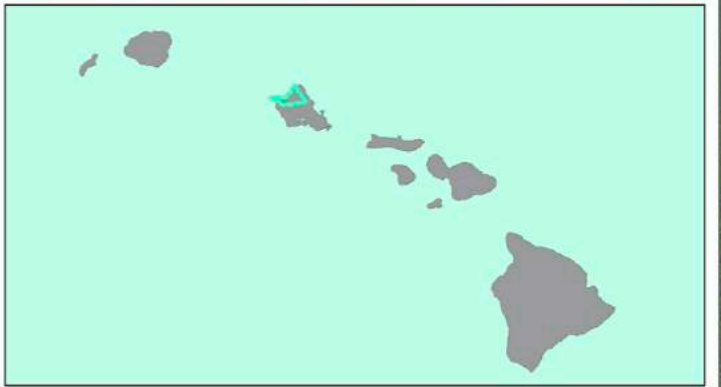
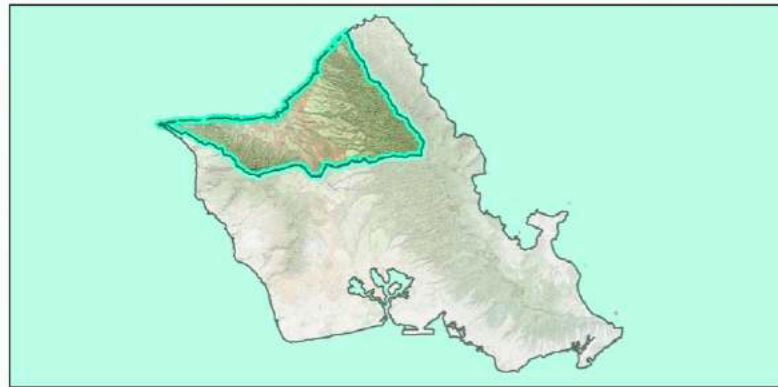


COMMUNITY WILDFIRE PROTECTION PLAN



NORTH SHORE O'AHU, HAWAII 2021



Coordinated and developed by Hawai'i Wildfire Management Organization, in partnership with and funded by Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife and the USDA Forest Service

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MUTUAL AGREEMENT SIGNATURE PAGE

The following three entities mutually agree to the final contents of this North Shore Community Wildfire Protection Plan: State of Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife; City and County of Honolulu Fire Department; and City and County of Honolulu Emergency Management Agency.

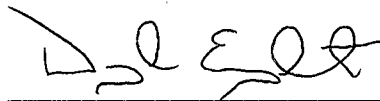
This plan:

- Was collaboratively developed by agencies, entities, community members, and individuals with interest or jurisdiction in North Shore, O'ahu.
- Assesses wildfire hazards in the natural and built environment.
- Provides the concerns, recommended actions, and priorities of those who live and work in the area to better reduce wildfire threats, mitigate hazards, improve public safety, and protect natural resources from the impacts of wildfire.
- Is written to appropriately begin and inform wildfire mitigation action planning at the local level, and is not regulatory or binding.

Pursuant to the 2003 Healthy Forest Restoration Act (HFRA), the following signatures represent mutual agreement of the contents of this CWPP.



David G. Smith
Department of Land and Natural Resources
Division of Forestry and Wildlife



Daryl Evangelista
City and County of Honolulu Fire Department



Hirokazu Toiya
City and County of Honolulu Emergency Management Agency

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NORTH SHORE, O'AHU

COMMUNITY WILDFIRE PROTECTION PLAN

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ACRONYMS

Army Fire: U.S Army Garrison, Hawai'i, Directorate of Emergency Services Wildland Firefighting Management Team

DLNR-DOFAW: Department of Land and Natural Resources, Division of Forestry and Wildlife

FFD: Federal Fire Department

HFD: City and County of Honolulu Fire Department

HWMO: Hawai'i Wildfire Management Organization

Funding for this project was provided by USDA Forest Service- Fire and Aviation Management, Cooperative Fire Grant Program. This institution is an equal opportunity provider.

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EXECUTIVE SUMMARY

This Community Wildfire Protection Plan (CWPP) was developed by the Hawai'i Wildfire Management Organization (HWMO) with guidance and support from government agencies and representatives, community members, local organizations, and decision makers concerned about wildfire issues in North Shore, O'ahu, Hawai'i. State of Hawai'i Department of Land and Natural Resources- Division of Forestry and Wildlife (DLNR-DOFAW) and City and County of Honolulu Fire Department (HFD) were the primary partners to HWMO in carrying out this CWPP process.

The North Shore CWPP focuses on wildfire preparedness and readiness, hazard assessment and reduction, and the wildfire mitigation priorities of those who live and work in the area. The process used to develop this plan engaged a diversity of agencies and individuals concerned with the at-risk area, following the guidelines and requirements of federal programs such as the Federal Emergency Management Agency (FEMA) Pre-Disaster Mitigation program and the National Fire Plan (NFP).

Stakeholder participants in the development of this plan agree that wildfire threats are imminent and can lead to widespread damage to North Shore watersheds, natural resources, and human communities. The danger of wildfire is related to high numbers of human-caused ignitions, dry conditions, steep slopes, high fire potential of vegetation, and challenging firefighting conditions. In the last decade, numerous areas of North Shore have burned. CWPPs serve mainly as a mechanism for assessing, communicating, and preparing for wildfire collaboratively. They are not enforceable or regulatory. The mitigation actions recommended within the document are intended to inspire projects and inform next-step actions. Participation and action are voluntary and rely on all parties understanding that everyone plays a role in wildfire safety and protection. A CWPP is a first step toward increased public-private collaboration toward wildfire awareness, preparedness, and hazard reduction.



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NORTH SHORE COMMUNITY WILDFIRE PROTECTION PLAN

PART I
OVERVIEW

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INTRODUCTION

The communities, lands, and waters of North Shore, O’ahu, Hawai’i, have been classified as having moderate to extreme risk of wildfire occurrence and impacts. The safety of residents, and the protection of private property, community infrastructure, and natural and cultural resources, is a shared responsibility between residents and communities; owners, developers and associations; private businesses and municipal service operators; and county, state and federal governments. The aim of this Community Wildfire Protection Plan (CWPP) is to carry out wildfire protection planning that inspires, informs, and aids subsequent actions for North Shore.

THE PURPOSE OF WILDFIRE PROTECTION PLANNING IS TO:

- Motivate and empower local government, communities, and property owners to organize, plan, and take action on issues impacting the safety and resilience of values at risk.
- Enhance levels of fire resilience and protection to the communities and infrastructure.
- Identify the threat of wildland fires in the area.
- Identify wildfire hazards, education, and mitigation actions needed to reduce risk.
- Identify strategies to reduce the risks to structures, infrastructure, and commerce in the community during a wildfire.
- Transfer practical knowledge through collaboration between stakeholders toward common goals and objectives.

INTENDED OUTCOMES OF WILDFIRE PROTECTION PLANNING:

1. Improve community safety through:

- Coordination and collaboration
- Public awareness and education
- Increased wildfire prevention and preparedness
- Widespread hazard reduction efforts
- Improved wildfire response capacity
- Development of long term strategies
- Ongoing risk reduction communications

2. Catalyze efforts to guide planning and sustained implementation of actions toward:



**FIRE ADAPTED
COMMUNITIES**



**RESILIENT
LANDSCAPES**



**SAFE & EFFECTIVE
WILDFIRE RESPONSE**

PROCESS- HOW A CWPP IS DEVELOPED

1. The project is launched, partnerships are established, administrative and funding processes are completed.
2. The community risk assessment is reviewed, updated, and/or performed as necessary.
3. Opportunities are coordinated and offered for interested parties (community members, government agencies, other relevant/concerned individuals and entities) to review wildfire information, discuss concerns, identify strategies, and prioritize recommended actions.
4. Wildfire information and community input results are used to develop the CWPP document.
5. The CWPP is finalized via review and signatures of Fire, Forestry, and Emergency Management departments to meet federal compliance requisites.

TIMELINE- THE DEVELOPMENT OF THE NORTH SHORE CWPP

February 2020	DLNR-DOFAW initiated the project and worked with HWMO to complete all contract and administrative components.
March-Aug 2020	HWMO developed area and fire maps for the planning process, confirming boundaries and goals with partners. A COVID-adaptation plan and virtual workshops were developed, planned, and advertised for upcoming agency and community meetings.
August 2020	A virtual workshop was held with fire and emergency services agency representatives with jurisdiction and interest in the North Shore CWPP area to: <ul style="list-style-type: none">- Review the purpose, intent, and next steps for the CWPP.- Plan collaborative workshop with relevant agencies, organizations, and community members for discussion of wildfire concerns.- Discuss and determine strategy for adapting the process to COVID-19 social distancing and travel restrictions.
November 2020	A virtual community wildfire planning workshop was held, co-hosted by North Shore Community Land Trust and Hawai'i Wildfire Management Organization. Representatives from fire, forestry, and natural resource management agencies attended, along with local groups, organizations, and residents.
February 2021	DLNR-DOFAW and HWMO worked together to complete a comprehensive hazard assessment for the residential areas within the North Shore CWPP area.
April-July 2021	HFD worked with HWMO to complete a comprehensive hazard assessment for the fire environment and fire protection capacity within the North Shore CWPP area.
August 2021	HWMO completed all background information, research, mapping, and processing of agency and community priorities based on input provided during workshops and assessments. CWPP document was provided back to DLNR-DOFAW for review, edits, and to collect final signatures.

PARTNERSHIPS AND COLLABORATIONS

This CWPP process and the resulting planning document was developed by Hawai'i Wildfire Management Organization with guidance, input, and assistance from:

- Hawai'i Department of Land and Natural Resources, Division of Forestry and Wildlife
- City and County of Honolulu Fire Department
- University of Hawaii, Mānoa, CTAHR, Extension
- Federal Fire Department
- U.S Army Garrison, Hawai'i, Directorate of Emergency Services Wildland Firefighting Management Team
- North Shore Community Land Trust
- Community members and local groups/organizations from the North Shore area

FUNDING

Funding for the project originated from the USDA Forest Service- Fire and Aviation Management Cooperative Fire Program. DLNR-DOFAW requested contractor bids through the State of Hawai'i Procurement Office, selecting Hawai'i Wildfire Management Organization to complete the project in February 2020.

STATEMENT OF LIABILITY

A CWPP helps communities clarify and refine priorities for the protection of life, property, and critical infrastructure. It is intended to create a foundation of collaboration and communication among diverse parties toward achieving wildfire risk reduction goals.

A CWPP is not a binding, regulatory document. The action plans are voluntary. The process and the associated document are mechanisms for assessing risk, discussing, learning, and planning collaboratively across sectors and neighboring communities. This is not a pre-determined, top-down, outside-expert or single-agency-driven determination of future activities, but rather a compilation of information and priorities derived from agency and community concerns and recommended actions, meant to inspire, inform, and guide wildfire preparedness activities. This is in line with the improved understanding across the country that everyone who lives and works in a fire prone areas has a role to play when it comes to preventing ignitions, reducing hazards, and ensuring a wildfire-informed, wildfire-ready, and wildfire-resilient community. A CWPP does not provide or guarantee funding, but does qualify entities in the area to apply for certain wildfire mitigation funding opportunities.

The activities suggested by this document, the assessments and recommendations of fire experts and officials, and the plans and projects outlined by the community, are made in good faith according to information available at this time. HWMO and DLNR-DOFAW assume no liability and make no guarantees regarding the level of success users of this plan will experience. Despite efforts to prevent or contain wildfires, fires still occur. The intention of all decisions and actions made under this plan is to reduce the potential for, and the consequences of, wildfire.

COVID-19 STATEMENT

In an effort to maintain a highly collaborative, effective, and safe CWPP process during several variations of social and travel restrictions across the county and state, the majority of this CWPP was

completed through virtual meetings and workshops. Any additional information, community input, and/or action plans generated will be added to this document as updates in the appendix, and are to be considered of equal importance and utility as this original document. The collaborators involved in the development of this CWPP are committed to a long-term process of community engagement, partnership, and wildfire risk reduction.

PLANNING AREA

The North Shore CWPP is part of a series of CWPPs across the City and County of Honolulu, which includes Western O’ahu (2016) , North Shore CWPP (this document), and East Honolulu (upcoming). At the time of writing, more than half the state is covered by CWPPs.

CWPP BOUNDARIES

The CWPP boundaries established for the North Shore plan follow the boundaries established for North Shore neighborhood boards (Map 1).

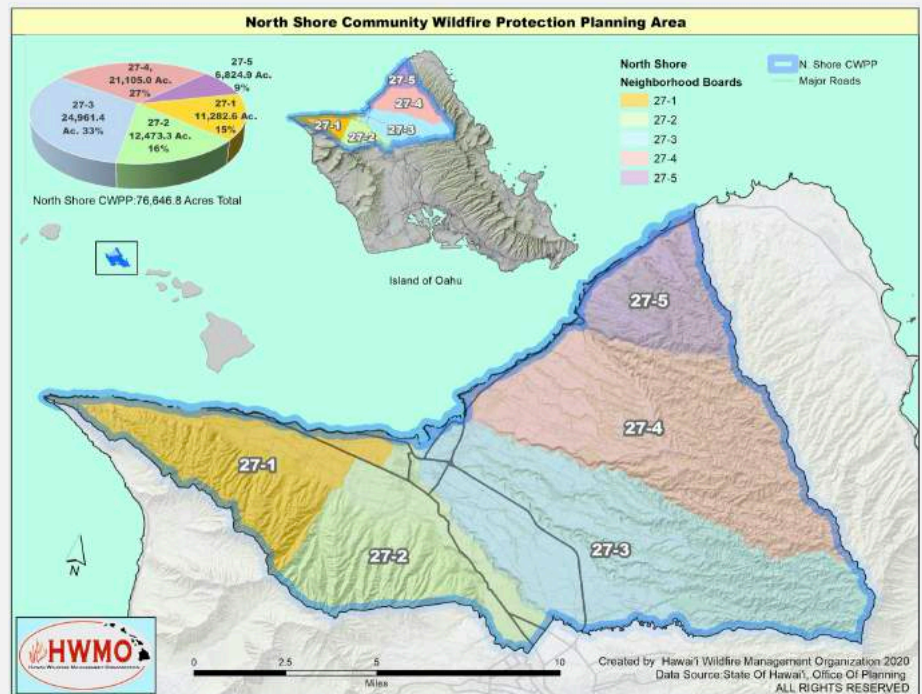
COMMUNITIES AT RISK

Located in an area of O’ahu that is less developed than many other parts of the island, the North Shore CWPP region is considered at high risk of wildfire due to frequent human-caused ignitions, windy and seasonally dry conditions, steep and inaccessible terrain, extensive fire-prone grassland and shrubland areas (eg. Mokule’ia), and limited access and traffic congestion that slows emergency response times.

There are seven residential or military communities, five of which have populations between 2,000 and 4,000 people as of

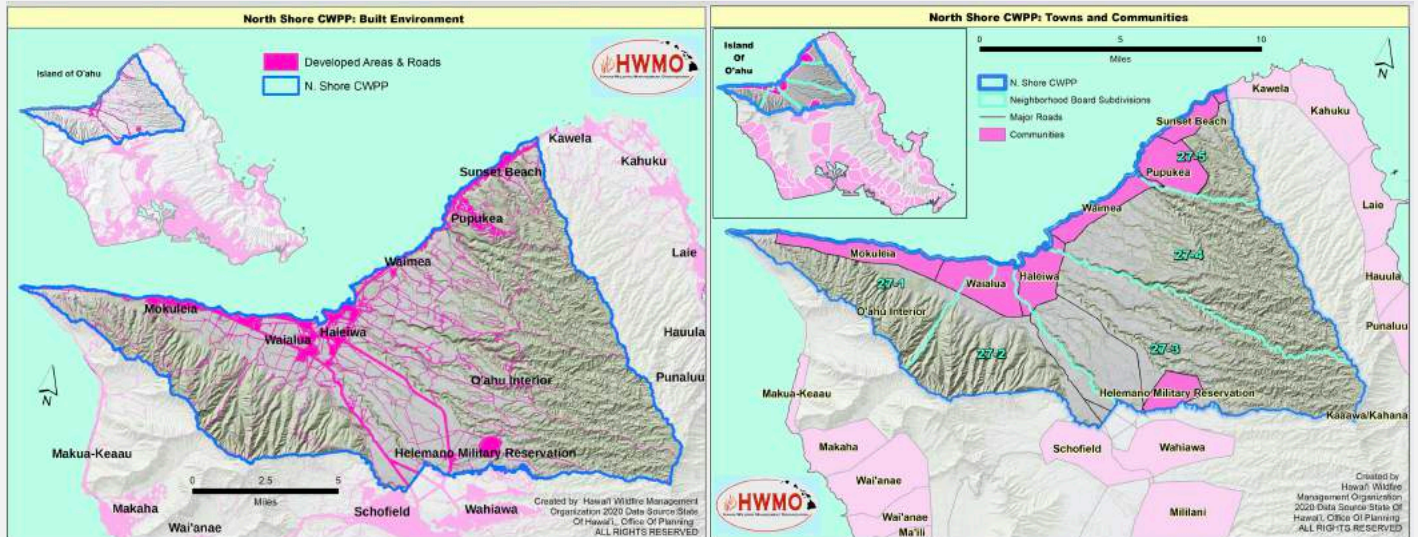
2019. Helemano Military Reservation (population 3,965) is a military housing complex for the U.S. Army’s Schofield Barracks. Coastal communities have one primary egress option (north) along Kamehameha Highway. These constraints can often limit emergency response access to the fire-prone, wildland areas behind homes. Once wildfires spread into steep, upland areas, the lack of roads and difficult terrain frequently limit fire response to costly aerial operations (i.e., bucket drops by helicopters), as conditions are often too dangerous to put firefighters on the ground. Maps 2 and 3 depict developed areas and communities within the North Shore area.

The planning area also includes government and privately owned lands (Map 4), two-thirds of which are owned by either Kamehameha Schools or Castle & Cooke, the former owners of the Dole Plantation. The latter is now being sold or leased as individual farm lots. The Department of Land and Natural Resources (DLNR) manages important coastal and upland natural resources in the project area, which are located in both the northern Wai’anae and Ko’olau mountains.

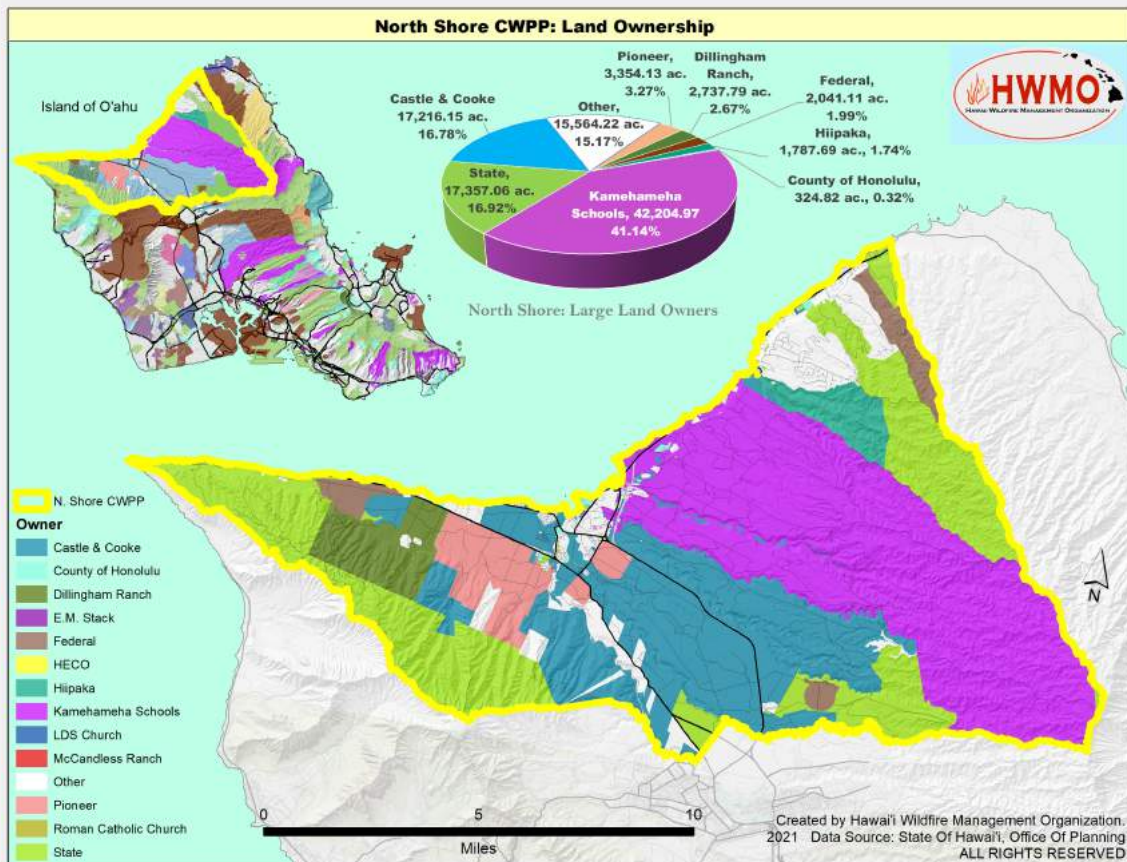


Map 1. North Shore CWPP planning boundaries.

Finally, the coastal areas and beaches consist of residential communities and support world renowned water recreational opportunities through numerous public right-of-way access points. Called the "Seven Mile Miracle", the stretch of reef from Haleiwa to Sunset Beach brings surfers and tourists from all over the world. The Hawai'i Visitors and Convention Bureau estimates that more than half of the state's 7 million visitors in pre-pandemic times made the trek to the North Shore at some time during their stay. A major economic driver, these fragile coastlines also can be impacted by upland wildfires which can negatively impact water quality and coral reef viability.



Map 2 (left). Developed areas and roads in North Shore. Map 3 (right). Towns and communities in North Shore.



Map 4. Land ownership in the North Shore CWPP area.

NORTH SHORE COMMUNITY WILDFIRE PROTECTION PLAN

PART II

**WILDFIRE CHARACTERISTICS
AND CONSIDERATIONS**

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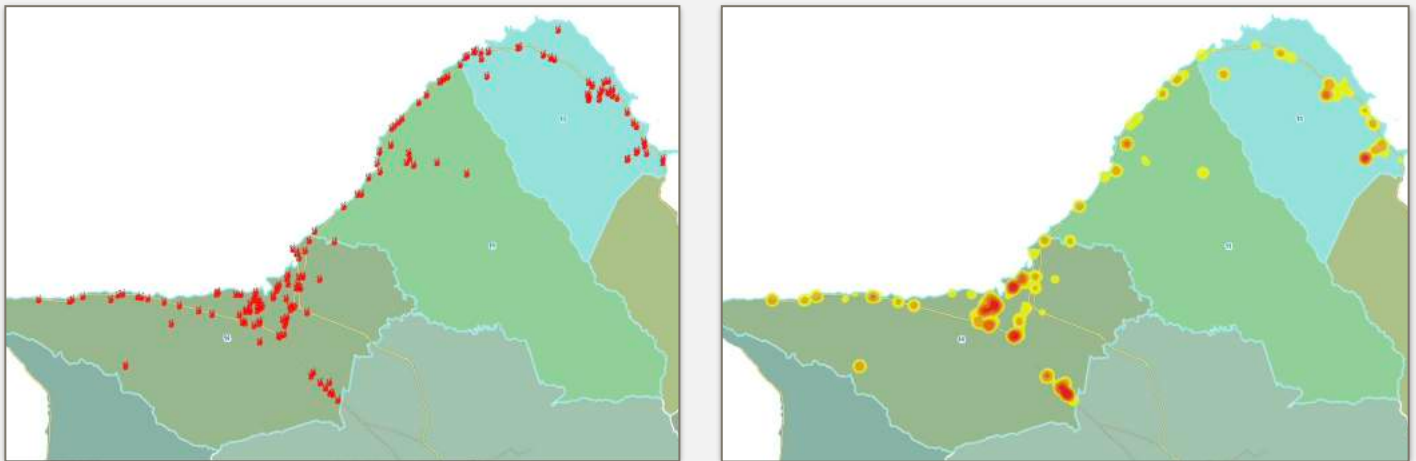
FIRE HISTORY

WILDFIRE OCCURRENCE

The majority of wildfires on O‘ahu are caused by human error or arson, especially near developments, power line right of ways, and along roadsides. Some of the valleys and ridges throughout the North Shore have access roads (multiple ignition points) and contain irreplaceable archaeological sites and rare plants and animals. These roads vary from paved with public access to unpaved and/or restricted in access. Significant fire hazards include unmanaged grasses and shrubs, unattended campfires, vehicle-caused ignitions, and sparking equipment and power lines. Once ignited, these fires spread rapidly and threaten nearby community infrastructure, neighborhoods, grazing lands, and valuable native flora and fauna.

Specifically, some former agriculture lands once cultivated for sugar have been overtaken by fire-prone weeds. Once ignited along the interface, wildfire can spread rapidly through and around residential areas, threatening property, life, critical infrastructure, and both natural and cultural resources.

The fire history maps below show individual ignition locations (Map 5) and concentration “hotspots” of ignitions over the eleven years (Map 6). Areas of high human activity have a high probability to become repeat ignition hot spots. Across Hawai‘i, humans are the cause of wildfires 99% of the time (only 1% are from natural causes such as lava or lightning). Reducing ignitions is a major important component of reducing wildfire occurrence and damages.

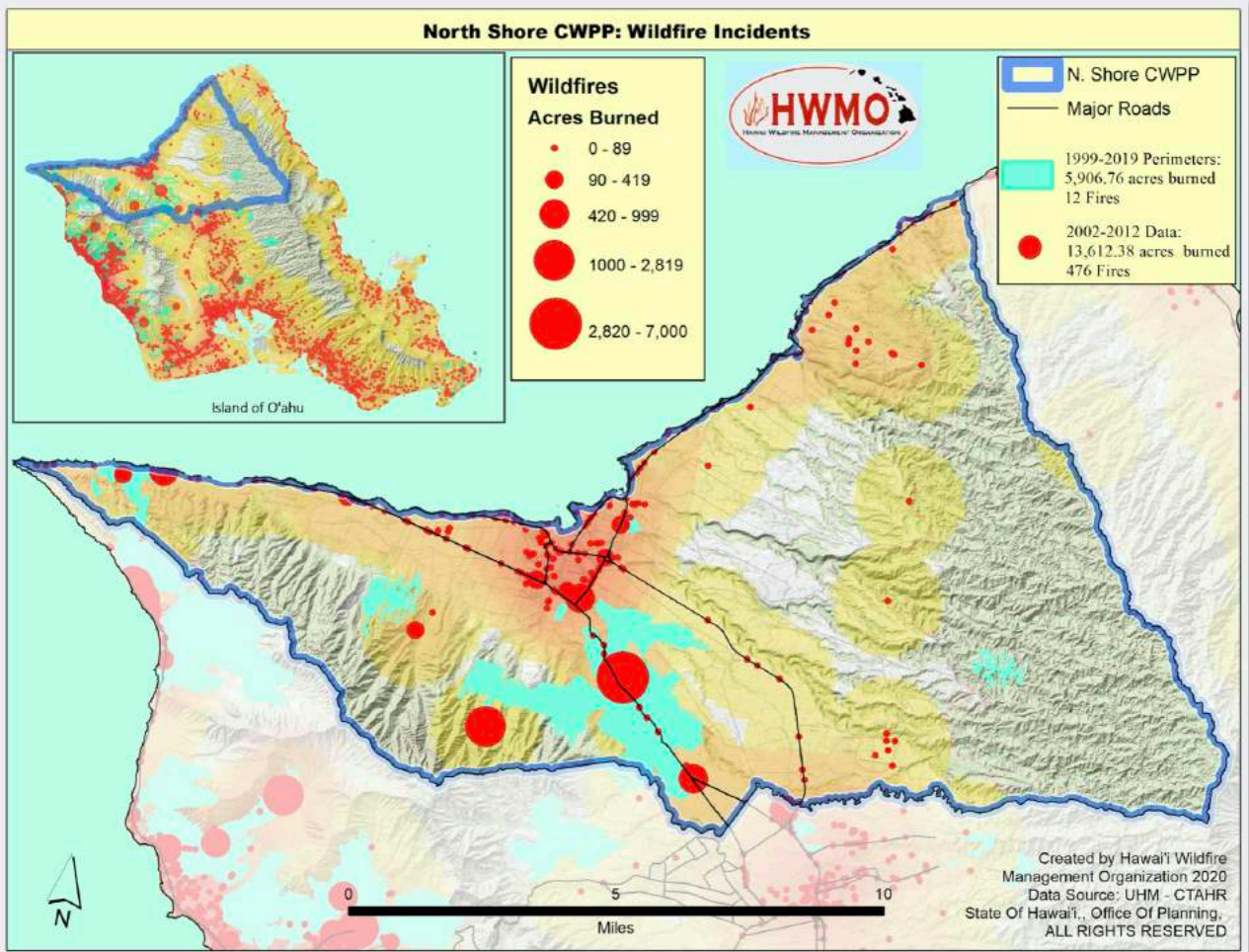


Map 5 (left) wildfire ignitions. Map 6 (right). Concentrated ignition “hot spots”. Both represent fires 2009 - 2020.

NOTABLE FIRES

Wildfires have repeatedly been a problem on the North Shore, particularly in the lowland grasslands, shrublands and adjacent communities, and only occasionally in the upper forests of Waialua and Mokule‘ia. The loss of large-scale sugar and pineapple cultivation which once dominated the landscape from

Wahiawa to Waialua has exacerbated the problem because of the transition of formerly irrigated croplands into alien grasslands. More challenging still is that these flammable areas are adjacent to roadways.



Map 7. Wildfire incidents 2002- 2019. Note that fire incident are mapped using different formats, due to differences in available data types. For several large fires, perimeters were captured after the event. For all others, ignition locations were recorded as red circles, with size indicating relative magnitude of the fire it represents.

The closure of Waialua Sugar Mill in 1996 prompted the sale and lease of former Dole Plantation lands (owned by Castle and Cooke) to the public. Lots ranging in size from one to 1,000 acres remain zoned as agriculture. However, additional homes, roads and electrical infrastructure are now being built to support various food and ornamental plant crops among private landowners. This proximity of increased human presence beside unsold or un-leased fallow lots poses an increased fire threat, coupled with the historic use of the area for recreation, farming, and development.

The abandonment of cultivated monocultures combined with increased use and access has led to wildfire hotspots concentrated between the towns of Wahiawā and Waialua. Live fire munitions training from Schofield Barrack's West Range adjacent to Wahiawā has accidentally caused fires to escape beyond the fire break road boundaries. Notable fires (Table 1) include small fires in Waialua, Dillingham Airfield, and Ka'ena, happening periodically and ranging in size from under 100 acres to a 7,000 acre fire in 2007 which threatened Hale'iwa town and prompted evacuations and an electrical grid shutdown.

Notable Fires Since 2000 In the North Shore Area			
Location	Date	Size (acres)	Threatened Resources
Waialua	Aug 2020	2,000	Five structures threatened, closure of Kaukonahua Road
Schofield / Waialua	May 2019	525	Training range, Kaukonahua Road, neighboring forests and shrublands
Mokule'ia	June 2017	450	Mokule'ia Forest Reserve and Pahole Natural Area Reserve
Schofield / Waialua	Oct 2013	300	Training range and neighboring forests and shrublands
Waialua	Aug 2007	7,000	Poamoho Estates, electrical grid shut down, multiple road closures, residents near Hale'iwa evacuated
Mokule'ia	early 2000s	> 100	Dillingham airfield, Ka'ena, Mokule'ia

Table 1. Notable fires 2000 - 2021, North Shore, O'ahu.

Alien-dominated lowland forests, shrublands and grasslands in the northern Wai'anae mountains provide much of the upland fuel which has burned repeatedly in the past. Although the population density of the North Shore remains relatively low compared to much of O'ahu, the Wahiawā community and the coastal towns of Waialua, Mokule'ia and Hale'iwa remain most at risk. A series of visual images below (Images 2 and 3) provide a visualization of fires in the two areas with frequent fires within the CWPP area: eastern and central/upland.

In addition, recreational use of the North Shore continues to rise. DLNR manages access throughout the Waialua and Mokule'ia areas, and recently acquired Helemano (2,800 ac) and Waimea (3,700 ac). DLNR is mandated to manage sensitive natural resources while providing access and public recreational opportunities. An increase in both permitted campers and illegal trespassers, and therefore accidental ignitions, is expected. For example, the Mokule'ia fire in 2017 (Image 1), which caused the closure of Pahole Natural Area Reserve, was caused by a truck, while at least three recent wildfires from camps in the northern Ko'olaus were reported in upland rainforests, areas previously thought to be at low wildfire risk. As the climate warms and periods of drought become more frequent, native rainforests like these will require more vigilant attention in planning for wildfire mitigation.



Image 1. Helicopter dropping 2000 gallons of water during the 2017 Mokule'ia fire. Courtesy: DLNR.



Image 2. (Map/image series of 3). Burned area visualization of notable fires in the eastern portion of the North Shore CWPP area in the last decade. Burned areas were mapped onto Google Earth images. Courtesy: C. Trauernicht.

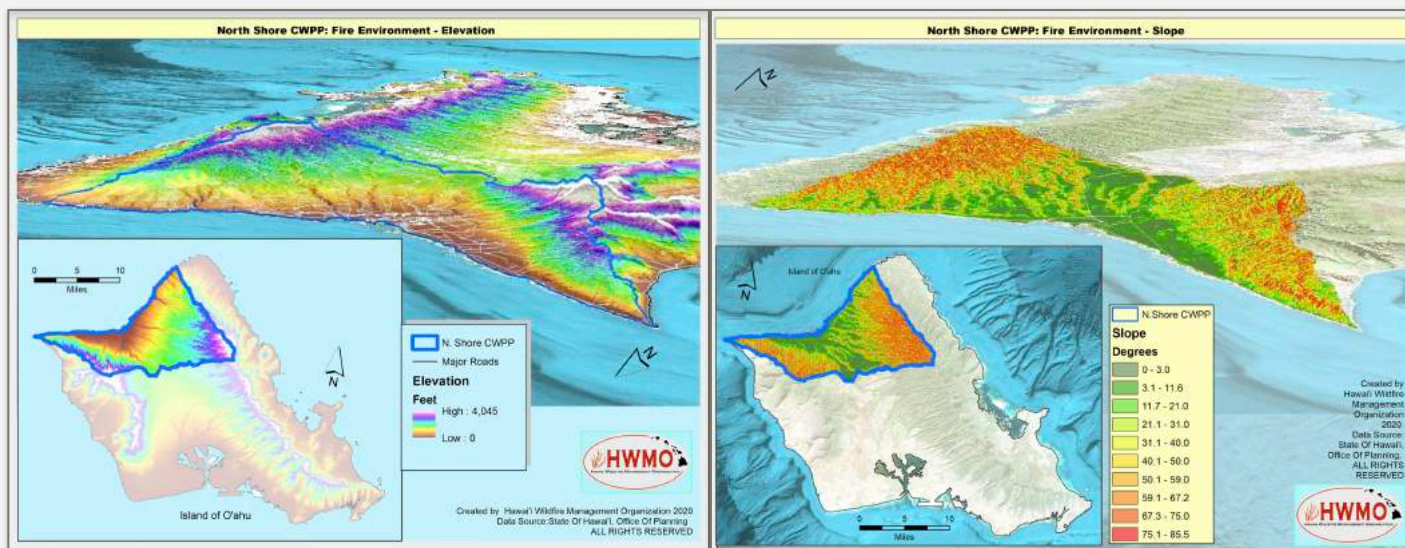


Image 3. (Map/image series of 4). Burned area visualization of notable fires in central and upland portions of the North Shore CWPP area in the last decade. Burned areas were mapped onto Google Earth images. Courtesy: C. Trauernicht.

FIRE ENVIRONMENT

WILDFIRE DRIVERS

The factors that contribute to wildfire occurrence and spread are a combination of fuels, topography, climate, and weather conditions during a fire event. In the North Shore, these can stack up to yield a high risk of wildfire, rapid spread, and significant impacts from summit to sea, and to both people and environment.



Map 8 (left). Elevation across North Shore CWPP area. Map 9 (right). Slope across the North Shore CWPP area.

TOPOGRAPHY

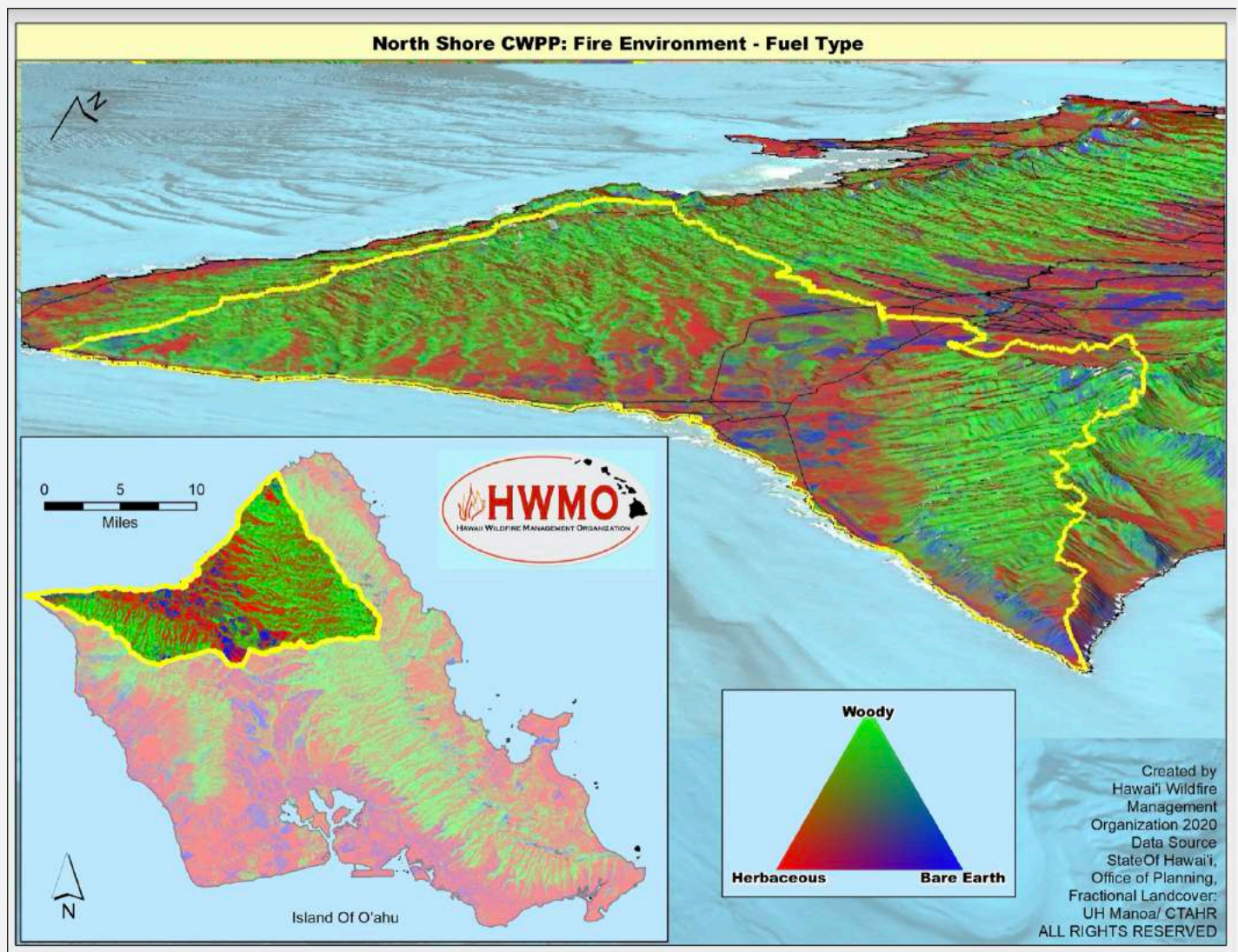
Topography influences fire behavior principally by the steepness of the slope and exposure to sun and wind influences. However, the configuration of the terrain such as narrow draws, saddles and so forth can influence fire spread and intensity. In general, the steeper the slope, the higher the uphill fire rate spread and intensity. The more exposure to sun and wind, the hotter, drier, and more primed to burn the vegetation will become.

Topography is an important determinant of wildfire behavior in North Shore. The project area spans coastal beaches and gently sloping lowlands, bounded by steep cliffs and ravines in both the northern Ko'olau and Wai'anae mountains encompassing O'ahu's highest point, Mt. Ka'ala (4,045 ft). The mountain ranges rise abruptly between the leeward and windward coasts and central plains of O'ahu. They are characterized by rugged, and often inaccessible terrain. Wildfires spread more quickly as they progress upslope. Sun-exposed, south-facing slopes will be drier and burn at higher intensity. This topography creates dangerous conditions when wildfires occur. It limits the ability of emergency response agencies to effectively contain and suppress wildfires, and constrains evacuation options for local communities. Map 8 depicts the span of elevations across the planning area. Map 9 depicts slope across the North Shore CWPP area.

FUEL

Fine “flashy” fuels ignite more easily and spread faster with higher intensities than coarser fuels. For a given fuel, the more there is, and the more continuous it is, the faster the fire spreads and the higher its intensities. Fine fuels take a shorter time to burn out than coarser fuels.

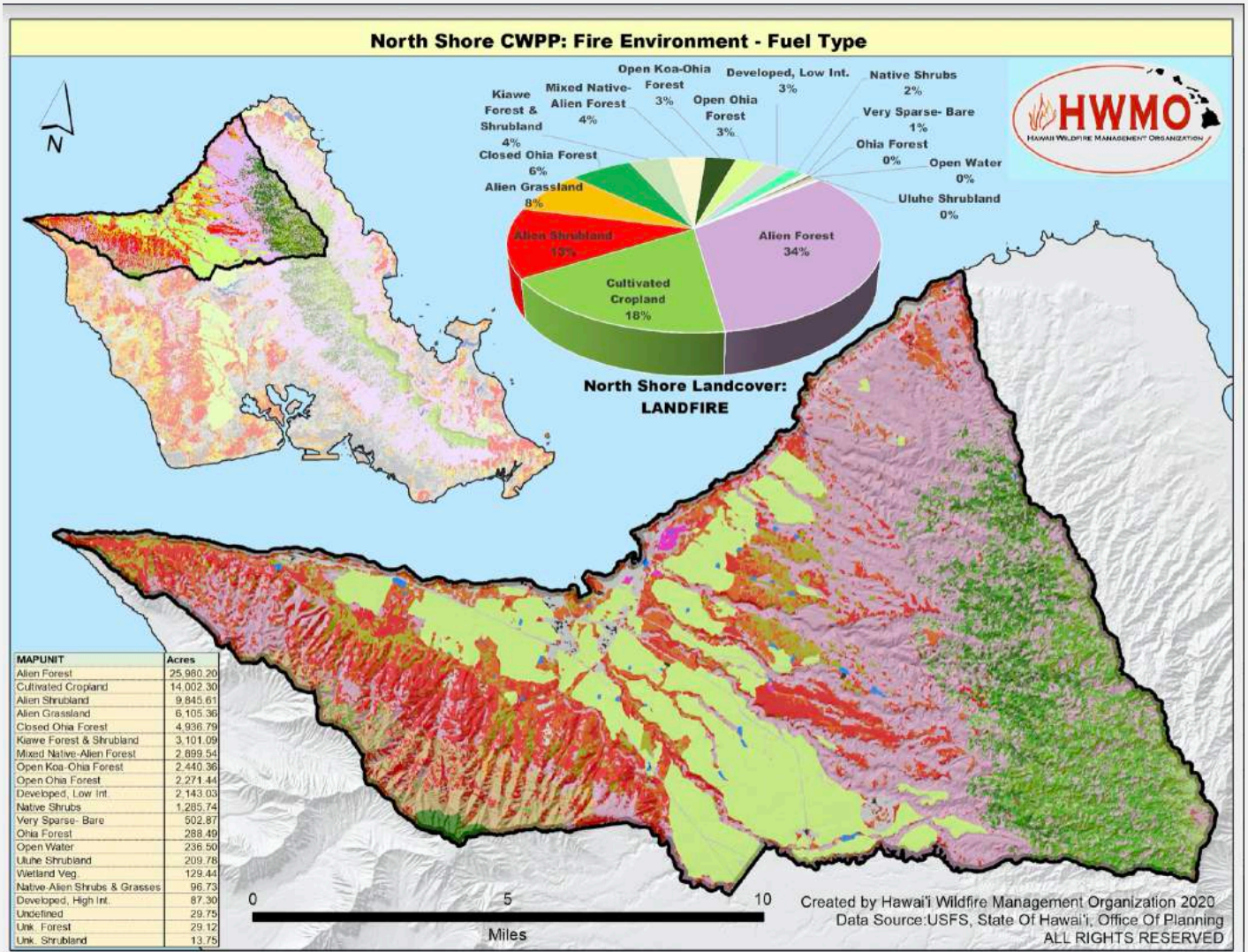
Since the North Shore covers a vast stretch of topographic and climatic characteristics from summit to sea and from east to west, a mosaic of landcover types exist within the area. Map 10 characterizes fuels in the CWPP area by indicating whether it is grass, woody, or bare ground. Visualizing by class of vegetation illustrates how easily fire will ignite (grasses are flashy, dry easily and ignite readily) and how quickly fire might spread (what type and whether it is contiguous or patchy). Patchy or non-contiguous fuels can slow the spread of fire and/or provide options for fire control.



Map 10. Fuel type: Woody/green, herbaceous (grass, shrubs, forbs)/red, and bare earth/blue.

A large amount of land is covered by croplands (Map 11) as well as mixed grasslands, shrublands and forests dominated by introduced species, particularly in lowland areas (<1,000 ft elevation). These fuels may encroach residential areas and may be especially prolific on unmanaged, vegetated gulches, and former agricultural lands.

Although no detailed non-native vegetation survey data exists for the entire project area, Guinea grass (*Megathyrus maximus*) is the dominant alien fire threat which has largely replaced the croplands. It provides abundant fuels which cure rapidly in dry conditions, is easily ignitable even in humid conditions, and allow fires to spread rapidly, creating dangerous conditions for fire responders. Guinea grass is particularly problematic as it is fast-growing, invades a wide range of ecosystems, and alters the flammability and fuel load of a given area. Natural resource managers have experienced Guinea grass producing extra long flame lengths and generating a lot of heat during wildfires. Studies by Dr. Lisa Ellsworth, et.al, confirm extreme fire behavior in this fuel type, especially during periods of low fuel moisture.



Map 11. Fuel types across the CWPP area. Note that very few areas contain low fire hazard fuel types.

Lower elevation forests on the North Shore contain various non-native tree species most notably albizia and eucalyptus species, ironwood (*Casuarina equisetifolia*), African tulip (*Spathodea campanulata*), monkeypod (*Samanea saman*), koa haole (*Leucaena leucocephala*) and kiawe (*Prosopis pallida*). Although fire behavior in these mixed forests is poorly documented, natural managers and fire fighters have observed certain problematic fire-promoting characteristics. For example, both koa haole and kiawe can form thick, dense stands and are flammable. According to

local firefighters, koa haole pods have been known to travel several miles during strong wind events. These pods can act as firebrands and ignite vegetation near houses or other structures directly, as well as igniting new spot fires during a large wildfire event.

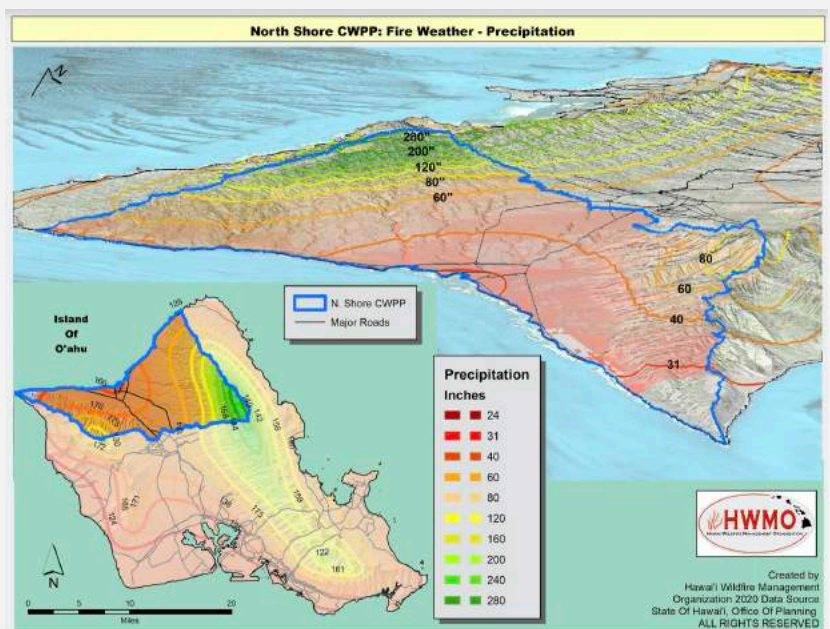
In addition, Norfolk pine plantations, eucalyptus and iron wood trees are of particular concern in the North Shore area. Ironwood can be problematic because of the needle litter and duff which burns easily and spreads fire along underground root systems, making suppression efforts difficult. The chemical content in eucalyptus leaves and bark prevents decomposition, resulting in large and persistent fuel loads beneath live trees. These increased fuel loads can result in high intensity fires that result in 'torching' or vertical fire spread into tree canopies as has been observed in eucalyptus stands during wildfires across the state.

In addition, fuels from lowland grasslands and shrublands can carry a wildfire upslope much more quickly than a flat area due to convection, or the pre-heating of fuels at higher elevations. As a result, recurrent fires in these lower elevation grasslands and shrublands effectively 'erode' the edges of upland forested areas, which become replaced by grasses and increase the risk of future fires over time. Upper elevation forests in the northern Ko'olau and Wai'anae mountains contain important native ecosystems. The Wai'anae mountains in particular house some of the last remaining dryland and mesic (i.e., drier than rainforest) tropical forests remaining on O'ahu.

CLIMATE AND WEATHER

The North Shore is exposed to prevailing moisture-laden, north-east trade winds, and as such, conditions are wetter on the north- and east-facing slopes. Typical of many areas, larger fires tend to occur during droughts and drier seasons, but wet periods may increase the quantity of available vegetative fuels, thereby increasing the wildfire risk.

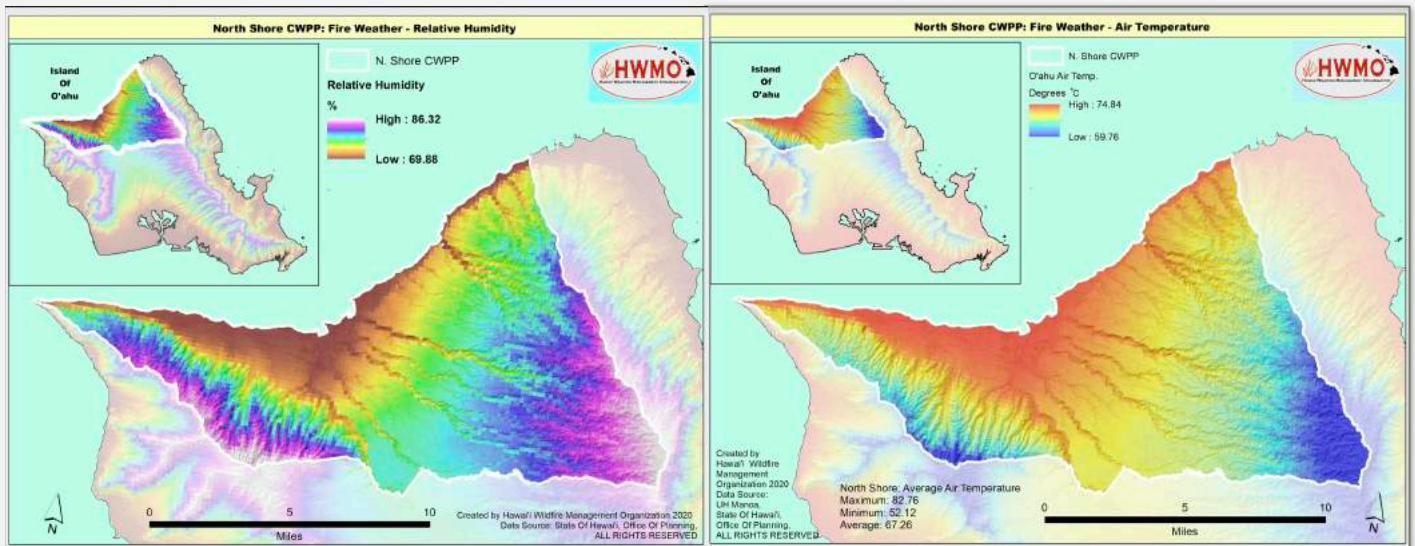
The North Shore CWPP area has variable rainfall (Map 12) and humidity (Map 13), depending on seasonal precipitation and elevational gradients. Drier conditions tend to persist at lower elevations, making neighborhoods and lands near the coast particularly vulnerable to wildfire starts (although wildfires can ignite under certain conditions even in high humidity). Also, while elevation in windward slopes contribute to greater precipitation levels, tradewind shadowing from windward ranges on leeward slopes contributes to lower precipitation even at higher elevations.



