



**A Collaborative, Landscape-Level Approach to
Reduce Wildfire Hazard Across Hawai'i**

2018-19 Vegetation Management

**Rapid Mapping Assessment
and**

Collaborative Action Planning

Hawai'i Statewide Summary

This report is dedicated to all those whose decisions about the built and natural environment in Hawai'i affect our vulnerability and/or resilience to wildfire, including:

Emergency responders and **volunteers** who respond to wildfire;

Policymakers aligning funding and legislation to strategically and effectively reduce wildfire hazards and keep our communities safe;

Planners, developers, and designers who include strategic wildfire mitigating designs in communities, infrastructure corridors, and buffers between human ignitions and precious wildland ecosystems;

Maintenance workers and **community members** who do all of the great hazard mitigation and vegetation management;

Ranchers managing animals and maintaining fencing and water to protect our communities and ecosystems from wildfire;

Tourism industry informing visitors about wildfire and invasive species in Hawai'i and the importance of helping protect this valuable place they come to visit;

Land stewards removing invasive species, restoring the forest, working the land, and transitioning the landscape to a lower wildfire risk;

Agency representatives responsibly managing heritage resources;

And everyone who is working to protect our communities and landscapes from wildfire and invasive species.

Project Lead

Hawai'i Wildfire Management Organization
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- State Division of Forestry and Wildlife (Mike Walker)
- University of Hawai'i CTHAR Cooperative Extension (Dr. Clay Traurnicht)

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Cover Photo: View of West Maui mountains and Mā'alaea. Photo Credit: HWMO



Collaborative Action Planning Workshop at Kailapa. Photo Credit: HWMO

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In case of
fire jargon

Glossary of Terms

Fuel/ Hazardous Vegetation

Flammable vegetation.

Fuel Load

How much flammable vegetation is there, how dense, how tall, how much will burn if ignited?

Vegetative Fuels Management Activities

Any vegetation management activity that reduces wildfire hazard (whether that is its sole purpose or a positive byproduct of the activity).

PROJECT SUMMARY

Vegetation Management and Wildfire in Hawaii

In Hawaii, wildfire has devastating impacts on our communities and native ecosystems. With land use and climate changes, wildfire is a significant and growing hazard in many places across Hawaii.

Research in wildfire science shows that vegetation is a key ingredient in the recipe for recurring wildfire. **Vegetation management is essential for wildfire hazard mitigation strategies that reduce wildfire hazard; create safer conditions for firefighters; and serve as key climate adaptation strategies** for our communities, economies and environment.

Fire follows fuel and the impacts do not abide by property boundaries. Therefore, **reducing wildfire hazard is a landscape-level issue that we need to collaboratively tackle together to create safer and more wildfire resilient communities.**

Project Background

In 2015, the Hawai'i Wildfire Management Organization (HWMO) Technical Advisory Committee, comprised of more than 35 fire and natural resource experts from across the state, initiated this project to:

- Better understand all of the important **wildfire hazard reduction already happening** by diverse land managers;
- Identify and **prioritize actions** that address the island-wide wildfire issue to **optimize expenditures** and efforts, and **maximize protection** at the landscape-scale;
- **Kick-start collaboration**, share information, and **integrate wildfire-thinking into current activities** to address the cross-boundary wildfire risk.

This purpose of this report is to share input from professionals and community that participated in the statewide 2018-19 Rapid Mapping Assessment of Vegetation Management and Collaborative Action Planning Workshops. This Statewide Summary Report is supplemental to the six in-depth island reports which provide additional island specific detail.

Rapid Mapping Assessment of Vegetation Management

During 2018-2019, HWMO contacted all large landowners with >1% of the island area and agencies managing vegetation. A majority participated in the mapping project.

Across Hawaii, **128 groups** contributed to the Rapid Mapping Assessment of Vegetation Management including:

- Agencies such as highways maintenance, parks, military, utilities;
- Businesses in farming, ranching, forestry, and tourism;
- Non-profits, watershed partnerships, and community groups.

Hawai'i Statewide Rapid Mapping Assessment Summary Findings:

~ **1.1 million acres** and **4,300 miles** of **current** firebreaks, fuel reduction or fuel conversion mapped statewide.

~**400,000 acres** and **350 miles** of **needed** firebreaks, fuel reduction or fuel conversion mapped statewide.

Collaborative Action Planning Workshops

Professional and community input on priority action was collected through Collaborative Action Planning Workshops held in all four counties across Hawai'i during 2018-2019. The **182 participants** statewide represented diverse groups including agency representatives, emergency responders, land owners, community groups, technical experts, ranchers, planners, legislative representatives, businesses, and more.

Themes that emerged in multiple workshops across the state are summarized in the *Statewide Summary: 10 Take-Aways*. All concerns and suggested actions are captured in *Appendix A: Participant Input Lists*.

Major concerns and recommended actions for each island are summarized in each island report (separate reports).

Online Survey

As a follow-up, HWMO conducted a brief online survey targeted at anyone managing vegetation. Selected results from the **87 survey respondents** are presented throughout this report.

WILDFIRE HAZARD ACROSS HAWAI‘I

THE PROBLEM? – Fire follows fuel...and vegetation is fuel!

Wildfires do not recognize fences or ownership boundaries.

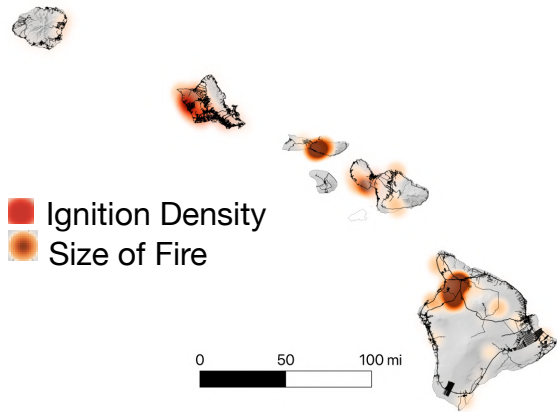
Ignitions



Fuel (Hazardous Vegetation)



Widespread Impacts



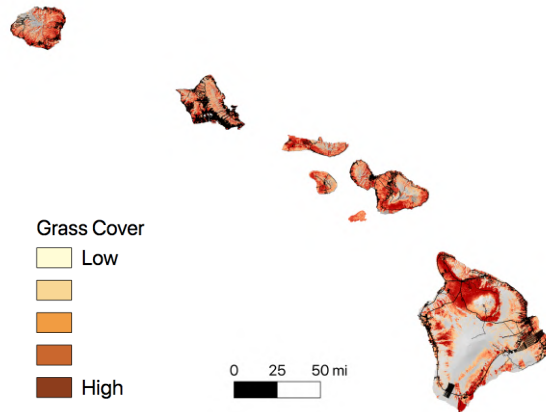
People Spark Fire

In Hawai‘i, most **wildfires are caused by people**.

The majority are accidental, and are started by hot exhaust, sparks from equipment, open fires, cigarettes, fireworks, and more.

These ignitions often occur along **roadsides** and **community boundaries**.

Source: HWMO 2002-2012 data



Fire Follows Fuel

Dry grass and other fine fuel is quick to ignite.

Some invasive, fire-prone grasses including fountain grass and guinea grass benefit and spread with wildfire.

They are the first to regrow after a burn, choking out native plant communities and **increasing fire risk**.

Source: UH Manoa 2018



THE SOLUTION? – Collaborative, cross-boundary vegetation management.

Reducing wildfire hazard and protecting our future requires a landscape-scale, all-hands approach to strategically coordinate limited funding and human resources. Together we can achieve multiple benefits and win-win solutions.

THE VALUE OF BEING PROACTIVE ABOUT WILDFIRE IS ENORMOUS!

Vegetation management and wildfire hazard mitigation strategies reduce wildfire hazard, create safer conditions for firefighters, and serve as key climate adaptation strategies for our communities, economies and environment.

Multiple Benefits — Value of Being Proactive:

- ❖ Healthy, functioning ecosystems
- ❖ Productive landscapes
- ❖ Safe communities and businesses

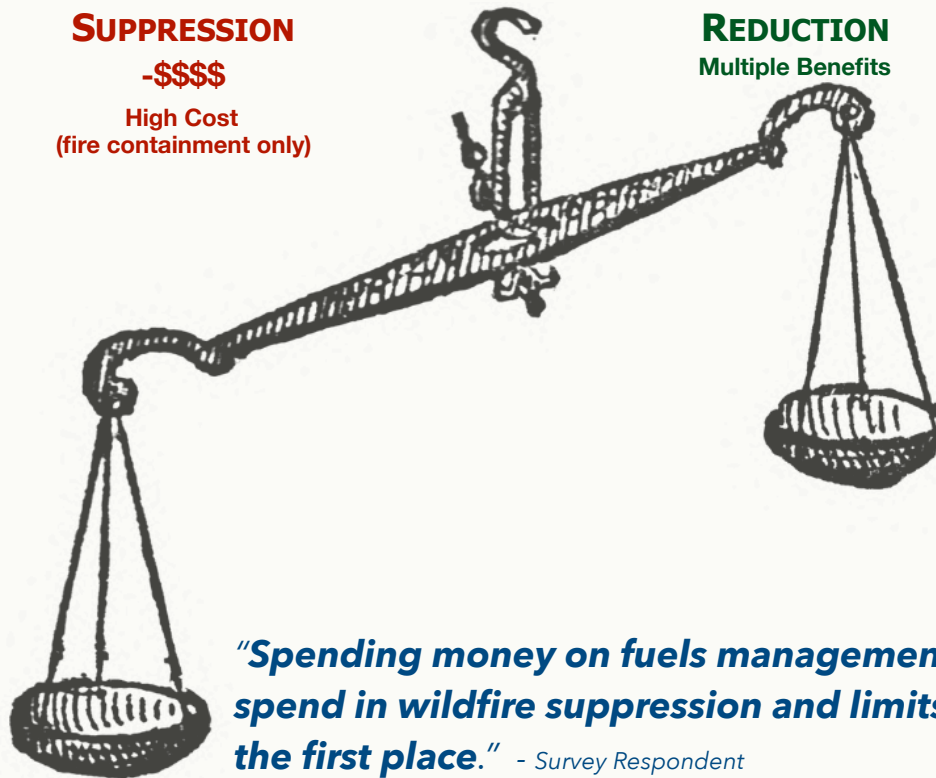
Reactive Cost of Wildfire Response:

- \$ Money spent on emergency response, personnel, firetrucks, helicopters, fuel, equipment, etc.
- \$ Damage to infrastructure — costs to repairs/rebuilding
- \$ Destruction of irreplaceable native ecosystems and subsequent increased wildfire hazard
- \$ Damage to coastal resources of community, and tourism and economic value
- \$ Health costs associated with smoke and other impacts
- \$ Need for National Guard or FEMA response

REACTIVE FIRE SUPPRESSION

-\$\$\$\$
High Cost
(fire containment only)

PROACTIVE HAZARD REDUCTION Multiple Benefits



“Spending money on fuels management reduces the amount we spend in wildfire suppression and limits the potential for fire in the first place.” - Survey Respondent

(Question: Why is vegetation management important from your perspective?)

Proactive Benefit of Prevention:

- ✓ Comparatively **lower \$ spent for active management of landscape** than fighting wildfires and recovering after wildfires have burned lands, homes, and infrastructure.
- ✓ Proactive activities that are more **cost-effective** than waiting until a firefighting response is required and urgent include:
 - Preventing ignitions through public education
 - Reducing wildfire spread potential through **vegetation management**
 - Developing quick and easy **access for firefighting and evacuations**

WHY FOCUS ON VEGETATION MANAGEMENT?

**Managing vegetation is the key to reducing wildfire hazard at all scales!
Due to the year-round growing season in Hawai‘i, maintenance is often
necessary multiple times per year.**

Fire Can Only Burn Where There Is Fuel to Burn

What makes vegetation hazardous? As plants dry out during dry or drought periods they become flammable, and are thus called **hazardous vegetation or hazardous fuel**. Hazardous vegetation can be dried grass, leaf litter, shrubs, or trees with dead branches. These types of vegetation ignite easily and “add fuel to the fire.”

Recipe for Fire

Long-term, big picture perspective
↓

- **Flame (Does fire start?):**
Key Factors: **Fuel**, oxygen and ignition
- **Wildfire (Where does wildfire burn?):**
Key Factors: **Fuel/hazardous vegetation**, weather, and topography
- **Fire Regime (How does wildfire reoccur?):**
Key Factors:
 - **Vegetation: Is it hazardous?**
 - **Climate:** Are there fire weather conditions?
 - **Ignitions:** What is the social and land-use context? (i.e. people’s behavior and natural ignitions)

Adapted from the three “fire triangles”

Vegetation as fuel is a key ingredient for wildfire.

Wildfire Hazard Mitigation Strategies

How to Reduce the Spread and Impacts of Wildfire:

- **Firebreaks:** Strategic integration of fire infrastructure including **firebreaks around our communities and important resources** during planning and development stages can provide access for firefighters; break the continuity of fuel to passively slow the spread of wildfire across the landscape; and serve as emergency egress when wildfire is coming from a different direction.
- **Fuel Reduction:** Immediate action to **reduce fuel and breaking the connectivity of fuel to our valued resources** (e.g. ladder fuel reduction, managed grazing).
- **Fuel Conversion:** Long-term **conversion of our landscapes to be less burnable** (e.g. Firewise community practices, active agriculture and native restoration efforts).

