



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

2018-19 Vegetation Management

**Rapid Mapping Assessment
and**

Collaborative Action Planning

Maui Report

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 fire 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
(Team: Elizabeth Pickett, Lele Kimball, Melissa Kunz, Orlando Smith, Pablo Beimler, Tamara Hynd) with collaborative support from:

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

Funding

- Hawai'i State Grant-in-Aid Program, 2016
- U.S. Forest Service, Pacific Southwest Region, under the terms of Grant No. 16-11052012-146 and No. 17-DG-11052012-143. USDA is an equal opportunity provider and employer.

HWMO Photo Credits:

Elizabeth Pickett
Lele Kimball
Melissa Kunz
Orlando Smith
Pablo Beimler
Tamara Hynd

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



Collaborative Action Planning Workshop at Wailuku. Photo Credit: HWMO

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

CONTENTS

Project Summary	1
Wildfire Hazard Across Maui	2
The Value of Being Proactive About Wildfire Is Enormous!	3
Why Focus on Vegetation Management?	4
Maui Areas of Concern and Prioritized Actions: 2018 Collaborative Action Planning on Vegetation Management	5
What’s Already Happening on Maui? 2018 Rapid Mapping Assessment of Vegetation Management	11
Appendix A: Collaborative Action Planning Participant Input List	26
Appendix B: Rapid Mapping Assessment Data Collection Details	28
Appendix C: Resources	29



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 fire-thinking into current activities** to address the cross-boundary wildfire risk.

This Maui Report is one of six island reports developed 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. Additionally, a Statewide Summary Report was created to summarize findings across the state.

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 Hawai'i, **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.

Maui Rapid Mapping Assessment Summary Findings:

- ~ **217,000 acres** and **560 miles** of **current** firebreaks, fuel reduction or fuel conversion mapped on Maui.
- ~ **132,000 acres** and **90 miles** of **needed** firebreaks, fuel reduction or fuel conversion mapped on Maui.

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.

Maui Collaborative Action Planning Workshop Summary:

A workshop was held on Maui with a total **41** participants. Areas of concern were identified through a collaborative mapping process and prioritized actions are presented in the format of "What's the Issue" and "What Can We Do" based on participant discussion and prioritization. All concerns and suggested actions are captured in *Appendix A: Participant Input Lists*.

Themes that emerged in multiple workshops across the state are summarized in the *Hawai'i Statewide Summary* (separate report).

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 the reports.

WILDFIRE HAZARD ACROSS MAUI

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

Wildfires do not recognize fences or ownership boundaries.

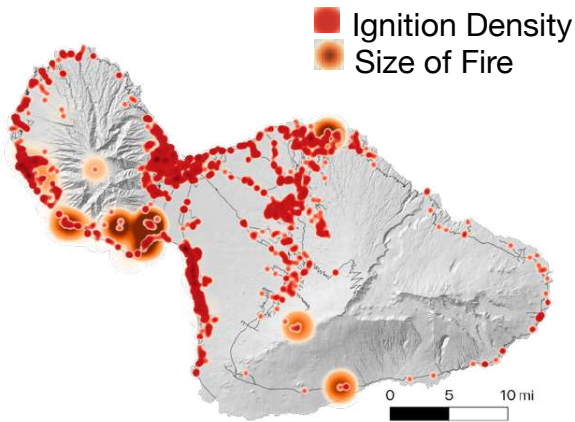
Ignitions



Fuel
(Hazardous Vegetation)

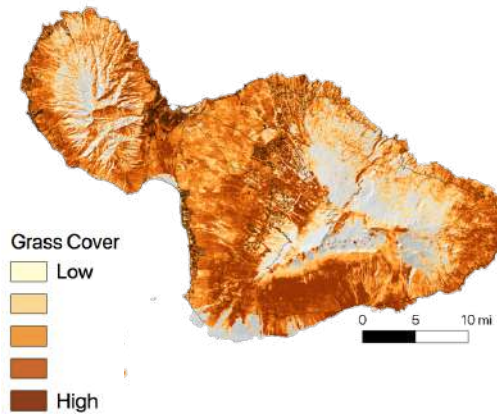


High Wildfire Risk



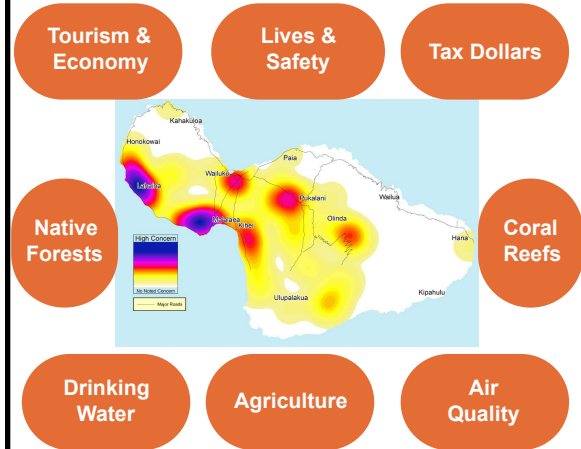
People Spark Fire

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



Widespread Impacts

Professionals and community dealing with the impacts of wildfire have identified **priority areas** where wildfire **hazard and values at risk overlap**.
Source: HWMO 2019 Action Planning Workshop data

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

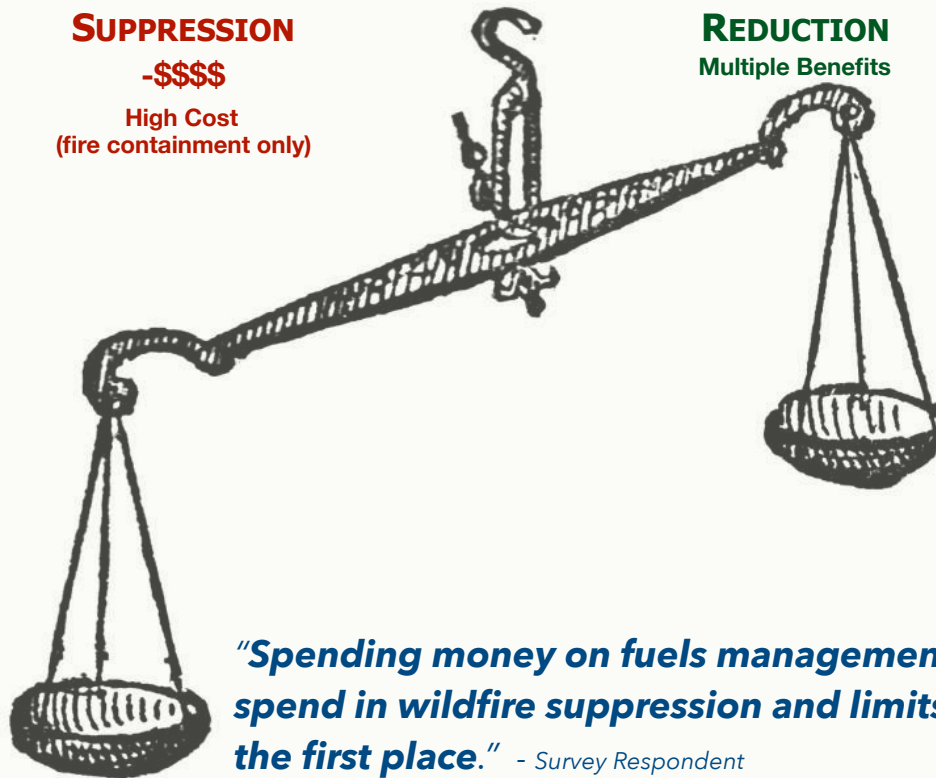
Reactive Cost of Fire Response:

- \$ 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 fires 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).



Collaborative Action Planning Workshop at Wailuku, on Maui September 27, 2018. Photo Credit: HWMO

Maui Areas of Concern and Prioritized Actions:

2018 COLLABORATIVE ACTION PLANNING ON VEGETATION MANAGEMENT Qualitative Project Findings



Professionals and community came together to identify areas of concern and discuss and prioritize actions to reduce wildfire hazard. Input was gathered through an Action Planning Workshop held on Maui with 41 participants representing diverse groups including:

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

The following *Maui Priorities* are summaries of actions prioritized by workshop participants.

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.



Maui Summary

2018 Collaborative Action Planning Workshop Highlighted Concerns and Priority Actions

What Are the Issues?

- **There Are 'Hotspot Areas' with Recurring Fire Starts that Threaten Critical Infrastructure**
- **Fire Infrastructure Needs Regular Funding for Maintenance But Currently Lacks Funding**
- **Green Waste Dumping and Overgrown Vegetation Creates Wildfire Hazard in Communities**

What Can Be Done? (Top Recommendations)

- **Protect Infrastructure and Prevent Wildfires**
- **Integrate Fire-Thinking in Long-Term Planning and Policies Supportive of Landscape-Level Vegetation Management**
- **Make Green Waste Removal Easy and Accessible**



Collective Areas of Concern Collaborative Mapping Process

1. First, Collaborative Action Planning Workshop participants identified and drew areas that contain “Values at Risk” on a map of Maui.
2. Next participants identified areas where there are **hazardous fire conditions** due to **fuel load, fire weather, and a history of ignitions**.
3. Once all of these areas were drawn on the map, each participant was asked to use stickers to identify their priorities for **where to start first for hazard reduction activities**.

This process generated the heat map to the right.

