2020 Update to the Hawai‘i Statewide Agricultural Land Use Baseline

Prepared for
Hawai‘i Department of Agriculture

Prepared by
University of Hawai‘i at Hilo
Spatial Data Analysis & Visualization Research Laboratory

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Acknowledgments

This report is dedicated to the memory of Jeffrey Melrose and the farmers, ranchers, and other members of the agricultural community in Hawai‘i that have been impacted by the COVID-19 Pandemic.

We would like to acknowledge Department of Agriculture Director Phyllis Shimabukuro-Geiser for her commitment to update the 2015 statewide agricultural land use baseline and make this project a reality, and to her staff for their generous assistance and support.

We would also like to specifically thank Doug Beaton, Darrell Bueno, Ed Boteilho, Roberta Chun, Sylvie Cares, Sharon Dansereau, Chris English, Noland Eskaran, Nicole Galase, Hunter Heaivilin, Amy Koch, Natalie Kurashima, Bruce Mathews, Brian Miyamoto, Ben Nyberg, Jesse Potter, William Stormont, Julie Tulang, Chantal Vos, Erin Weingarten, Heath Williams, and the many other people and organizations that provided assistance, insights, and information for this report.

Executive Summary

This report, along with the associated maps and geospatial data layers for the islands of Kauaʻi, Oʻahu, Molokaʻi, Lānaʻi, Maui, and Hawaiʻi, provides an update to the more exhaustive 2015 statewide agricultural land use baseline (Melrose et al. 2015).

In the five years between the 2015 statewide agricultural land use baseline and this report, the overall acreage of planted crops on the Hawaiian islands decreased by 21% (-31,207 acres) (Table 1). This overall decline is primarily due to the 2016 closure of the Hawaiian Commercial & Sugar Company (HC&S) on Maui, which removed 38,810 acres of sugarcane production from the state.

Statewide, outside of the major decline in sugarcane, there was an overall 7% increase in planted acres for all other crop types from 2015 to 2020 (+7,588 acres). Of these statewide gains, the largest was in diversified agriculture, which rose 22% (+3,695 acres), with approximately half of that increase coming from Maui alone, which more than doubled its planted acreage in diversified crops.

The statewide gains in diversified agriculture are an important step forward in food self-sufficiency, but more substantial increases in cropland acreage will be needed to make significant progress towards stated local food production targets (Act 151, Session Laws of Hawaiʻi 2019), particularly in the face of climate change.

Papaya, tropical fruit, and taro also saw double digit percentage increases statewide, while the remaining crop types saw either more modest increases or relatively minor decreases, with the exception of dairy which dropped 53% (-990 acres) due to a closure on Hawaiʻi Island.

Kauaʻi, with 23,191 mapped cropped acres in 2020, saw overall increases, largely driven by activity in seed production (+956 acres, or 7.2%) and commercial forestry (+816 acres, or 47%). The remaining crop types on Kauaʻi experienced a mixture of modest changes, including minor losses in diversified crops (-53 acres).

Oʻahu, with 23,277 cropped acres in 2020, saw increases across all crop categories (minus papaya) during this period, with the largest gains in diversified crops (+730 acres, or 7.4%).

Molokaʻi, with 3,874 cropped acres in 2020, was largely stable between 2015-2020, with an overall change of <1% in cropped and pasture areas. The largest gain was

in tropical fruits (+174 acres, or 405%), while the largest loss was in pasture (-390 acres, or -1%).

Lānaʻi, with just 105 cropped acres in 2020, saw an increase of 40 acres in diversified crops relative to 2015. Increases in agricultural productivity due to a new indoor hydroponics project associated with Sensei Farms Lānaʻi are not captured in this report.

Maui, with 7,718 cropped acres in 2020 (-82% from 2015), saw the most agricultural change of any of the Hawaiian Islands during the period between 2015-2020. The loss of sugarcane production drove an overall decrease that was partially offset by gains in other crop types, notably diversified crop (+1,823 acres, or 115%), macadamia nuts (+606 acres, or 325%), and tropical fruits (+508 acres, or 488%). Seed production (-107 acres) and pineapple (-134 acres) both decreased on Maui, while pasture was up 6,794 acres (6%).

The situation on Hawaiʻi Island, with 62,436 cropped acres mapped in 2020, is also mixed. Gains in most crop types, led by diversified crops (+1,077 acres, or 33%), were offset by losses in four crop categories (aquaculture, commercial forestry, dairy, and flowers/foliage/landscape). Some of these losses were a direct result of the 2018 lower east rift zone volcanic eruption, which engulfed a number of important agricultural holdings. Sugarcane, absent on Hawaiʻi Island in recent years due to past sugarcane plantation closures, has returned in the form of a 14 acre planting for rum production in the Hāwī area.

Pasture, which makes up 83% of the overall agricultural footprint in the state, rose by 4,132 acres (1%), with gains on Maui and Kauaʻi offsetting losses on Oʻahu and Hawaiʻi Island. These losses to pasture are due to a combination of reasons including inactivity (indicated by significant natural vegetation regrowth), conversion to other agricultural uses, residential development, and minor reclassifications and adjustments relative to the 2015 baseline study.

Most recently, the COVID-19 pandemic has been devastating for agriculture statewide. Demand for fresh produce dropped dramatically with mandated stay-at-home orders and closures to the tourism industry, seriously affecting farming operations and the agricultural workforce across Hawaiʻi. COVID-19 impacts are not reflected in this report, as the imagery used in our analysis was collected prior to any pandemic-related changes or closures, but are worth mentioning as the pandemic is reshaping the economy and will certainly affect the stateʻ s agricultural footprint in the near future.

Table 1. Summary of 2020 Agricultural Footprint for the major Hawaiian Islands.

	2020 Crop Summary by Acreage						State Total		Change from 2015	
Crop Type	**Hawai'i**	**Kaua'i**	**Maui**	**Moloka'i**	**Lāna'i**	**O'ahu**	**2020**	**2015**	**Acres**	**%**
Aquaculture	162	183	-	26	-	300	670	651	**19**	**3**
Banana	599	30	64	-	-	360	1,053	969	**84**	**9**
Coffee	6,028	3,806	944	122	-	169	11,068	10,149	**919**	**9**
Commercial Forestry	20,921	2,559	36	2	-	27	23,546	22,864	**682**	**3**
Dairy	865	-	-	-	-	-	865	1,855	**-990**	**-53**
Diversified Crop	4,343	1,146	3,405	1,017	95	10,595	20,601	16,904	**3,697**	**22**
Flowers / Foliage / Landscape	1,538	150	144	26	10	510	2,378	2,432	**-54**	**-2**
Macadamia Nuts	21,405	-	793	7	-	2	22,207	21,545	**662**	**3**
Papaya	3,207	-	-	109	-	164	3,480	2,824	**656**	**23**
Pineapple	-	-	959	-	-	3,437	4,396	4,508	**-112**	**-2**
Seed Production	-	14,255	647	2,352	-	7,376	24,630	23,728	**902**	**4**
Sugarcane	14	-	-	-	-	-	14	38,810	**-38,796**	**-100**
Taro	67	546	113	2	-	77	805	612	**193**	**32**
Tropical Fruits	3,311	516	612	216	-	260	4,915	3,980	**935**	**23**
Crop Total:	**62,461**	**23,191**	**7,718**	**3,880**	**105**	**23,277**	**120,632**	**151,831**	**-31,199**	**-21**
Pasture	552,091	42,345	115,241	37,867	-	18,035	765,579	761,429	**4,150**	**1**
Total Agriculture:	***614,552***	***65,536***	***122,959***	***41,747***	***105***	***41,312***	***886,211***	***913,261***	***-27,050***	***-3***

Introduction

This report was prepared for the Hawai‘i State Department of Agriculture (DOA) by the University of Hawai‘i at Hilo Spatial Data Analysis and Visualization (SDAV) research laboratory. It accompanies a comprehensive set of digital spatial data that depict the 2020 footprint of agriculture crops and pasture lands on the islands of Kaua‘i, O‘ahu, Moloka‘i, Lāna‘i, Maui, and Hawai‘i. These data layers are hosted by the Hawai‘i Statewide Planning and Geographic Information System (GIS) Program portal at https://planning.hawaii.gov/gis/.

The purpose of the project was to document changes to Hawai‘i’s agricultural footprint since the 2015 report was released to better inform state policy makers, managers and the broader agricultural community regarding recent changes and trends. The five year interval between the 2015 baseline and this report is a major improvement over the 35 year gap between the 2015 report and the prior statewide assessment in 1980.

In addition to documenting changes over the past five year period, we also examined the agricultural footprint on O‘ahu, Hawai‘i, and Kaua‘i, as it relates to lands designated as Important Agricultural Lands by the State Land Use Commission, pursuant to Hawai‘i Revised Statutes ("HRS") §§ 205-44 and -45 and Hawai'i Administrative Rules ("HAR") §§ 15-15-98, -99, -120, and -121. We also examined the agricultural footprint related to active leases in the Hawai‘i Department of Agriculture‘s Agricultural Park Program.

The report was created from an assemblage of geospatial datasets, primarily high-resolution (2018-2020) satellite imagery used as a base layer for digitization (Figure 1). Additional datasets include existing GIS layers provided by the State of Hawai‘i’s Office of Planning Statewide GIS Program (https://geoportal.hawaii.gov) and other data generously provided by landowners and managers.

Digitized crop locations and boundaries were verified through a combination of on-the-ground site visits, video meetings and presentations of draft layers with agricultural stakeholders and landowners, and solicitations for comments and feedback through a publicly accessible online web mapping portal. In several cases, private landowners shared their own digital data of crop use on their properties and/or were helpful in reviewing draft maps to confirm or correct mapped crop boundaries.

These data layers represent our best efforts to capture the scale and diversity of commercial agricultural activity on Kauaʻi, Oʻahu, Molokaʻi, Lānaʻi, Maui, and Hawaiʻi in 2020 and should be used for information purposes only. The digital crop and pasture layer data are provided for public use.

In this 2020 assessment, as in the 2015 baseline report, in-field roads, field edges, warehouses, and related farm structures are all part of farm related uses. Gulches and unused lands were generally not counted. As a result, the crop acreage numbers provided in this report may be 10% or more than what industries might report. That difference is not intended to correct industry numbers but rather to express a broader metric of the area of land that is deployed to support a given agricultural use.

A complete description of the Crop Mapping Protocols used in this study is included in the Appendix and attached to the metadata associated with the provided digital geospatial layer.

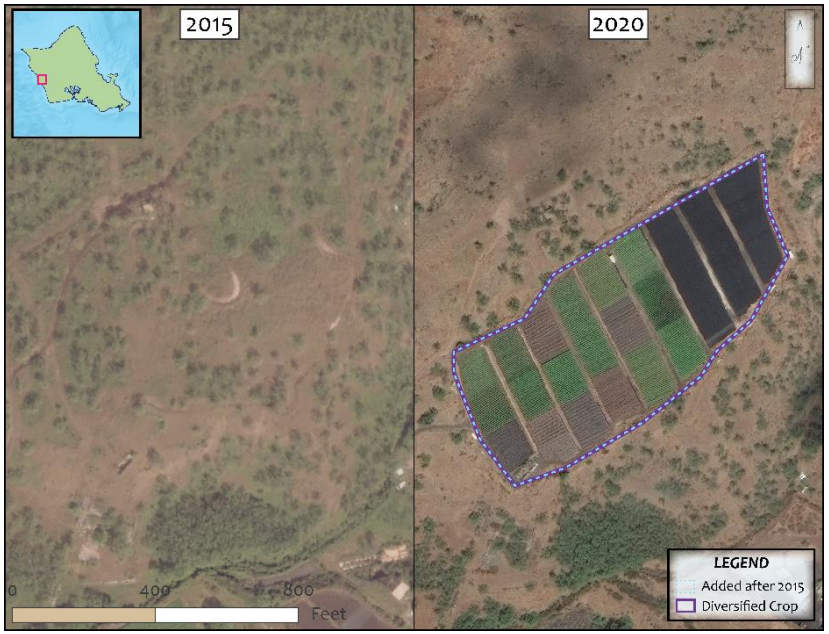


Figure 1. Satellite imagery from 2015 and 2020 showing the establishment and digitized outline of a new 10 acre plot of intensive diversified crops on the Waiʻanae Coast of Oʻahu. Sources: Esri, DigitalGlobe, and Maxar.

Kauaʻi 2020 Agricultural Footprint

The island of Kauaʻi (Figure 2) has seen a mixture of gains and losses across crop categories since 2015, with an increase of 1,882 acres (8.8%) in overall cropped area. Seed production continues to have the largest footprint on the island, with 14,255 acres mapped in active use (61% of the total cropped area on Kauaʻi).

Coffee continues to be the second largest crop on Kauaʻi (3,806 acres), followed by commercial forestry (2,559 acres). Seed production, commercial forestry, and taro all saw acreage increases >100 acres between 2015-2020, with the remaining crop categories holding steady or showing slight decreases (Table 2). Pasture continues to make up the majority (65%) of agricultural acreage on Kauaʻi at 42,345 acres.

Kauai	Acreage		Change (2015 to 2020)	
Crop Type	**2015**	**2020**	**Acres**	**%**
Aquaculture	183	183	0	0.0
Banana	26	30	4	15.8
Coffee	3,788	3,806	18	0.5
Commercial Forestry	1,743	2,559	816	46.8
Diversified Crop	1,199	1,146	-53	-4.4
Flowers / Foliage / Landscape	165	150	-15	-9.1
Seed Production	13,299	14,255	956	7.2
Taro	443	546	103	23.3
Tropical Fruits	463	516	53	11.4
Crop Total	**21,309**	**23,191**	**1,882**	**8.8**
Pasture	41,933	42,345	412	1.0
Total	**63,242**	**65,536**	**2,294**	**3.6**

Table 2. Summary of Kauaʻi Island Agricultural Footprint and changes between 2015 (Melrose et al. 2015) and 2020.

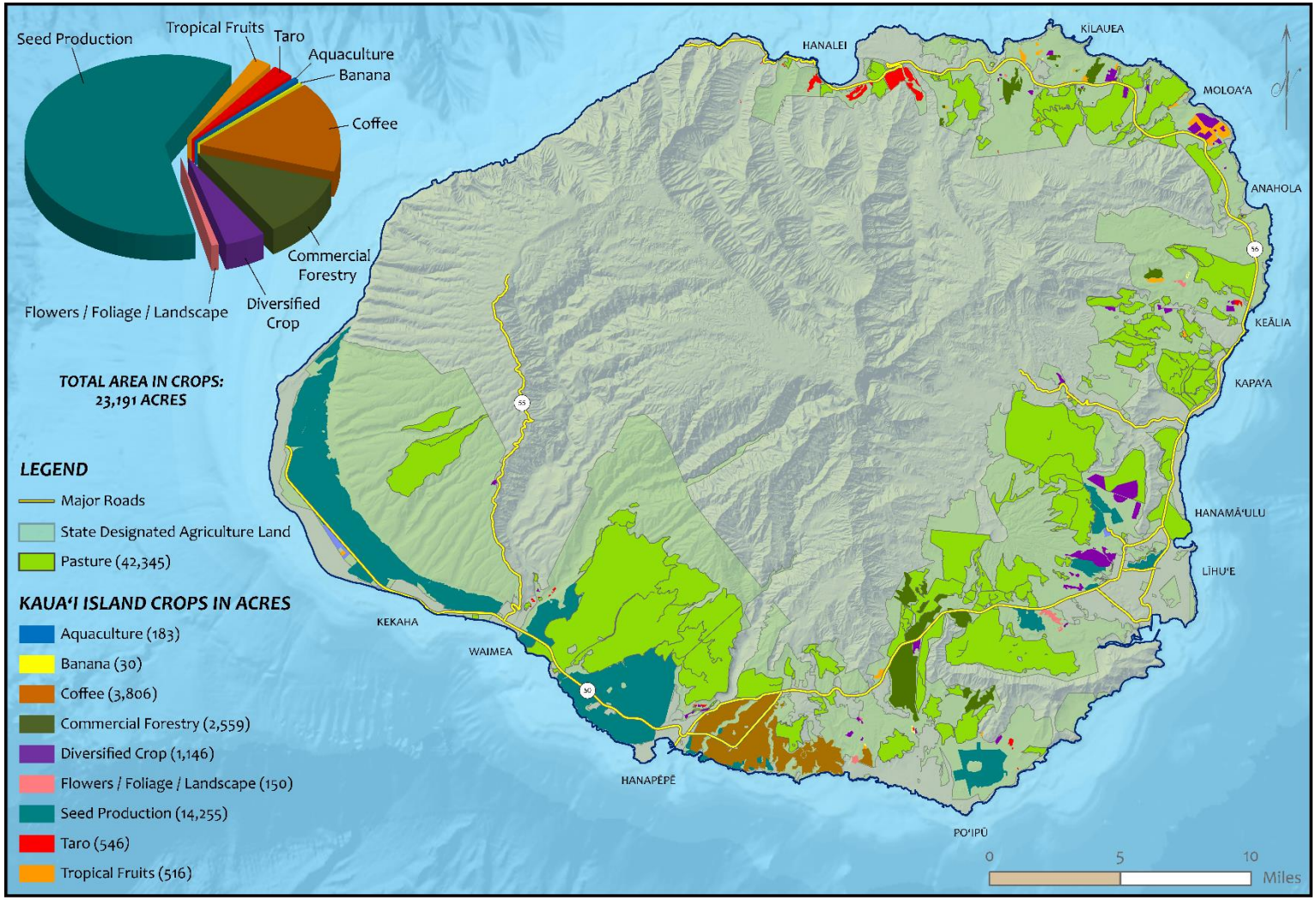


Figure 2. Kaua'i Island Agricultural Footprint in 2020.

KAUA'I ISLAND CROP SUMMARY (2020)

The southwestern shore of Kauaʻi, stretching from the Mānā coastal plain to the fertile fields below Kalāheo, contains the largest concentrated areas of seed production, coffee, and pasture on the island (Figure 3). While coffee plantings and pasture lands in this region have remained largely stable, areas in seed production show significant changes relating to crop rotations and buffer areas (Figure 4).

Figure 3. Agricultural footprint from the Mānā coastal plain to Hanaʻpēpē.

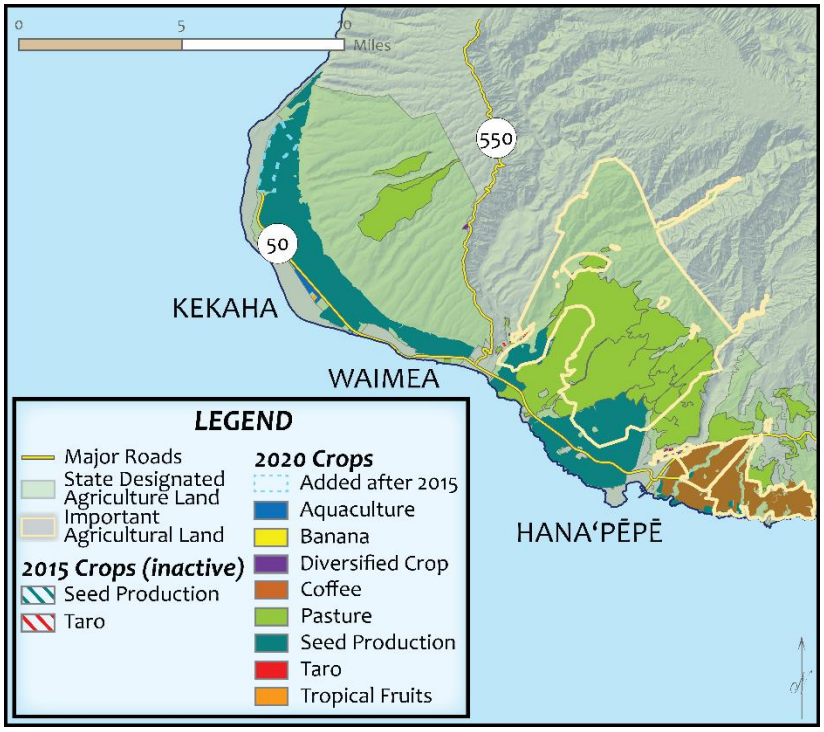


Figure 4. Satellite images from 2014 and 2019 showing extensive changes to seed production plantings north of Kekaha. Sources: Esri, DigitalGlobe, and Maxar.

Southeastern Kauaʻi, from the southern point of Poʻipū up past Hanamāulu in the moku of Līhuʻe, contains a variety of agricultural crops intermixed with large areas of pasture. Seed production, diversified agriculture, and flowers/foliage/landscape are all present in this area (Figure 5). This region also holds the greatest amount of commercial forestry plantings on the island and saw extensive harvesting and planting activities between 2014 to 2020 (Figure 6).