Areas of Concern and Prioritized Actions:

2018-19 COLLABORATIVE ACTION PLANNING ON VEGETATION MANAGEMENT

Qualitative Project Findings



Collaborative Action Planning Workshops

Professionals and community came together to identify areas of concern and discuss and prioritize actions to reduce wildfire hazard. Input was gathered through six workshops held across the Hawaiian islands. The **182** participants that contributed statewide included representation from:

- Land owners
- Agencies
- Emergency responders
- Community groups
- Community members
- Technical experts
- Ranchers
- Businesses
- Planners
- Legislative representatives
- And more...

Achievability of priorities was not evaluated and any specific planning effort should include additional place-based input and best practices.

All concerns, proposed actions, and number of votes can be found in *Appendix A: Participant Input Lists*.

See [Appendix C](#) for more resources on best practices.





Hawai'i Statewide Summary – 10 Take-Aways

The **10 Take-Aways Summary** is based on themes that emerged during participant discussions across multiple collaborative action planning workshops.

The purpose of this summary is to bring to light considerations relevant across our islands.

In this section, text in light blue boxes like this one are suggestions proposed and prioritized during Collaborative Action Planning Workshops.

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1. WE HAVE A WILDFIRE PROBLEM, WE NEED ACTION!

Some Areas Have the Right Recipe for Recurring Wildfire

Hazardous Vegetation:

- ✓ Invasive fire-promoting grasslands and grass-invaded native dry forests (fuel).

Fire Weather Conditions:

- ✓ Dry
- ✓ Hot
- ✓ Windy

Ignitions (examples of sources):

- ✓ Roadside accidents
- ✓ Power lines arcing and sparking
- ✓ Hot exhaust on dry grass, dragging chains
- ✓ Machinery sparks
- ✓ Fireworks
- ✓ ...many more!

Fire weather conditions are familiar for those in many leeward and saddle areas. Remember, wildfire **hazard becomes more widespread in drought conditions.**

"Fire is a threat every summer. We have lost a lot to previous wildfires."

-Survey Respondent (Question: Why is vegetation management important from your perspective?)

Recipe for Fire

Long-term, big picture perspective

- **Flame (Does it start?):**
Key Factors: **Fuel, oxygen and ignition**
- **Wildfire (Where does it burn?):**
Key Factors: **Fuel/hazardous vegetation, weather, and topography**
- **Fire Regime (How does it perpetuate?):**
Key Factors:
 - **Vegetation:** Is it hazardous?
 - **Climate:** Are there fire weather conditions?
 - **Ignitions:** What is the social and land-use context? (i.e. people's behavior and natural ignitions)

Adapted from the three "fire triangles"

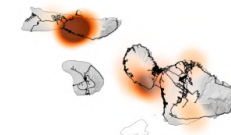
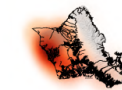
Values at Risk

Values at risk is fire jargon for the things that matter to us, **resources or areas that we want to protect from wildfire.** These include:

- **Community areas** e.g. homes, hospitals, schools, parks
- **Municipal infrastructure** e.g. roads, power, water
- **Natural resource areas** e.g. watersheds, makai reefs, water resources, species and ecosystems
- **Cultural resources** e.g. places of cultural heritage, subsistence gathering areas, significant ecosystems, water resources, soil resources, makai reefs
- **Livelihood areas** e.g. tourism, businesses, agricultural lands (grazing lands/ forestry, farming)



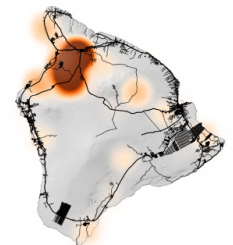
Areas with Recurring Wildfire Issues 2002-2012



■ Ignition Density
■ Size of Fire



0 50 100 mi





2. COLLABORATE ACROSS BOUNDARIES FROM MAUKA TO MAKAI - “WE ARE IN IT TOGETHER”

Fire Is a Landscape-Level Problem with Widespread Impacts Mauka to Makai

Recognizing that wildfire doesn't abide by jurisdictional boundaries, and that land use and mauka wildfires impact makai resources, a **collaborative and coordinated public-private effort is essential to reducing wildfire risk** and its significant impacts to our communities and landscapes.



Mauka-makai view from Pu'u Wa'a wa'a. Photo Credit: HWMO

There is widespread interest in enhancing collaboration among partners including agencies, private land owners, community groups, planners, elected officials, emergency responders, and more.

Together! All-Hands Approach

Participants of the action planning workshops keyed in on the need for enhanced agency collaboration in wildfire management and greater landscape level collaboration. Prioritized ideas relevant to collaboration include:

Increase **regional collaboration** and engagement of landowners and relevant parties **in high wildfire risk areas**. Need **relevant agencies and groups "at the table"** including road maintenance, tourism, utility companies, etc.

Coordinate official agreements, **public-private partnerships** with large landowners **so that all can contribute to wildfire response and pool equipment and water resources** to address long fire response time in rural communities.

Enhance collaboration between agencies and adjacent land owners to **share resources to maintain "good roads"** with less roadside fuel hazard.

Keep inviting people to the table because **tackling the issue together is so important**.

Mauka-Makai Perspective

Its all connected!

Due to our island nature, **everything mauka** (toward the mountain) **flows makai** (toward the sea). In areas without vegetation cover, water picks up **sediment, pollutants, nutrients** and **heat** and flows makai to our reefs with devastating impacts.

Prioritize wildfire prevention in mauka areas to protect the water supply and reef areas — **"Protect what is mauka to protect makai"**.

Increase invasive species management and biosecurity - **more effective when we are all doing it**.

Return fallow agriculture to active use for food production.

Develop **island-wide wildfire prevention and vegetation management plan**.

Collaborate on **post-fire restoration** response to **reduce immediate impacts** such as sediment runoff and **long-term vegetation conversion and restoration** that is locally-appropriate using "fire event" opportunity.

Interested in collaboration on cross-boundary projects with key partners in your region?

[Connect with us here.](#)



3. FOCUS ON LOCALLY-APPROPRIATE AND LOCALLY-ADAPTED SOLUTIONS

Our Islands Are Diverse and Unique, Our Behaviors and Actions Need to Consider This Context

We live in a biodiversity hotspot on volcanic islands in the tropical ocean with a unique and increasing wildfire problem.

We need locally-appropriate approaches for wildfire-prevention/ and suppression due to:

- high variability in climate, geology, vegetation across Hawai'i landscapes;
- our unique and irreplaceable ecosystems; and
- places of significant cultural heritage.

While solutions to reduce wildfire threat may be similar across Hawaii, the diversity and uniqueness of our landscapes, land use, and communities, requires consideration of numerous factors when developing locally-appropriate approaches to wildfire prevention and emergency response.



Wili wili , unique dry forest tree.

Situational Awareness - Local Variations

Fire hazard varies based on location and throughout the year due to wet/dry cycles. In our unique landscapes, one place may have extreme fire-weather conditions while another experiences wet-season.

Promote safe behaviors in extreme fire weather conditions (e.g. dry, windy, and hot). People most often cause fire! Therefore, one of the most important things we can do is raise awareness.

Identify leads to maintain local weather stations and communicate info on each island (could incorporate **local fire-condition in more local news and media weather broadcasts**).

"If our forest burns, those naturally occurring species will be lost from the area forever." -

Survey Respondent (Question: Why is vegetation management important from your perspective?)

Unique and Irreplaceable Ecosystems of Value

We only have a tiny fragment of dry forest ecosystems remaining and those left are threatened by wildfire and invaded by fire-promoting species.

Incorporate consideration for **sensitive cultural heritage and irreplaceable and threatened native ecosystems** during fire suppression and wildfire hazard mitigation.

Restore landscapes mauka to makai to protect and enhance cultural and community resources.

Significant and Important Cultural Heritage

Consolidate and **communicate research on best-practices for local issues** including:

- Fire in dry forest ecosystems specifically related to **restoration techniques and removal of invasive fire-prone grasses**;
- Which methods are **appropriate and effective tools in specific areas** e.g. grazing, back burning, firebreaks;
- Use of native and **culturally important plants for green breaks** that provide multiple benefits.



4. INCLUDE DIVERSE PERSPECTIVES TO INFORM PLANS, POLICIES AND MANAGEMENT ACTIONS

Cross-Disciplinary Review Helps Achieve Multiple Benefits, Identify Tradeoffs and Avoid Foreseeable, Yet Unintended Impacts

Due to the interconnected nature of our landscape and diverse values in Hawai'i, it is important to ensure sufficient cross-disciplinary input is gathered for plans and policies.

Action planning workshop participants emphasized the importance of incorporating diverse expertise and perspectives to optimize protection value of hazard reduction activities while also mitigating any impacts they might cause. Examples include designing roads/fuel breaks in tandem with erosion control and prevention methods; using Minimal Impact Suppression Techniques (MIST) during firefighting efforts; and developing a wildfire plan ahead of time to ensure that sensitive areas are priorities for protection.

Enhance policy consistency among agencies and develop process to reconcile competing priorities related to vegetation management.

Ensure **cross-disciplinary review of plans to reduce negative impacts and unintended consequences** (for example consider erosion control for firebreaks).

Strategic Grazing: A Tool to Reduce Wildfire Hazard



While significant damage has occurred across Hawai'i landscapes from poorly managed feral ungulates and historic overgrazing, strategic and well managed grazing is an important tool to reduce fuel loads. **Strategic grazing as a fire fuels management tool was a top recommendation of workshop attendees.**

Grazing corridors and buffers around roadway, electric power lines, and around community areas can help protect these important areas as well as reduce fuel right at the source of where most wildfires start.

Well managed grazing requires adequate **fencing and water infrastructure** and **ensuring protection both animals and native plant communities.**

Invest in strategic fencing to manage appropriate grazing.

Grazing Buffer Considerations:

Water infrastructure:

- **Water for livestock = more grazing pressure** and thus more fuel reduction.
- Water pipe stands or holding tanks to have appropriate connections for firefighting (dual use of water).

Fencing:

- A must for strategic grazing and to protect important biodiversity resources.
- Long-lasting fencing includes not damaged by wildfire.

Protect Cultural Sites During Emergency Response

Hazard mitigation and wildfire suppression activities can have negative impacts on significant natural and cultural resources. Impacts to these resources need to be considered so that resources are protected.



Coordinate with fire department with pre-fire planning and ongoing communication to ensure that **firefighters know where important places are** (including fragile ecosystems and cultural sites) **during wildfires and emergency response action.**



5. INTEGRATE WILDFIRE-THINKING IN PLANNING AND DEVELOPMENT

Including Firefighting Infrastructure and Strategic Open Space in Communities Can Reduce Wildfire Hazard

In Hawai'i, developed areas are frequently mixed and adjacent to wildland areas, open space, and agricultural lands (active and fallow).

Unmanaged vegetation in these areas can be a wildfire hazard.

Managed open space can function to reduce wildfire hazard around communities and provide multiple benefits. In appropriate areas, incorporating fire infrastructure designs in new development could reduce wildfire hazard of existing developed areas.

Workshop participants identified some approaches to strategically use open space areas at all scales in and around communities to reduce wildfire hazard, including:

Multiple Benefits of Fire Infrastructure

- **Firebreaks** around communities can function as emergency access, multi-use paths, etc.
- Grazing for **fuel reduction** with strategic water access supports ranchers and firefighters.
- Managed and maintained open space around community areas (e.g. parks and recreation areas, ball fields, golf course, community spaces) create **less burnable areas** around communities.
- Removing certain fire-promoting invasive species (including fountain grass) from natural areas can **reduce the ignition potential** of those areas.



Launiupoko multi-use pathway and firebreak. Credited by residents as the critical infrastructure allowing firefighters to protect homes during a 2016 fire. Photo Credit: Gordon Firestein, Launiupoko Firewise Community

Site Level

The ignitability of a home, from design to building materials and vegetation maintenance around a home or building makes a big difference to whether a home will be defensible by firefighters.

Incorporate Firewise principals in building and landscaping designs (e.g. "hardened homes"; low ignition potential; separating fuel/vegetation).

Subdivision/ Neighborhood Level

In unbuilt areas, vegetation grows! Integrating wildfire mitigating infrastructure in planning, development, and maintenance examples include:

Reduce fuel and convert vegetation to lower ignition potential in areas surrounding neighborhoods and high ignition areas (e.g. roads, electric utilities, homes).

Incorporate firebreaks around communities and critical resources (they can function as emergency egress/access or multi-modal paths/healthy transportation network).

Integrate **water infrastructure with appropriate connections for fire department** in grazing management, firebreak infrastructure, etc.

Landscape-Level

Fire ignition risks can be reduced through improved design of infrastructure corridors (e.g. roads and electric utility).

Use existing 'infrastructure' (e.g. roads, and bare lava flows) as firebreaks and **plan for wildfire in areas with recurring wildfire problems.**

Consider buried utilities or above ground encapsulated **utility corridors that prevent sparking in storms and windy areas.**

Develop safer road corridors with fuel reduction, water infrastructure, vegetation conversion and management of fire-promoting grasses, etc.



6. FUND THE MAINTENANCE

Spending on Maintenance Could Save Money

Hazard reduction, i.e. maintenance, can ensure or “insure” against loss from wildfire. Participants identified need to:

- **Strategically align and pool funds** – agencies and adjacent land owners.
- **Develop local funding sources** (e.g. legislative funding, carbon credit, agency mandates, PUC tariffs, gas taxes, etc.).
- **Develop incentives for private land owners actively managing vegetation:** (e.g. tax incentives, insurance incentives).

Financial resources are needed along with human resources that are skilled and knowledgeable in vegetation management (i.e., targeted species removal) to have people who can do!

“Spending money on fuels management reduces the amount we spend in wildfire suppression and limits the potential for fire in the first place.”

