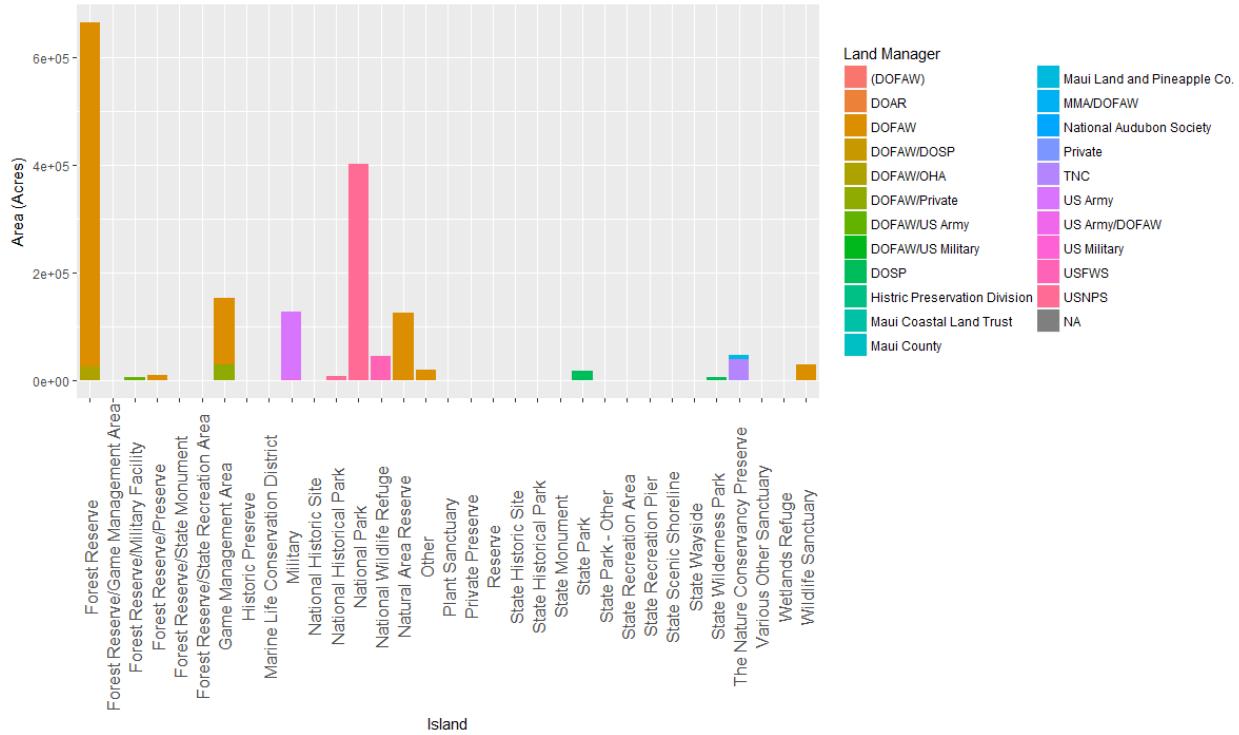
```

Appendix N. Methods for Selection of Reserve Areas

Had an HSA meeting where we talked about the conservation layers to decide on which ones were worth doing the calculations on for the HSA.

Steve said that we shouldn't use the State conservation area layer or the protected areas as of 2014 layer at all (which greatly simplifies my task in R).





Talking to Cheryl and Susan, they suggested the following categories of Reserve Types be included:

In addition, Susan thought it would be interesting to add the State Conservation Area Protected Status back in or at least identify areas of Protective status that are NOT also in the reserves layer.