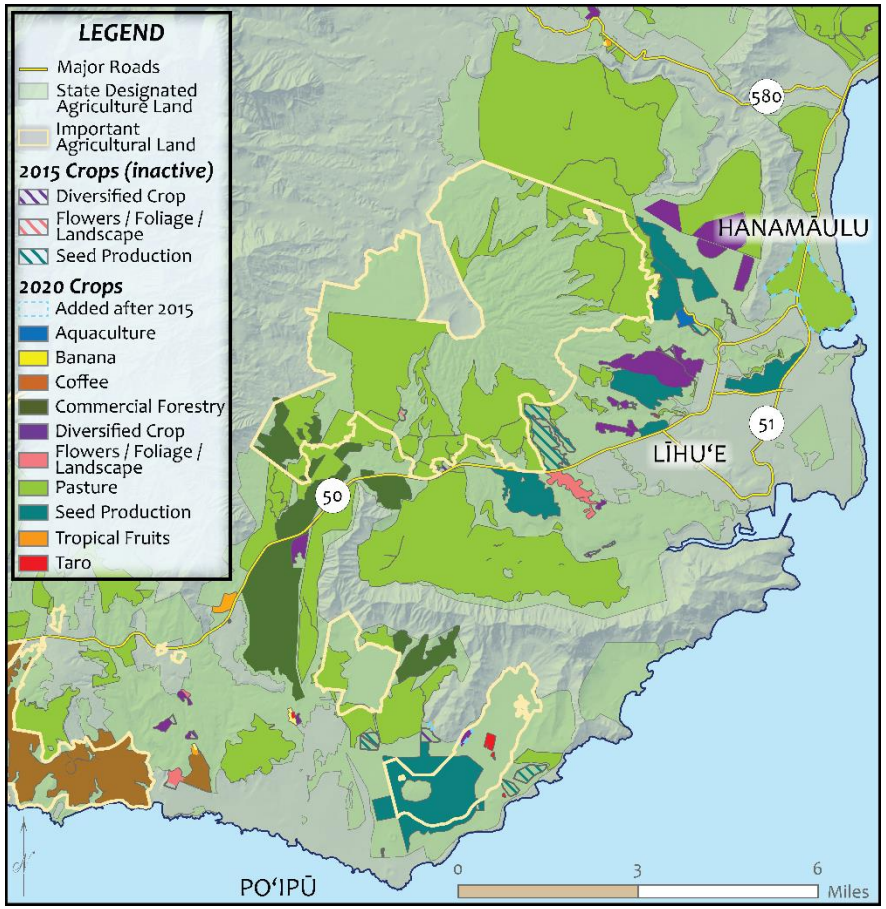


Figure 5. Agricultural footprint for southeastern Kauaʻi.

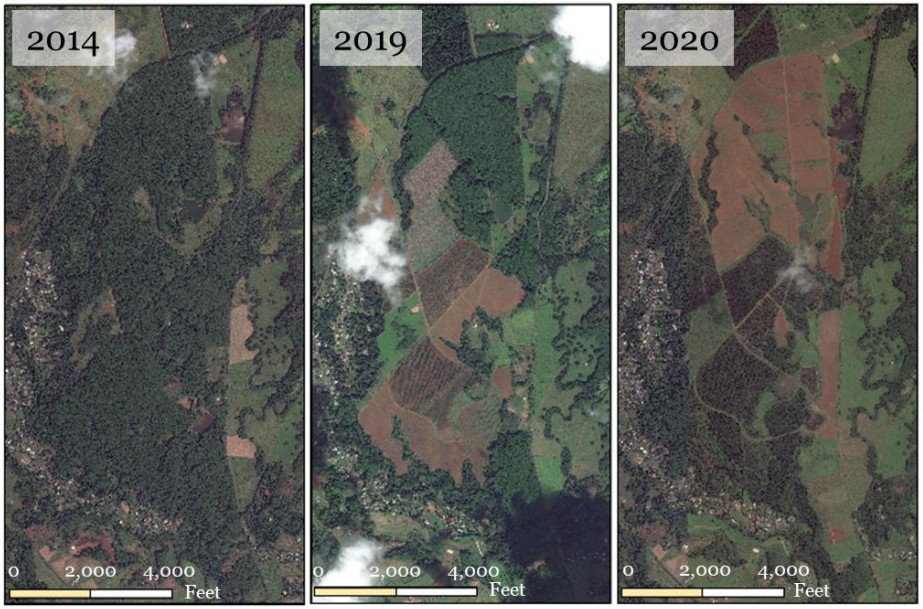
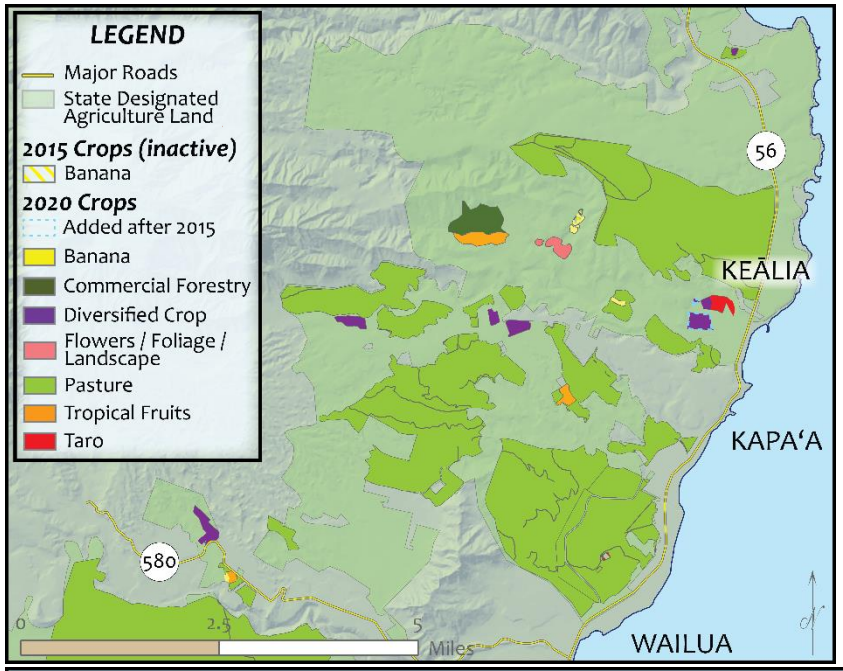


Figure 6. Satellite images from 2014, 2019, and 2020 showing extensive changes to commercial forestry plantings south of Highway 50 above Kōloa. Sources: Esri, DigitalGlobe, and Maxar.



Continuing up the eastern shore of Kauaʻi, from Wailua to Keālia, there are smaller plantings of various crops situated within a larger matrix of pasture lands (Figure 7). The north shore of Kauaʻi, from Moloaʻa stretching west, presents a sequence of different crop types that shift from diversified crops and tropical fruits to commercial forestry to the largest concentration of wetland taro agriculture in the state of Hawaiʻi, located around Hanalei (Figure 8).

Figure 7. Agricultural footprint for eastern Kauaʻi.

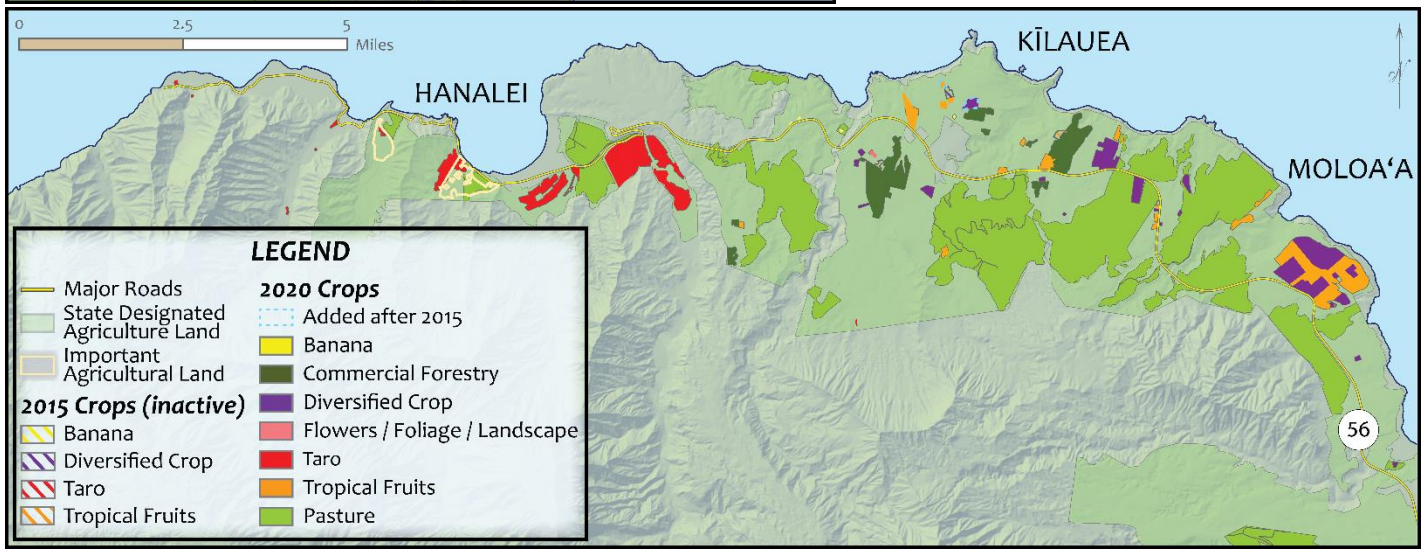


Figure 8. Agricultural footprint for the north shore of Kauaʻi.

Important Agricultural Lands: Kaua‘i Island

On the island of Kaua‘i there are 37,410 acres designated as Important Agricultural Lands (IAL) by the State Land Use Commission (Figure 9). Within the IALs, 51% (19,200 acres) were in active agricultural use in 2020. Pasture makes up slightly more than two-thirds of these lands (13,173 acres) and the remaining land is used for crops (5,763 acres) and commercial forestry (264 acres). Of the cropped IAL land, 51% is used to grow coffee (2,916 acres), 48% is used for seed production (2,776 acres), and the remaining 1% is used to grow taro, diversified crop, and banana.

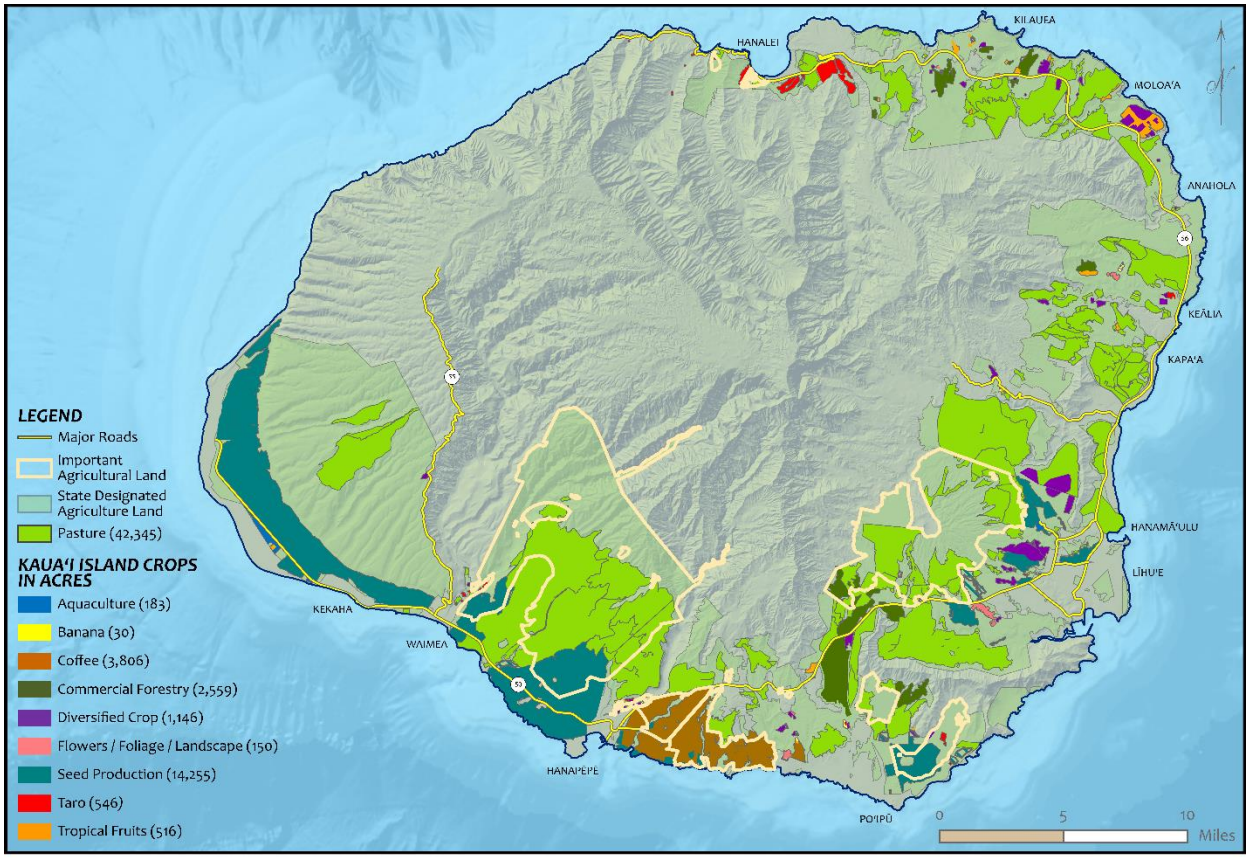
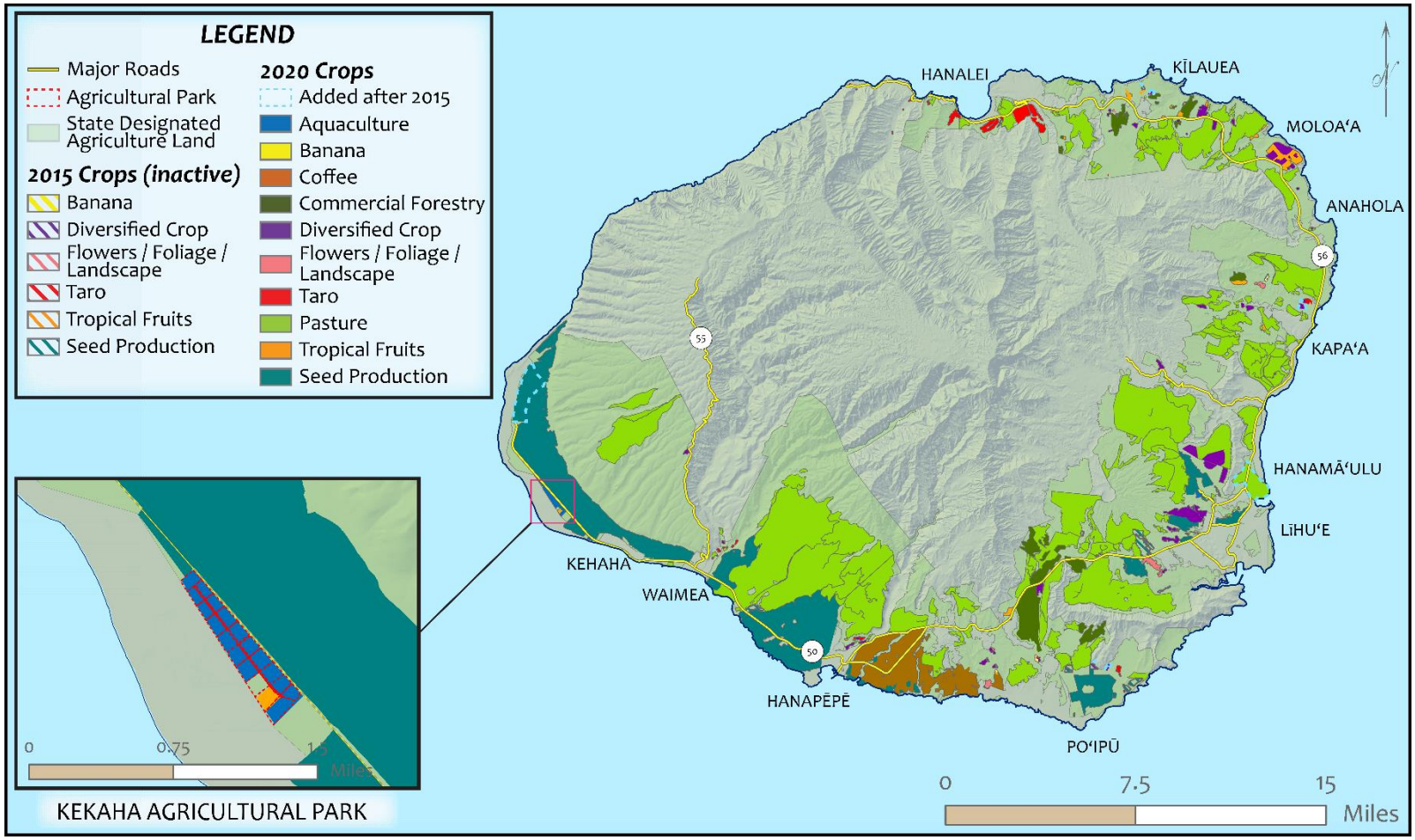


Figure 9. Agricultural footprint and Important Agricultural Land designation areas (yellow outline) on the island of Kaua‘i.

Agricultural Parks: Kauaʻi Island

On the island of Kauaʻi, there is one active Agricultural Park (Kekaha) totaling 160 leased acres as of 2020, based on GIS data provided by the Department of Agriculture (Figure 10). Of these leased acres, 94% (150 acres) were mapped as being in active cultivation in 2020. The vast majority of these (140 acres) were in aquaculture for Kauaʻi shrimp, with the remaining 10 acres in tropical fruit.

Figure 10. Active Agricultural Park leases (red outline) on Kauaʻi.



O‘ahu Island 2020 Agricultural Footprint

The island of O‘ahu (Figure 11) has seen slight gains across almost all crop categories since 2015, and continues to produce the majority of diversified crops in the state, with 10,595 acres in production in 2020 (Table 3). Diversified crop, which gained over 700 acres between 2015-2020, is followed by seed production (7,376 acres in 2020) and pineapple (3,437 acres in 2020) as the next largest crop categories, with most other crops composing <500 acres islandwide.

In the central plain of O‘ahu, from ‘Ewa Beach (Figure 12) up to Waimea Bay on the North Shore (Figure 13), diversified crops (8,000 acres) and seed production (7,400 acres) continue to play major roles, with scattered smaller plantings of banana, pineapple, and other crop types.

O‘ahu	Acreage		Change (2015 to 2020)	
Crop Type	**2015**	**2020**	**Acres**	**%**
Aquaculture	274	300	26	9.5
Banana	345	360	15	4.3
Coffee	168	169	1	0.6
Commercial Forestry	26	27	0.2	0.8
Diversified Crop	9,865	10,595	730	7.4
Flowers / Foliage / Landscape	484	510	26	5.4
Macadamia Nuts	0	2	2	NA
Papaya	166	164	-2	-1.2
Pineapple	3,414	3,437	23	0.7
Seed Production	7,333	7,376	43	0.6
Taro	51	77	26	51
Tropical Fruits	227	260	33	14.5
Crop Total	22,353	23,277	924	4.1
Pasture	18,464	18,035	-429	-2.3
Total	40,817	41,312	495	1.2

Table 3. Summary of O‘ahu agricultural footprint and changes between 2015 (Melrose et al. 2015) and 2020.

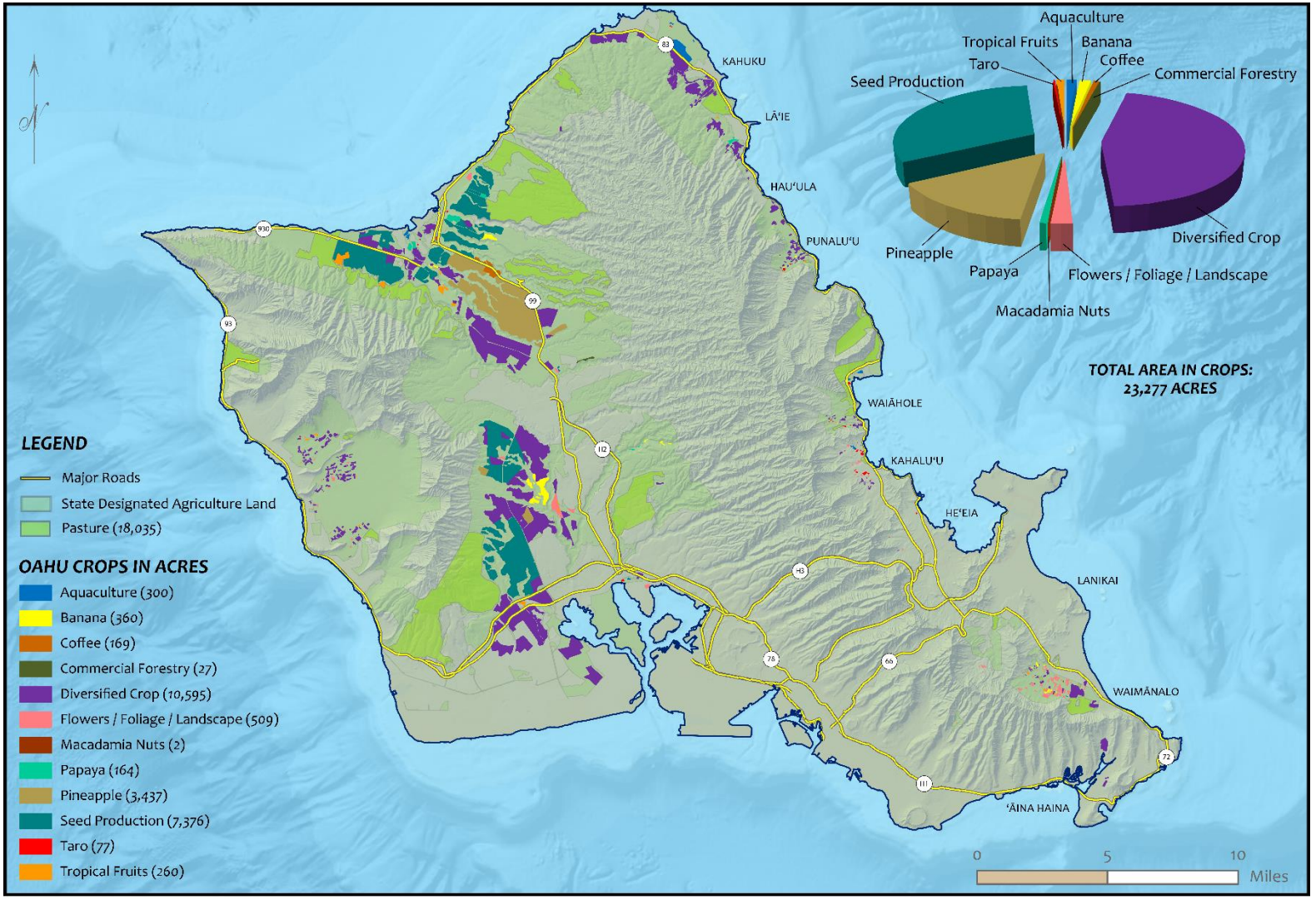


Figure 11. O'ahu Agricultural Footprint in 2020.