- Survey Respondent (Question: Why is vegetation management important from your perspective?)

Every action planning workshop group across the state highlighted the **need for maintenance funding.**

This is overwhelmingly the #1 priority of the O’ahu collaborative action planning workshop participants.

Raise Awareness of Value of Hazard Mitigation

In order to raise awareness of the value of maintenance for fire infrastructure among decision-makers, participants suggested:

Connecting with legislators to **raise awareness of the costs and impacts of wildfire** to increase wildfire prevention funding.

Capture costs of wildfire suppression (e.g. emergency personnel, lives, resources, helicopter) and do a **cost/benefit analysis of prevention versus wildfire suppression and losses/impacts from wildfire.**

Local Funding Mechanisms - Preventative Approach

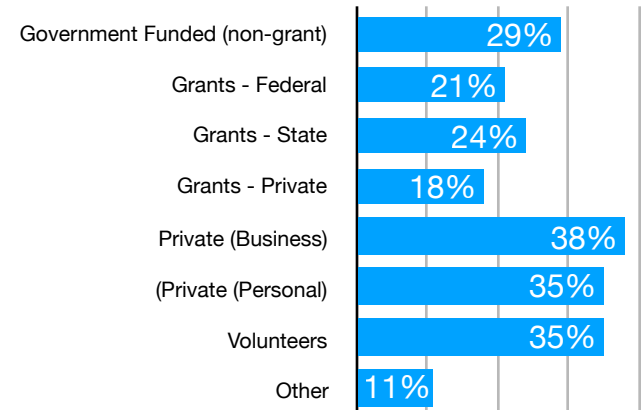
There is a gap in funding for maintenance of fire infrastructure and vegetation hazard mitigation.

Roads are critical fire infrastructure and road maintenance needs funding to do the job! Availability of federal funding is variable and currently funding is mostly focused on wildfire suppression.

Encourage maintenance funding for fire infrastructure including **development of local funding mechanisms.**

Create **in-state funding** for establishment and **maintenance of fire infrastructure** reflective of ongoing maintenance needs due to multiple growing seasons in Hawai’i.

Funding Sources for Vegetation Management Across Hawai’i



Question: What types of funding sources do you rely on? Based on 87 survey respondents statewide managing hazardous vegetation.



7. REVIEW AND UPDATE CRITICAL POLICIES

Policies Are Instrumental in Aligning Efforts and Enabling Funding to Reduce Wildfire Hazard

Collaborative Action Planning Workshop participants identified several policy areas related to vegetation management and reducing wildfire hazard that need to be addressed, including:

Establish policies enabling community capacity development (e.g. training, fire department liaison, volunteer fire departments).

Integrate Firewise practices in planning code (subdivision, building safety, community development plans, general plan).

Consider policies for **enforcement of brush abatement and risky fire behavior.**

Ensure cross-disciplinary review of plans and policies to reduce unintended consequences.



Fountain grass, an invasive fire-promoting grass takes hold on bare lava. Photo Credit: HWMO

Water Use for Firefighting

Include wildfire use in policies and plans for new water resources, including in dam policies, and keep water resources maintained.

Permit water sharing among agencies and large landowners (using agricultural water for fire suppression).

Biosecurity/ Invasive Species

An issue of widespread concern was biosecurity and invasive fire-promoting species. **By removing and preventing the spread of problem invasive grasses, we reduce the wildfire hazard to our landscapes.**

For example, on Molokai, land stewards report that there is no guinea grass sighted, yet. But lets keep it that way!

Update policies related to **biosecurity and fire-promoting species** including fountain grass and guinea grass.

Vegetation Management

Vegetation is managed by a patchwork of land owners and agencies with diverse priorities and capacities. Through policy we can align efforts to reduce wildfire hazard of vegetation at all scales from home to landscape-scale.

Create comprehensive vegetation management policies with appropriate process for reconciling diverse priorities.

Establish policies making proper disposal of greenwaste easier and more accessible.

Consider **agency mandates for vegetation management** (including the Public Utilities Commission).

Encourage **incentives** including tax benefits and insurance reductions **for active vegetation management.**



8. TAKE ACTION IN YOUR COMMUNITY

Preparing for Wildfire Can Reduce Wildfire Risk and Wildfire Impacts in Your Community

Building local capacity through training and pre-fire communication in coordination with the Fire Department could drastically reduce the impact of wildfires that do start and would be particularly beneficial in rural areas with recurring wildfire issues.

The need to build more local capacity in wildfire prevention, hazard mitigation, and emergency response was voiced at several action planning workshops. Suggestions included:

"[Red card certifications] would not only help our hui be a part of local fire suppression if called upon, but would help our organization think in terms of wildfire management to better prevent wildfire outbreak."

- Survey Respondent (Question: Why is vegetation management important from your perspective?)



Firewise hazard assessments are opportunities for shared learning for communities and emergency response professionals. Photo Credit: HWMO

Community Capacity Building

Designate **community liaisons for emergency response** communications.

Increase coordination with CERT and training.

Provide 'Red card' wildland fire training for community groups.

Prepare and practice for emergency response.

Raise Awareness / Be Prepared

Increase community awareness to include community as part of the solution. Community has the power to take action with greater awareness. **Share existing resources** including Wildfire LOOKOUT! and Ready Set Go!

Engage neighborhoods in Firewise outreach, planning, and hazard reduction activities.

Address fuel and hazard mitigation at all scales in community areas; remove debris from gutters, limb up trees, and separate tree canopies from roofs.

Coordinate collaborative **post-fire restoration response to reduce immediate impacts** such as sediment runoff and restoration that reduces future wildfire threats.

Resources:

1) Wildfire LOOKOUT!

<http://www.hawaiiwildfire.org/lookout>

2) Ready, Set, Go! Wildland Fire Action Guide

<http://www.Hawaiiwildfire.org/fire-resource-library-blog/rsg-your-personal-wildland-fire-action-guide>.

3) Firewise Communities Recognition Program and Online Portal

<http://firewise.org/usa-recognition-program.aspx>



9. PRIORITIZE FUEL MANAGEMENT AROUND FREQUENT IGNITION AREAS

Managing Vegetation in Fire Hotspot Areas Protects Both Critical Infrastructure and Can Reduce Wildfire Spread

Fortunately, **by prioritizing fuel management near critical road and power infrastructure and communities areas**, we can address both areas of frequent ignitions and **protect lives, property, and important resources**. Slowing the spread helps firefighters contain wildfires that do start more quickly.

Acknowledging limited resources, Collaborative Action Planning Workshop participants suggested prioritization of efforts, including:



Wai'anae area on O'ahu has recurring wildfires. Photo Credit: HWMO

Prioritize Strategic Action

Reduce fuels around critical infrastructure including power lines, roads, communication towers, water infrastructure, etc.

Reduce roadside fuel hazards.

Engage large landowners to **enhance fuels reduction and grazing near community areas.**

Prioritize funding for regular, annual maintenance of strategic firebreaks.

Clear around transformers and under power lines to address the frequent ignitions and protect important infrastructure.

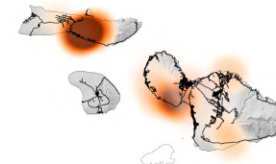
Establish and maintain firebreak buffers around communities.

Areas with Recurring Fire Issues Hawaii Fire History 2002-2012



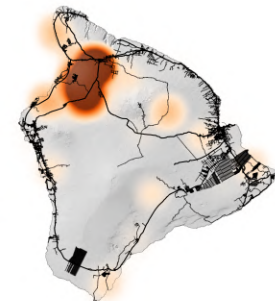
Areas with frequent ignitions:

- Roadsides
- Power lines
- Community Areas
- Boundaries/Untended Areas



■ Ignition Density
■ Size of Fire

0 50 100 mi



Keep a Lookout

Increase community awareness and keep watch. **Be on a lookout in areas with suspected arson.**

Prioritize areas with frequent ignitions and significant wildfires to address the complex social and environmental issues creating "hot spot areas".

10. TARGET HOTSPOT AREAS — ROADSIDE IGNITIONS

10 Take-Aways

Managing Roadside Vegetation Provides Big ‘Bang for the Buck’ by Managing Vegetation at the Source of Ignitions and Enhancing Fire Infrastructure

Roads as Firefighting Infrastructure

Roads are great firebreaks because they are wide, unburnable surface. They are critical during emergencies to reduce response time and for access and egress.

Roads that are enhanced with adjacent fuel reduction/lower ignition potential vegetation also keep firefighters safer and more effective at in their initial response.

With access to water that has appropriate firefighting connections, our enhanced firebreak roads provide critical firefighting infrastructure.

“developing firebreaks (with adjacent fuel breaks to reduce fuel load next to the firebreak, so safe burnout operations can be done along the firebreak)... are very efficient ways to increase the likelihood fire suppression resources will be able to contain wildfires in initial attack.”

-Survey Respondent (Question: Why is vegetation management important from your perspective?)

During the Collaborative Action Planning Workshops, there was a widespread call for more strategic management of hazardous vegetation along roadsides.

Participants identified needs to both increase frequency of maintenance in some cases and expand widths for roadside vegetation management.

Workshop participants identified numerous actions to address the roadside ignition problem and strategically align limited resources including:

Roads as Sources of Ignitions

Roads also tend to be where many fire ignitions occur due to the presence of people and a lot of things that are hot or spark (e.g. machinery, exhaust, cigarettes).

They also tend to be a conduit of invasive species spread when seeds hitch a ride on equipment.

Roads where adjacent land is maintained with low fuel load/ or low flammability vegetation can reduce the intensity and spread of wildfires that do start and helps firefighters more quickly contain a wildfire.

Make it a Priority!

Roads are both great firebreaks and a major source of ignitions. **This makes managing roadside vegetation a major priority!** Maintenance crews need funding and support to maintain enhanced firebreaks.



Collaborate with relevant parties including regional partners, adjacent landowners, and road maintenance agencies to **keep fuel loads low near roads by pooling resources and aligning efforts.**

Prioritize enhanced firebreaks to protect communities, critical infrastructure and important resources.

Integrate fire-thinking into the development process to **ensure good/safe roads, adequate emergency access, and water infrastructure.**

Establish **stable funding** source reflective of the need for of on-going, **year-round vegetation maintenance** in Hawai'i.

Locally-Appropriate Solutions

- Encourage alternative methods to manage roadside vegetation (because common herbicide practice can leave dead and ignitable fuels) including **roadside conversion of vegetation to lower ignition potential** such as:
 - Targeted fire-promoting invasive species removal;
 - Shaded green breaks adjacent to roadside with tree canopy shading out understory vegetation and increasing moisture;
 - Appropriate bio-cultural restoration between roadside and adjacent multi-use paths (e.g. enhanced firebreak).

What's Already Happening?

2018-19 RAPID MAPPING ASSESSMENT OF VEGETATION MANAGEMENT Quantitative Project Findings



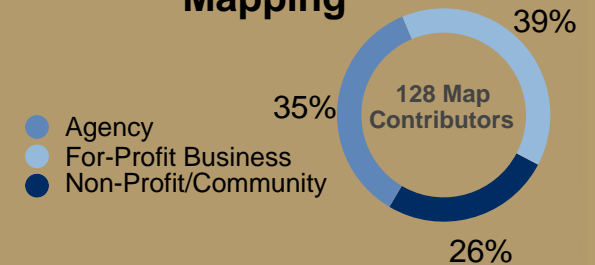
Rapid assessment mapping workshops held across the state. Photo Credit: HWMO



Rapid Mapping Assessment

During 2018-2019, HWMO contacted all large landowners with >1% of the island area and agencies managing vegetation. A majority participated in the mapping project. Map contributors included agencies, community groups and businesses across the state.

128 Groups Contributed to Mapping



This section presents summary results of the 2018-19 Vegetation Management Mapping Assessment.


In addition to mapping areas of vegetation management, land stewards identified reasons for managing vegetation, which methods were used, and how frequently they managed areas.

See [Appendix B](#) for details on data collection methods.



Hawai'i Statewide Summary

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Hawai'i Statewide 2018-19 Mapping Snapshot:	21
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Reasons for Proposed Vegetation Management	25
How Often Are Land Stewards Managing Vegetation?	26
What Methods Are Used to Manage Vegetation?	27




What was mapped?

Current Areas: Land managers in Hawai'i were asked to identify and map areas where they manage vegetation in a way that reduces wildfire hazard either as the primary purpose or as a byproduct of other activities.

Some contributors identified specific areas where vegetation management was taking place while others identified broad areas within which some management was occurring.

Proposed Areas: Mapping contributors were asked to identify priority areas in need of additional management of vegetation.

See Appendix B for all mapping methods.



Wildfire Hazard Mitigation Strategies

Wildfire disasters are preventable!

Wildfire hazard mitigation strategies address a key fuel of wildfire—vegetation.

Wildfire hazard mitigation strategies incorporated in and between our communities provide multiple benefits. Many ongoing activities already function as wildfire hazard mitigation including: managed grazing and agricultural areas; roads and multi-use paths; maintained community and recreation areas; and removal of fire-promoting invasive species.

Map contributors identified which type of hazard mitigation strategy was implemented in each area mapped.

Firebreaks: Access and Defensive Line



Firebreaks are typically scraped down to bare soil or other non-combustable material and are sometimes created during an emergency response.

Firebreaks can provide access for firefighters, break the continuity of fuel to passively slow the spread of wildfire across the landscape, and serve as emergency egress when wildfire is coming from

a different direction.

Firebreaks can be strategically incorporated in development through pre-fire planning. Roads can also be considered firebreaks (even while they are the location of many wildfire starts).

