Invasive Vegetation Management: An Overview of Two Fire Risk Species

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MEM Capstone Project

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Motivation

Wildfire risk has increased in the Pacific[1]

Hawai‘i Invasive Species Council, Hawai‘i lacks a regulatory list of "invasive species," though scientists estimate that the number of such species is in the thousands[2]

The islands' rich native biodiversity provided an important aspect to Native Hawaiian culture[3]

Hawai‘i is home to around 1,400 native plants, with nearly 90 percent of them being endemic[4]

Figure 1. Morella faya tree taken in Pico de La Bandera, Gran Canaria by Krzysztof Ziarnek

Invasive

- Morella faya (*Morella faya*)
- Fountain grass (*Pennisetum setaceum*)

Figure 2. Fountain grass taken by Stegodonte

Background

- Invasive Species
  - Alter fuel characteristics and fire regimes[5]
  - Invasive plants are more widespread along with the increase in fire incidents[6]

  - Hawai‘i has had an increase in burned areas with fires intensifying[7]
  - Evidence suggests that grass-invaded habitats show higher predicted fire behavior[8]

Objectives

WHAT I WANT TO ACHIEVE

- Perform a literature analysis to identify literature gaps and key points of invasive species behavior regarding faya and fountain grass
- Clean up and organize dataset to contain only faya and fountain grass data per each management unit
- Provide evidence concerning invasive management and potential analysis tool

Approach

STEPS AND ACTION

STEP 01

Gathered literature relating to topics including invasive species management, global invasive management, grass-fire cycle, faya and fountain grass in Hawaiʻi

STEP 02

Extracted data variables using Microsoft Access.
Variables chosen:
- Worker hours
- Individual plants treated
- Herbicide used
- Total area (A)

STEP 03

Built and organized the final dataset in Microsoft Excel to contain management units and yearly treatment information totals

Results

Literature Review

RESEARCH FINDINGS
AND HIGHLIGHTS

01

Grass and Woody Invasions

Fusco et al. (2021)
The human—grass—fire cycle: how people and invasives co-occur to drive fire regimes.

Kerns et al. (2020)
Invasive grasses: A new perfect storm for forested ecosystems?

Brown J.K. (2003)
Coarse woody debris: managing benefits and fire hazard in the recovering forest.

02

Ecological Impacts of Faya

Loh et al. (2008)
Influence of woody invader control methods and seed availability on native and invasive species establishment in a Hawaiian forest.

Vitousek et al. (1987)
Biological Invasion by *Myrica faya* Alters Ecosystem Development in Hawaii.

03

Ecological Impacts of Fountain Grass

Rowe et al. (2022)
Comparing common fountain grass removal techniques: Cost efficacy and response of native plant community.

Litton et al. (2008)
A non-native invasive grass increases soil carbon flux in a Hawaiian tropical dry forest.

Management Unit Data

Site Name&Block Category	SEA Morfray Information	Total	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Year Last Treated
AINAHOUNORTH	Total Individuals Treated and uprooted	2141	312	0	200	0	412	0	547	0	0	670	0	0	0	0	0	0	0	0	0	0	0	0	2009
	Total Herbicide Use	210	100	0	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Total Worker Hours	73.625	13	0	14.5	0	16	0	15	0	0	15.125	0	0	0	0	0	0	0	0	0	0	0	0	
	Total Area in Acres	46.996876	46.997	46.99688	46.9969	46.997	46.997	46.997	46.997	46.997	46.997	46.997	46.997	46.997	46.997	46.997	46.997	46.997	46.997	46.997	46.997	46.997	46.997	46.997	
	Area (Acres) per hour	0.6383277	3.6151		3.24116		2.9373		3.1331			3.1072													
	Stems Per Hour	29.080	24.000		13.793		25.750		36.467			44.298													
	Herbicide Per Hour	2.852	7.692		7.586		0.000		0.000			0.000													
HILINAPALIEXPNEW	Total Individuals Treated and uprooted	1591	0	0	0	0	199	0	0	0	0	0	244	0	339	809	0	0	0	0	0	0	0	0	2013
	Total Herbicide Use	5.8	0	0	0	0	5.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Total Worker Hours	169.5125	0	0	0	0	14	0	0	0	0	0	17.125	0	38.288	100.1	0	0	0	0	0	0	0	0	
	Total Area in Acres	2054.114	2054.1	2054.114	2054.11	2054.1	2054.1	2054.1	2054.1	2054.1	2054.1	2054.1	2054.1	2054.1	2054.1	2054.1	2054.1	2054.1	2054.1	2054.1	2054.1	2054.1	2054.1	2054.1	
	Area (Acres) per hour	12.117773					146.72						119.95		53.65	20.521									
	Stems Per Hour	9.386					14.214						14.248		8.854	8.082									
	Herbicide Per Hour	0.034					0.414						0.000		0.000	0.000									
HILINAPALINORTHEXP	Total Individuals Treated and uprooted	4186	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1690	538	1448	0	0	0	0	510	2021
	Total Herbicide Use	6.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	6.2	
	Total Worker Hours	1018.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	368.5	155	290	0	0	0	0	205	
	Total Area in Acres	2279.865	2279.9	2279.865	2279.87	2279.9	2279.9	2279.9	2279.9	2279.9	2279.9	2279.9	2279.9	2279.9	2279.9	2279.9	2279.9	2279.9	2279.9	2279.9	2279.9	2279.9	2279.9	2279.9	
	Area (Acres) per hour	2.2384536															6.1869	14.709	7.8616					11.121	
	Stems Per Hour	4.110															4.586	3.471	4.993					2.488	