Department of Agriculture STATE OF HAWAII

O'AHU CROP SUMMARY (2020)

SDAV UH HILO

University of Hawai'i Hilo

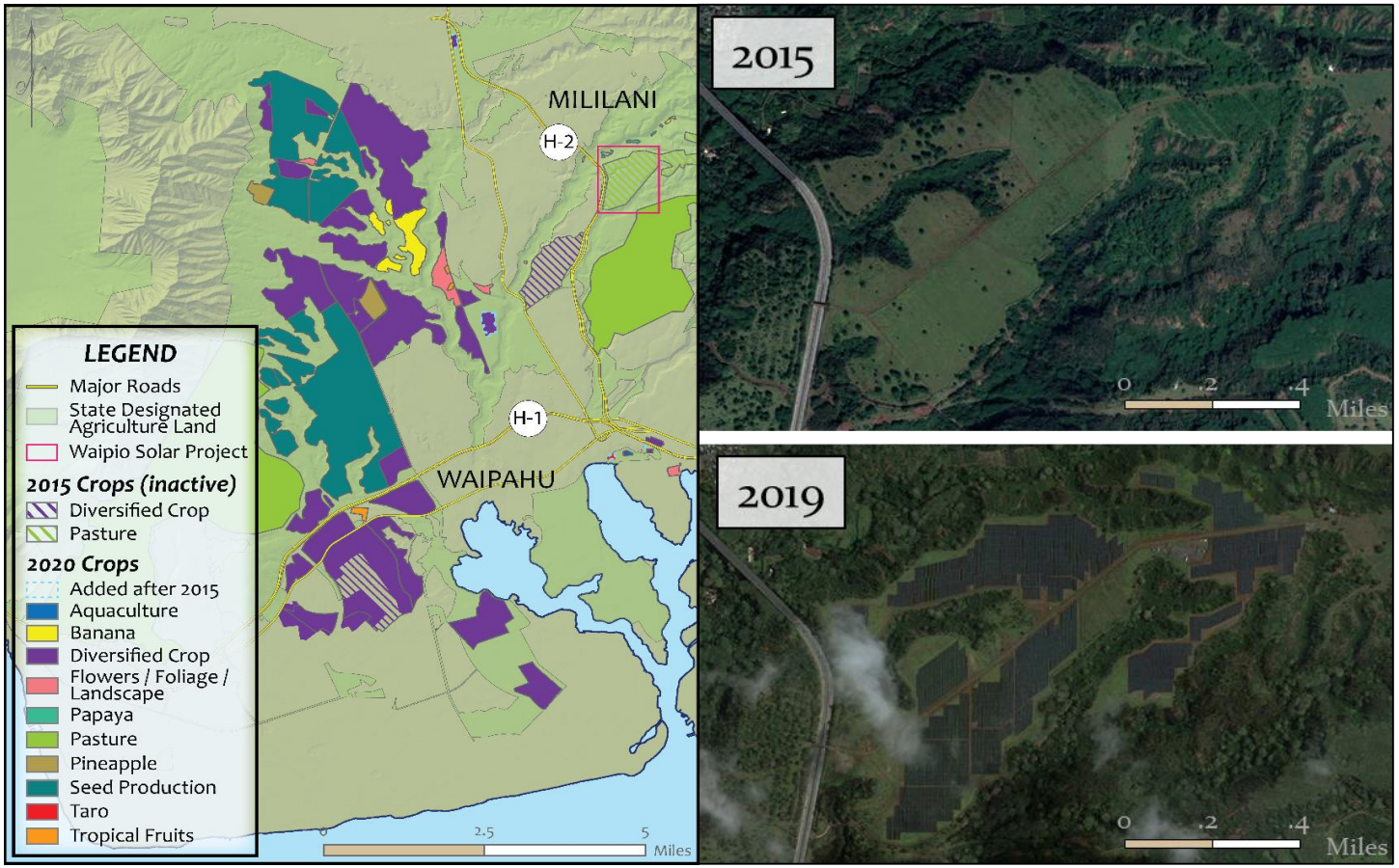


Figure 12. (Left) Agricultural footprint in the lower Central Plain, pink inset box depicts area shown in satellite imagery at right. (Right) Satellite images from 2015 and 2019 showing development of the Waipio Solar project on former pasture. Sources: Esri, DigitalGlobe, and Maxar.

Two notable agricultural losses in the central plain are located alongside the H-2 Highway: a subdivision development, occurring on what had been 359 acres of diversified crop lands, and the creation of the Waipio Solar project on 515 acres of former cattle pasture owned by NRG in Central Oʻahu (Figure 12).

Although limited sheep grazing is planned for a portion of the Waipio Solar to manage vegetation, these two cases provide good examples of the competing interests for land that continue to impact agriculture in Hawai‘i.

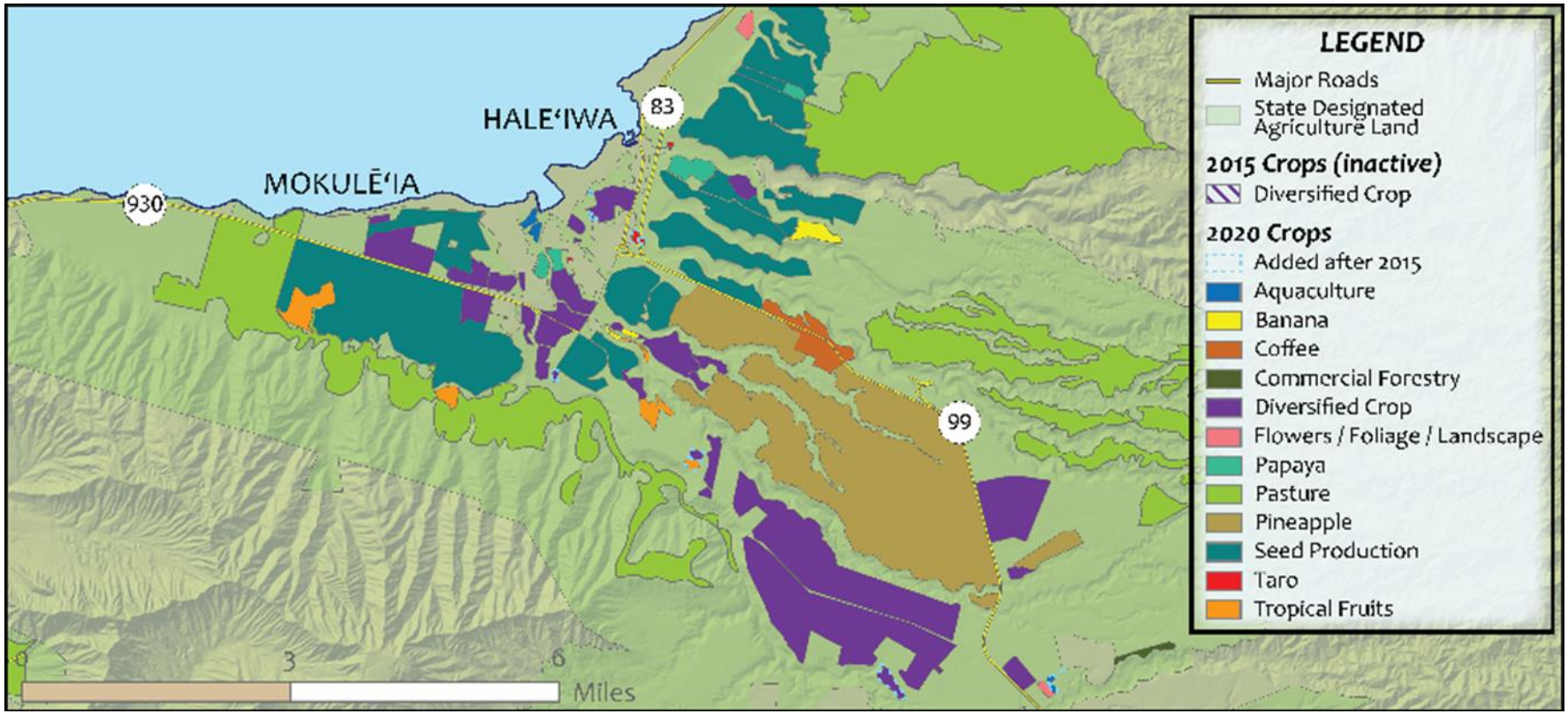


Figure 13. Agricultural footprint in the upper Central Plain of O‘ ahu.

On the Waiʻanae Coast, diversified crop continues to be an important crop category and has reached 562 acres, an expansion of over 40 acres from the 2015 assessment. Flowers/foliage/landscape, tropical fruit, and pasture also remain active in this area (Figure 14).

In northern Oʻahu, along the windward coast from Turtle Bay to Kahaluʻu, there are 1,544 acres in diversified crop, the dominant crop category in this area. Aquaculture, banana, and flowers/foliage/landscape all saw minor (<10 acres) increases in acreage in this area between 2015-2020.

The Waimānalo area was largely unchanged, adding ~20 new acres of flowers/foliage/landscape, raising this crop category up to 212 acres in this region.

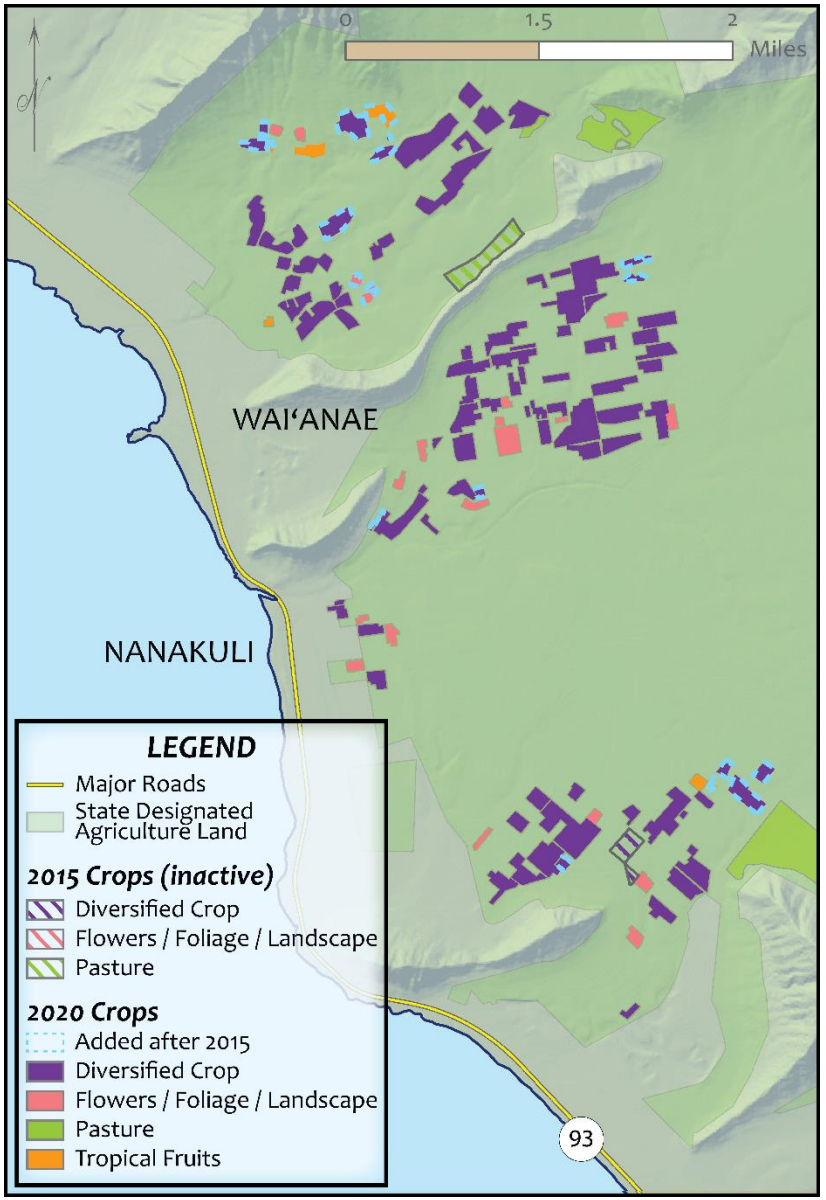


Figure 14. Agricultural footprint on the Waiʻanae Coast.

Important Agricultural Lands: O‘ahu

On the island of O‘ahu there are 15,205 acres designated as Important Agricultural Lands (IAL) by the State Land Use Commission (Figures 15, 16, and 17). Of these, 60% (9,150 acres) were in active agriculture in 2020. Pasture makes up a bit more than half of these lands (4,957 acres) and cropped farmland (4,188 acres) the remainder. Of the cropped IAL areas, two-thirds (2,787 acres) is made up of seed production, followed by 952 acres in diversified crops.

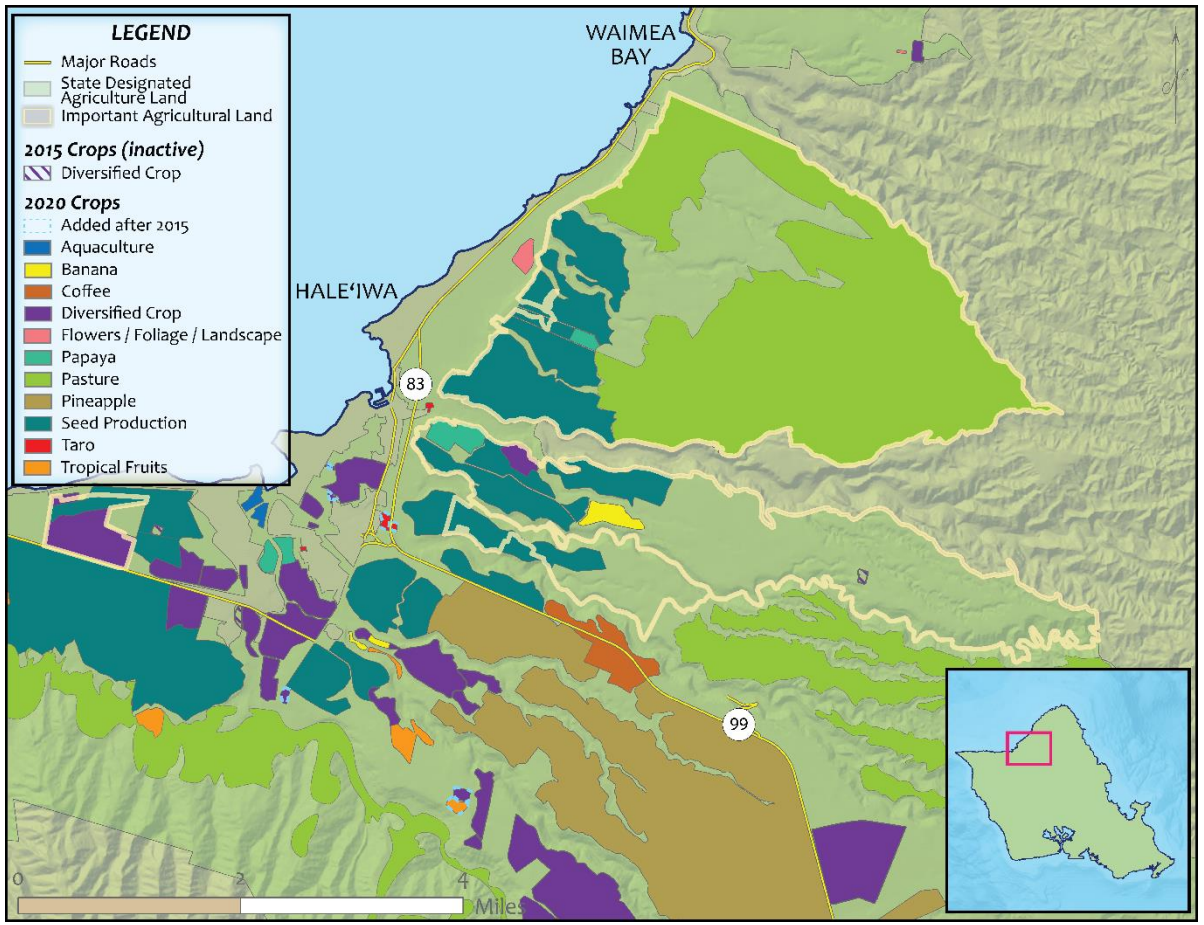


Figure 15. Agricultural footprint and Important Agricultural Land designation areas (yellow outline) on upper Central Plain of O‘ ahu.

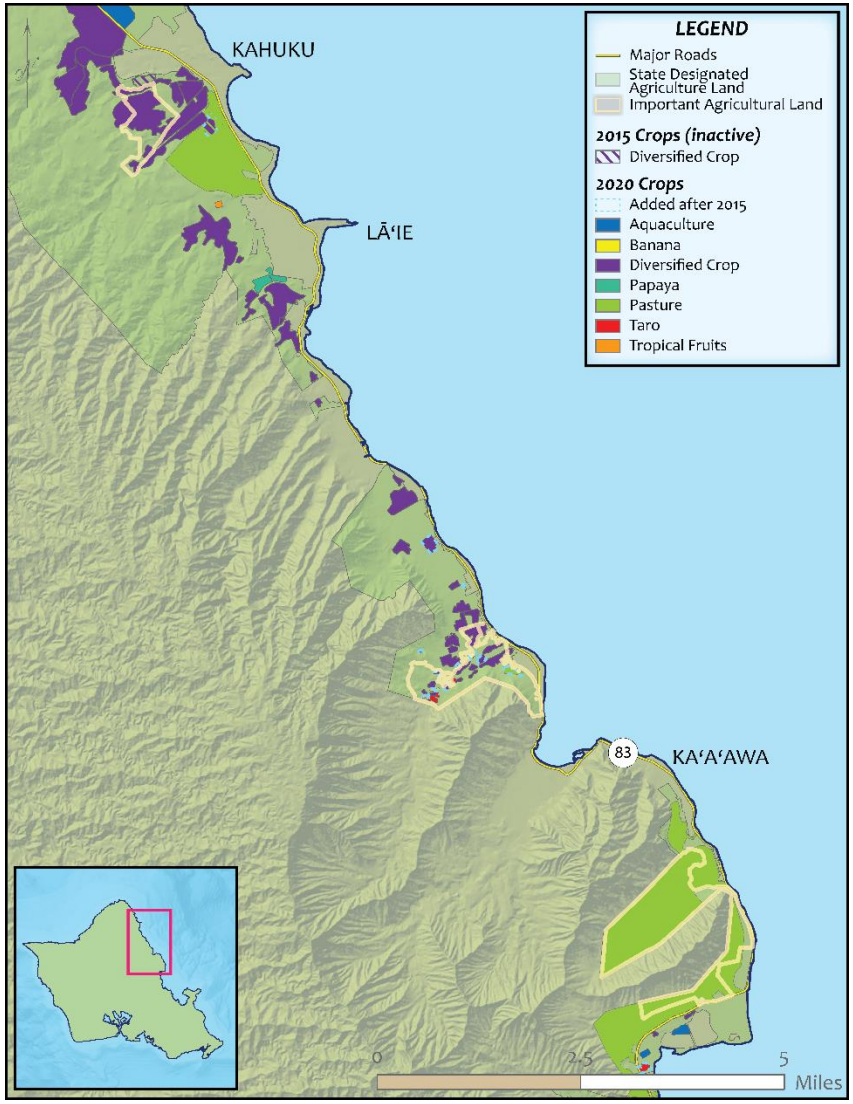


Figure 16. Agricultural footprint and Important Agricultural Land designation areas (yellow outline) on Windward coast of Oʻ ahu.