Planning for wildfire can help locate both permanent and emergency response firebreaks to protect values at risk and minimize unintended impacts including erosion and destruction of culturally significant sites.

Enhanced Firebreaks: Multiple Strategies

Enhanced firebreaks are those with reduced flammability or quantity of fuel on either side. **Enhanced firebreaks provide the greatest protection for firefighters** because as a wildfire approaches, it loses intensity if there is less fuel to burn.

When there is also adequate access to water, even better!

Enhanced firebreaks allow firefighters to be more effective in their initial response to fire. That is why roadside maintenance of vegetation is so important.

Fuel Reduction: Reduced Fuel to Burn



Fuel reduction is an immediate action that can significantly reduce wildfire hazard.

Fuels reduction activities **reduce the amount of burnable vegetation to slow the spread of wildfire** and break continuity of fuel across the landscape. Fuels reduction areas and linear **fuel breaks** require frequent maintenance and active management. Maintenance matters!

In Hawai'i, it only takes a few rainstorms for vegetation to re-grow and if unmanaged, **vegetation becomes hazardous fuel during the next dry spell or drought.**

Fuel Conversion: Make it Less Burnable



Conversion is a long-term solution to reducing wildfire hazard at the landscape-scale. **Fuels conversion** essentially means **transitioning vegetation from a higher fire risk to a lower one, or reducing flammability of vegetation cover.**

Because fuel load is constantly growing **active land management is necessary.**

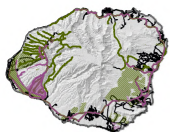
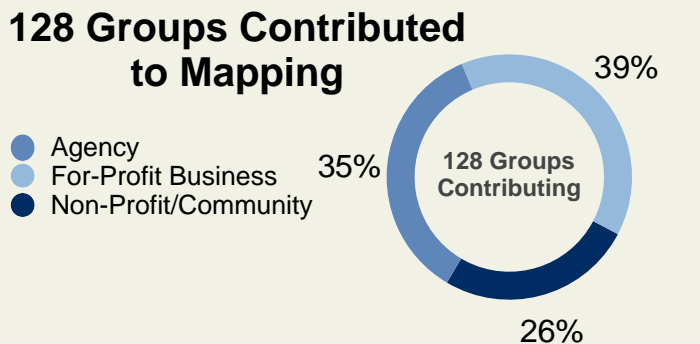
Fuel conversion is best used in combination with firebreaks and fuel reduction for immediate hazard reduction to protect places we value.

Integrated Approach: Multiple Strategies

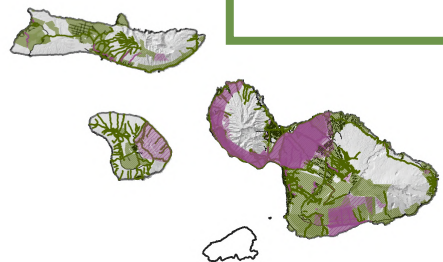
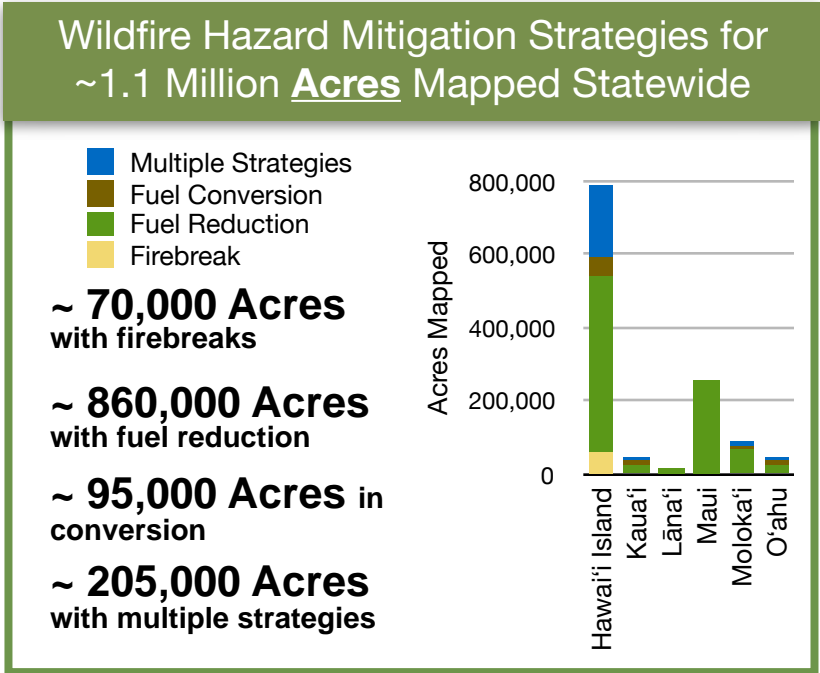
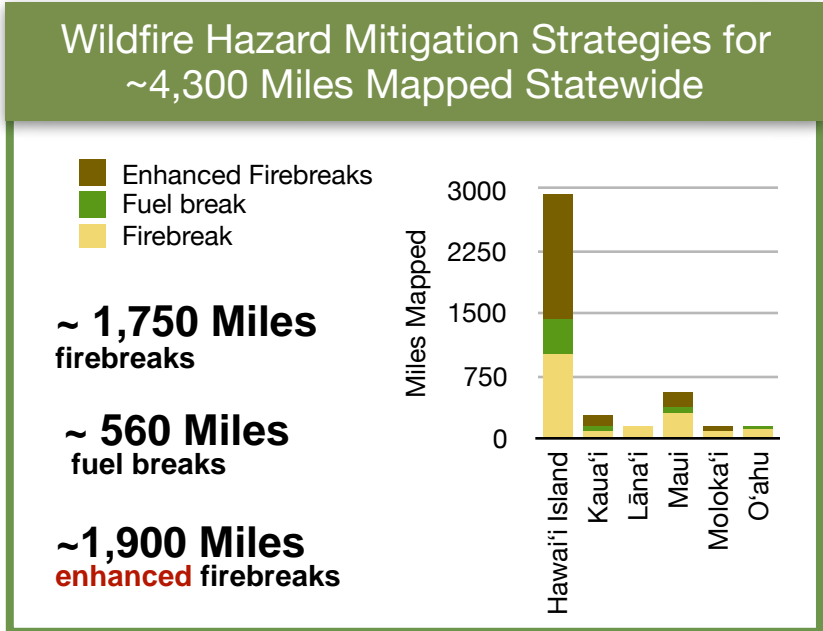
A combination of multiple strategies provides the greatest protection.

Areas with integrated strategies include grazing lands and agricultural lands with firebreaks throughout; native ecosystem restoration projects; and well maintained community areas, to name a few.

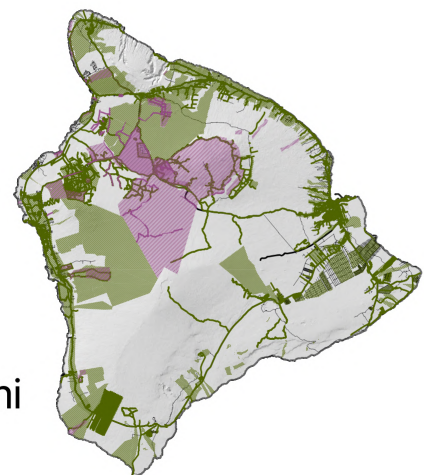
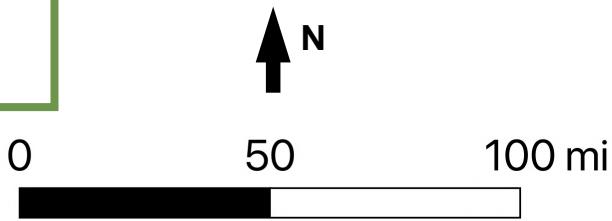
Hawai'i Statewide 2018-19 Mapping Snapshot: Current Vegetation Management



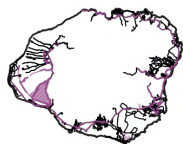
- Current Vegetation Management
- Proposed Vegetation Management
- Roads



* Does this map not jive with what you see on the ground? See Appendix B for mapping methods and data collection details.



Proposed Additional Vegetation Management



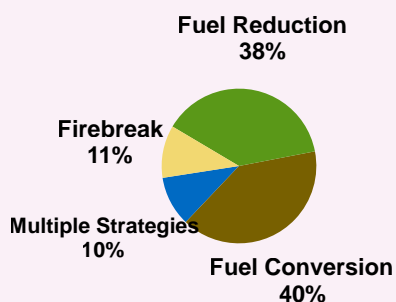
Some proposed areas were based on:

- Areas with **future plans and projects**
- Areas with **hazardous fuel load** (dry grass and woody debris, particularly non-native grasslands)
- Areas prone to **fire weather conditions** (dry, hot, windy weather — often in dry leeward areas but **more widespread in drought conditions and quick to spread with wind**)

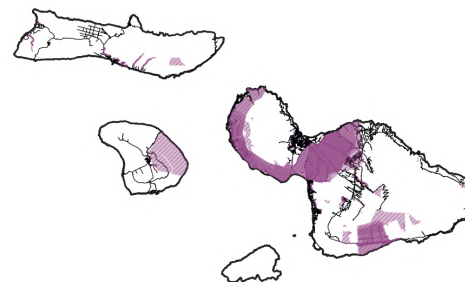
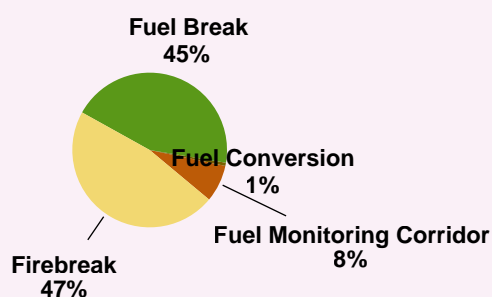
- Areas to **create buffers and safe access and defensible space** for firefighters to protect key places we value such as:
 - Communities
 - Infrastructure
 - Livelihoods
 - Cultural resources
 - Environmental resources
- Areas with **abundant human-caused ignitions** (near roadways/ machinery/ power lines, etc.)

What Hazard Mitigation Strategy Is Proposed?

~ 400,000 Acres
Needed Vegetation
Management Statewide

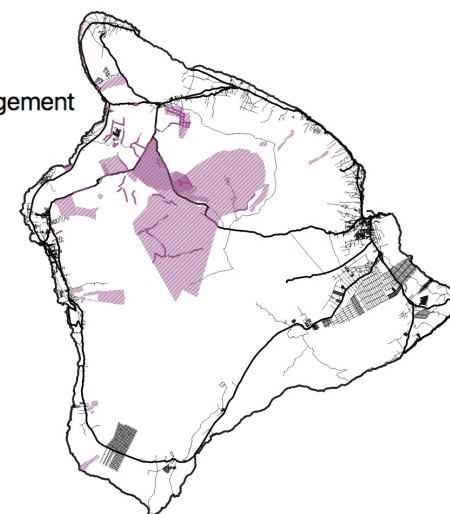


~350 Miles
Needed Vegetation
Management Statewide



* See [Appendix B](#) for mapping methods and data collection details.

--- Proposed Vegetation Management
— Roads



Why Manage Vegetation?

Stated Reasons Why Land Stewards Manage Vegetation

Much of the vegetation management occurring across the state is for reasons other than wildfire.

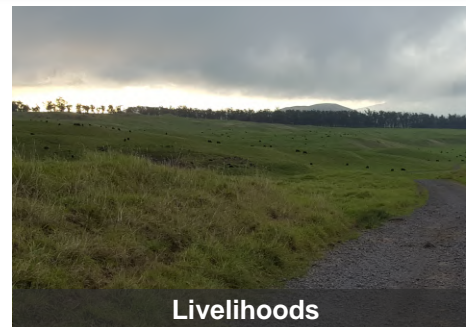
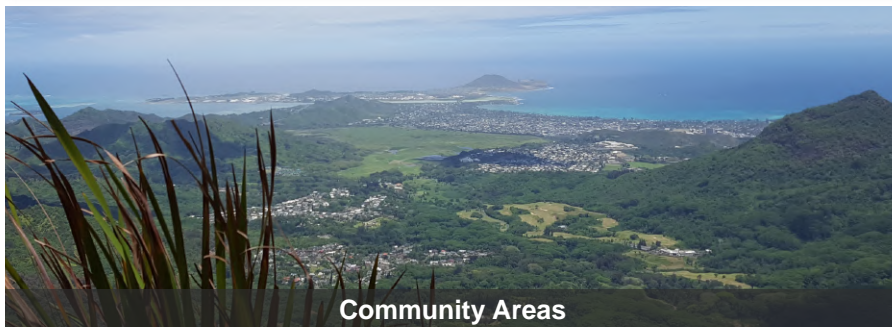
By **integrating fire-thinking** into existing management activities and **increasing collaboration** among adjacent land stewards, we can **optimize the effectiveness of limited resources.**

Reasons for managing vegetation include protecting places and resources we value, 'values at risk' such as:

- Protecting environmental resources (e.g. native habitats; functioning watersheds; mauka forest to reefs makai)
- Protecting cultural heritage (e.g. significant places and resources)
- Protecting and maintaining community areas (e.g. people, homes, recreation areas)
- Protecting municipal infrastructure (e.g. roads, power lines, communication towers, water infrastructure)
- Protecting livelihoods (e.g. ranching, agriculture and forestry operations)

In some instances, vegetation is maintained due to conditions such as:

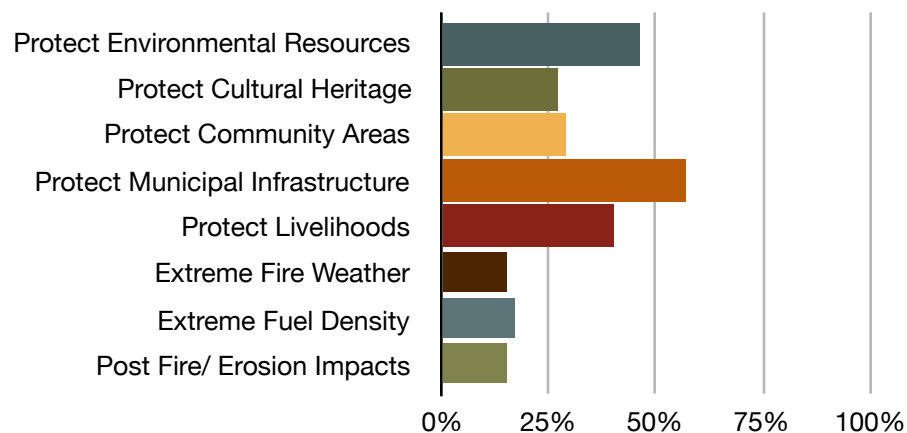
- Extreme fuel load (i.e., hazardous vegetation)
- Extreme fire weather (i.e., hot, dry, windy conditions often experienced on the leeward sides of the islands)
- Post-fire erosion impacts (i.e., soil loss and sedimentation on makai reef areas)



Reasons for Current Vegetation Management

For each area mapped, land managers in Hawai'i were asked **why they manage the vegetation in that area.**

For Which Reasons Are ~ 1.1 Million Acres of Vegetation Managed Across Hawai'i?