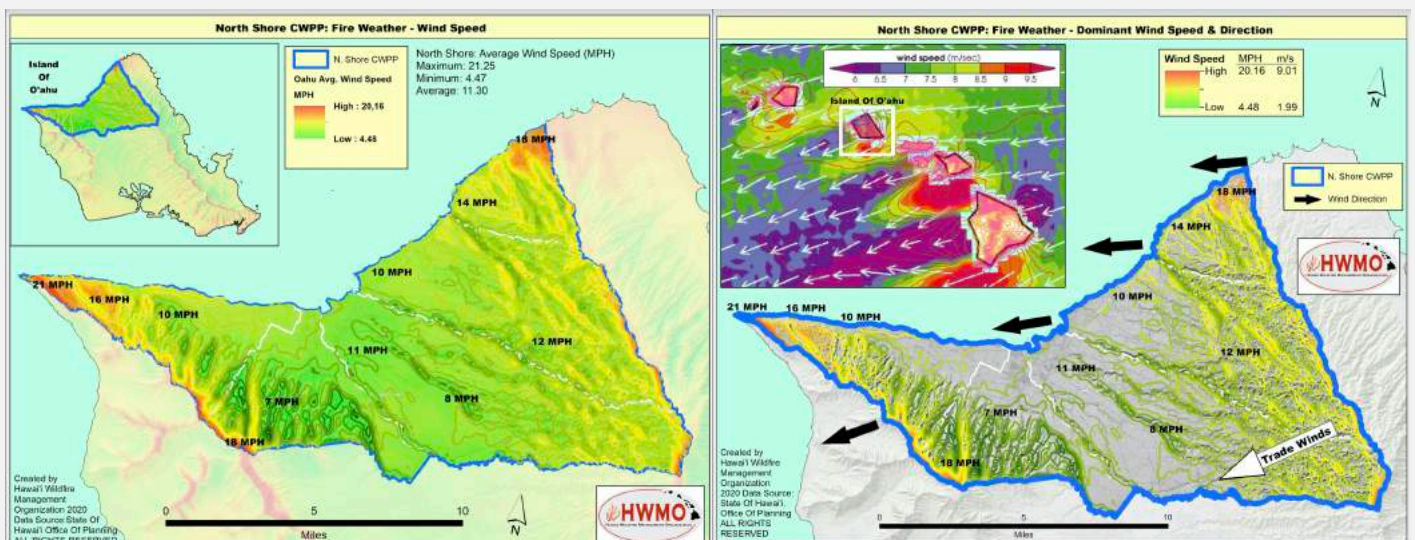
Map 12. Precipitation/rainfall gradients across North Shore.

Rainfall is typically greater in mauka (upland) areas, which may result in lower fire risk on average in these areas. However, due to more abundant vegetation in the higher elevations, mauka areas may experience wildfire risk during periods of drought.

Wind speed also significantly influences the rate of fire spread and fire intensity. The higher the wind speed, the greater the spread rate and intensity. Wind speeds vary slightly across the the North Shore (Map 15) depending on if one is within a gulch, ravine, along the coast or at higher elevations. For example, in more sheltered, inland areas, the average wind speed hovers around 8 mph. However, in more exposed locations such as north and west coastlines and mountain ridges, wind speeds range between 12 - 21 mph, with gusts even higher. As noted earlier, fires that begin in the lowlands can easily be pushed by prevailing north-east trade winds into the upland areas (Map 16), particularly the northern Wai'anae mountains which are exposed to more solar radiation and higher temperatures.



Map 13 (left). Relative Humidity. Note that in Hawai'i, wildfires can ignite and carry across the landscape even in high humidity. Map 14 (right). Average Air Temperature. Note that low relative humidity and high temperatures (higher fire risk conditions) overlap in the lowland areas.



Map 15 (left). Average wind speeds. The North Shore area experiences land-sea breezes as well as tradewind and storm-associated wind patterns. Map 16 (right). Dominant wind direction. Winds are driven by the trade wind pattern with localized disruptions due to topography, seasonal anomalies, and storms, often making them erratic.

WILDFIRE IMPACTS

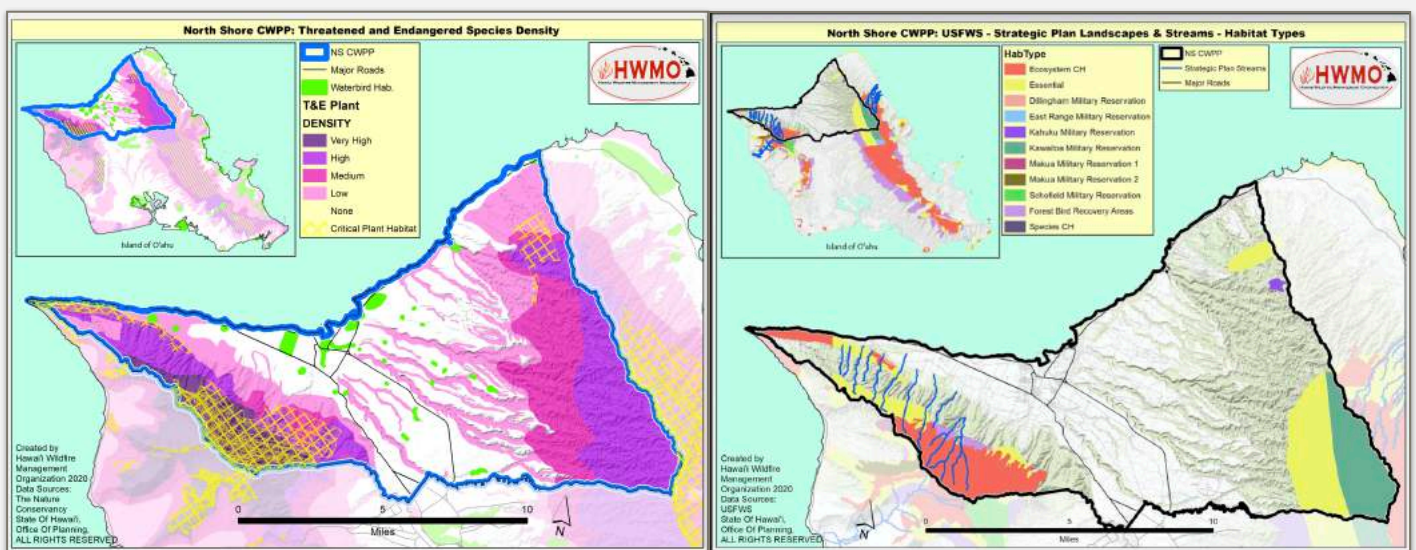
Wildfire impacts span from summit to sea, causing challenges to the health of land, sea, and air. Natural, cultural, municipal, and community resources are all effected, and challenged by, wildfires.

IMPACTS TO NATURAL AND CULTURAL RESOURCES

Recurrent wildfires result in the conversion of both native and non-native forested areas to fire-adapted grasslands and shrublands. As a result, these fire-prone ecosystems are expanding in many parts of the state. Wildfire is a major cause of the loss and degradation of native forest and other habitat.

Many of the natural and cultural resources across the North Shore CWPP area are exposed to wildfire impacts given the dominance of highly flammable surrounding fuels (former agriculture lands, grasslands and shrublands), the prevalence of episodic drought, especially in the Wai‘anae mountains, and the high number of human-caused ignitions. These impacts are compounded by the fact that land-based, aquatic, and marine-based natural and cultural resources all lie within close proximity across the region.

The upland areas of the Wai‘anae and Ko‘olau mountains contain O‘ahu’s most biologically diverse native ecosystems with high concentrations of threatened, endangered species and their critical habitats (Maps 17). For example, Pahole Natural Area Reserve is home to 50 endangered species, many of them critically endangered, while Ka‘ena Point contains important habitat for migratory sea birds such as the Laysan albatross. In addition, upland rainforests owned by Kamehameha Schools (and not yet mapped for critical habitat) contain some of the best remaining in-tact ecosystems on O‘ahu. The CWPP area includes several US Fish and Wildlife Service strategic plan designations (Map 20) due to protection needs of these sensitive and important natural resources.



Map 17 (left). Density of Threatened and Endangered Species within the CWPP boundaries. Map 18 (right). Landscapes and stream habitats designated for strategic protection by US Fish and Wildlife Service.

Most of the plant and animal species within these native ecosystems do not survive and/or recover from wildfires. In addition, the conversion of forest to grasslands due to fire increases the potential for future and larger fires by expanding the availability of fine fuels.

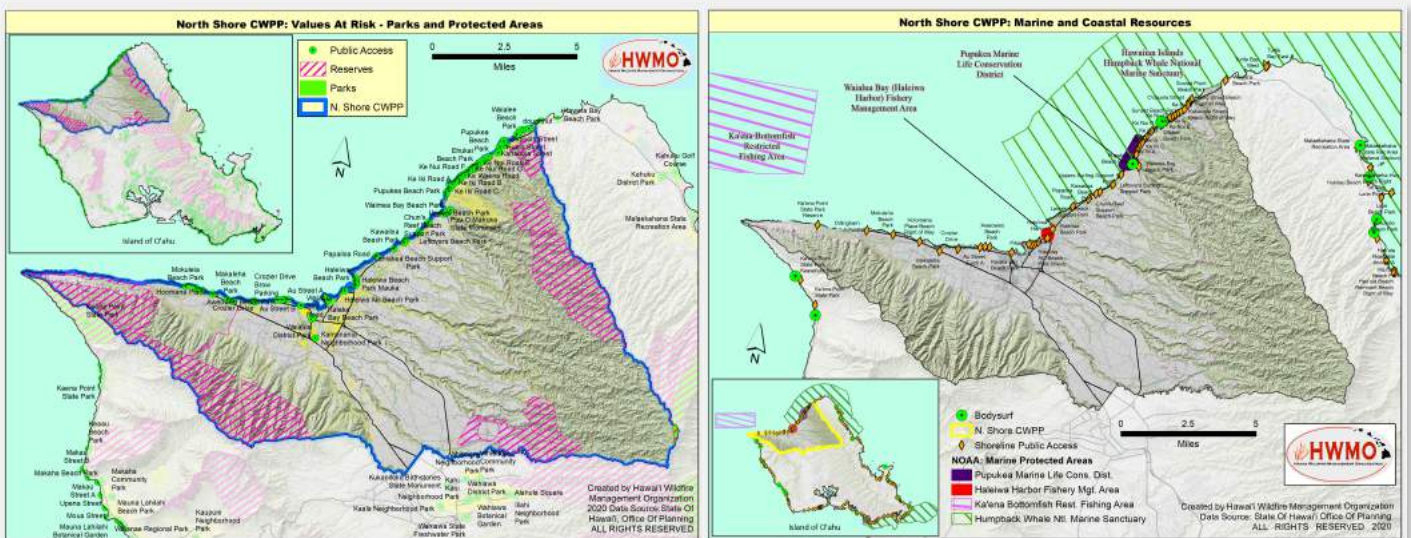
Wildfire also increases the potential for erosion and sediment delivery from upland to coastal and nearshore areas. The immediate loss of vegetation after a wildfire directly exposes soils to rainfall, which can dramatically increase erosion. Wildfire can also alter the physical and chemical properties of soils, making them more prone to surface run-off which can increase the downstream flooding and sediment delivery. Specifically, Kaiaka Bay (near Haleiwa) is a drainage for six watersheds within the project area. It is considered an impaired waterway by the Hawai'i Department of Health due to sedimentation and erosion from the upland agricultural plains. Future fires in the areas and the associated soil run-off will compound the coastal water quality problem.

Forest loss and increased downstream sediment delivery to nearshore reefs have important implications for cultural resources—specifically tourism, recreation, food resources, and spiritual practices. Sediment loading destroys reefs and impacts nearshore fisheries which are critical subsistence resources to many O'ahu families.

In addition, burned areas can remain closed to the public for days to months due to landslide and tree-fall danger, limiting access to areas for hiking, hunting, gathering plants, and tending cultural sites. Many valleys on O'ahu contain high concentrations of archaeological sites. Although fire may have limited direct impacts on these resources, suppression efforts, such as water drops, can damage these culturally important landscape features. Frequent fires also impact powerlines and communication infrastructure, and can lead to road closures - exacerbating already congested traffic areas.

High value resources to protect within the CWPP boundaries include critical habitat for threatened and endangered species (as noted earlier), parks and protected areas (Map 19), and marine and coastal resources (Map 20).

IMPACTS TO COMMUNITIES AND MUNICIPAL RESOURCES



Map 19 (left). Parks and protected areas. Map 20 (right). Marine and coastal resources. Note that in areas across Hawai'i, including North Shore, coastal areas are not only direct impacts from fire, but by post-fire effects such as erosion, flooding, nearshore sedimentation, and water quality degradation.

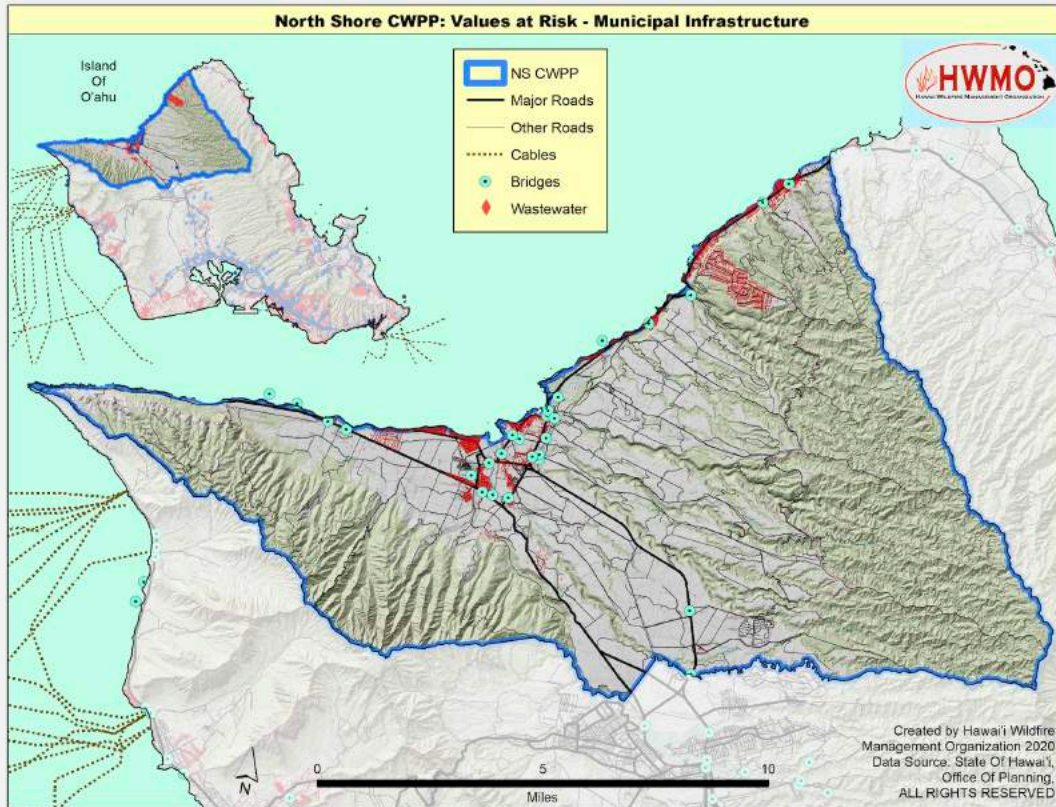
Wildfires threaten lives, homes, and human health in several ways. Some farm lots or former monocrop fields may have unmanaged/untended fire fuels interspersed within developed areas, promoting fire spread through communities and into surrounding areas. This creates an increased hazard to lives and homes in the area. Air quality is greatly reduced from smoke during fires not only from fires within the North Shore CWPP planning area, but from frequent fires on the adjacent leeward Wai'anae coast.

Wildfires also impact economic and municipal infrastructure and activities. Burned soil from wildfires decreases groundwater recharge, which can affect drinking water supplies.

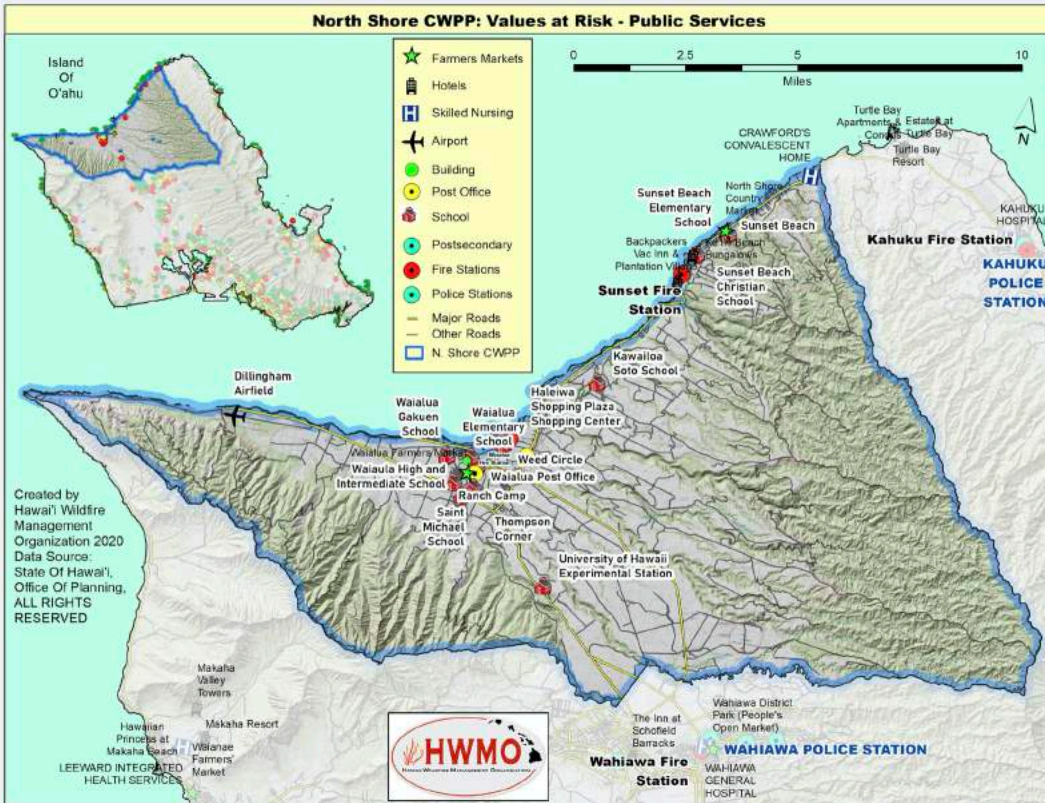
As noted above, post-fire rain events cause erosion that damages nearshore resources, which can have effects on one of the area's primary economic bases— coastal and marine-based tourism, as well as resident and visitor recreational activities.

Traffic and road closures during fire events and post-fire flooding also block access routes and keep people from their homes and work, and are costly to local government. This is especially disruptive in the North Shore area which has limited infrastructure (roads, bridges, hospitals, etc.) to support both its resident population as well as the millions of tourists who visit every year.

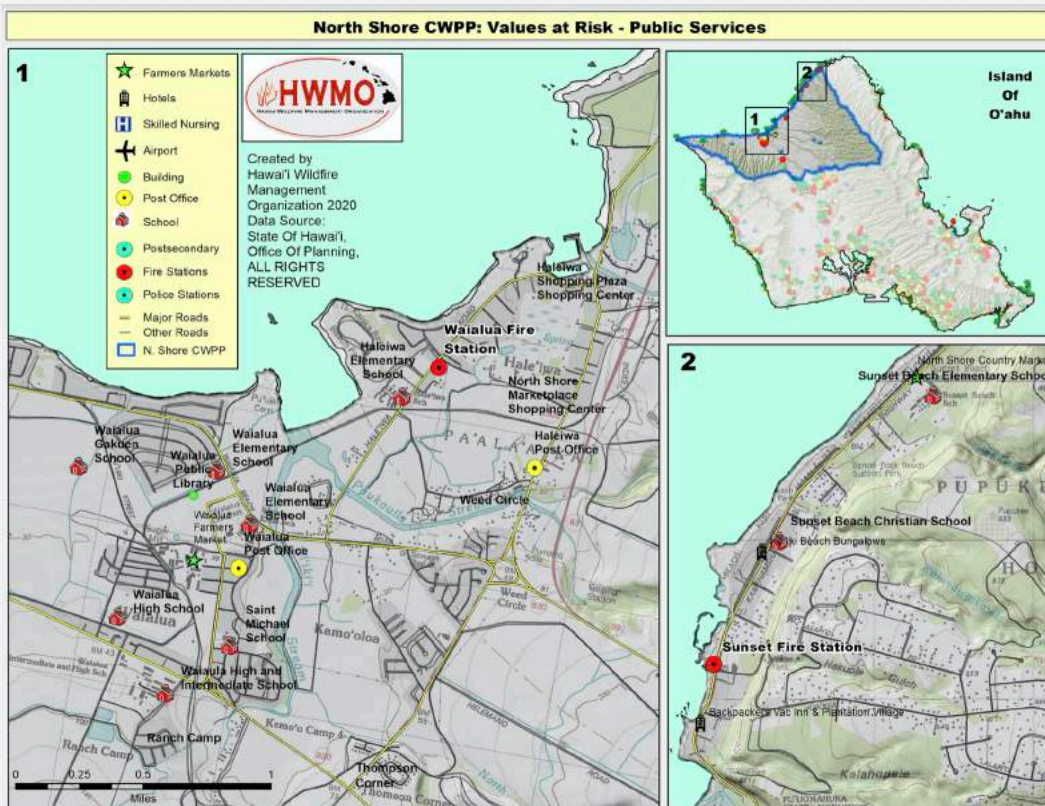
Municipal infrastructure and public services are highlighted in Maps 21-23 to indicate priority values to protect from wildfire in the North Shore area.



Map 21. Location of major municipal infrastructure to protect from wildfire impacts.



Map 22. Location of public service infrastructure to protect from wildfire impacts. Note that public services exist in key cluster areas. This map shows the spread over the entire planning area. See Map 23 for better resolution of services per cluster.



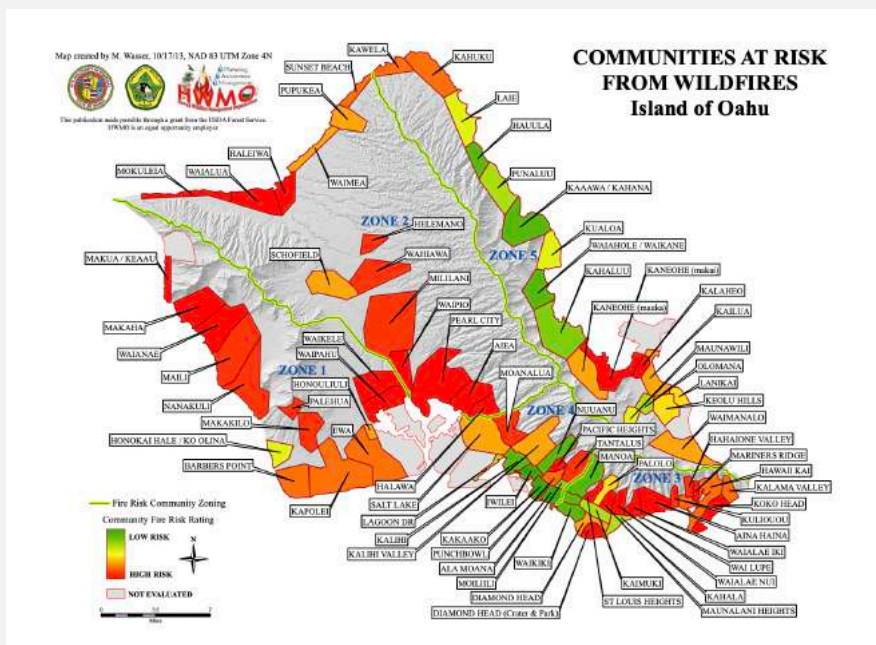
Map 23. Zoom-in map of key public service locations in the most densely populated regions of the CWPP planning area.

HAZARD ASSESSMENT

COMMUNITIES AT RISK FROM WILDFIRE

In the 2013 Communities at Risk from Wildfires map, which is the most recent statewide wildfire assessment, the communities within North Shore are rated as having a moderate to high level of risk (Map 24). Community boundaries were delineated on this map by DLNR-DOFAW to capture relative wildfire risk across regions, with fairly simplistic breakdowns of community areas to accommodate some local detail on broader set of island-wide and statewide maps.

For this 2021 North Shore CWPP, the hazard assessments were conducted using a more refined delineation of neighborhood boundaries was used, see details below.



Map 24. Communities at Risk from Wildfires map for O'ahu. Note that North Shore areas are assessed and rated as moderate-high or high risk as of 2013 as part of the most recent statewide assessment.

Both the 2013 and 2021 assessments and maps ONLY rate areas where there are residents living and working in built structures, neighborhoods, and established communities. Gray areas on the map indicate areas with no residential or community infrastructure. These areas are considered wildland areas, and therefore were not assessed or rated with this method. Threats to wildland areas are detailed and described within the earlier section of this document, entitled Part II: Wildfire Characteristics.

2021 UPDATED WILDFIRE HAZARD ASSESSMENT

The purpose of the required community risk assessment is to:

- Provide site-specific information to the public to promote wildfire awareness.
- Help identify and prioritize areas for treatment.
- Determine the highest priority uses for available financial and human resources.

The methods for this plan's community wildfire risk assessment followed the guidelines established by the HFRA. The wildfire risk assessment also follows the guidelines and requirements of the FEMA Pre-Disaster Mitigation program and the National Fire Plan. Locally, we have opted to name the effort Wildfire Hazard Assessment, rather than Wildfire Risk Assessment.

HWMO, DLNR-DOFAW, and HFD completed an assessment of the community areas within North Shore using a process that rates 36 wildfire hazard characteristics, which have been further grouped into 5 categories. The five categories assessed for wildfire hazard are, Subdivision Hazard, Vegetation Hazard, Building Hazard, Fire Environment Hazard, and Fire Protection Hazard.

The purpose of looking in depth at each category and specific hazard is to identify the factors that put each community most at risk, and to enable mitigation action plans and activities that are targeted toward reducing risk in the factors that most need attention per area.

Table 1 details the categories assessed within each of the five categories (total 36 in 5 categories). Table 2 provides the hazard assessment results for each developed area assessed in North Shore. Maps per hazard category are included below (Maps 25-29), and represent the total hazard across all individual hazards per category. Several large landholdings are also present in the area, but lie outside of the assessed subdivisions. For this reason, they were assessed separately and are included in the appendix.

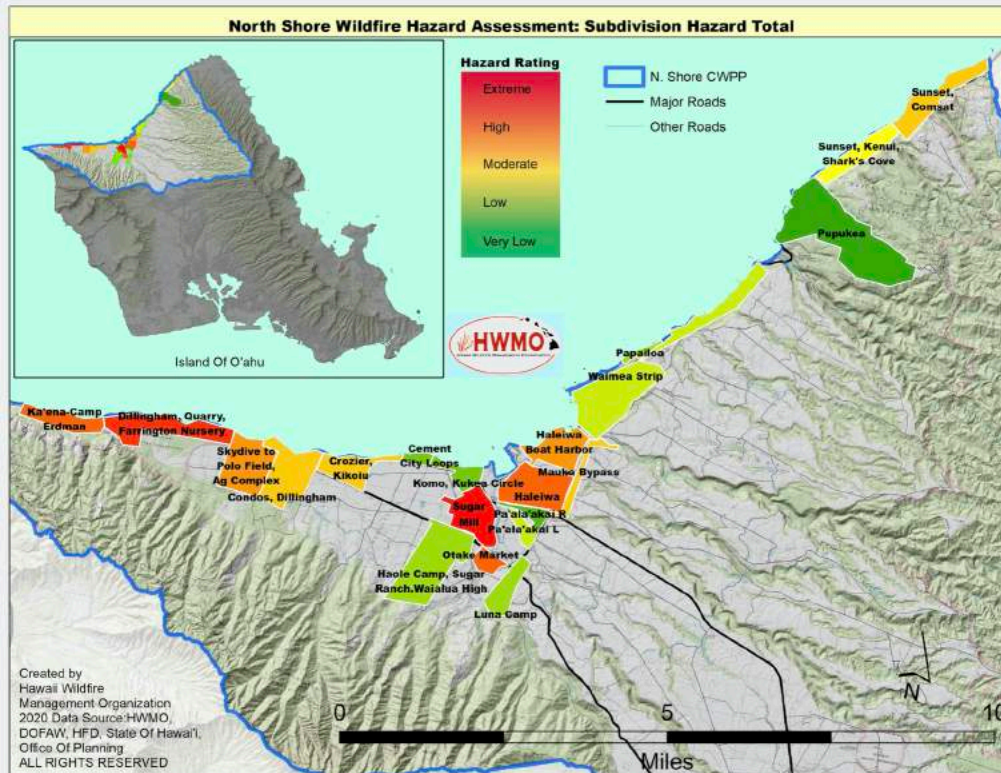
Hazards Assessed Per Category	
Hazard Category	Individual Hazards Assessed Within Category
Subdivision Hazard	Fire Service Access Home Setbacks Ingress/Egress Private/Landowner Firewise Landscaping and Defensible Space Proximity of Subdivision to Wildland Areas All Season Road Condition Road Maintenance Road Width Street Signs Structure Density Unmanaged, Untended, Undeveloped Land
Vegetation Hazard	Defensible Space: Fuels Reduction Around Homes & Structures Fuel Loading Fuel Structure & Arrangement Proximity of Flammable Fuels Around Subdivision Vegetation Within 300' of Homes
Building Hazard	Siding/Soffits Roofing Assembly Structural Ignitability Under-Skirting Around Decks, Lanai, Post & Pier Structures Utilities Placement: Gas & Electric
Fire Environment Hazard	Average Rainfall Prevailing Wind Speeds & Direction Slope Topographic Features that Adversely Affect Wildland Fire Behavior Seasonal or Periodic High Hazard Conditions Ignition Risk
Fire Protection Hazard	Response Time Community Planning Practices & Ordinances Community Fire Safe Efforts & Programs Already in Place Fire Department Structural Training & Expertise Local Emergency Operations Group or Citizen Group Proximity to Fire Stations Water Source Availability Wildland Fire Response Capacity of Initial Response Agency Interagency Cooperation

Table 2. Overview of hazard assessment categories and the individual hazards that comprise them.

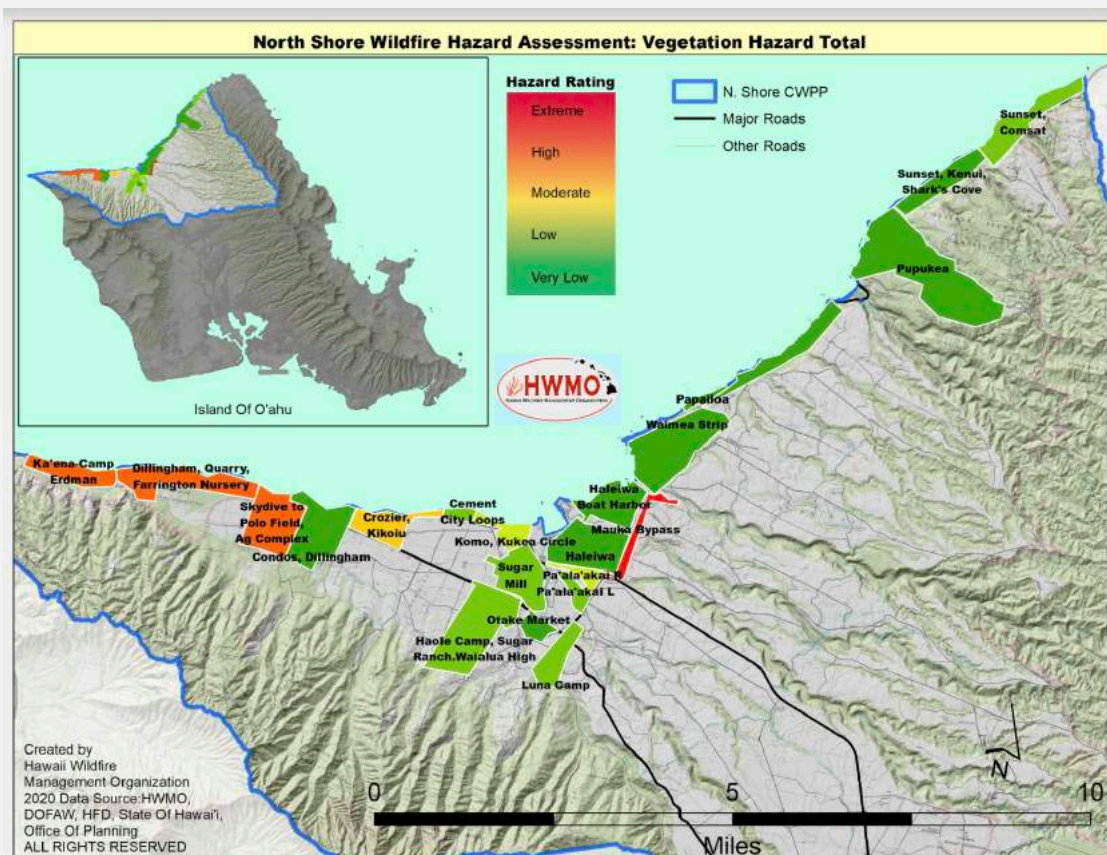
NORTH SHORE HAZARD ASSESSMENT RESULTS FOR DEVELOPED AREAS

Community Area	Hazard Assessment assistance from DLNR-DOFAW			Hazard Assessment assistance from HFD	
	Subdivision Hazard	Vegetation Hazard	Building Hazard	Fire Environment Hazard	Fire Protection Hazard
Camp Erdman	High	High-Extreme	High	Extreme	Extreme
Dillingham, Quarry, Farrington Nursery	Extreme	High-Extreme	Moderate	Extreme	High
Skydive to Polo Field, Ag Complex	High	High-Extreme	Low	Extreme	Low
Condos, Dillingham	Moderate	Low-Very Low	Low	Moderate	Low
Crozier, Kikoiu	Moderate	Moderate	Low	Low	Very Low
Cement City Loops	Low	Low	Very Low	Very Low	Very Low
Komo, Kukea Circle	Low	Low-Moderate	Low-Very Low	Very Low	Very Low
Sugar Mill	Extreme	Low	High-Extreme	Low-Moderate	Very Low
Haole Camp, Sugar Ranch, Waialua High	Low	Low	Low	Moderate	Very Low
Otake Market	High	Very Low	High	Low-Moderate	Very Low
Luna Camp	Low	Low	Low	High	Moderate
Paa'ala'akai L	Low	Low	Low	Low	Very Low
Paa'ala'akai R	Very Low	Low-Moderate	Very Low	Very Low	Very Low
Haleiwa Boat Harbor	High	Very Low	Low	Very Low	Very Low
Mauka Bypass	Moderate	Extreme	Extreme	High	Very Low
Haleiwa	High-Extreme	Very Low	Low	Moderate	Very Low
Waimea Strip	Low	Very Low	Low	Low	Very Low
Papailoa	Low	Very Low	Low	Low	Very Low
Pupukea	Very Low	Very Low	Very Low	Moderate	Very Low
Sunset, Kenui, Shark's Cove	Moderate	Very Low	Low-Very Low	Moderate-High	Very Low
Sunset, Comsat	Moderate-High	Low	Low	Moderate-High	Very Low

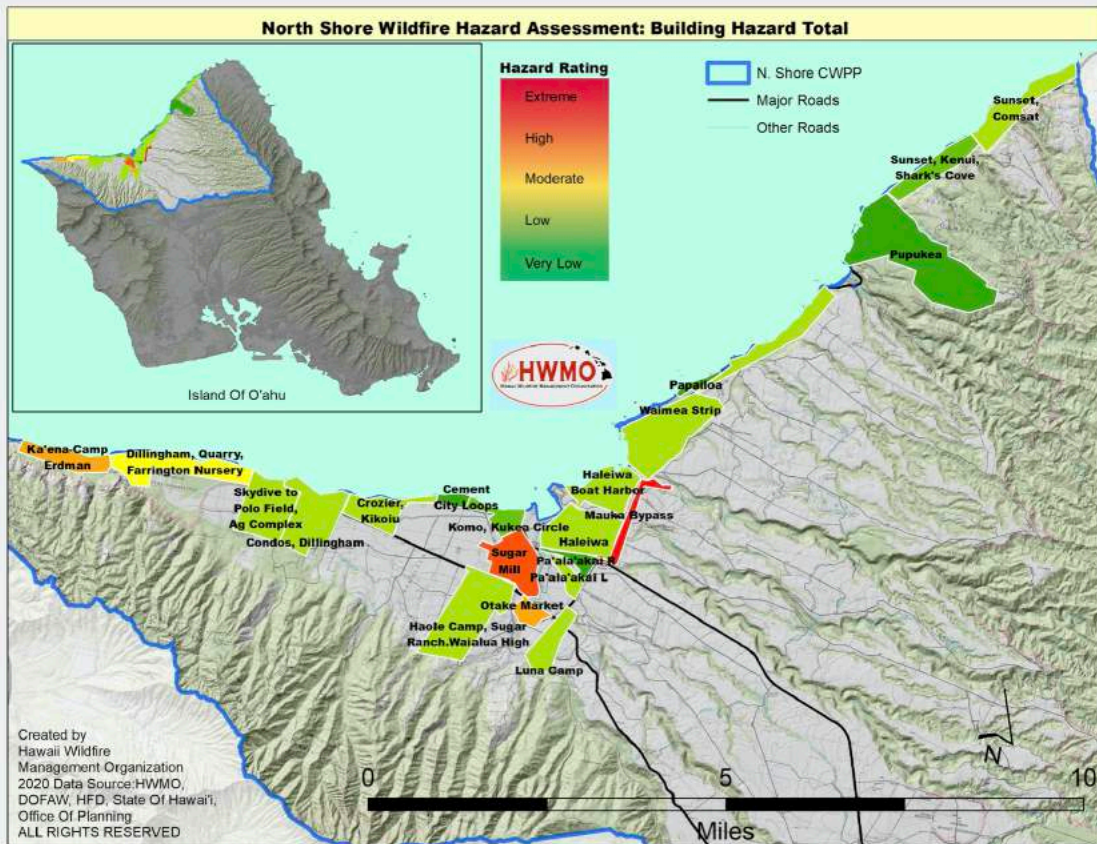
Table 3. Hazard assessment results per developed area within the North Shore CWPP boundaries.



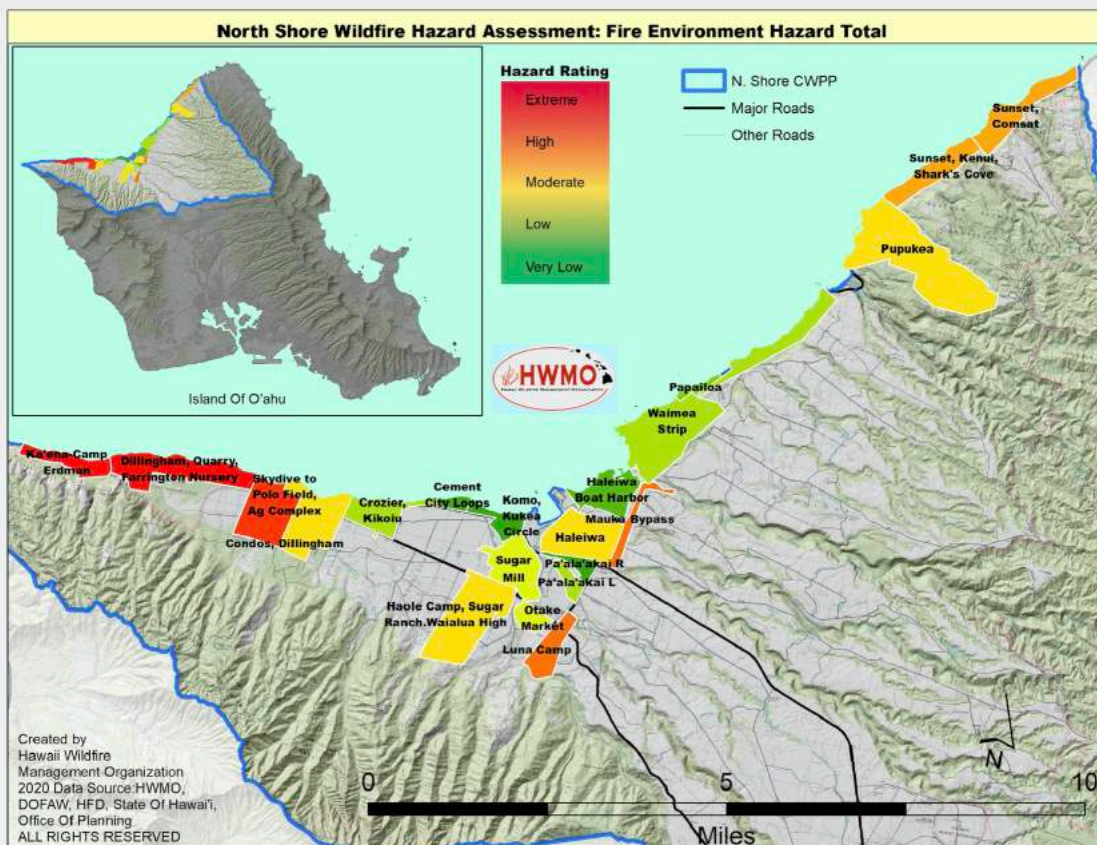
Map 25. 2021 Subdivision Wildfire Hazard Assessment Results, based on individual ratings for: Fire Service Access, Home Setbacks, Ingress/Egress, Private/Landowner Firewise Landscaping and Defensible Space, Proximity of Subdivision to Wildland Areas, All Season Road Condition, Road Maintenance, Road Width, Street Signs, Structure Density, and Unmanaged, Untended, Undeveloped Land. Wildland areas (grey) were assessed separately.



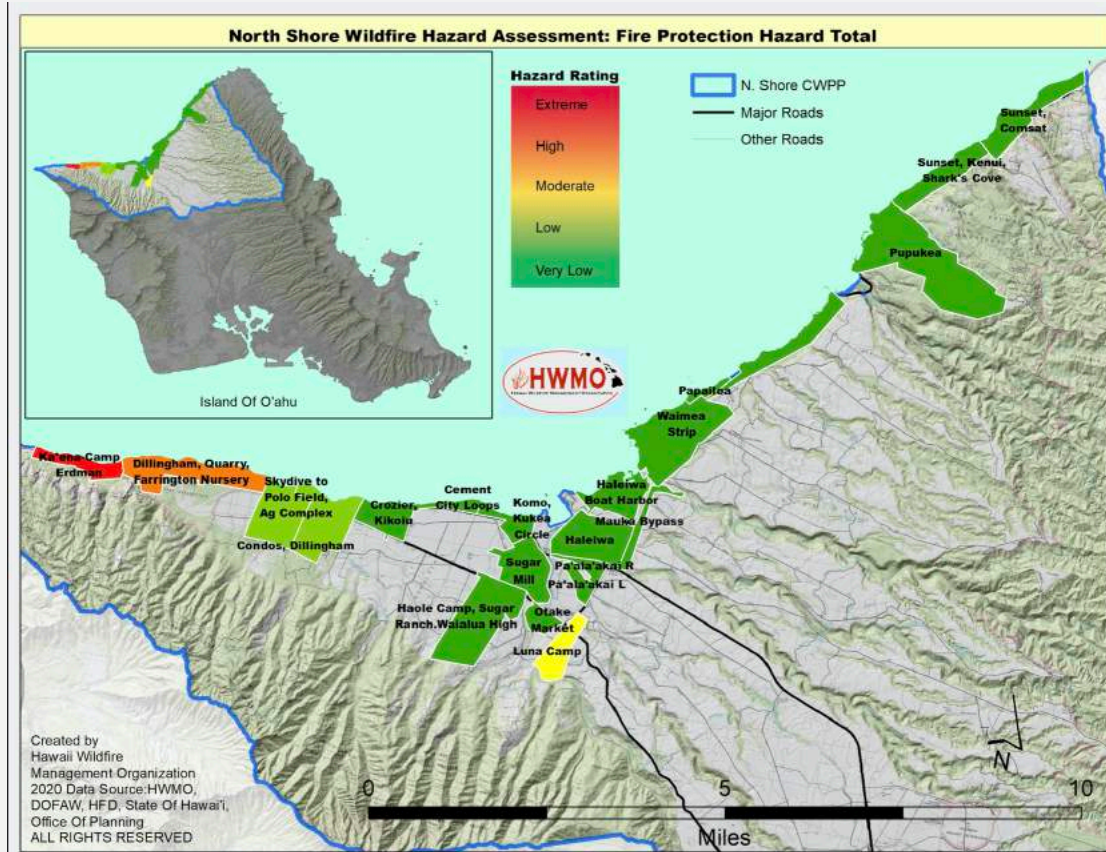
Map 26. 2021 Vegetation Wildfire Hazard Assessment Results, based on individual ratings for: Defensible Space: Fuels Reduction Around Homes & Structures, Fuel Loading, Fuel Structure & Arrangement, Proximity of Flammable Fuels Around Subdivision, and Vegetation Within 300' of Homes. Wildland areas (grey) were assessed separately.



Map 27. 2021 Building Wildfire Hazard Assessment Results, based on individual ratings for: Siding/Soffits, Roofing Assembly, Structural Ignitability, Under-Skirting Around Decks, Lanai, Post & Pier Structures, and Utilities Placement for Gas & Electric. Wildland areas (grey) were assessed separately.



Map 28. 2021 Fire Environment Wildfire Hazard Assessment Results, based on individual ratings for: Average Rainfall, Prevailing Wind Speeds & Direction, Slope, Topographic Features that Adversely Affect Wildland Fire Behavior, Seasonal or Periodic High Hazard Conditions, and Ignition Risk. Wildland areas (grey) were assessed separately.



Map 29. 2021 Fire Protection Wildfire Hazard Assessment Results, based on individual ratings for: Response Time, Community Planning Practices & Ordinances, Community Fire Safe Efforts & Programs Already in Place, Fire Department Structural Training & Expertise, Local Emergency Operations Group or Citizen Group, Proximity to Fire Stations, Water Source Availability, Wildland Fire Response Capacity of Initial Response Agency, and Interagency Cooperation. Wildland areas (grey) were assessed separately.

EMERGENCY RESPONSE

FIRE SUPPRESSION

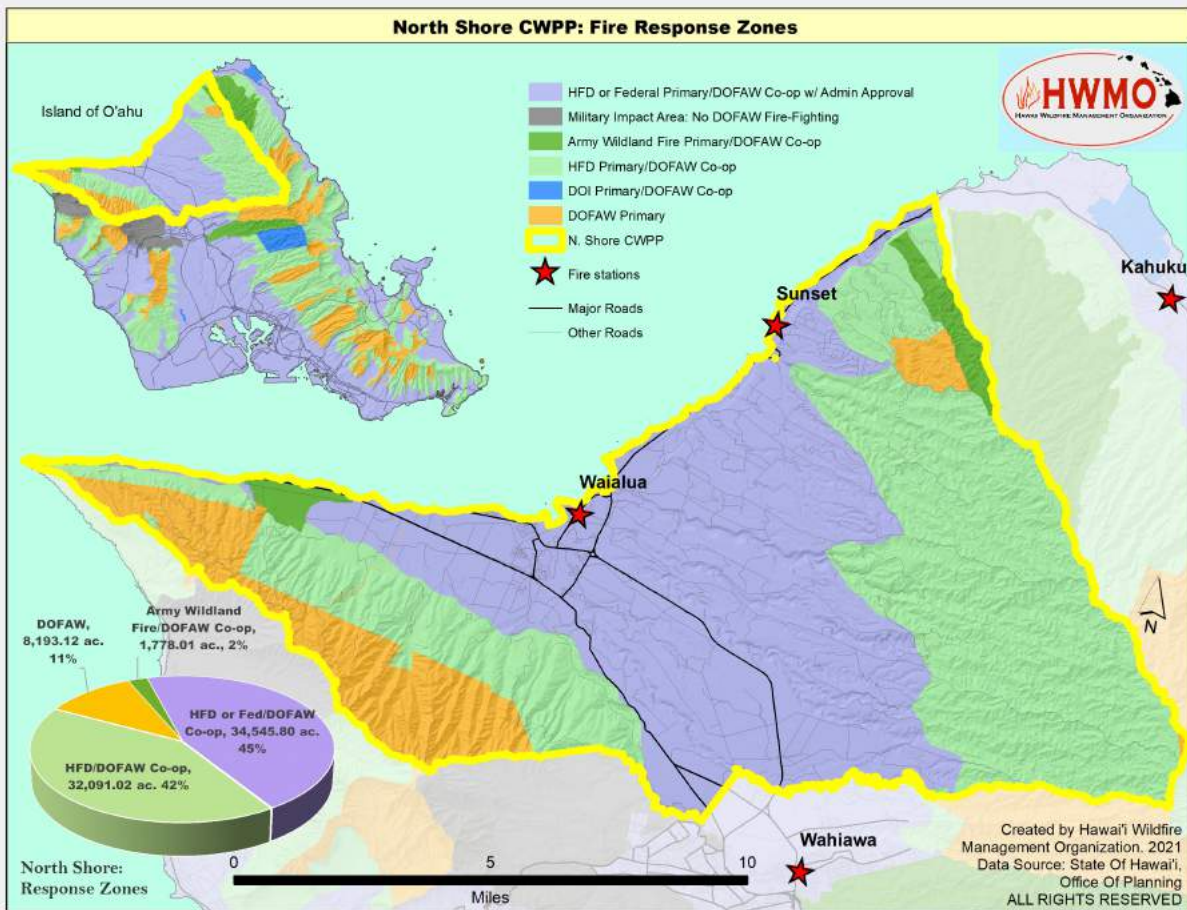
Initial response to the majority of wildfires (as well as all medical and other emergencies) is the responsibility of City and County of Honolulu Fire Department (HFD). State Division of Forestry and Wildlife (DLNR-DOFAW) responds to wildfire events on state lands and provides additional wildland firefighting assistance when state lands are threatened and/or mutual aid agreements are invoked. The Federal Fire Department (FFD) and U.S Army Garrison, Hawai'i, Directorate of Emergency Services Wildland Firefighting Management Team (Army Fire) also have jurisdiction in the area, respond to fires on their lands, and respond to mutual aid requests. Each are described in more detail below, with individual and shared response zones depicted in Map 30.

HFD resources and equipment are spread across the entire county and are made available when needed if they are not already in use. HFD has 44 fire stations across O'ahu, nearly half of which are concentrated in or near Honolulu. Two fire stations lie within the North Shore CWPP area, including one in Sunset Beach and another in Waialua which also services Hale'iwa town (Map 30). The HFD suppression force lies within the Fire Operations division of HFD. The Fire Operations division responds to fires, hazardous materials incidents, technical rescues, natural disasters and emergency medical calls. HFD also participates in many wildfire-relevant nonemergency activities to enhance public safety and maintain response readiness: commercial and public school fire inspections; pre-incident planning; public education (including prevention); community risk reduction; and code enforcement.

DLNR-DOFAW is the primary responder for wildfires on lands managed by the state, which accounts for 11% of the North Shore CWPP boundaries. DLNR-DOFAW also co-responds with county and federal fire agencies, which is determined by mutual aid agreements and memoranda of agreement or understanding. In addition to suppression, DLNR-DOFAW manages and protects natural and cultural resources, as well as public use and recreation on lands within DLNR-DOFAW jurisdiction.

FFD is a Department of Defense multi-service Fire Department that was consolidated in 1979 from Army, Navy, and Air Force fire departments. On O'ahu, FFD now provides fire protection and emergency medical services to all Department of Defense military installations (198 square miles), and provides mutual aid to the City and County of Honolulu (396 square miles), some of which lies with the North Shore CWPP planning boundaries.

Army Fire is specialized toward wildland fire management, and responds to wildfires within its designated and mutual response jurisdictions in the North Shore CWPP areas on behalf of the U.S. Army. While active in the protection of life and property from fire, the U.S. Army also works toward the protection of the state's endangered plant and animal species through numerous prevention and protective initiatives.



Map 30. Fire Response Zones. Indicates areas where fires are suppressed by City and County of Honolulu Fire Department, DLNR-DOFAW, Federal Fire Department, and Army Wildland Fire. Fire station locations are also depicted.

MULTIPLE-AGENCY AGREEMENTS

Memoranda of Agreement, Memoranda of Understanding, and/or Mutual Aid Agreements are in place among HFD, DLNR-DOFAW, FFD, and Army Fire. These agreements identify the suppression responsibilities of each party as well as other fire management activities such as joint participation in prevention, training, and equipment acquisition. Fire response zones are delineated in Map 30.