	Total Individuals Treated and uprooted	Total Herbicide Used	Total Worker Hours	Total Area in Acres	Area (Acres) per hour	Stems per hour	Herbicide per hour
Total	69482	61760.420	5594.546	1999.625	4.502	151.115	90.865
2000	371	530.000	36.000	1999.625	72.285	30.917	44.167
2001	2430	1070.000	93.500	1999.625	109.427	184.753	92.538
2002	1972	51545.000	169.000	1999.625	59.977	91.424	1647.750
2003	2733	7525.000	153.150	1999.625	195.414	111.127	270.103
2004	278	0.000	28.000	1999.625	12.657	9.929	0.000
2005	4870	0.000	270.377	1999.625	67.061	201.773	0.000
2006	2062	719.000	98.922	1999.625	33.197	113.022	34.782
2007	3561	0.000	189.219	1999.625	118.359	201.392	0.000
2008	1955	0.000	53.123	1999.625	319.166	205.574	0.000
2009	3448	0.000	161.063	1999.625	81.229	169.228	0.000
2010	1649	0.000	134.123	1999.625	51.972	90.789	0.000
2011	1234	0.000	78.187	1999.625	185.870	103.430	0.000
2012	3597	0.000	180.320	1999.625	70.281	185.867	0.000
2013	5181	1.400	151.179	1999.625	76.605	253.843	0.158
2014	9770	1.960	246.684	1999.625	108.434	460.363	0.114
2015	292	0.000	100.000	1999.625	3.008	2.920	0.000
2016	4718	0.030	311.700	1999.625	24.549	154.540	0.001
2017	0	0.000	0.000	1999.625	0.000	0.000	0.000
2018	0	0.000	0.000	1999.625	0.000	0.000	0.000
2019	16897	357.805	2314.500	1999.625	5.004	30.965	1.832
2020	0	0.000	0.000	1999.625	0.000	0.000	0.000
2021	2464	10.225	825.500	1999.625	1.401	8.142	0.031

Implications of the research

PRACTICAL APPLICATION

Provide land managers tools to make better decisions for future invasive management practices

Build a management history to link current state of vegetation to new system

Areas of improvement

FOR FUTURE RESEARCH

Expand upon studying other invasive plants as well and their connection, if any, to fire

More studies done concerning the ecosystem structural changes afterwards

Implement the continuation of monitoring the treatments of all invasives

Thank You!

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Images

Figure 1

Ziarnek, K., (2024). Morella faya kz15 [Photograph]. Wikimedia. https://upload.wikimedia.org/wikipedia/commons/d/de/Morella_faya_kz15.jpg, https://creativecommons.org/licenses/by/4.0/legalcode.en

Figure 2

Stegodonte, (2022). Cenchrus setaceus [Photograph]. Wikimedia. https://upload.wikimedia.org/wikipedia/commons/3/3a/Cenchrus_setaceus.jpg, https://creativecommons.org/licenses/by/4.0/legalcode.en

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