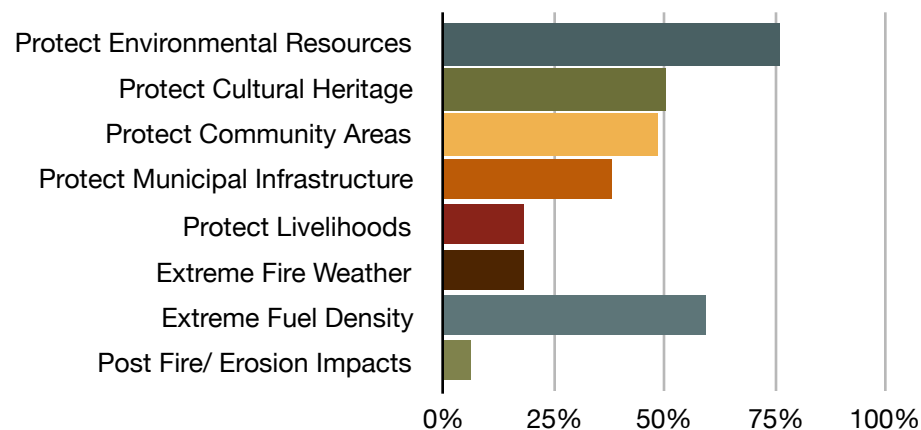


Percent of total acres mapped managed for each reason. In many cases multiple reasons were reported for vegetation management in the same area.

More than **50% of the 1.1 million acres** mapped **are maintained to protect municipal infrastructure**, including power lines and roadways. Our road maintenance crews and power companies are already doing a lot to maintain vegetation and reduce wildfire hazard.

There are often multiple overlapping reasons for managing vegetation. For example, strategic grazing may protect places from wildfire hazard and provide livelihoods.

For Which Reasons Are ~4,300 Miles of Vegetation Managed Across Hawai'i?



Percent of total miles mapped managed for each reason. In many cases multiple reasons were reported for vegetation management in the same area.

Roughly **75% of the 4,300 miles** mapped **are maintained to protect environmental resources**. More than **50% are managed specifically because of extreme fuel density**. Firebreaks and fuel breaks are valuable wildfire management strategies that help protect our environmental resources mauka and makai that are foundational to the prosperity and wellbeing of our communities.

How Often Are Land Stewards Managing Vegetation?

Land managers in Hawai'i were asked to report on how often they manage the areas mapped.

Due to the nature of our growing season in Hawai'i, vegetation management can be a year-round necessity. It doesn't take long for a wildfire hazard to re-grow and **maintenance is often necessary multiple times per year**. Interestingly, research shows a **relationship between heavy rainfall and wildfire due to the amount of vegetation growth and resulting extreme fuel load as weather changes and vegetation dries out**.

How Often Is Vegetation Currently Managed Across the ~ 1.1 Million Acres Mapped?

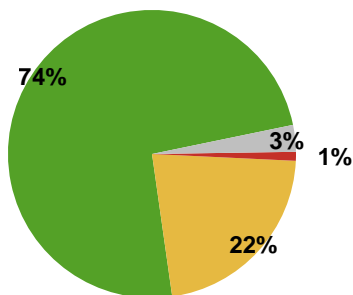
Frequency of Maintenance

- Unknown Maintenance
- Irregularly or Unmaintained
- Maintained Every Few Years
- Maintained Multiple Times Per Year

Most areas mapped, **74% of the acres, are currently managed multiple times per year.**

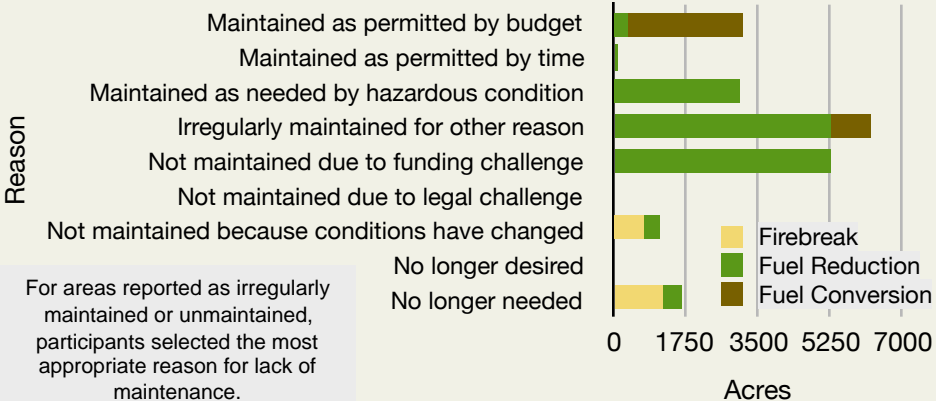
On the flip side, **roughly a quarter of all areas are managed less than yearly.**

More than 5,000 acres are *not maintained due to funding challenges* and another ~3,000 acres are maintained *as permitted by budget*.



Percent of ~1.1 million acres mapped statewide.

Reasons for the 1% (~100,000 Acres) Mapped With Irregular Maintenance or Unmaintained



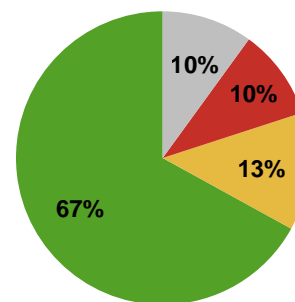
How Often Is Vegetation Currently Managed Across the ~4,300 Miles Mapped?

Frequency of Maintenance

- Unknown Maintenance
- Irregularly or Unmaintained
- Maintained Every Few Years
- Maintained Multiple Times Per Year

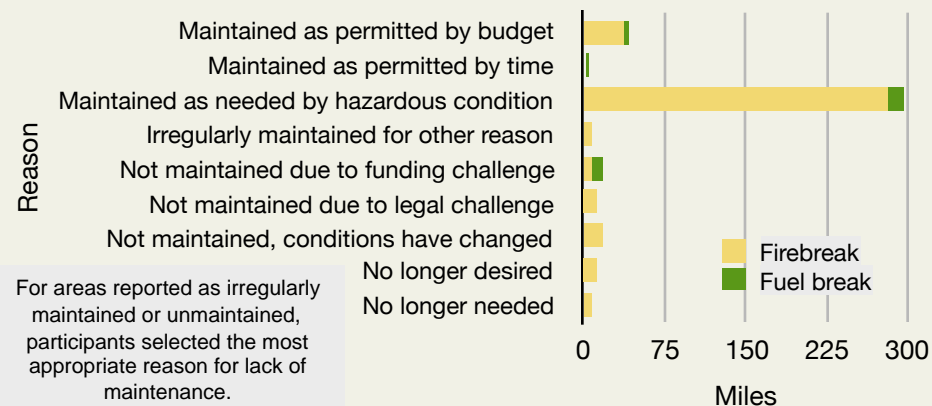
Most miles mapped, **67% of miles, are managed multiple times per year.**

Of note, 10% are irregularly maintained or unmaintained. Looking closer into the data, most of these areas are *maintained as needed by hazardous condition*.



Percent of ~4,300 miles mapped statewide.

Reasons for the 10% (~430 Miles) Mapped With Irregular Maintenance or Unmaintained











What Methods Are Used to Manage Vegetation?

Vegetation Management Methods

Mapping contributors reported on which methods are used to manage vegetation for the areas mapped. In some instances, multiple methods are used to manage vegetation in the same areas.

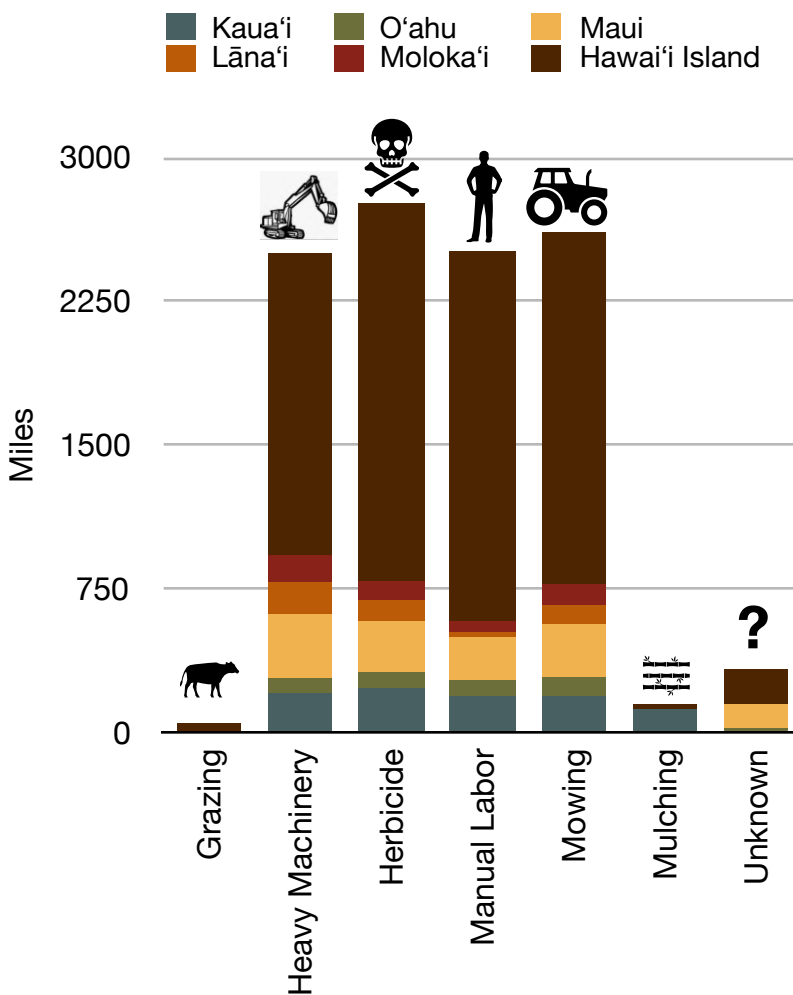
Land managers in Hawai'i were also asked what kind of coverage of the area was being managed.

Methods of Fuels Management:

-  Grazing
-  Heavy Machinery
-  Herbicide
-  Manual Labor
-  Mowing
-  Mulch
-  Prescribed Fire
-  Shade cloth

How Is Vegetation Managed Across Hawaii for Miles Mapped?

Methods by Island



Of the roughly 4,300 miles mapped, the four most **widespread methods include herbicide, mowing, manual labor and heavy machinery.**

Interestingly, these methods are often used in combination to manage the same fuel break or firebreak.

While grazing is only a small component of vegetation managed (for miles mapped), there are still examples of ranchers strategically grazing to create fuel breaks.

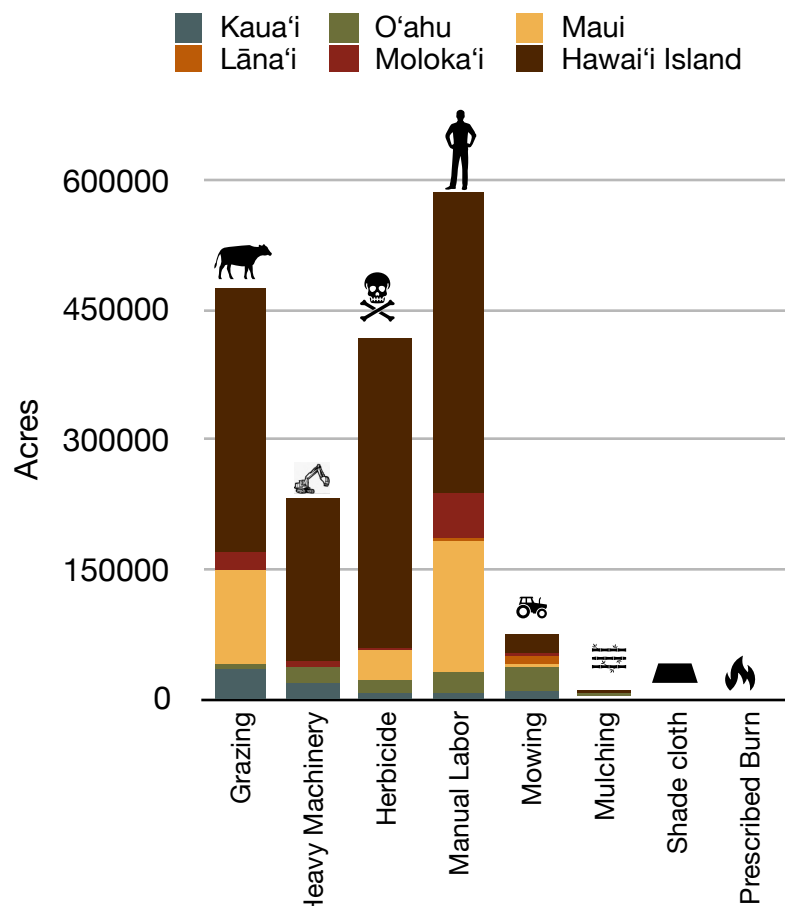
Mulching is also a reported method for fuel breaks. While mulch does burn, it slows the spread of wildfire and reduces the intensity of the wildfire.