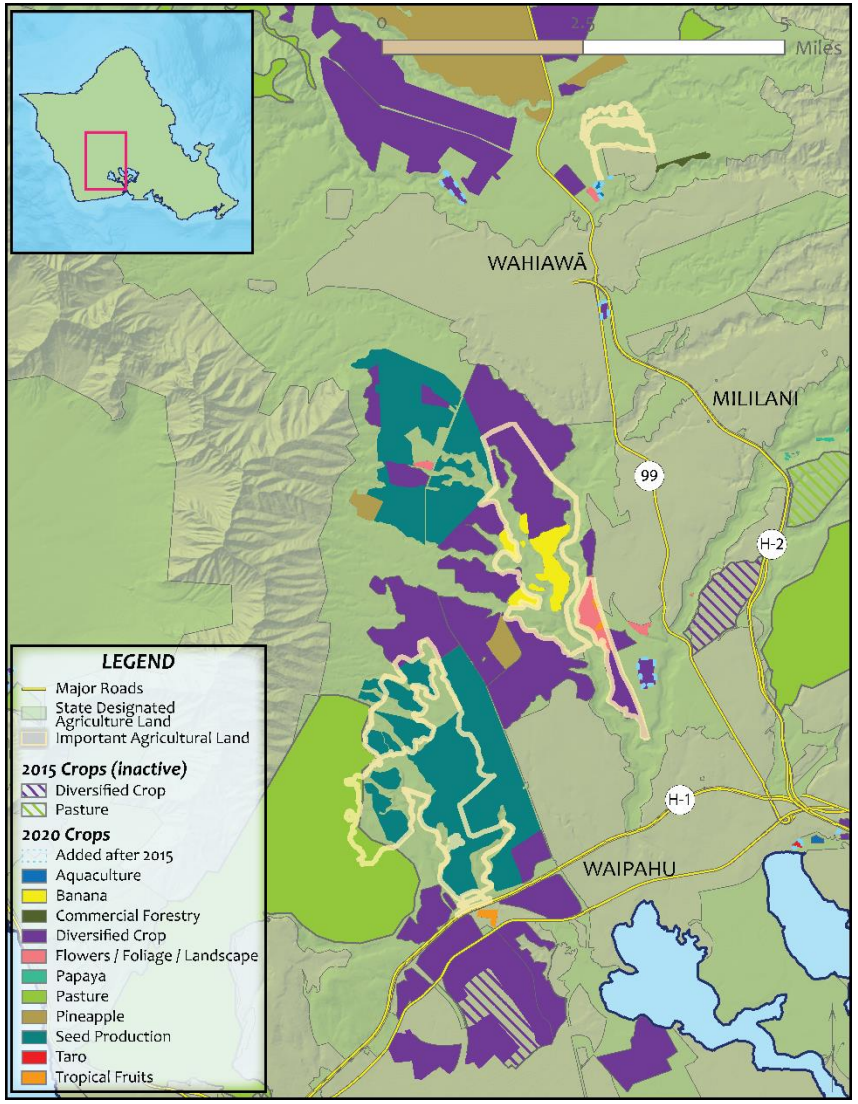


Figure 17. Agricultural footprint and Important Agricultural Land designation areas (yellow outline) on the lower Central Plain of Oʻ ahu.

Agricultural Parks: Oʻahu

The Hawaiʻi Department of Agriculture Division of Agricultural Resource Management operates the Agricultural Park Program, where lands are set aside specifically for agriculture-related activities. On the island of Oʻahu, there are four active Agricultural Parks (Kahuku, Kalaeloa, Waiʻanae, and Waimānalo) totaling 637 leased acres as of 2020, based on GIS data provided by the Department of Agriculture (Figure 18). Of these leased acres, 368 acres were mapped as being in active cultivation in 2020, with the vast majority of these (327 acres) being in diversified crops. It is worth noting that not all of the agricultural-related activities occurring on these lands, specifically some agricultural plots less than three acres in size, fallow lands, and the meat processing operation in Kalaeloa, were mapped under the Crop Mapping Protocols used in this study (see Appendix).

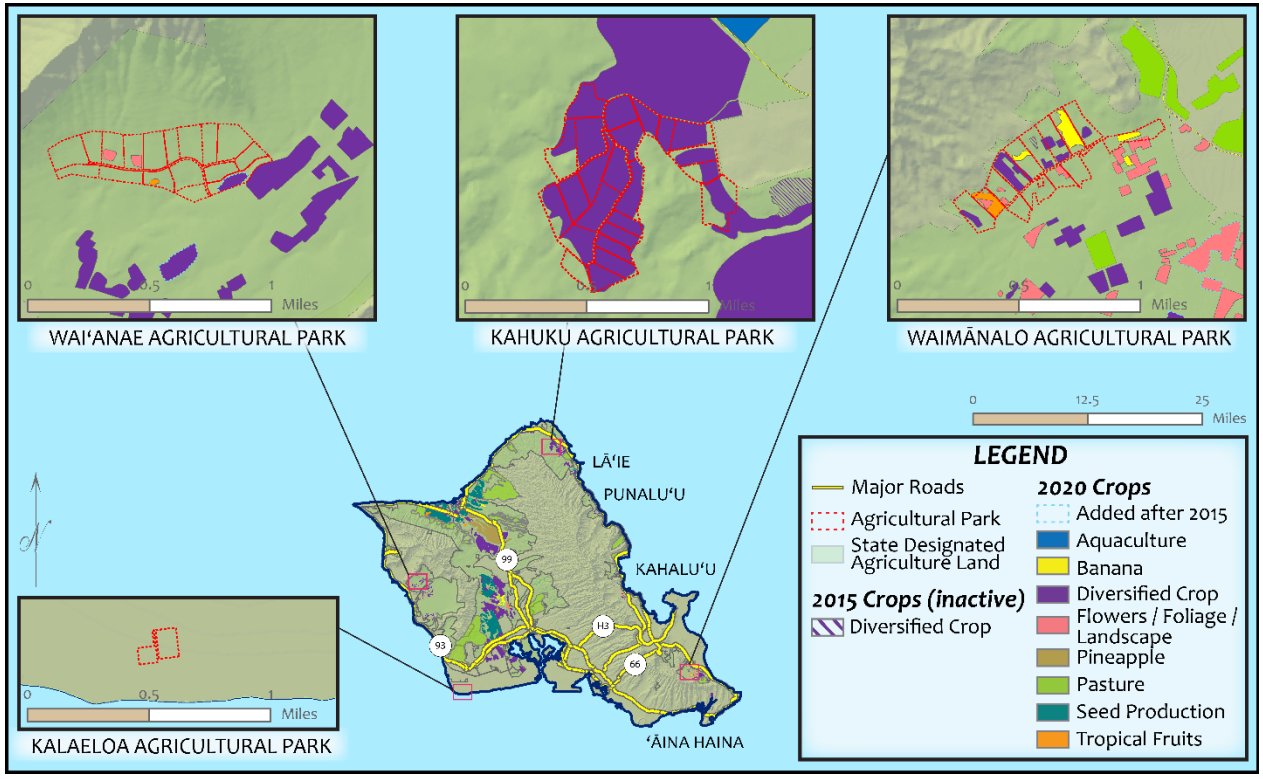


Figure 18. Active Agricultural Park Program leases (red outline) on Oʻ ahu.

Molokaʻi 2020 Agricultural Footprint

Since 2015, agriculture on Molokaʻi has remained largely stable (Table 4, Figure 19). Minor losses in aquaculture and pasture have been offset by increases in other crop types, including diversified agriculture and tropical fruits. The increased acreage in tropical fruit (+174 acres) is the result of new planting in the Hoʻolehua plain (Figure 20). Seed production continues to be the largest crop on Molokaʻi (2,352 acres), followed by diversified agriculture (1,017 acres). Pasture continues to comprise the vast majority (91%) of agricultural acreage on Molokaʻi at 37,867 acres, covering an area roughly double that dedicated to pasture on the island of Oʻahu.

Molokaʻi	Acreage		Change (2015 to 2020)	
Crop Type	**2015**	**2020**	**Acres**	**%**
Aquaculture	28	26	-3	-9.6
Coffee	123	122	0	0.0
Commercial Forestry	0	2	2	100.0
Diversified Crop	937	1,017	80	8.5
Flowers / Foliage / Landscape	26	26	0	0
Macadamia Nuts	-	7	7	NA
Papaya	93	109	16	17.6
Seed Production	2,342	2,352	10	0.4
Taro	2	2	0	0.0
Tropical Fruits	43	216	174	405.4
Crop Total	**3,593**	**3,880**	**286**	**8.0**
Pasture	38,261	37,867	-394	-1.0
Total	**41,854**	**41,747**	**-108**	**-0.3**

Table 4. Summary of Molokaʻi agricultural footprint and changes between 2015 (Melrose et al. 2015) and 2020.

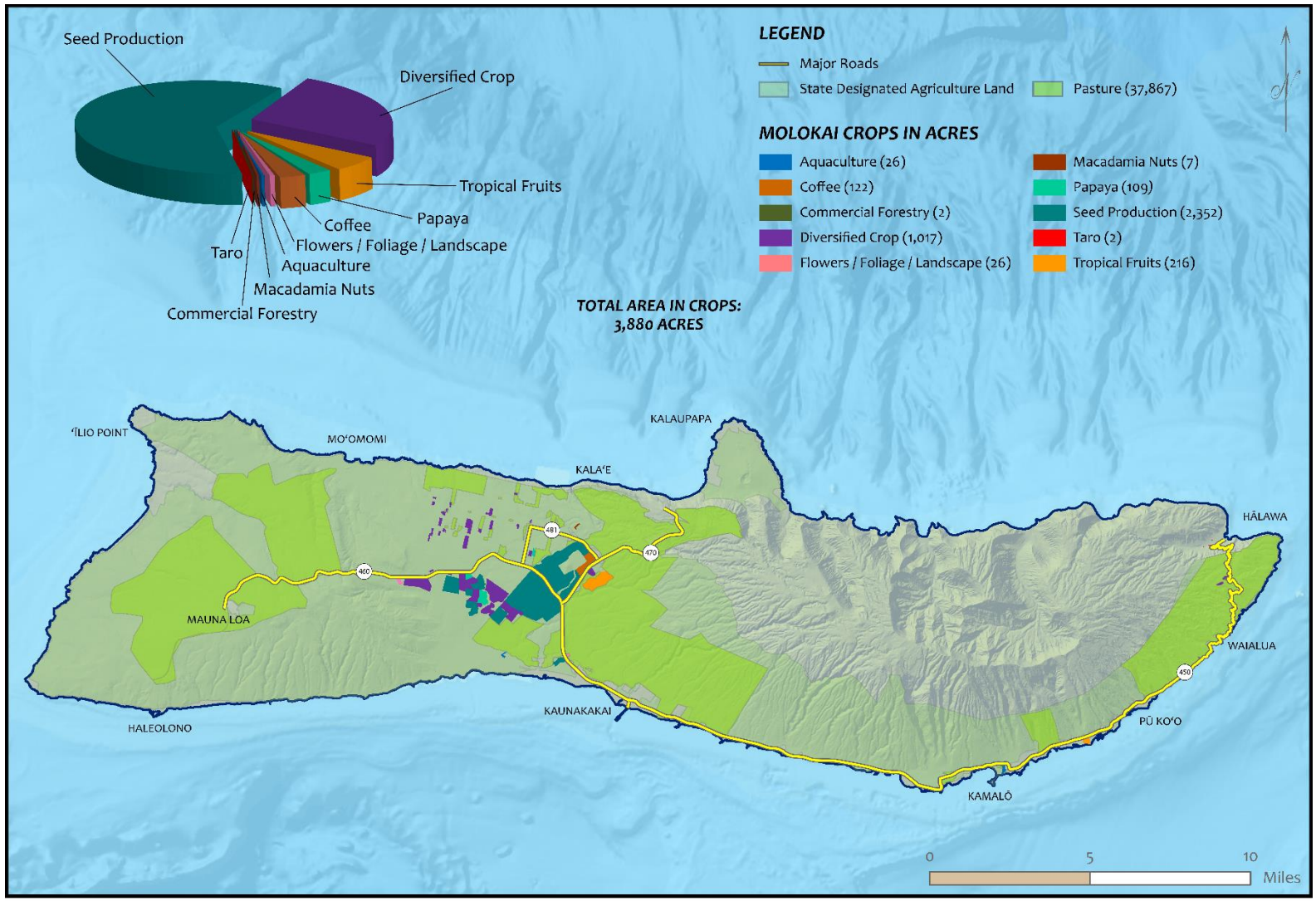


Figure 19. Molokaʻi Island Agricultural Footprint in 2020.

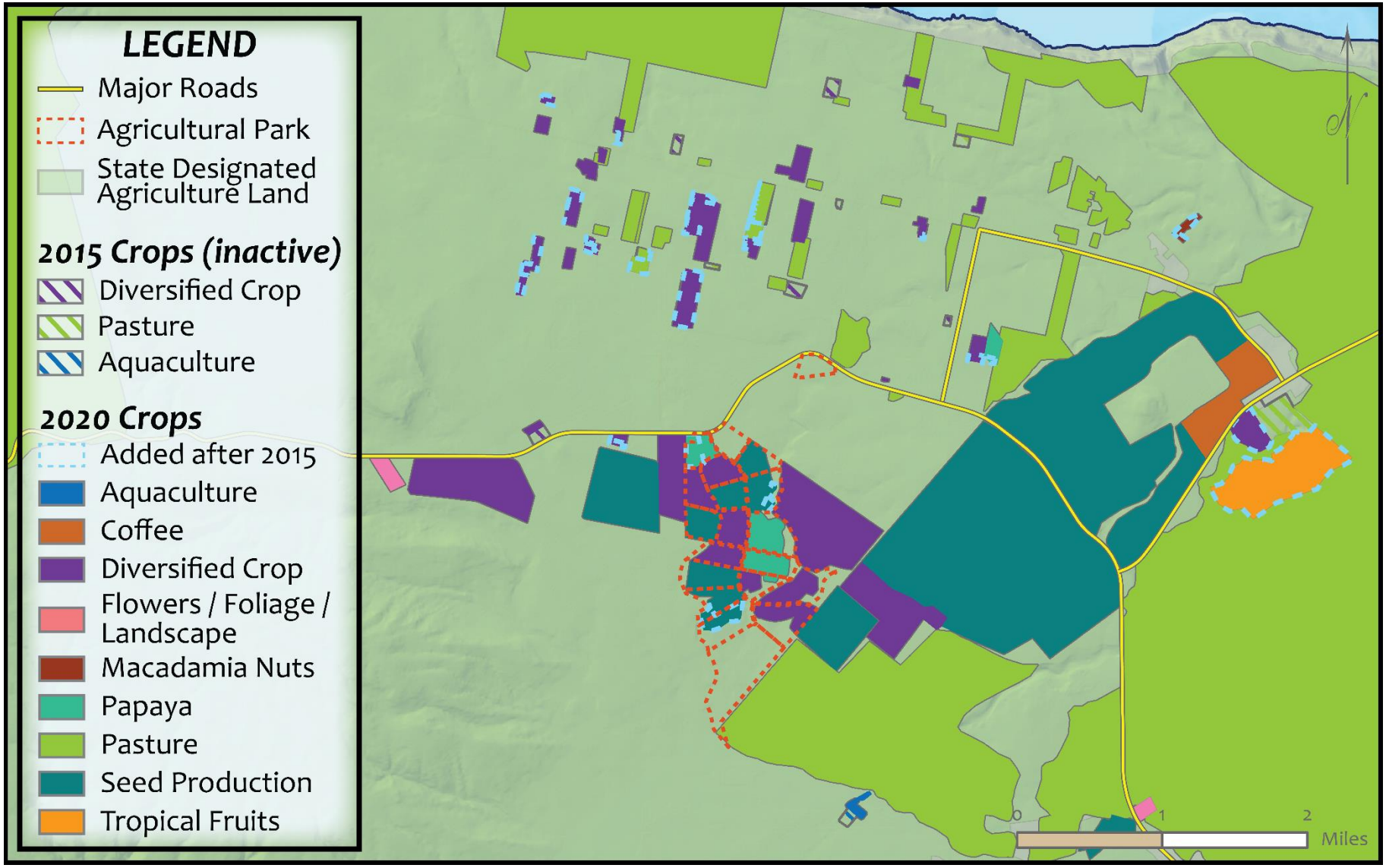


Figure 20. Agricultural Footprint in the Hoʻolehua plain on the island of Molokaʻi.

Lānaʻi 2020 Agricultural Footprint

The island of Lanaʻi continues to have a relatively small agricultural footprint, but showed a significant increase in diversified crop acreage, rising from 54 acres in 2015 to 95 acres in 2020 (Table 5). Beyond these increases in conventionally cropped agriculture (Figure 21, 22), an ambitious hydroponic facility began commercial production in 2020. Sensei Farms Lānaʻi is producing vegetables for resorts on Lānaʻi, with plans to expand production to help meet consumer demand across the state.

Lānaʻi	Acreage		Change (2015 to 2020)	
Crop Type	**2015**	**2020**	**Acres**	**%**
Diversified Crop	54	95	40	74
Flowers/Foliage/Landscape	10	10	0	0
Total	**65**	**105**	**40**	**62**

Table 5. Summary of Lānaʻi agricultural footprint and changes between 2015 (Melrose et al. 2015) and 2020.

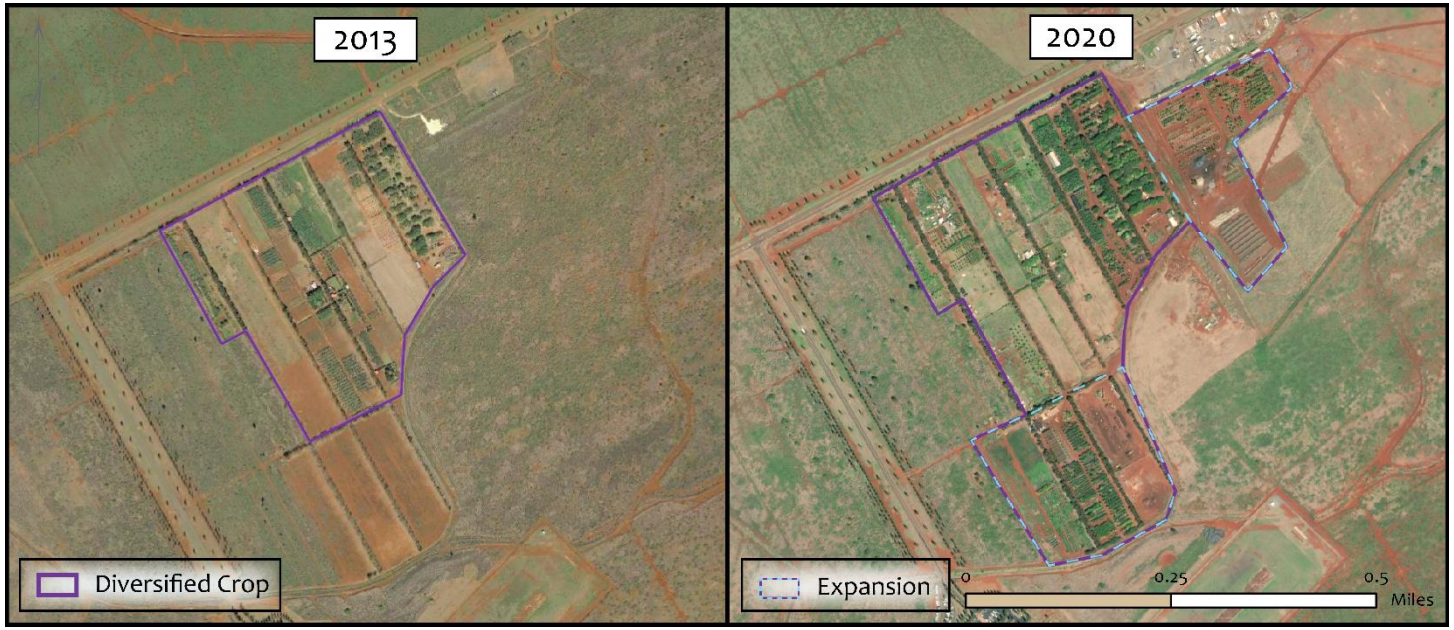


Figure 21. Lānaʻi Island Agricultural Footprint in 2020. Sources: Esri, DigitalGlobe, and Maxar.

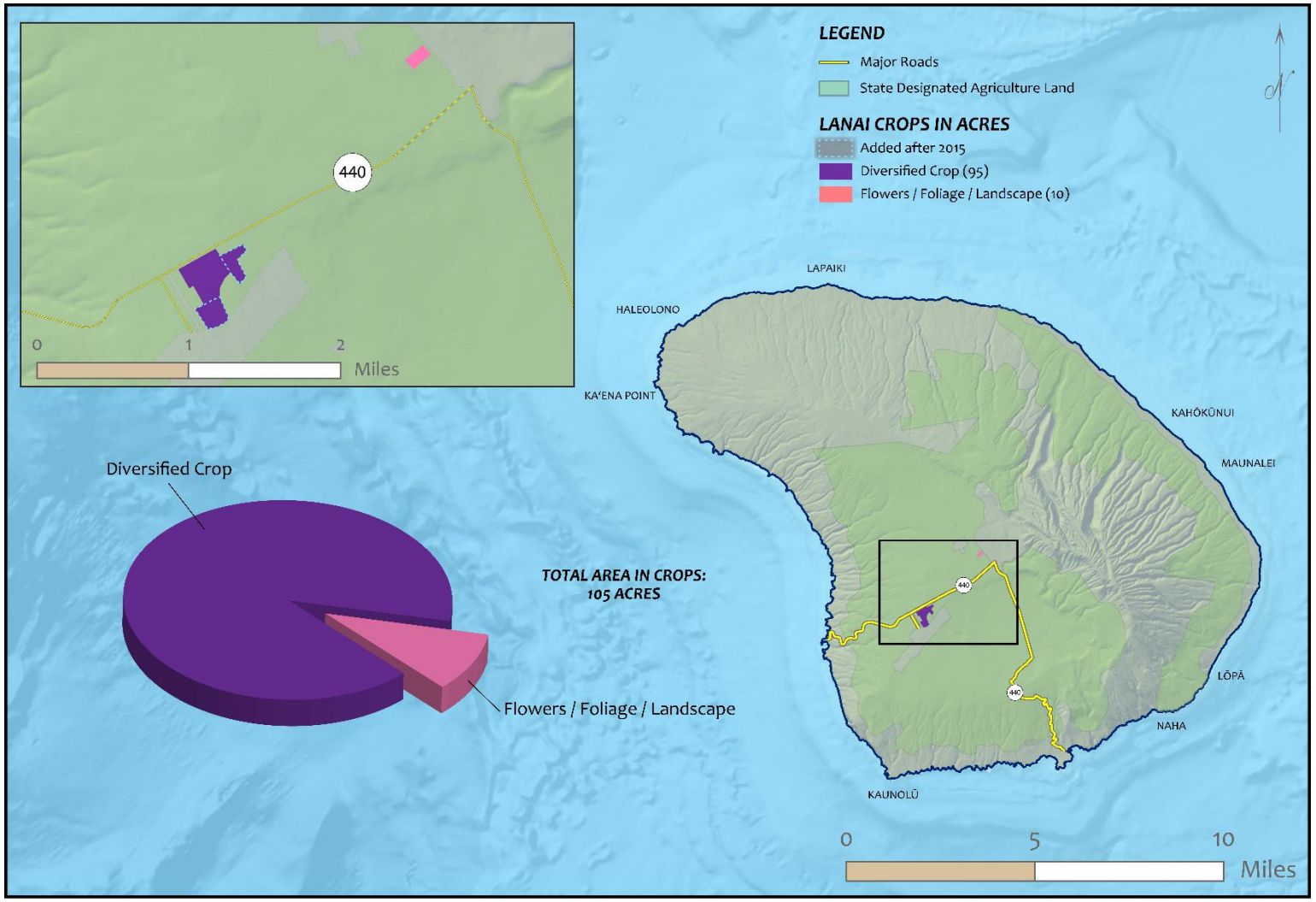


Figure 22. Lānaʻi Island Agricultural Footprint in 2020.