EMERGENCY MANAGEMENT DOCUMENTS AND OTHER PLANS

The CWPP is non-regulatory and cooperative in nature. The plan provides (1) a foundation for increased communication, coordination and collaboration among agencies and the public, (2) identification and prioritization of areas for hazardous fuel reduction projects and wildfire mitigation actions, and (3) assistance meeting federal and state planning requirements and qualifying for assistance programs. The CWPP is designed to work in conjunction with other county and state plans, operational policies, assessments, and programs, etc., including but not limited to:

City and County of Honolulu:

- City and County of Honolulu Drought Mitigation Strategies
- Board of Water Supply North Shore Watershed Management Plan

State of Hawai'i:

State Drought Plan (2017)

State of Hawai'i Hazard Mitigation Plan (2018)

State Division of Forestry and Wildlife Operational Policy for Wildfire Control

DLNR Forest Action Plan (2016)

EVACUATION PROTOCOLS AND NEEDS

Evacuation protocols for neighborhoods and areas in North Shore have been determined for natural hazards such as tsunamis, and can be found in the documents listed below. However, fire safety zones for all neighborhoods and areas of North Shore are yet to be determined, and are a priority action determined by the public as part of this CWPP process.

The following resources are available for disaster planning and preparedness:

- City and County of Honolulu Department of Emergency Management website
- Homeowner's Handbook to Prepare for Natural Disasters (University of Hawai'i, Sea Grant)
- State Emergency Operations Plan #4: Firefighting
- Tsunami Evacuation Zones
- Pacific Tsunami Warning Center
- National Weather Service Central Pacific Hurricane Center

STATE FIRE CODE

The Hawai'i State Fire Code is adopted by the State of Hawai'i according to Chapter 132 of the Hawai'i Revised Statutes, with modifications to the 2018 National Fire Protection Association 1 Fire Code. The Fire Code of the City and County of Honolulu is adopted with modifications from the State Fire Code. For more information on City and County of Honolulu and Hawai'i State Fire Codes, visit <https://fire.honolulu.gov/fire-code/>

WILDFIRE PREVENTION

Several agencies are working both independently and collaboratively on wildfire prevention activities in the North Shore CWPP area.

HFD Fire Prevention Bureau works toward saving lives and property and protecting the environment by promoting fire prevention and other public safety education programs. HFD Fire Prevention Bureau administers the fire prevention program for the City and County of Honolulu; plans and develops rules, regulations, and procedures in the enforcement of fire codes; assists in the formulation and revision of the State Fire Code and the Fire Code of the City and County of Honolulu; administers fire safety and education programs; administers plans reviews; develops and conducts a fire inspection program; and conducts fire investigations to determine the origin and cause of fires within its jurisdiction.

DLNR is statutorily mandated to take measures for the prevention of wildland fires within DLNR-DOFAW managed lands and to cooperate with county and federal fire agencies in developing plans

and programs for prevention assistance of wildfires on lands not managed by DOFAW. **DLNR-DOFAW** is involved with and committed to the following community risk reduction initiatives: supporting the development and action plans of Community Wildfire Protection Plans, locally administering the U.S. Forest Service Wildland-Urban Interface grant program, serving as the state liaison for the Firewise USA™ community risk reduction program (in partnership with HWMO), and administering State Legislature Grant-In-Aid awards given to local organizations who are working on wildfire-related projects (in 2021, these include HWMO and Ka'ala Farm, Inc.)

HWMO is a nonprofit organization founded in 2000 to focus on wildfire prevention and risk reduction activities. The organization serves as a hub of wildfire information, mitigation, and project assistance across Hawai'i. HWMO supplements and complements agency wildfire efforts, aims to meet community hazard reduction needs, and coordinates/leads multi-jurisdictional and multi-partner wildfire projects. HWMO develops and offers educational wildfire prevention, preparedness, and planning workshops for diverse audiences and stakeholder groups; leads the development of Community Wildfire Protection Plans and fire management plans; serves as the community liaison for the Firewise USA program (in partnership with DLNR-DOFAW), assisting communities with their applications, renewals, and offering learning and connecting opportunities among the 15 Firewise-recognized communities across Hawai'i; leads multi-partner wildfire collaboration projects and groups; and implements cross-boundary fuels management projects. HWMO also collaborates closely with the Cohesive Wildland Fire Management Strategy, Western Region and the Fire Adapted Communities network, liaising with and sharing best practices between Hawai'i and national partners. HWMO works together with the University of Hawai'i to implement the Pacific Fire Exchange project, a fire science communication project that develops, collates, and shares best available wildfire information on behalf of a broad partnership that includes DLNR-DOFAW, USDA Forest Service, County Fire Departments, and other forestry and fire entities.

University of Hawai'i at Mānoa College of Tropical Agricultural and Human Resources (UHM-CTAHR) has several researchers, extension specialists, and some graduate students who synthesize and develop new information on topics pertaining to wildfire. Faculty expertise includes range management, forestry, ecology, social science, and fire science which has contributed to a range of wildfire-related products such as fuels data, maps, risk models, and other information. HWMO and UHM-CTAHR Cooperative Extension partner to implement the Pacific Fire Exchange project (PFX). PFX is a fire science communication project that works to improve the availability and sharing of fire science relevant to the Pacific Island region to support and inform the wildfire mitigation work of land managers and emergency responders.

Together, **all of the above entities** participate in and support the multi-agency statewide *Wildfire and Drought Lookout!* awareness and preparedness campaign each year; conduct wildfire hazard assessments (often in partnership with each other); and collaborate whenever possible to protect life, property, and natural resources from the impacts of wildfire.

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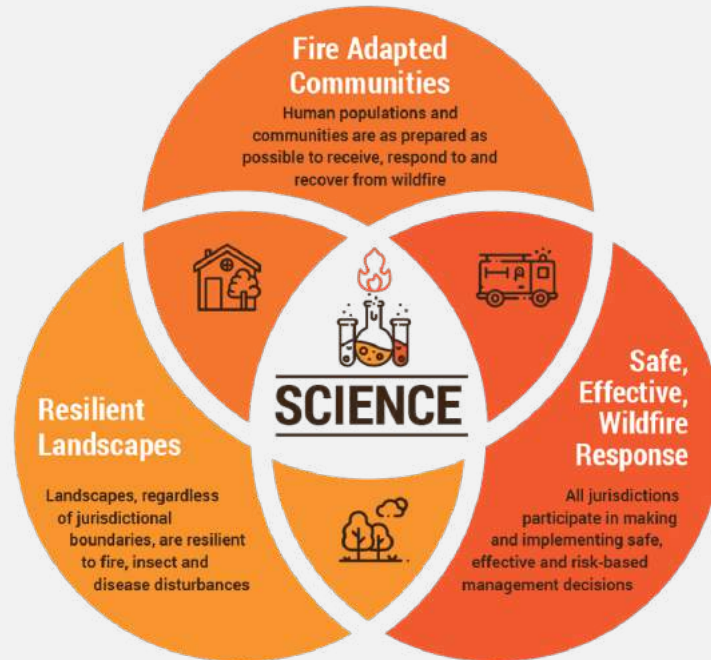
NORTH SHORE COMMUNITY WILDFIRE PROTECTION PLAN

PART III
WILDFIRE ACTION
PRIORITIES

WILDFIRE ACTION PRIORITIES

NATIONAL COHESIVE WILDLAND FIRE MANAGEMENT STRATEGY

The *National Cohesive Wildland Fire Management Strategy* (subsequently referred to as Cohesive Strategy) encourages communities to develop a dynamic approach to planning for, responding to, and recovering from wildland fires. It provides a framework for wildfire-related discussion, efforts, and goals across the United States. The overarching national strategy is further divided into three regions for tighter collaboration and coordination in each area. Hawai'i falls into the Western Region. The three categories are: Fire-Adapted Communities, Resilient Landscapes, and Safe and Effective Wildfire Response. Considering each and addressing all three is necessary for effective wildfire preparedness and protection.



Graphic 1. National Cohesive Wildland Fire Management Strategy graphic.

Public and government agency participants during the North Shore CWPP planning process identified hazard reduction priorities for the North Shore area. The input provided by participants were focused first by having discussions according to the National Cohesive Wildland Fire Management Strategy categories and goals for the CWPP planning area as a whole. Then, facilitators hosted a round robin of breakout groups, allowing all participants to provide input on all three categories as they pertain to the North Shore area. Concerns, recommended actions, and priorities were identified and recorded for each focal area and its goals, yielding the information provided below.

ACTION PRIORITIES PER CATEGORY

RESILIENT LANDSCAPES

DISCUSSION

Across many parts of the North Shore area, unmanaged fire-prone vegetation is a high priority concern. These fuels occupy vacant lots and unleased and/or fallow agricultural areas. Community and government agency workshop participants discussed the need for sustained maintenance of fuels and an increased capacity to manage vegetation for the long-term. Additional concerns related to fire impacts on lands and waters included preventing and addressing erosion after fire, a need for stream restoration, reforestation where possible/allowable, and the protection of sensitive areas and habitats. Wildfire ignition sources in the wildland areas were also discussed in these breakout groups. (Additional ignition-related concerns and priorities are detailed further in the Fire Adapted Communities section).

GOALS FOR RESILIENT LANDSCAPES

Lands, waters, and cultural resources across all jurisdictions and land ownerships must be supported to become resilient to fire-related disturbances in accordance with management objectives. The specific end-state goals are as follows:

1. Risk of wildfire occurring and impacting lands and waters is diminished.
2. Pre-fire hazards are managed and mitigated (reducing ignitions/managing vegetative fuels).
3. Sensitive resources are minimally or not damaged during wildfire events by the firefighting effort.
4. Post-fire recovery, rehabilitation, and restoration are supported.

NORTH SHORE RESILIENT LANDSCAPES ACTION PRIORITIES

Hazard Reduction:

- Implement fuel reduction projects to reduce fire ignition and spread, especially in fallow agricultural lands. Large agricultural parcels in Waialua are a top fuels management priority. Methods might include mechanical, grazing, controlled burns, outplanting/fuel conversion, to address immediate risk reduction needs as well as long-term sustained management.
- Increase the use of grazing through incentives, education and support for rotating cattle to reduce fire risk, secure water resources for cattle.
- Work toward greater capacity to enforce fuels management codes.
- Establish long-term funding and capacity-building opportunities to help residents, landowners, and managers of agricultural lots deal with grasses and fuel loads.
- Address the causes of fires that take place in wildland areas, such as campfires, vehicles including dirt bikes, and trespassing into fire prone areas. Priorities include education, enforcement, and improved prevention of un-permitted access to high risk areas and/or during high fire risk periods.

Education:

- Reach out to community members, those who lease agricultural lots, and elected officials about the critical need to address vegetative fuel hazards. Develop and/or distribute fuels reduction information to these same groups.
- Engage community members more intentionally and regularly about preventing fire ignitions in wildland areas.

Natural Resource Protection:

- Where possible, convert fire-prone monoculture agricultural areas (many of which were once native forests) to less-fire prone, restorative native species.
- Prevent and remediate post-fire erosion via several methods:
 - Reduce regrowth of, or new populations, of *Grevillia robusta* (Southern silky oak), ironwood & eucalyptus on recently burned land. Plant less fire-prone species. Suggestions include native species in general, less labor intensive species like a'alii, aweoweo, and fruit trees.
 - Revegetate stream banks and drainage areas after fire to stabilize soil and prevent downslope/nearshore sedimentation.
 - Employ erosion control textiles, mats, and similar to stabilize soils after fire. Biodegradable options are preferred.
 - Plan for succession and resiliency after the next fire by layering native species in time and space.
 - Identify and prepare for post-fire planting through seed banking and the development of best practices for seed scattering and large-scale replanting efforts that could/should occur after fire.

Planning and/or Policy:

- Identify, map, and plan fuel breaks and fuels management areas across property boundaries at a landscape scale.
- Enhance existing fire codes and/or introduce legislation to better address and enforce fuels management in the wildland-urban interface.

SPECIFIC TREATMENTS FOR VALUES AT RISK

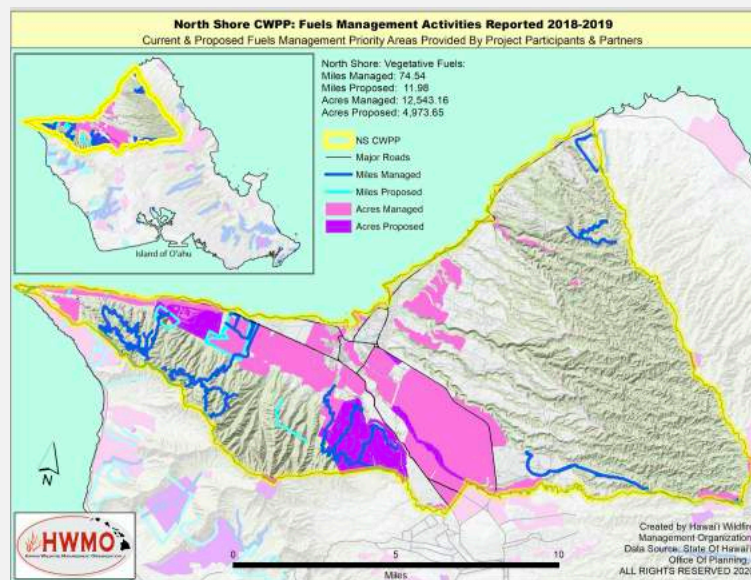
A CWPP must identify and prioritize areas for hazardous fuel reduction treatments and recommend the types and methods of treatment that will protect one or more at-risk communities and essential infrastructure. Based on the fuel hazard ratings acquired during the hazard assessment, recommendations for the type and method of vegetative fuels reduction treatments for high fuel hazard areas are listed in Table 3 below:

Resource, Structure, or Value at Risk	Fuel Hazard Rating	Type of Treatment
Mauka forest lands, parks, reserves	High or Extreme if unmanaged and weather conditions are dry and windy.	Mechanical, hand labor, chemical, fuels conversion. Animals/ grazing if strategically managed.

Resource, Structure, or Value at Risk	Fuel Hazard Rating	Type of Treatment
Grasslands and scrublands	High or Extreme if unmanaged and/or left fallow, and weather conditions are dry.	Mechanical, manual, chemical fuels reduction. Fuels conversion via restoration, reforestation, or a return to active agriculture. Animals/grazing if strategically managed.
Homes, structures with large lots or heavy vegetation, and historical sites	Moderate to Extreme	Firewise strategies around the structures and home ignition zones. Reduce fuel along property boundaries and along driveways/roadsides. Weedwhip, hand-pull, mow, grazing, herbicide, trim branches. Clear debris piles. Convert fuels to drought-tolerant, fire-resistant (preferably native) plants or to actively managed, hydrated, weed-free agriculture. Reduce ladder fuels. Complement vegetation management strategies with home hardening (replace ignitable/burnable materials with non combustible materials).
Roadsides	Moderate to Extreme (depending on location, weather conditions, and frequency of management).	Conduct roadside fuels treatments at frequency that matches fuel growth (keep low), maximize width of roadside reduction areas. Convert roadside fuels to fire-resistant plants that require little or no maintenance and are less ignitable.
Unmaintained Agricultural lands	High to Extreme.	Mechanical, manual, animal, and/or chemical reduction of fuels. Re-establish active agriculture. Convert to less fire-prone species. Implement reforestation and/or restoration projects. Strategically harden most fire-prone sections of any new development areas.

Table 4. Hazardous Fuels Treatment Types.

In 2018, land managers across Hawai'i contributed to a fuels management mapping project, wherein participants indicated areas that have some level of active fuels management occurring. The project was coordinated by HWMO, in partnership with DLNR-DOFAW and the University of Hawai'i Wildland Fire Extension Specialist. Participants in the mapping project also indicated additional areas they believe would be necessary to address with fuels management activities to achieve optimal fire mitigation. While participation was voluntary, and therefore, not a complete representation of all that is occurring and needed in the North Shore areas, it does provide a starting point for discussion and fuels management project planning (Map 31).



Map 31. 2018-19 Voluntary reporting of current and proposed/needed hazardous fuels management activities.

FIRE ADAPTED COMMUNITIES

DISCUSSION

Despite frequent and notable fires in the area, and the increasing fire risk due to increased drought episodes, many residents across North Shore are not as informed, engaged, or active in wildfire preparedness and hazard reduction as is necessary for optimal safety and prevention. The variation in fire risk and frequency across the planning areas was cited as an obstacle to overcome for whole-area preparedness and participation in wildfire preparedness and ignition reduction. Community outreach and education programs, technical assistance, opportunities, and capacity-building were discussed and prioritized by workshop participants. Accidental ignitions were another key concern, with illegal “chop shops”, illegal burning of trash, campfires, utilities, and vehicles were cited as causes of fires that needed more education and enforcement to help address. Limited evacuation routes and firefighting access to the lands surrounding and adjacent to farm and community areas were also highly prioritized concerns that were discussed.

FIRE ADAPTED COMMUNITIES GOALS

Human populations and infrastructure must be able to withstand wildfires without loss of life or property. Communities must become as prepared as possible to endure, respond to, and recover from wildland fire. Everyone must know they play a role in prevention and safety and must do their part. This includes the following:

1. Roles and responsibilities established in all jurisdictions and across all communities and landownership for mitigating fire threats and impacts.
2. People accept and act upon their responsibility to prepare families and properties.
3. Risk to community areas and resources, including municipal resources, is diminished.
4. Effectiveness of activities is monitored and shared and is relevant to local mitigation and other plans.

NORTH SHORE FIRE ADAPTED COMMUNITIES ACTION PRIORITIES

Policies and Planning:

- Update local and state policy frameworks for wildfire issues.
- Expand brush abatement codes and requirements for:
 - Agricultural lands.
 - Wildland-urban interface areas.
 - Off-grid living in fire-prone areas (especially those not historically inhabited or those with limited firefighting access and water or high fuel loads).
- Add wildfire issues and impacts into North Shore Sustainable Communities Plan, and the hazard and disaster plans that do not yet include wildfire safety and preparedness.
- Work with planning department, planners, and developers to ensure that best practices for building in the Wildland urban interface are used. Ideally require new and modified developments to be “Firewise” from the earliest of design stages, and through to plant choices and maintenance of landscaping in fire-prone areas.
- Formalize local wildfire coordinating groups in each area:

- Those in rural and/or agricultural areas can better understand neighbors' capabilities, know who has what equipment, and coordinate projects and educational offerings.
- Plan and implement the reduction of fire prone vegetation across ownership areas to increase capacity and engagement of a broader set of land managers and residents, and make whole areas safer.

Community Education and Action:

- Improve public knowledge about what to do during fires:
 - Education on evacuation protocol or locations.
 - Improve communication with communities during fire events and evacuations Improve ingress and egress for firefighting and evacuation.
 - Engage community members in advocating for secondary/emergency access and evacuation roads.
 - Launch campaign, install signage, and provide widespread education on how to spot and report fires and/or suspicious arson behavior.
- Increase homeowner awareness and preparedness:
 - Offer programs that build community awareness, group mentality/culture, and attitudes toward wildfire prevention and preparedness.
 - Coordinate and engage existing groups to discuss and plan for wildfire. Use existing networks to establish new wildfire-focused collaborative efforts. Support neighborhoods and communities to participate in the Firewise program.
 - Provide best practices education and assistance for homeowners to establish defensible space around homes.
 - Provide risk assessments to homeowners and neighborhoods.
 - Use a grassroots approach to disseminating education and information.
 - Work within the school system and youth programs to disseminate information and engage families in fire preparedness.
 - Provide information, and pursue outreach and education programs for residents and area managers to treat structural ignitability of homes and buildings.*
- Grow engagement and action of those who own and manage larger lots and agricultural lands:
 - Provide education and support to ensure roads are graded/groomed/maintained.
 - Provide education toward the need and responsibility to address fire risk on fallow lands (for example; create reasonable fire breaks, request reasonable treatment of lands).
 - Support/engage Kamehameha Schools and other large landowners in taking action, establishing and maintaining firebreaks.
 - Offer education on chainsaw and equipment use.
 - Engage the people who are moving to more rural environment without the more rural knowledge or sense of responsibility (i.e; everyone works together in each place; it is essential to have risk reduction capacity, such as water pumps, chainsaw use knowledge, and must clear fire prone vegetation regularly).
 - Find and pursue grants for equipment, training, vegetation removal.

- Create a way to coordinate and communicate among landowners and land managers in each area.
- Educate on, and conduct, formal planning for livestock evacuation.
- Improve fire prevention signage:
 - At access points in wildland areas.
 - Around high risk communities.
 - Along the interface between agricultural lots and wildland areas.
 - Around common ignitions areas (to prevent accidental ignitions via vehicles, campfires, etc., and to remind people to report suspicious behavior to thwart arson).

Infrastructure:

- Develop secondary egress road(s) to aid in evacuation options. (For example Drum Road, which has padlocks and is in disrepair, could be a viable option).
- Work with Hawaiian Electric to ensure power infrastructure is properly maintained, anything in disrepair that may arc or spark is prioritized for repair/replacement, power line access road fuels are consistently and adequately managed, and that they are strong partners in community education and area-wide hazard mitigation efforts.

Enforcement:

- Increase enforcement of brush abatement.
- Widen brush abatement distance around perimeter of fallow agricultural or large lands, and in wildland-urban interface areas.

** Strategies for treating structural and home/yard ignitability in Hawai'i have been established through the Hawai'i version of the Ready, Set, Go! Action guide. This informational resource is included as an appendix to this document and should be used by residents in North Shore to treat structural, home, and yard ignitability.*

SAFE AND EFFECTIVE WILDFIRE RESPONSE

DISCUSSION

Due to the remoteness of the area and the limited infrastructure throughout, many residential areas are poorly set up for wildfire response. The most pressing issue is a lack of water, but long response times due to distance, ingress/egress issues, inadequate road signage for locating homes, and an increasing number of lots being developed contribute to firefighting challenges.

SAFE AND EFFECTIVE WILDFIRE RESPONSE GOALS

All jurisdictions will continuously work together toward making and implementing safe, effective, efficient risk-based wildfire management decisions to ensure that:

1. Injuries and loss of life for public and firefighters is diminished.
2. Adequate infrastructure and capacity: water, access, equipment, training.
3. Pre-fire multi-jurisdictional planning occurs.
4. Response, esp. when jurisdiction is shared, is efficient and effective.

NORTH SHORE SAFE AND EFFECTIVE WILDFIRE RESPONSE ACTION PRIORITIES:

Access:

- Improve access and response time by establishing additional firefighting access in rural and Wildland areas, and behind private large lots and agricultural lots in the wildland-urban interface areas.
- Ensure HFD has access to minor gates as well as major gates. Implement and/or improve program to register private lockwith HFD.
- Improve firefighting access by including access as a priority in the design and location of new and re-graded fuel breaks.
- Improve infrastructure design and access for firefighting and evacuation, to include:
 - Ingress and egress.
 - Wider roads.
 - Adequate turnarounds.
 - Staging areas.
 - Road and fuelbreak signs.

Water:

- Install, standardize, and map additional pumps, catchment tanks, reservoirs, standpipes that can be accessed and used for firefighting.
- Identify and connect into existing water resources of large scale agriculture that can be made available for firefighting.
- Secure funding for reservoir construction.
- Install water tanks for helicopter dipping.
- Increase helicopter assistance and the ability to conduct larger water drops from closer water sources
- Establish and/or better implement system for the permitting of wells.
- Ensure that future management and usage of the ditch historically managed by Dole enables water and access for firefighting.

Planning:

- Conduct collaborative planning and mapping of firefighting resources, infrastructure, water resources, access, fuelbreaks, turnarounds, etc. Develop a fire management plan, that includes pre-fire mitigation priority areas and action plans.

CWPP IMPLEMENTATION AND MAINTENANCE

HFRA requires that the City and County of Honolulu Fire Department, City and County of Honolulu Emergency Management Agency, and Department of Land and Natural Resources- Division of Forestry and Wildlife have all reviewed and approved the final contents of the North Shore CWPP. The plan is signed by each agency in order to meet HFRA and FEMA requirements.

Across the state and country, there is a changing understanding and paradigm related to wildfire: reducing wildfire occurrence and impacts takes the participation and action of all who live and work in an area. There is a role for everyone to play to reduce risk, enhance preparedness, and ensure the safety and integrity of our community and natural resources. Firefighting is the last line of defense, with much to also be done ahead of time to reduce fire's ability to ignite and spread, and to prepare homes and people to withstand wildfire.

It is for these reasons that the North Shore CWPP was developed: to collaborate, co-determine priorities, and encourage participation by all parties. ***Because of the non-regulatory nature of the CWPP, the relevance and effectiveness of the North Shore CWPP will rely heavily upon initiative and involvement by individuals, groups, organizations, and government in the North Shore area.***

Expertise, technical support, and implementation assistance will be provided by the appropriate agencies and organizations involved in fire issues in the North Shore area. Area residents are urged to contribute time and effort toward creating defensible space, reducing structural ignitability, and working at the community level to initiate and maintain wildfire protection projects.

The lead entities for the development of this plan, DLNR-DOFAW, HFD, and HWMO intend to provide technical support, identify and coordinate funding when possible, and collaborate toward ongoing wildfire risk reduction efforts in North Shore. Together, representatives will identify sources of funding for projects, document the successes and lessons learned from those projects, and evaluate and update the CWPP as needed and as possible.

Many North Shore CWPP action items will require actively pursuing funding for projects, staying informed and in contact with one another, and updating this CWPP regularly so that it remains a "living" document. All who have been involved in the development of this CWPP are committed to building community awareness of these issues so that North Shore will continue to make progress toward the goals of having Fire Adapted Communities, Resilient Landscapes, and Safe and Effective Wildfire Response in North Shore.

NORTH SHORE COMMUNITY WILDFIRE PROTECTION PLAN

APPENDIX

APPENDIX A:

READY, SET, GO! HAWAI'I VERSION WILDFIRE ACTION GUIDE

APPENDIX B:

**RAPID ASSESSMENT OF LARGE LANDHOLDINGS ALONG WILDLAND-
URBAN INTERFACE**

APPENDIX C:

HAZARD ASSESSMENT RATINGS KEY

APPENDIX A

READY, SET, GO! HAWAI'I VERSION

WILDFIRE ACTION GUIDE

Includes the following key information:

Wildfire in Hawai'i Overview

🏠 Firewise Landscaping Recommendations

🏠 Home Hardening

Family Emergency Planning

Situational Awareness

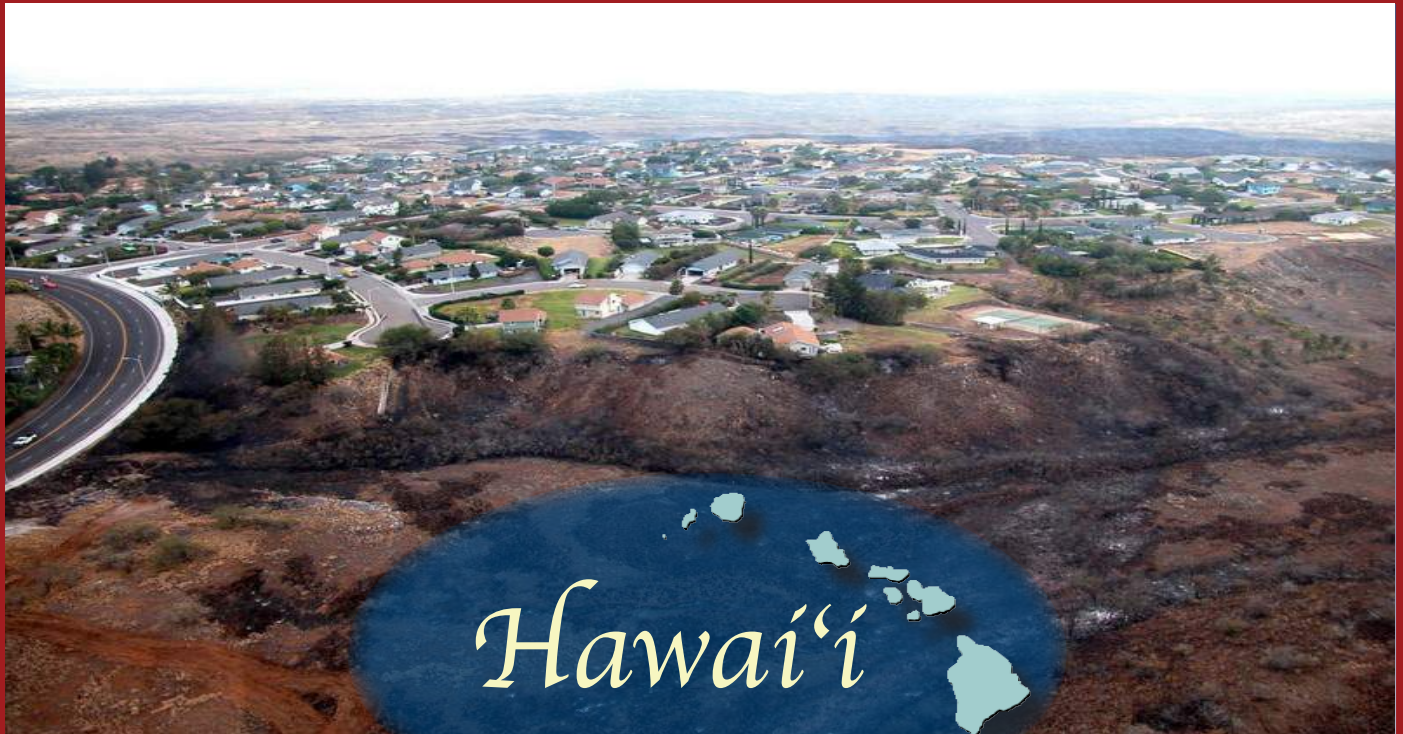
Evacuation

🏠 *Items with this symbol fulfill the CWPP requirement for strategies to reduce structural ignitability.*

READY, SET, GO!

YOUR PERSONAL WILDLAND FIRE ACTION GUIDE

Rev. 2021



This guide was developed by Hawaii Wildfire Management Organization, in partnership with:



READY, SET, GO!

Wildland Fire Action Guide

Saving Lives and Property
Through Advanced Planning



The fire season is now a year-round reality in many areas across the Hawaiian Islands, requiring firefighters and residents to be on heightened alert for the threat of wildland fire.

Each year, wildland fires consume hundreds of homes across the nation in the Wildland-Urban Interface (WUI), and Hawaii is at a similar risk. Studies show that as many as 80 percent of the homes lost to wildland fires could have been saved if their owners had only followed a few simple fire-safe practices. In addition, wildland fire related deaths occur because people wait too long to leave their home.

In the event of a wildland fire, our first responders take every precaution to help protect you and your property. However, the reality is that in a major wildland fire event, there will simply not be enough fire resources or firefighters to defend every home.

Successfully preparing for a wildland fire enables you to proactively take personal responsibility for protecting yourself, your family and your property. In this Action Guide, we hope to provide the tips and tools you need to prepare for a wildland fire threat (Ready), have situational awareness when a fire starts (Set), and to act early (Go!).

The Ready, Set, Go! Program works in complimentary and collaborative fashion with the Firewise USA® program and other existing wildland fire public education efforts. Utilizing firefighters and local wildland fire prevention expertise, it amplifies their messages to individuals to better achieve the common goal of wildland fire preparedness.

Many residents have built homes and landscaped without fully understanding the impact a fire can have on them and few have adequately prepared their families for a quick evacuation.

It's not a question of **if** but **when** the next major wildland fire will occur. Through advanced planning, understanding and preparation, we can all be partners in the wildland fire solution. We hope you find the tips in the following pages helpful in creating heightened awareness and a more fire-safe environment for you, your family and firefighters.

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Living in the Wildland Urban Interface and the Ember Zone

Ready, Set, Go! Begins with a House That Firefighters Can Defend

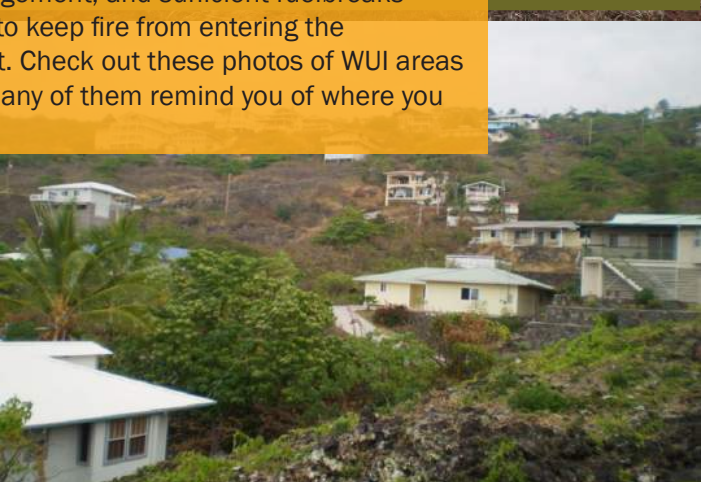
Defensible Space Works!

If you live next to a natural area, the Wildland Urban Interface, you should provide firefighters with the defensible space they need to protect your home. The buffer zone you create by removing weeds, brush and other vegetation helps keep the fire away from your home and reduces the risk from flying embers. Firewise Communities and other wildland fire preparedness education programs provide valuable guidance on property enhancements.



Consider This

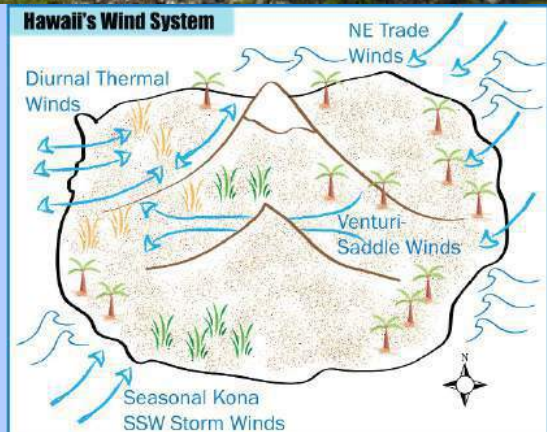
Unmanaged vegetation between and around homes increases the risk of wildland fire spreading throughout the community, endangering lives and property. Pre-fire planning, fuels management, and sufficient fuelbreaks allow firefighters the space they need to keep fire from entering the community during a wildland fire event. Check out these photos of WUI areas from different parts of the islands. Do any of them remind you of where you and your family live?



Not Only the Homes on the Wildland Boundary are at Risk

A home within one mile of a natural area is in the Ember Zone. Wind-driven embers can attack your home. You and your home must be prepared well before a fire occurs. Ember fires can destroy homes or neighborhoods far from the actual flame front of the wildland fire. These threats are amplified in Hawaii due to the culmination of thermal, saddle, storm, and trade winds that create a complex system of strong, erratic winds (see diagram on right).

Fire is wind-driven. Know your wind-related risks.



Hawaii's Growing Wildland Fire Problem

And Why We Should Be Concerned

Traditionally, Hawaii ecosystems existed with a very limited presence of wildland fire. However, as climate conditions and land uses have changed over recent time, non-native, fire-adapted vegetation have rapidly spread through our wildland landscapes and toward community boundaries. In addition, communities are expanding further into fire-prone areas, increasing the risk of wildland fires that threaten natural resources, including native habitats, and people's lives and homes.

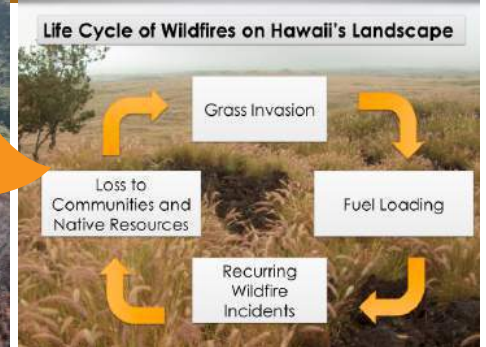
Impacts on Natural Resources



Invasive vegetation such as guinea and fountain grass spread easily and rapidly.



These plants also ignite easily. After the fire, they re-sprout and out-compete native plants, spreading over a larger area than before.



All it takes is another spark and the same area will burn hotter, more intensely, and over a larger area than before. This creates a vicious fire cycle.

Wildland fire, fueled by the build-up of dry vegetation and driven by a complex system of hot dry winds, are extremely difficult, expensive, and dangerous to control. Hawaii's wide diversity of challenging terrains add to the challenge for firefighters.



Did You Know?

26% of the state land cover is nonnative grassland. These grasses are fire-prone and spread more and more with each fire.

Mauka Fires Affect Makai Health and Safety



Large fires destroy vegetation that help hold down soil. Heavy winds can lift the soil and create dust storms that impact air quality and human health.



In addition, Hawaii's high-intensity rain events can sweep away soil through erosion, runoff and landslides.



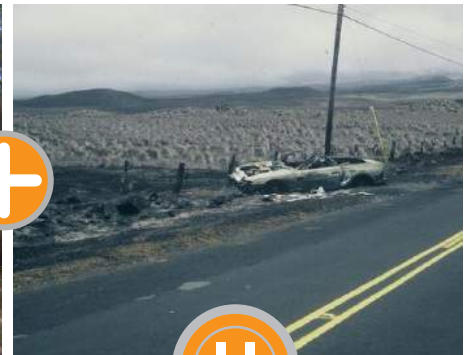
Rivers and streams carry the debris and sediment into the ocean polluting coral reefs and negatively affecting sea life. This adversely affects commerce such as fishing and marine/coastal-based tourism.

Impacts on People & Communities

Towns and cities expanding outwardly into formerly undeveloped areas...

and large areas of fallow, invasive, or un-managed vegetation...

and a steady increase in human ignition sources via human error and intention...



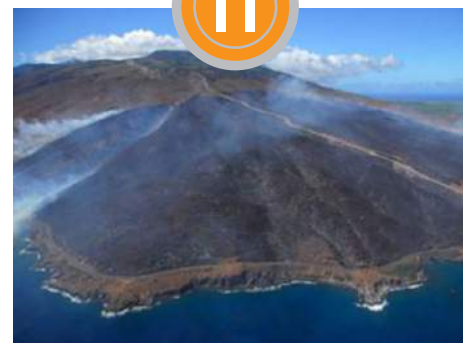
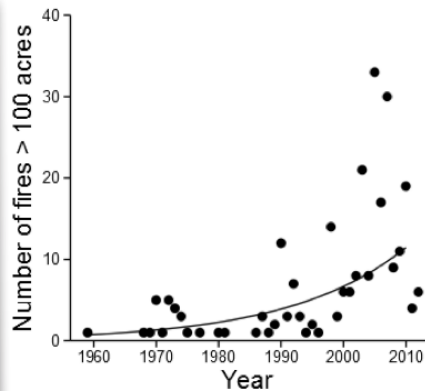
Did You Know?

Hawaii experiences more than 1,000 wildfires per year, burning an average of 20,000- 40,000 acres each year.

On average, every island has at least one 1,000 acre fire every year.

Wildfires in Hawaii are increasing in size, frequency, and impacts.

Every island and every area (windward, leeward, mauka, makai) can be at risk under the right conditions, mainly during periods of dry weather and high winds.

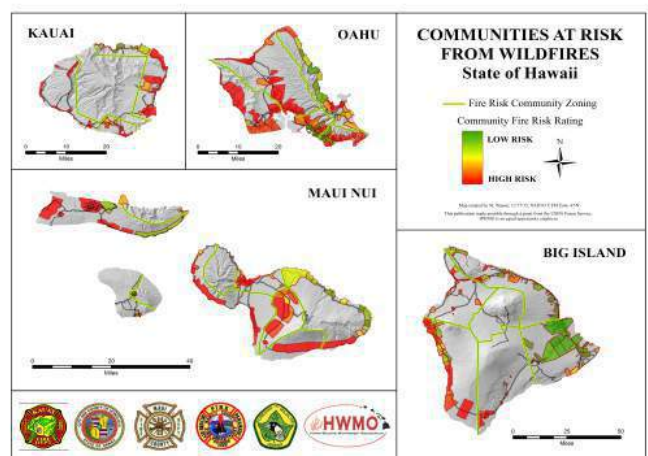


...are increasing the size, frequency, and intensity of fires across all of the islands on both wet and dry sides.

Future Outlook

Climate change is increasing the length and frequency of drought periods, creating drier conditions. Scientists predict these trends will continue and even worsen, which will result in larger fires that are more severe and intense. As more areas become drier, they will become more prone to wildfire. If your area is currently low risk in the map below, it likely is still at risk during very dry periods. Under certain conditions, such as dry periods and heavy winds, anywhere can burn, and we are seeing that occur. As a result, it's best if you take action now, rather than later, when it may be too late.

The Communities at Risk from Wildfires Map (on right) was the result of an effort that looked at 36 hazard characteristics that contribute to wildfire risk for neighborhoods and communities (gray areas were NOT assessed). Many of Hawaii's communities are at moderate to high risk of wildfire for reasons ranging from climate to lack of water to lack of community awareness and action. Many of the challenges are ones we can address with collaborative action.



How You Can Make a Difference

We need to create **resilient landscapes and communities** across Hawaii. You can play a significant role by increasing resilience in and around your own home and preparing your family for a potential wildland fire event. Use the following pages as a guideline.

What is Defensible Space?



Defensible space is the required space between structures and the wildland area that, under normal conditions, creates a sufficient buffer to slow or halt the spread of wildfire to a structure. It protects the home from igniting due to direct flame or radiant heat. Defensible space is essential for structure survivability during wildland fire conditions. For more information about defensible space zones and preparedness techniques within each, visit the Firewise USA® website, www.firewise.org.

ZONE ONE

Zone One extends 30 feet out from buildings, structures, decks, etc.

- Remove all dead or dying vegetation.
- Remove “**ladder fuels**” (low-level vegetation that allows the fire to spread from the ground to the tree canopy). Create at least 6 feet of separation between low-level vegetation and tree branches. This can be done by reducing the height of low-level vegetation and/or trimming low tree branches.
- Create “fire-free” area within 5 feet of home, using non-flammable landscaping materials and/or high-moisture content, drought-resistant vegetation.
- Trim tree canopies regularly to keep their branches a minimum of 10 feet from structures and other trees.
- Remove leaf litter (dry leaves/pine needles) from yard, roof and rain gutters.
- Relocate woodpiles or other combustible materials into Zone Two.
- Remove combustible material and vegetation from around and under decks, lanai, or the entire house if foundation is post-and-pier.
- Remove or prune vegetation near windows.

ZONE TWO *

Zone Two extends 30 to 100 feet out from buildings, structures and decks. You can minimize the chance of fire jumping from plant to plant by removing dead material and removing and/or thinning vegetation. The minimum spacing between vegetation is three times the dimension of the plant.

- Remove “ladder fuels.”
- Cut or mow annual grass down to a maximum height of 4 inches.
- Trim tree canopies regularly to keep their branches a minimum of 10 feet from other trees/cluster of trees.

* For larger properties, consider areas outside of Zone Two as a third zone to address. Continue reducing ladder fuels, managing fuels, hardening structures, and properly storing combustible materials.



Actions You Can Take Today!



Weed around the property regularly, especially areas that a lawn mower is not appropriate for (tall dry grasses, rocky terrain, etc.)



Remove leaf litter and other debris that accumulate around the building, under vegetation, and other collection areas.



Remove leaf litter, straw and other debris from under and around propane tanks to create 10 feet of clearance around it.



Eliminate ladder fuels by pruning tree branches on trees around the property to within at least 6 feet of the ground, using a bypass lopper (seen above), pruner saw, or long reach/hand pruner.



Remove flammable materials from underneath the house, decks, porches, and lanai. Common flammables include scrap-wood, firewood, and combustible furniture.



Mow the lawn regularly to keep grasses shorter than 4 inches tall around the home. Do not mow in the heat of the day or when the wind is blowing. Never mow in dry vegetation.

Watch Out for Exotic Vegetation

Non-native trees, such as ironwood (seen below) constantly drop needles, leaves, branches, and other debris, so it's best to stay on top of removing them from the ground before the pile becomes a major project. Consider reforesting these areas with native trees that don't drop large amounts of debris.



Invasive grasses such as guinea and fountain grass grow rapidly when un-managed and can dry out very quickly, creating a major fire hazard. Weed them often and consider replanting with low-lying, drought-tolerant, native ground cover.



Defensible Space - Hawaiian Style

Consider selecting native plants from this list that are most relevant to your area:



Mamaki



Kolea



Maia Pilo



'Ilima Papa



Bonamia



'Ākia



'A'alii



'Akoko



'Ihi



Nānū



Pōhinahina



Ma'o Hau Hele



Koki'o



'Ūlei



Wiliwili



Koai'a



Uhiuhi



Hala Pepe



'Ohi'a Lehua



Ko'oko'olau



'Ohe Makai



'Iliahi



Nehe



Alahe'e



'Ala'ala Wai Nui



Kolomona



Koai'a

Creating defensible space does not necessarily mean eliminating the presence of greenery on your property. You can still landscape around your home to make it fire-safe without compromising beauty and aesthetics. By planting native, drought-tolerant plants (**xeriscaping**) around your home, you can:

- Protect your home from wildland fire ignition and spread
- Beautify your property
- Perpetuate an important natural and cultural resource
- Decrease the maintenance needs of your landscaping

For the drier areas of Hawaii, consider that native dryland plants are specially adapted to local conditions and require less upkeep, water, and fire maintenance, saving yourself a great deal of time, money, and resources. Non-native, lush plants often drop hazardous debris and can become fire prone in drought conditions.

Homes with Great Xeriscaping



Did You Know?

The same winds that blow hazardous debris toward a collection area (underneath shrubs, under the lanai, next to outer edges of home, etc.) will likely carry embers during a wildland fire to that same spot, and ignite that pile. That's why it's incredibly important to consistently remove debris from these areas long before a wildland fire occurs.

What is a Hardened Home?

Construction materials and the quality of the defensible space surrounding it are what give a home the best chance to survive a wildland fire. Embers from a wildland fire will find the weak link in your home's fire protection scheme and gain the upper hand because of a small, overlooked or seemingly inconsequential factor. However, there are measures you can take to safeguard your home from wildland fire. While you may not be able to accomplish all the measures listed below, each will increase your home's, and possibly your family's, safety and survival during a wildland fire.

Home Improvements

Gutter Guards or Screens



ROOFS

Roofs are the most vulnerable surface where embers land because they can lodge and start a fire. Roof valleys, open ends of barrel tiles and rain **gutters** are all points of entry.

EAVES

Embers can gather under open **eaves** and ignite exposed wood or other combustible material.

Enclosed Eaves



VENTS

Embers can enter the attic or other concealed spaces and ignite combustible materials. Vents in eaves and cornices are particularly vulnerable, as are any unscreened **vents**.

Screened Vents



WALLS and FENCING

Combustible siding or other combustible or overlapping materials provide surfaces or crevices for embers to nestle and ignite. Combustible **fencing** can become engulfed and if attached to the home's sidings can carry the fire right to the home.

Non-Combustible Fencing



WINDOWS and DOORS

Embers can enter gaps in doors, including garage doors. Plants or combustible storage near **windows** can be ignited from embers and generate heat that can break windows and/or melt combustible frames.

Windows Clear of Vegetation



BALCONIES and DECKS

Embers can collect in or on combustible surfaces or the undersides of decks, lanai, and balconies, ignite the material and enter the home through walls or windows. Post-and-pier homes, common throughout Hawaii, are especially vulnerable since most, if not all, of the underside of the house is exposed.

To harden your home even further, consider protecting your home with a residential fire sprinkler system. In addition to extinguishing a fire started by an ember that enters your home, it also protects you and your family year-round from any fire that may start inside your home.

Roof: Your roof is the most vulnerable part of your home because it can easily catch fire from wind-blown embers. Homes with wood-shake or shingle roofs are at high risk of being destroyed during a wildland fire.

Build your roof or re-roof with fire-resistant materials such as composition, **metal** (as seen in picture) or tile. Block any spaces between roof decking and covering to prevent ember intrusion.

Clear pine needles, leaves and other debris from your roof and gutters.

Cut any tree branches within ten feet of your roof.

Deck/Patio Cover: Use heavy timber or non-flammable construction material for decks.

Enclose the underside of balconies and decks with fire-resistant materials to prevent embers from blowing underneath.

Keep your deck clear of combustible items, such as baskets, dried flower arrangements and other debris.

The decking surface must be ignition resistant if it's within 10 feet of the home.

Non-Combustible Fencing: Make sure to use non-combustible fencing to protect your home during a wildland fire.

Home Site and Yard: Ensure you have at least a 100-foot radius of defensible space (cleared vegetation) around your home. Note that even more clearance may be needed for homes in severe hazard areas. This means looking past what you own to determine the impact a common slope or neighbors' yard will have on your property during a wildland fire.

Cut dry weeds and grass before noon when temperatures are cooler to reduce the chance of sparking a fire.

Landscape with fire-resistant plants that have a high moisture content and are low-growing.

Keep woodpiles, propane tanks and combustible materials away from your home and other structures such as garages, barns and sheds.

Ensure that trees are far away from power lines.

Inside: Keep working fire extinguishers on hand.

Install smoke alarms on each level of your home and near bedrooms. Test them monthly and change the batteries twice a year.

Driveways and Access Roads: Driveways should be designed to allow fire and emergency vehicles and equipment to reach your house.

Access roads should have a minimum 10-foot clearance on either side of the traveled section of the roadway and should allow for two-way traffic.

Ensure that all gates open inward and are wide enough to accommodate emergency equipment.

Trim trees and shrubs overhanging the road to a minimum of 13 1/2 feet to allow emergency vehicles to pass.

Home in the WUI

Chimney: Cover your chimney and stovepipe outlets with a non-flammable screen of 1/4-inch wire mesh or smaller to prevent embers from escaping and igniting a fire. Make sure that your chimney is at least 10 feet away from any tree branches.

Vents: Vents on homes are particularly vulnerable to flying embers. All vent openings should be covered with 1/8-inch or smaller metal mesh. Do not use fiberglass or plastic mesh because they can melt and burn. Attic vents in eaves or cornices should be baffled or otherwise protected to prevent ember intrusion (mesh is not enough).

Address: Make sure your address is clearly visible from the road.

Walls: Wood products, such as boards, panels or shingles, are common siding materials. However, they are combustible and not good choices for fire-prone areas. Build or remodel with fire-resistant building materials, such as plaster, cement, masonry or stucco. Be sure to extend materials from foundation to roof.

Non-Combustible Enclosed Eaves: Box in eaves with non-combustible materials to prevent accumulation of embers.

Raingutters: Screen or enclose rain gutters to prevent accumulation of plant debris.

Water Supply: Have multiple garden hoses that are long enough to reach any area of your home and other structures on your property. If you have a pool or well, consider a pump.

Garage: Have a fire extinguisher and tools such as a shovel, rake, bucket and hoe available for fire emergencies. Install a solid door with self-closing hinges between living areas and the garage. Install weather stripping around and under door to prevent ember intrusion. Store all combustibles and flammable liquids away from ignition sources.

Windows: Heat from a wildland fire can cause windows to break even before the home ignites. This allows burning embers to enter and start internal fires. Single-paned and large windows are particularly vulnerable. Install dual-paned windows with the exterior pane of tempered glass to reduce the chance of breakage in a fire. Limit the size and number of windows in your home that face large areas of vegetation.

READY, SET, GO!

Create Your Own Action Guide

Now that you've done everything you can to protect your house, it's time to prepare your family. Your **Wildland Fire Action Guide** must be prepared with all members of your household well in advance of a fire. Use these checklists to help you gain a situational awareness of the threat and to prepare your Wildland Fire Action Guide. For more information on property and home preparedness before a fire threat, review the preparedness checklist on the Firewise Communities website, www.firewise.org.

Ready – Preparing for the Fire Threat



Take Action for Your Community

- Talk to your community members and community association about creating a Community Wildfire Protection Plan (CWPP). Hawaii Wildfire Management Organization can assist with this process.
- Coordinate with local county CERT teams.
- Get to know your neighbors. If there are any elderly or handicapped residents, or others with limited mobility, plan with them on how you can best assist them in the event of a wildland fire.

- Create a **Family Disaster Plan** that includes meeting locations and communication plans and rehearse it regularly. Include in your plan the evacuation of pets and large animals such as horses.
- Have fire extinguishers on hand and train your family how to use them.
- Ensure that your family knows where your gas, electric and water main shut-off controls are and how to use them.
- Plan several different evacuation routes.
- Designate an emergency meeting location outside the fire hazard area.
- Assemble an emergency supply kit as recommended by the American Red Cross (www.redcross.org).
- Appoint an out-of-area friend or relative as a point of contact so you can communicate with family members who have relocated.
- Maintain a list of emergency contact numbers posted near your phone and in your emergency supply kit.
- Keep an extra emergency supply kit in your car in case you can't get to your home because of fire.
- Have a portable radio or scanner so you can stay updated on the fire.
- Have a clear list and easy access location for necessary medications, glasses and other health aids.

Set – Situational Awareness When a Fire Starts

- Evacuate as soon as you are set! Do not wait for evacuation orders. Get out early - you can always return home if it is safe. This protects you, decreases traffic, and allows firefighters to focus on fire suppression. See more under the “Go” section.
- Alert family and neighbors.
- Dress in appropriate clothing (i.e., clothing made from natural fibers, such as cotton, and work boots). Have goggles and a dry bandana or particle mask handy.
- Ensure that you have your emergency supply kit on hand that includes all necessary items, such as a battery powered radio, spare batteries, emergency contact numbers, and ample drinking water.
- Stay tuned to your TV or local radio stations for updates, or check the fire department Web site.
- Remain close to your house, drink plenty of water and keep an eye on your family and pets until you are ready to leave.