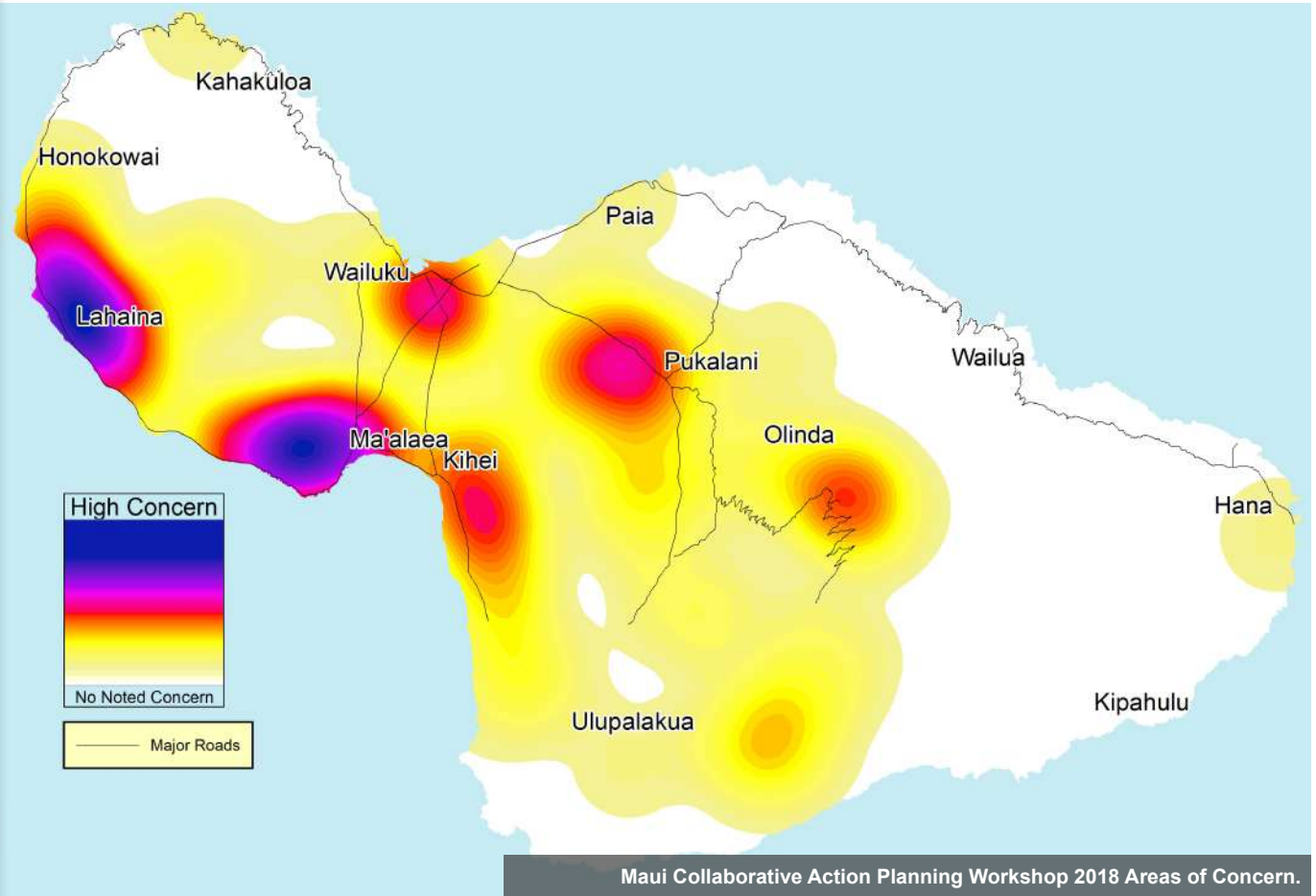
Collaborative Prioritization Process

1. Participants discussed their concerns related to priority areas and brainstormed possible solutions/ actions.
2. After discussing next step actions and solutions, participants voted on their **priority actions**.

The following *Maui Priorities* are summaries of priority actions voted on by workshop participants.

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*.



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, substance gathering areas, significant ecosystems, water resources, soil resources, makai reefs
- **Livelihood areas** e.g. tourism, businesses, agricultural lands (grazing lands/ forestry, farming)



What's the Issue?

There Are 'Hotspot Areas' with Recurring Fire Starts that Threaten Critical Infrastructure

What Can We Do?

Protect Infrastructure and Prevent Wildfires



Power lines are critical infrastructure for our communities.

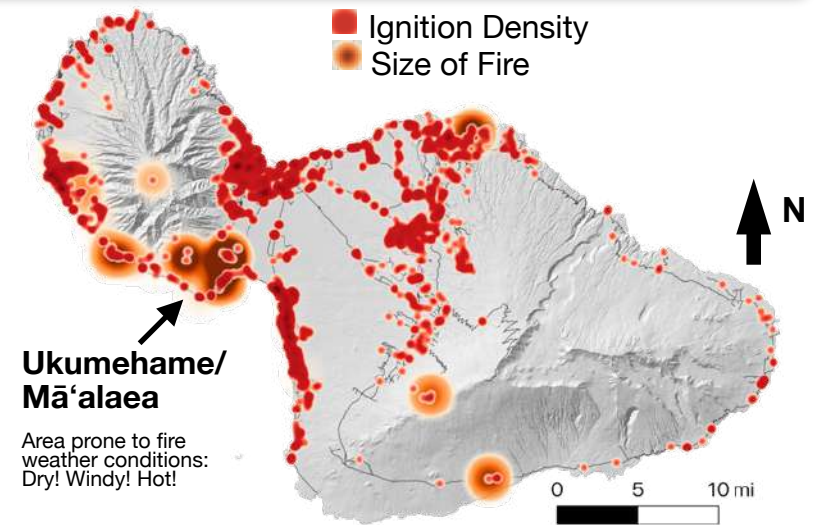
Aboveground power lines are vulnerable to wildfire and can even provide the ignition (sparks) that could start a wildfire, particularly in windy or stormy conditions.

There are long-term solutions for **reducing power line-related wildfire hazards** such as infrastructure upgrades. More immediate solutions include fuels reduction and firebreaks around power infrastructure in "hotspot" areas whichever the source of ignition.

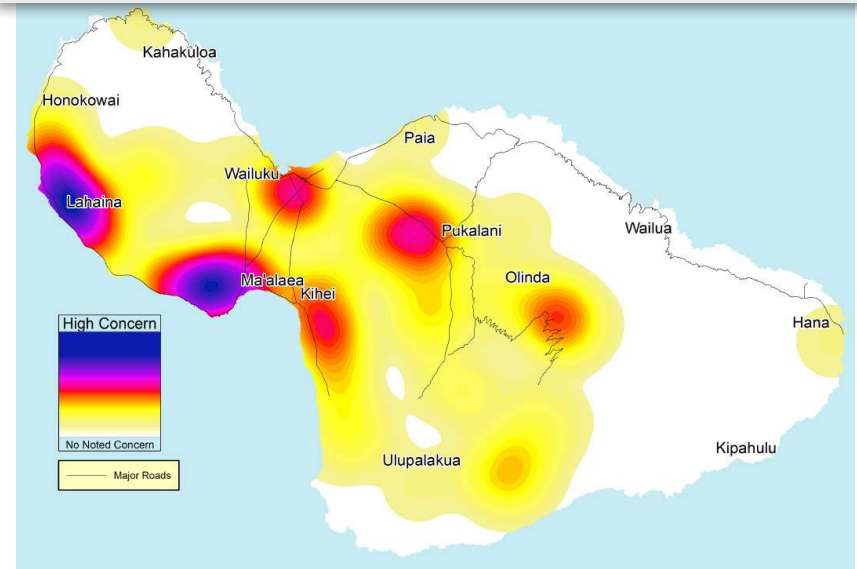
During the Collaborative Action Planning Workshop, participants identified long-term and immediate actions to reduce wildfire starts near power lines including:

- **Clear around transformers and under power lines** to address the frequent ignitions and **protect important infrastructure** in Ukumehame/Mā'alaea.
- **Update/improve/bury power lines to address power line-related ignitions**, particularly in dry and windy areas such as Ukumehame/Mā'alaea.
- Use **strategic grazing** such as "West Maui Goat" herds (available across West Maui) to **reduce fuels in high ignition areas** including near power lines in Ukumehame/Mā'alaea.
- Increase enforcement for homeless camps in the area.

Maui Fire History 2002-2012



2018 Action Planning Workshop Highest Concern Areas





What's the Issue?

Fire Infrastructure Needs Regular Funding for Maintenance But Currently Lacks Funding

What Can We Do?

Integrate Fire-Thinking in Long-Term Planning and Policies Supportive of Landscape-Level Vegetation Management

The value of prevention vastly outweighs the cost. This becomes evident as we tally the costs of wildfire from the emergency response costs, losses of property and resources, and long-term negative impacts on our communities and habitat.

When it comes to prevention, maintenance is the key, and requires stable, long-term funding.

By **integrating fire-thinking into existing activities and plans**, limited resources can go a lot further.

Developers and planners can create safer communities by incorporating firebreaks, green breaks, and fuel reduction buffers that protect properties and adjacent wildland areas.

These firebreaks and green breaks surrounding communities can be integrated into land development and function also as emergency access or routes, public greenspace or open space, active living paths, etc. for **multiple benefits**.