LĀNAʻI CROP SUMMARY (2020)

Maui 2020 Agricultural Footprint

Of all the Hawaiian islands, the island of Maui has seen the most dramatic changes to its agricultural landscape between 2015-2020 (Table 6, Figure 23). The final closure of the Hawaiian Commercial & Sugar Company (HC&S) in 2016 removed 38,810 acres of sugarcane production from the island, contributing to an overall decline in cropped acreage of 82%. These overall losses have been partially offset by the largest documented increase in diversified crop observed on any of the Hawaiian Islands over this time period, rising from 1,582 acres to 3,405 acres, an increase of 115%. Diversified agriculture is now the largest crop on Maui, followed by pineapple, which dropped 12% down to 959 acres.

Maui	Acreage		Change (2015 to 2020)	
Crop Type	**2015**	**2020**	**Acres**	**%**
Banana	62	64	2	3
Coffee	545	944	399	73
Commercial Forestry	33	36	3	10
Diversified Crop	1,582	3,405	1,823	115
Flowers / Foliage / Landscape	134	144	10	8
Macadamia Nuts	186	793	606	325
Pineapple	1,094	959	-134	-12
Seed Production	754	647	-107	-14
Sugarcane	38,810	0	-38,810	-100
Taro	54	113	59	109
Tropical Fruits	104	612	508	488
Crop Total	**43,359**	**7,718**	**-35,640**	**-82**
Pasture	108,447	115,241	6,794	6
Total	**151,806**	**122,959**	**-28,847**	**-19**

Table 6. Summary of Maui agricultural footprint and changes between 2015 (Melrose et al. 2015) and 2020.

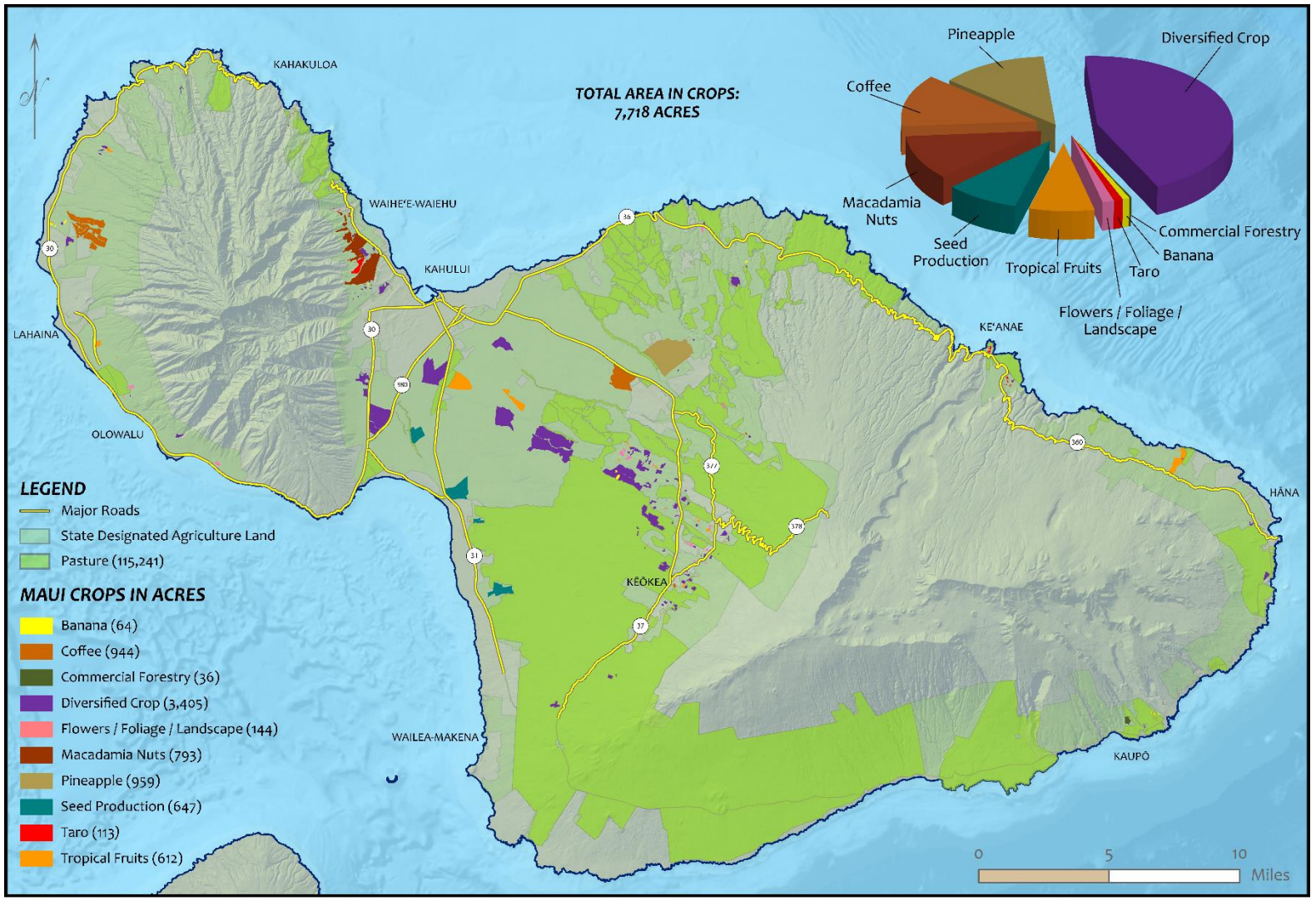


Figure 23. Maui Island Agricultural Footprint in 2020.

Department of Agriculture STATE OF HAWAII

MAUI CROP SUMMARY (2020)

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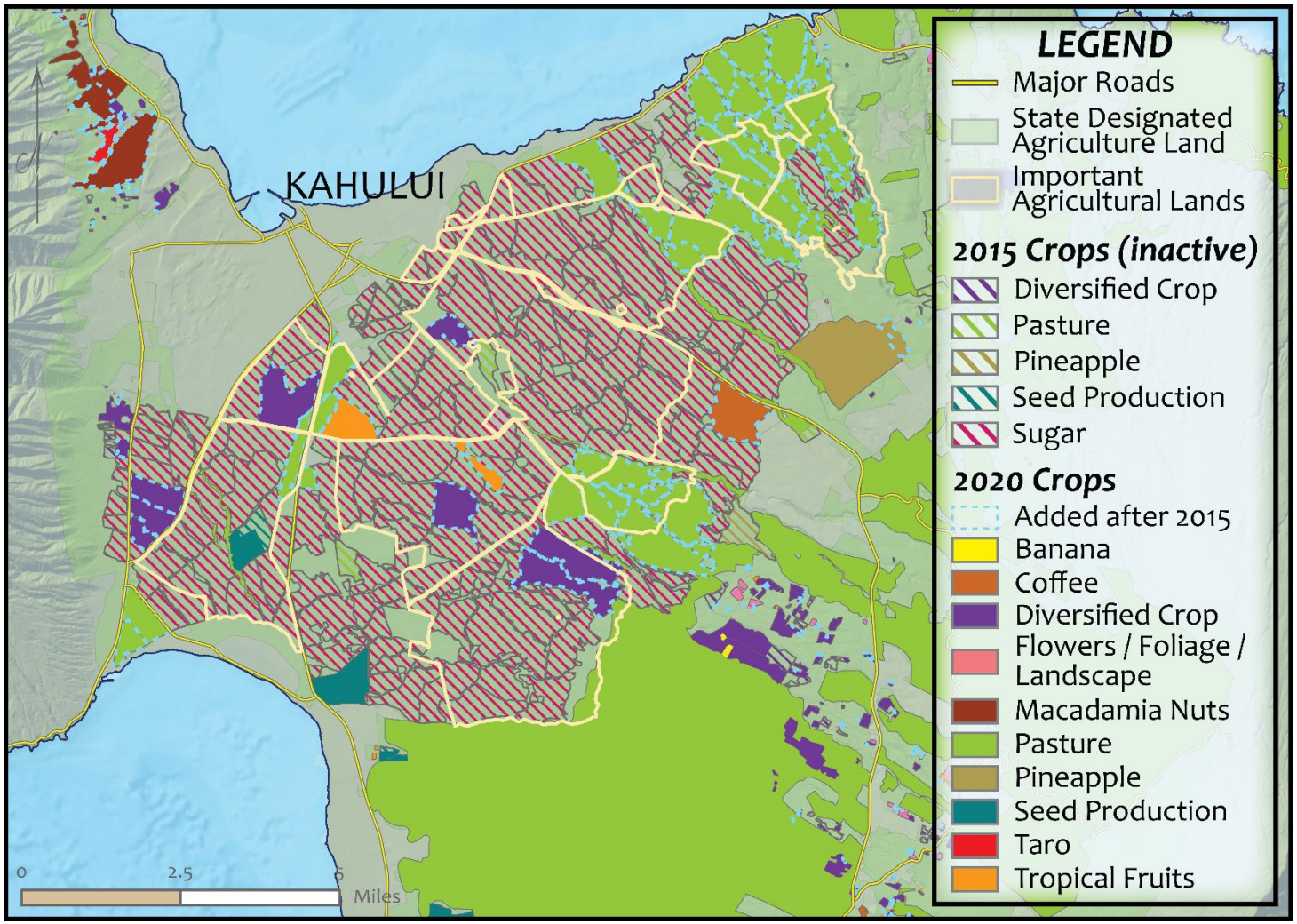
University of Hawai'i Hilo

Figure 24. New plantings and former sugarcane lands in the area of Kahului on Maui Island.



Coffee and macadamia nut, the next two largest plantings saw significant increases during this period, as did tropical fruits. These increases are occurring not only on former sugarcane lands (Figure 24, Figure 25), but also with new plantings across the island (Figure 26).

Figure 25. (Left) Satellite image showing sugarcane plantings in the western central plain in 2015. (Right) Satellite image showing the same area converted to diversified crop or fallow fields. Sources: Esri, DigitalGlobe, and Maxar.

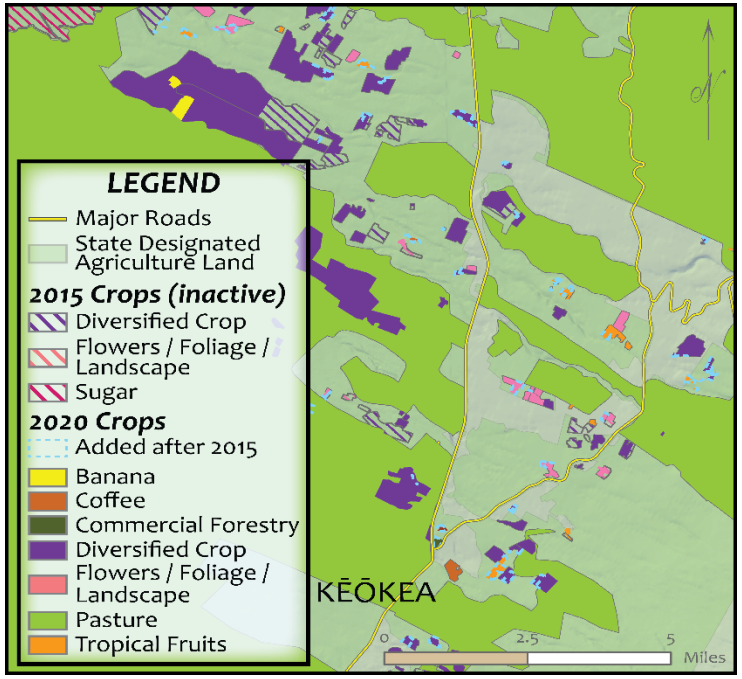


Figure 26. Agricultural change, including new plantings, in the upcountry area of Kēōkea on Maui Island.

Hawai‘i Island 2020 Agricultural Footprint

Since 2015, Hawai‘i Island agriculture (Figure 27) has faced a number of trials, from a volcanic eruption in the Puna district and flooding and losses from Hurricane Lane in 2018 to the recent discovery of coffee leaf rust in October 2020. These events, along with ongoing issues impacting pastures and cropland, such as the spread of invasive pests like the coffee-berry borer (Johnson and Manoukis, 2020) and Two-Lined Spittlebug (Thorne et al. 2018), all contribute to the challenges experienced by Hawai‘i Island ranchers and farmers.

Despite these and other challenges, Hawai‘i Island continues to be the state‘ s primary producer for a number of important crops, including coffee, flowers/foliage/landscape, macadamia nuts, papaya, and tropical fruit. Hawai‘i Island also holds the vast majority of the state‘ s acreage in commercial forestry (20,921 acres) and pasture (552,091), though acreage in these categories dropped slightly from 2015 (Table 7).

	Acreage		Change (2015 to 2020)	
Crop Type	**2015**	**2020**	**Acres**	**%**
Aquaculture	165	162	-3	-2
Banana	536	599	63	12
Coffee	5,525	6,028	503	9
Commercial Forestry	21,061	20,921	-140	-1
Dairy	1,855	865	-990	-53
Diversified Crop	3,266	4,343	1077	33
Flowers / Foliage / Landscape	1,612	1,538	-74	-5
Macadamia Nuts	21,359	21,405	46	0
Papaya	2,566	3,207	641	25
Sugarcane	-	14	14	N/A
Taro	61	67	6	10
Tropical Fruits	3,144	3,311	167	5
Crop Total	**61,150**	**62,460**	**1310**	**2**
Pasture	554,324	552,091	-2,233	0
Total	**615,474**	**614,551**	**-923**	**0**

Table 7. Summary of Hawai‘ i Island Agricultural Footprint and changes between 2015 (Melrose et al. 2015) and 2020.

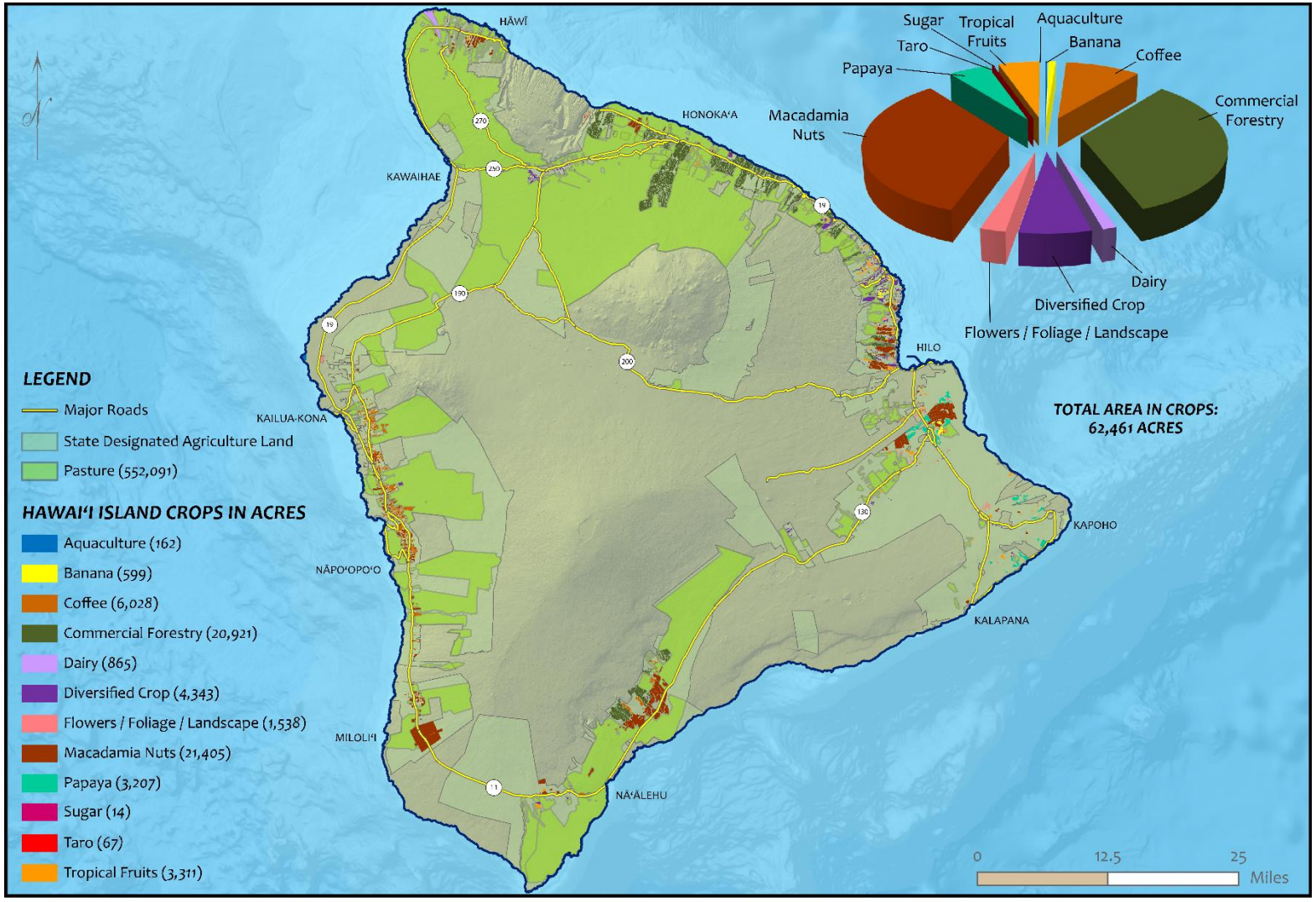


Figure 27. Hawai'i Island Agricultural Footprint in 2020.

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HAWAI'I ISLAND CROP SUMMARY (2020)

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University of Hawai'i Hilo

The South Hilo District continues to be one of the more productive agricultural areas in the state (Figure 28). Macadamia nut, commercial forestry, banana, and tropical fruit plots were largely unchanged from 2015-2020, while diversified crops displayed much more variability, driven in part by Okinawan sweet potato planting practices.