If You are Trapped: Survival Tips

- Shelter away from outside walls.
- Bring garden hoses inside house so embers don't destroy them.
- Patrol inside your home for spot fires and extinguish them.
- Wear long sleeves and long pants made of natural fibers such as cotton.
- Stay hydrated.
- Ensure you can exit the home if it catches fire (remember if it's hot inside the house, it is four to five times hotter outside).
- Fill sinks and tubs for an emergency water supply.
- Place wet towels under doors to keep smoke and embers out.
- After the fire has passed, check your entire property and extinguish any fires or embers.
- If there are fires that you can not extinguish with a small amount of water or in a short period of time, call 9-1-1.

Outside Checklist

- Gather up flammable items from the exterior of the house and bring them inside (e.g., patio furniture, children's toys, door mats, etc.) or place them in your pool.
- Turn off propane tanks.
- Don't leave sprinklers on or water running - they can waste critical water pressure.
- Leave exterior lights on.
- Back your car into the driveway. Shut doors and roll up windows.
- Have a ladder available.
- Patrol your property and extinguish all small fires until you leave.
- Seal attic and ground vents with pre-cut plywood or commercial seals if time permits.

Inside Checklist

- Shut all windows and doors, leaving them unlocked.
- Remove flammable window shades and curtains and close metal shutters.
- Remove lightweight curtains.
- Move flammable furniture to the center of the room, away from windows and doors.
- Shut off gas at the meter. Turn off pilot lights.
- Leave your lights on so firefighters can see your house under smoky conditions.
- Shut off the air conditioning.



Go – Leave Early

By leaving early, you give your family the best chance of surviving a wildland fire. You also help firefighters by keeping roads clear of congestion, enabling them to move more freely and do their job in a safer environment.

WHEN TO LEAVE

Leave early enough to avoid being caught in fire, smoke or road congestion. Don't wait to be told by authorities to leave. In an intense wildland fire, they may not have time to knock on every door. If you are advised to leave, don't hesitate!

WHERE TO GO

Leave to a predetermined location (it should be a low-risk area, such as a well-prepared neighbor or relative's house, a Red Cross shelter or evacuation center, motel, etc.). Your local Community Wildfire Protection Plan will also have locations listed.

HOW TO GET THERE

Have several travel routes in case one route is blocked by the fire or by emergency vehicles and equipment. Choose an escape route away from the fire.

WHAT TO TAKE

Take your emergency supply kit containing your family and pet's necessary items.



EMERGENCY SUPPLIES

The American Red Cross recommends every family have an emergency supply kit assembled long before a wildland fire or other emergency occurs. Use the checklist below to help assemble yours. For more information on emergency supplies, visit the American Red Cross Web site at www.redcross.org.

- Three-day supply of water (one gallon per person per day).
- Non-perishable food for all family members and pets (three-day supply).
- First aid kit.
- Flashlight, battery-powered radio, and extra batteries.
- An extra set of car keys, credit cards, cash or traveler's checks.
- Sanitation supplies.
- Extra eyeglasses or contact lenses.
- Important family documents and contact numbers.
- Map marked with evacuation routes.
- Prescriptions or special medications.
- Family photos and other irreplaceable items.
- Easily carried valuables.
- Personal computers (information on hard drives and disks).
- Chargers for cell phones, laptops, etc.

Note: Keep a pair of old shoes and a flashlight handy in case of a sudden evacuation at night.

READY, SET, GO!

For Large Landowners & Land Managers



Ready

Prepare Your Family, Employees, and Visitors

- Go through the previous guidelines (pgs. 12-14) with your family in addition to this section.
- Have at least two exits for your headquarters and primary residence for your evacuation plan.
- If you have a GPS device, pre-program it with multiple escape routes.
- Keep an emergency supply kit in all ranch and personal vehicles.

Prepare Your Animals

- Create a livestock evacuation plan.
- Ensure proper registering and branding of livestock.
- Establish a back-up plan for feeding livestock if grazing land is destroyed by fire.

Know Your Area's Conditions

- Track the weather daily. Take note of changing conditions.
- If the weather is too dry: close the area, avoid risky equipment operations, or driving over dry vegetation. Fires can start by simply idling your car over grass. Make sure all vehicles' catalytic converters are in working order.

Prepare Your Property

- Create and maintain firebreaks (vegetation removed down to bare, mineral soil) each year prior to fire season around pastures and structures. This will allow access for suppression. The width of the firebreaks should be at least 3x the fuel height.
- Reduce vegetation and remove combustible material around all structures.
- When selecting for understory vegetation (below trees), choose those that are less fire-prone and don't dry out quickly, and those that don't create ladder fuels.
- Prioritize assets by assessing the risk and value of each and the effort it would take to protect them.
- Maintain your equipment (power tools, mowers, catalytic converters, etc.) Make sure working spark arrestors are installed and maintained on equipment.
- Reinforce fences with metal posts, if applicable.
- Create a safe zone clear of all vegetation for equipment.
- Clear vegetation around fuel tanks and other highly combustible equipment.
- Create a fire pre-plan for your property that includes insights from your fire department and wildland fire experts. Discuss your plan and property specifics with local firefighters ahead of time. (See pre-plan insert on next page).

For Large Landowners & Land Managers

Set

Go

Your Family, Employees, and Visitors

- Follow guidelines from page 13.
- Alert family, ranch hands, field workers, or anyone else who is on your property.
- Make sure you have a contact list or meeting location coordinated ahead of time to ensure everyone's safety.

Your Animals

- Hook up your stock trailer and load your animals.
- Unlock and open gates so livestock can escape flames and firefighters can gain access.
- Close all barn doors so horses and livestock will not go into a burning building.

Your Property

- Follow guidelines from page 13.
- Move equipment into a safe zone that is clear of combustible fuels.
- Close all doors, windows, and turn on exterior/interior lights in barns and other structures.
- Shut off gas supply and propane tanks.

Catch the Fire Before it Burns Out of Control

Have suppression tools & methods available on site:

- Fire extinguisher
- Phone on site
- Water
- Keys to the dozer
- Fire tools

- Follow guidelines from page 14.
- Ensure all people have safely evacuated.
- Stay in communication with fire operations. Ask questions, offer assistance, and give permission. Your invaluable knowledge of the area will prove useful for firefighters who are there to help protect your land and resources. Fire crews can then run an operation that meets your needs as well as theirs.

Pre-Plan: Ensure Firefighters Have Access

- Make sure address posts are clearly visible and marked in contrasting colors.
- Keep copies of gate keys and a written list of combinations in a known location.
- Make sure your property is properly mapped out and that your county fire department has a copy of the map.
- Maintain roads far in advance of fire season. Make sure there is enough room for fire trucks to drive through and that large turn-outs for emergency vehicles are available. Hazards to look out for include: overhanging trees, low power lines, bridges with weight restrictions, boggy areas, and rural residence internal fencing.
- Establish "safety zones" (large areas free of vegetation and other hazardous conditions for firefighters to retreat to).
- Maximize water source access and availability (hydrants, ditches, reservoirs, water tanks, etc.). Ensure pumps and hoses are available and that the size and type of outlets are standard fittings.
- If you would like to offer your equipment (water, tank, tractor) for firefighting, make arrangements and contacts prior to use for proper tracking and reimbursement.

Post in a location where **every** member of your family can see it, such as on the fridge or front door.

Our Family's Wildland Fire Action Guide

Well before fire danger is **HIGH**, prepare your family and residence for potential wildfires. Monitor your local media for the latest information on any incident, and make certain your mobile phones have "In Case of Emergency" (ICE) information loaded.

Our family members will call this out-of-area/state contact to report that we are safe:

Name: _____ Phone number(s): _____

Pre-program this into cell phones. Keep it current. Make sure the person agrees to be available/responsive.

If separated and unable to access our home or neighborhood, our family will meet at this safe location:

Primary: _____

Secondary: _____

If our children are in school during an emergency, they will be evacuated to this/these locations:

School 1: _____

Child(ren): _____ School Contact Info: _____

School's Evacuation Protocol: _____

School 2: _____

Child(ren): _____ School Contact Info: _____

School's Evacuation Protocol: _____

Our emergency go-bag is located: _____

Essential items to grab before leaving (medication, glasses, etc.): _____

We will do this with our pets: _____

Our pet emergency go-kit (food, water, bowl, leash, crate, etc.) is located: _____

Neighbors/others in our area we have agreed to help or check on during an emergency or evacuation:

Name: _____ Address: _____ Phone: _____

How we have agreed to assist and/or make sure they are ok: _____

Name: _____ Address: _____ Phone: _____

How we have agreed to assist and/or make sure they are ok: _____

Local Fire Department Information Numbers (Circle the appropriate contact)

Hawaii (County) Fire Dept.
(808) 932-2912



Honolulu Fire Dept.
(808) 723-3473



Maui Fire Dept.
(808) 876-4690



Kauai Fire Dept.
(808) 241-4985



Safety Tip

Remember to **PRACTICE** your evacuation plan each year with your family, and keep it up to date!

Emergency Plan Notes

Use the space below to add any additional information to your family's evacuation plan.

Off-island plans during fire season? Plan ahead!

If you are a seasonal resident or property owner, or if you know you will be away, it is critical that you take personal responsibility for your property and the safety of those who may occupy it during your absence. Unmitigated hazards on your property can significantly affect an entire neighborhood, especially adjacent homes and yards. Remember, if an ember lands and ignites a fire on your property, that fire can easily spread and threaten additional lives and homes within the community, whether you are physically present or not. It is up to you to ensure your home, yard, and property are READY at all times.

Essential preparedness actions for part-time and traveling residents:

1. Ensure your vegetation and structures will be managed and maintained to withstand embers and mitigate wildfire ignition and spread while you are away.

Keeping your yard lean (via strategic, Firewise planting methods and trimmed grasses and trees), green (meaning watered and alive, not dry or dead), and clean (regularly maintained, no debris or leaf piles) applies all year long. What is your property and vegetation maintenance plan? How will you know if your plan is successfully occurring?

2. Create a wildfire information packet for any seasonal or temporary guests who will be staying at your property, familiarizing yourself with all potential evacuation routes and how they may have changed over the year.

Introduce your guests to neighbors that may need their help evacuating. Who are those neighbors, in which houses do they live, and what are their contact numbers? Where can guests find your emergency supplies box or evacuation go-bag?

3. Be a good neighbor. Be active in your community, even if you only consider yourself a part-time or seasonal resident.

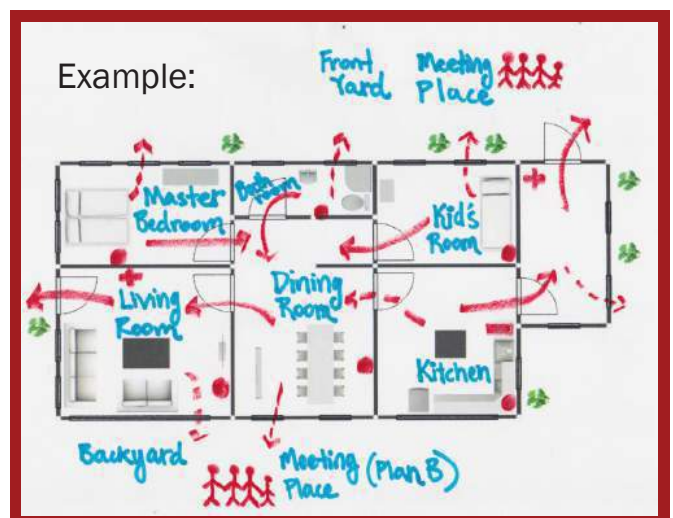
Get to know your neighbors and provide your contact information to them, so that you can work together to find solutions to unexpected risks or hazards within the community, particularly any stemming from your property or that may endanger your property while you are away.

Post in a location where **every** member of your family can see it, such as on the fridge or next to a phone.

Our Family's Home Evacuation Plan

Draw a floor plan or map of your home with the space provided below:

- Show all doors and windows.
- Mark two ways out of each room with arrows (1st choice: solid and 2nd choice: dotted).
- Mark all smoke alarms in the house with a ● .
Mark all fire extinguishers with a ■ .
- Mark your emergency kit with a + . Keep kits close to your 2 main exits.
- Pick and mark a main meeting place (and a backup alternative) outside the house where everyone can meet, away from any hazards.
- Remember to practice your plan at least twice a year.





READY, SET, GO!



Residential Safety Checklist Tips To Improve Family and Property Survival During A Wildland Fire

Home	Yes	No
1. Does your home have a metal, composition, or tile (or other non-combustible) roof with capped ends and covered fascia?	<input type="checkbox"/>	<input type="checkbox"/>
2. Are the rain gutters and roof free of leaves, needles and branches?	<input type="checkbox"/>	<input type="checkbox"/>
3. Are all vent openings screened with 1/8 inch (or smaller) mesh metal screen?	<input type="checkbox"/>	<input type="checkbox"/>
4. Are approved spark arrestors on chimneys?	<input type="checkbox"/>	<input type="checkbox"/>
5. Does the house have non-combustible siding material?	<input type="checkbox"/>	<input type="checkbox"/>
6. Are the eaves "boxed in" and the decks, lanai, and/or pier-and-posts enclosed?	<input type="checkbox"/>	<input type="checkbox"/>
7. Are the windows made of at least double-paned or tempered glass?	<input type="checkbox"/>	<input type="checkbox"/>
8. Are the decks, porches, lanai, and other similar areas made of non-combustible material and free of easily combustible material (e.g. plastic furniture)?	<input type="checkbox"/>	<input type="checkbox"/>
9. Is all firewood at least 30 feet from the house?	<input type="checkbox"/>	<input type="checkbox"/>

Defensible Space	Yes	No
1. Is dead vegetation cleared 100 feet from the house? (Consider adding distance due to slope of property.)	<input type="checkbox"/>	<input type="checkbox"/>
2. Is there separation between shrubs?	<input type="checkbox"/>	<input type="checkbox"/>
3. Are ladder fuels removed?	<input type="checkbox"/>	<input type="checkbox"/>
4. Is there a clean and green area extending at least 30 feet from the house?	<input type="checkbox"/>	<input type="checkbox"/>
5. Is there a non-combustible area within five feet of the house?	<input type="checkbox"/>	<input type="checkbox"/>
6. Is there separation between trees/tree clusters?	<input type="checkbox"/>	<input type="checkbox"/>

Emergency Access	Yes	No
1. Is the home address visible from the street?	<input type="checkbox"/>	<input type="checkbox"/>
2. Is the home address made of fire-resistant materials?	<input type="checkbox"/>	<input type="checkbox"/>
3. Are street signs present at every intersection leading to the house?	<input type="checkbox"/>	<input type="checkbox"/>
4. Are street signs made of fire-resistant materials?	<input type="checkbox"/>	<input type="checkbox"/>
5. Is flammable vegetation within 10 feet of the driveway cleared and are overhanging obstructions removed?	<input type="checkbox"/>	<input type="checkbox"/>
6. If a long driveway is present, does it have a suitable turnaround area?	<input type="checkbox"/>	<input type="checkbox"/>

--This is a high value resource--
 Please pass this on to others
 instead of throwing in the trash.
 It could save a life or home!

Ready, Set, Go!
www.wildlandfireRSG.org
 Hawaii Wildfire
 Management Organization
www.hawaiiwildfire.org



APPENDIX B

RAPID ASSESSMENT OF LARGE LANDHOLDINGS ALONG WILDLAND-URBAN INTERFACE

Wildland Urban Interface Large Landholding Rapid Assessment

North Shore Community Wildfire Protection Plan

Name: Dillingham Ranch

Approximate Acreage: 2,740 acres

Assessment Completed by Representatives from State Division of Forestry and Wildlife and Hawaii Wildfire Management Organization

Assessment Category	Detail	Notes
Structures	Number	Approximately 18, ranging from containers/stables/office/farm house
	Condition	Farm house: aging/still has original infrastructure/wood Containers: new/metal Stables: unknown, mix of wood/may be some corrugated roofing
	Level of Use	7 days/week
	Purpose	stables, animal housing, wedding venue etc
	General Ignitability	Most structures have flammable components. Vegetation is well managed in most of the area. Steel containers have low flammability.
Fuels	Type	Grass (Megathyrsus maximus), Leucaena leucocephala, some larger Monkey pod shade trees
	Continuity	Patchy, noncontinuous, well managed at ranch and in some bordering areas, becomes more densely packed, including increased vertical continuity of fuels approaching the Pahole NARS
	Density	med/low
	Height:	grasses below 6ft on ranch, in regions bordering grasses may reach approx 6ft.
	Maintenance	Small grounds crew, manages ranchland + the surrounding area. Proactively maintained a firebreak behind the ranch.
Fire Suppression Considerations	Firefighting Access	Parcel accessed off Farrington Highway, roads within ranch are ~20ft wide, dirt roads that may be difficult to access during heavy rains. Most roads loop throughout the complex and there is adequate turnaround space for vehicles. Roads well maintained and connected around the entirety of the property
	Water Availability for Firefighting	There is a small reservoir on the west side of the ranch, it is not however part of the Dillingham property in my understanding and may only be seasonally full at the time of the assessment. Otherwise ocean access may be the best available source of water for any firefighting on/near this property.
	Special Features, Sensitive or High Value Resource to Protect	Property is at/near the bottom of the Pahole NARS, where there are populations of native plants (Lobelia sp., etc).

Wildland Urban Interface Large Landholding Rapid Assessment

North Shore Community Wildfire Protection Plan

Name: Kamananui Ranch

Approximate Acreage: 1,572 acre, undeveloped ranch

Assessment Completed by Representatives from State Division of Forestry and Wildlife and Hawaii Wildfire Management Organization

Assessment Category	Detail	Notes
Structures	Number	1 x 20 foot storage container and shade canopy
	Condition	new
	Level of Use	5 days/week
	Purpose	equipment storage for machine operator
	General Ignitability	Canopy flammable, storage container steel (low flammability)
Fuels	Type	Grass (Megathyrus maximus), Leucaena leucocephala.
	Continuity	Continuous. Only broken up by roads at lowest elevations (0-400ft). Then forested patches of Acacia confusa, Syzygium cumini, Psidium cattleianum in the mid elevations (400-1000 ft). Grass lower density in upper elevations of mixed forestry plantings and remnant native forest patches (1000ft plus)
	Density	High
	Height:	6 ft in areas unburned by August 2020 fire, 3 ft in new post fire growth
	Maintenance	Feral herd of ~150 cows and small feral herd of horses doing sporadic grazing, mostly in flat low lying lands at stream bottom. Ranch roads of varying width (<15 ft in most places were mostly successful as fuel breaks in last fire, only some minor slopover observed.
	Fire Suppression Considerations	Firefighting Access
Water Availability for Firefighting		Stream flow in kaukonahua stream is intermittent and is determined by outflow of Lake Wilson reservoir. Flow is only steady during times of rain when the reservoir's spillway is open. There is water in an irrigation ditch on the property that could be siphoned to fill a helicopter dip tank and/or fill brush tanks but needs the proper infrastructure to be added to the ditch with permission of Dole, Inc who manage the irrigation ditch. There are two reservoirs along Kaukonahua Road that helicopters use to dip out of.
Special Features, Sensitive or High Value Resource to Protect		There are remnant populations of endangered plants in the upper gulches of the property including: Hibiscus brackenridgei, Colubrina oppositifolia, Nototrichium humile, Abutilon sandwicensis, and potentially Isodendron longifolium and Mezoneuron kavaense.

APPENDIX C

HAZARD ASSESSMENT RATINGS KEY

Wildfire Hazard Assessment Key (for Developed/Community Areas)

Subdivision Hazard Rating			
Rating Element	Low (Score =1)	Moderate (Score=2)	High (Score=3)
Ingress/ Egress	Multiple entrances and exits are well equipped for fire trucks with turnarounds.	Limited access routes. 2 ways in and 2 ways out. Moderate grades.	Narrow, dead end roads or 1 way in, 1 way out. Steep grades
Road Maintenance	Wide loop roads that are maintained, paved or solid surface with shoulders.	Roads maintained. Some narrow two lane roads with no shoulders.	Narrow and or single lane, minimally maintained, no shoulders.
Road Width	24'+ wide. Wide roads with drivable shoulders and good visibility allow two-way traffic. Streets in the downtown area are the widest streets in town. Interior streets are smaller and are easily blocked by parked vehicles.	20'-24' wide. Medium width roads with drivable shoulders and good visibility, support evacuation and emergency response time.	Less than 20 feet wide. Narrow roads coupled with poor visibility limit evacuation and emergency response. Traffic problems will occur. Entrapment is likely.
All-season Road Condition	Flat or gently sloping surfaced roads can support high volumes of large fire equipment.	Surfaced road with 5%+ grade or non-surfaced road with <5% grade that can still support fire equipment. Road and right-of-way maintenances is essential for access and visibility.	Narrow, steep, or non-surfaced roads are difficult to access. One-way traffic is a hazard. Overhanging brush may damage fire equipment. Jeep trails and seasonal roads limit 2wd emergency response equipment.
Fire Service Access	Adequate turnaround space is available for large fire equipment.	<300' with no turnaround. Short or dead-end streets will become crowded with homeowner's vehicles.	300'+ with no turnaround. Long dead-end streets will become crowded with vehicles. Two-way visibility is an issue.
Street signs	Present. Most are at least 4' in size and are reflectorized.	Present and reflectorized with some exceptions.	Not present.
Structure Density	Low structure density and low ignition probability.	Density and ignition probability are both moderate, or one is high but is balanced by the other being low.	Dense structures with high ignition probability.
Home Setbacks	Majority (50%+) of homes are set back from property lines and slopes by at least 30 feet.	10-50% of homes have defensible setbacks from property lines and sloped areas.	<10% of homes have defensible setbacks from property lines. Buildings located close to dangerous topographic features such as the tops of slopes.

Wildfire Hazard Assessment Key (for Developed/Community Areas)

<p>Unmanaged, untended, undeveloped lands</p>	<p>Few to no weedy vacant lots. Few to no undeveloped unmaintained vegetated areas or corridors between homes. Less than 10% of lots remain undeveloped and pose an additional wildfire hazard due to lack of maintenance and/or restricted access.</p>	<p>Some isolated unmaintained lots or undeveloped vegetated areas within subdivision. 10-50% of lots have not been developed and pose an additional wildfire hazard due to lack of maintenance and/or restricted access. Hazard ranking is dependent on ignition risk, size of area, and fuel type.</p>	<p>Abundant unmanaged, vegetated corridors and vacant lots throughout community. Agricultural lands irregularly maintained leaving dry weedy species causing increased ignition risk. Numerous ladder fuels and high risk fuels. Greater than 75% of lots have not been developed or Separation of adjacent structures that can contribute to fire spread</p>
<p>Private landowner actions / Firewise landscaping and defensible space</p>	<p>70% of homes have improved survivable space around property, reduced ignition risk, hardened homes, and no ladder fuels.</p>	<p>30-70% homes have improved survivable space around property and well-maintained landscapes.</p>	<p><30% of homes have defensible space, hardened home features, or Firewise landscaping</p>
<p>Proximity of subdivision to wildland areas</p>	<p>Wildland areas share no borders with the subdivision. Little to no undeveloped and unmaintained vegetated areas within community. Little to no ladder fuels along community boundaries.</p>	<p>Wildland areas adjoin subdivision on 1-2 sides.</p>	<p>Wildland areas surround subdivision on at least 3 sides.</p>

Wildfire Hazard Assessment Key (for Developed/Community Areas)

Vegetation Hazard Rating around Subdivision			
Rating Element	Low (1)	Moderate (2)	High (3)
Proximity of flammable fuels around subdivision	Greater than 100'	40-100'	Less than 40'
Type of predominant vegetation within 300' of homes	Grasses less than 6 inches in height. Light leaf litter.	Grasses 6–12 inches in height. Grasses 6-12" tall. Light brush and small trees. Patchy fuels.	Dense grass, brush, timber, and/or hardwoods. Moderate to heavy dead and downed vegetation. Fuels greater than 12 feet tall. Heavy vegetation.
Fuel loading	0-30% cover	31-70% cover	71-100% cover
Fuel structure and arrangement	Non-contiguous or patchwork arrangement. Little to no ladder fuels.		Uninterrupted vegetation, pervasive ladder fuels.
Defensible Space/ Fuels reduction around homes & structures	Vegetation is treated 100 feet or more from structures.	31-100 ft of vegetation treatment from structures.	Less than 30 ft of vegetation treatment from structures.

Wildfire Hazard Assessment Key (for Developed/Community Areas)

Building Hazard Rating			
Rating Element	Low (1)	Moderate (2)	High (3)
Roofing Assembly	Greater than 75% of homes have Class A roofs (metal, asphalt, or fiberglass roofing material).	50-75% have Class A roofing.	Less than 50% of homes have Class A roofing.
Siding/ Soffits	Greater than 75% of homes have fire resistant siding and soffits.	50-75% of homes have fire resistant siding and soffits.	Less than 50% of homes have fire resistant siding and soffits.
Under-skirting around decks, lanais, post-and-pier structures.	Greater than 75% of homes have the equivalent of fine non-combustible mesh screening to protect underneath from flying embers and ignition	50-75% of homes have the equivalent of fine non-combustible mesh screening	Less than 50% of homes have the equivalent of fine non-combustible mesh screening
Utilities Placement- Gas and Electric	All underground or none.	One underground, one above ground.	Both above ground.
Structural Ignitability	Greater than 75% of houses are spaced with cleared boundaries. Flammables and combustible materials stored according to fire-safe principles.	50-75% of homes store combustibles properly.	Less than 50% of homes store combustibles properly. Houses close to each other.

Wildfire Hazard Assessment Key (for Developed/Community Areas)

Fire Hazard Rating						
* Note: two elements have unique scoring for better assessment accuracy						
Rating Element	Low (1)		Moderate (2)		High (3)	
Slope	Flat to slight slope (10%)		Moderate slopes (10-30%)		Steep slopes (>30%)	
Average rainfall *Score 1-6 instead	High precipitation (Score=1)	(Score=2)	(Score=3)	(Score=4)	(Score=5)	Low precipitation (Score=6)
Prevailing wind speeds and direction *Score 1-4 instead	Wind rarely (less than 10% of time) exceeds 15 mph. Protection from predominant winds.		Wind rarely (less than 10% of time) exceeds 15 mph.		Wind frequently (50% or more of time) exceeds 15 mph or frequent exposure to predominant winds or transitional/converging wind directions.	
Seasonal or periodic high hazard conditions	Area has no major seasonal increase of fire hazard.		Area is occasionally (e.g., once per decade) exposed to fire prone conditions: drought, lightning storms, desiccated vegetation, and/or strong dry winds		Area is seasonally exposed to unusually severe fire weather, drought conditions, lightning storms, desiccated vegetation, and/or strong dry winds	
Ignition risk	Little to no natural (lightning or lava) ignition risk. No history of arson. Wildland areas absent or distant from public and/or vehicular access.		Some history of wildfire, but not particularly fire prone area due to prevailing lack of fire prone conditions, weather, and vegetation type.		Most historic wildfire events were anthropogenic with easy access to wildland areas via roads or proximity to development OR natural ignition sources such as lightning or lava are prevalent. Fire prone area. High rate of ignitions or history of large scale fires and/or severe wildfire events.	
Topographical features that adversely affect wildland fire behavior	None.				Major features that influence fire spread, such as box canyon, ravines, chutes, saddles, transition zones.	

Wildfire Hazard Assessment Key (for Developed/Community Areas)

Fire Protection Hazard			
Rating Element	Low (1)	Moderate (2)	High (3)
Water source availability	Pressurized water source availability. 500 GPM less than 1000 ft spacing.	Non-pressurized water source availability (offsite or draft location) or dipsite. Homes on catchment water have fire-hose hookups.	Water unavailable, or offsite water more than 20 minute roundtrip
Response time	Within 15 minutes	16-30 minutes	Greater than 30 minutes
Proximity to fire station	Less than 5 miles	6-10 miles	More than 10 miles
Fire department structural training and expertise	Large fully paid fire department with personnel that meet NFPA or NWCG training requirements and have adequate equipment.	Mixed fire department. Some paid and some volunteer personnel. Limited experience, training, and equipment to fight fire.	Small, all volunteer fire department. Limited training, experience, and budget with regular turnover of personnel. Do not meet NFPA or NWCG standards.
Wildland firefighting capability of initial response agency	Sufficient personnel, equipment, and wildland firefighting capability and experience. Good supply of structural and wildland fire apparatus and misc specialty equipment	Limited personnel, and or equipment but with some wildland firefighting expertise and training. Smaller supply of fire apparatus in fairly good repair with some specialty equipment.	Fire department non-existent or untrained/unequipped to fight wildland fire. Minimum amount of fire apparatus, which is old and in need of repair. None or little specialty equipment.
Interagency Cooperation	Mutual aid agreements and resources available to deploy.	Mutual aid agreements but limited resource availability.	No mutual aid agreements.
Local emergency operations group or other similar	Active EOG or CERT. Evacuation plan in place.	Limited participation in EOG or similar. Have some form of evacuation process.	EOG or CERT team, etc. organized and active, prepared for evacuation processes
Community planning practices and ordinances	County/local laws, zoning ordinances, and codes require use of fire safe residential and subdivision designs. Fire department actively participates in planning process and enforces ordinances. Residents are compliant.	Have voluntary ordinances for fire safe practices. Local officials have an understanding of appropriate wildfire mitigation strategies. Fire department has limited input to fire safe planning and development efforts and limited enforcement. Residents are mostly compliant.	No local codes, laws, or ordinances requiring fire safe building or practices. Community standards for fire safe development and protection are marginal or non-existent. Little to no effort has been made in assessing and applying measures to reduce wildfire impact. Ordinances are not enforced and/or residents are not compliant.
Community fire-safe efforts and programs already in place	Organized and active groups provide educational materials and programs throughout the community.	Limited provision of or interest in educational efforts. Fire Department or local group does some limited prevention and public education.	No interest or participation in educational programs. No prevention education by local fire department.

APPENDIX D

LARGE FORMAT MAPS FOR PROJECT PLANNING

LARGE FORMAT MAPS FOR PROJECT PLANNING

Maps within CWPP document provided here in large format:

Map 1. North Shore CWPP planning boundaries

Map 2. Developed areas and roads in North Shore

Map 3. Towns and communities in North Shore

Map 4: Land ownership in the North Shore CWPP area

Map 5. Wildfire ignitions

Map 6. Concentrated ignition "hot spots"

Map 7. Wildfire incidents 2002- 2019

Map 8. Elevation across North Shore CWPP area

Map 8b. Elevation, alternative perspective

Map 9. Slope across the North Shore CWPP area

Map 9b. Slope, additional perspective

Map 10. Fuel type: Woody, herbaceous, and bare earth

Map 10b. Fuel type: Woody, herbaceous, and bare earth, alternative perspective

Map 11. Fuel types across the CWPP area

Map 11b. Fuel types: LANDFIRE Classifications

Map 12. Precipitation/rainfall gradients across North Shore

Map 12b. Precipitation, additional perspective

Map 13. Relative humidity

Map 14. Average air temperature

Map 15. Average wind speeds

Map 16. Dominant wind direction

Map 17. Density of Threatened and Endangered Species within the CWPP boundaries

Map 18. Landscapes and stream habitats designated for strategic protection by US Fish and Wildlife Service

Map 19. Parks and protected areas

LARGE FORMAT MAPS FOR PROJECT PLANNING

Map 20. Marine and coastal resources

Map 21. Location of major municipal infrastructure to protect from wildfire impacts

Map 22. Location of public service infrastructure to protect from wildfire impacts

Map 23. Zoom-in map of key public service locations

Map 24. 2012 State Communities at Risk from Wildfires map for O'ahu

Map 25. 2021 Subdivision Wildfire Hazard Assessment Results

Map 26. 2021 Vegetation Wildfire Hazard Assessment Results

Map 27. 2021 Building Wildfire Hazard Assessment Results

Map 28. 2021 Fire Environment Wildfire Hazard Assessment Results

Map 29. 2021 Fire Protection Wildfire Hazard Assessment Results

Map 30. Fire Response Zones

Map 31. 2018-19 Voluntary reporting of current and proposed/needed hazardous fuels management activities

Additional maps that may be useful for project planning:

Map A1: Satellite imagery for CWPP area

Map A2: Topographic Map of CWPP area

Map A3: Watershed boundaries

Map A4: Water features in the CWPP area

Map A5: Population density

Map A6: Moisture zones

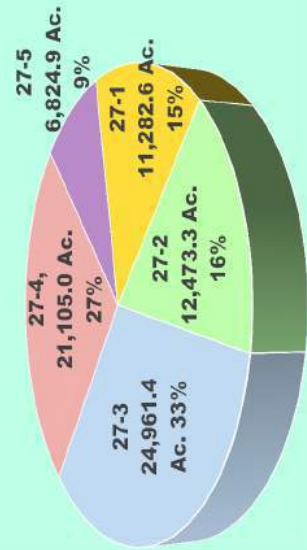
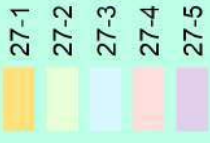
Map A7: Solar Radiation

Map A8: Aspect

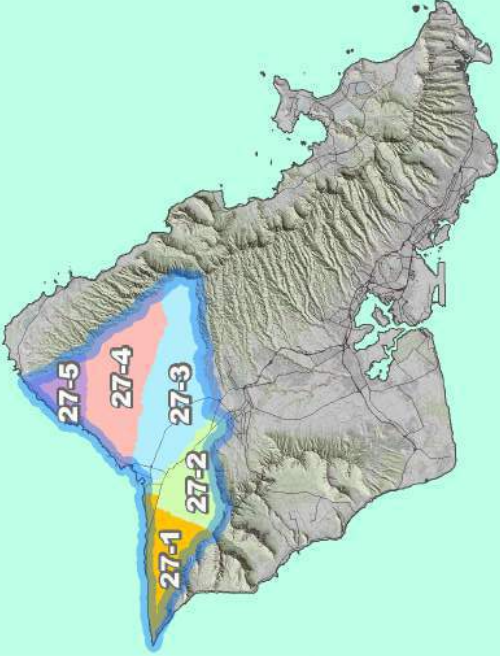
Map A9: Soil Type

North Shore Community Wildfire Protection Planning Area

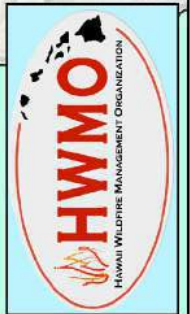
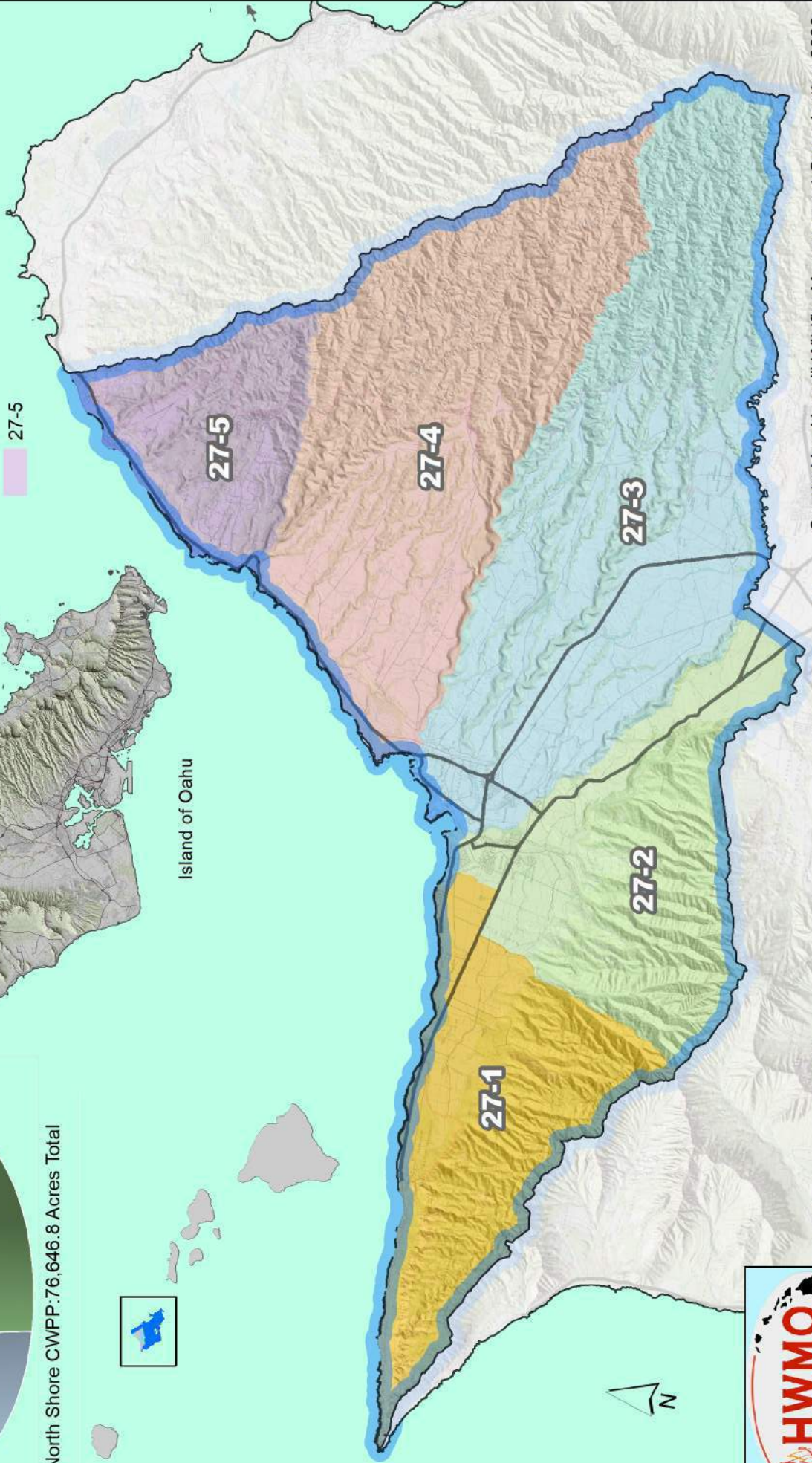
North Shore
Neighborhood Boards



North Shore CWPPP: 76,646.8 Acres Total

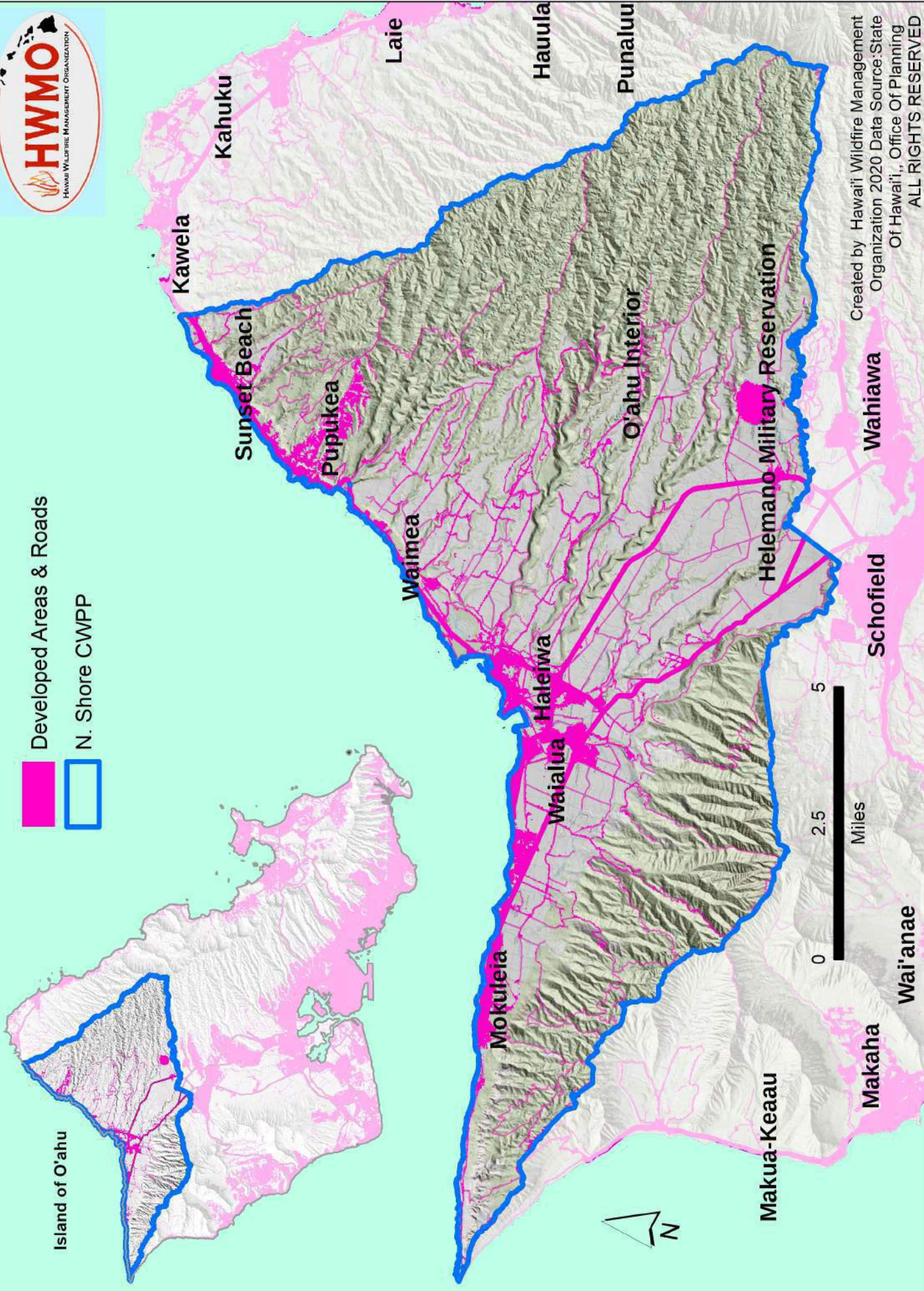


Island of Oahu



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North Shore CWPP: Built Environment

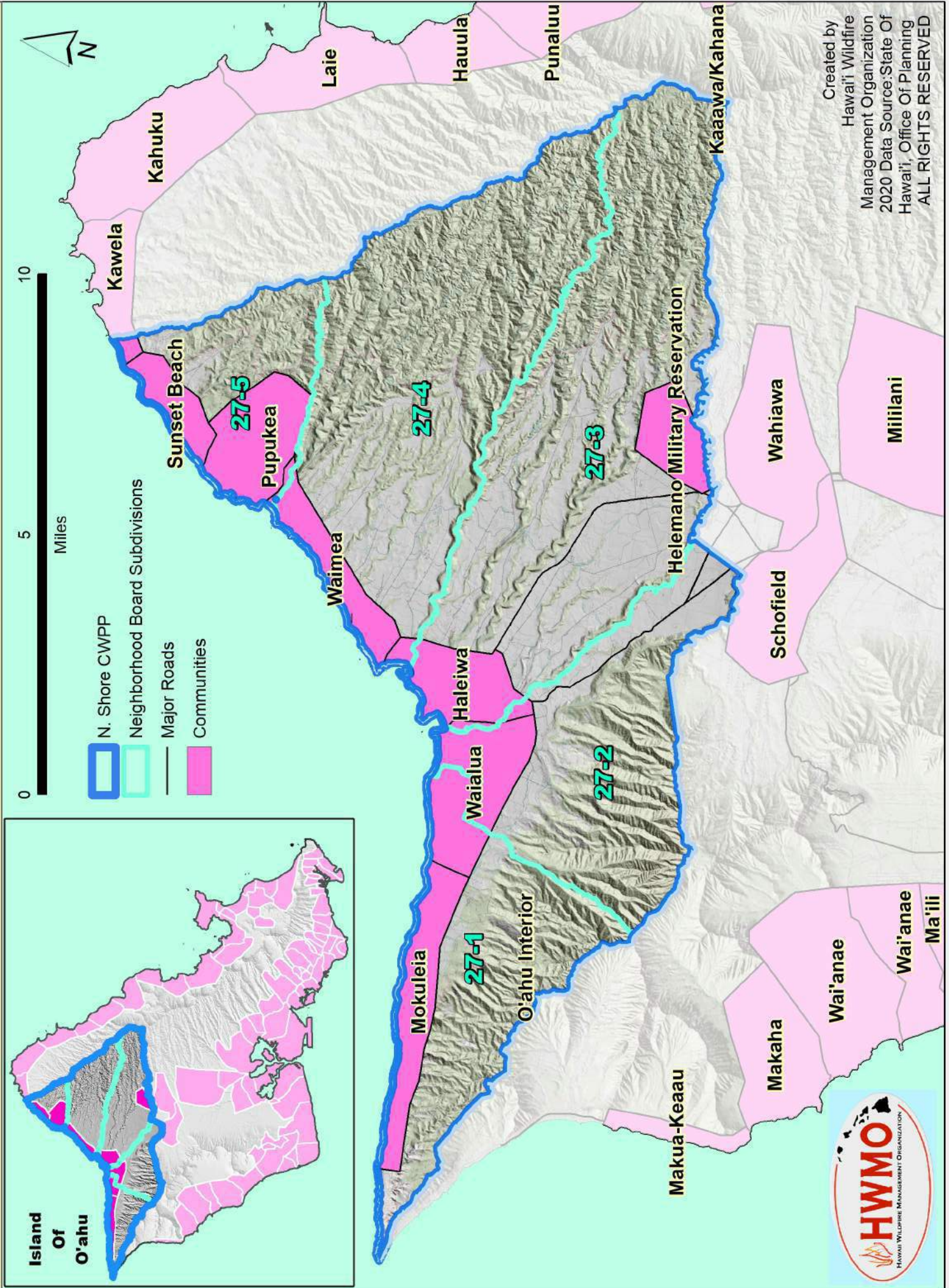


- Developed Areas & Roads
- N. Shore CWPP

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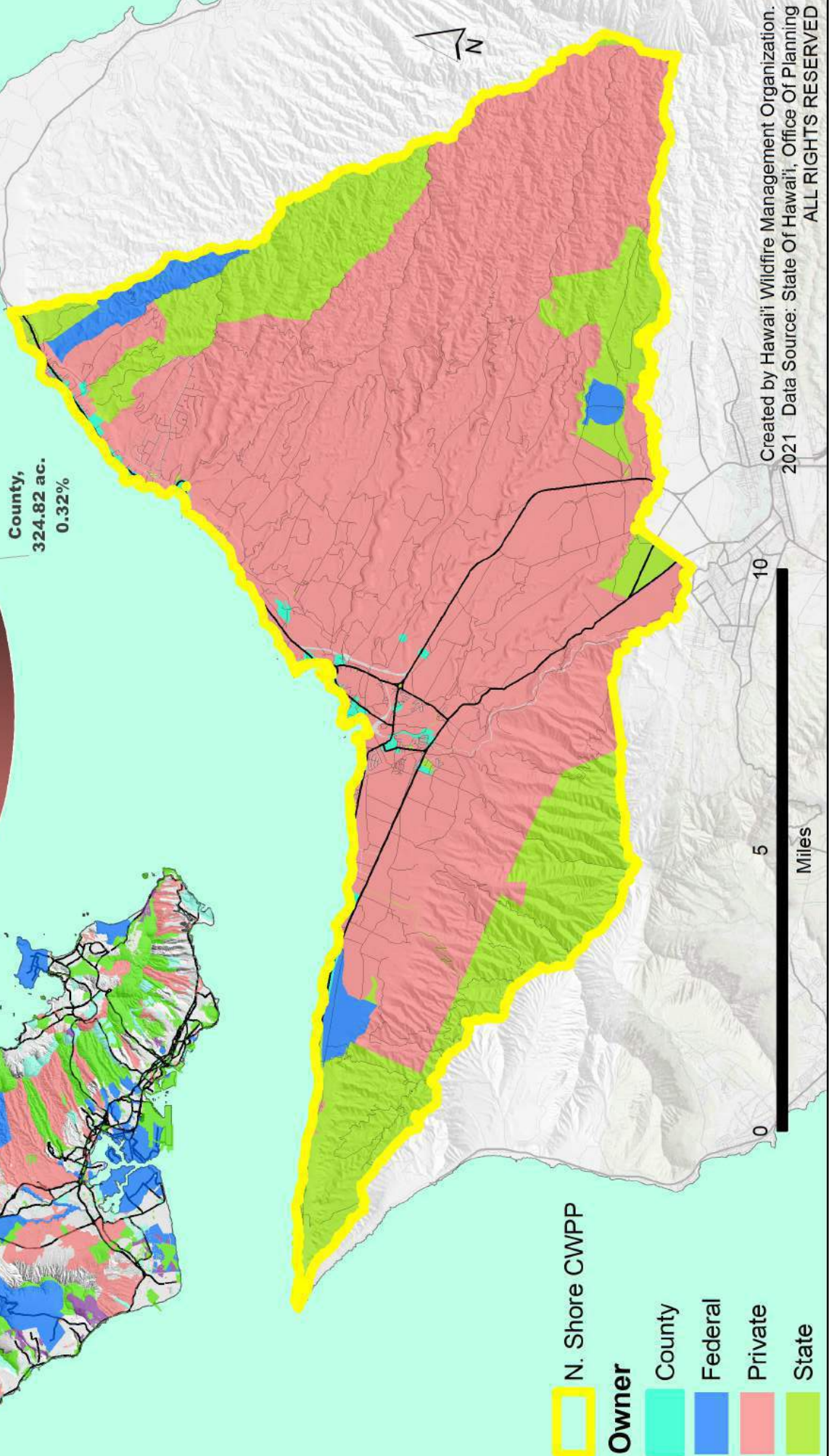
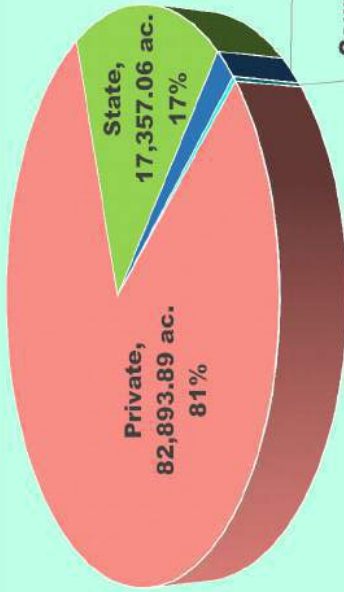
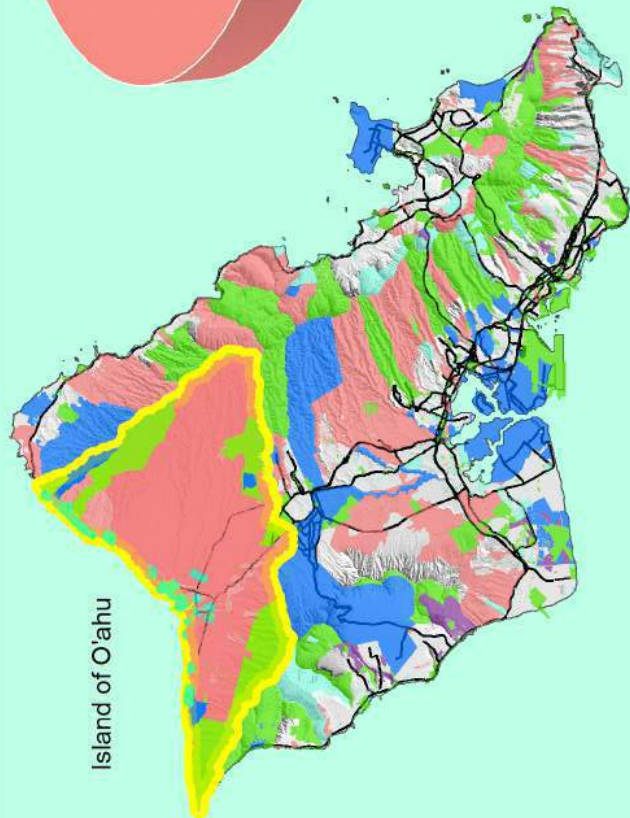
North Shore CWPP: Towns and Communities



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North Shore CWPP: Public & Private Land Ownership