During the Collaborative Action Planning Workshop, participants identified numerous maintenance actions needed including:

- **Include dip tanks in an integrated wildfire management plan with ongoing maintenance**, particularly in remote, fire-prone areas such as Kahikinui.
- Establish **sustained funding source** for establishment and **maintenance** of wildfire infrastructure.
- **Increase roadside maintenance** particularly in areas with high fuel loads and ladder fuels such as the pine plantation outside Haleakalā National Park.
- Create a whole-island, whole-county **prevention and vegetation management plan** with focus on sources of wildfire (e.g. roadsides, power lines, encampments, etc.).
- **Establish and maintain fuel breaks around communities**, particularly in areas of patch urban areas and wildland such as Kahului/Wailuku areas.
- **Maintain firebreak access system** particularly in remote, fire-prone areas such as Kahikinui.

What's the Issue?

Green Waste Dumping and Overgrown Vegetation Creates Wildfire Hazard in Communities

What Can We Do?

Make Green Waste Removal Easy and Accessible

Piles of dead branches backing up to fencelines can be wildfire hazards for communities.

Some Firewise communities have taken on this challenge through both **education of residents about these wildfire hazards** and **making it easy to get rid of green waste** through green waste dumpsters in the community or mulching/chipper community days.

We need to make it as easy as possible for people to choose to safely deal with their green waste.



Green waste removal.

Collaborative Action Planning Workshop participants identified actions that would help alleviate green waste dumping at the island and community scale, including:

- Enhance **access to green waste dumpster/chipper programs**, particularly in communities where urban and rural development mix such as Kahului/Wailuku areas.
- Implement **green waste bins at recycling centers**, particularly helpful if they are accessible during weekends and extended hours.
- Implement **fuels management educational program** for small landowners including agricultural and residential.

What's Already Happening on Maui?

2018 RAPID MAPPING ASSESSMENT OF VEGETATION MANAGEMENT

Quantitative Project Findings

Rapid Mapping Assessment: Maui 2018 Snapshot	12
Wildfire Hazard Mitigation Strategies:	13
Firebreaks	13
Fuel Reduction	18
Fuel Conversion	22



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.

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.

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.

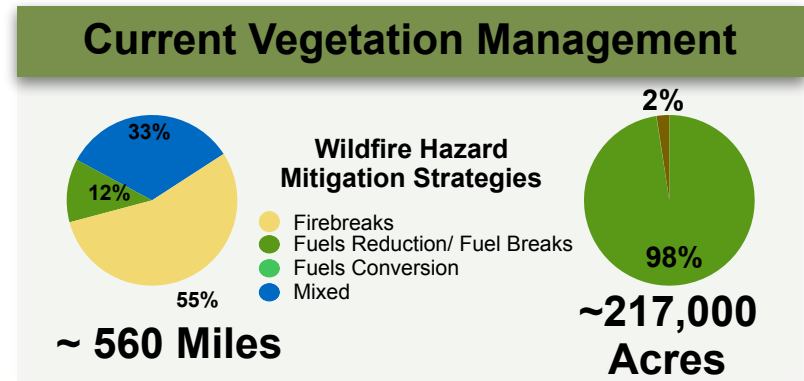
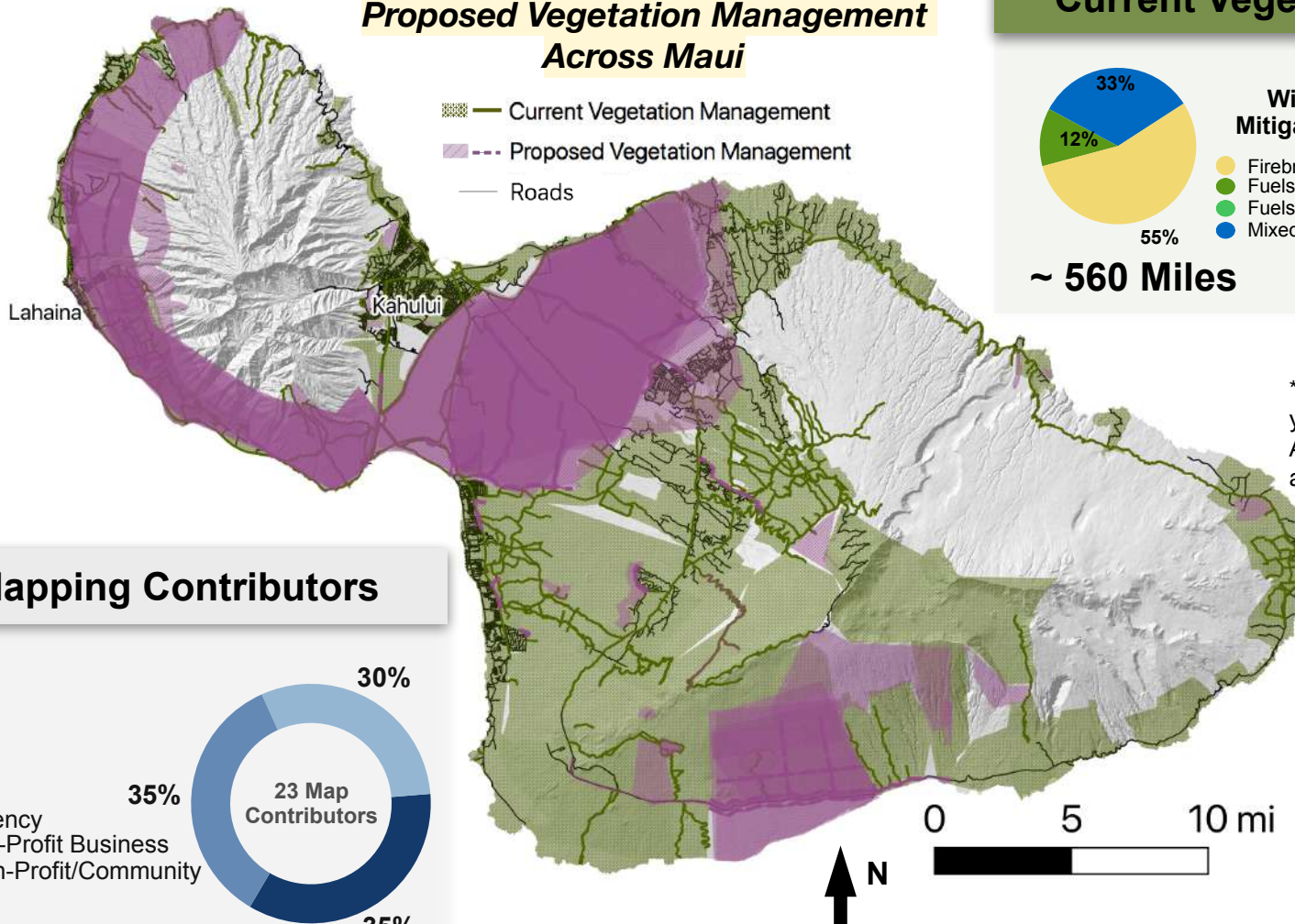
Proposed Areas: Mapping contributors were asked to identify priority areas in need of additional management of vegetation.

See *Appendix B* for all data collection methods.



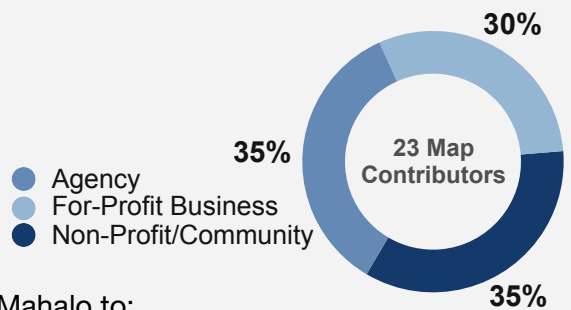
Rapid Mapping Assessment: Maui 2018 Snapshot

Current Vegetation Management and Proposed Vegetation Management Across Maui



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

Mapping Contributors



Mahalo to:

- Alexander & Baldwin
- Auwahi Forest Restoration Project
- Auwahi Wind Energy
- Bayer
- Maui County Department of Water Supply
- Department of Hawaiian Homelands
- State Department of Transportation Maui District
- DLNR Division of Forestry and Wildlife - Maui Nui
- Haleakalā Ranch
- Hāna Ranch
- Hawai'i Army National Guard
- DLNR State Parks Maui District
- Launiupoko Firewise Community
- Leeward Haleakalā Watershed Restoration Partnership (representing Kaupō Ranch, Kahikinui Firewise Committee, G.F. Thompson, Kaonoulu Ranch, Nu'u Mauka Ranch)
- Maui Cattlemen's Association
- Maui Electric
- National Park Service
- Skyline Conservation Initiative / Pohakuokala Gulch Restoration Project (skylineconservation.org)
- The Nature Conservancy
- U.S. Fish and Wildlife Service
- Vares Contracting, Inc. (www.VaresContracting.com)
- Waiohuli Firewise Community
- West Maui Mountain Watershed Partnership

Wildfire Hazard Mitigation Strategies: Firebreaks

Firebreaks: Infrastructure for Access and Defense!

A firebreak does not stop wildfire advancing on its own but provides access and a defensible line for firefighters.

The Takeaway:

Roads = firebreaks.

Firebreaks can double as emergency egress when wildfire is coming from a different direction.

The **greatest protection** occurs **when firebreaks are enhanced** with reduced flammability or quantity of fuel on either side and adequate access to water.

Runoff and erosion impacts for both established firebreaks and those created during an emergency response should be considered and mitigated.



Lahaina Pali Trail Fire. Even a well used footpath or mountain bike trail could be used as a firefighting asset. Photo Credit: West Maui Mountains Watershed Partnership

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

Wildfire Hazard Mitigation Strategies: FIREBREAKS

Snapshot 2018-19: Current & Proposed Firebreaks on Maui

Firebreaks are typically scraped down to **bare soil or other non-combustable material**.