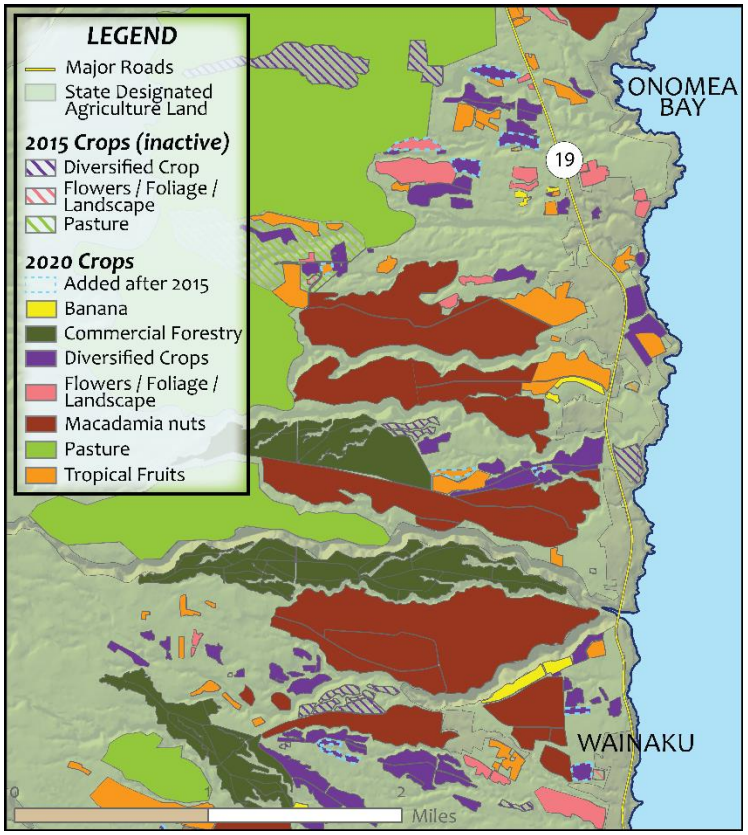
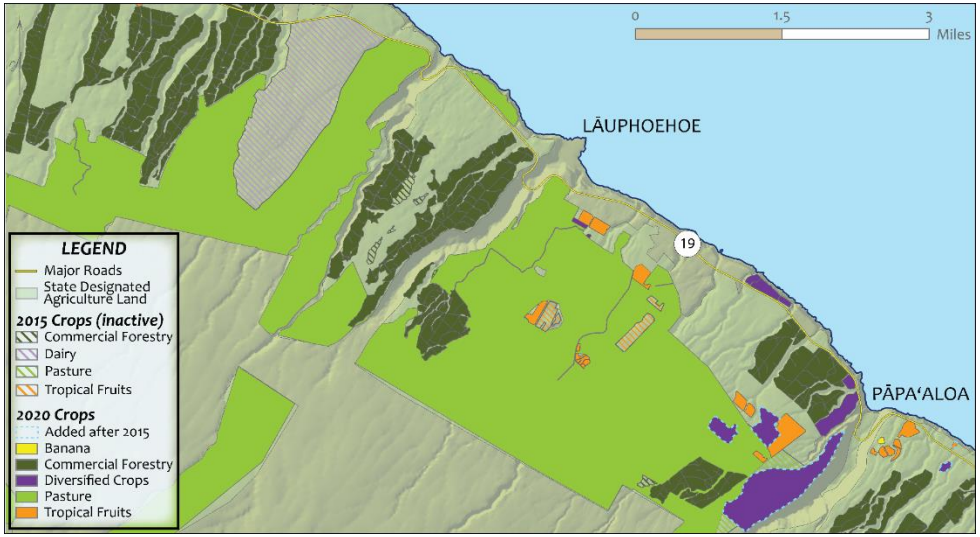


Figure 28. Agricultural footprint for South Hilo District.

Further north, the Hāmākua coast is home to the majority of the state‘ s commercial forestry acreage and a patchwork of highly productive agricultural lands (Figure 29). This area saw the closure of the Big Island Dairy facility in 2019, leaving the Clover Leaf Dairy in Hāwī as the last remaining large-scale dairy in the state. Other changes since the 2015 baseline assessment include a slight increase in taro cultivation in the Waipi‘ o Valley, and minor changes in actively cropped areas for tropical fruit and diversified crop categories, including the establishment of a number of newly active plots mauka of Pāpa‘ aloa.

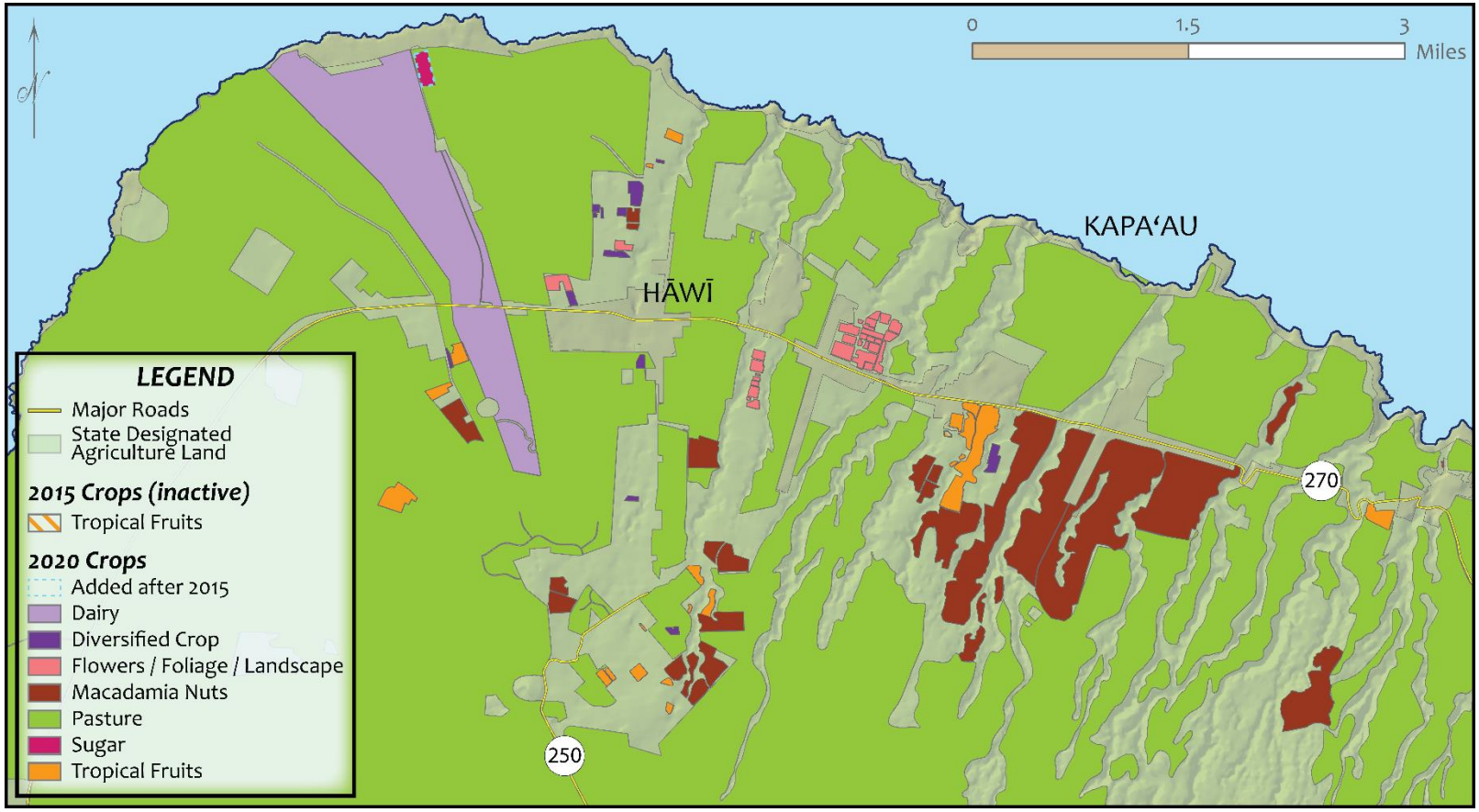
Figure 29. Agricultural footprint on the Hāmākua Coast.



The agricultural footprint of North and South Kohala remained largely stable between 2015-2020 and continues to be dominated by pasture lands for cattle production. In the Hāwī area, one notable new change was the addition of 14 acres of irrigated sugarcane cultivation as part of a distillery operation (Figure 30).

This marks the first return of commercial sugarcane plantings on Hawai'i Island since the sugarcane plantation closures in the twentieth century (Jones and Osgood, 2015; Melrose et al. 2015).

Figure 30. Agricultural footprint in North Kohala.



Around the town of Waimea, a concentration of diversified agriculture plots totaling 509 acres produce a variety of truck crops (Figure 31).

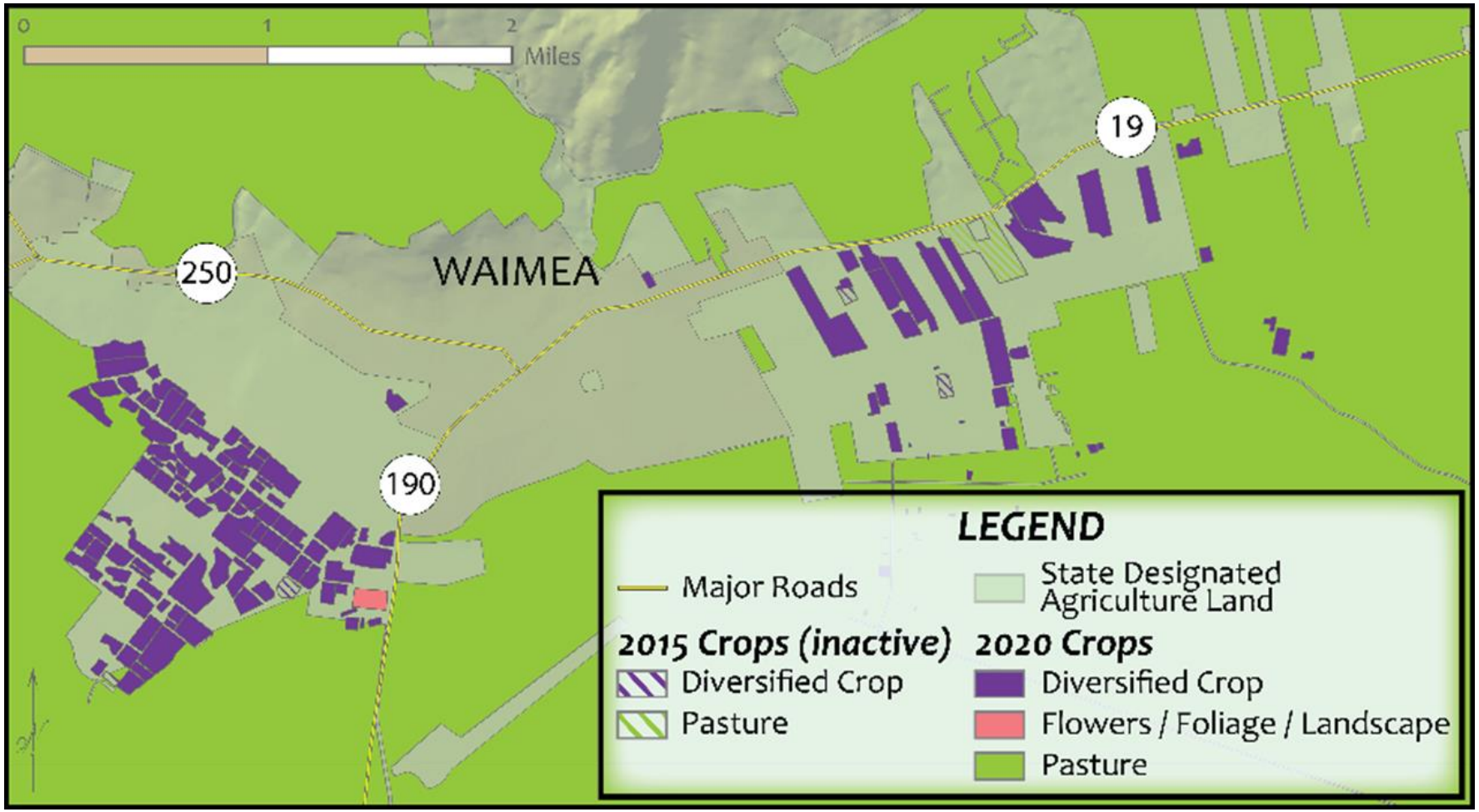


Figure 31. Agricultural footprint around the town of Waimea.

The agricultural lands of North and South Kona remain largely in coffee and macadamic nut cultivation, with pockets of tropical fruit, flowers/foliage/landscape, and banana. One notable change from the 2015 baseline in this area is the addition of a new large-scale coffee farming operation in Kealakekua (Figure 32). As of early 2020, Kona Hills, LLC, had opened ~230 acres for coffee planting, with additional clearing and planting underway.

In the Kaʻ ū district in the southern portion of Hawaiʻi Island, there was essentially no change in the pasture or cropped area between 2015 and 2020. Minor additions to diversified crop acreage were mapped around Volcano Village. In the Keaʻ au area, there were slightly expanded plantings in banana, papaya, and diversified crops, with stable footprints in macadamia nut and tropical fruit.

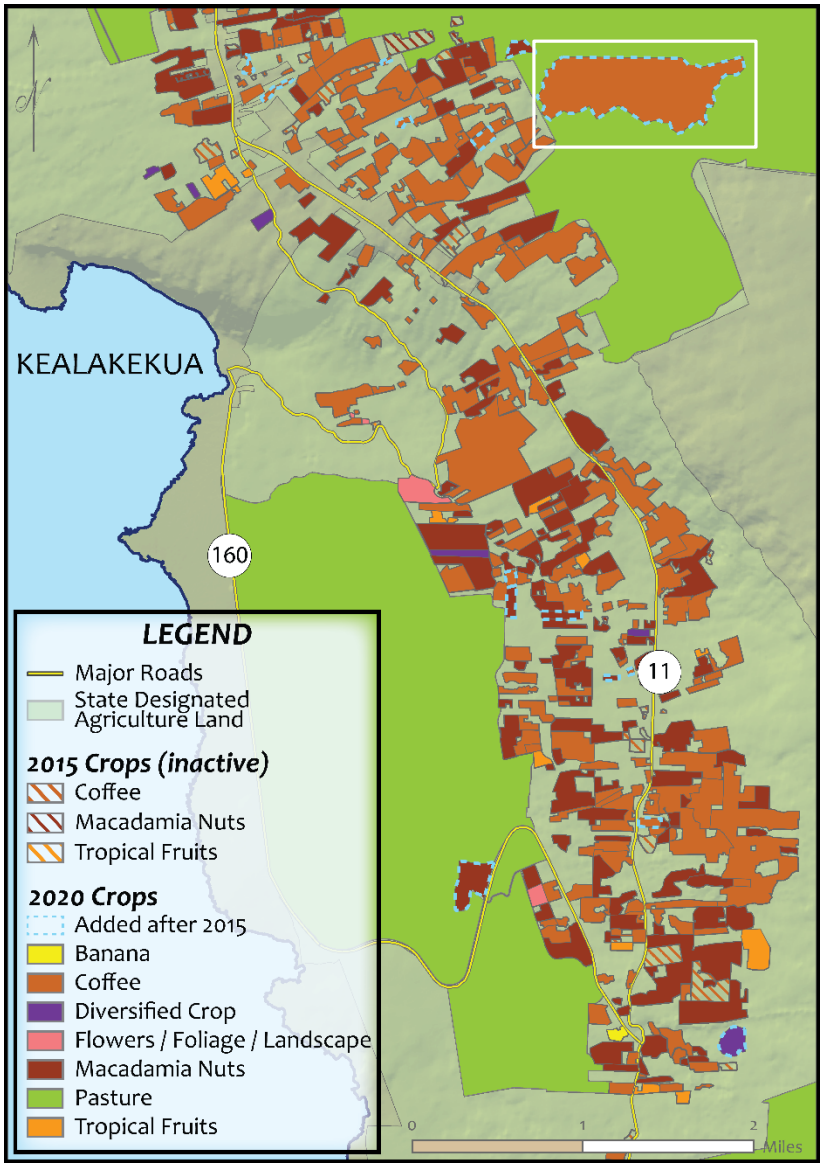


Figure 32. Agricultural footprint in South Kona near Kealakekua, white box indicates location of a new large-scale coffee farm.

Some of the most dramatic changes on Hawai'i Island occurred in the Puna district, where lava from the 2018 eruption of the Lower East Rift Zone covered almost 9,000 acres (Neal et al. 2019).

Impacted farmers have had to contend with the loss of cropped areas and severe access issues, as a number of fields not engulfed by lava, particularly papaya and tropical fruit, were cut off from transportation routes. These affected fields collectively total ~ 1,000 acres and include diversified crop, flowers/foliage/landscape, macadamia nut, papaya, and tropical fruit crop categories (Figures 33 and 34).

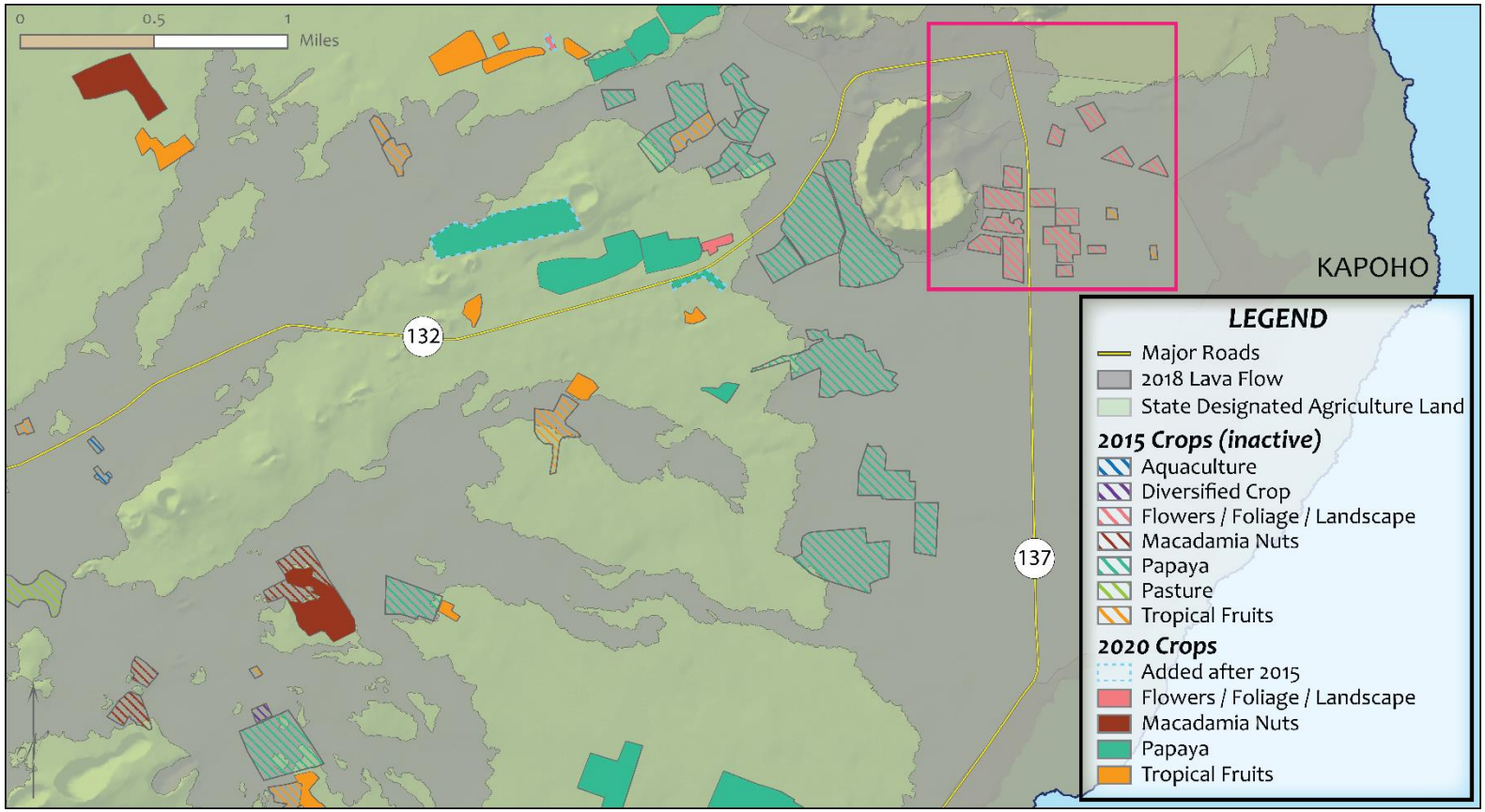


Figure 33. Portion of the agricultural footprint in Puna District impacted by the 2018 volcanic eruption. Pink inset box depicts area shown in satellite imagery in Figure 34.

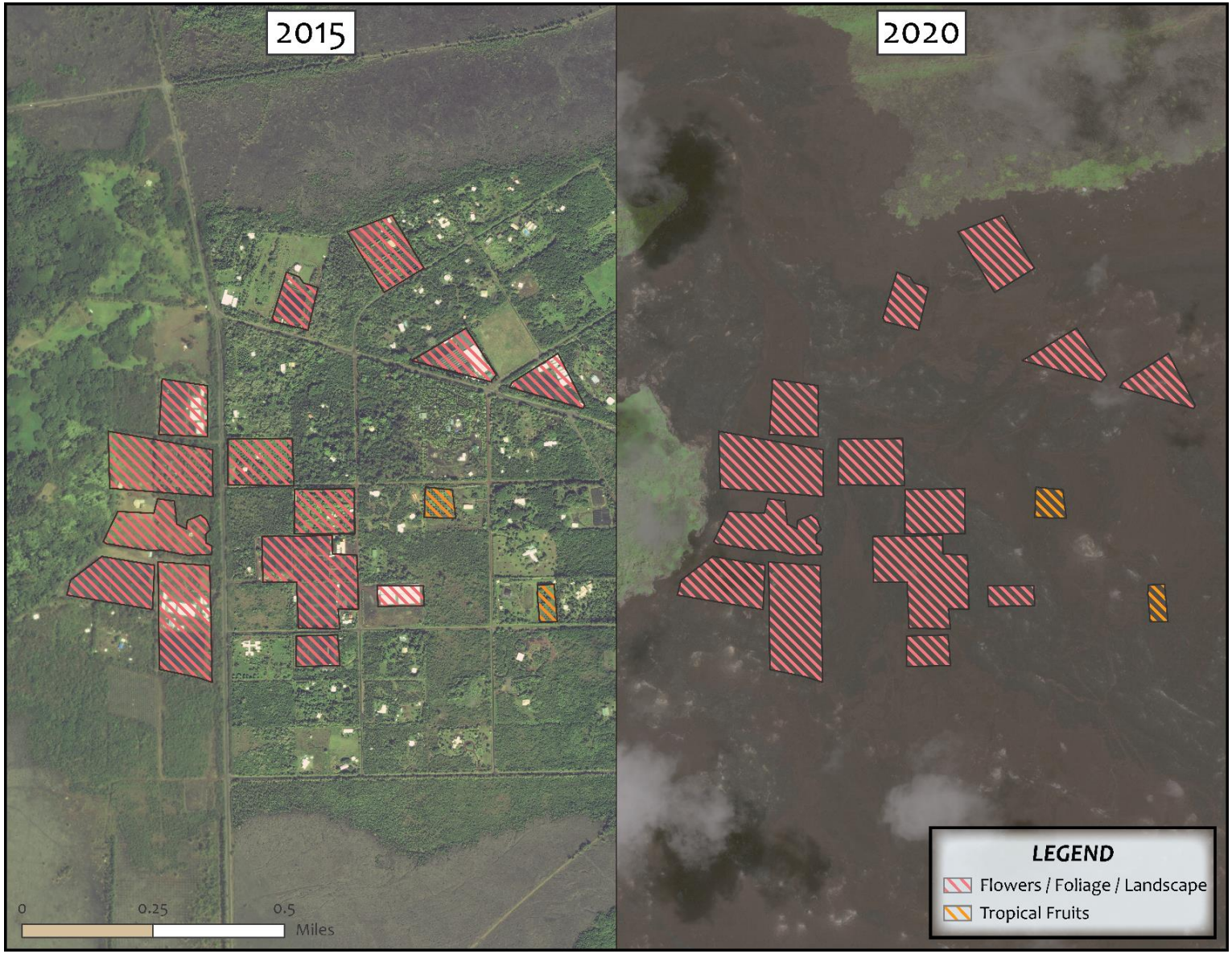


Figure 34. Satellite images from 2015 and 2020 showing a subset of the agricultural and residential area in the Puna District impacted by the 2018 volcanic eruption. Sources: Esri, DigitalGlobe, and Maxar.