Owner

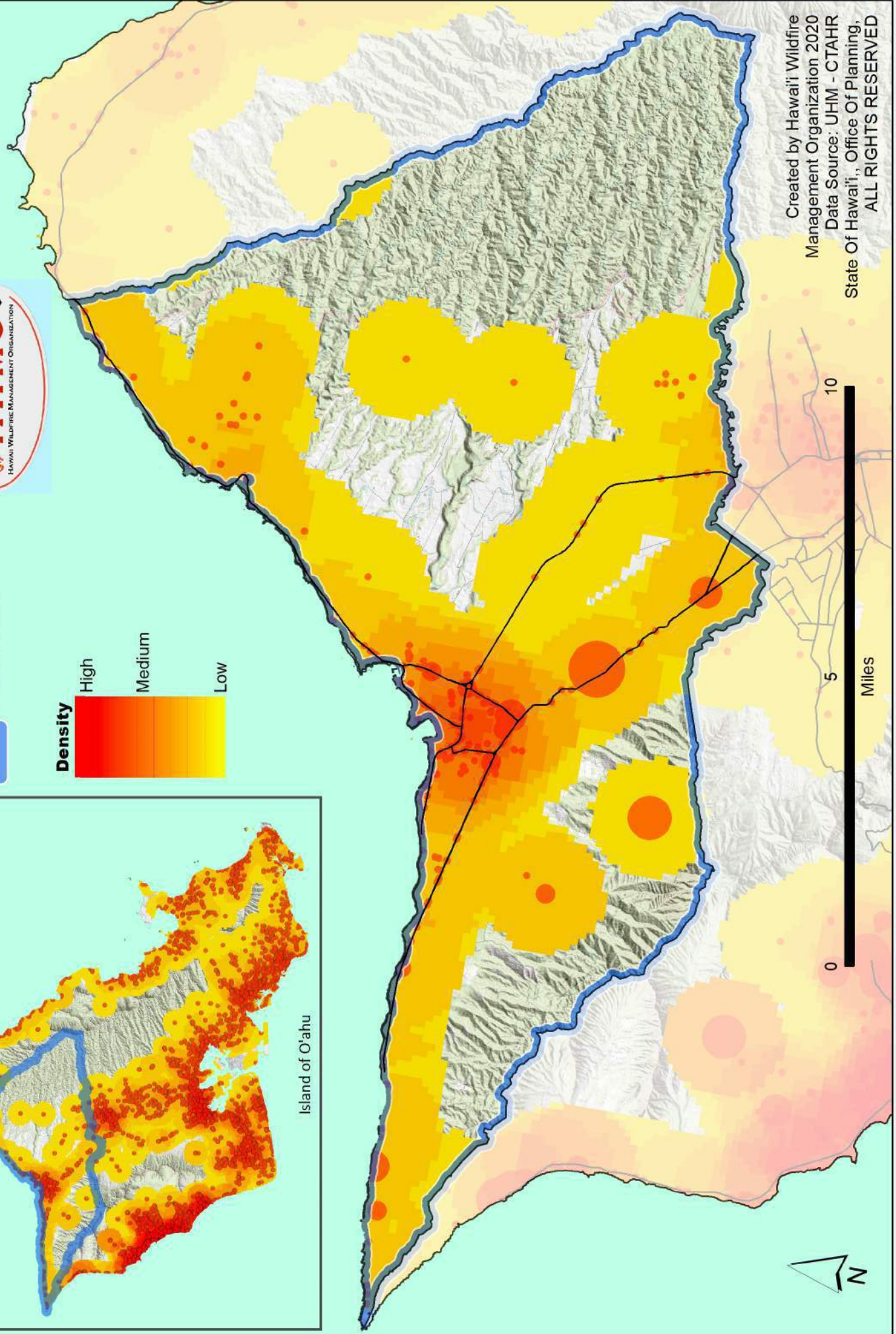
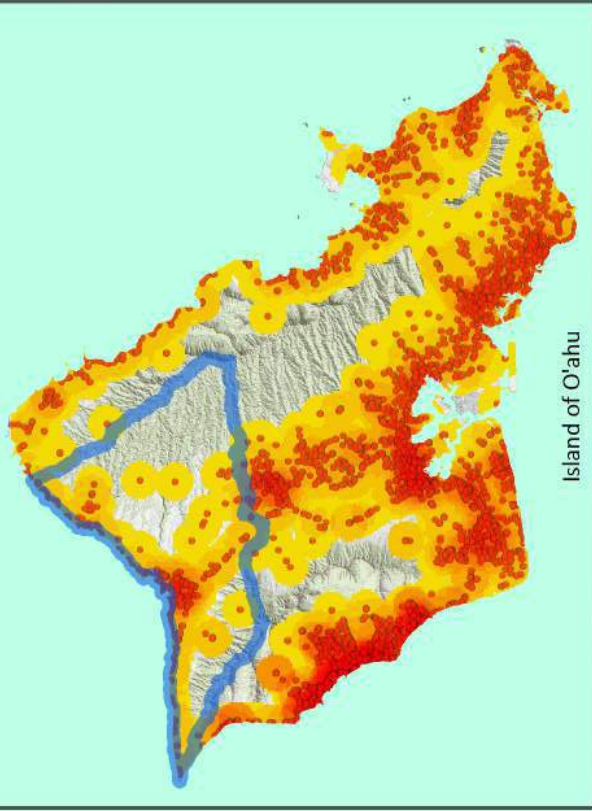
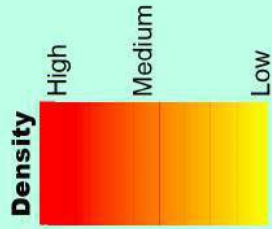
- N. Shore CWPP
- County
- Federal
- Private
- State



North Shore CWPP Wildfire Incidents: Density



- Major Roads
- N. Shore CWPP



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North Shore CWPP: Wildfire Incidents



N. Shore CWPP

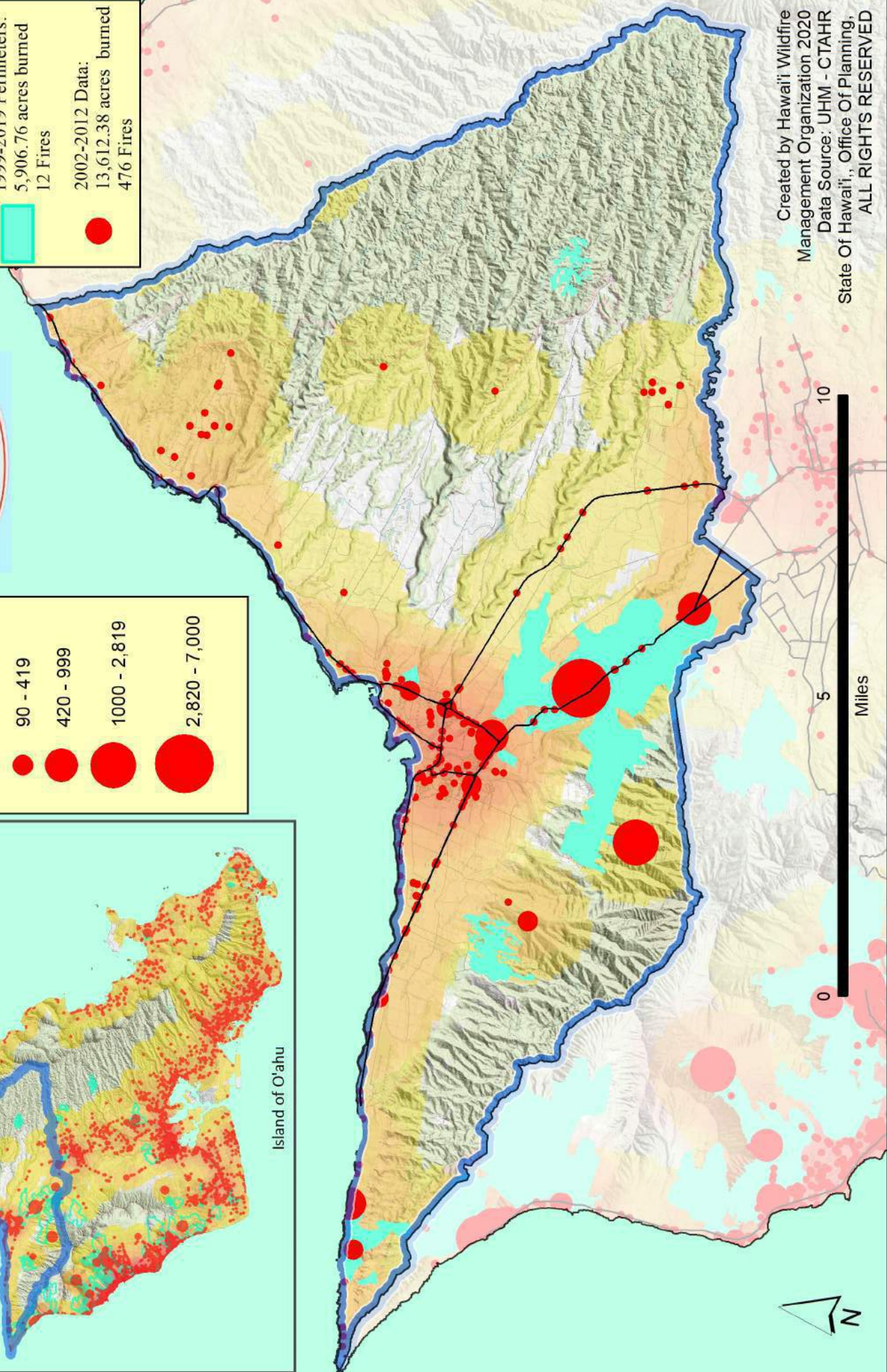
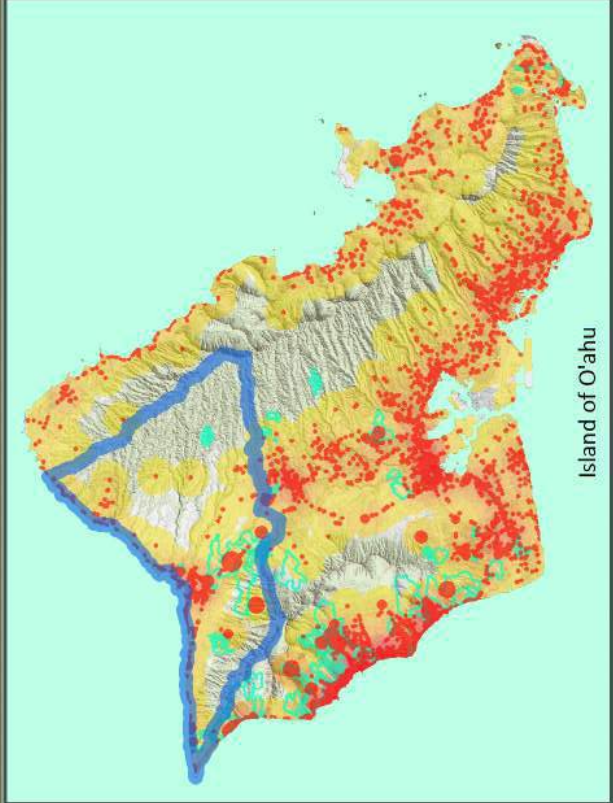
Major Roads

1999-2019 Perimeters:
5,906.76 acres burned
12 Fires

2002-2012 Data:
13,612.38 acres burned
476 Fires

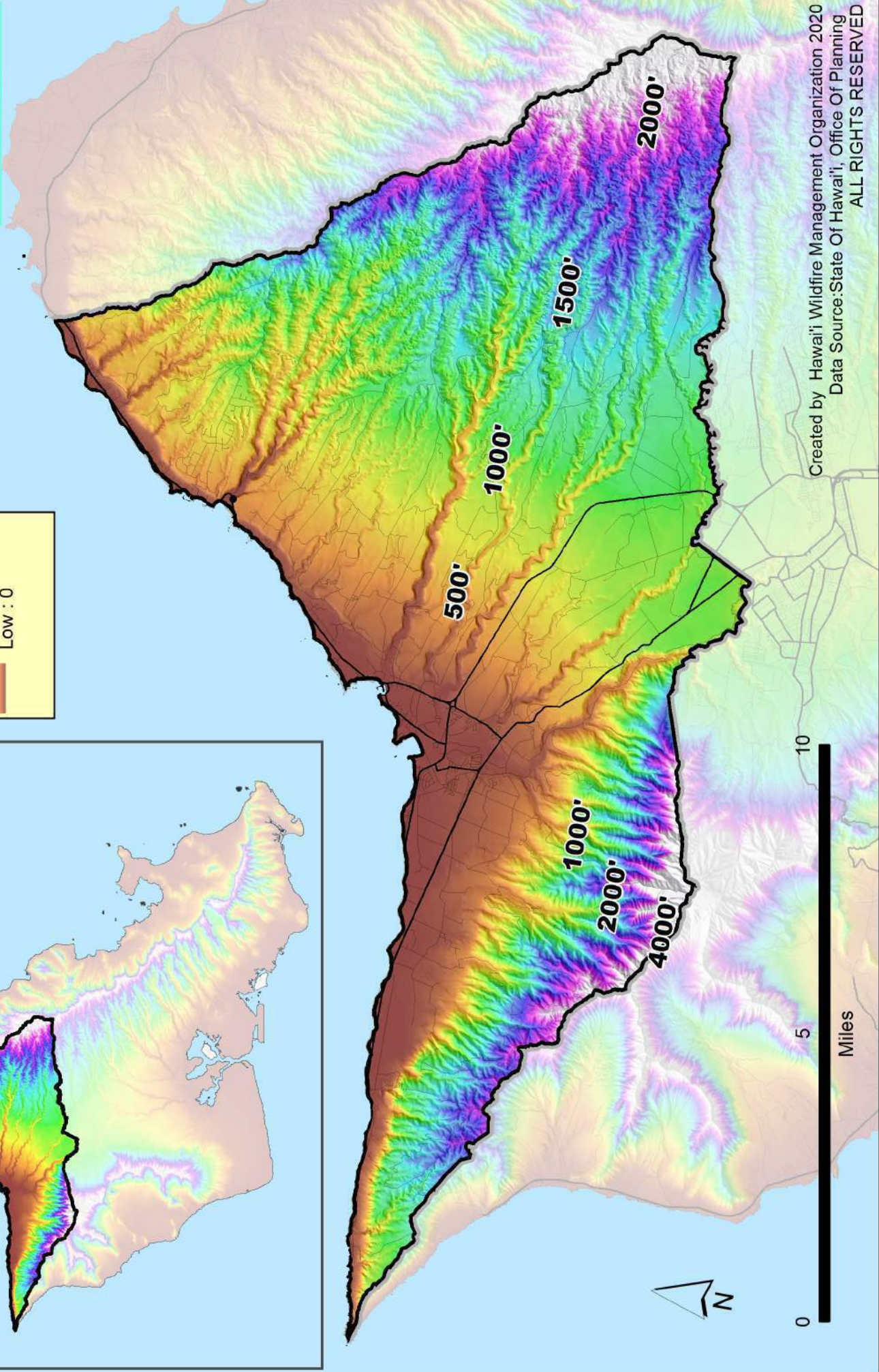
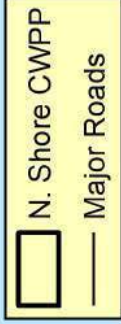
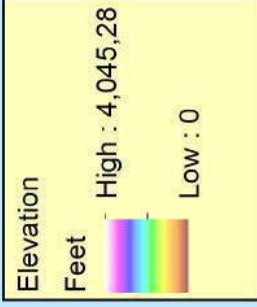
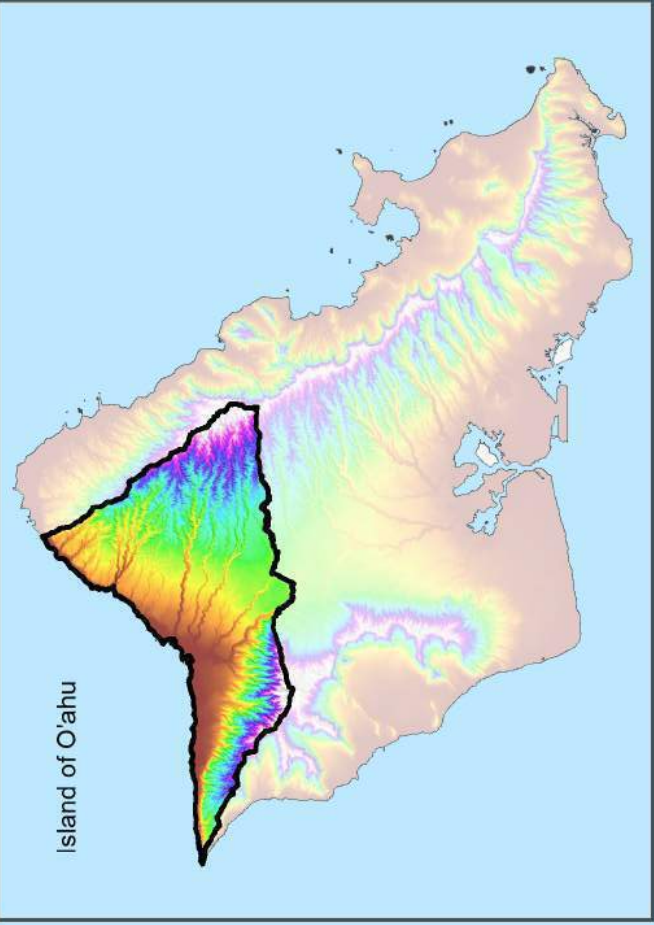
Wildfires Acres Burned

- 0 - 89
- 90 - 419
- 420 - 999
- 1000 - 2,819
- 2,820 - 7,000

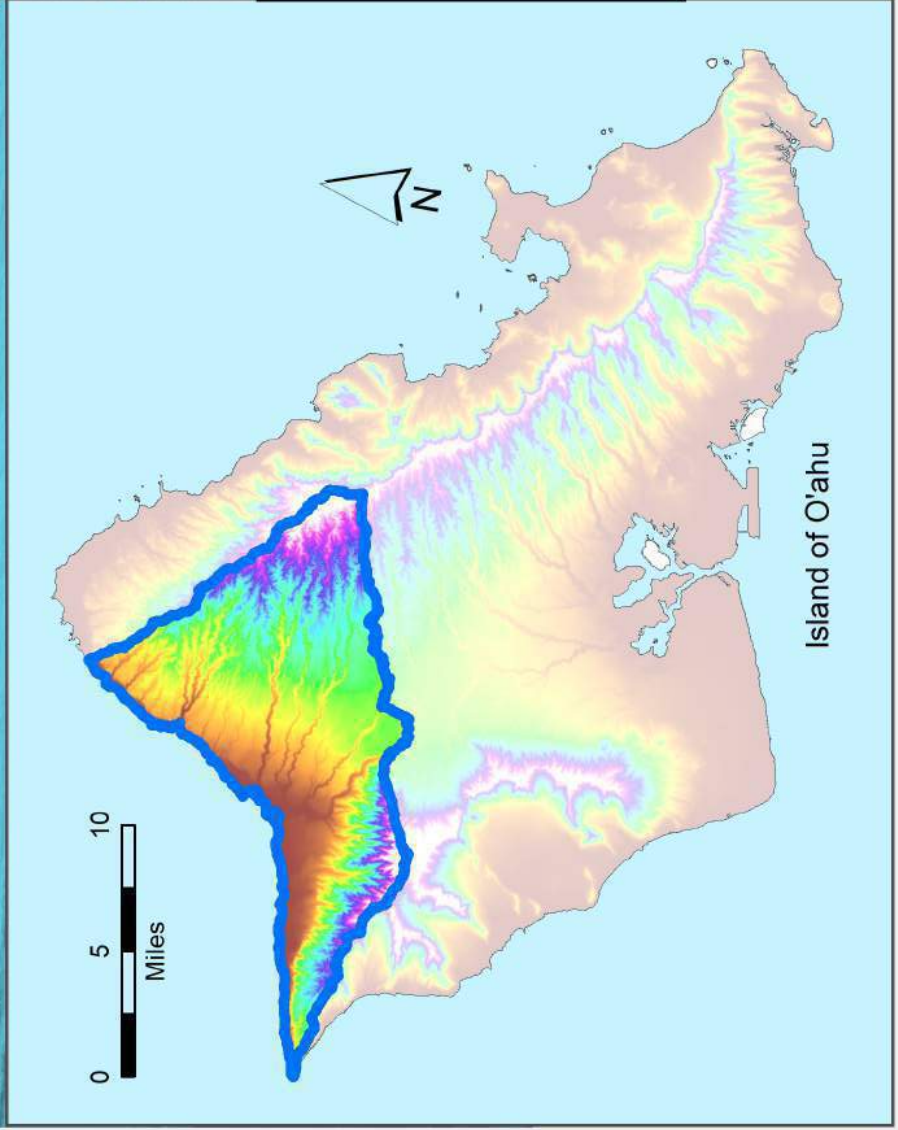
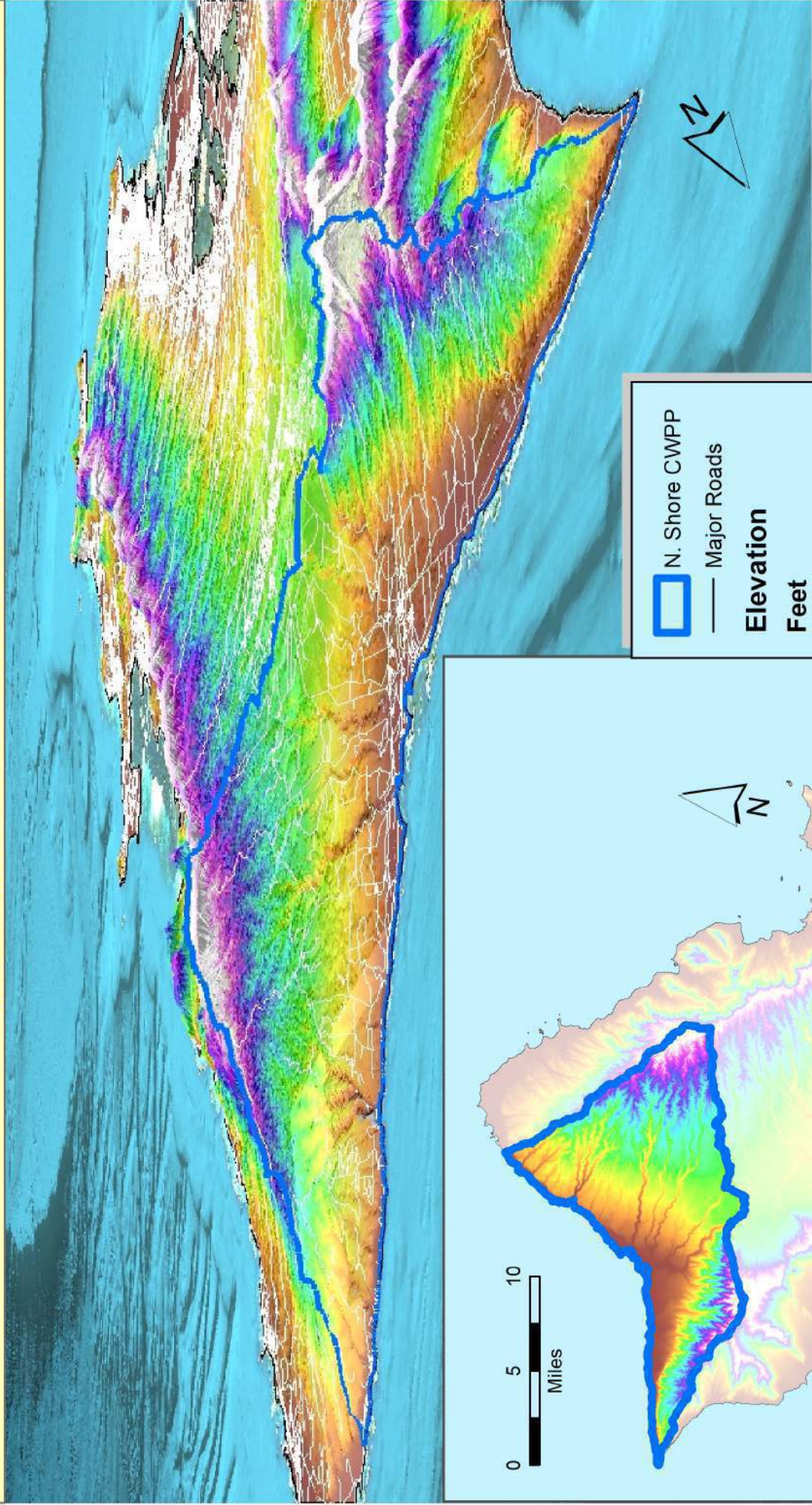



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North Shore CWPP: Fire Environment - Elevation



North Shore CWPP: Fire Environment - Elevation




 N. Shore CWPP

 Major Roads

Elevation

Feet

 High : 4,045

Low : 0



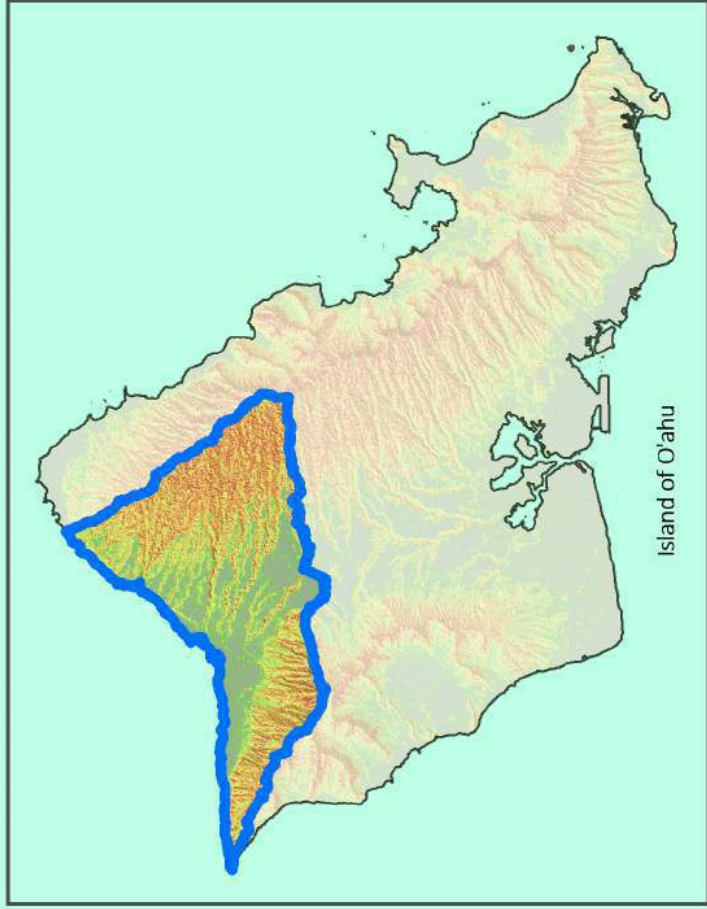
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North Shore CWPP: Fire Environment - Slope

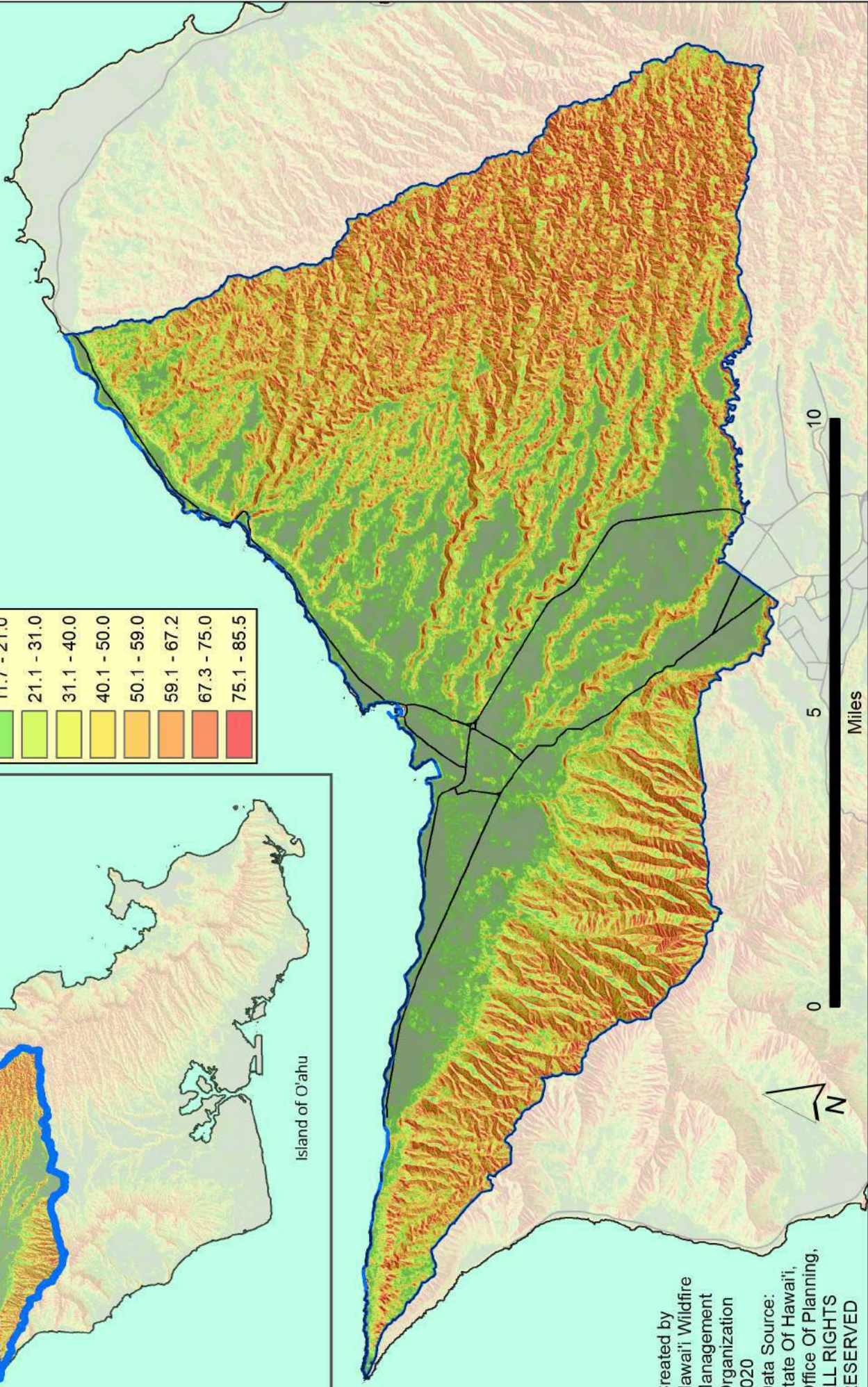


N. Shore CWPP
 Major Roads

Slope Degrees
0 - 3.0
3.1 - 11.6
11.7 - 21.0
21.1 - 31.0
31.1 - 40.0
40.1 - 50.0
50.1 - 59.0
59.1 - 67.2
67.3 - 75.0
75.1 - 85.5

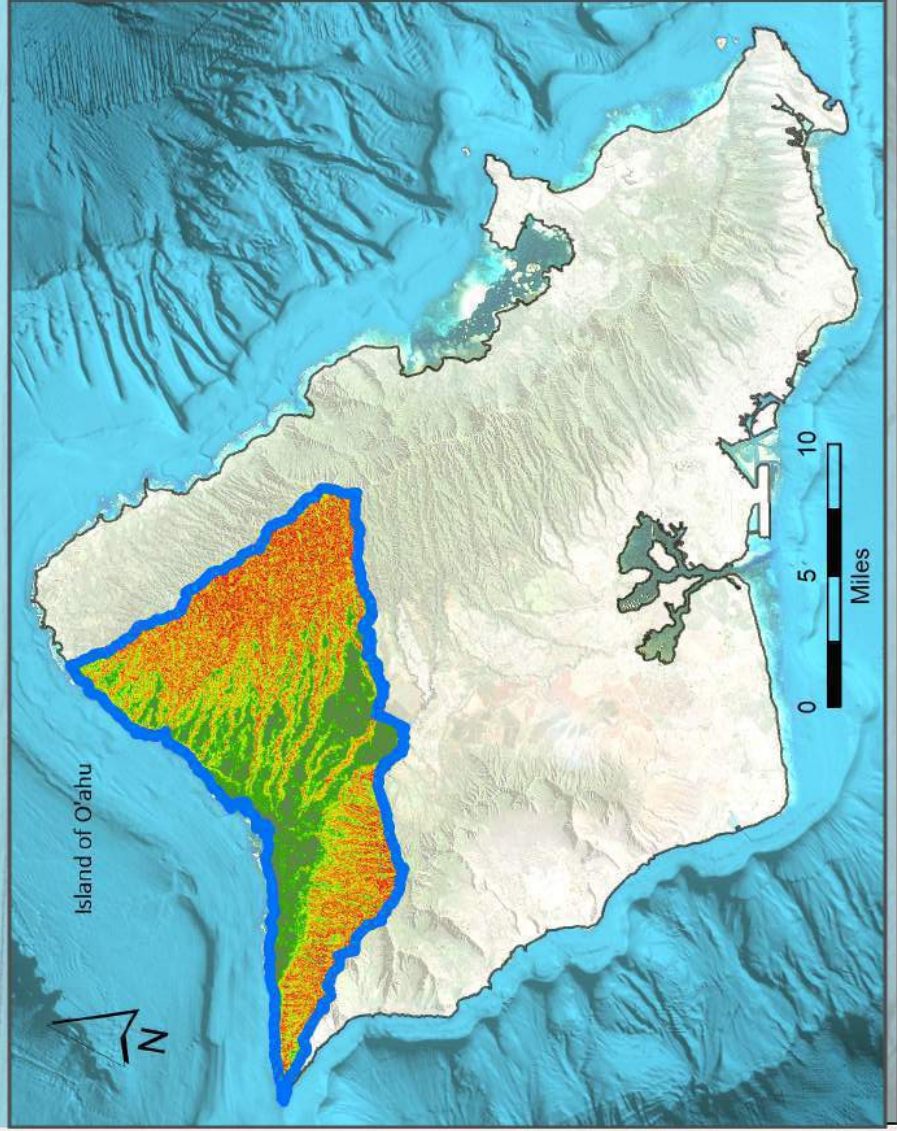
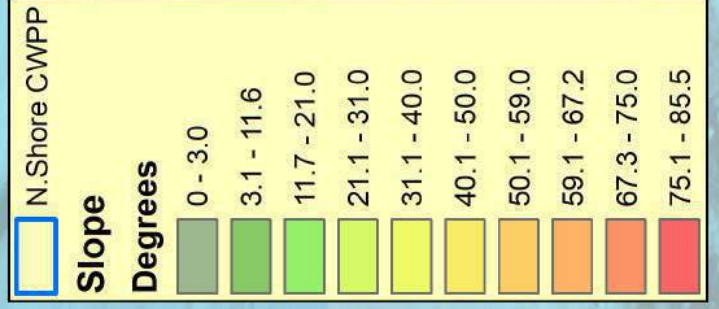
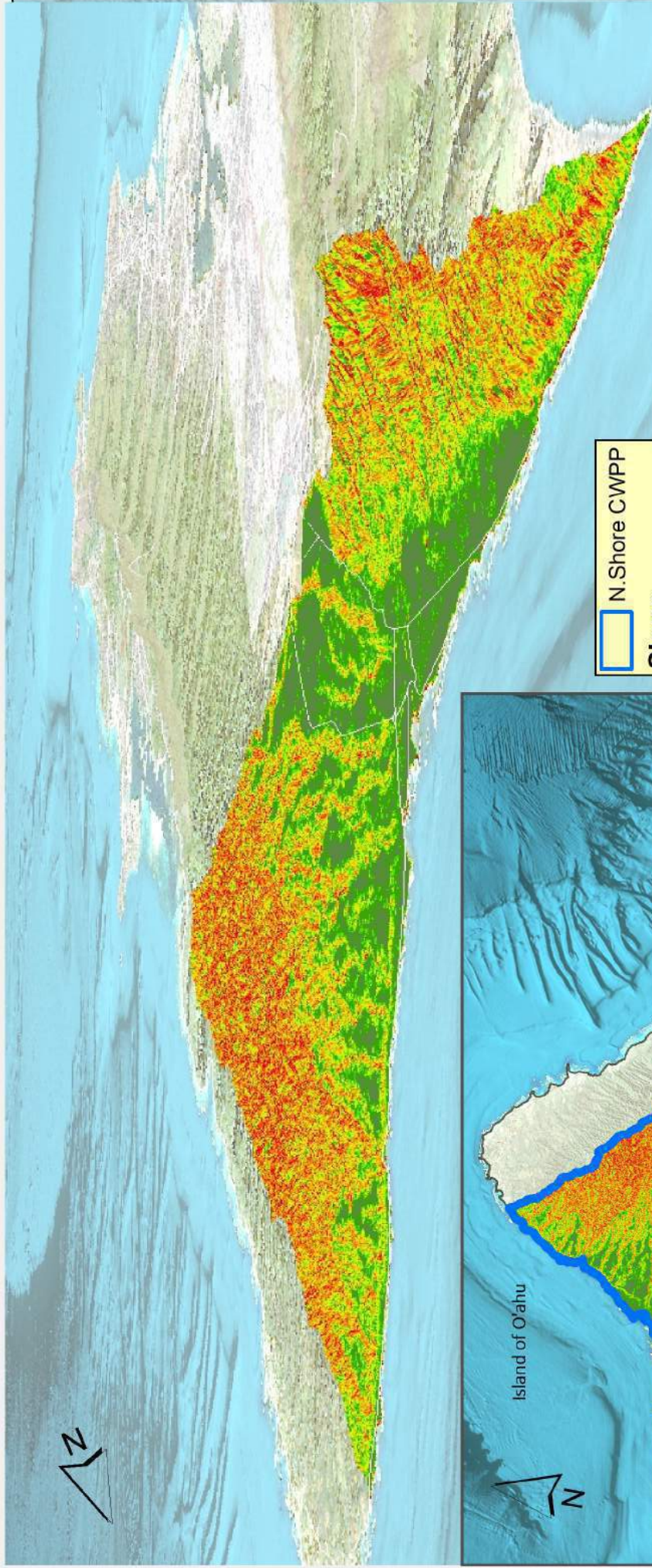


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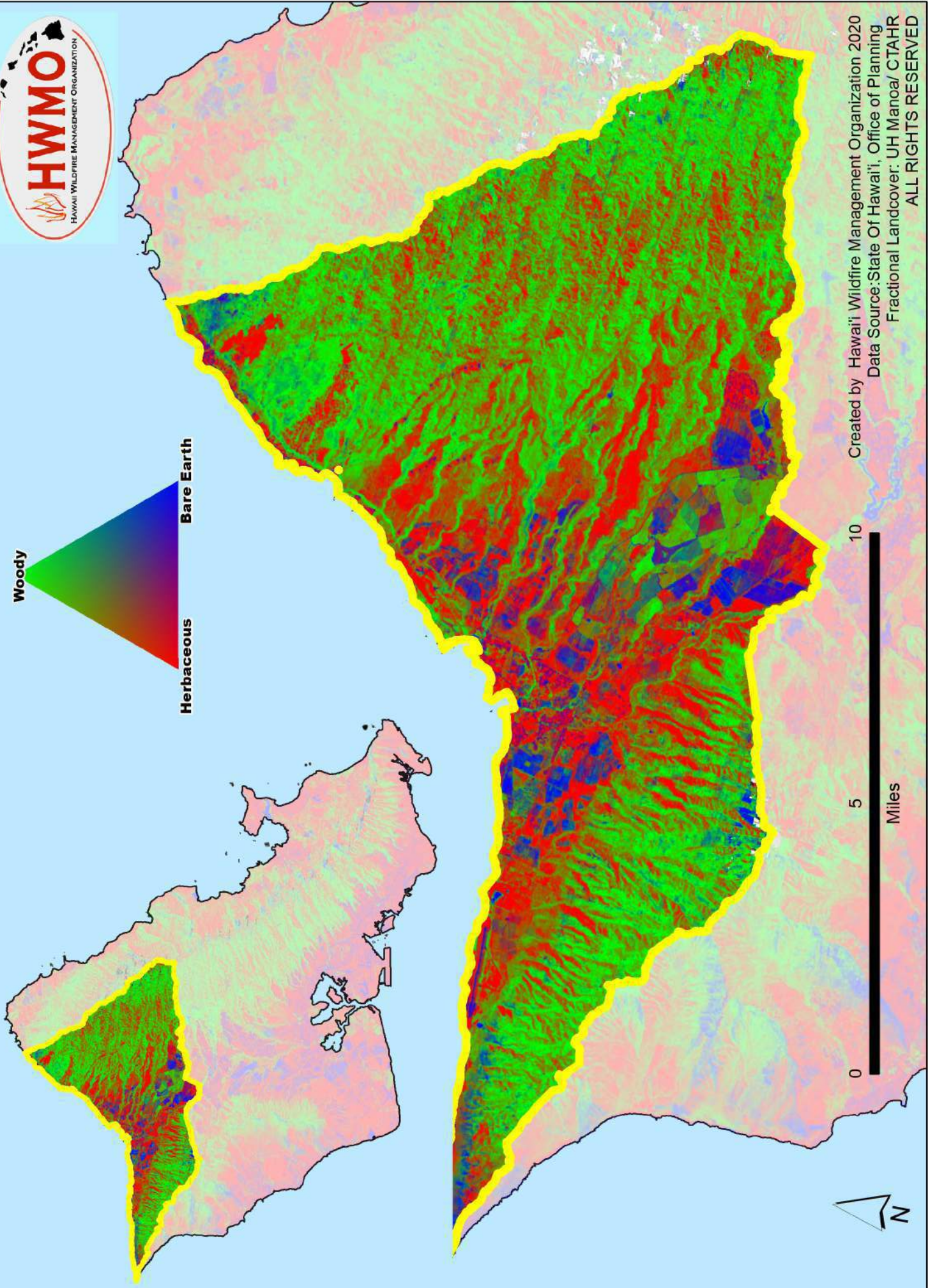
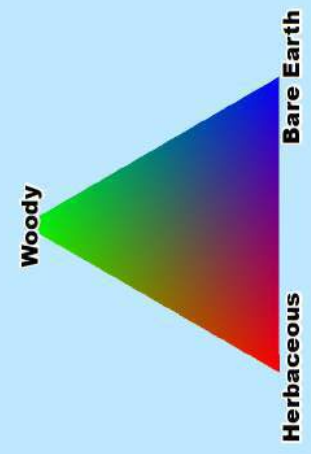


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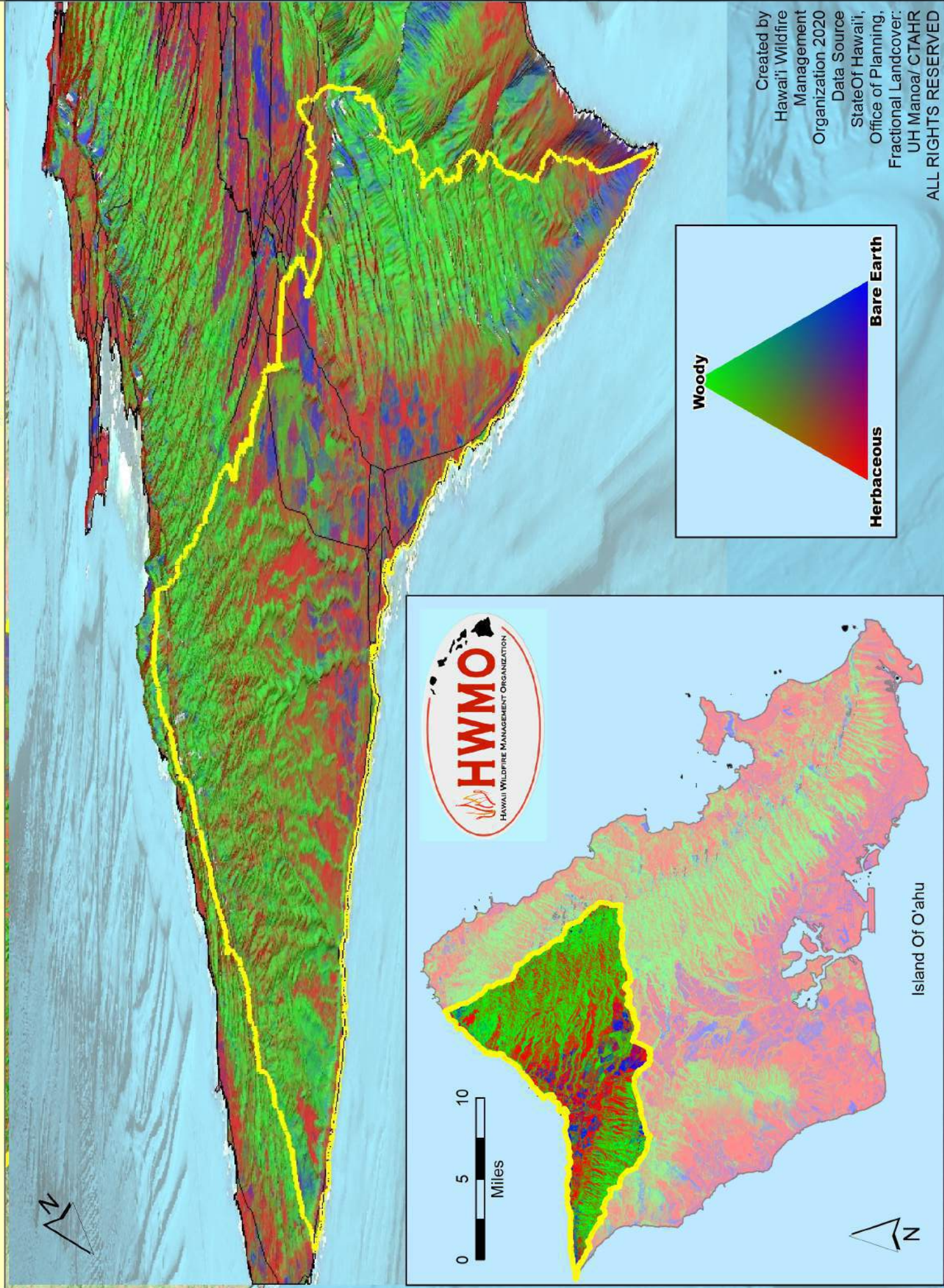


North Shore CWPP: Fire Environment - Fuel Type

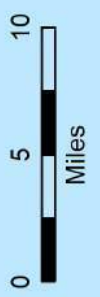
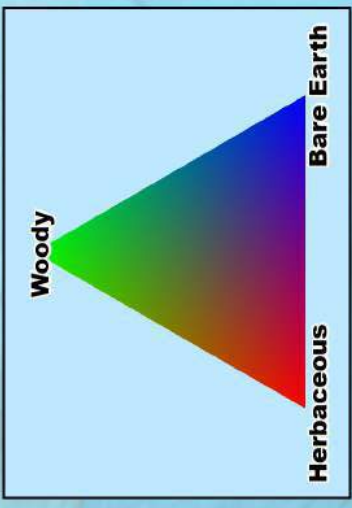


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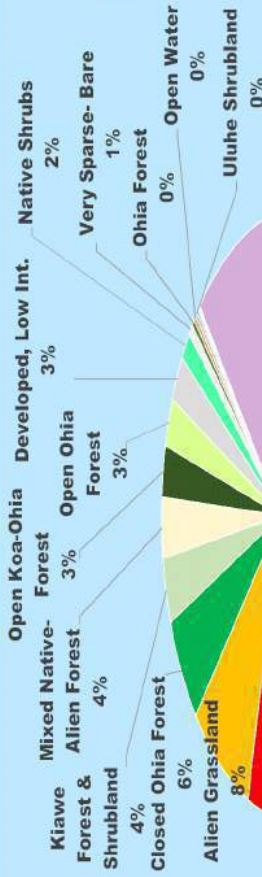


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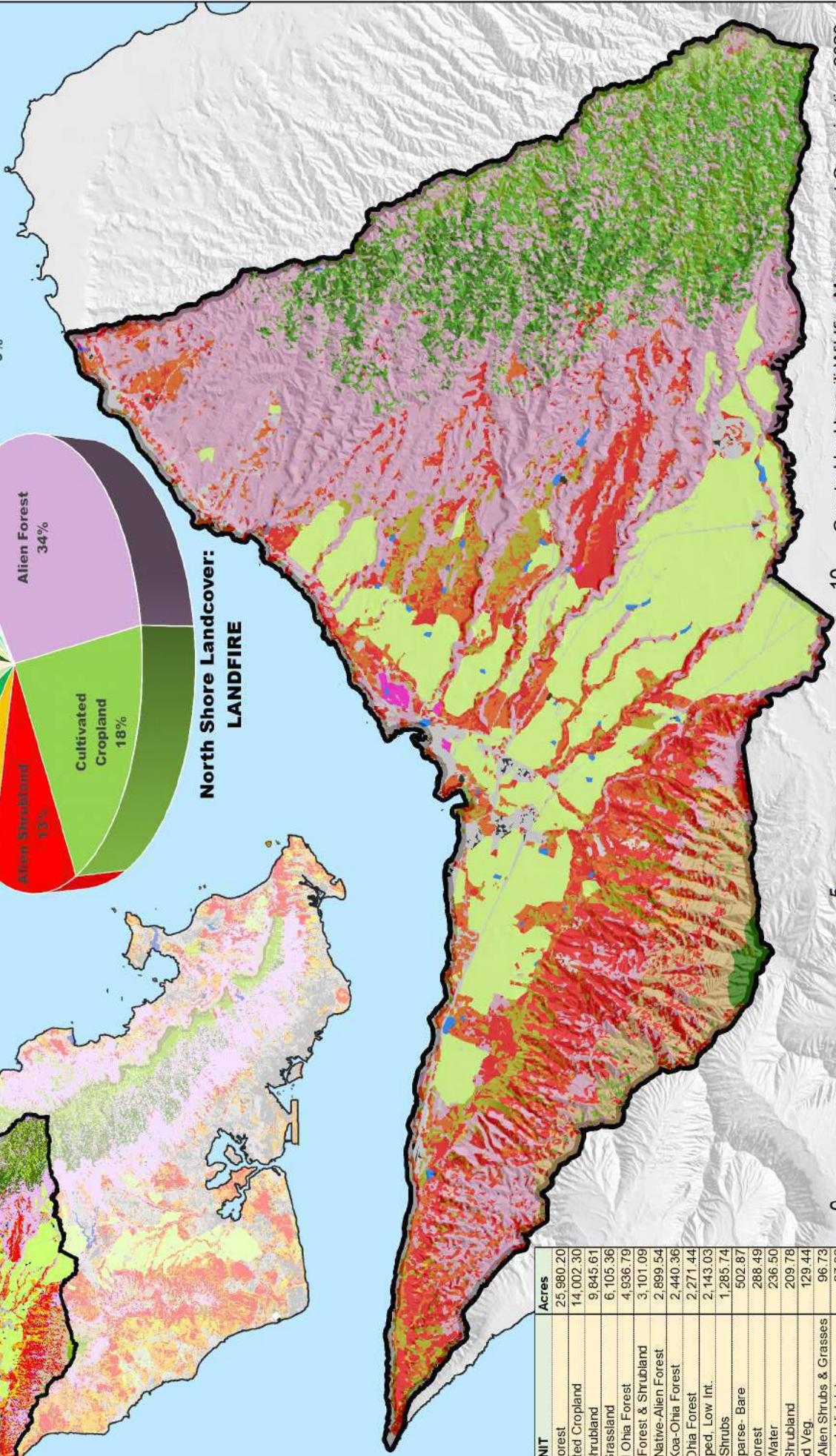
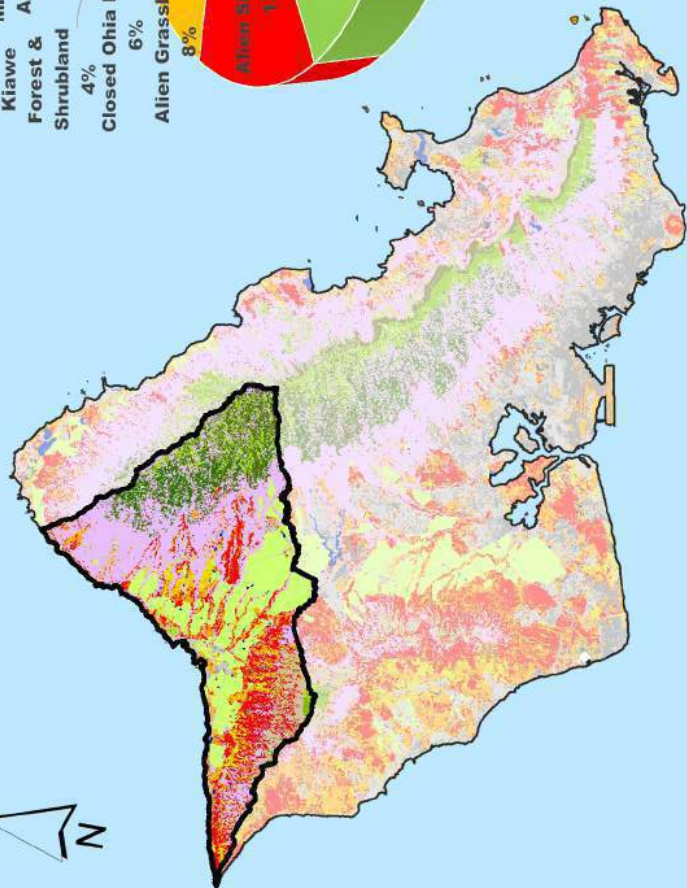


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North Shore CWPP: Fire Environment - Fuel Type