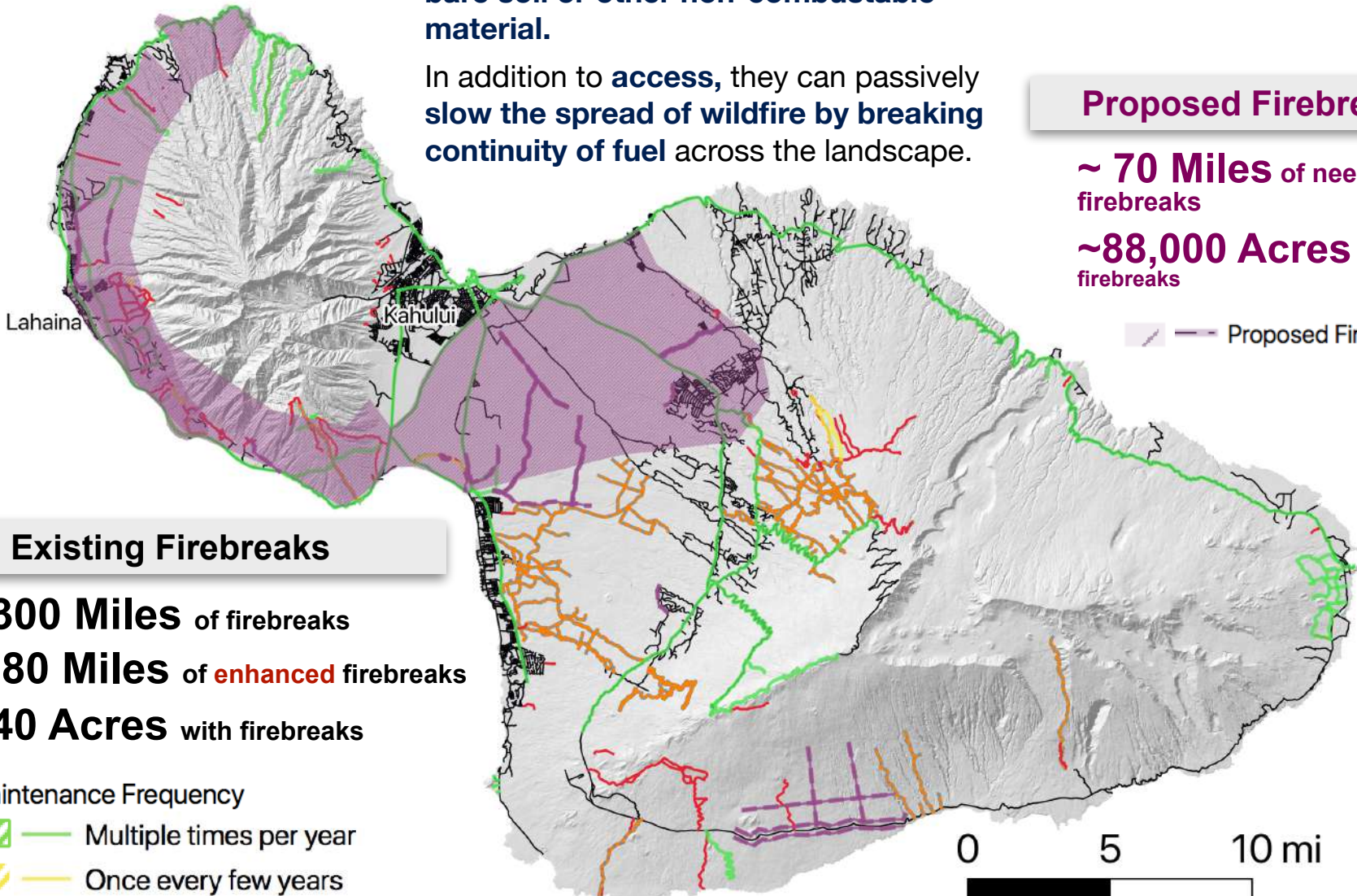
In addition to **access**, they can passively **slow the spread of wildfire by breaking continuity of fuel** across the landscape.

Proposed Firebreaks

~ **70 Miles** of needed firebreaks

~ **88,000 Acres** in need of firebreaks

— Proposed Firebreak



Existing Firebreaks

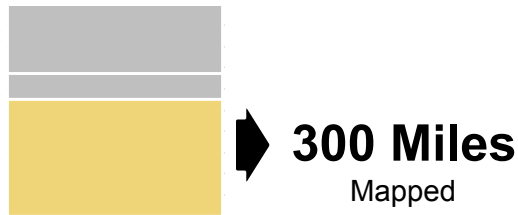
- ~ **300 Miles** of firebreaks
- ~ **180 Miles** of **enhanced** firebreaks
- ~ **40 Acres** with firebreaks

Maintenance Frequency

- Multiple times per year
- Once every few years
- Irregularly or Unmaintained
- Unknown Maintenance

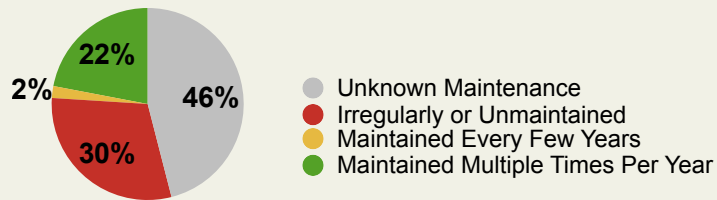
Wildfire Hazard Mitigation Strategies: FIREBREAKS

Maui Snapshot 2018-19: Miles of Existing Firebreaks



Roughly 300 miles of firebreaks were mapped by Maui land stewards.

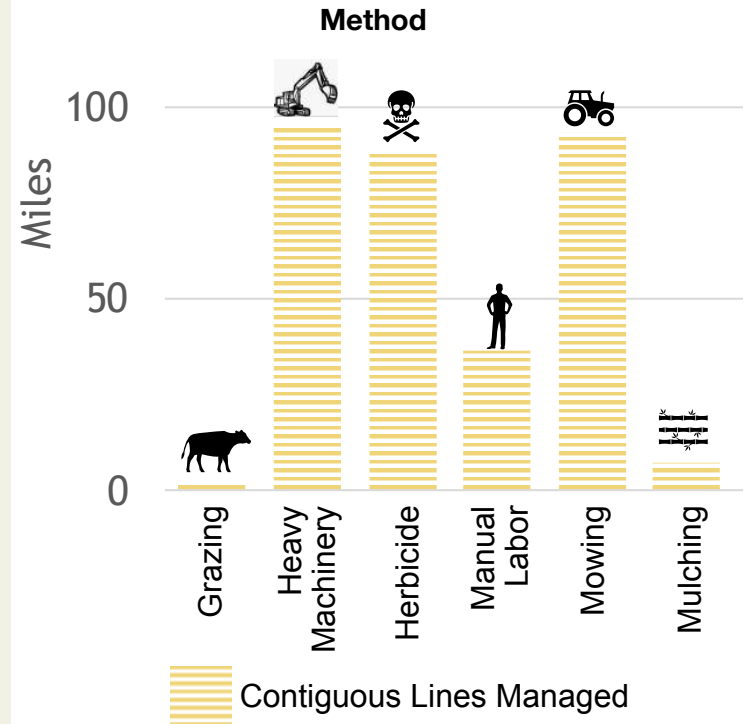
Maintenance Frequency of Existing Firebreaks



Self-reported maintenance frequency by mapping contributors.

Only 22% of these miles are maintained multiple times per year. Firebreaks with irregular or unknown maintenance reported may not be as effective or safe for firefighters due to the rapid growth of vegetation in Hawai'i.

How Are Maui Land Stewards Creating and Maintaining Firebreaks?

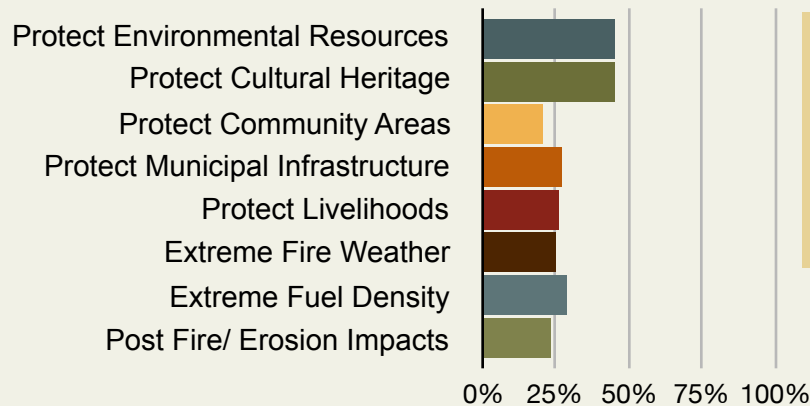


In some instances multiple methods are used to manage the same area.

The most common methods used to maintain firebreaks are *heavy machinery, mowing, and herbicide.*

While mowing may not create a "firebreak" defined as "reduced to bare soil," access roads that are grassy and mowed do provide important firefighting infrastructure and may reduce erosion impacts or other externalities of completely bare firebreaks.

Reasons Why Firebreaks Are Established and Maintained on Maui



Firebreaks on Maui are created and maintained for diverse reasons.

Percentage of total miles of firebreaks on Maui maintained for each reason. In several instances, multiple reasons were reported for managing the same areas.