Important Agricultural Lands: Hawai‘i Island

On the island of Hawai‘i there are 56,772 acres designated as Important Agricultural Lands by the State Land Use Commission. Of these, 96% (54,555 acres) were in active agriculture in 2020. Pasture makes up over 90% of these lands (49,812 acres) and commercial forestry (4,743 acres) the remainder (Figure 35). There are no cropped fields of any type on Hawai‘i Island within the Important Agricultural Lands designation zone.

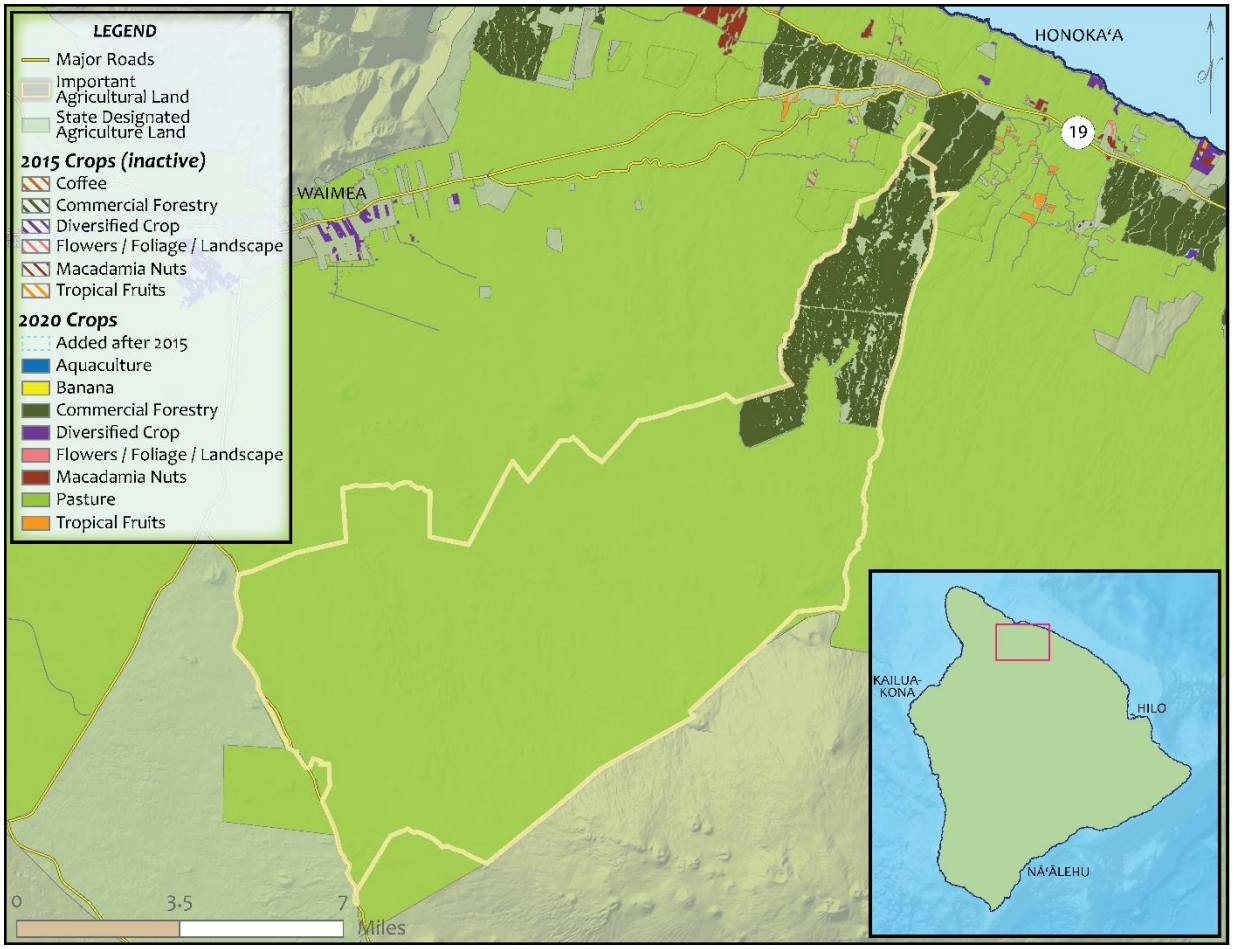


Figure 35. Agricultural footprint and Important Agricultural Land designation areas (yellow outline) on the island of Hawai‘i.

Agricultural Parks: Hawai‘i Island

On the island of Hawai‘i, there are four active Agricultural Parks (Hāmākua, Keāhole, Pāhoa, and Pana‘ewa) totaling 1,571 leased acres as of 2020, based on GIS data provided by the Department of Agriculture (Figure 36). Of these leased acres, more than half (887 acres) were mapped as being in active cultivation in 2020. Of these, 44% (390 acres) were in flowers/foliage/landscape, 40% (355 acres) in pasture, and the remainder scattered across various other crop types. It is worth noting that not all of the agricultural-related activities occurring on these lands, specifically some agricultural plots less than three acres in size and fallow fields, were mapped under the Crop Mapping Protocols used in this study (see Appendix).

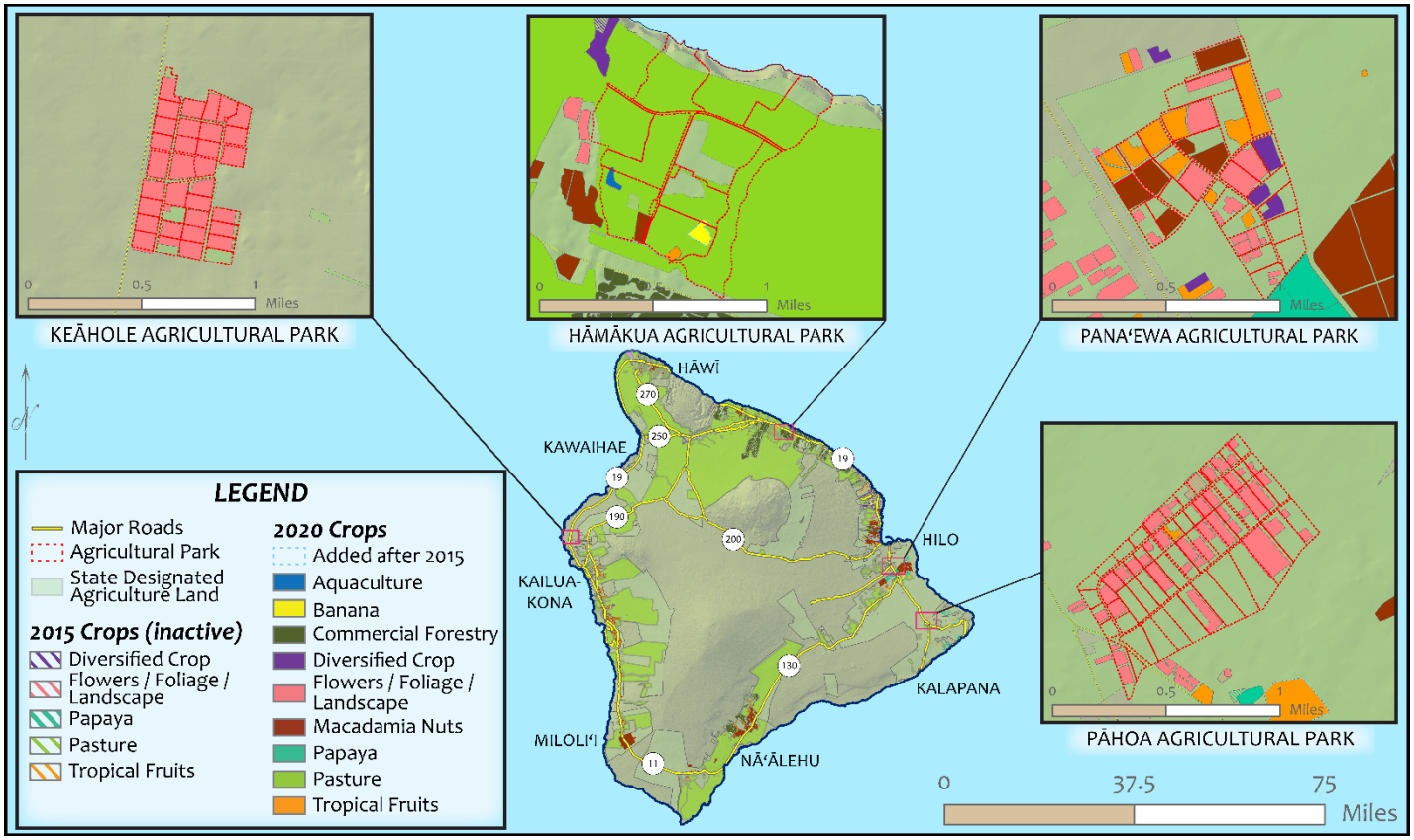


Figure 36. Active Agricultural Park leases (red outline) on the island of Hawai‘i.

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Appendix

A1. Crop Mapping Protocols

The 2020 Update to the Hawai‘i Statewide Agricultural Land Use Baseline: Kaua‘i, O‘ahu, Moloka‘i, Lāna‘i, Maui, and Hawai‘i, was created from an assemblage of geospatial datasets, primarily high-resolution (2018-2020) satellite imagery used as a base layer for digitization. Every effort was made to use satellite imagery from 2020, but in a few areas with persistent cloud cover or other issues, imagery from 2019 or 2018 was used. Additional datasets used in the project include GIS layers provided by the State of Hawai‘i’s Office of Planning Statewide GIS Program and other data provided by major landowners and managers.

Digitized crop locations and boundaries were verified through a combination of on-the-ground site visits, video meetings and presentations of draft layers with agricultural stakeholders and landowners, and solicitations for comments and feedback through a publicly accessible online web mapping portal. In several cases, private landowners shared their own digital data of crop use on their properties and/or were helpful in reviewing draft maps to confirm or correct mapped crop boundaries.

In this 2020 update, as in the 2015 baseline report, in-field roads, field edges, warehouses, and related farm structures are considered part of farm-related uses. Gulches and unused lands were generally not counted. As a result, the crop acreage numbers provided in this report may be 10% or more than what industries might report. That difference is not intended to correct industry numbers but rather to express a broader metric of the area of land deployed to support a given agricultural use.

These data layers represent our best efforts to capture the scale and diversity of commercial agricultural activity on Kaua‘i, O‘ahu, Moloka‘i, Lāna‘i, Maui, and Hawai‘i in 2020. We have made every effort to make all images, maps, graphs, data, and other information provided accurate and error-free. However, we do not guarantee the accuracy of any images, maps, graphs, data, or other information. All content is provided without warranty of any kind and is not intended for any regulatory use. The digital crop and pasture layer data are provided for public use and for informational purposes only. If you find any errors in this work, please contact Ryan Perroy at rperroy@hawaii.edu so that we can correct them.

The University of Hawai‘i at Hilo Spatial Data Analysis and Visualization (SDAV) Laboratory carried out the work under the direction of Dr. Ryan Perroy. Eszter Collier was the primary geospatial analyst and cartographer, and Erin Weingarten, Hunter Heaivilin, and Ben Nyberg provided additional project support.

Funding for the 2020 Update to the Hawai‘i Statewide Agricultural Land Use Baseline: Kaua‘i, O‘ahu, Moloka‘i, Lāna‘i, Maui, and Hawai‘i was provided by the Hawai‘i State Department of Agriculture.

The following protocols were used to generate the 2020 Agricultural Land Use spatial layers:

§ This project focused on commercial agricultural operations with a three-acre minimum crop mapping area. In recognition of the importance of smaller scale producers to Hawai‘i’s agricultural community, commercial operations less than three acres were included where they could be reasonably identified from the satellite imagery.

§ Mapped units follow actual cropped areas as identified in satellite imagery, not TMK parcel boundaries.

§ Agricultural lands that did not display actual vegetation growth but appeared to be part of an active agricultural rotation (freshly tilled fields, etc.), were included in acreage summaries.

§ For papaya and other crops that rotate every three to four years, mapping efforts focused on active production areas and did not include fallowed fields.

§ Packing or processing facilities and in-field access roads were generally included in acreage summaries.

§ Homes, reservoirs, unfarmable gulches, and major roadways separating field areas were not mapped.

§ “Agri-scaping” of private residences was not mapped.

§ Small backyard orchards and what appear to be home use vegetable gardens were not mapped.

§ Equestrian uses, including arenas and boarding and riding facilities, were not mapped.

§ Rooster cultivation was not mapped.

§ Piggeries were not mapped.

§ Poultry farms were not mapped.

§ Industrial meat processing facilities were not mapped.

A2. Crop Categories & Considerations

§ Aquaculture includes active shrimp farms, working fishponds, algae raceways, and research/production facilities.

§ Bananas include fields in contiguous plantings larger than 2-3 acres. Throughout the state, bananas are also cultivated in gulches, along farm boundaries, and in small patches within smaller, diversified farm operations. These smaller mixed plantings are generally incorporated into the surrounding farm and labeled as Diversified Crops.

§ Coffee includes both larger plantation-type scale operations and smaller farm plantings larger than two acres in coffee growing regions like Kona, Kaʻū, and elsewhere. The North and South Kona region on Hawaiʻi Island were difficult to map accurately based on a practice some farmers have adopted to plant both macadamia nuts and coffee on the same ground, making it challenging to confidently discern these coffee-macadamia crop boundaries from satellite imagery.

§ Commercial Forestry plantings include both short and long rotation tree crops. Plantings include eucalyptus and other species intended for timber, fiber or energy production, and higher value hardwoods like koa and mahogany planted for eventual commercial harvest and not for native forest restoration.

§ Dairy includes core milking and on-farm processing facilities, the surrounding pastures, and croplands under active dairy use.

§ Diversified Crops includes a wide range of products that are grown either outdoors or in greenhouses. The category includes many of Hawaiʻi's small farms and much of its local, fresh vegetables including tomato, cucumbers, leaf crops, beans, and asparagus. This category also includes smaller plantings such as banana, tropical fruit, papaya, and coffee that were too small to map out individually. Also included in the category are export crops such as Okinawan sweet potato, basil, and Asian spices.

§ Flowers/Foliage/Landscaping includes a wide variety of products including hothouse or shade cloth grown orchids, anthuriums, tropical flowers, potted nursery plants, field stock, sod farms, and landscape trees.

§ Macadamia Nuts include orchards that appear to be actively maintained and harvested. Orchards range from hundreds of acres in South Kona, Kaʻ ū, and Puna to small and mid-size plantings throughout Hawaiʻi Island and a new site on Oʻahu.

§ Papayas are mapped in areas where significant commercial papaya production occurs. Mapping efforts focused on lands that appeared to be planted and in active production. Fallow lands that might be available for future papaya planting were not mapped but are an important part of what the papaya industry needs to produce in a sustainable fashion. Smaller plantings of papaya on mixed-crop farms are mapped as Diversified Crops.

§ Pasture includes areas in active commercial cattle operation where fencing is apparent and water troughs and/or cattle trails can be identified. Small pasture plots in diverse, rural homesteads were not the focus of this mapping effort but were included where larger parcels and contiguous pasture areas were present. Lands that were formerly in pasture use but have now been purchased by the military, the National Park Service, or withdrawn from pasture in favor of native forest restoration were not included in the pasture layer. Rangelands that are fenced and grazed only seasonally were mapped as pastureland.

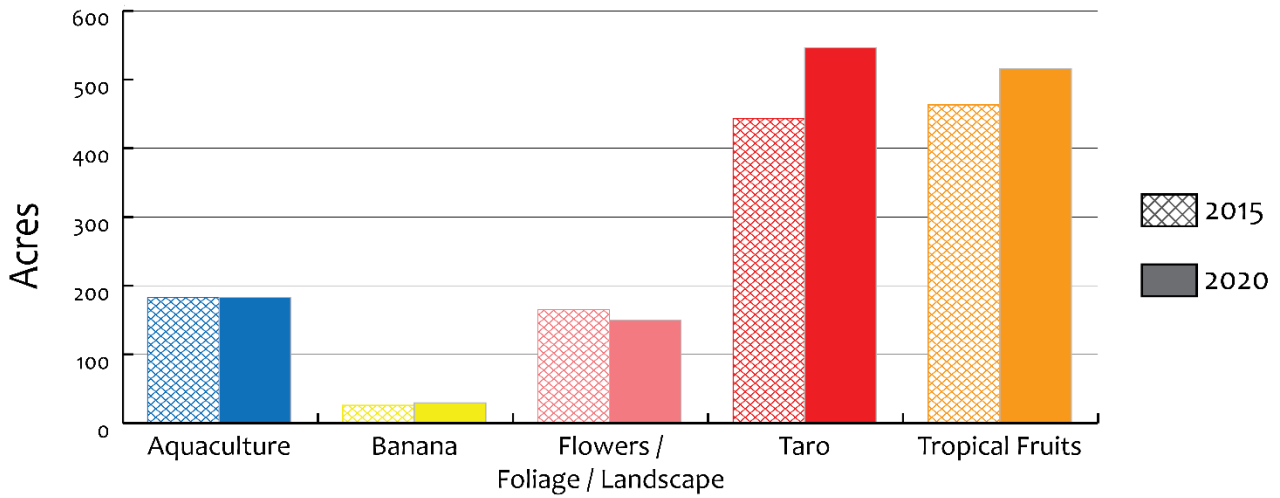
§ Pineapples include areas planted in large to mid-size operations primarily on Oʻahu. Smaller plantings mixed within smaller diversified farm operations are mapped and labeled as Diversified Crops.

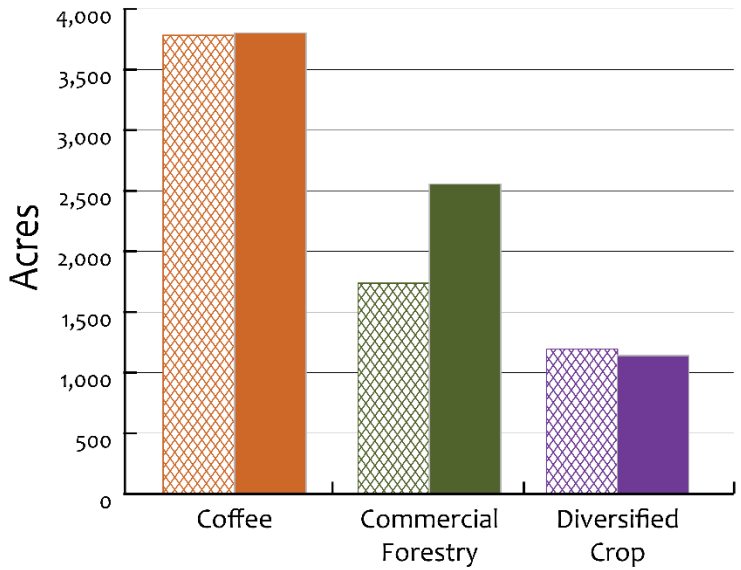
§ Seed Production includes all arable lands in use by the seed companies at the time of this survey. Areas depicted include in-field roads, pollen drift buffers, and areas managed for future crop rotation. Net acres actually planted in corn or other seed crops will be substantially less than the gross acres depicted. The industry estimates that they use approximately 25% of their farmable land at any time for active growing.

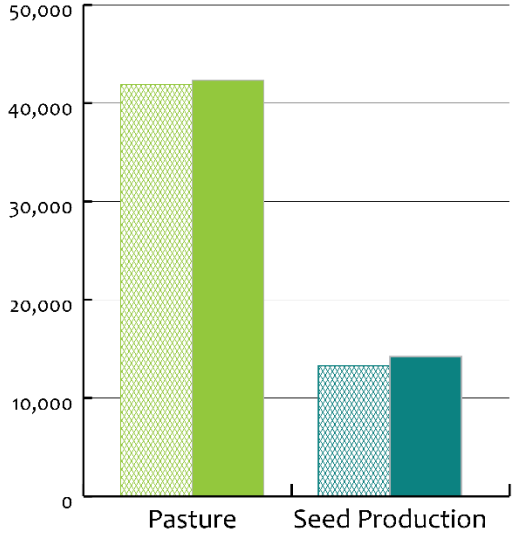
§ Taro includes crops grown in wetland settings only. Dryland taro is included in the Diversified Crops category.