North Shore Landcover: LANDFIRE

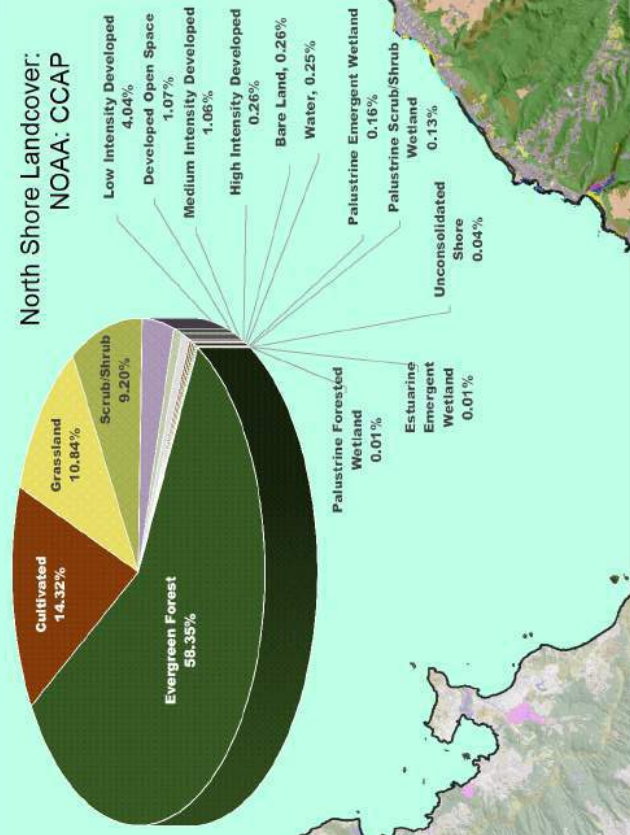


MAPUNIT	Acres
Alien Forest	25,980.20
Cultivated Cropland	14,002.30
Alien Shrubland	9,845.61
Alien Grassland	6,105.36
Closed Ohia Forest	4,936.79
Kiawe Forest & Shrubland	3,101.09
Mixed Native-Alien Forest	2,899.54
Open Koa-Ohia Forest	2,440.36
Open Ohia Forest	2,271.44
Developed, Low Int.	2,143.03
Native Shrubs	1,285.74
Very Sparse-Bare	502.87
Ohia Forest	288.49
Open Water	236.50
Uluhe Shrubland	209.78
Wetland Veg.	129.44
Native-Alien Shrubs & Grasses	96.73
Developed, High Int.	87.30
Undefined	29.75
Unk. Forest	29.12
Unk. Shrubland	13.75

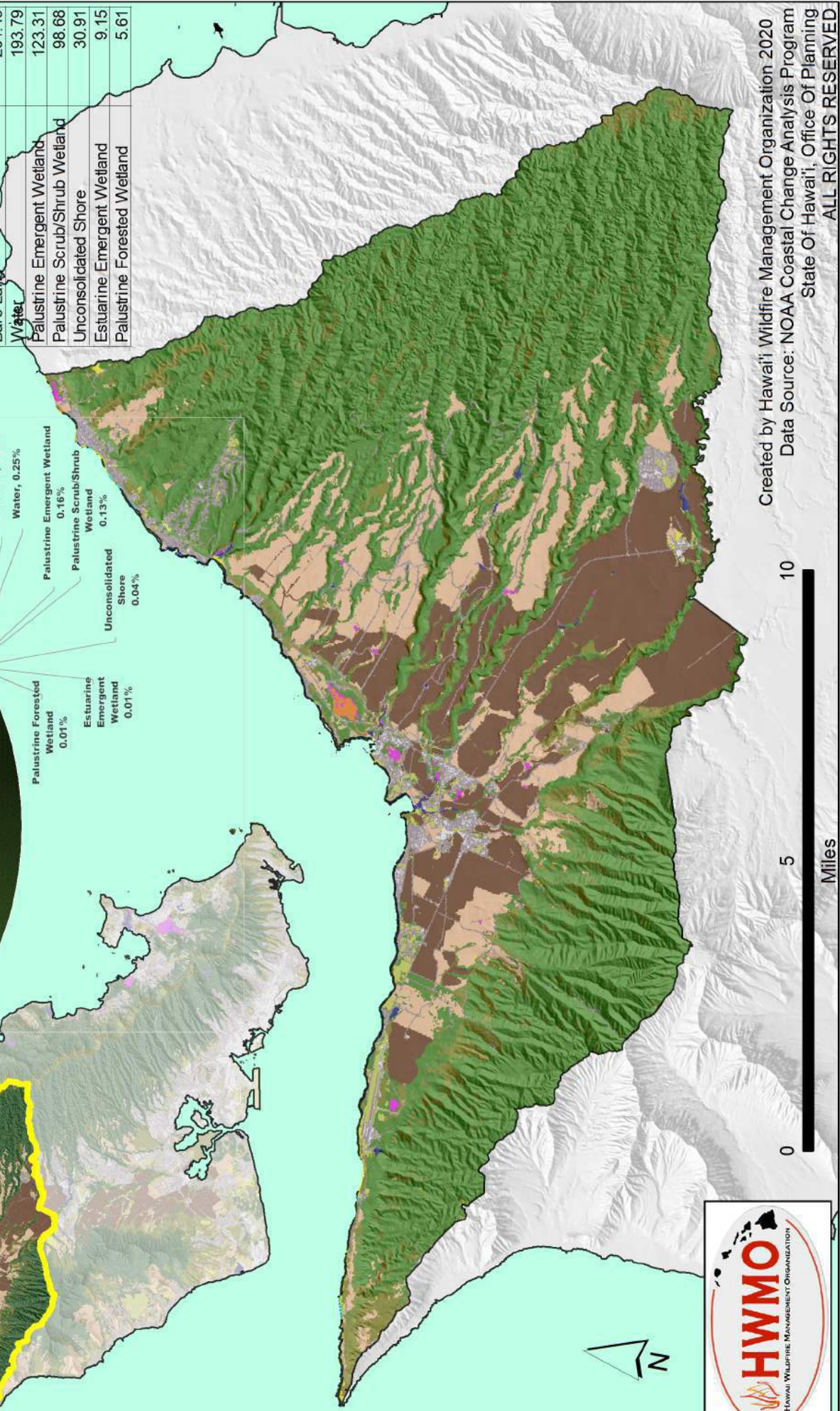
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North Shore CWPP: Fire Environment - Fuel Type

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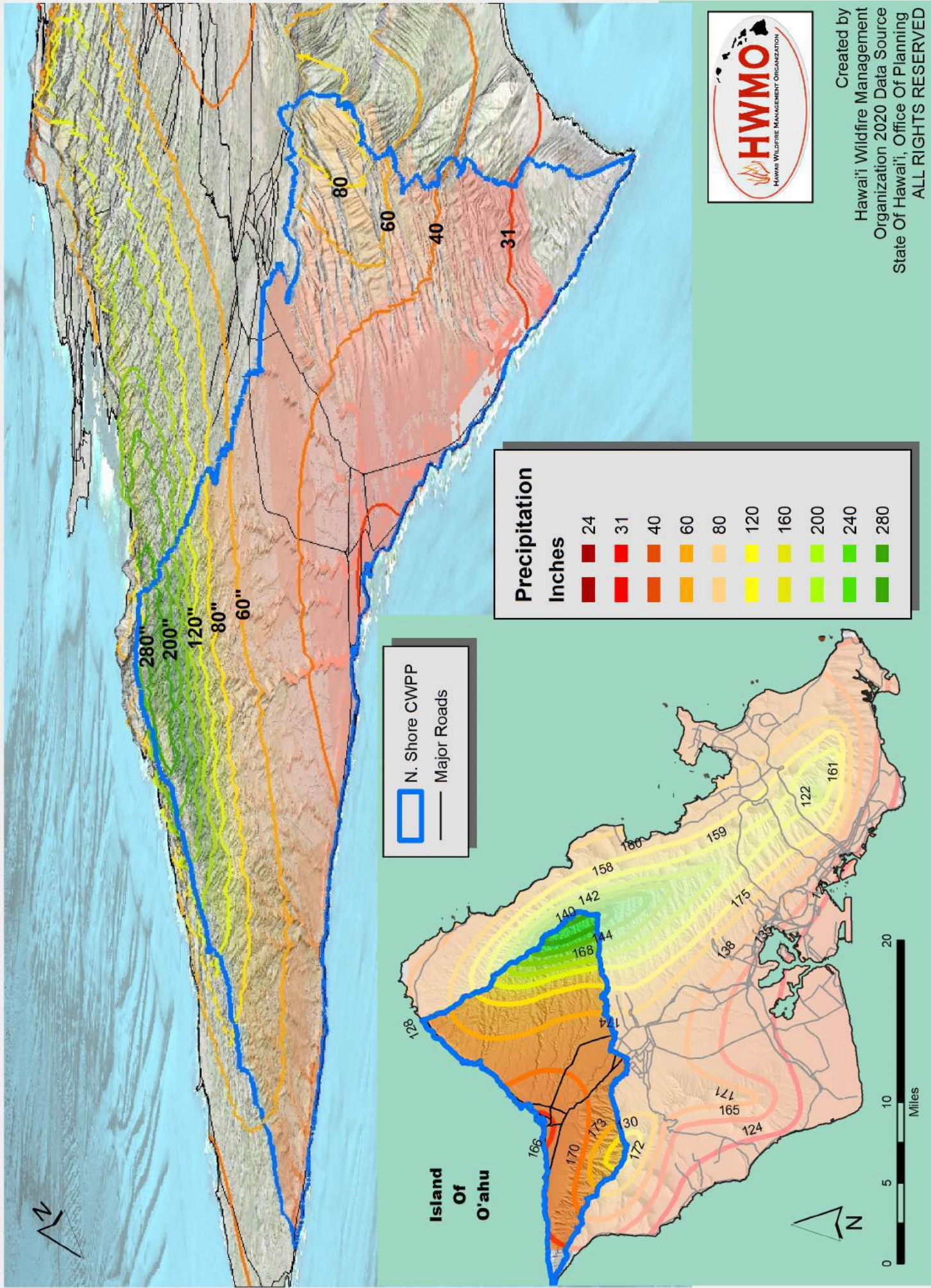


Landcover	Acres
Evergreen Forest	44,713.61
Cultivated	10,969.83
Grassland	8,308.04
Scrub/Shrub	7,046.70
Low Intensity Developed	3,099.39
Developed Open Space	817.54
Medium Intensity Developed	810.43
High Intensity Developed	201.68
Bare Land	201.49
Water	193.79
Palustrine Emergent Wetland	123.31
Palustrine Scrub/Shrub Wetland	98.68
Unconsolidated Shore	30.91
Estuarine Emergent Wetland	9.15
Palustrine Forested Wetland	5.61



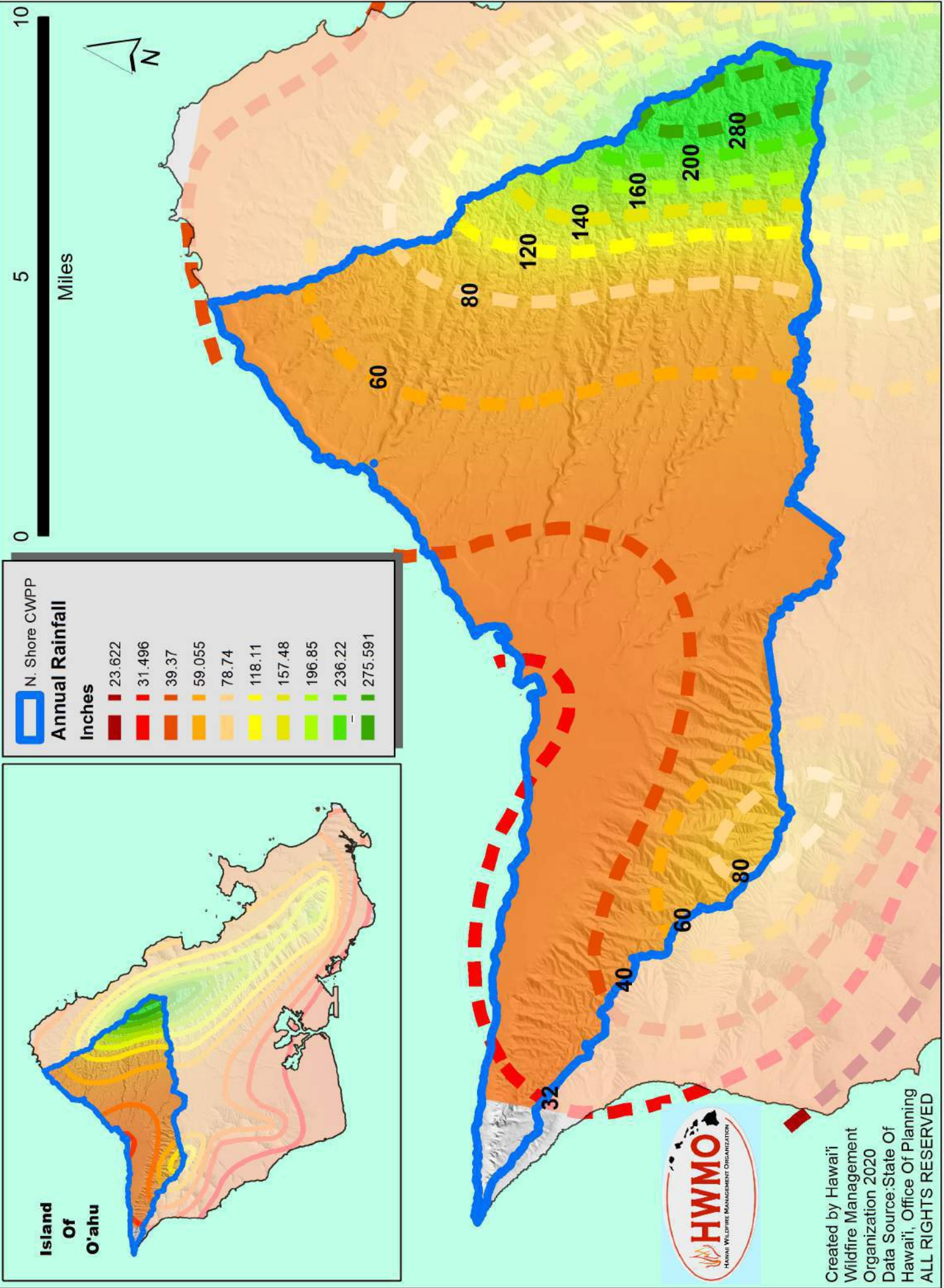
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North Shore CWPP: Fire Weather - Precipitation

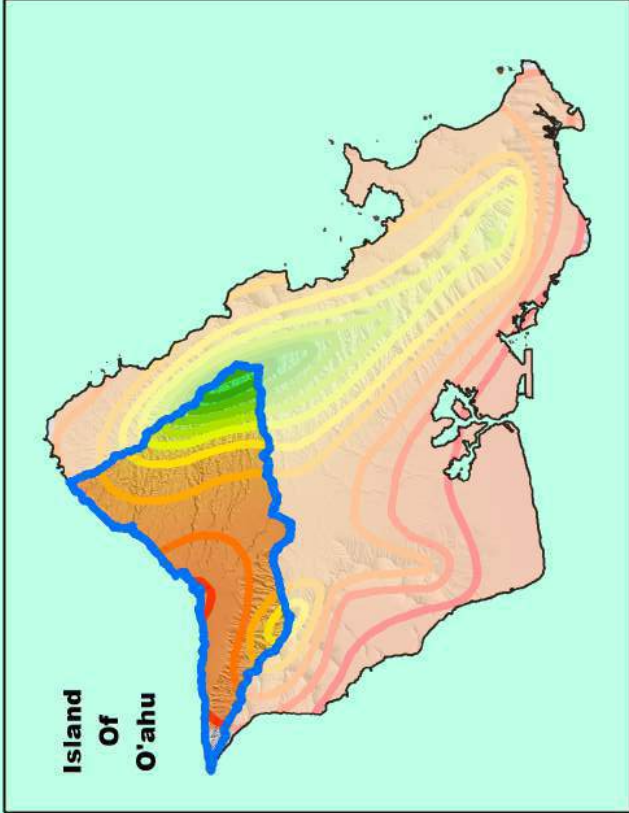


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 Organization 2020 Data Source
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North Shore CWPP: Fire Weather - Precipitation



N. Shore CWPP	
Annual Rainfall	
Inches	Color
23.622	Dark Red
31.496	Red
39.37	Orange-Red
59.055	Orange
78.74	Light Orange
118.11	Yellow-Orange
157.48	Yellow
196.85	Light Green
236.22	Green
275.591	Dark Green



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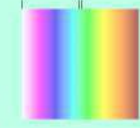
North Shore CWPP: Fire Weather - Relative Humidity



N. Shore CWPP

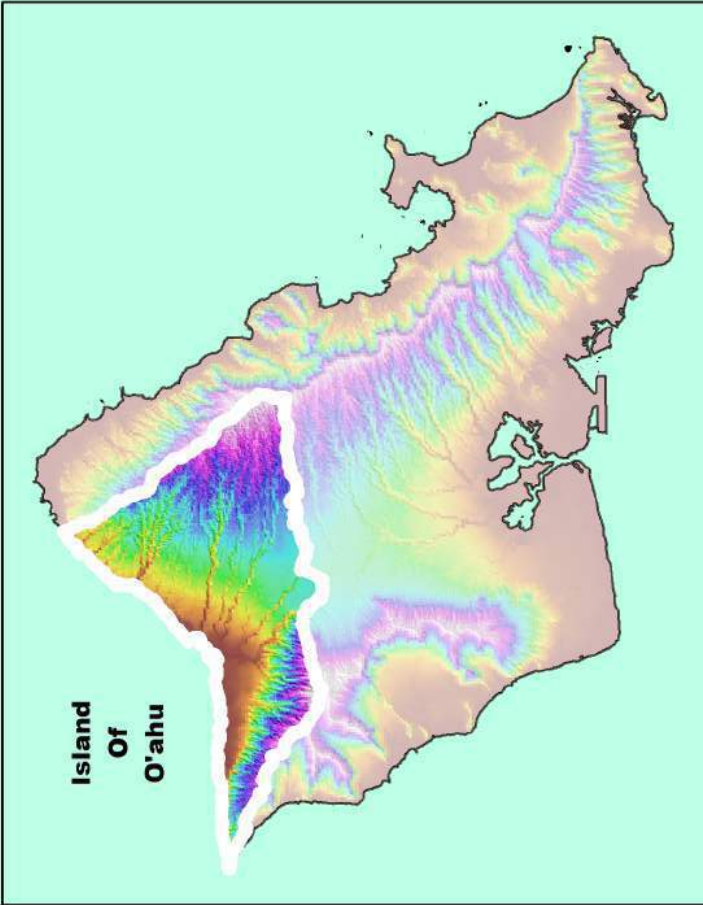
Relative Humidity

%

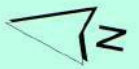
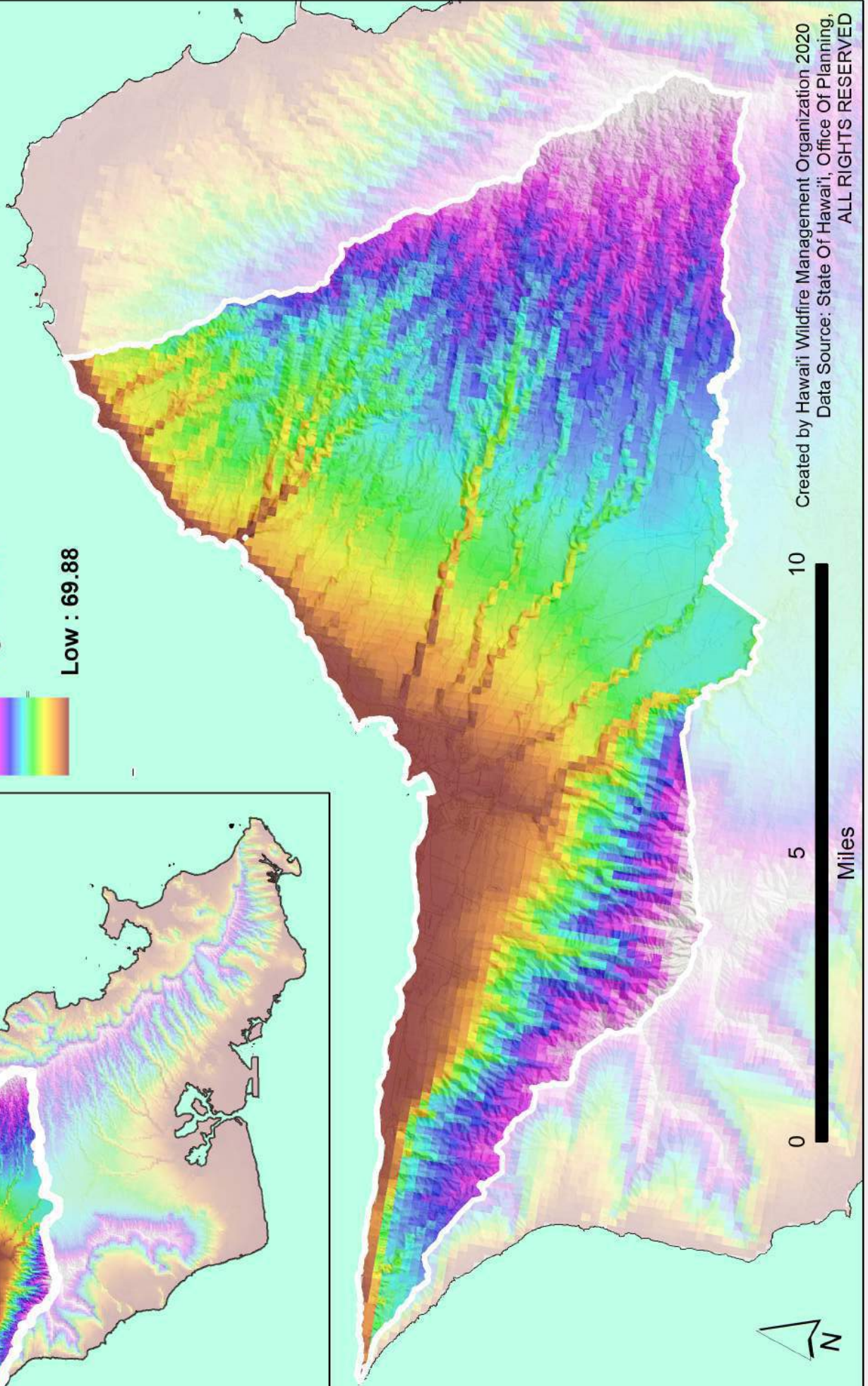


High : 86.32

Low : 69.88



Island
Of
O'ahu



0

5

10

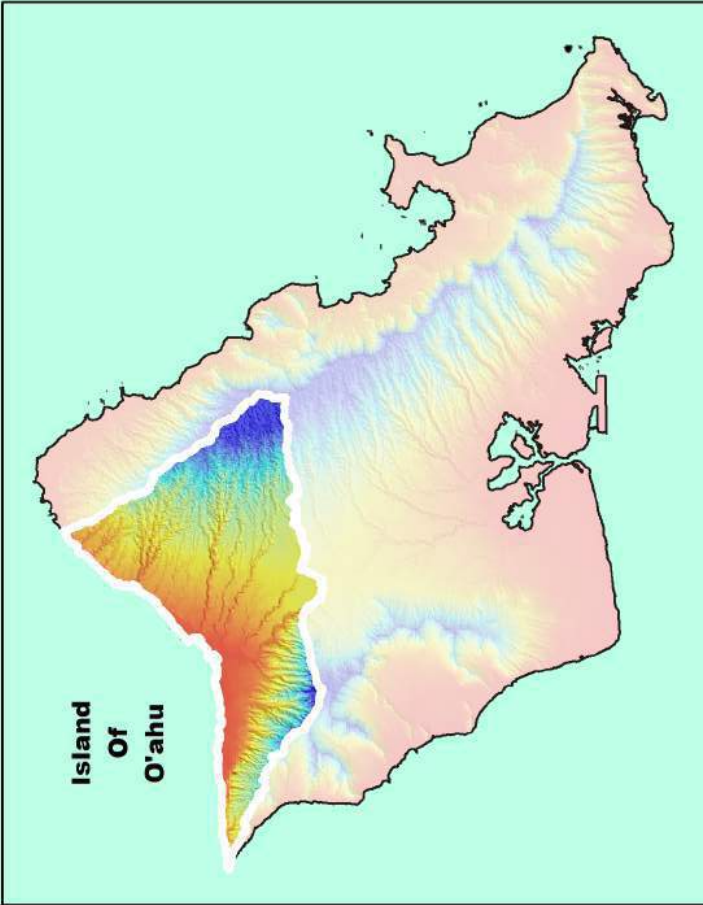
Miles

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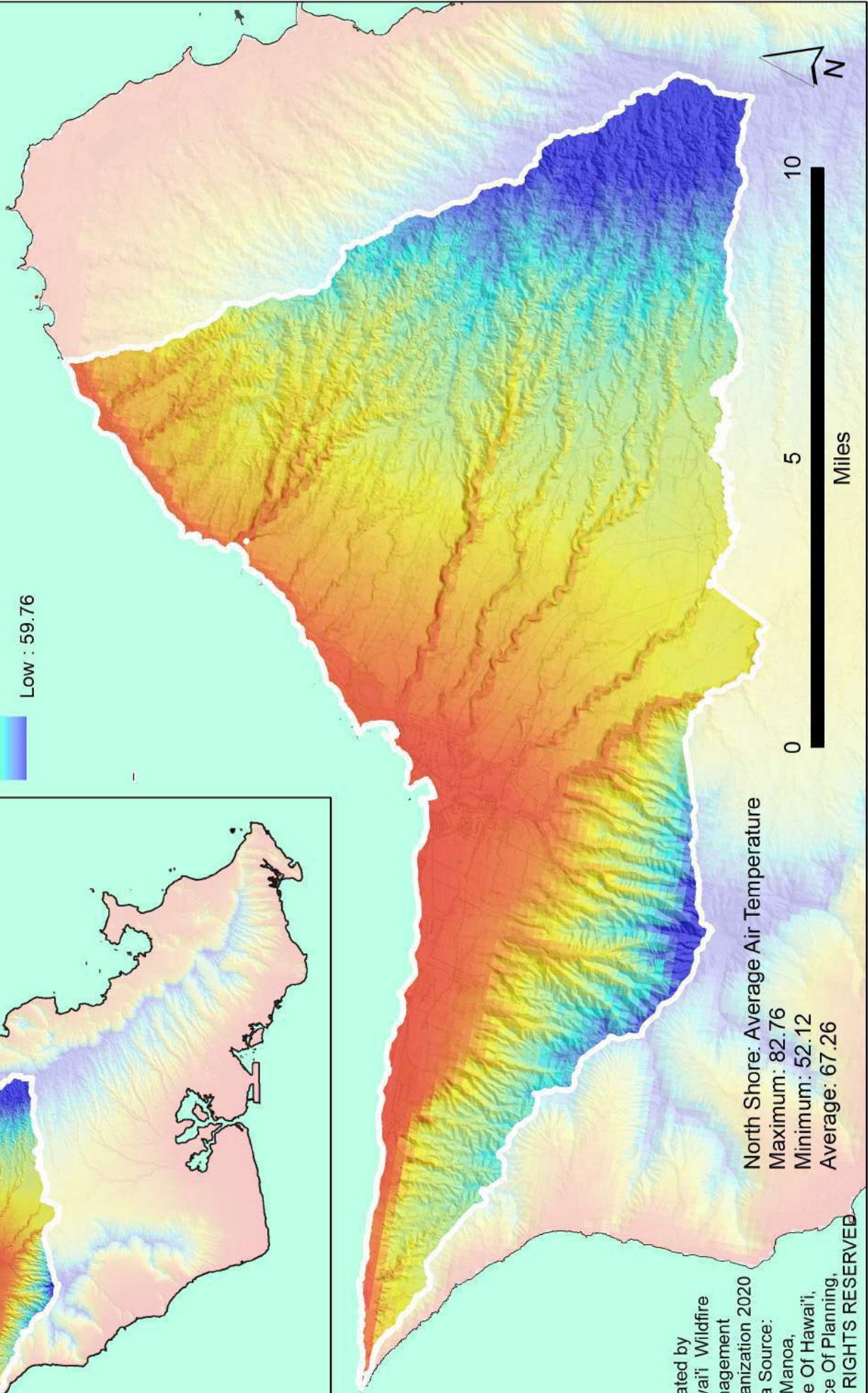
North Shore CWPP: Fire Weather - Air Temperature



N. Shore CWPP
O'ahu Air Temp.
Degrees °C
High : 74.84
Low : 59.76



Island
Of
O'ahu

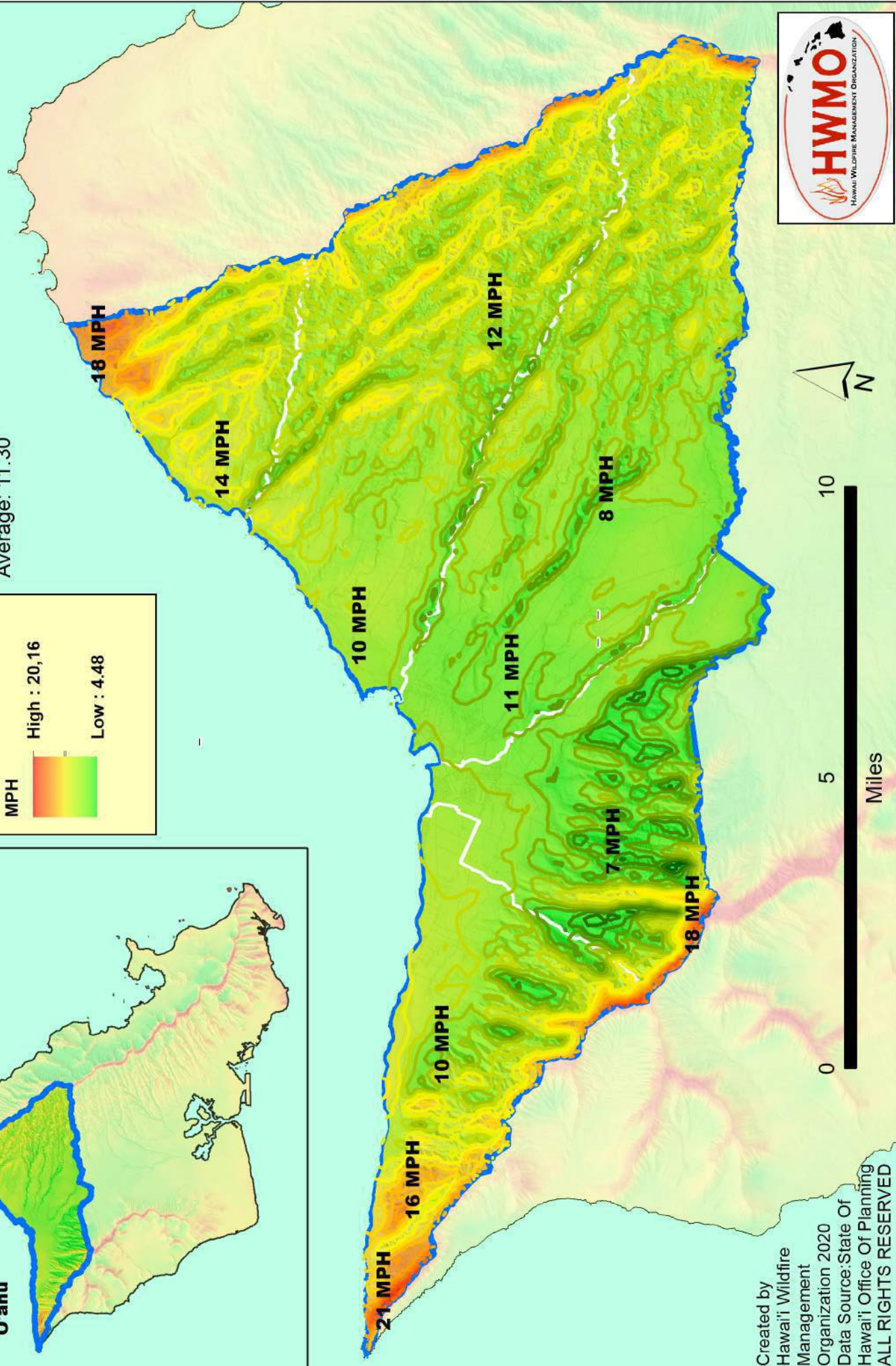
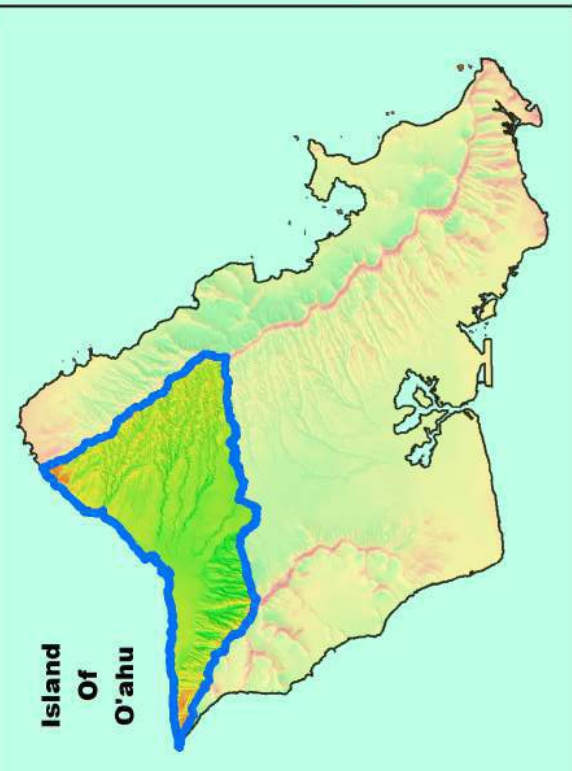
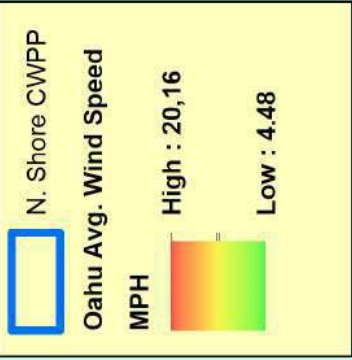


North Shore: Average Air Temperature
Maximum: 82.76
Minimum: 52.12
Average: 67.26

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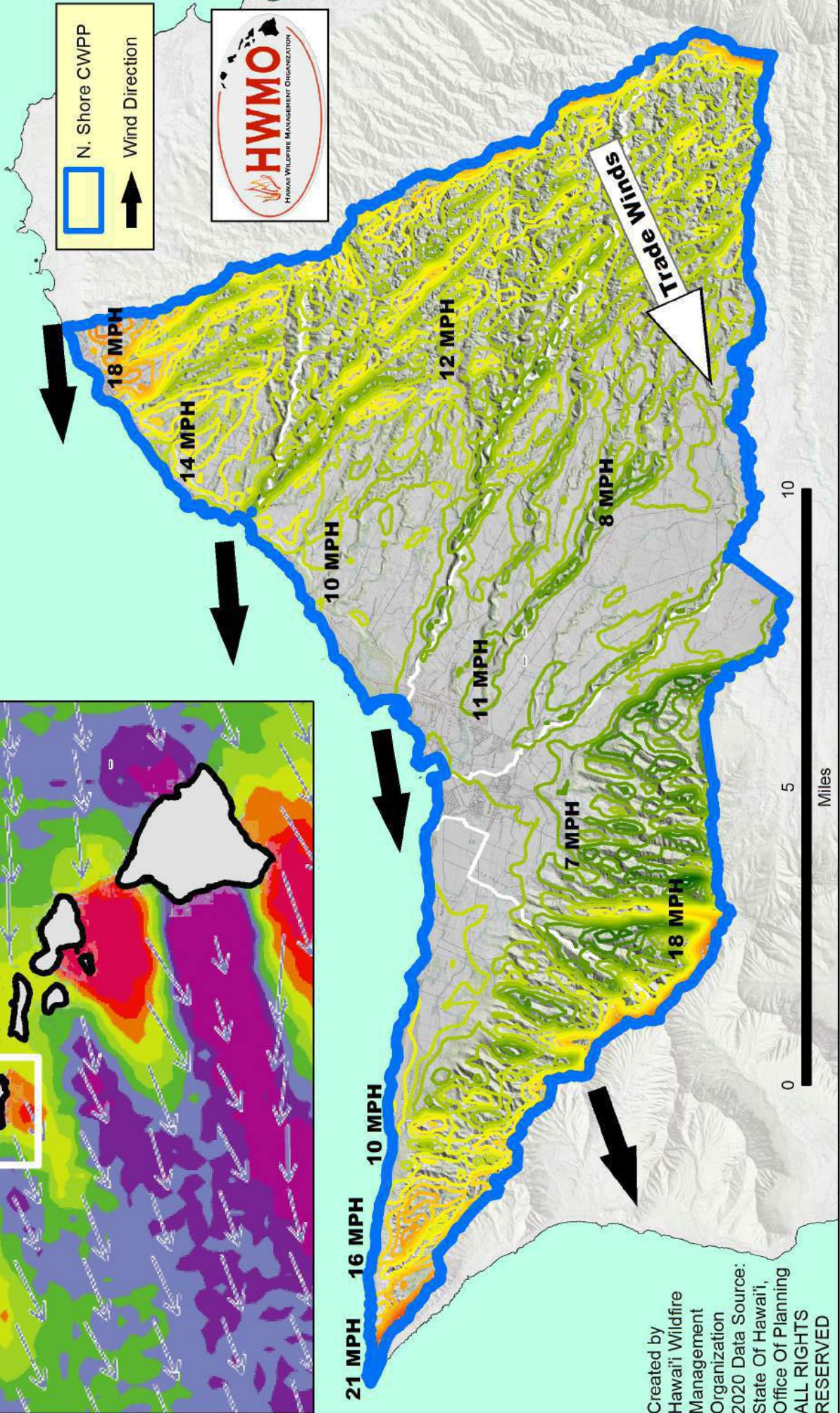
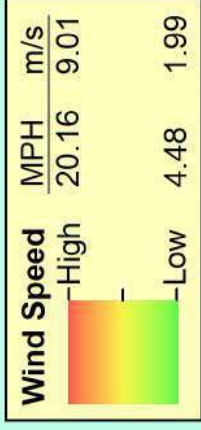
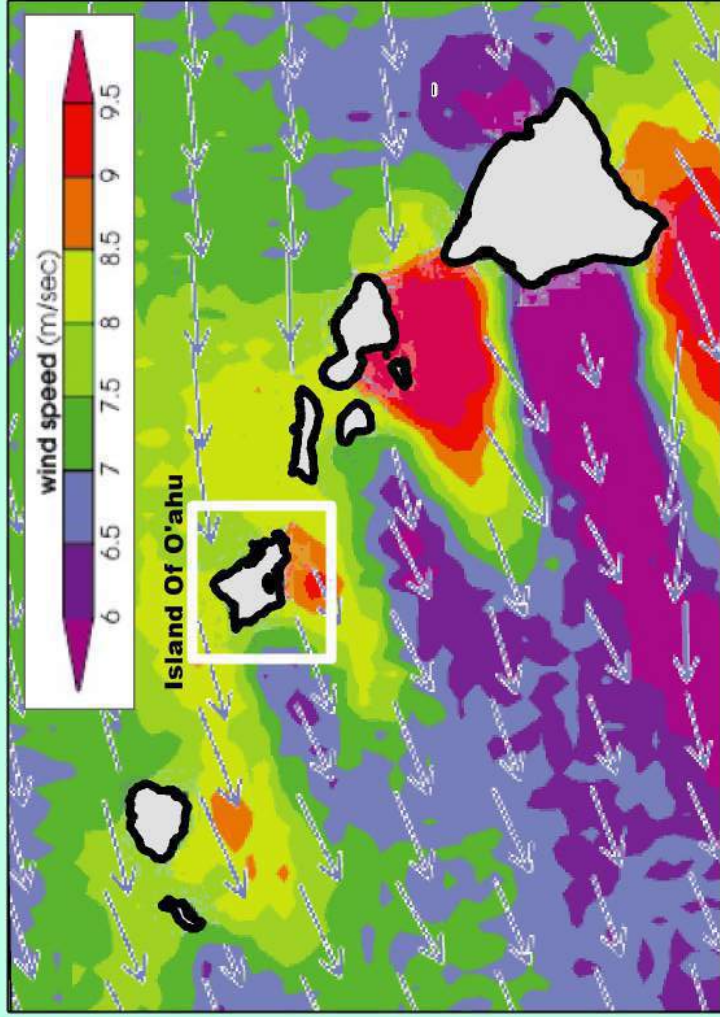
North Shore CWPP: Fire Weather - Wind Speed

North Shore: Average Wind Speed (MPH)
 Maximum: 21.25
 Minimum: 4.47
 Average: 11.30



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North Shore CWPP: Fire Weather - Dominant Wind Speed & Direction

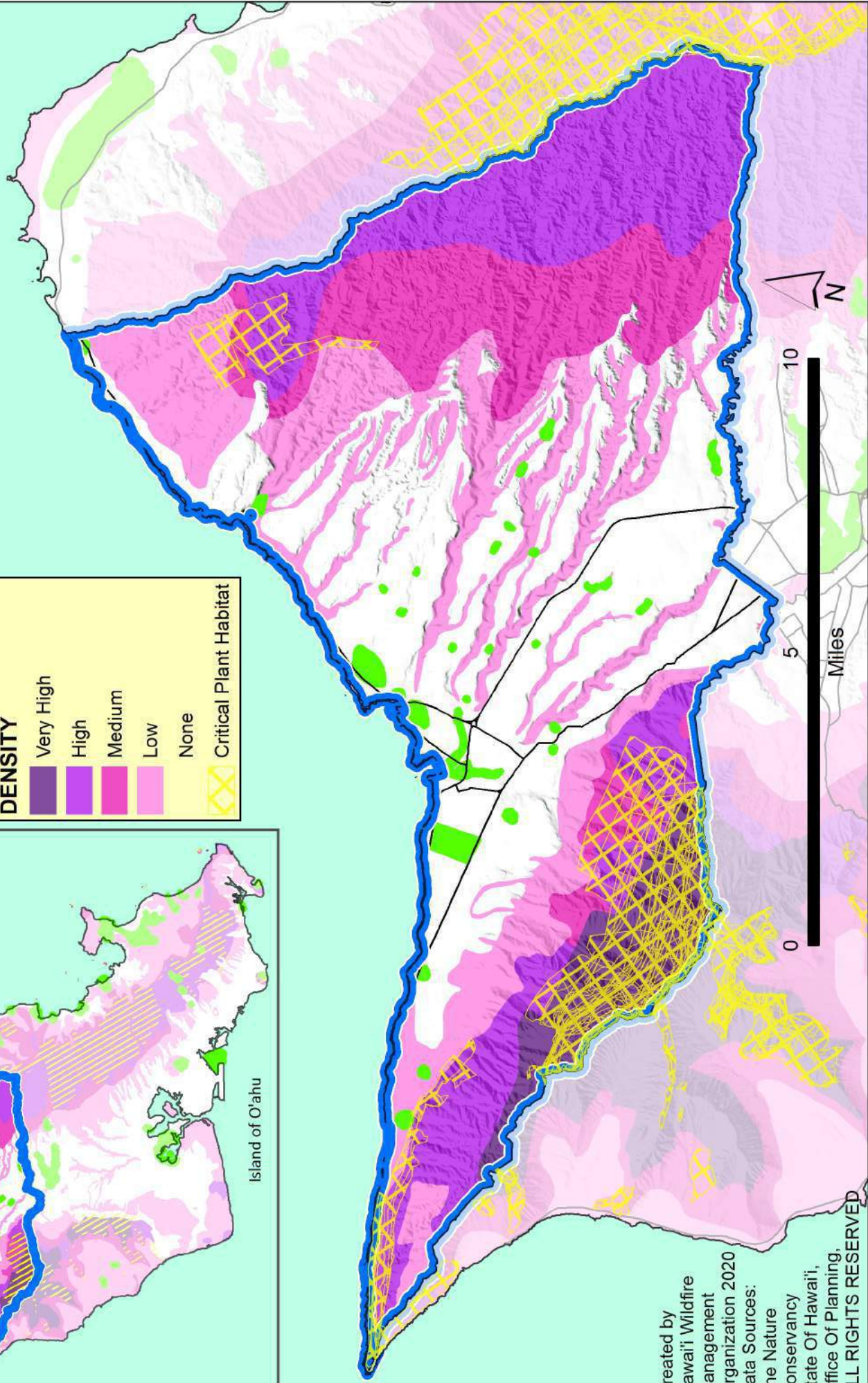
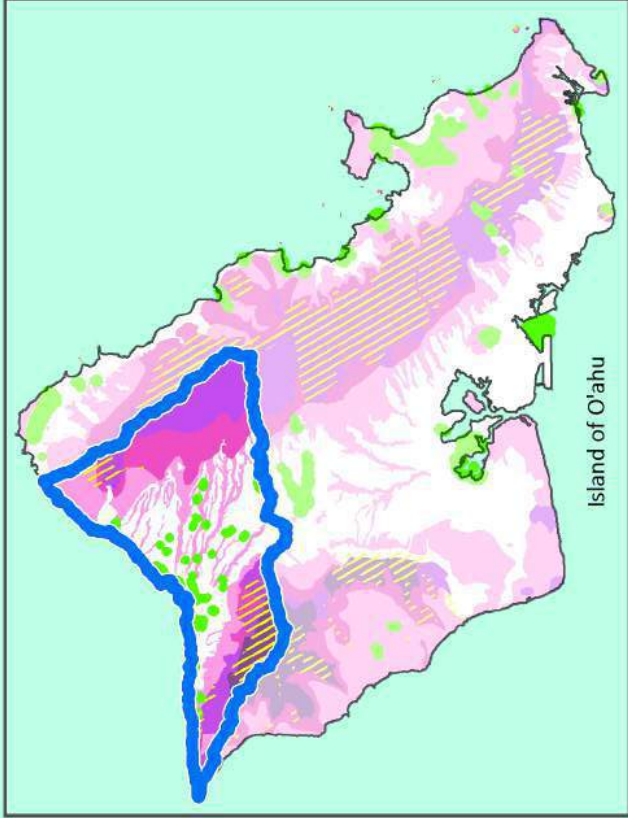


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North Shore CWPP: Threatened and Endangered Species Density



NS CWPP
 Major Roads
 Waterbird Hab.
T&E Plant
DENSITY
 Very High
 High
 Medium
 Low
 None
 Critical Plant Habitat



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 Conservancy
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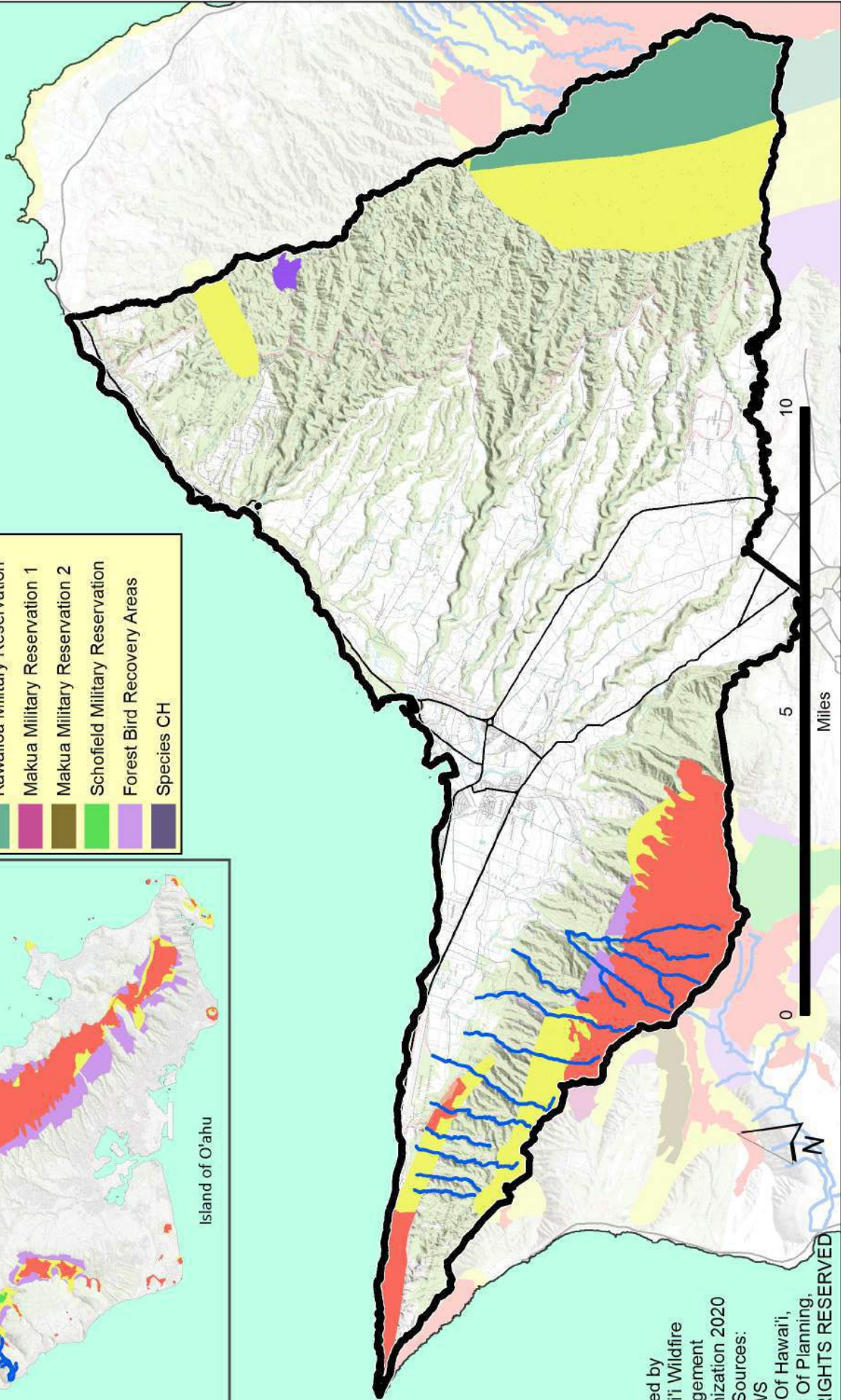
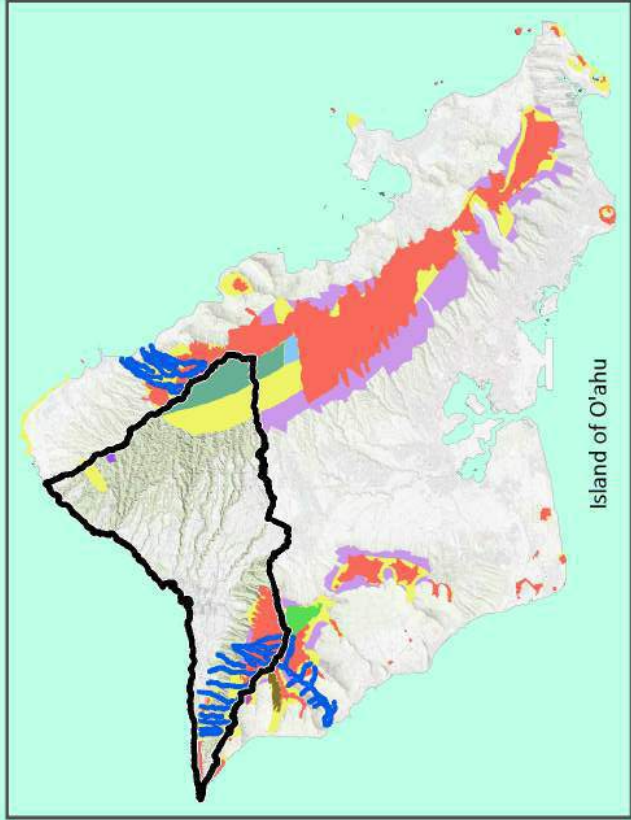
North Shore CWPP: USFWS - Strategic Plan Landscapes & Streams - Habitat Types



NS CWPP
 Strategic Plan Streams
 Major Roads

Hab Type

	Ecosystem CH
	Essential
	Dillingham Military Reservation
	East Range Military Reservation
	Kahuku Military Reservation
	Kawailoa Military Reservation
	Makua Military Reservation 1
	Makua Military Reservation 2
	Schofield Military Reservation
	Forest Bird Recovery Areas
	Species CH