Wildfire Hazard Mitigation Strategies: FIREBREAKS

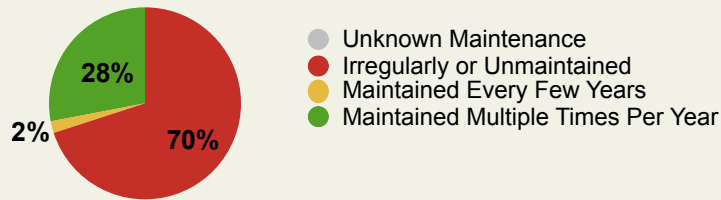
Maui Snapshot 2018-19: Acres With Existing Firebreaks



40 Acres
Mapped

Some mapping participants identified general areas where there are firebreaks, roughly 40 acres on Maui.

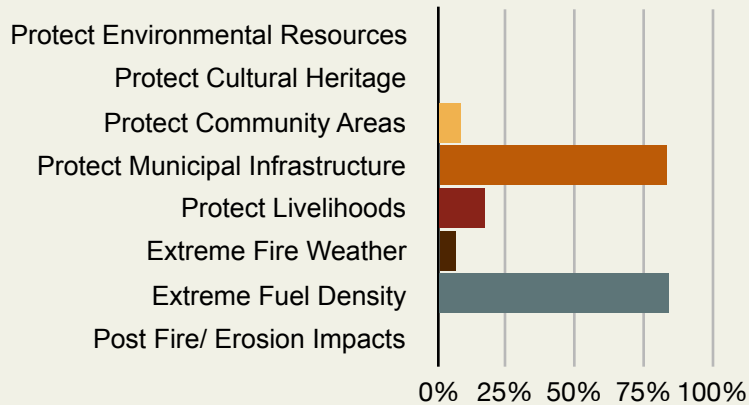
Maintenance Frequency of Existing Firebreaks



Self-reported maintenance frequency by mapping contributors.

Most of these areas are irregularly or unmaintained.

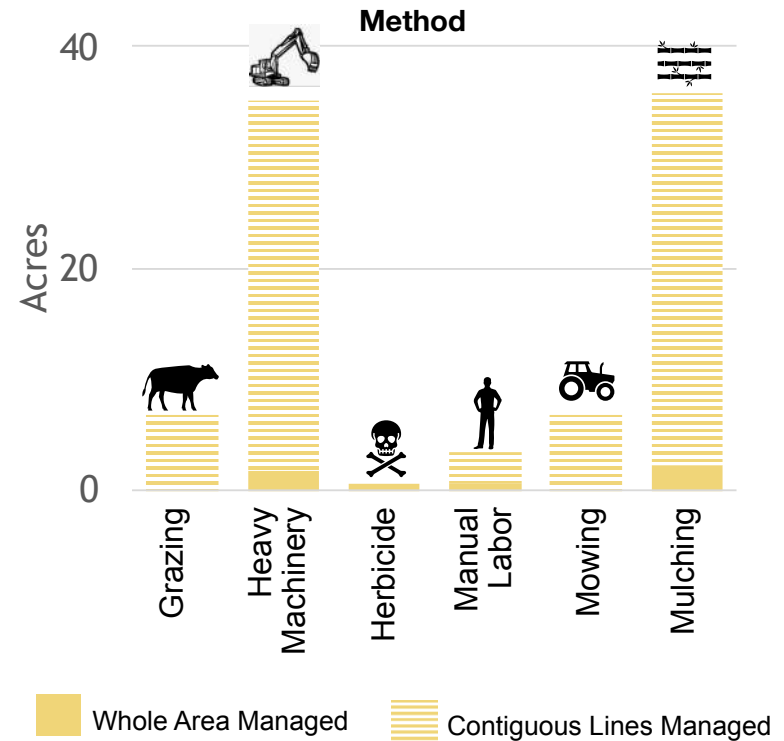
Reasons Why Firebreaks Are Established and Maintained on Maui



Percentage of total acres with firebreaks on Maui maintained for each reason. In several instances, multiple reasons were reported for managing the same areas.

These areas are managed to *protect municipal infrastructure* (e.g. power lines, communication towers, water facilities, etc.) particularly when there is *extreme fuel density*.

How Are Maui Land Stewards Creating and Maintaining Firebreaks?



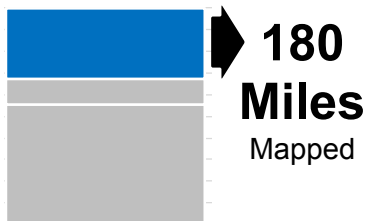
In some instances multiple methods are used to manage the same area.

In these areas, the most commonly reported methods are *heavy machinery* and *mulching*. Likely, these methods are combined using the heavy machinery to mulch otherwise hazardous woody vegetation.

Although mulch can still burn, it does so much more slowly than standing fuel and only burns on the ground making it safer for firefighters and slows the progression of wildfire.

Wildfire Hazard Mitigation Strategies: **Enhanced FIREBREAKS**

Maui Snapshot 2018-19: Miles of Enhanced Firebreaks



Enhanced firebreaks provide the greatest protection to 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.

Lines mapped as both firebreaks and fuel reduction are considered enhanced firebreaks. Many roads are enhanced firebreaks due to the wide pavement or gravel surface and fuel reduction on either side.

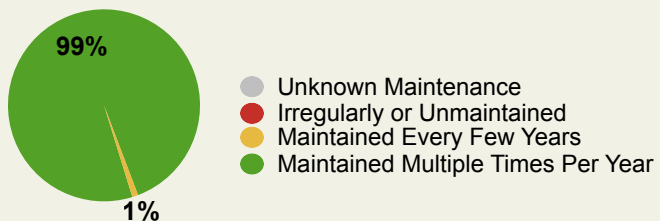
How Are Maui Land Stewards Creating and Maintaining **Enhanced** Firebreaks?



Multiple methods are used together to maintain enhanced firebreaks.



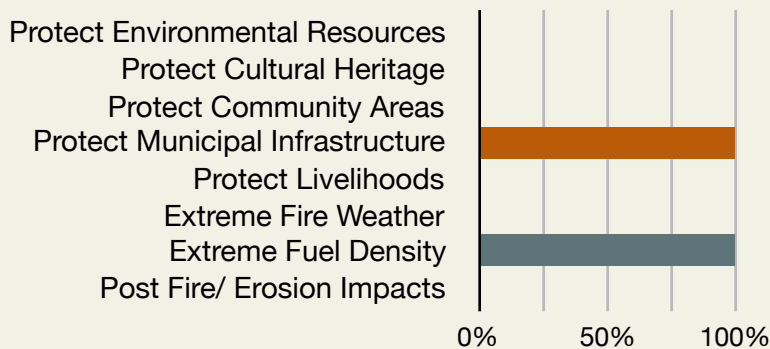
Maintenance Frequency of **Enhanced** Firebreaks



Interestingly, nearly all miles of enhanced firebreaks are maintained multiple times per year, likely reflecting the ongoing fuel reduction needs of vigorous vegetation growth and multiple growing seasons in Hawaiʻi.

Self-reported maintenance frequency by mapping contributors.

Reasons Why **Enhanced** Firebreaks Are Established and Maintained on Maui



Enhanced firebreaks are maintained to protect municipal infrastructure and due to extreme fuel density.

Percentage of total miles of enhanced firebreaks on Maui maintained for each reason. In several instances, multiple reasons were reported for managing the same areas.

Fuels Reduction: Decrease how much is available to burn!

Fuels reduction is an immediate action that can significantly reduce wildfire hazards.

The Takeaway:

Fuels reduction areas can require **frequent maintenance and active management.**

Linear fuel reduction, or fuel breaks, slow the spread of wildfire and are beneficial along roadsides and other areas with frequent ignitions.

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.**



Waiohuli Chipper Day 2017.
Photo Credit: Lance De Silva, Waiohuli Firewise Community.

Wildfire Hazard Mitigation Strategies: **FUELS REDUCTION**

Snapshot 2018-19: Current & Proposed Fuels Reduction on Maui

Fuels reduction activities reduce the amount of burnable vegetation to slow the spread of wildfire and break continuity of fuel across the landscape.