§ Tropical Fruit includes a range of products such as breadfruit, rambutan, avocado, longan, lychee, citrus, cacao, and other orchard fruit trees planted for commercial harvest. Small backyard orchards were not mapped and are not counted in the summary of tropical fruit acreage.

A3. Kaua‘i 2015 and 2020 Comparison

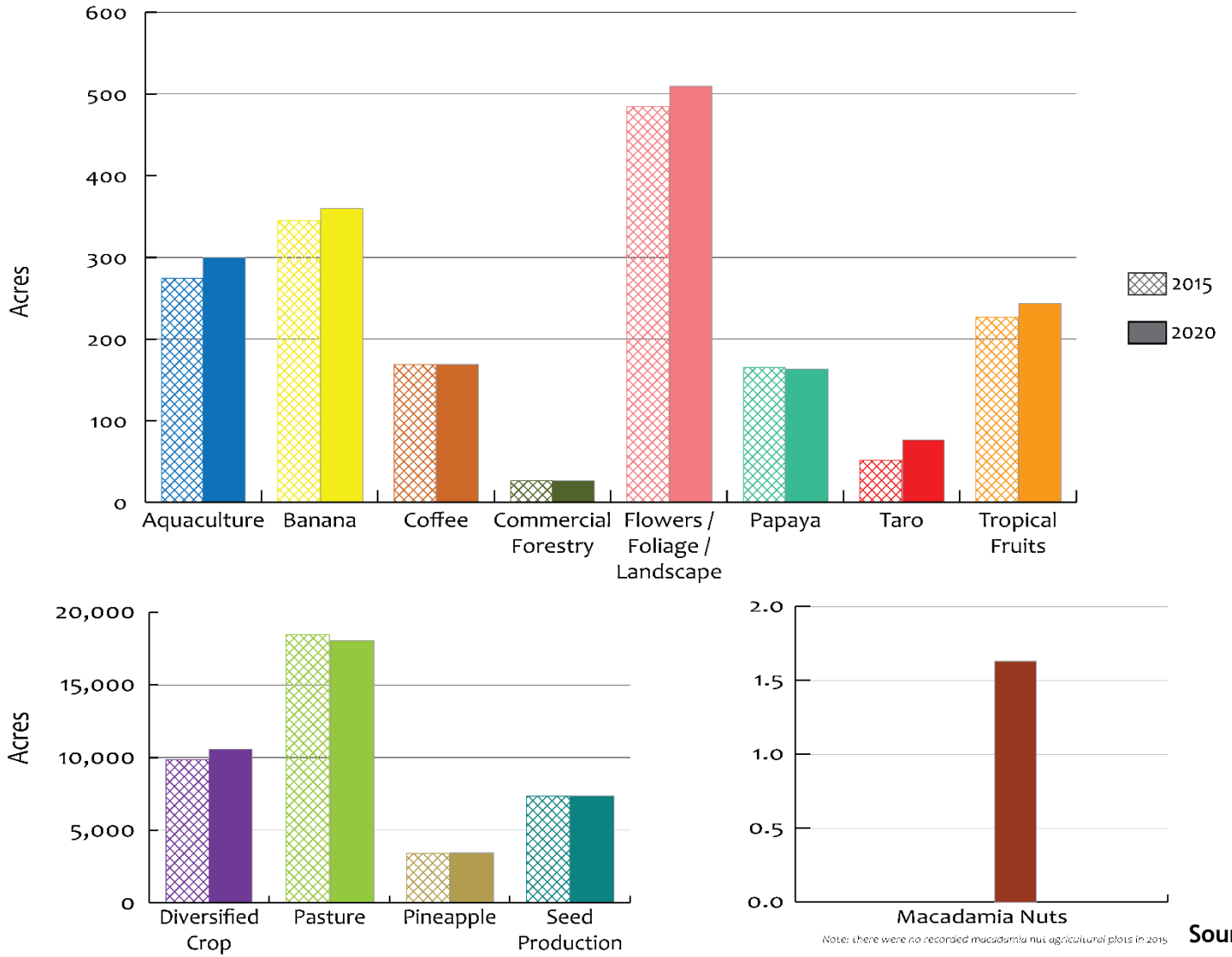






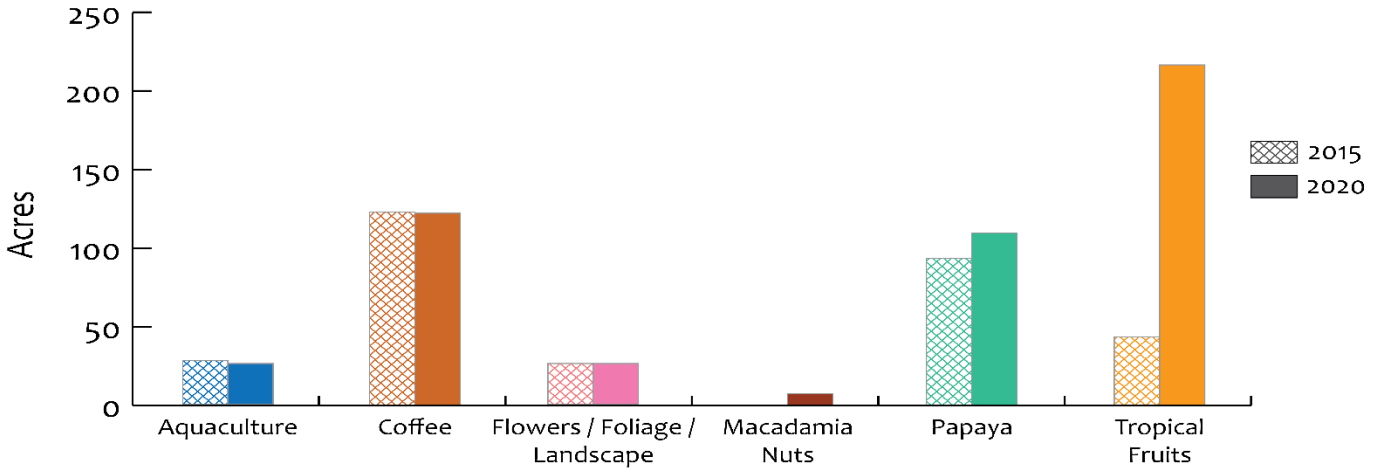
Sources: Melrose et al. 2015 and this report.

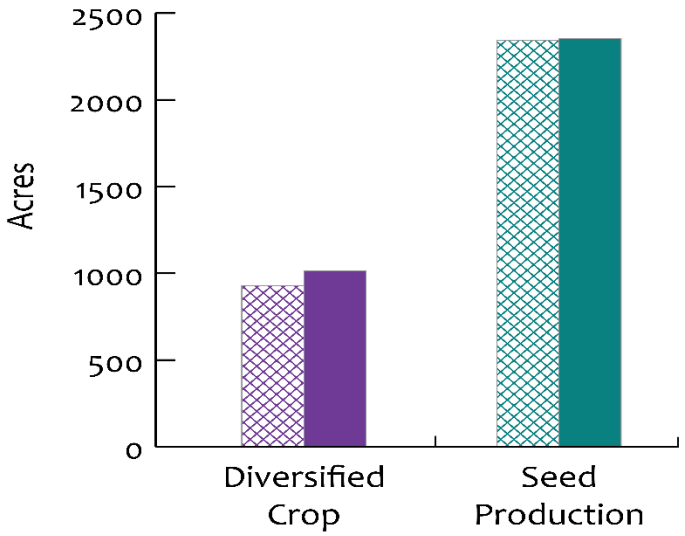
A4. O‘ahu 2015 and 2020 Comparison

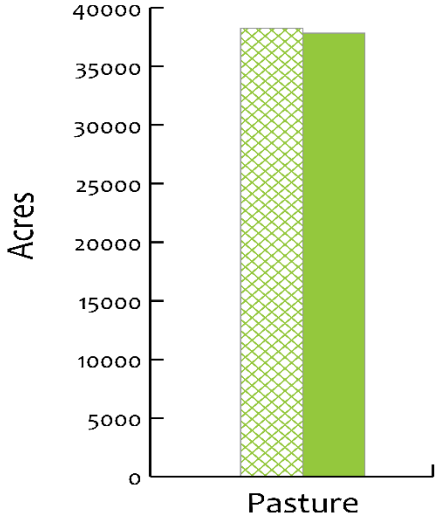


Sources: Melrose et al. 2015 and this report.

A5. Moloka‘i 2015 and 2020 Comparison

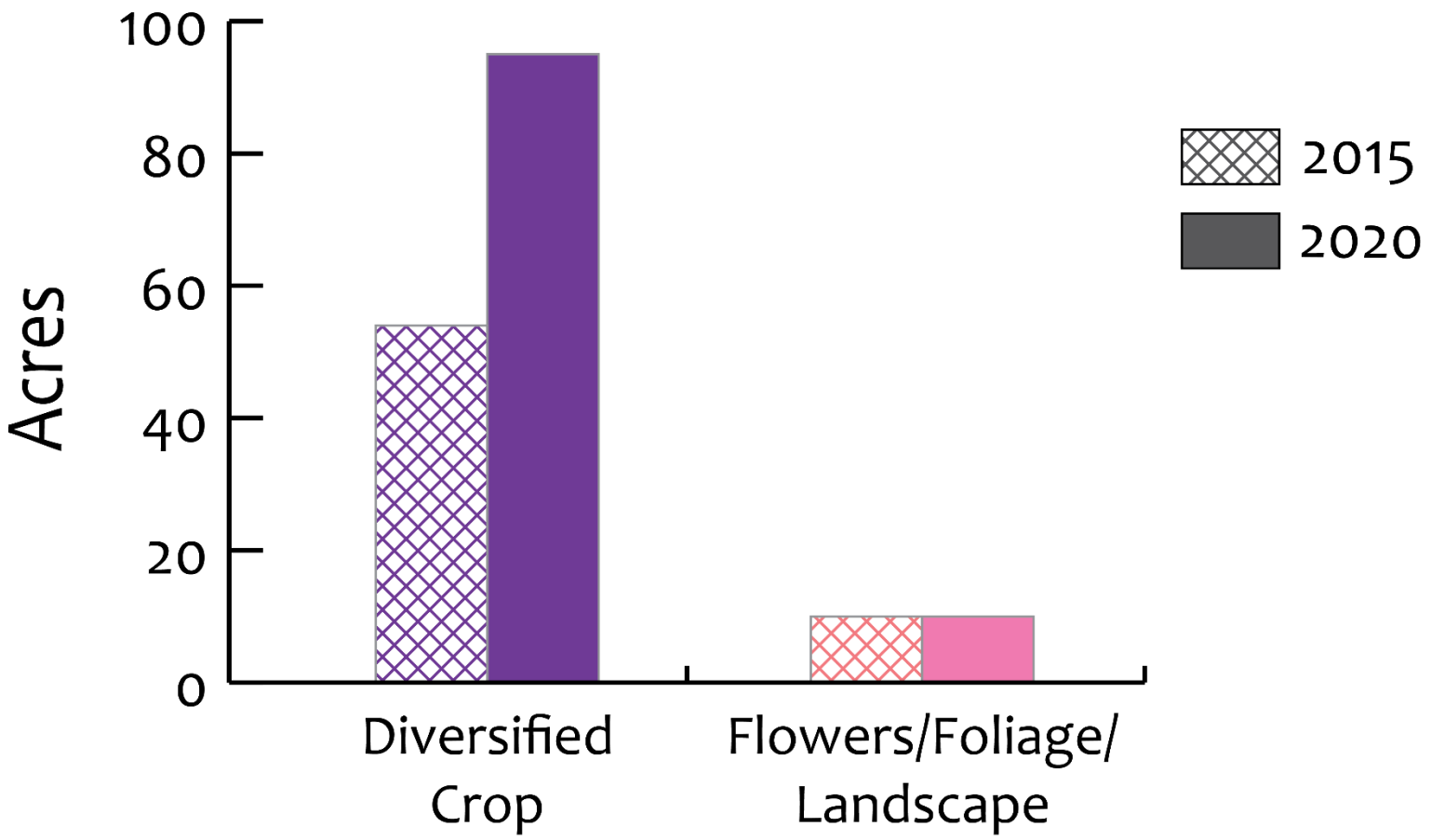




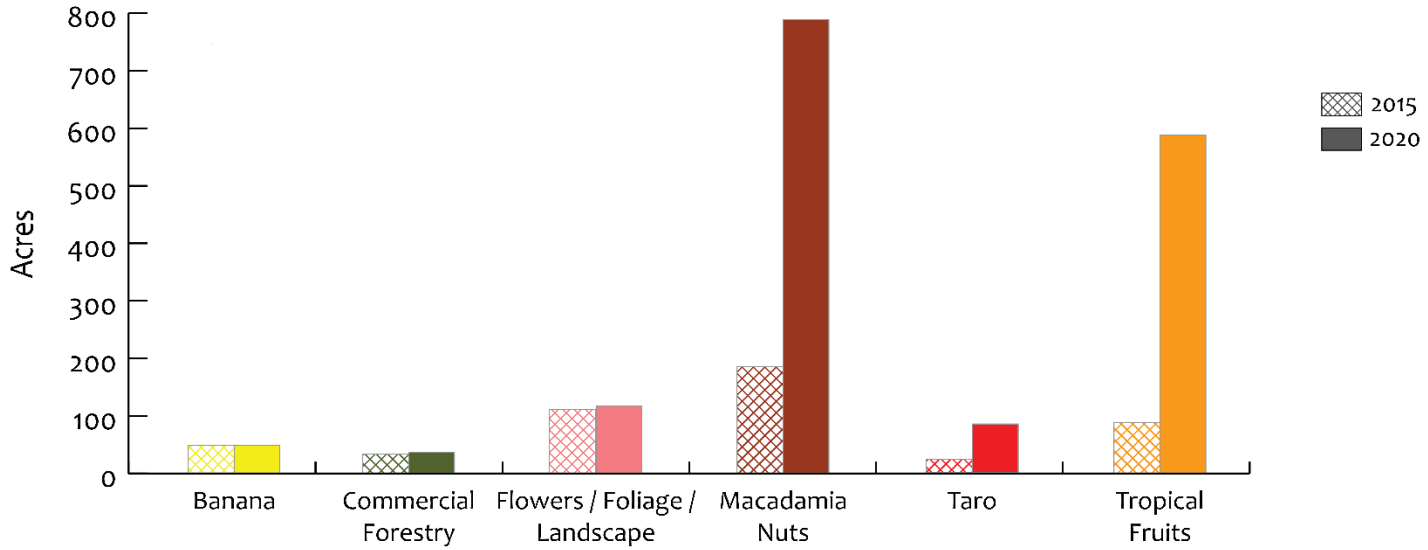


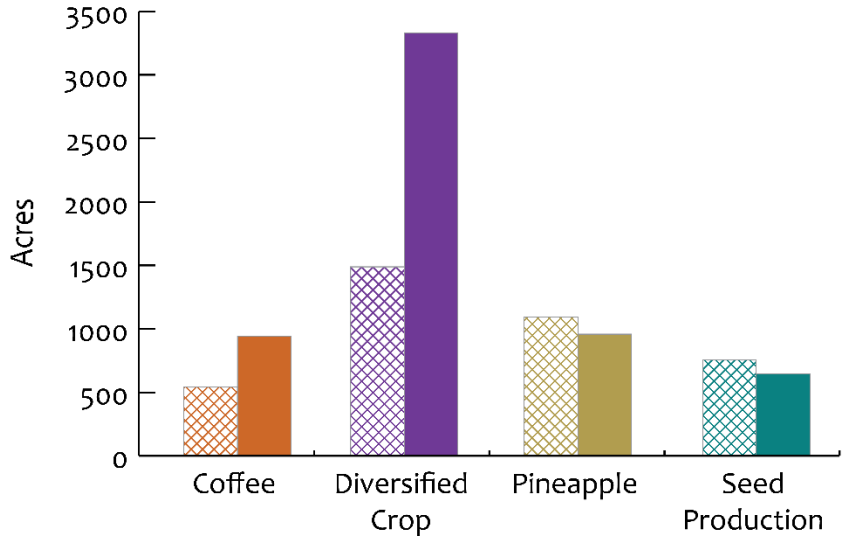
Sources: Melrose et al. 2015 and this report.

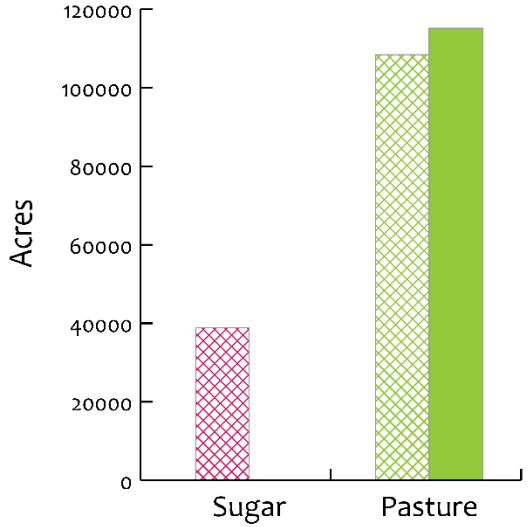
A6. Lānaʻi 2015 and 2020 Comparison



A7. Maui 2015 and 2020 Comparison

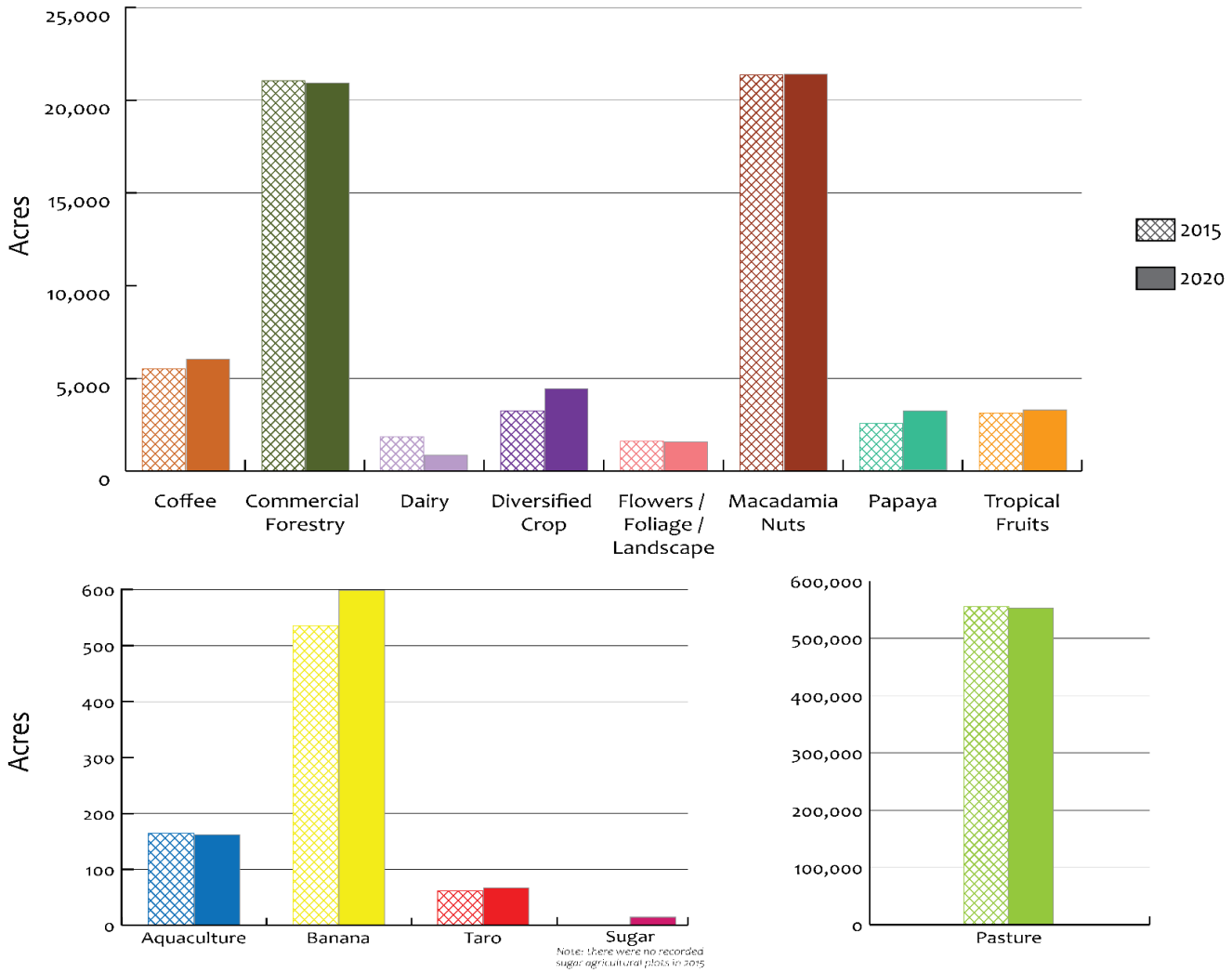






Sources: Melrose et al. 2015 and this report.

A8. Hawai‘i 2015 and 2020 Comparison



Sources: Melrose et al. 2015 and this report.