```
[1] "Forest Reserve"
[2] "Forest Reserve/Game Management Area"
[3] "Forest Reserve/Military Facility"
[4] "Forest Reserve/Preserve"
[5] "Forest Reserve/State Monument"
[6] "Forest Reserve/State Recreation Area"
[7] "Game Management Area"
[8] "Historic Preserve"
[9] "Marine Life Conservation District"
[10] "Military"
[11] "National Historic Site"
[12] "National Historical Park"
[13] "National Park"
[14] "Natural Area Reserve"
[15] "National Wildlife Refuge"
[16] "Other"
[17] "Plant Sanctuary"
[18] "Private Preserve"
[19] "Reserve"
[20] "State Historic Site"
[21] "State Monument"
[22] "State Park"
[23] "State Park - Other"
[24] "State Recreation Area"
[25] "State Recreation Pier"
[26] "State Scenic Shoreline"
[27] "State Wayside"
[28] "The Nature Conservancy Preserve"
[29] "State Wilderness Park"
[30] "Various Other Sanctuary"
[31] "Wetlands Refuge"
[32] "Wildlife Sanctuary"
```

> managers

[1] "(DOFAW)"	"DOAR"
[3] "DOFAW"	"DOFAW/DOSP"
[5] "DOFAW/OHA"	"DOFAW/Private"
[7] "DOFAW/US Army"	"DOFAW/US Military"
[9] "DOSP"	"Histric Preservation Division"
[11] "Maui Coastal Land Trust"	"Maui County"
[13] "Maui Land and Pineapple Co."	"MMA/DOFAW"
[15] "National Audubon Society"	"Private"
[17] "TNC"	"US Army"
[19] "US Army/DOFAW"	"US Military"
[21] "USFWS"	"USNPS"