All miles mapped were reported as being managed in contiguous lines.

Methods used to manage vegetation for the ~4,300 miles mapped statewide by island.

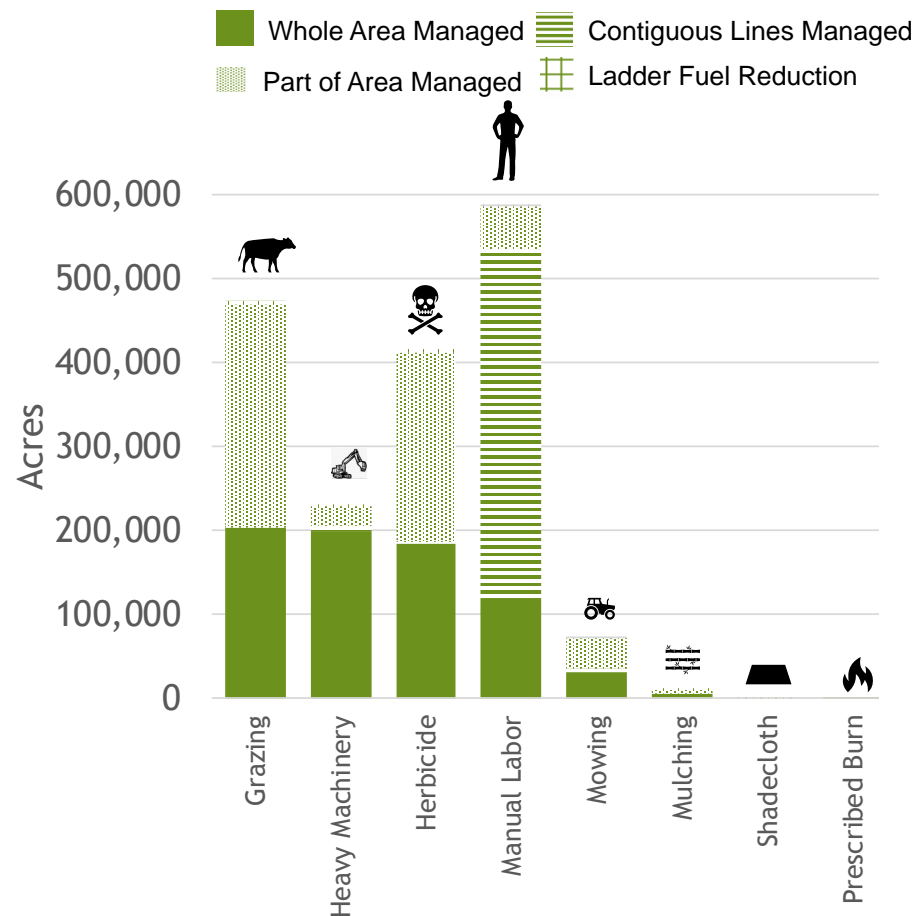
How Is Vegetation Managed Across Hawaii for Acres Mapped?

Methods by Island



Methods used to manage vegetation for the ~1.1 million acres mapped statewide by island

Methods by Coverage of Area



Methods used to manage vegetation and coverage of management for the ~1.1 million acres mapped statewide.

Of the approximately 1.1 million acres mapped, the **most widespread method is manual labor**. Manual labor includes weed whacking and chainsaw use to reduce fuel; or hand weeding and planting. Most of the area managed with manual labor is related to clearing vegetation in contiguous lines around power infrastructure.

Grazing and herbicide are also widespread methods. More than half of the areas using these methods have only part of the area managed. Even so, **a patchwork of reduced fuel can significantly slow the spread of wildfire** across a landscape.

Furthermore, land stewards using herbicide for targeted removal of invasive, fire-promoting species, not only reduce fuel, but helping transition to lower ignition potential landscape by removing these fire-promoting species and preventing them from further invading the landscape.

Also of note, prescribed burns are used in only a small fraction of cases as a method managing vegetation.

APPENDIX A: COLLABORATIVE ACTION PLANNING PARTICIPANT INPUT LISTS

Hawai'i Island - Hilo Participant Input List	30
Hawai'i Island - Kailapa Participant Input List	32
Kaua'i Participant Input List	34
Maui Participant Input List	35
Moloka'i Participant Input List	36
O'ahu Participant Input List	38



For the following participant input lists:

1. Concerns are numbered
 - Suggested solutions brainstormed by participants are bulleted
 - **Suggestions that were voted on after discussion by participants are bold (# of Votes)**



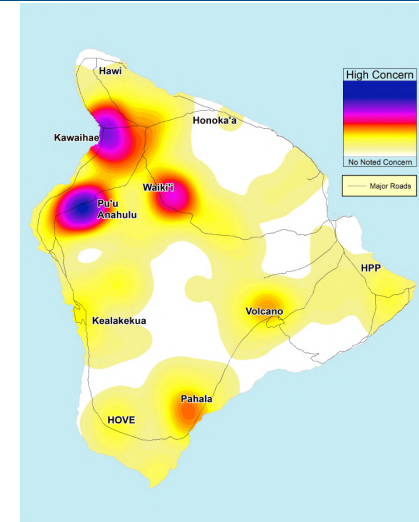
Hawai'i Island - Hilo Participant Input List

(1 of 2)

Hawai'i Island Participant Input From Hilo Workshop Held February 22, 2019

GENERAL CONCERNS

- Limited aerial suppression resources (expensive, big ticket items)
 - Contract aerial wildfire suppression resources (for island and state)
- Decision-makers unaware of costs and impacts of wildfire (why they should care)
 - Field trips with legislators (annual tour/workshop)
 - Coordinated approach to communicate with legislators
 - Opportunities for data sharing between different agencies
 - "Mauka to makai" framework for coordinated messaging
 - Sign-on letter for workshop participants or develop petitions
 - Encourage more people to contact their representatives about wildfire issues.
 - Reach out to Community Development Plan (CDP) action committees in outreach to include Firewise principles in CDPs and County General Plan.
 - Develop template slides for partners to use and spread awareness
 - Connect with legislators to capture and communicate all expenses and costs of wildfire including restoration and work years later like removing dead standing snags
- Limited recording and reporting of costs/impacts of wildfire (\$ numbers are important for communicating importance to legislators)
 - Connect with legislators (include them in wildfire hazard mitigation dialogue) (1)**
 - Capture costs of wildfire across agencies and groups and communicate that cost
 - Collaborate with invasive species groups to capture costs
 - Collect records and develop recommendations on how information is recorded so that costs are more easily traceable
- Electric utility hazard
 - Engage power companies in the wildfire hazard mitigation discussion
- Use of tools and machinery in high wildfire hazard conditions
 - Pursue policy/legislation (4)**
- Lack of enforcement/consequences for ignitions, high fire risk behaviors, and negligence of hazardous vegetation
 - Juvenile fire start education program
 - Identify models/precedents for enforcement
- Mitigation measures can have unintended consequences
 - Ensure cross-disciplinary review of plans for reducing negative impacts (for example, consider erosion control for firebreaks) (1)**
- Maintenance of fire infrastructure not typically funded
 - Fund the maintenance (2)**
 - Explore funding from Hawai'i Tourism Authority (part of tourism tax could go toward preserving natural and cultural resources that people are coming to see)
 - Develop strategy/recommendations for plant community conversion to low maintenance and low fire hazard
- Spread of invasive species and lack of biosecurity defense so that new invasive species can still get in
 - Develop cohesive strategy for landscape-scale vegetation management
 - Connect the dots and communicate to funders the issue of biosecurity, invasive species, and wildfire
 - Encourage tourism authority to understand and take on the issue (if we don't protect what we have of value, we will lose the things we have of value)
 - Elevate the issue and encourage state government to take proactive role to prevent more issues
- Ignitions in dead vegetation along roadsides managed with herbicide
 - Explore vegetation type conversions along roadways and replanting (acknowledging limitations and safety concerns) (2)**



maintenance and low fire hazard

Hawai'i Island Participant Input From Hilo Workshop Held February 22, 2019

NORTHWEST Area Specific Concerns:

1. Lack of water resources in much of South Kohala
 - **Pursue legislative permission to share water for firefighting purposes (1)**
 - Expand water resources
 - Utilize Waikoloa well pump flush water for wildfire suppression such as helicopter dip tanks or wildfire mitigation
 - Explore possible tax incentives (such as donation of water to HWMO non-profit for wildfire mitigation) for landowners cooperatively sharing fire infrastructure
 - Expand definition of water for agricultural use to include firefighting
 - Seek grant funding to assist ranchers with dip tanks (dual use for livestock and firefighting)
2. Pu'u Anahulu wildfire hazard
 - Increase prescribed burning
 - Increase grazing
3. Kawaihae area — high ignition density along with dense and flammable vegetation hazard
 - Convert area to lower fire hazard vegetation type
 - Coordinate with ranchers to bring water for livestock to high ignition areas to

reduce fuel (where there is water, there is higher grazing pressure and thus more fuel reduction)

1. Waikoloa Road hazard
 - Funding resources for water infrastructure both for livestock and wildfire suppression that is resilient to fire hazards and long-lasting (not damaged by wildfire or not exposed to fire)
 - Discuss benefits of strategic grazing and integrate into new developments
 - Explore installation of green breaks that people want to use and maintain (biocultural restoration)

SOUTHERN Area Specific Concerns:

1. Faya in Volcano Golf Course area
 - **Education of homeowners about defensible space and Firewise practices (1)**
 - Integrate Firewise into CDPs and the county General Plan
2. Fountain Grass in Hawaiian Ocean View Estates (HOVE)
 - Continue to support education and outreach to homeowners (identify community leader to spread the word)
 - Encourage agency-led fountain grass removal assistance (e.g. BIISC)

3. In Manukā, fountain grass is encroaching on previously natural fuel breaks (bare lava flows) and native forests
 - Conduct prescribed burns
 - Coordinate with adjacent landowners that harbor fountain grass reserves
 - Continue ongoing communication and outreach
 - Prioritize target limited resources in areas to maintain existing fuel breaks
 - Landscape-scale approach in coordination with other organizations/ owners makes it easier to get funding and more effective fuels reduction projects for fine fuels management

NORTHEAST Area Specific Concerns

1. Saddle Road roadside fuels
 - MOU with Kilohana G.S camp (ongoing)
 - Keamoku grazing program
 - Expand grazing on north side of DKI with appropriate exclosures to protect threatened and endangered species from grazing herds (fences for herds)
2. Fountain grass and gorse along Mauna Kea Access Road
 - Work with county to reduce fuels along road (also reduces ant habitat)



Hawai'i Island - Kailapa Participant Input List

(1 of 2)

Hawai'i Island Participant Input From Kailapa Workshop Held February 26, 2019

GENERAL CONCERNS

1. Rapid 'Ōhi'a Death (ROD) leads to standing fuels (particular area of concern in Puna and South Kona)
 - Map and incorporate ROD areas into fuels and hazard planning
2. Need to communicate location-specific wildfire danger rating because of high variability in Hawai'i
 - **Identify leads to maintain weather stations and communicate info on each island (1)**
 - App in development at UH for real-time weather/fire weather conditions for Hawai'i
 - Site specific data collecting and reporting – citizen science and web platform
3. Need critical information to be available for emergency response during a wildfire (e.g. pre-fire planning / road access info for emergency response vehicles)
 - Develop centralized source / GIS data to gather information needed during an emergency response and provide workshops to agencies on how to access information and increase familiarity between groups
 - Resurrect HWMO resource mapping project and coordinate with fire department
4. Lack of financial sustainability for projects — need for more stable funding sources for wildfire prevention and hazard mitigation
 - **Capture cost of wildfire suppression (e.g. emergency personnel, lives, resources, helicopters, etc.). Do cost/benefit analysis of upfront capital costs or maintenance costs of prevention versus costs of suppression plus losses, destruction, and impact of wildfire (3)**
 - Communicate urgency and costs of wildfire issue to those making funding decisions

- Leverage and coordinate funds from different agencies and stakeholder groups
 - Develop local funds for wildfire prevention/hazard mitigation and post-fire restoration
4. Because of high variability in climate, geology, vegetation in Hawai'i, need locally-appropriate approaches for wildfire prevention and suppression
 - Consolidate and communicate research on what methods are more effective and appropriate tools in specific areas; Lots of tools in the toolkit so that we can “use the right hammer” – e.g. grazing, back burning, firebreaks, etc.
 - Data collection, analysis, and communication of effectiveness of different tools
 5. Recurring wildfire in invasive grass landscapes
 - **Increase collaborative response in post-fire restoration. Have deliberate plans for after fires happen; be ready to mobilize within a short time frame; hold post-fire workshops to develop post-fire action team and planning (e.g. Burned Area Emergency Response) including emergency sediment control, land-use goals, revegetation process in order to transition to a less fire-prone landscape (3)**