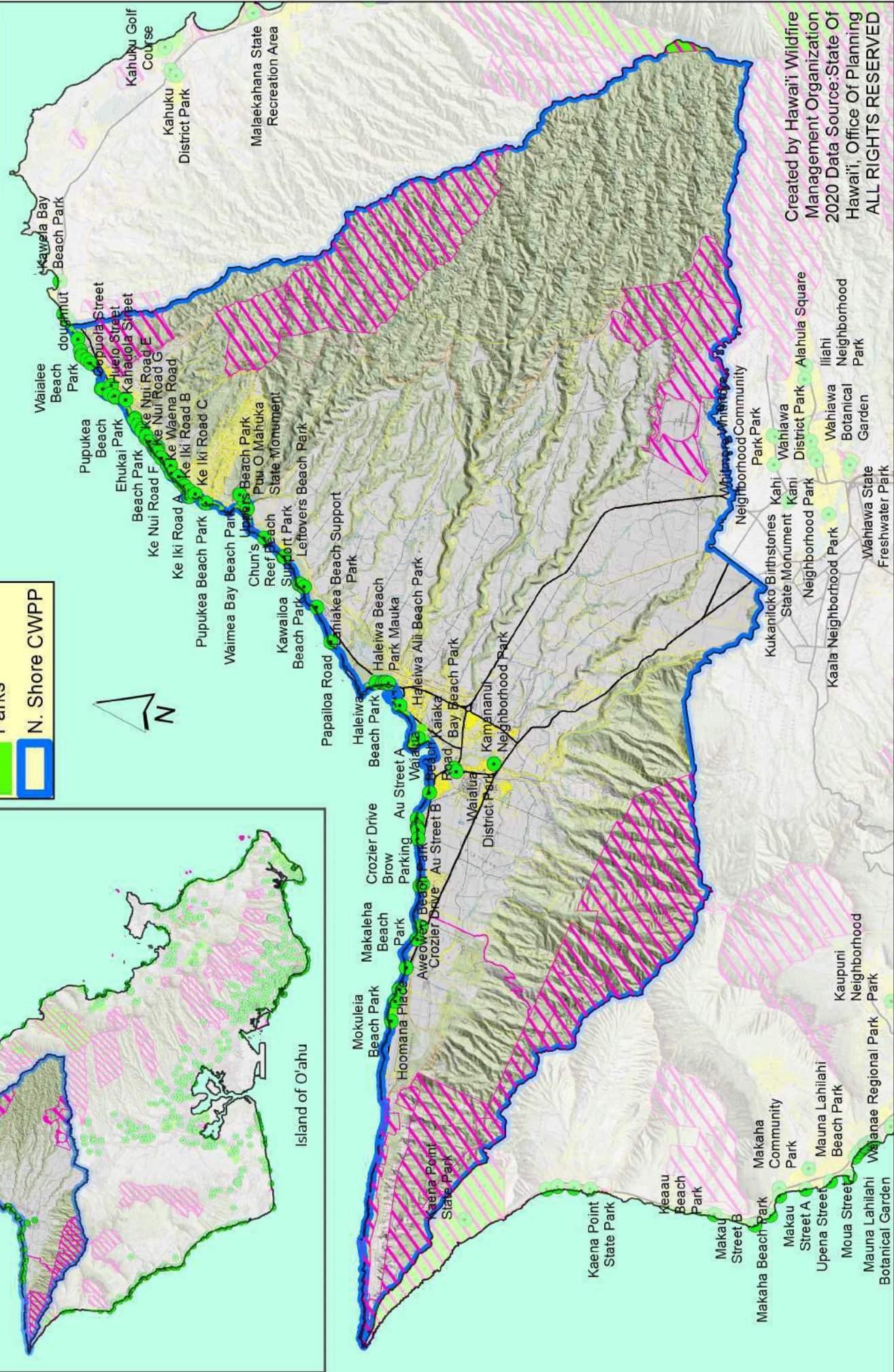
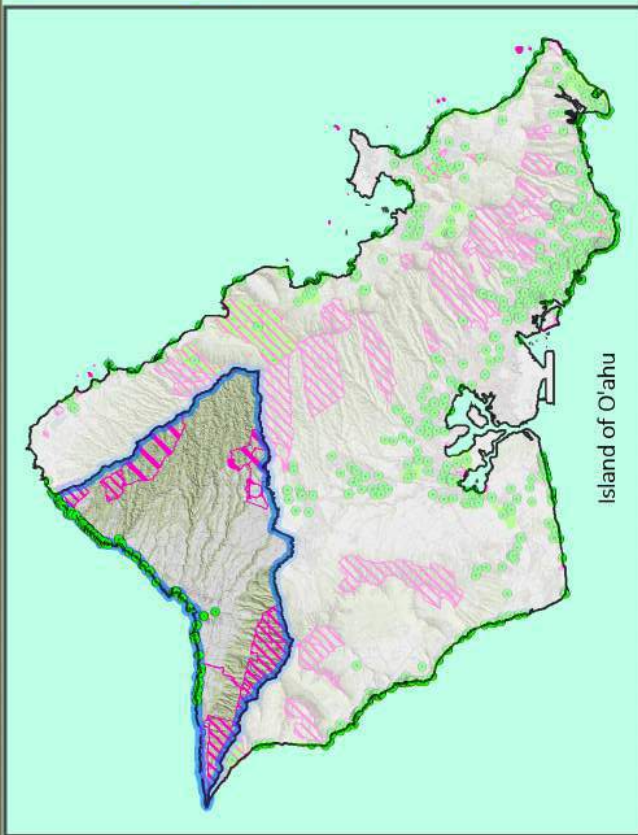
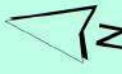


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 Data Sources:
 USFWS
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North Shore CWPP: Values At Risk - Parks and Protected Areas

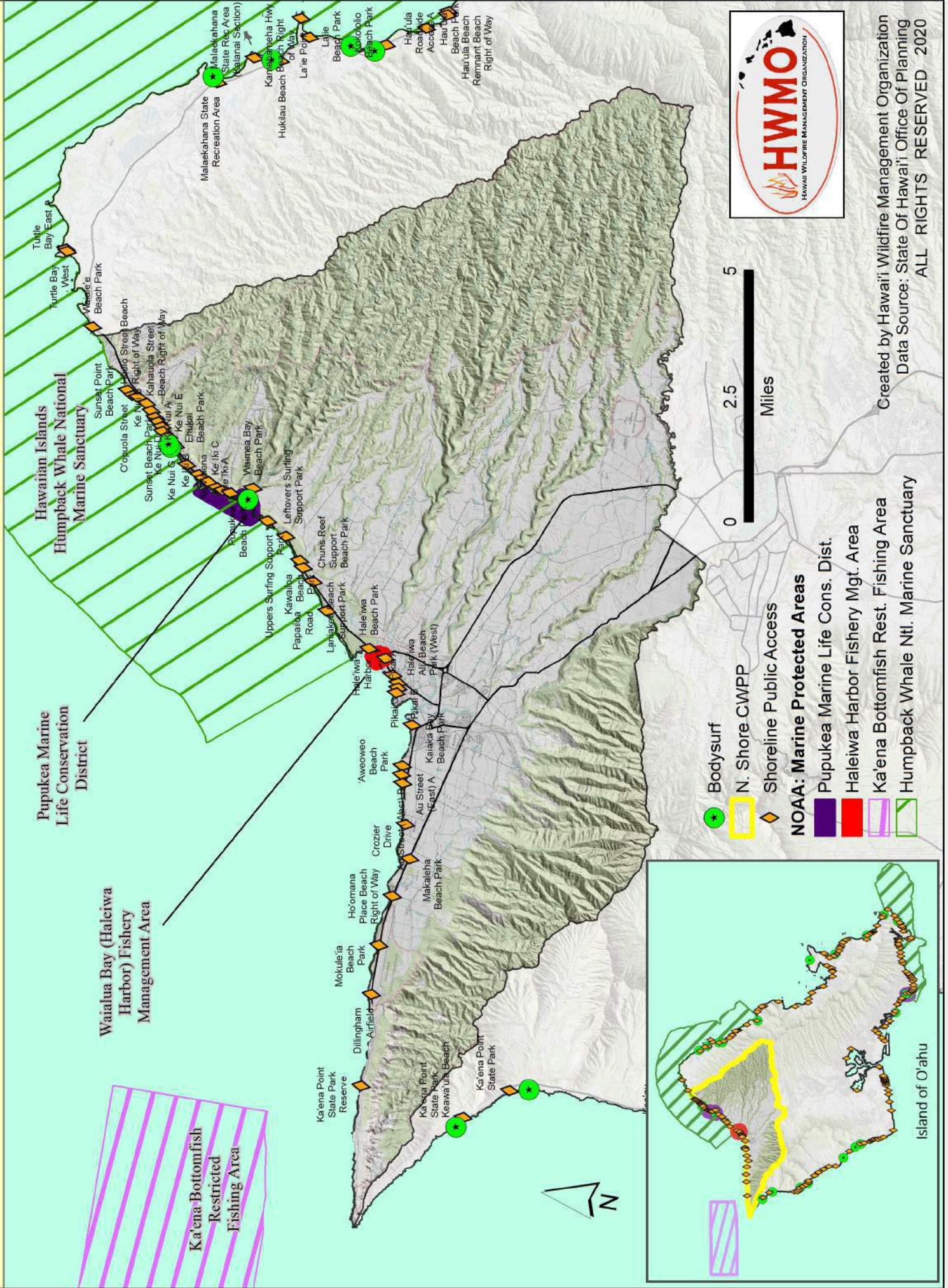


● Public Access
 Reserves
 Parks
 N. Shore CWPP



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North Shore CWPP: Marine and Coastal Resources



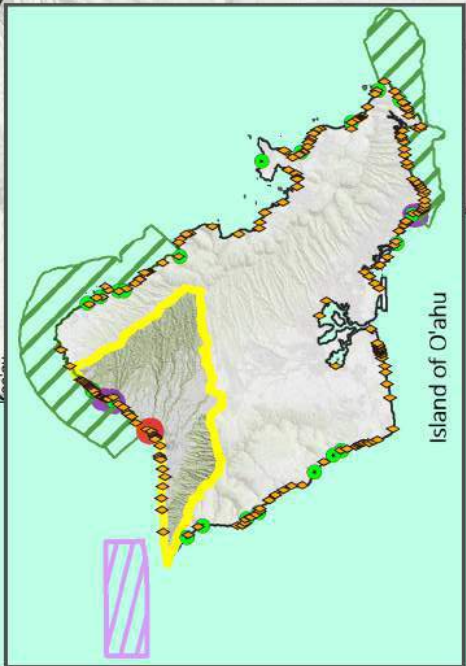
Pupukea Marine Life Conservation District

Waialua Bay (Haleiwa Harbor) Fishery Management Area

Hawaiian Islands Humpback Whale National Marine Sanctuary

Kaena Bottomfish Restricted Fishing Area

- Bodysurf
- N. Shore CWPP
- Shoreline Public Access
- NOAA: Marine Protected Areas
- Pupukea Marine Life Cons. Dist.
- Haleiwa Harbor Fishery Mgt. Area
- Ka'ena Bottomfish Rest. Fishing Area
- Humpback Whale Ntl. Marine Sanctuary

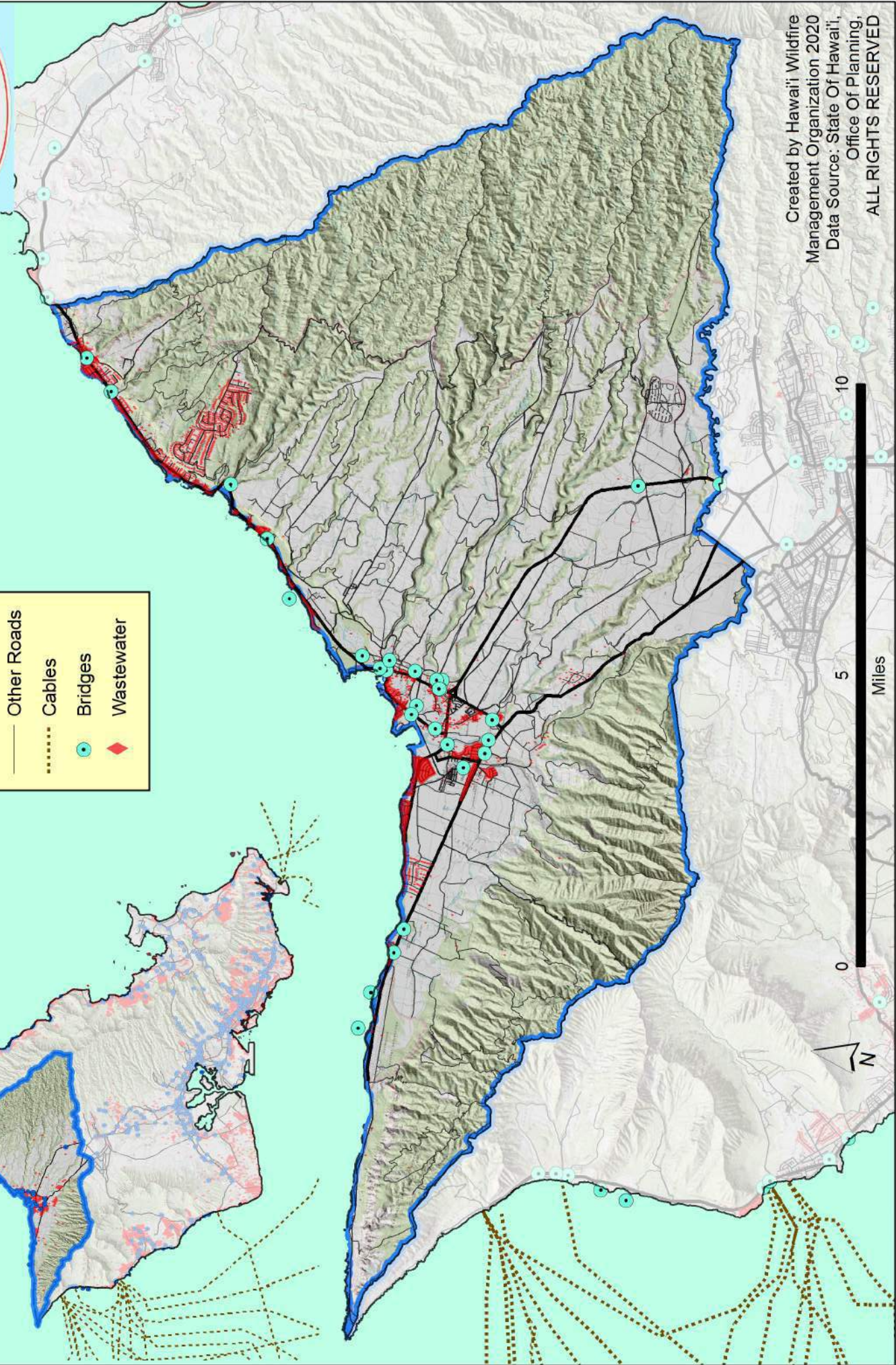
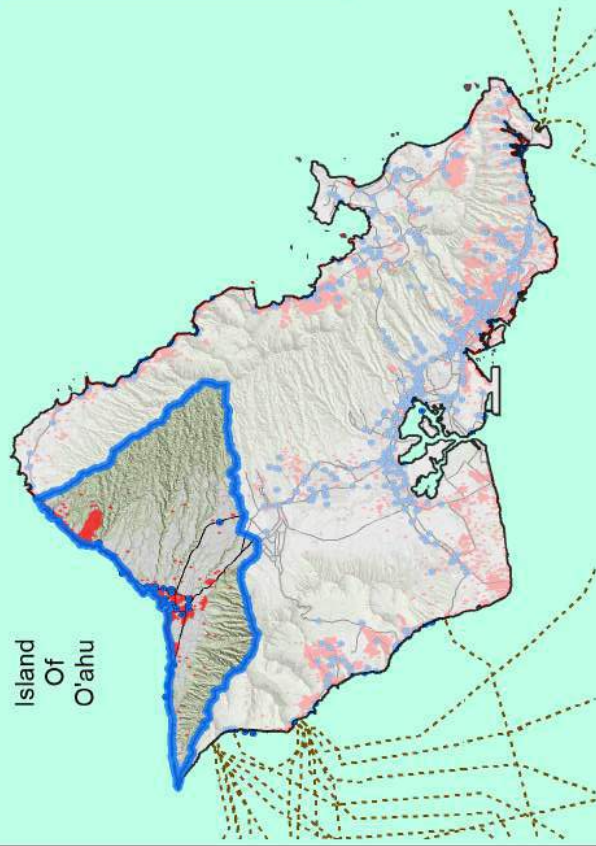


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North Shore CWPP: Values at Risk - Municipal Infrastructure



- NS CWPP
- Major Roads
- Other Roads
- Cables
- Bridges
- Wastewater

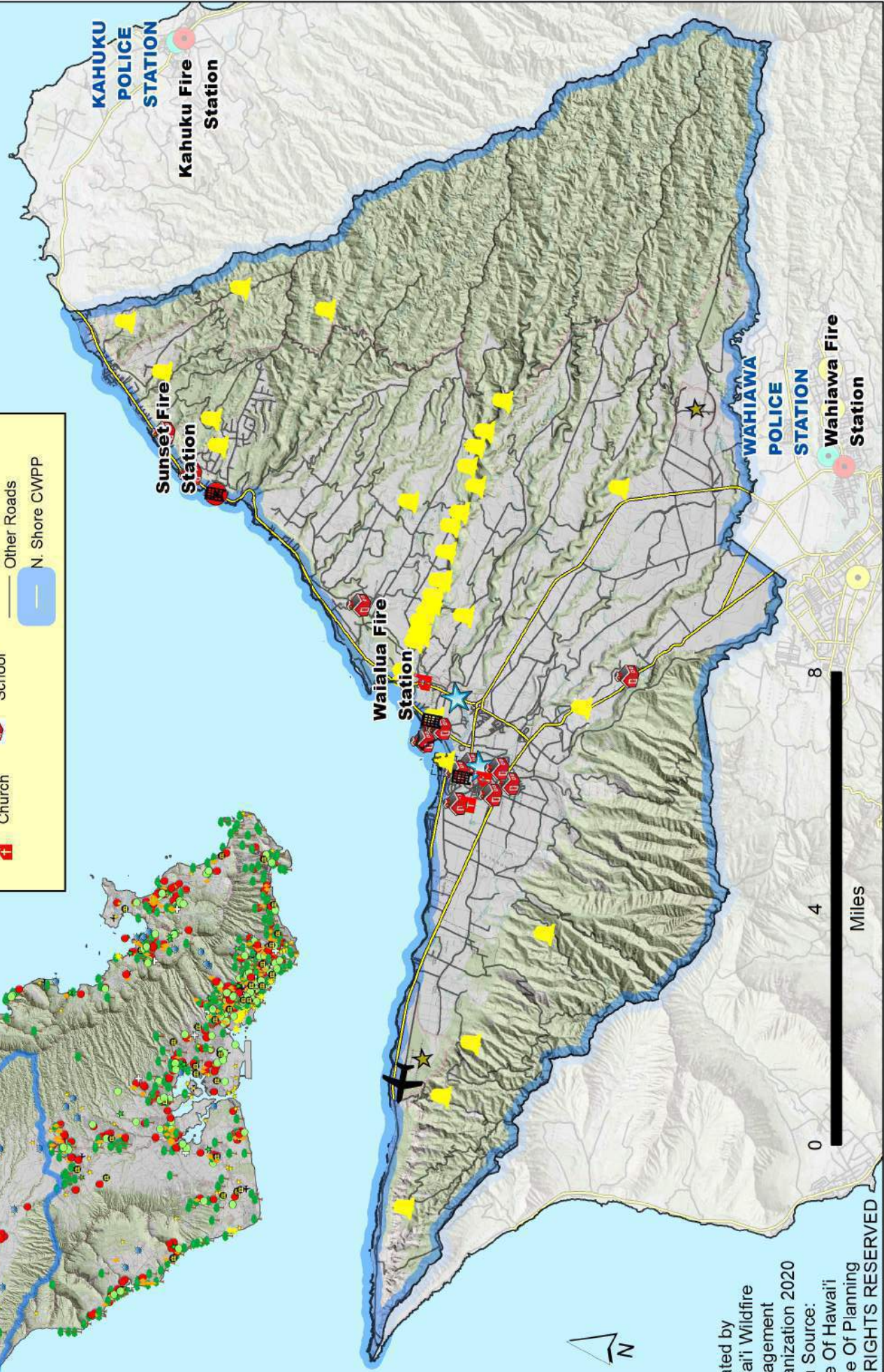
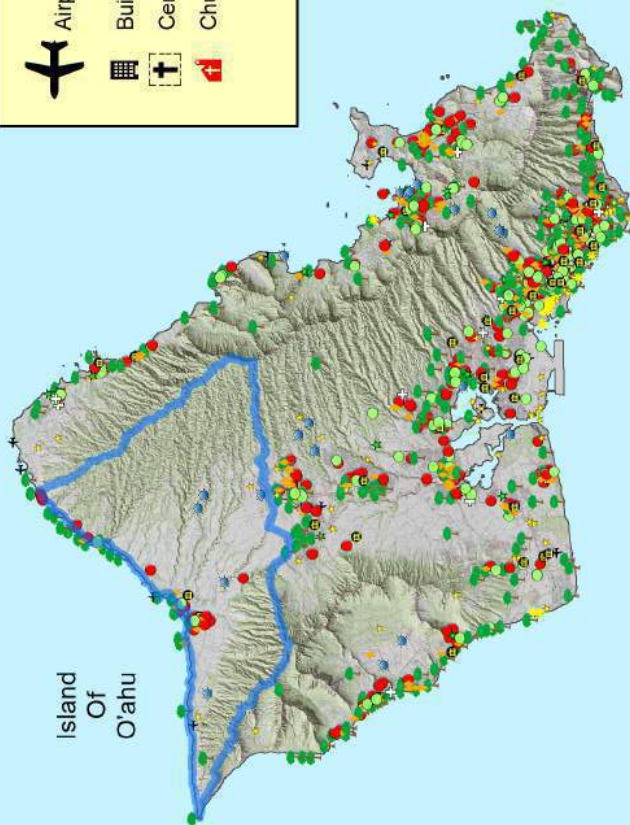


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North Shore CWPP: Values at Risk - Public Services

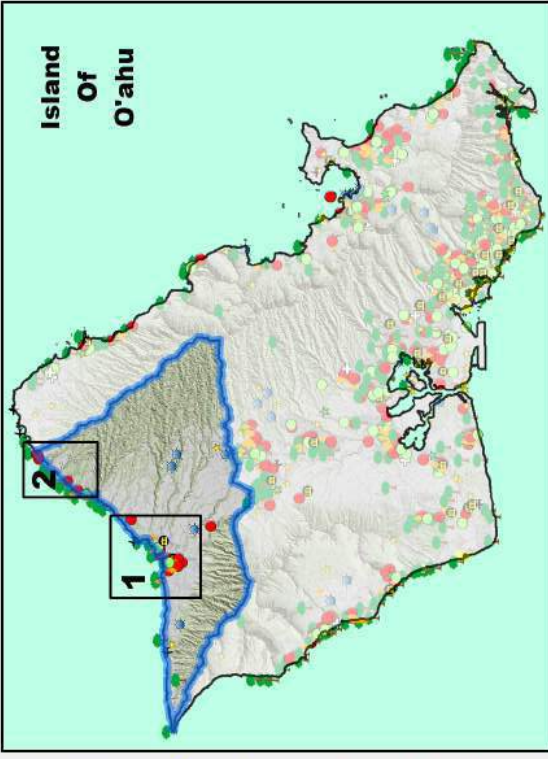
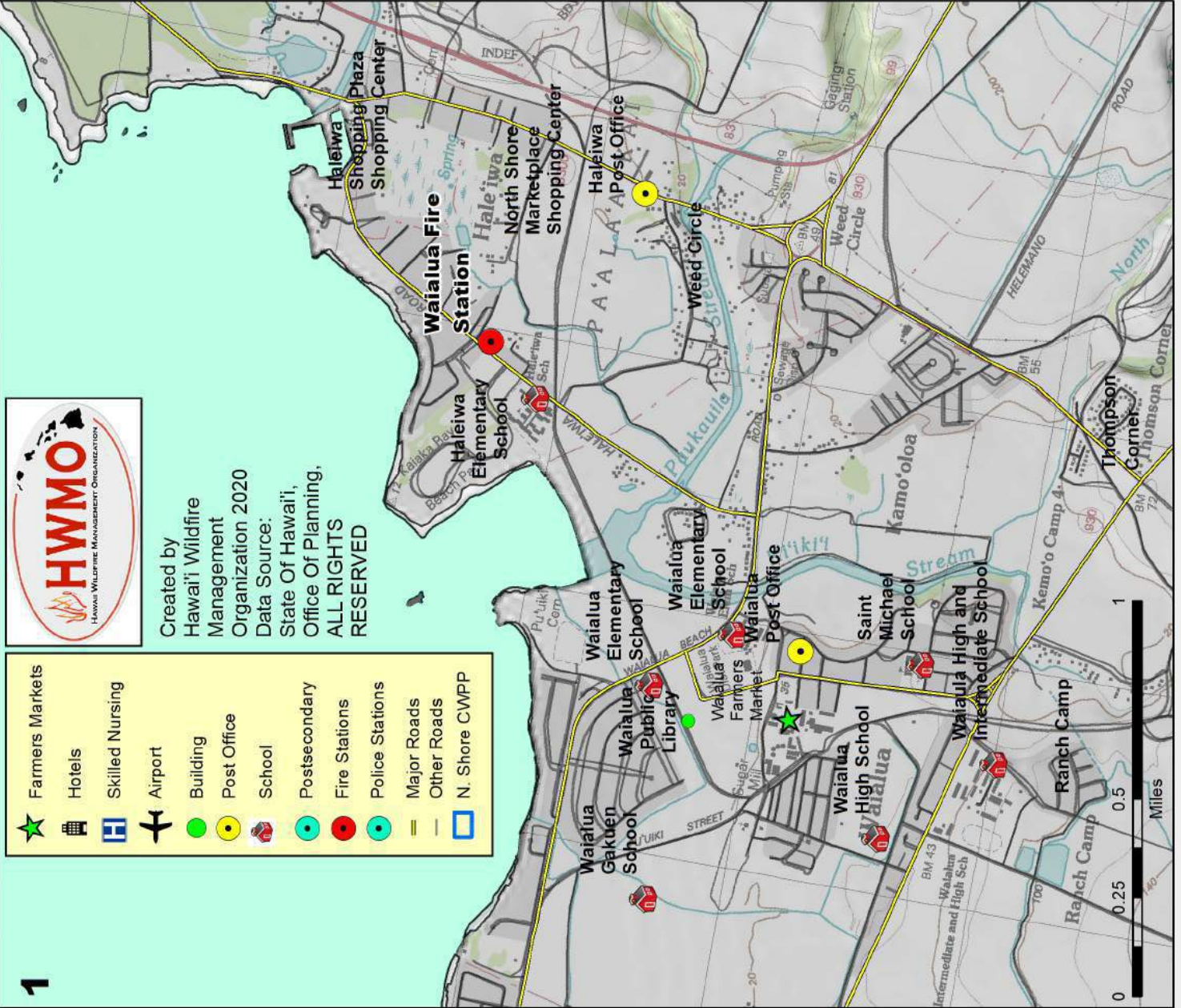


	Airport		Postsecondary Inst.
	Building		Fire Stations
	Cemetery		Police Stations
	Church		Major Roads
	Civil		Other Roads
	Military		N. Shore CWPP
	Post Office		
	School		



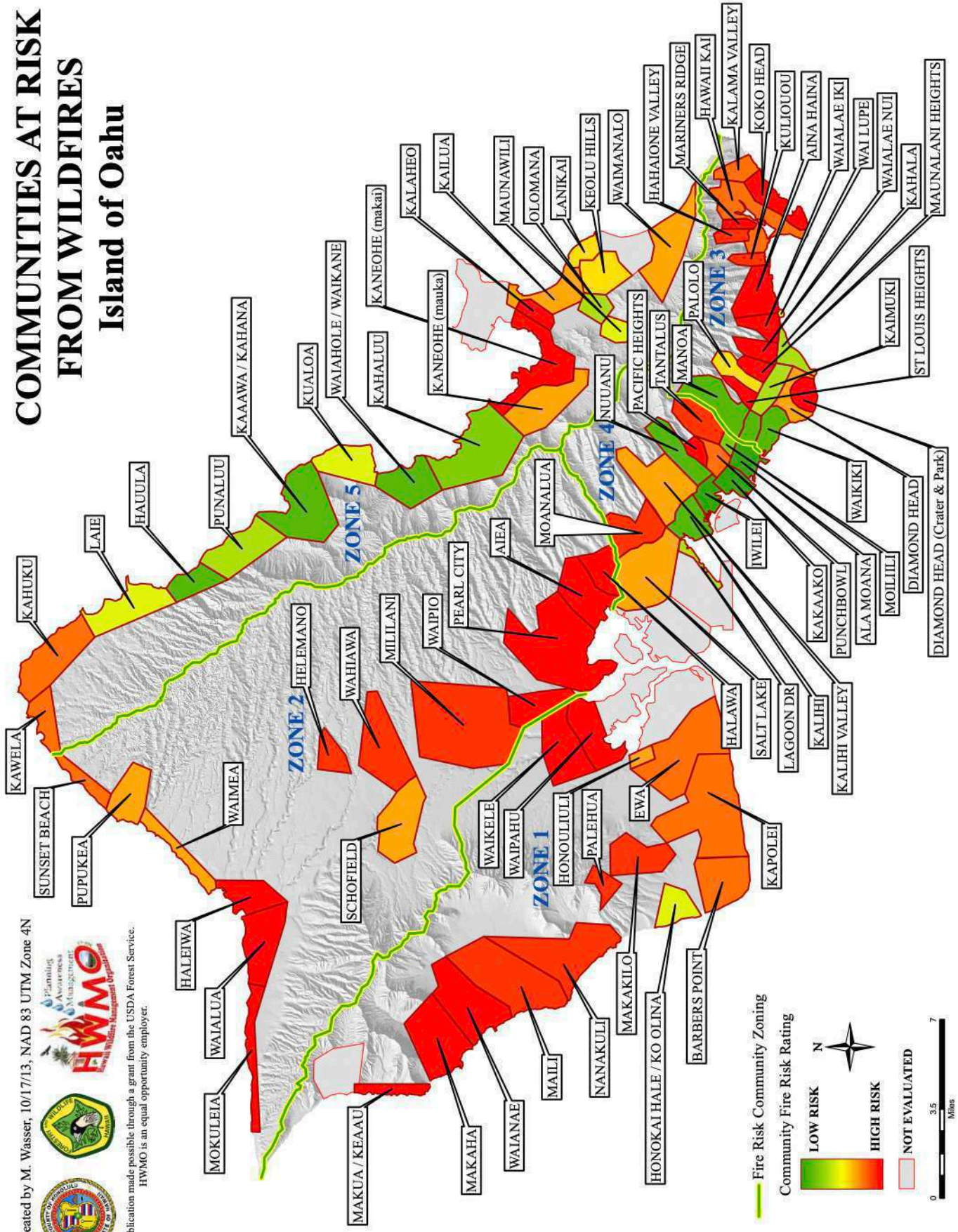
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North Shore CWPP: Values at Risk - Public Services



COMMUNITIES AT RISK FROM WILDFIRES

Island of Oahu

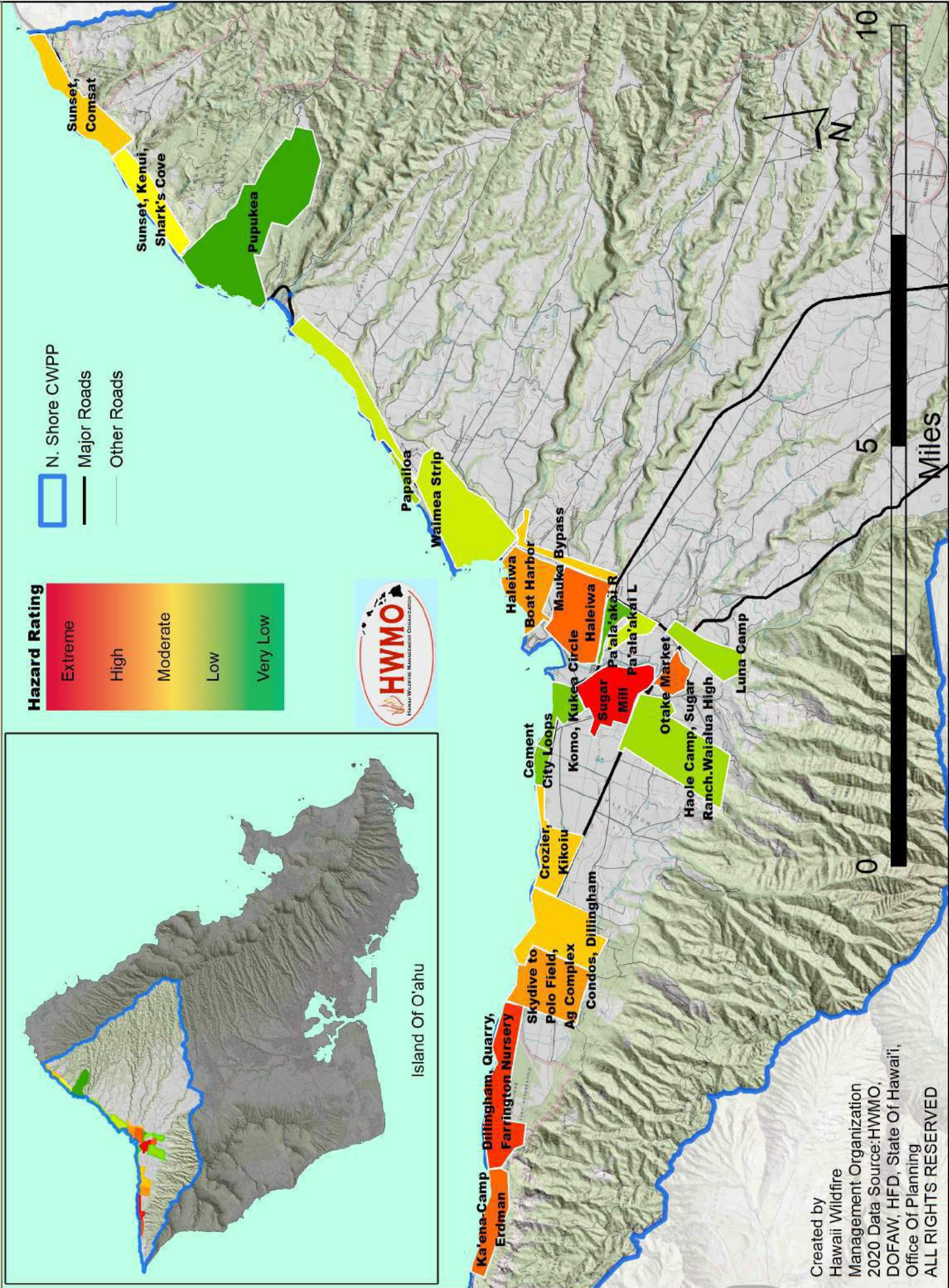
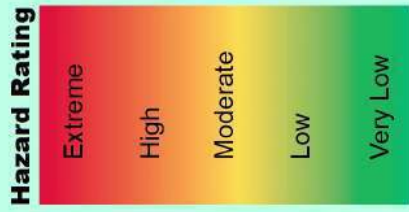
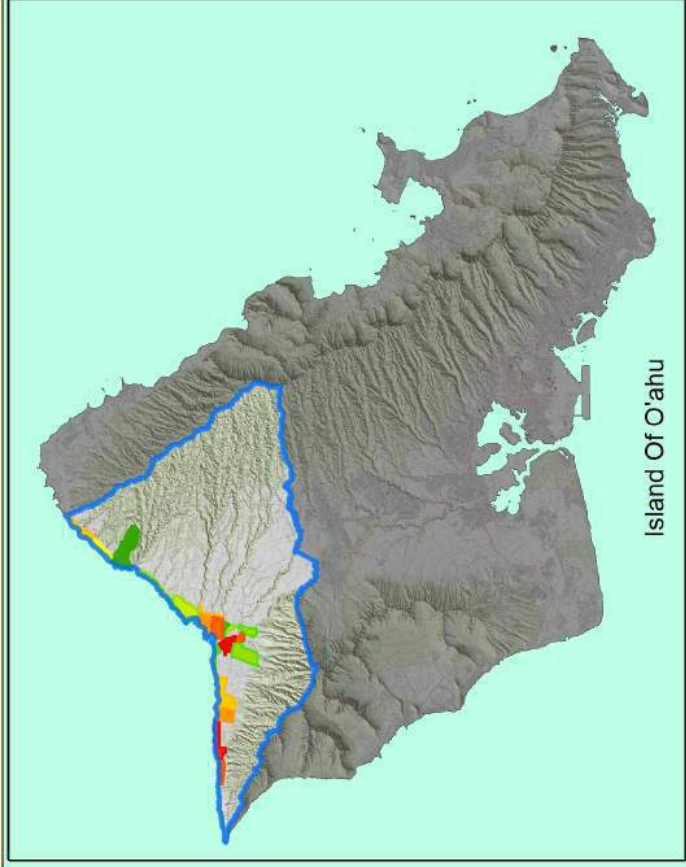


Map created by M. Wasser, 10/17/13, NAD 83 UTM Zone 4N



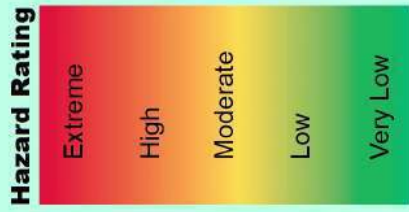
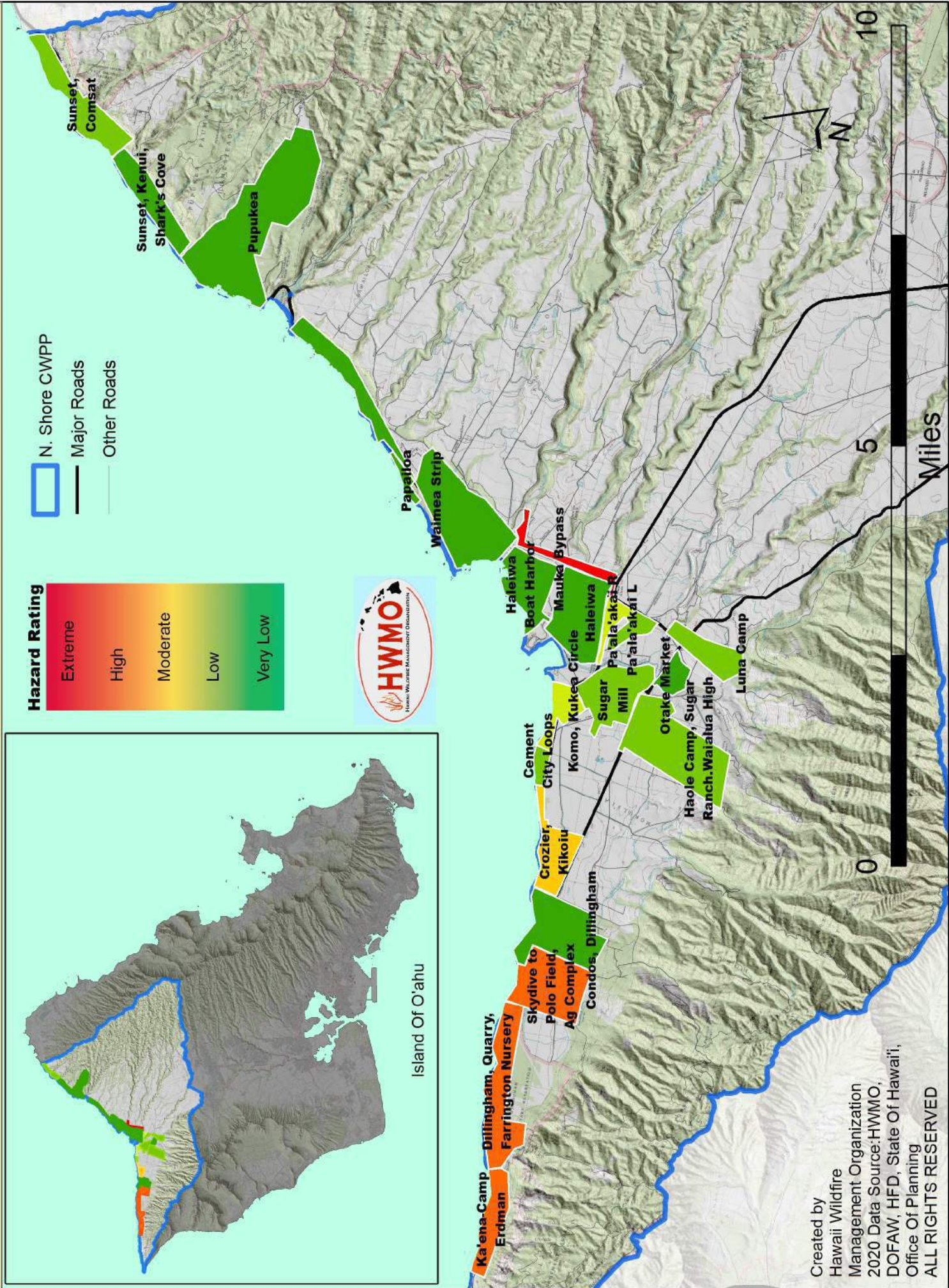
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North Shore Wildfire Hazard Assessment: Subdivision Hazard Total



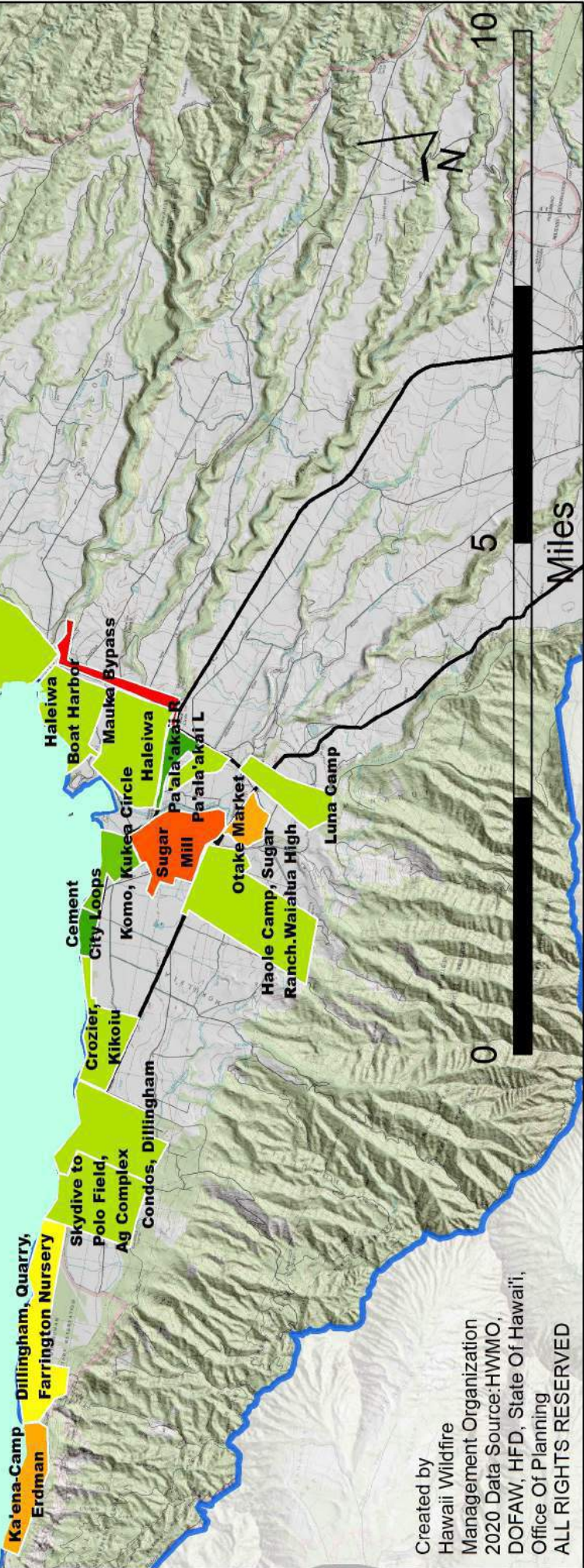
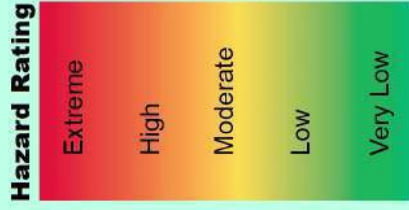
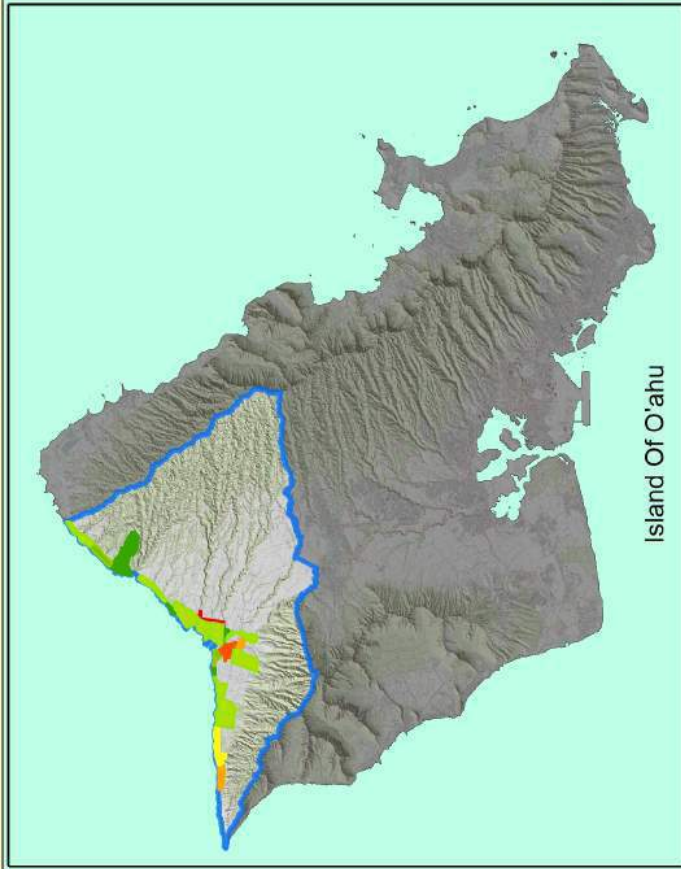
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North Shore Wildfire Hazard Assessment: Vegetation Hazard Total



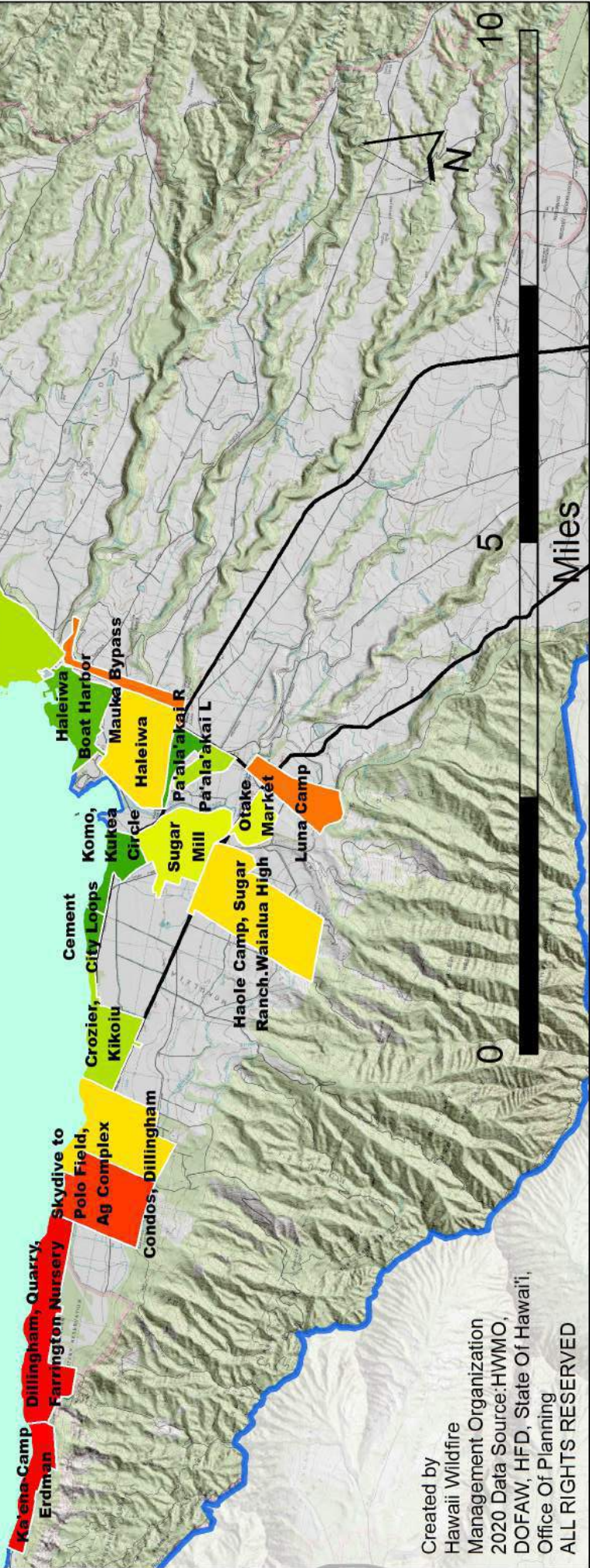
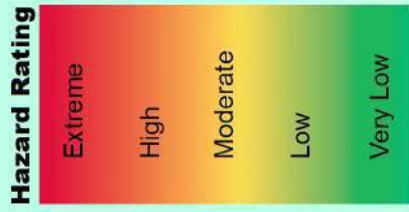
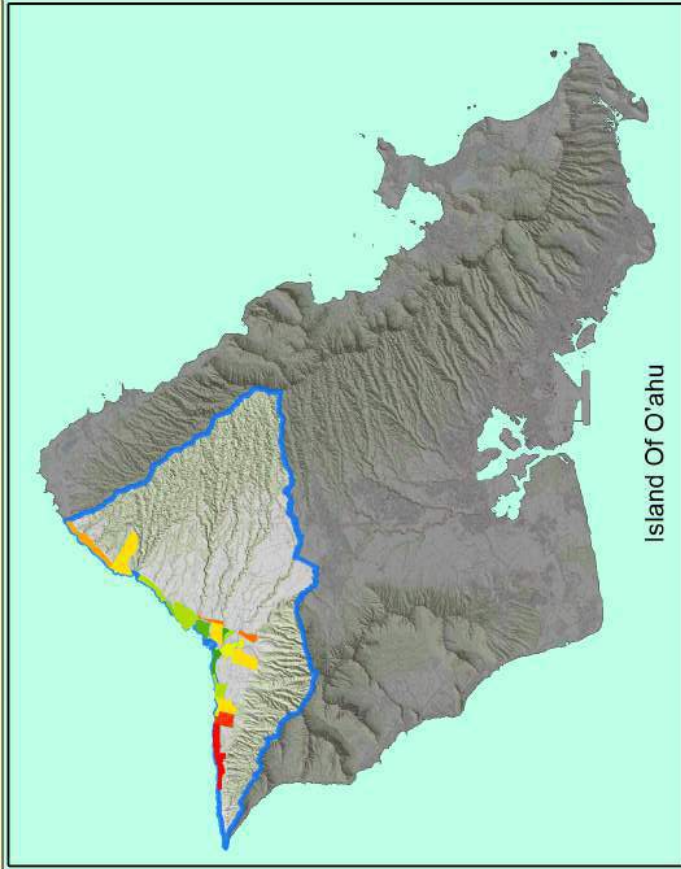
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North Shore Wildfire Hazard Assessment: Building Hazard Total