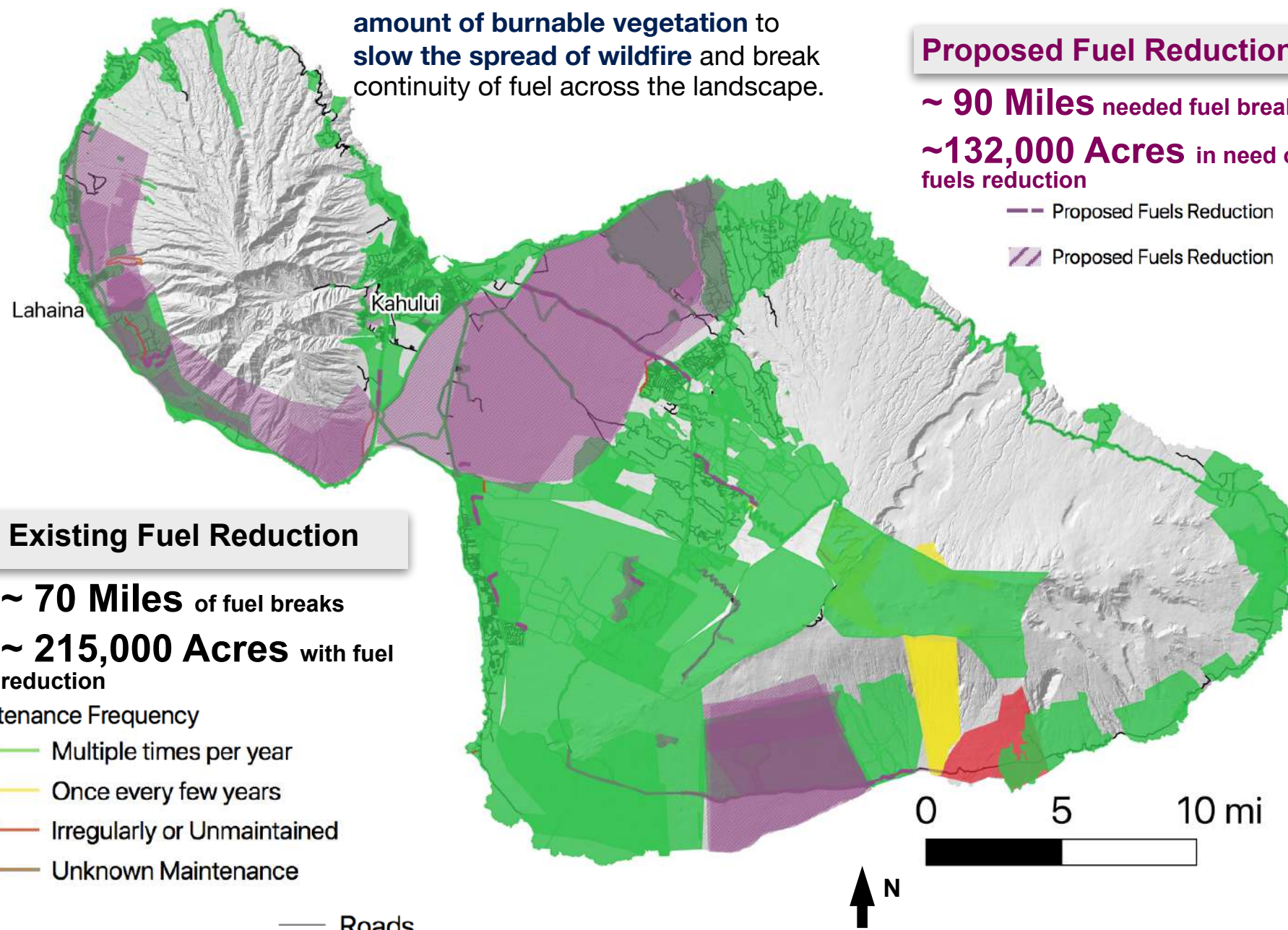
Proposed Fuel Reduction

~ 90 Miles needed fuel breaks

~132,000 Acres in need of fuels reduction

— Proposed Fuels Reduction

▨ Proposed Fuels Reduction



Existing Fuel Reduction

▨ ~ 70 Miles of fuel breaks

● ~ 215,000 Acres with fuel reduction

Maintenance Frequency

— Multiple times per year

— Once every few years

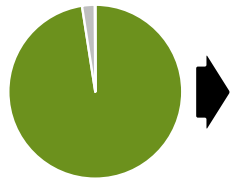
— Irregularly or Unmaintained

— Unknown Maintenance

— Roads

Wildfire Hazard Mitigation Strategies: **FUELS REDUCTION**

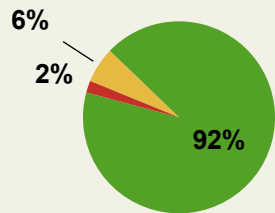
Maui Snapshot 2018-19: Acres of Active Fuels Reduction



215,000
Acres
Mapped

On Maui, fuel reduction is by far the most common vegetation management strategy reported with roughly 215,000 acres.

Maintenance Frequency of Fuel Reduction

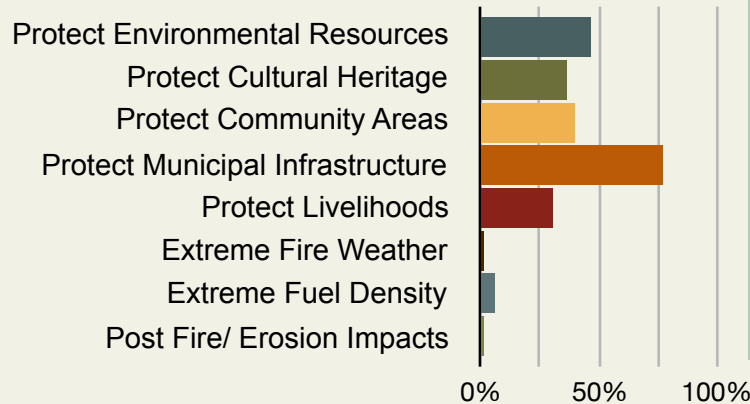


- Unknown Maintenance
- Irregularly or Unmaintained
- Maintained Every Few Years
- Maintained Multiple Times Per Year

Most areas are actively managed and *maintained multiple times per year.*

Self-reported maintenance frequency by mapping contributors.

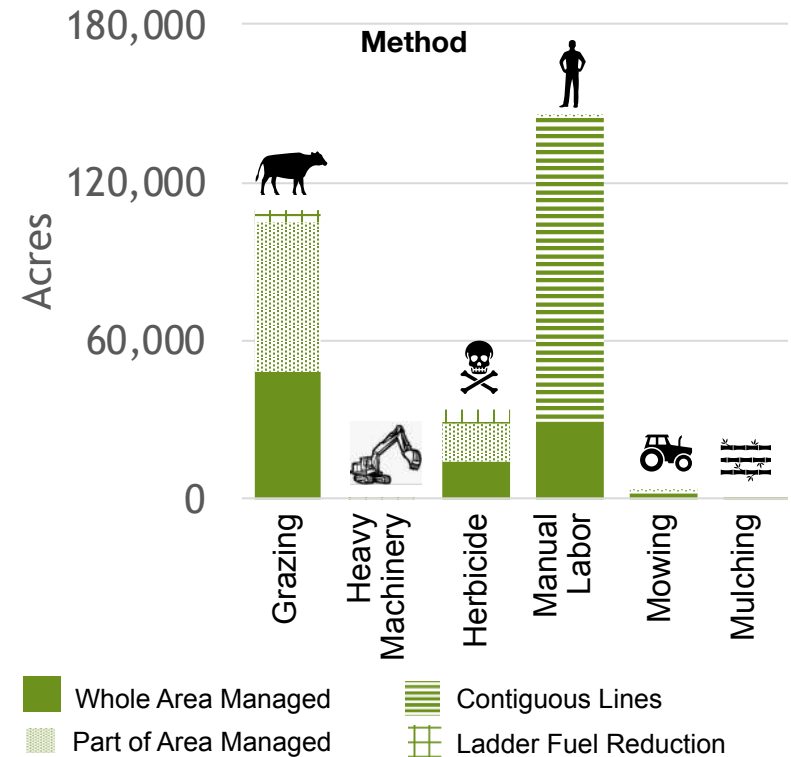
Reasons for Acres of Fuel Reduction on Maui



Fuel reduction is occurring for multiple reasons. The most area of fuel reduction on Maui is managed to *protect municipal infrastructure.*

Percentage of total acres of fuel reduction on Maui maintained for each reason. In several instances, multiple reasons were reported for managing the same areas.

How Are Maui Land Stewards Reducing Fuel?



- Whole Area Managed
- Part of Area Managed
- ▨ Contiguous Lines
- ▨ Ladder Fuel Reduction

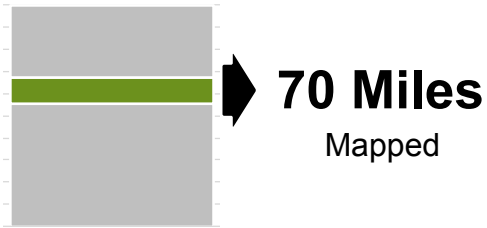
In some instances multiple methods are used to manage the same area.

While there are more total acres reported as managed with *manual labor*, *grazing* has a greater acreage where whole area is managed. The areas where contiguous lines are managed with manual labor are primarily areas beneath and around power lines.

Most of the area reported is only *partly managed* or *contiguous lines* of fuel reduction are managed. Even so, a patchwork of reduced fuel can significantly slow the spread of wildfire across a landscape. Both reduction of flashy fuels such as grasslands and reduction of woody vegetation is occurring.

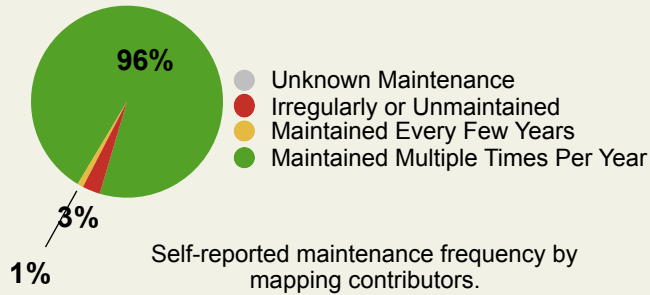
Wildfire Hazard Mitigation Strategies: **FUELS REDUCTION**

Maui Snapshot 2018-19: Miles of Active Fuels Reduction



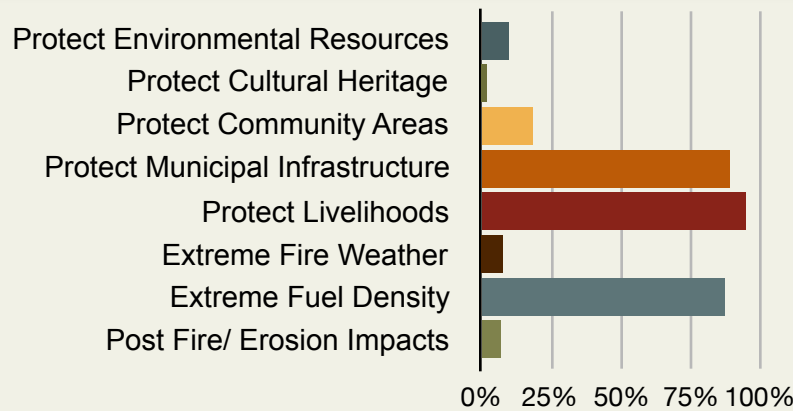
Land stewards on Maui mapped roughly 70 miles of fuel breaks, or linear fuel reduction.