- **Take opportunity that wildfire events provide to replace invasive plants like Fountain Grass by reseeding with less fire-prone and more desirable species (e.g. pili grass or forest restoration, as appropriate) (2)**
 - Accept and expect wildfire to return – plan for fire, use existing infrastructure such as roads and natural bare lava flows for firebreaks
6. High wildfire hazard in areas that have been deforested and converted to dry grasslands (for example, in Kohala)
 - Get more people to plant and restore the forests and watersheds
 - Need to find a balance of feral animal grazing as a fuels reduction tool and their destructive impacts (for example, Pelekane and Honokoa watersheds)
 - Identify areas where grazing is an appropriate fuels reduction tool
 - When using grazing as a tool, recognize it as a service and “sweeten the pot” for ranchers to make strategic grazing worth their while
 - Develop access and water resources within appropriate grazing areas in coordination with fire department

Hawai'i Island Participant Input From Kailapa Workshop Held February 26, 2019

KA'Ū Area Specific Concerns

1. Need to protect critical infrastructure such as Waste Water Treatment Plant above Na'alehu from wildfire hazard
 - **Develop wildfire plan for waste water treatment plant (1)**
2. Protect Kāwā community resources including food and cultural resources mauka to makai
 - **Restoration mauka to makai (1)**
 - Become a Firewise community in Kāwā
3. Need to protect Waikapuna and Kalae cultural resources during wildfire response/ and suppression activities (because of sensitivity and value of resource; regular occurrence of wildfire in those landscapes; and the destructive potential of uniform firebreaks bulldozed)
 - Communication (on maps or other) about endangered species and cultural resources (e.g. areas to protect and avoid)
 - Pre-fire communication with the fire department (proactive approach)
 - Designated liaison between community/ stewards and fire response team
 - Locate, map, and communicate species of concern and areas of sensitivity to emergency response team
4. Ka'ū has recurring wildland fires and community is underserved regarding fire emergency response capacity
 - **Build/ assist capacity of on-the-ground groups in Ka'ū so that community can support wildfire suppression effort (1)**
 - Organize community rapid response team and resource/contact for fire department (e.g. to open up water lines; cut firebreak lines; point of contact for fire department; consider training needs; provide info to drivers and vehicles; maps; levels of accessibility for different vehicles of different roads; open gates/gate codes; provide phone numbers; identify sensitive areas such as cultural and natural resources)

- Develop more connectivity with CERT (Community Emergency Response Team)
- Establish well-known firebreaks for areas that burn regularly
- Apply for WUI (Wildland Urban Interface Grant Application period June to August 2019 for FY2020)

KOHALA and HĀMĀKUA Area Specific Concerns

1. Roadside fuels and traffic both increasing in fire-prone area along Daniel K. Inouye highway and Saddle Road near Waiki'i Ranch community, thus increased wildfire risk
 - Additional roadside fuels management
 - Fuels reduction (grazing) buffer along Keamoku area
 - Establish consortia of agencies to share assets to improve roads to make "good roads" that have less roadside fuel hazard
2. Spread of invasive fire-prone grasses and high fuel load in Ka'ōhe area of Mauna Kea in part due to sheep eradication; hunters no longer maintaining roadway fuel breaks; lack of DOFAW resources to control invasive grasses
 - **Reintroduce sheep as a managed population of grazers in strategic areas (2)**
 - **DOFAW to continue to improve roads as firebreaks (widen and mulch) (1)**
 - Gather data and examine trade-offs of ungulate removal/reintroduction and make information available, such as cost/benefit analysis; include benefits from resource users (e.g. hunters maintaining firebreaks as a result of use)
 - Close access to area in extreme conditions
 - Get word out ("don't park on dry grass" to prevent ignitions; use and spread Wildfire LOOKOUT! materials)
 - Expand/enhance fire danger and risk communication in fire-prone areas (considering road signage constraints)
3. Need for expanded roadside fuels management near Pu'u Wa'a Wa'a due to high wildfire risk and

significant potential impact of wildfire to critical ecosystems and Kona's watersheds

- **Engage DOT and partners (4)**
4. Erosion onto coral reefs after wildfire, in particular in Honokoa and Pelekane watersheds due to unique geology/soils, increased potential for human caused ignitions in the area, and increased development
 - **Target ignition risks along highway (prevention and hazard mitigation) (1)**
 - **Increase engagement and coordination among landowners and regional partners (e.g. DHHL and Queen Emma) (1)**
 - Balance feral animal grazing to maintain enough vegetation cover to prevent erosion
 - As development and access to area increases, make sure that fire department and other agencies engaged in pre-planning phase to ensure appropriate water access and adequate ingress/egress improvements
 5. High fuel loads along Hāmākua area roads
 - Convert fuel areas to food crops (creates shaded fire breaks, plus food security and jobs)



Mahalo to all of the workshop participants who contributed their input and expertise.

Kaua'i Participant Input List

(1 of 1)

Kaua'i Participant Input From Workshop Held February, 21, 2019

NORTH and EAST Area Specific Concerns

1. Need for private landowner assistance / programs
 - **Explore funding and technical assistance opportunities for private landowners and community programs (2)**
2. Anahola — Fuel loads need to be decreased
 - **Grazing via community group or rancher in limited areas (due to concern about cattle near ocean); Fuel breaks (1)**
3. Bridge by marina in Wailua; wildfire shuts highway, Kapa'a residents blocked; Cane Haul Road has high fuels
 - **Fuels management; Strategic fuel break (1)**
4. Decommissioned reservoirs
 - **Add water sources; New rules for water/dams should include planning for wildfire use, integrating wildfire into plans/policies for dams; dry pipe (1)**
5. Access: Need firefighting and fuels management access but do not want to increase ignitions; also deal with Rapid 'Ōhi'a Death
 - Manage fuels as possible and remove dead 'ōhi'a
6. Dealing with Guinea grass
 - Grazing?
7. Moloa'a Farms needs to increase awareness
 - Kaua'i Farmers United training; KKCR "In the Garden, On the Farm" program
8. Sleeping Giant - High usage and high number of ignitions

- Outreach/education for recreational users

WEST and SOUTH Area Specific Concerns

1. Need to manage fuels in fallow agricultural lands
 - **Manage fuels in these areas; Return to active use such as vegetable agriculture / food production (5)**
2. ADC land / Waimea Canyon Drive suspected arson issues
 - **Managing fuels; Better lookouts / people on watch; Keep water resources maintained (2)**
3. Koke'e area has high number of visitors and hazardous conditions (and only landline communications)
 - **Better roadside fuels management and communication with public/drivers during wildfires (1)**
4. Koke'e cabins at risk with high potential for entrapment
 - **Inspect houses and help residents with fireplaces/wiring/etc.; Increase regulations; Insert wildfire prevention practices in leases (they are state-owned); Better communication DURING wildfire incidents; Volunteer team / trained initial responders; Education for safety purposes (evacuate early,**

mitigate/manage hazards ahead; learn to safely defend); Improve communications for firefighting (repeaters and cell tower); Physical addresses and signage (1)

5. Abandoned homes and buildings with unmanaged fuels
 - Legislation/laws that owners and businesses must manage fuels
6. LThu'e and Poipu water no longer flowing; irrigation expensive
 - Work to support grazing
7. Markets needed for eucalyptus removal and food/vegetables/agriculture
 - Forest products industry to manage cleared timber
8. Moving cattle is costly and challenging
 - Sheep instead of cattle? (KIUC model); Beware of sheep getting loose and choose area carefully
9. State-owned land has strict regulations, which limits grazing opportunities; Over-grazing caused erosion
 - Grazing needs to come with grazing management plan that limits impacts
10. Wildland Urban Interface issues in South area (i.e., Poipu, Koloa)
 - Work with large landowners



Mahalo to all of the workshop participants who contributed their input and expertise.

Maui Participant Input List

(1 of 1)

Maui Participant Input From Workshop Held September, 27, 2018

GENERAL CONCERNS

1. Need landscape-scale vegetation management plan
 - **Develop whole island, whole county prevention and vegetation management plan with focus on sources of fire (5)**

CENTRAL Area Specific Concerns

1. Wailuku/Kahului – Area has lots of values at risk including dense population and infrastructure (airport, hospital, etc.); along with potential wildfire hazards, such as sparks from people, fallow land in between developed areas, green waste dumping, and windy conditions
 - **Establish and maintain fuel breaks around communities (5)**
 - **Implement green waste dumpster/chipper program in communities (5)**
 - **Include green waste bins at recycling centers (accessible hours including weekends) (1)**
 - Develop wildfire management plans among community associations
 - Increase community wildfire education, particularly related to landscaping choices and dumping green waste in gulch behaviors
 - Pursue planning avenues such as zoning, planning, and CCRs, where communities are required to maintain edges for low wildfire hazard



2. Upcountry Maui (Hāili'imaile, Pukalani, 'Ōma'opio, Kula) – Area has high population density; main roads used heavily and are ignition hazards; and tall grasses/flashy fuels surround
 - **Implement fuels management educational program for small landowners including agricultural and residential (1)**
 - Convert flashy fuels to lower ignition potential
 - Use prescribed burning to reduce fuel load
 - Manage/reduce haole koa fuel
 - Use nomadic strategic grazing to reduce fuel

WEST Area Specific Concerns

1. Ukumehame/Mā'alaea – Main road artery (potential ignitions)
 - Post fire danger road signs
2. Ukumehame/Mā'alaea – Need more discrete components about wildfire sources
 - **Use data-informed mitigation measures (2)**
3. Ukumehame/Mā'alaea – Power transmission lines (cause fires, vulnerable infrastructure); homeless camp ignitions
 - **Clearing around transformers and under power lines (8)**
 - **Update/improve/bury power lines (4)**
 - **Utilize “West Maui Goat” herds (available across West Maui) (4)**
 - **Increase enforcement capacity of homeless camps (1)**
4. Lahaina – Need in-state funding to manage vegetative hazards
 - **Establish a sustained in-state funding source (1)**
 - Engage insurance companies in funding hazard reduction

EAST Area Specific Concerns

1. Kahikinui – Area is remote, long emergency response time, lack of water, limited access roads, increasing wildfire danger and exposure, and need for roadside maintenance
 - **Maintain firebreak access system (6)**
 - **Install dip-tanks and include an integrated plan and maintenance (3)**
 - Continue relationship between Auwahi Wind Farm and community
 - Increase access to equipment
2. Haleakalā National Park – High fuel load due to old pine plantation adjacent to road and ladder/duff adjacent to forest preserve (biomass removal is a limitation)
 - **Shrink pine plantation (3)**
 - **Increase roadside maintenance (2)**
 - **Investigate logging opportunities (1)**
 - **Incentivize work with ranchers for more fuels management (1)**
 - More fuel reduction
 - Share DLNR Division of Forestry and Wildlife logging report with The Nature Conservancy (TNC) and Haleakalā Ranch
 - Continue National Park working with TNC
 - Work with city and state highways to maintain roadsides and create strategic planning



Mahalo to all of the workshop participants who contributed their input and expertise.

Moloka'i Participant Input List

(1 of 2)

Moloka'i Participant Input From Workshop Held April 2, 2019

GENERAL CONCERNS

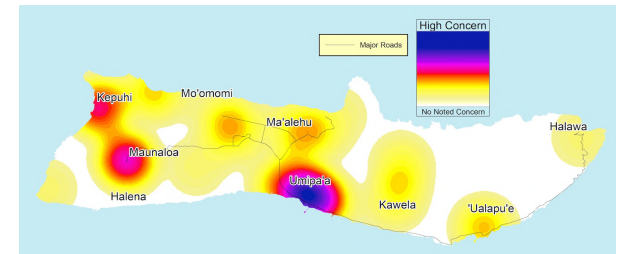
1. Potential for wildfire situation to get worse if there is the introduction of certain fire-prone species including fountain grass and Guinea grass
 - Interisland agricultural inspections
 - Work with Invasive Species Council (MISC) to safeguard against introduction of new problematic species
2. Management of feral animals; need to balance benefit of fuels reduction with damage from feral ungulates.
 - **Strategic fencing to manage appropriate grazing (1)**
 - Open hunting — 'walk only'
 - Balance feral animal introduction and grazing domesticated animals with negative impacts

EAST SIDE Area Specific Concerns

1. Kaunakakai Town — Lots of values at risk including community areas and important infrastructure for the island (schools, harbor, wastewater treatment, etc.); Area is 'heartbeat of the island'; has hazardous vegetation both from surrounding private landowners and homeowners dumping green waste "across fencelines"; Lots of ignitions and history of fire spreading out from town
 - **Establish and maintain firebreak buffers around town including old fire roads (3)**
 - **Enhance community awareness to include community as part of the solution. Community has the power to take action with greater awareness so share existing**

resources including Wildfire LOOKOUT! and Ready Set Go! (1)

- Continue to engage private landowners (including through Moloka'i Fire Task Force)
 - Encourage landowners to implement firebreaks or fuels reduction (grazing) buffers around town
 - Seek funding for fuels management in coordination with large landowners using in-kind match, such as existing grazing efforts
2. Kawela 3 Access Road to Preserve Areas— Critical and strategic firebreak that has been key to stopping past wildfires spreading East; Maintenance is underfunded and needs yearly maintenance as road is prone to erosion
 - **Prioritize funding to keep road maintained on a regular, annual basis (6)**
 3. Kilohana School Wave Crest – Community area to protect; community hub
 - Keep community areas maintained
 4. Pu'u o Hoku Ranch – Area is difficult for wildfire response; only has one ingress/ egress and a 5 ton bridge capacity limit that may restrict firefighting access, plus long distance from fire station
 - **Create additional emergency access (1)**
 - Increase helicopter options
 5. Mauka Watershed Areas and South Shore Reefs – wildfire impacts to mauka areas negatively impact watershed collection areas and important reef areas which provide food for the community
 - **Prioritize wildfire prevention in mauka areas to protect the water**



supply and reef areas — "Protect what is mauka to protect makai" (2)

6. Kamakou Preserve — Pine and eucalyptus plantations have potentially hazardous fuel loads
 - Thinning and ladder fuel reduction; Silviculture management
 - Contain the spread of invasive trees beyond plantation and use plantation as a buffer to prevent wildfire spread to native forest more mauka
7. DOFAW and TNC Base Yard — Need to protect infrastructure to coordinate and fight wildfires
 - Prioritize fuels reduction and hazard mitigation around base yard areas



Mahalo to all of the workshop participants who contributed their input and expertise.