```
> levels(reservedata$NAME)
[1] "AIIHI-KINAI NATURAL AREA RESERVE"
[2] "AHUIKINI STATE RECREATION PIER"
[3] "AHUPUAA O KAHANA STATE PARK"
[4] "AIEA BAY STATE RECREATION AREA"
[5] "AKAKA FALLS STATE PARK"
[6] "AKINA PRESERVE (NATURE CONSERVANCY)"
[7] "ALAU ISLAND SEABIRD SANCTUARY"
[8] "DIAMOND HEAD STATE MONUMENT"
[9] "EWA FOREST RESERVE (POAMOHO SEC.)"
[10] "EWA FOREST RESERVE (WAIMANO SEC.)"
[11] "FREEMAN SEABIRD PRESERVE"
[12] "GREEN ISLAND WILDLIFE SANCTUARY"
[13] "HAENA STATE PARK"
[14] "HAKALAU FOREST NATIONAL WILDLIFE REFUGE"
[15] "HAKALAU FOREST NATIONAL WILDLIFE REFUGE S.KONA SEC"
[16] "HALEAKALA NATIONAL PARK"
[17] "HALEKII-PIHANA HEIAU STATE HISTORIC SITE"
[18] "HALELEA FOREST RESERVE"
[19] "HAMAKUA FOREST RESERVE (AHUALOA SEC.)"
[20] "HAMAKUA FOREST RESERVE (HANAPAI SEC.)"
[21] "HAMAKUA FOREST RESERVE (HOEA KAAO SEC.)"
[22] "HAMAKUA FOREST RESERVE (HONOKAIA SEC.)"
[23] "HAMAKUA FOREST RESERVE (KAINEHE SEC.)"
[24] "HAMAKUA FOREST RESERVE (KALOPA SEC.)"
[25] "HAMAKUA FOREST RESERVE (KALOPA SEC.) / KALOPA GMA"
[26] "HAMAKUA FOREST RESERVE (KEAA SEC.)"
[27] "HAMAKUA FOREST RESERVE (PAAUILO SEC.)"
[28] "HAMAKUA FR (KALOPA SEC.) / KALOPA STATE REC. AREA"
[29] "HAMAKUA MARSH WILDLIFE SANCTUARY"
[30] "HAMAKUA MARSH WILDLIFE SANCTUARY (PUU O EHU)"
[31] "HANA FOREST RESERVE"
[32] "HANALEI NATIONAL WILDLIFE REFUGE"
[33] "HANAPEPE SALT PONDS HISTORIC PRESERVE"
[34] "HANAUMA BAY STATE UNDERWATER PARK"
[35] "HANAWI NATURAL AREA RESERVE"
[36] "HAPUNA BEACH STATE RECREATION AREA"
[37] "HAPUNA BEACH STATE RECREATION AREA (WAIALEA SEC.)"
[38] "HAUOLA FOREST RESERVE"
[39] "HAUULA FOREST RESERVE"
[40] "HAWAII VOLCANOES NATIONAL PARK"
[41] "HEEIA STATE PARK"
```

[42] "HILO FOREST RESERVE (HUMUULA SEC.)"
[43] "HILO FOREST RESERVE (KAIWIKI SEC.)"
[44] "HILO FOREST RESERVE (KAMAEE SEC.)"
[45] "HILO FOREST RESERVE (KAUKU SEC.)"
[46] "HILO FOREST RESERVE (KUKUAU SEC.)"
[47] "HILO FOREST RESERVE (LAUPAHOEHOE SEC.)"
[48] "HILO FOREST RESERVE (OPEA SEC.)"
[49] "HILO FOREST RESERVE (PIHA SEC.)"
[50] "HILO FOREST RESERVE (WATERSHED RESERVE SEC.)"
[51] "HONO O NA PALI NATURAL AREA RESERVE"
[52] "HONOLUA-MOKULEIA MARINE LIFE CONSERVATION DISTRICT"
[53] "HONOLULU WATERSHED FOREST RESERVE"
[54] "HONOUILIULI FOREST RESERVE"
[55] "HONUAULA FOREST RESERVE"
[56] "HUELO ISLET SEABIRD SANCTUARY"
[57] "HULEIA NATIONAL WILDLIFE REFUGE"
[58] "HULIHEE PALACE"
[59] "HULU ISLET SEABIRD SANCTUARY"
[60] "IAO VALLEY STATE MONUMENT"
[61] "IOLANI PALACE STATE MONUMENT"
[62] "JAMES CAMPBELL NATIONAL WILDLIFE REFUGE"
[63] "KAALA NATURAL AREA RESERVE"
[64] "KAENA POINT NATURAL AREA RESERVE"
[65] "KAENA POINT STATE PARK"
[66] "KAHAKULOA GAME MANAGEMENT AREA"
[67] "KAHAUALEA NATURAL AREA RESERVE"
[68] "KAHIKINUI FOREST RESERVE"
[69] "KAHUA/PONOHOLO RANCH SPECIAL PERMIT AREA CO-OP GMA"