Maintenance Frequency of Fuel Breaks



Most areas mapped are *maintained multiple times per year*. When it comes to reducing wildfire hazard, regular, consistent maintenance is important and reliable maintenance funding is needed to respond to year-round growing seasons.

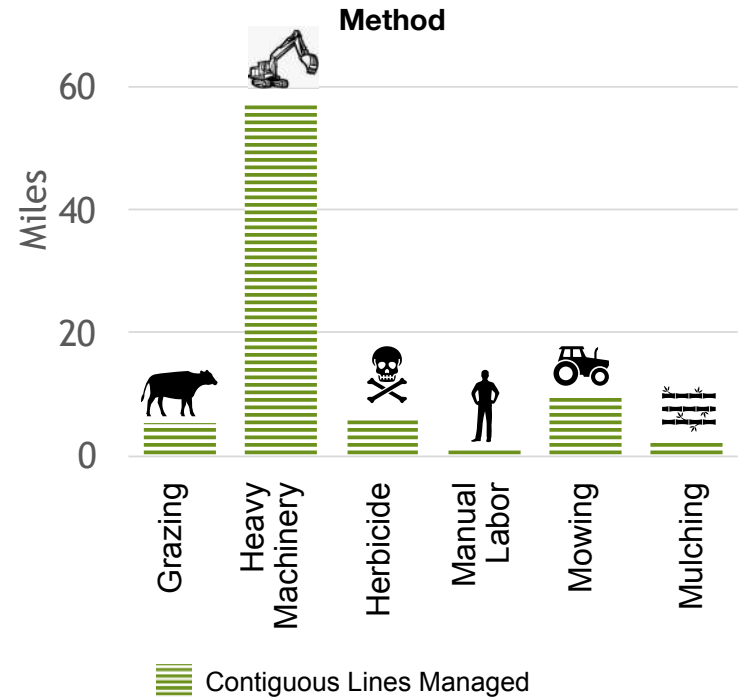
Reasons for Fuel Breaks on Maui



The reasons reported for most acres managed are *protecting livelihoods, municipal infrastructure, and due to extreme fuel density*.

Percentage of total miles of fuel reduction on Maui maintained for each reason. In several instances, multiple reasons were reported for managing the same areas.

How Are Maui Land Stewards Reducing Fuel?



In some instances multiple methods are used to manage the same area.

The most common method reported for linear fuel reduction is *heavy machinery*.

Other methods including *grazing, herbicide, manual labor, mowing, and mulching* are also used at the site-scale.

Fuels Conversion: Make It Less Burnable!

A long-term solution to reducing wildfire risk at the landscape scale.

Benign Neglect

Higher Fire Risk

(e.g. fallow agriculture, landscapes invaded by fire-promoting species; unmaintained vegetation around homes and community areas)



Actively Managed Landscapes

Lower Fire Risk

(e.g. active agriculture, targeted invasive species removal, maintained homes and community areas)

The Takeaway:

Fuels conversion is a long-term approach to reducing wildfire hazard through **active land management and reducing flammability**.

Many land management activities result in converting fuel whether it be agricultural lands, development of community and recreational areas, or removal of invasive species.

Including fire-thinking in these ongoing activities provides multiple benefits.



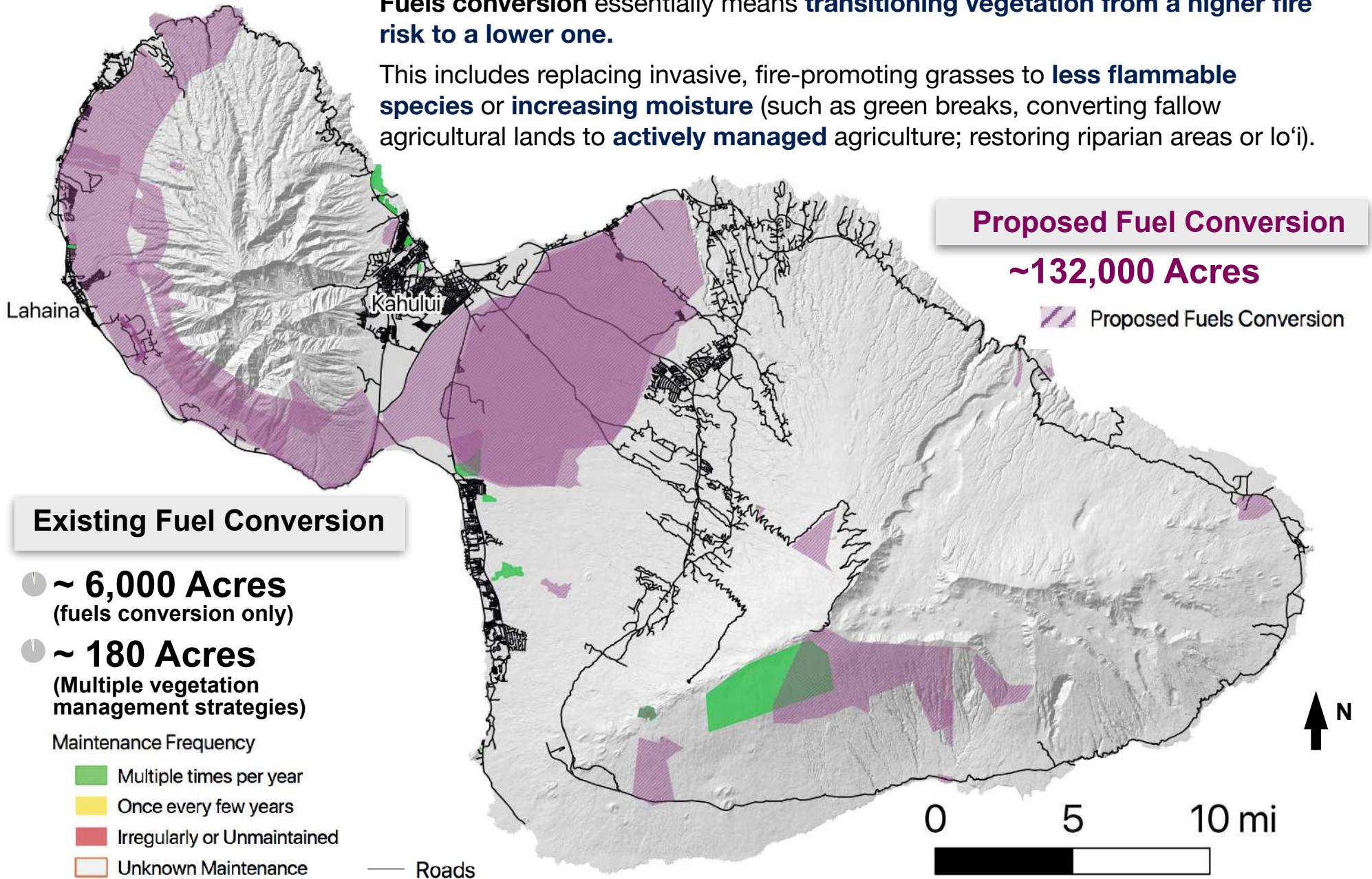
Auwahi Forest Restoration Project on leeward Haleakala, Maui.

Wildfire Hazard Mitigation Strategies: **FUELS CONVERSION**

Snapshot 2018-19: Current & Proposed Fuels Conversion on Maui

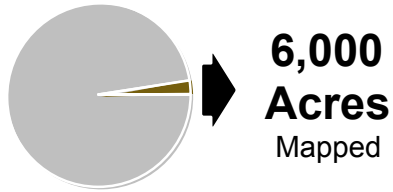
Fuels conversion essentially means **transitioning vegetation from a higher fire risk to a lower one**.

This includes replacing invasive, fire-promoting grasses to **less flammable species** or **increasing moisture** (such as green breaks, converting fallow agricultural lands to **actively managed** agriculture; restoring riparian areas or lo'i).



Wildfire Hazard Mitigation Strategies: FUEL CONVERSION

Maui Snapshot 2018-19: Acres of Active Fuel Conversion



Mapping participants identified roughly 6,000 acres of fuel conversion on Maui. Interestingly, roughly 132,000 acres were proposed as needing fuels conversion (that is more than 20 times the area currently managed). Likely, this is due to the vast acreage of fallow agricultural land in central Maui. Abandoned agricultural land due to shifting industry economics is a common thread across the Hawaiian Islands that has led to increased wildfire hazard.