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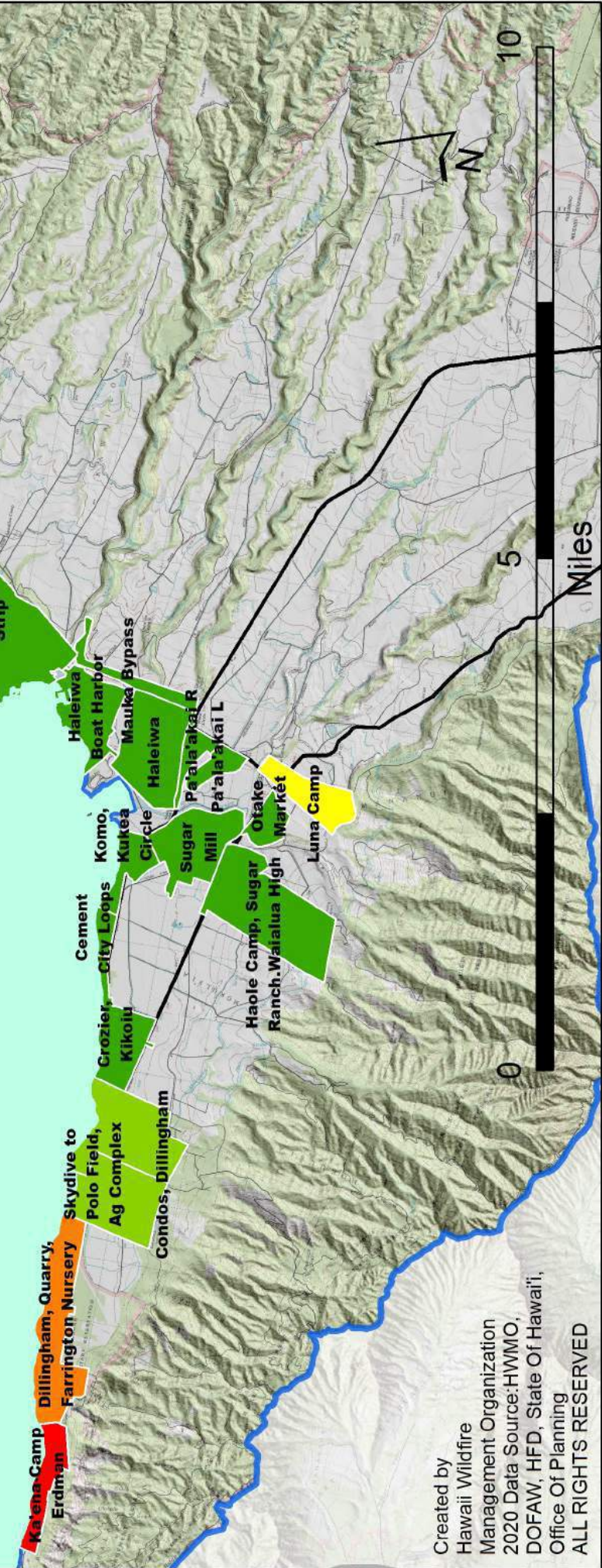
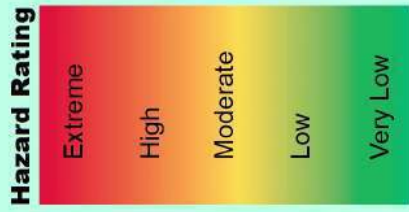
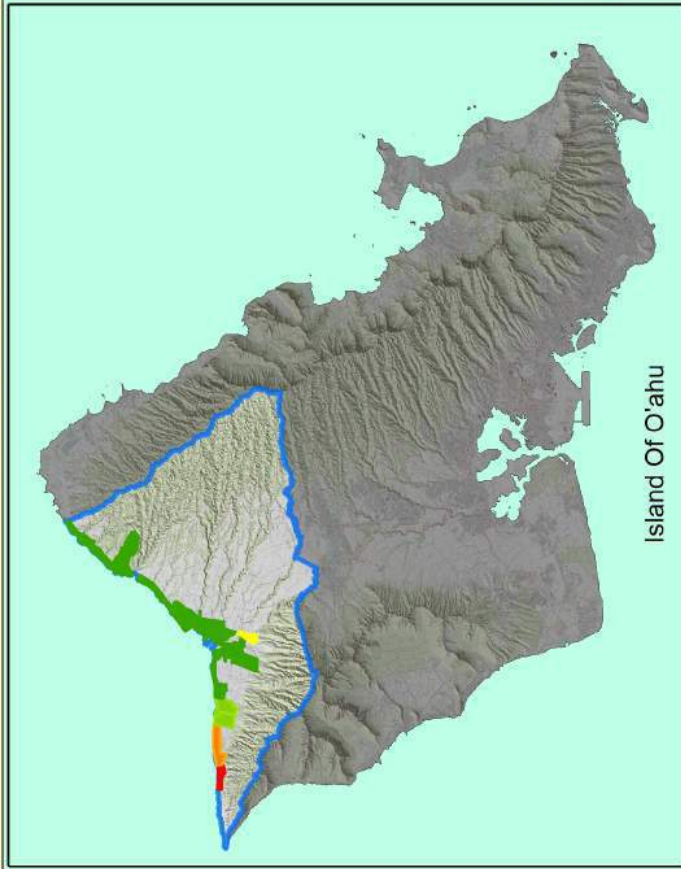
North Shore Wildfire Hazard Assessment: Fire Environment Hazard Total



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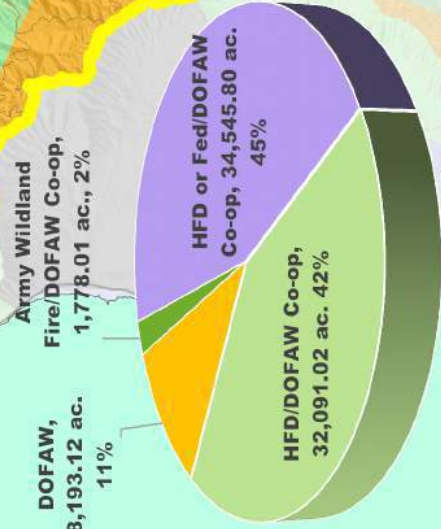
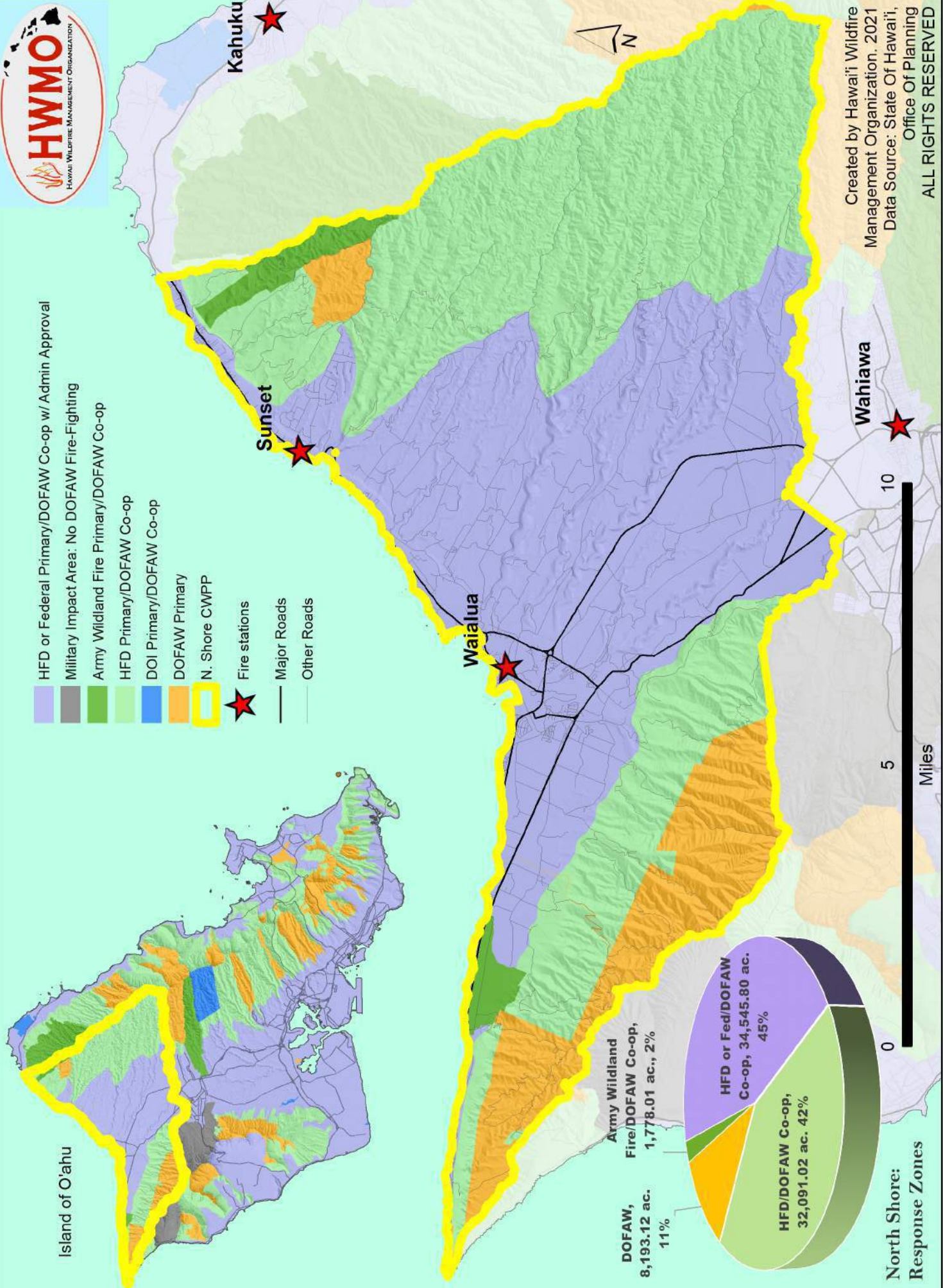


North Shore Wildfire Hazard Assessment: Fire Protection Hazard Total



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North Shore CWPP: Fire Response Zones



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North Shore CWPP: Fuels Management Activities Reported 2018-2019

Current & Proposed Fuels Management Priority Areas Provided By Project Participants & Partners

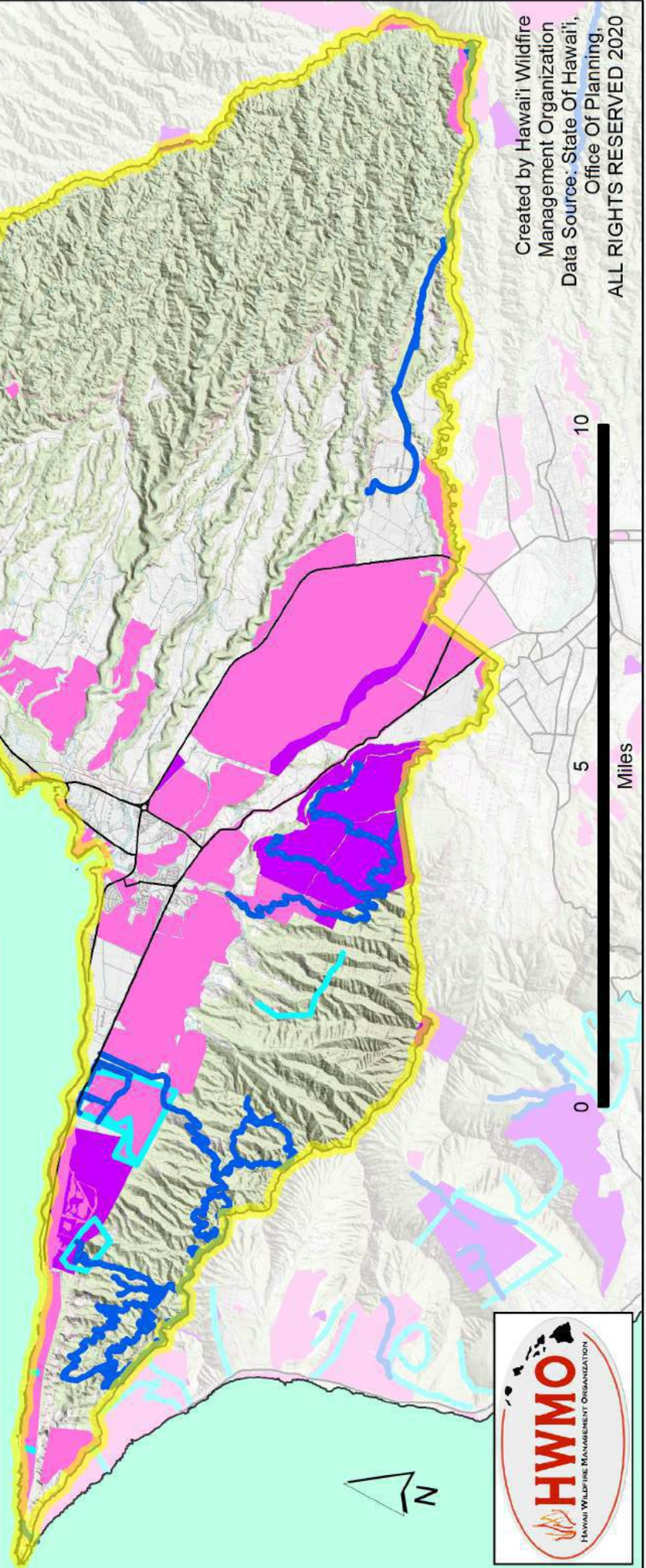
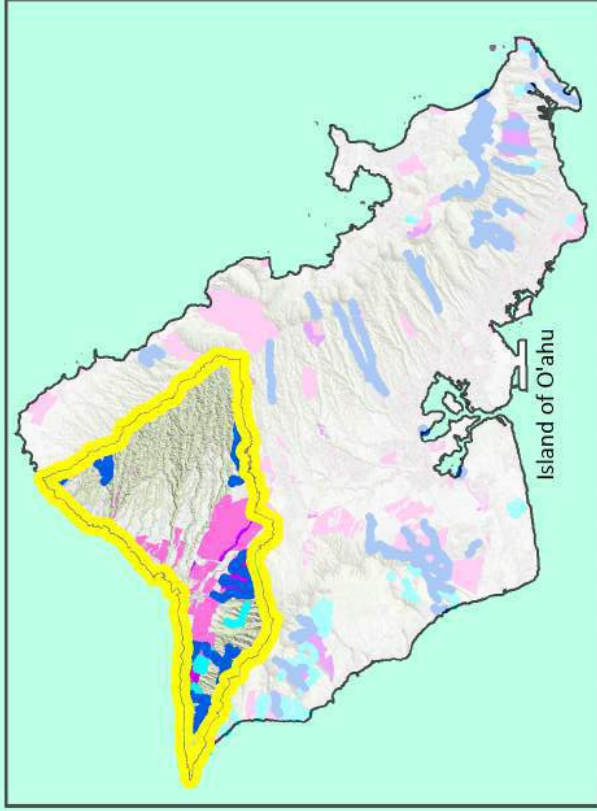
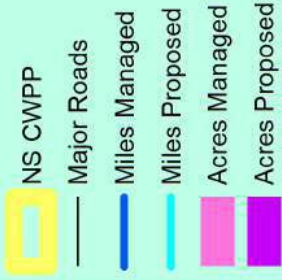
North Shore: Vegetative Fuels:

Miles Managed: 74.54

Miles Proposed: 11.98

Acres Managed: 12,543.16

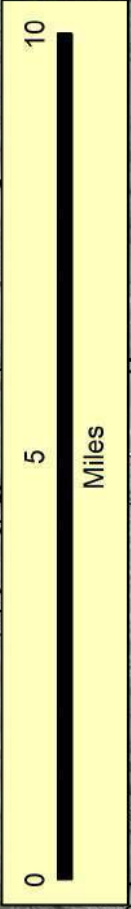
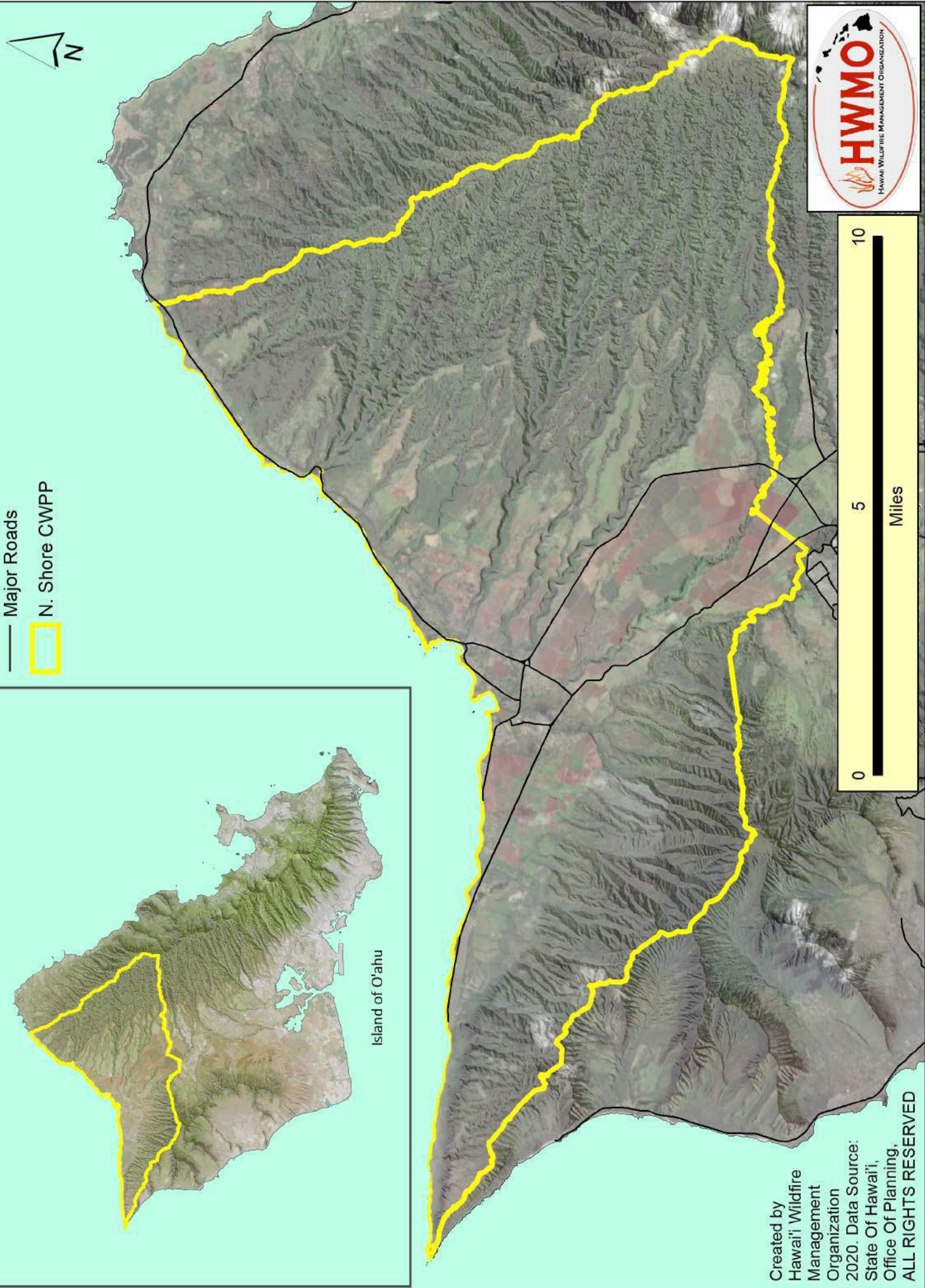
Acres Proposed: 4,973.65



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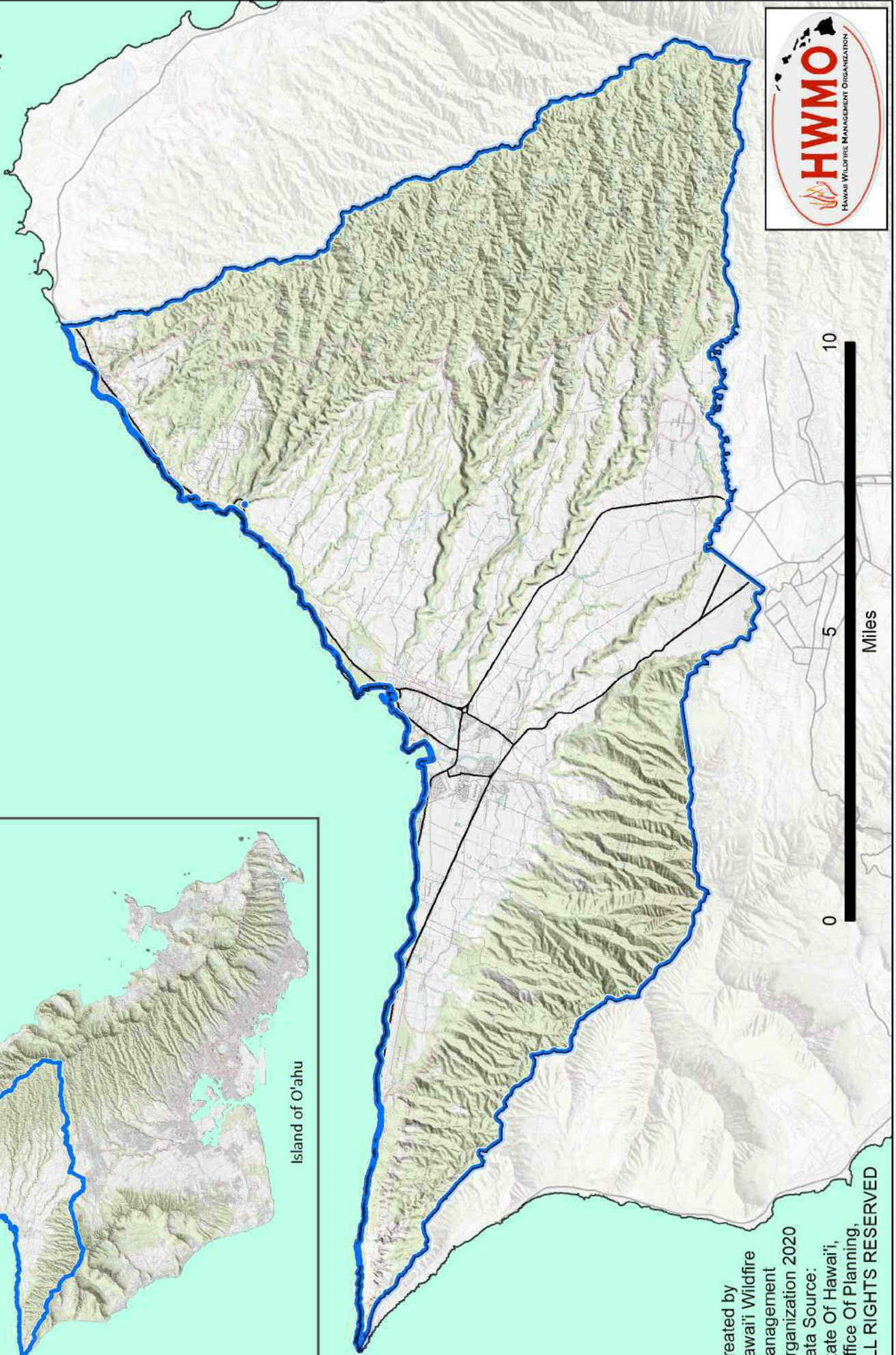
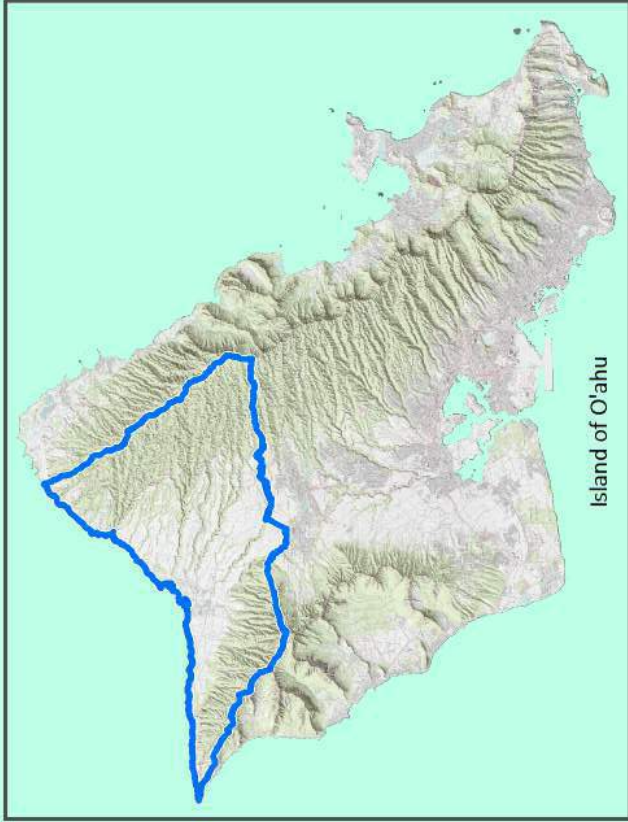
North Shore CWPP: Satellite Imagery

- Major Roads
- N. Shore CWPP



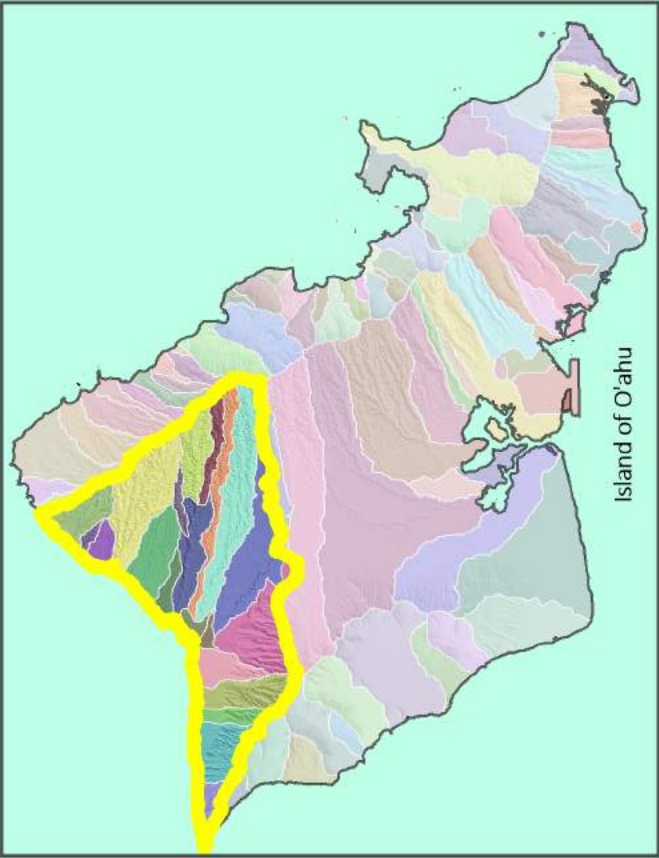
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North Shore CWPP: USGS Topographic Map

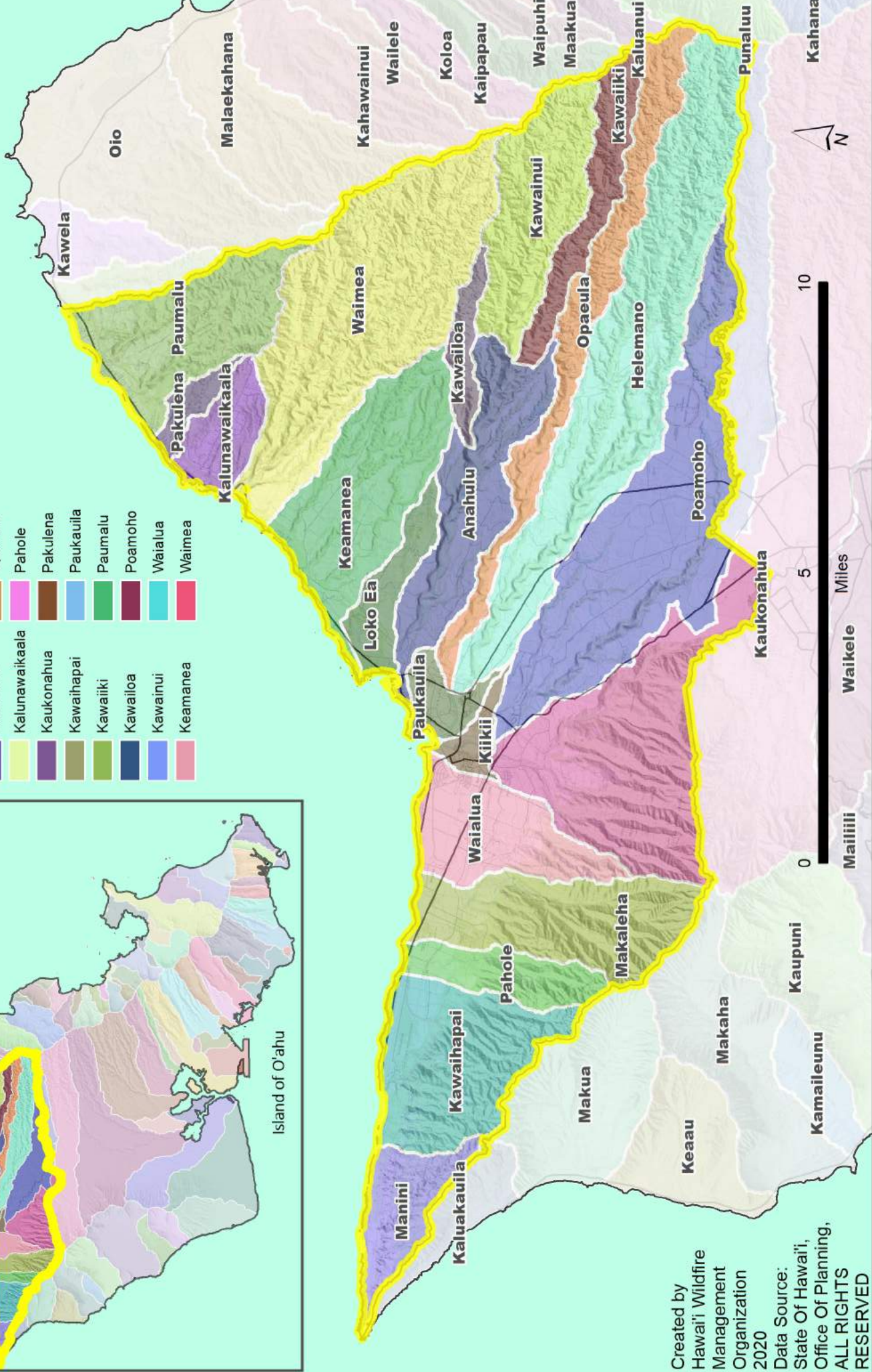


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North Shore CWPP: Watershed Boundaries



- NS CWPP
 - Major Roads
- Watersheds**
- Anahulu
 - Helemano
 - Kalunawaikaala
 - Kaukonahua
 - Kawaihapai
 - Kawaiiki
 - Kawailoa
 - Kawainui
 - Keamanea
 - Kiiiki
 - Loko Ea
 - Makaleha
 - Manini
 - Opaeuia
 - Pahole
 - Pakulena
 - Paukaulua
 - Paumalu
 - Poamoho
 - Waialua
 - Waimea



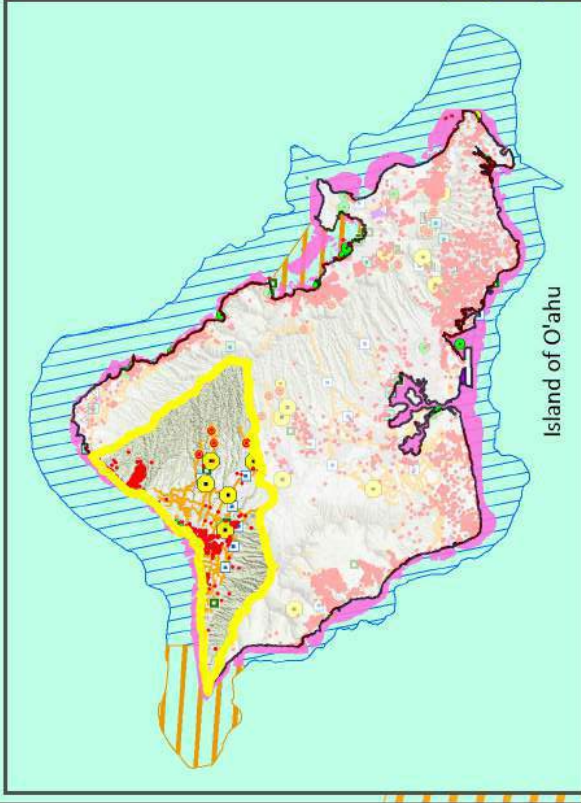
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North Shore CWPP: Water Features



Water Quality Classes:
 Class A: Marine Waters and Embayments
 Class AA: Open Coastal Waters

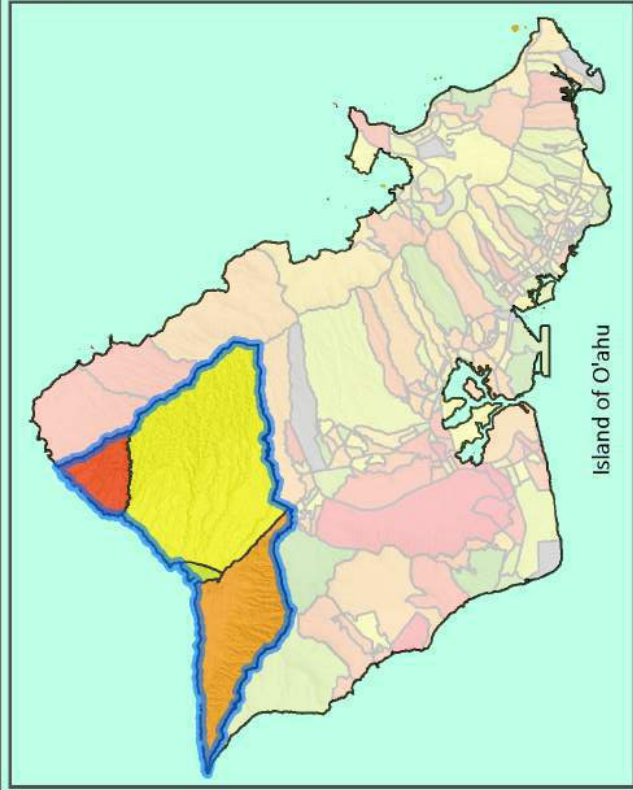
- NS CWPP
- Ditches
- Major Roads
- NHD Waterbodies
- Wetlands
- Lake A
- Reservoir AA
- Spring
- Swamp
- Tunnel
- Wastewater
- NID Dams
- Canal
- Dam
- Lake
- Reservoir
- Spring
- Swamp
- Tunnel



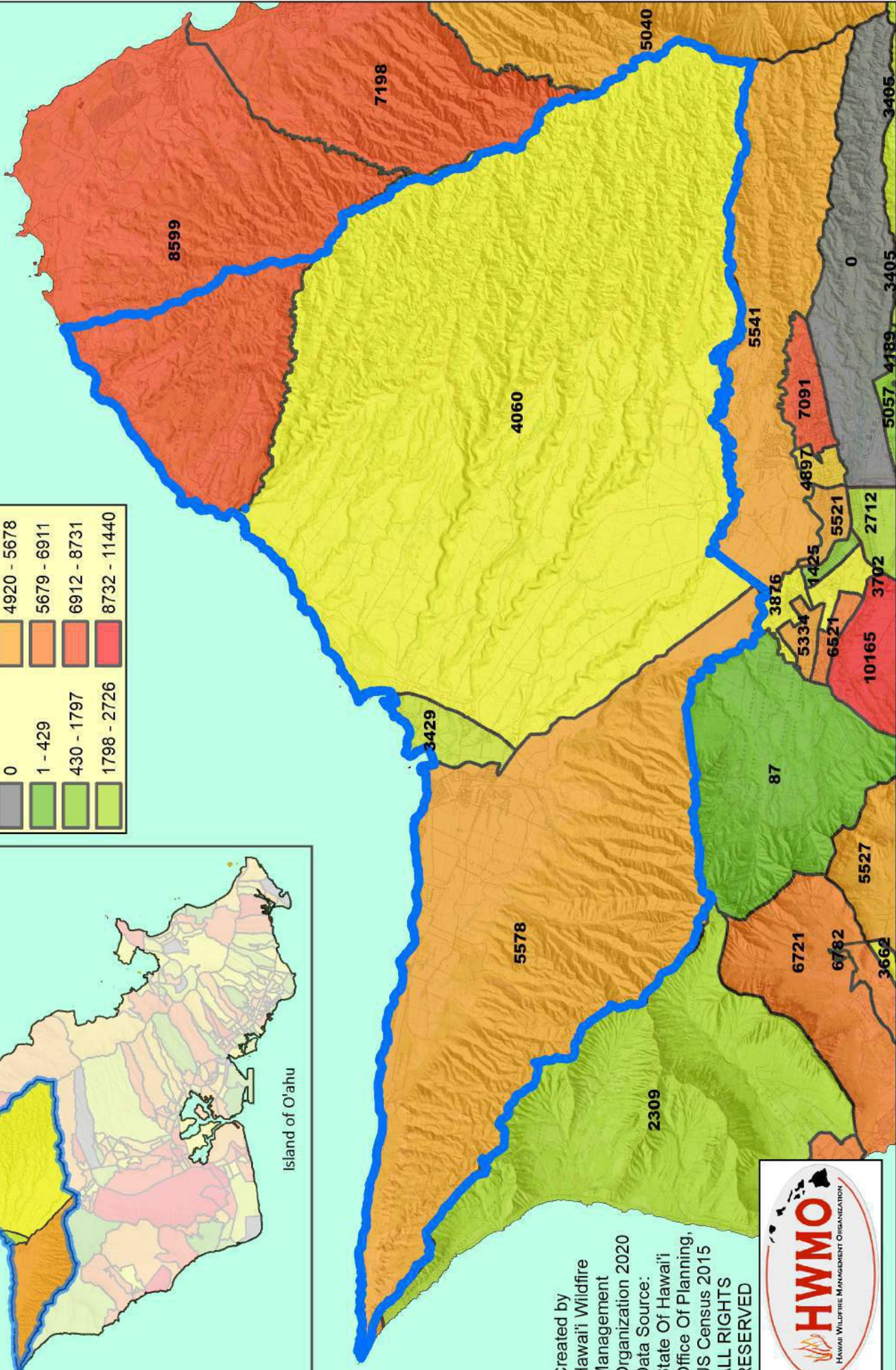
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North Shore CWPP: Population Density



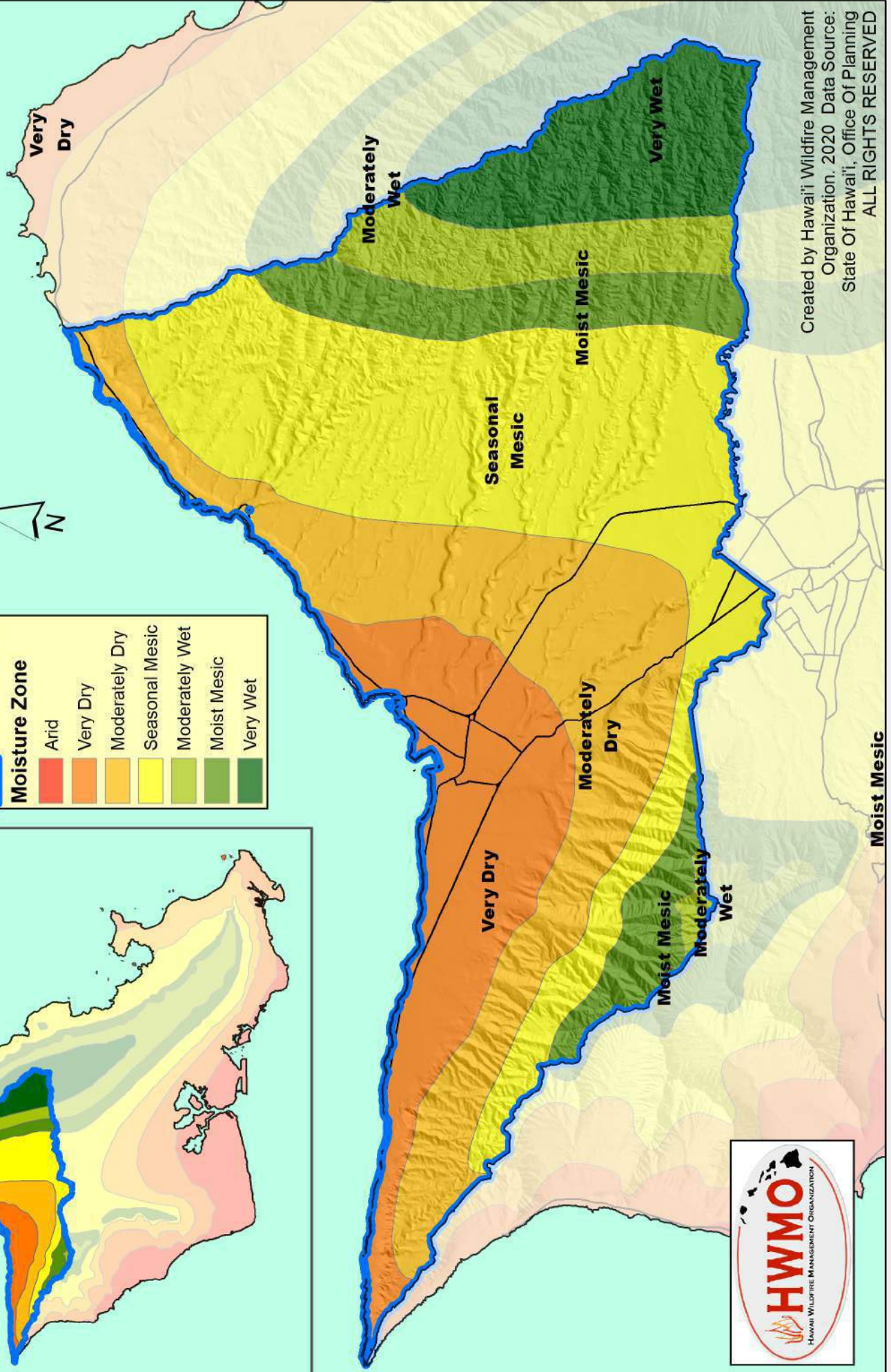
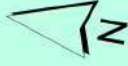
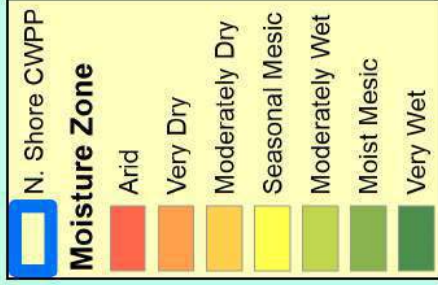
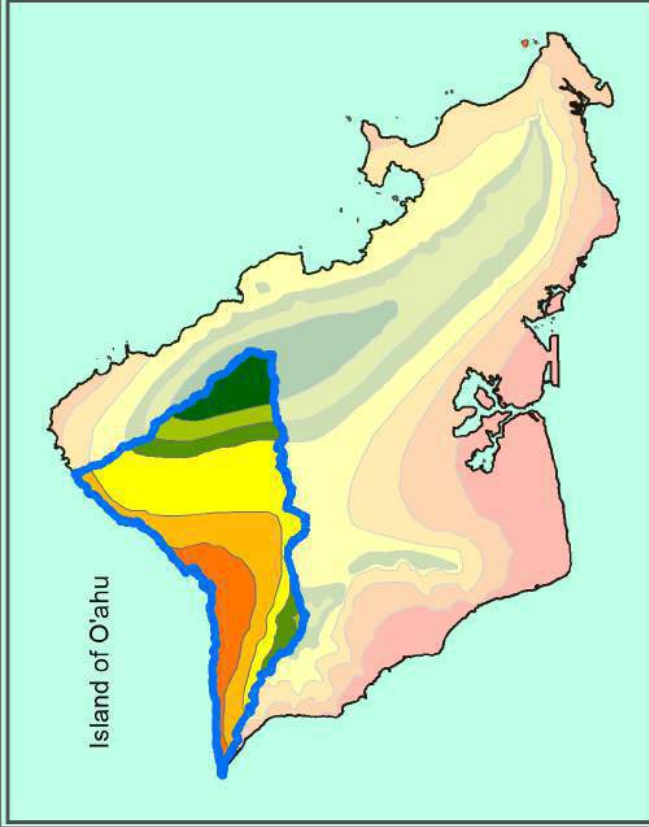
	NS CWPP
	2727 - 3483
	3484 - 4214
	4215 - 4919
	4920 - 5678
	5679 - 6911
	6912 - 8731
	8732 - 11440
	0
	1 - 429
	430 - 1797
	1798 - 2726



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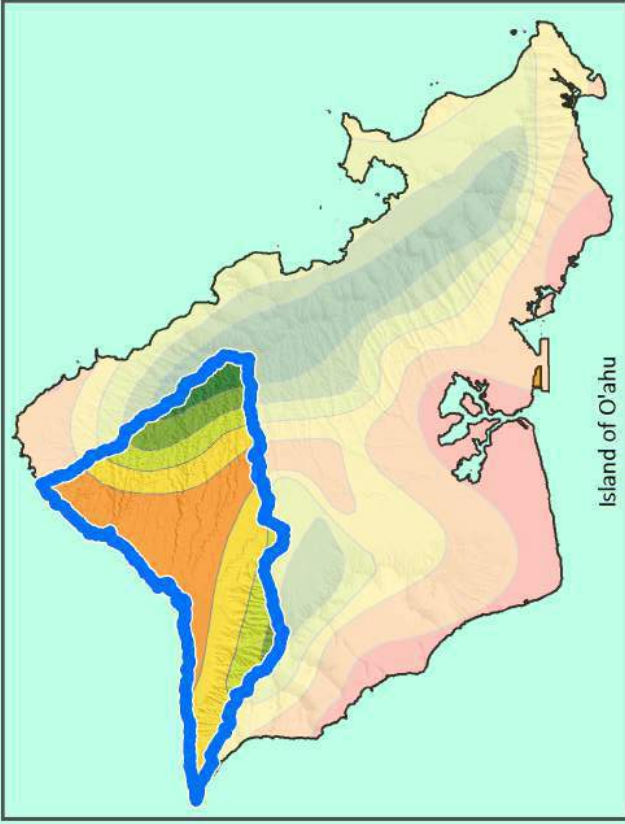


North Shore CWPP: Moisture Zones

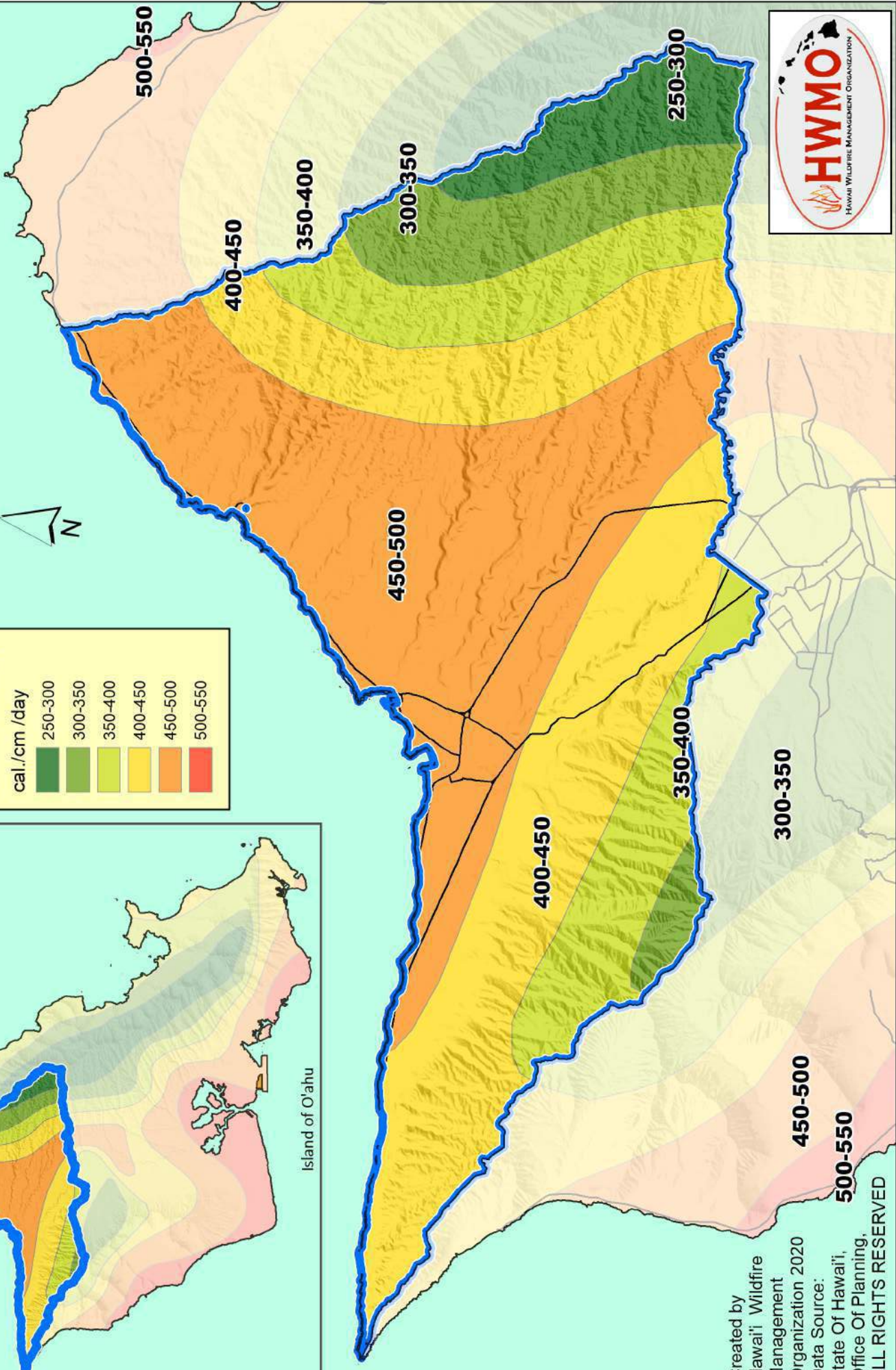


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North Shore CWPP: Fire Weather - Solar Radiation



NS CWPP
Major Roads
Solar Radiation cal./cm /day
250-300
300-350
350-400
400-450
450-500
500-550



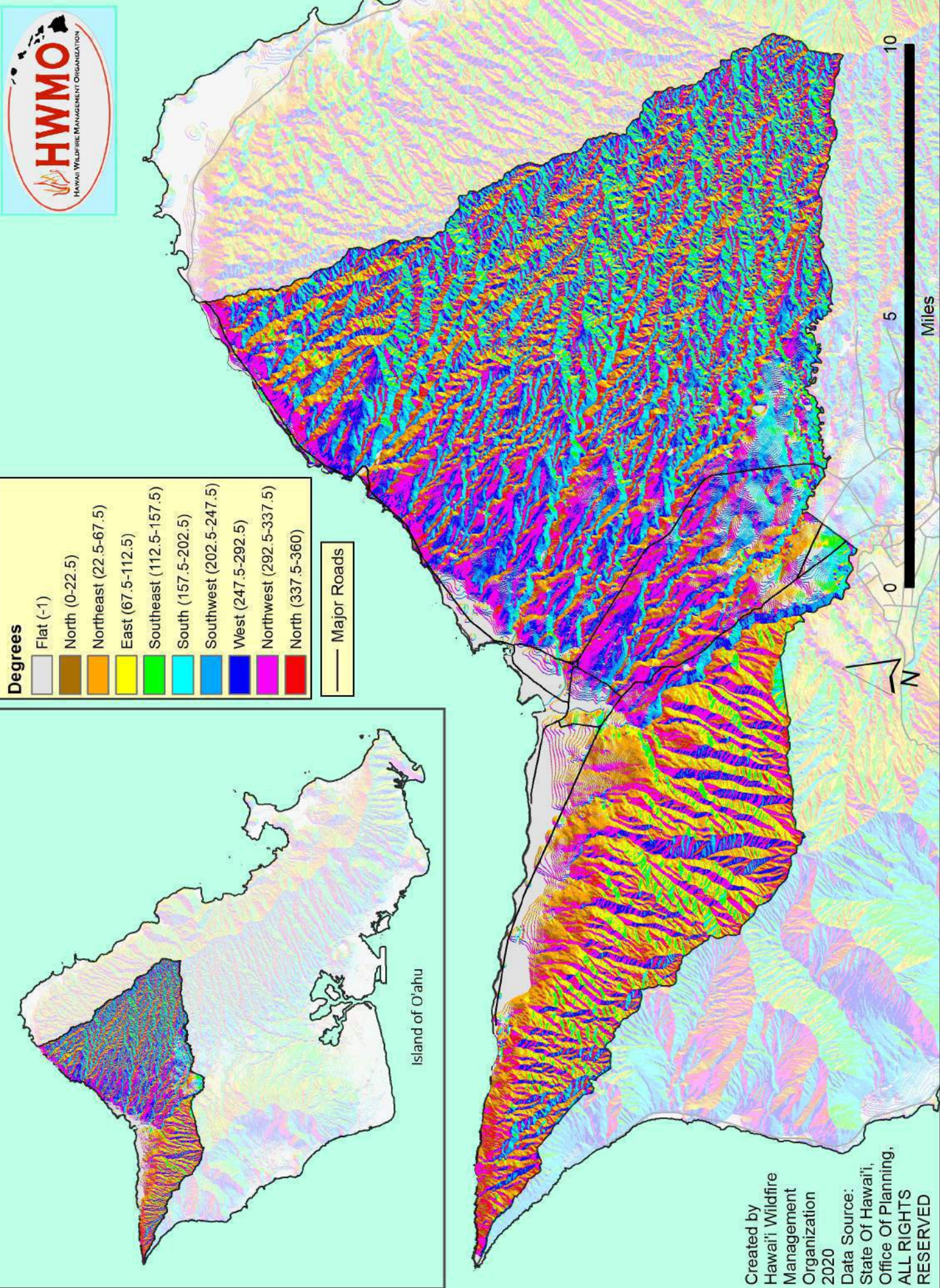
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North Shore CWPP: Fire Environment - Aspect

Degrees

Flat (-1)
North (0-22.5)
Northeast (22.5-67.5)
East (67.5-112.5)
Southeast (112.5-157.5)
South (157.5-202.5)
Southwest (202.5-247.5)
West (247.5-292.5)
Northwest (292.5-337.5)
North (337.5-360)

— Major Roads



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The following entities have a high level of interest in the protection of the North Shore area from wildfire, and have reviewed and support this Community Wildfire Protection Plan.

State Department of Land and Natural Resources- Division of Forestry and Wildlife
Kalanimoku Building; 1151 Punchbowl St. Room 325 Honolulu, HI 96813

City & County of Honolulu Fire Department
636 South St, Honolulu, HI 96813

City & County of Honolulu Emergency Management Agency
650 S King St, Honolulu, HI 96813

Hawai'i Wildfire Management Organization
65-1279 Kawaihae Rd. Ste 21, Kamuela, HI 96743

For inquiries related to the development of this plan, to add action plan projects, or for printed copies, please contact:
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