[70] "KAHUKU IKI PRESERVE (NATURE CONSERVANCY)"
[71] "KAHUKU MOTOCROSS"
[72] "KAIPAPAU FOREST RESERVE"
[73] "KAIWI SCENIC SHORELINE"
[74] "KAKAHIA NATIONAL WILDLIFE REFUGE"
[75] "KALAUPAPA NATIONAL HISTORICAL PARK"
[76] "KALEPA MOUNTAIN FOREST RESERVE"
[77] "KALOKO-HONOKOHAU NATIONAL HISTORICAL PARK"
[78] "KALUANUI NATURAL AREA RESERVE"
[79] "KAMAKOU PRESERVE (NATURE CONSERVANCY)"
[80] "KAMEHAME PRESERVE (NATURE CONSERVANCY)"
[81] "KAMILOLOA PLANT SANCTUARY"
[82] "KANAELE PRESERVE (NATURE CONSERVANCY)"
[83] "KANAHA POND WILDLIFE SANCTUARY"
[84] "KANAHA ROCK ISLET SEABIRD SANCTUARY"
[85] "KANAIO NATURAL AREA RESERVE"
[86] "KANEHO FOREST RESERVE"
[87] "KANEPUU PRESERVE (NATURE CONSERVANCY)"
[88] "KAOHE GAME MANAGEMENT AREA"
[89] "KAOHE MITIGATION"
[90] "KAOHIKAIPU ISLET SEABIRD SANCTUARY"
[91] "KAONOULU RANCH COOPERATIVE GAME MANAGEMENT AREA"
[92] "KAPAPA ISLAND SEABIRD SANCTUARY"
[93] "KAPAPALA COOPERATIVE GAME MANAGEMENT AREA"
[94] "KAPAPALA FOREST RESERVE"
[95] "KAPUNA SPRING WATER RESERVE"
[96] "KAPUNAKEA PRESERVE (NATURE CONSERVANCY)"
[97] "KAU FOREST RESERVE"
[98] "KAU FOREST RESERVE (KAMILO SECTION)"

- [99] "KAU FOREST RESERVE (KAPAPALA SEC.)"
- [100] "KAU PRESERVE (NATURE CONSERVANCY)"
- [101] "KAULA ISLAND SEABIRD SANCTUARY"
- [102] "KAUMAHINA STATE WAYSIDE"
- [103] "KAWAINUI MARSH WILDLIFE SANCTUARY"
- [104] "KEAIWA HEIAU STATE RECREATION AREA"
- [105] "KEALAKEKUA BAY STATE HISTORICAL PARK"
- [106] "KEALIA FOREST RESERVE"
- [107] "KEALIA POND NATIONAL WILDLIFE REFUGE"
- [108] "KEAOI ISLET SEABIRD SANCTUARY"
- [109] "KEAUHOU COOPERATIVE NENE SANCTUARY"
- [110] "KEAUHOU II (HUALALAI) COOPERATIVE NENE SANCTUARY"
- [111] "KEAUOHANA FOREST RESERVE"
- [112] "KEE HULA PLATFORM"
- [113] "KEKAHA GAME MANAGEMENT AREA"
- [114] "KEKAHA KAI STATE PARK"
- [115] "KEKEPA ISLET SEABIRD SANCTUARY"
- [116] "KEOLONAHIHI STATE HISTORICAL PARK"
- [117] "KEOLONAHIHI STATE HISTORICAL PARK-KEAKEALANIWAHINE"
- [118] "KEOPUKA ISLET SEABIRD SANCTUARY"
- [119] "KIHEWAMOKU ISLET SEABIRD SANCTUARY"
- [120] "KIHOLO PRESERVE (NATURE CONSERVANCY)"
- [121] "KILAUEA POINT NATIONAL WILDLIFE REFUGE"
- [122] "KIPAHOEHOE NATURAL AREA RESERVE"
- [123] "KIPAHULU FOREST RESERVE"
- [124] "KIPUKA A `UMI PRESERVE (NATURE CONSERVANCY)"
- [125] "KIPUKA AINAHOU NENE SANCTUARY"
- [126] "KOIA TREE SANCTUARY"
- [127] "KOHALA FOREST RESERVE"
- [128] "KOHALA FOREST RESERVE (POLOLU SEC.)"
- [129] "KOHALA FOREST RESERVE (WAIMANU SEC.)"
- [130] "KOHALA HIST. SITES ST. MONUMENT (KUKUIPAHU HEIAU)"
- [131] "KOHALA HIST. SITES STATE MONUMENT (MO'OKINI HEIAU)"
- [132] "KOHALA HIST.SITES S. M. (KAMEHAMEHA I BIRTH PLACE)"
- [133] "KOHALA WATERSHED FOREST RESERVE"
- [134] "KOKEE STATE PARK"
- [135] "KONA HEMA PRESERVE (NATURE CONSERVANCY)"
- [136] "KOOLAU FOREST RESERVE"
- [137] "KUAOKALA FOREST RESERVE"