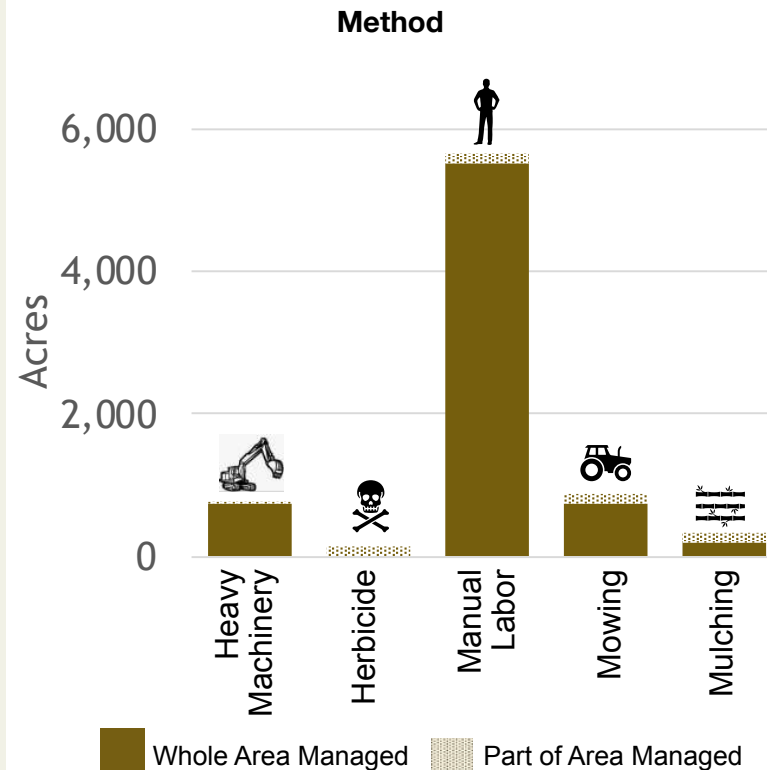
Maintenance Frequency of Active Fuel Conversion



Fuel conversion areas on Maui reported maintenance *multiple times per year*.

Self-reported maintenance frequency by mapping contributors.

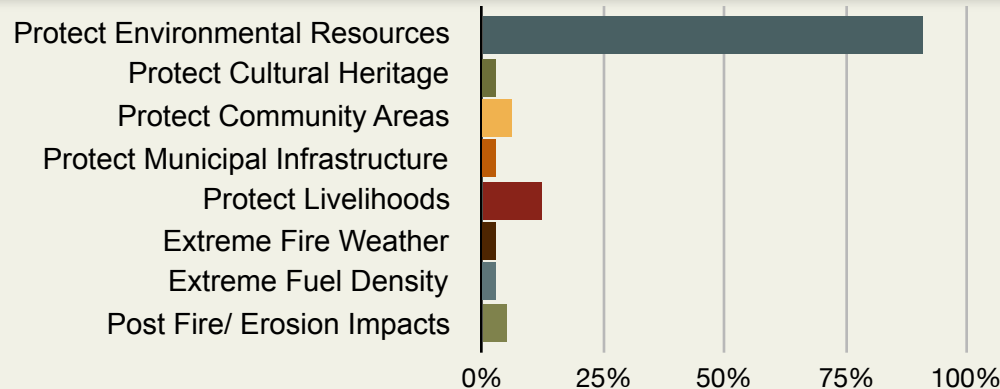
How Are Maui Land Stewards Are Implementing Fuel Conversion?



In some instances multiple methods are used to manage the same area.

The majority of this area is managed with *manual labor*.

Reasons for Acres of Fuel Conversion on Maui

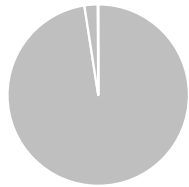


Percentage of total acres of fuel conversion on Maui maintained for each reason. In several instances, multiple reasons were reported for managing the same areas.

The majority of these areas are forest restoration projects managed for *protection of environmental resources*.

Wildfire Hazard Mitigation Strategies: **MULTIPLE STRATEGIES**

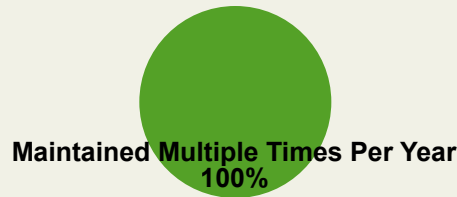
Maui Snapshot 2018-19: Acres With Multiple Hazard Mitigation Strategies



180 Acres
Mapped

Land stewards on Maui mapped roughly 180 acres managed using integrated strategies such as maintaining firebreaks, fuels reduction, and fuels conversion. Likely these are in and around communities as developed land also converts fuel.

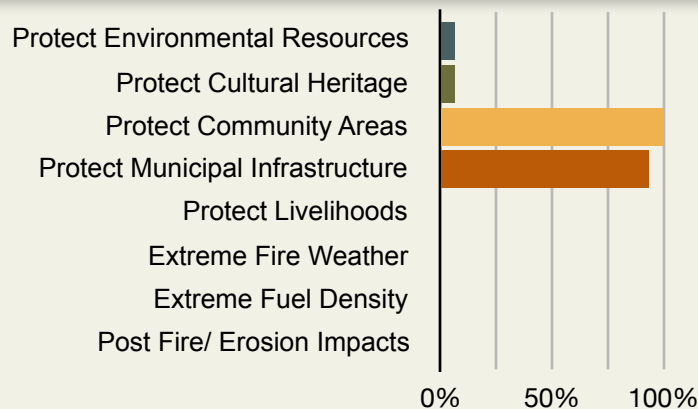
Maintenance Frequency of Areas With Multiple Strategies



Self-reported maintenance frequency by mapping contributors.

Areas with multiple ongoing strategies are actively managed and *maintained multiple times per year.*

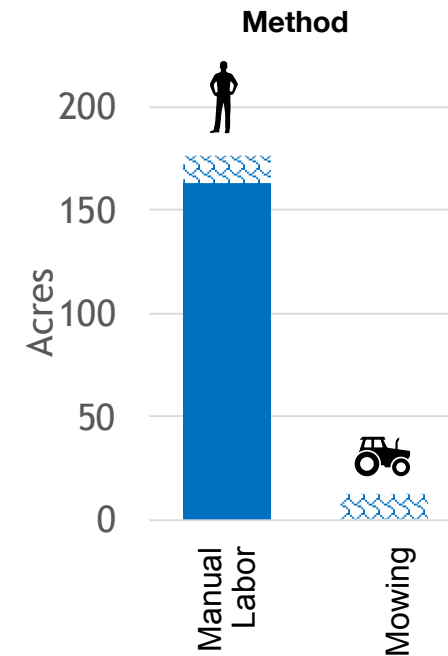
Reasons for Acres of Multiple Vegetation Management Strategies on Maui



There areas are predominately maintained to *protect community areas and municipal infrastructure.*

Percentage of total acres managed with multiple strategies on Maui maintained for each reason. In several instances, multiple reasons were reported for managing the same areas.

How Are Maui Land Stewards Implementing Multiple Vegetation Management Strategies?



■ Whole Area Managed ■ Unknown Area Managed

In some instances multiple methods are used to manage the same area.

Manual labor is the most widespread method for managing these areas.

Well maintained community areas such as mowed grass strips and areas where trees and shrubs are regularly pruned with dead branches removed create a lower fire hazard and enjoyable community open space.

APPENDIX A: COLLABORATIVE ACTION PLANNING PARTICIPANT INPUT LIST



For the following participant input list:

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



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 fire 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 fire 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.

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.

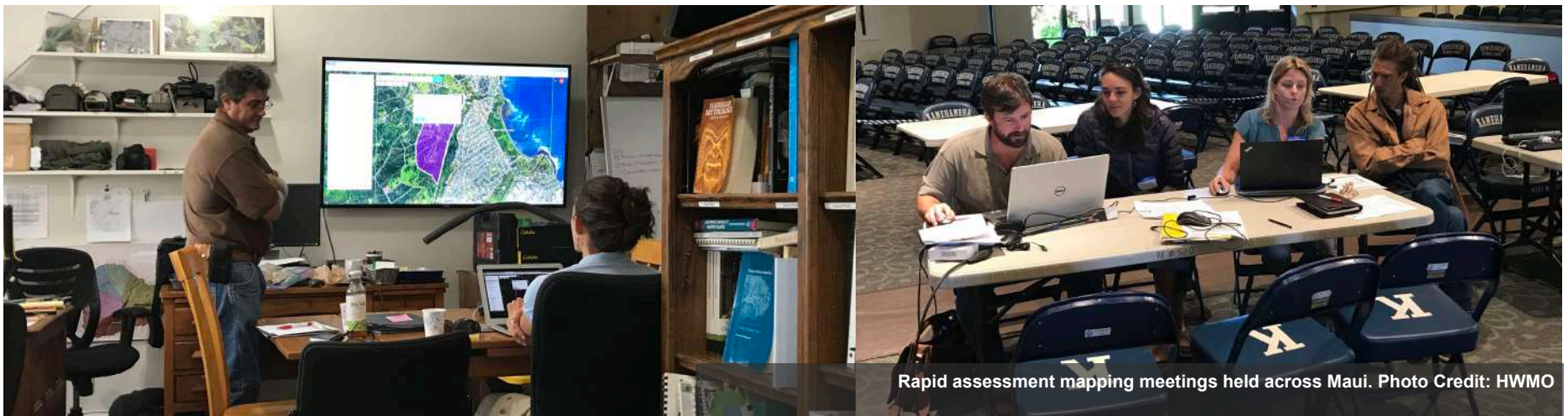
In an effort to maximize data quality, mapped areas and associated attributes were confirmed with mapping collaborators after all data was

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.



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