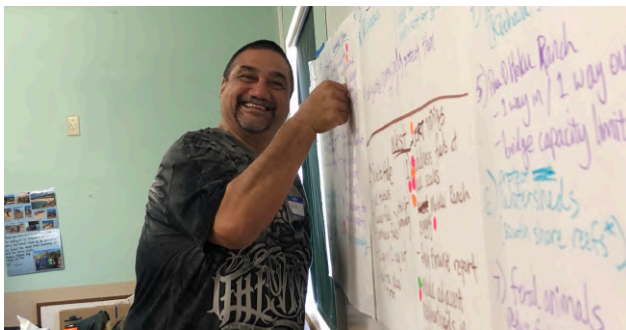
Moloka'i Participant Input From Workshop Held April 2, 2019

WEST SIDE Area Specific Concerns

1. Paniolo Hale — Community area to protect along with trees that are important and valuable to the community; Community has numerous wildfire hazards including wooden structures, woody ladder fuels leading to shingle roofs, contiguous canopy fuels and dry grass surrounding the area, and only one ingress/egress
 - Address fuel and hazard mitigation at all scales; remove debris from gutters, limb up trees, and separate tree canopies from roofs (5)
 - CERT trainings for community residents (2)
 - Engage and include adjacent neighborhoods in Firewise outreach, planning, and hazard reduction activities (2)
 - Engage Moloka'i Ranch to enhance fuels reduction and grazing near community (1)
 - Finish Firewise report and action plan for community

2. Maunaloa town — Area is community hub surrounded by fuel and has long fire response time; With the loss of plantation, there was a loss of manpower for wildfire response
 - Engage Moloka'i Ranch as a partner in wildfire suppression; Coordinate official agreement/public-private partnership so that all can contribute to wildfire response and pool equipment and water resources (similar to Parker Ranch and Waiki'i Ranch on Hawai'i Island) (7)
 - Revive volunteer fire crews; Capacity building of community response to wildland fire with training and equipment (federal excess property program to transfer older equipment to volunteer fire departments; CERT trainings) (6)
 - Establish fire station at Kaluakoi (3)
 - Continue ranch grazing
 - Community-driven approach

3. Protect important infrastructure including water supply, airport, communication towers
 - Prioritize fuels management around critical infrastructure (2)
4. North Coast area is important to prevent wildfire and protect native habitat, fishing, subsistence gathering, and unique cultural sites and burials
 - Prioritize fuels reduction and native plant restoration in the area; Remove keawe and chip to mulch to reduce fuel
5. DHHL Lands – Agricultural lands and homes surrounded by fuel
 - Prioritize fuel management around inhabited areas



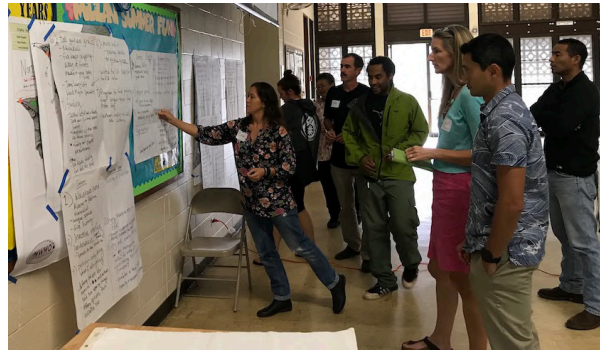
O'ahu Participant Input List

(1 of 2)

O'ahu Participant Input From Workshop Held February 19, 2019

GENERAL CONCERNS

1. Lack of long-term funding for maintaining fuels treatments
 - Pursue legislative funding support (14)
 - Encourage State of Hawai'i legislature to create program to provide consistent funding (i.e., quarterly) for projects on a longer-term basis that are reflective of Hawai'i's multiple growing seasons (e.g. carbon credit fund for wildfire mitigation like California's) (2)
 - Coordinate with volunteer groups like Team Rubicon for manpower on fire mitigation work (Mike: 808-785-9723)
 - Integrate efforts and provide input into County Hazard Mitigation Plan Update (Crystal: 808-723-8956 www.honolulu.gov/dem)
2. Stop spread of invasive grasses to new areas particularly mauka areas; Most native plants in Hawai'i aren't adapted to

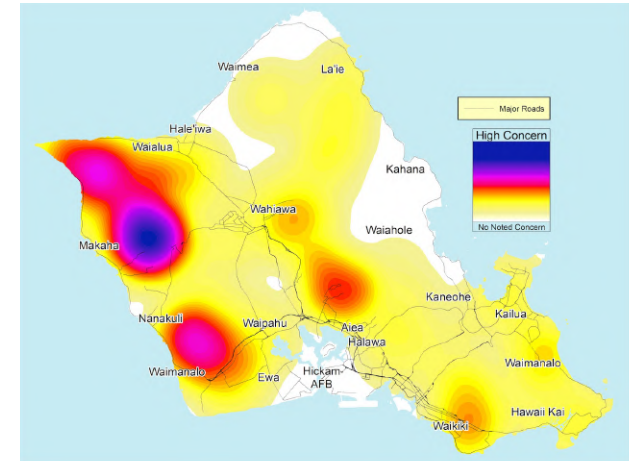


wildfire — they do not regenerate well after wildfire; Dryland forests do not develop closed canopy so cannot “shade out” grasses.

- Utilize grazing as a tool and carbon sequestration to fund restoration efforts (2)
- Explore alternative strategies to manage grass invasion including strategic grazing
- Research and compile information specific to dry forests

NORTH Area Specific Concerns

1. Waimea Valley – Limited manpower for restoration efforts and intense invasive grasses pressure
 - Continue to develop access roads and work with adjacent landowners for access (1)
 - Enhance restoration unit protection with interagency collaboration
 - Enhance outreach and education and volunteer capacity



EAST Area Specific Concerns

1. Limited information/recommendations for native plant restoration and transitioning plant communities to lower fire risk — particularly an issue in difficult terrain such as Hawai'i Kai
 - Identify techniques and methods; research on plant flammability, wildfire spread, and methods for plant community conversion
 - Develop clearinghouse for info and ways to share it that is accessible to both experts and lay people
 - High hazard urban interface in Hawai'i Kai (ignitions plus flammable fuels and rugged terrain)
 - Reduce hazards where there are high fire ignitions
 - Prioritize areas for attention with frequent ignitions and significant wildfires



O'ahu Participant Input From Workshop Held February 19, 2019

WEST Area Specific Concerns

1. Wai'anae area has many very important and unique native species from Ka'ena to Palehua to Honouliuli, and repetitive wildfires
 - Prioritize area for protection
2. Inactive interface landowners (large and small) resulting in “brush backing up to fencelines”
 - **Tie insurance rates to risk abatement or wildfire prevention education and awareness (2)**
 - More brush abatement enforcement
 - More incentives (tax breaks) for active management
 - Develop communication with landowners that currently do not maintain vegetation
3. Lack of adequate and consistent policies amongst agencies regarding vegetation management; Different policies between agencies so landowners are told two opposing things — there are differing opinions from experts, too
 - **Develop city, county, and state policies for vegetation management because agencies only fulfill mandates and can't take action or get funding without it them (4)**
 - **Enhance consistency/consensus between agencies — develop process for reconciliation/ compromise between competing**

priorities, values, and policies related to vegetation management for resolution in a timely fashion (2)

- Provide capacity building, assistance, and incentives for landowners to mitigate hazards as opposed to fining
4. Combination of high wildfire hazard factors in Wai'anae including lots of fallow ranch land that develops high fuel loads, frequent large wildfires in the region, lots of ignitions due to population, and need to protect critical habitat due to rare/unique species
 - Increase education about wildfire hazard of unmanaged areas, encourage management of lands “waiting for development”
 - Increase agriculture including ranching and farming
 - Plant koa/koai'a and enhance forest restoration in strategic areas.
 5. Power lines arcing and often have dry grass underneath (e.g. Palehua)
 - Reach out and engage HECO
 - Establish firebreaks along power lines
 - Invest in new technology to prevent arcing
 - Send letters to HECO and Public Utilities commission to encourage policies to require wildfire prevention
 6. Invasive grasses such as Guinea grass continue to spread, specifically in Nānākuli; wildfires keep converting more mauka

forests to grasslands (weed management specialist at position at UH remains vacant)

- **Provide more info and training specific to Guinea grass (3)**
 - Write to UH cooperative extension to fill weed management specialist role
7. Wai'anae Valley wildfire issues in “hot spot areas” — need local response team for known problem areas (near Ka'ala Farm) because emergency response time is too long and recurring burns every summer; Lives and safety of 'ohana in the valley at risk; Complex social issues including drugs and juvenile wildfire starts
 - **Keep inviting people to the table (people tackling the issue together is so important) (2)**
 - Develop volunteer fire department / local response team (with consideration of HFD concerns about liability)
 - Increase initial attack capabilities
 - **Explore models in other areas for developing local capacity response**



Mahalo to all of the workshop participants who contributed their input and expertise.

APPENDIX B: RAPID MAPPING ASSESSMENT DATA COLLECTION DETAILS

Mapping data was collected as a rapid assessment during 2018 and 2019. HWMO contacted all large landowners with >1% of each island's area and successfully had a majority participate in the mapping project. Mapping collaborators were engaged through one-on-one meetings and mapping workshops across the state. Other entities or groups were also welcome and participated. Some participants shared existing GIS files while others mapped areas using Google MyMaps (a free, collaborative, online mapping platform).

In addition to mapping areas of vegetation management, land stewards identified: the hazard mitigation strategy of the activity; reasons for managing vegetation; which methods were used; and how frequently they managed areas.

Some land owners mapped the exact areas of their activities while others, for privacy and other reasons, simply reported general areas where activities were taking place. Therefore, map areas and numbers of acres reported should be contextualized as such.

In an effort to maximize data quality, mapped areas and associated attributes were confirmed with mapping collaborators after all data was

converted in a compiled QGIS database. In some cases, areas were mapped by multiple groups, therefore efforts were made to minimize duplicate areas mapped when reporting acres using 'Dissolve' and 'Difference' geo-processing functions in QGIS 3.4

Feral animal grazing presented a particular problem for mapping because while feral animals do reduce fuel load (sometimes completely denuding the soil) they also have many undesirable impacts. During data collection, some groups reported areas with known 'significant feral animal grazing pressure'. Due to the lack of active management of the animals, these areas with no other management methods were excluded from maps and final data analysis.

Due to the nature of the data, maps are more reflective of active management of fuels and lands with "groups at the table for discussion" rather than depicting specific fuel load at any point in time.

This is the first ever state-wide dataset of vegetation management and can provide a great starting point for more specific or regional future planning efforts.



Rapid assessment mapping workshops held across the state. Photo Credit: HWMO

APPENDIX C: RESOURCES

1) Hawai'i Wildfire Management Organization Website

<http://www.hawaiiwildfire.org>

2) Pacific Fire Exchange

<http://www.pacificfireexchange.org>

3) University of Hawai'i CTAHR Cooperative Extension NREM Wildland Fire Program

<https://www.nrem-fire.org/>

4) Ready, Set, Go! Wildland Fire Action Guide

<http://www.Hawaiiwildfire.org/fire-resource-library-blog/rsg-your-personal-wildland-fire-action-guide>.

5) Native Plants Hawai'i

<http://nativeplants.Hawaii.edu/index/>.

6) University of Hawai'i College of Tropical and Human Resources (CTAHR) Weed Management Links

<http://www.ctahr.hawaii.edu/inweed/weedlinks.html>

7) USDA Natural Resources Conservation Service: Hawaii State-Listed Noxious Weeds

<http://plants.usda.gov/java/noxious?rptType=State&statefips=15>

8) Firewise Communities Recognition Program and Online Portal

<http://firewise.org/usa-recognition-program.aspx>

9) NRCS Field Office Technical Guides

<https://efotg.sc.egov.usda.gov/#/details>

Standards and specifications related to fuels management:

- Brush Management (Code 314)
- Forage and Biomass Planting (Code 512)
- Fuel breaks (Code 383)
- Grazing Land Mechanical Treatment (Code 548)
- Herbaceous Weed Control (Code 315)
- Land Clearing (Code 460)
- Prescribed Grazing (Code 528)
- Range Planting (Code 550)
- Riparian Forest Buffer (Code 391)

10) Joint Fire Science Program Brief: Prevent or Reduce Fire with Goats

http://www.firescience.gov/projects/briefs/99-1-3-02_FSBrief34.pdf



HWMO



HAWAII WILDFIRE MANAGEMENT ORGANIZATION