- [138] "KUAOKALA GAME MANAGEMENT AREA"
- [139] "KUIA NATURAL AREA RESERVE"
- [140] "KUKUIHOOLUA ISLET SEABIRD SANCTUARY"
- [141] "KULA FOREST RESERVE"
- [142] "KULIOUOU FOREST RESERVE"
- [143] "LAIE POINT STATE WAYSIDE"
- [144] "LANAI COOPERATIVE GAME MANAGEMENT AREA"
- [145] "LAPAKAHI STATE HISTORICAL PARK"
- [146] "LAUPAHOEHOE NATURAL AREA RESERVE"
- [147] "LAVA TREE STATE MONUMENT"
- [148] "LEHUA ISLAND SEABIRD SANCTUARY"
- [149] "LIHUE-KOLOA FOREST RESERVE"
- [150] "LUALUALEI FOREST RESERVE"
- [151] "MACKENZIE STATE RECREATION AREA"
- [152] "MAKAWAO FOREST RESERVE"
- [153] "MAKENA STATE PARK"
- [154] "MAKIKI VALLEY STATE RECREATION AREA"
- [155] "MAKUA KEAAU FOREST RESERVE"

- [156] "MALAEKAHANA STATE RECREATION AREA (KAHUKU SEC.)"
- [157] "MALAEKAHANA STATE RECREATION AREA (LAIE SEC.)"
- [158] "MALAMA KI FOREST RESERVE"
- [159] "MANA PLAINS FOREST RESERVE"
- [160] "MANANA ISLAND SEABIRD SANCTUARY"
- [161] "MANOWAIALEE FOREST RESERVE"
- [162] "MANUKA NATURAL AREA RESERVE"
- [163] "MANUKA STATE WAYSIDE"
- [164] "MAUI MOTOCROSS TRACK"
- [165] "MAUNA KEA FOREST RESERVE"
- [166] "MAUNA KEA FR / WAILUKU SILVERSWORD SANCTUARY"
- [167] "MAUNA KEA ICE AGE NATURAL AREA RESERVE"
- [168] "MAUNA KEA STATE RECREATION AREA"
- [169] "MAUNA LOA FOREST RESERVE"
- [170] "MOKAPU ISLET SEABIRD SANCTUARY"
- [171] "MOKEEHIA ISLET SEABIRD SANCTUARY"
- [172] "MOKU HALA SEABIRD SANCTUARY"
- [173] "MOKU MANA ISLET SEABIRD SANCTUARY"
- [174] "MOKU MANU ISLETS SEABIRD SANCTUARY"
- [175] "MOKU NAIO SEABIRD SANCTUARY"
- [176] "MOKUAEEAE ROCK ISLET SEABIRD SANCTUARY"
- [177] "MOKUALAI ISLET SEABIRD SANCTUARY"
- [178] "MOKUAUIA ISLET SEABIRD SANCTUARY"
- [179] "MOKUHOONIKI ISLET SEABIRD SANCTUARY"
- [180] "MOKULEA ROCK ISLET SEABIRD SANCTUARY"
- [181] "MOKULEIA FOREST RESERVE"
- [182] "MOKULUA ISLETS SEABIRD SANCTUARY"
- [183] "MOKUMANU ISLET SEABIRD SANCTUARY"
- [184] "MOKUPUKU ISLET SEABIRD SANCTUARY"
- [185] "MOLOAA FOREST RESERVE"
- [186] "MOLOKAI FOREST RESERVE"
- [187] "MOLOKINI ISLET SEABIRD SANCTUARY"
- [188] "MOOMOMI PRESERVE (NATURE CONSERVANCY)"
- [189] "NA PALI-KONA FOREST RESERVE"
- [190] "NA PALI-KONA FR / ALAKAI WILDERNESS PRESERVE"
- [191] "NA PALI COAST STATE WILDERNESS PARK"
- [192] "NAKULA NATURAL AREA RESERVE"
- [193] "NANAHOA ISLETS SEABIRD SANCTUARY"
- [194] "NANAKULI FOREST RESERVE"
- [195] "NANAWALE FOREST RESERVE"
- [196] "NANAWALE FOREST RESERVE (HALEPUAA SEC.)"
- [197] "NONOU FOREST RESERVE"
- [198] "NUUANU PALI STATE WAYSIDE"
- [199] "OAHU FOREST NATIONAL WILDLIFE REFUGE"
- [200] "OKALA ISLET SEABIRD SANCTUARY"
- [201] "OLAA FOREST RESERVE"
- [202] "OLAA FOREST RESERVE (MT. VIEW SEC.)"
- [203] "OLOKUI NATURAL AREA RESERVE"
- [204] "PAHOLE NATURAL AREA RESERVE"
- [205] "PAIKO LAGOON WILDLIFE SANCTUARY"
- [206] "PALAAU STATE PARK"
- [207] "PAOKALANI ISLET SEABIRD SANCTUARY"
- [208] "PAPANUI O KANE ISLET SEABIRD SANCTUARY"
- [209] "PAUWALU POINT WILDLIFE SANCTUARY"
- [210] "PEARL HARBOR NAT'L WILDLIFE REFUGE (KALAELOA)"
- [211] "PEARL HARBOR NATIONAL WILDLIFE REFUGE (MID LOCH)"
- [212] "PEARL HARBOR NATIONAL WILDLIFE REFUGE (W LOCH)"

- [213] "PELEKUNU PRESERVE (NATURE CONSERVANCY)"
- [214] "PMRF BARKING SANDS"
- [215] "PMRF MAKAHĀ RIDGE / PUU KA PELE FOREST RESERVE"
- [216] "POHAKULOA TRAINING AREA RESERVATION"
- [217] "POHAKULOA TRAINING AREA RESERVATION (KEAMUKU SEC.)"
- [218] "POHAKULOA TRAINING AREA RESERVATION / MAUNA KEA FR"
- [219] "POLIHALE STATE PARK"
- [220] "POLIPOLI SPRING STATE RECREATION AREA"
- [221] "POOPOO ISLET SEABIRD SANCTUARY"
- [222] "POPOIA SEABIRD SANCTUARY"
- [223] "POUHALA MARSH WILDLIFE SANCTUARY"
- [224] "PUAA KAA STATE WAYSIDE"
- [225] "PULEMOKU ISLET SEABIRD SANCTUARY"
- [226] "PUPUKEA-PAUMALU FOREST RESERVE"
- [227] "PUU ALII NATURAL AREA RESERVE"
- [228] "PUU ANAHULU GAME MANAGEMENT AREA"
- [229] "PUU HONAU O HONAUNAU NATIONAL HISTORICAL PARK"
- [230] "PUU KA PELE FOREST RESERVE"
- [231] "PUU KUKUI WATERSHED PRESERVE (ML&P)"
- [232] "PUU MAKALA NATURAL AREA RESERVE"
- [233] "PUU O MAHUKA HEIAU STATE HISTORIC SITE"
- [234] "PUU O UMI NATURAL AREA RESERVE"
- [235] "PUU UALAKAA STATE WAYSIDE"
- [236] "PUU WAAWAA FOREST BIRD SANCTUARY"
- [237] "PUU WAAWAA FOREST RESERVE"
- [238] "PUUKOHOLA HEIAU NATIONAL HISTORIC SITE"
- [239] "PUUKU ISLET SEABIRD SANCTUARY"
- [240] "PUUPEHE ISLET SEABIRD SANCTUARY"
- [241] "ROUND TOP FOREST RESERVE"
- [242] "ROYAL MAUSOLEUM STATE MONUMENT"
- [243] "RUSSIAN FORT ELIZABETH STATE HISTORICAL PARK"
- [244] "SACRED FALLS STATE PARK"
- [245] "SAND ISLAND STATE RECREATION AREA"
- [246] "SAND ISLAND WILDLIFE SANCTUARY"
- [247] "SOUTH KONA FOREST RES. (OLELOMOANA OPIHIHALI SEC.)"
- [248] "SOUTH KONA FOREST RESERVE (KAOHE SEC.)"
- [249] "SOUTH KONA FOREST RESERVE (KAPUA-MANUKA SEC.)"
- [250] "SOUTH KONA FOREST RESERVE (KUKUIOPAE SEC.)"
- [251] "ULUPO HEIAU STATE HISTORICAL PARK"
- [252] "UPPER WAIAKEA BOG SANCTUARY"
- [253] "UPPER WAIAKEA FOREST RESERVE"
- [254] "WAAHILA RIDGE STATE RECREATION AREA"
- [255] "WAHIAWA FRESHWATER STATE RECREATION AREA"
- [256] "WAIAHA SPRINGS FOREST RESERVE"
- [257] "WAIAHOLE FOREST RESERVE"
- [258] "WAIAHOLE FOREST RESERVE (IOLEKAA SEC)"
- [259] "WAIAHOLE FOREST RESERVE (WAIAHOLE SEC)"
- [260] "WAIAKEA 1942 LAVA FLOW NATURAL AREA RESERVE"
- [261] "WAIAKEA FOREST RESERVE"
- [262] "WAIANAE KAI FOREST RESERVE"
- [263] "WAIANAPANAPA STATE PARK"
- [264] "WAIHEE COASTAL DUNES AND WETLANDS REFUGE"
- [265] "WAIHOU SPRING FOREST RESERVE"
- [266] "WAIKAMOI PRESERVE (NATURE CONSERVANCY)"
- [267] "WAIKAMOI PRESERVE EMI (NATURE CONSERVANCY)"
- [268] "WAILOA RIVER STATE RECREATION AREA"
- [269] "WAILUA GAME MANAGEMENT AREA"

```

[270] "WAILUA RIVER STATE PARK"
[271] "WAILUA VALLEY STATE WAYSIDE"
[272] "WAILUKU RIVER STATE PARK"
[273] "WAIMANALO FOREST RESERVE"
[274] "WAIMANALO FR / MT OLOMANA STATE MONUMENT"
[275] "WAIMEA CANYON STATE PARK"
[276] "WAIMEA STATE RECREATION PIER"
[277] "WAINIHA PRESERVE (NATURE CONSERVANCY)"
[278] "WAO KELE O PUNA FOREST RESERVE"
[279] "WEST MAUI FOREST RESERVE"
[280] "WEST MAUI NATURAL AREA RESERVE (HONOKOWAI SEC)"
[281] "WEST MAUI NATURAL AREA RESERVE (KAHAKULOA SEC)"
[282] "WEST MAUI NATURAL AREA RESERVE (LIHAU SEC)"
[283] "WEST MAUI NATURAL AREA RESERVE (PANAELWA SEC)"

```

Talked to Steve about this, and we agreed to filter on the reserve type (rather than have to combine 2 filtering joins) and keep the highlighted ones above.

So, filtering first on the reserve type, we go from 362 reserve polygons to 133.

```

types2keep<-c("Marine Life Conservation District", "National Historical Park",
             "National Park", "National Wildlife Refuge", "Natural Area Reserve",
             "Private Preserve", "State Wilderness Park", "The Nature Conservancy Preserve",
             "Wildlife Sanctuary")

myreserves<-reserves[reserves$Type_Defin %in% types2keep,]

myreservedata<-myreserves@data

unique(myreserves$Type_Defin)

myreserveacres<-sum(myreserves$GIS_Acre)
> myreserveacres
[1] 663,634.9

> unique(myreserves$Type_Defin)
[1] Wildlife Sanctuary          Private Preserve
[3] National Historical Park   Natural Area Reserve
[5] The Nature Conservancy Preserve Marine Life Conservation District
[7] National Park               National Wildlife Refuge
[9] State Wilderness Park       33 Levels: Forest Reserve ... Wildlife Sanctuary
> unique(myreserves$MANAGEDBY)
[1] (DOFAW)                    National Audubon Society      USNPS

```

```
[4] DOFAW TNC DOAR
[7] Private Maui Land and Pineapple Co. USFWS
[10] DOSP
```

If I then filter out only those land owners we identified, we are left with only 55 polygons.

```
>
> myreservedata<-myreserves@data
> View(myreservedata)
> managers2keep<-c("Maui Coastal Land Trust", "Maui Land and Pineapple Co.",
+ "TNC", "USNPS", "USFWS")
> managedreserves<-myreserves[myreserves$MANAGEDBY %in% managers2keep,]
> View(managedreserves)
> View(managedreserves)
> levels(managedreserves$MANAGEDBY)
[1] "(DOFAW)" "DOAR"
[3] "DOFAW" "DOFAW/DOSP"
[5] "DOFAW/OHA" "DOFAW/Private"
[7] "DOFAW/US Army" "DOFAW/US Military"
[9] "DOSP" "Historic Preservation Division"
[11] "Maui Coastal Land Trust" "Maui County"
[13] "Maui Land and Pineapple Co." "MMA/DOFAW"
[15] "National Audubon Society" "Private"
[17] "TNC" "US Army"
[19] "US Army/DOFAW" "US Military"
[21] "USFWS" "USNPS"
> unique(managedreserves$MANAGEDBY) Maui Land and Pineapple Co.
[1] USNPS TNC
[4] USFWS
22 Levels: (DOFAW) DOAR DOFAW DOFAW/DOSP DOFAW/OHA DOFAW/Private ... USNPS
```

```
>
> managedreserveacres<-sum(managedreserves$GIS_Acre)
> managedreserveacres
[1] 501,710.1
```

It's not much different, ~100K acres, so I think I'm going to stick with the less restrictive query (keep other land managers in and choose reserves only by type). Keeps us less judgy about other people's land management.

This is a problem...I tried Niihau wetlands as a habitat, but since there are no reserves in this area, conservation clip ended up null, and so I can't do anything with it.

```
> conservclip<-gClip(myreserves, c )
Warning message:
In RGEOSBinTopoFunc(spgeom1, spgeom2, byid, id, drop_lower_td, unaryunion_if_
byid_false, :
  spgeom1 and spgeom2 have different proj4 strings
> plot(conservclip)
Error in plot.window(...) : need finite 'xlim' values
In addition: Warning messages:
1: In min(x) : no non-missing arguments to min; returning Inf
2: In max(x) : no non-missing arguments to max; returning -Inf
```

```
3: In min(x) : no non-missing arguments to min; returning Inf
4: In max(x) : no non-missing arguments to max; returning -Inf
> names(myreserves)
```

Fixed it by building a try statement into the code.

