An Economic Analysis of LFA eradication on Maui

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Is insect eradication feasible?

Early attempts to eradicate insects were expensive and largely unsuccessful. But with improvements in science, technology, and tools for detection, both surveillance and control costs have come down and success rates have gone up. Since 1890, there have been 760 documented attempts to eradicate insect populations worldwide with nearly half taking place in North America (Liebhold et al, 2016).

Despite numerous successful eradication efforts, it is often the case that even when an invasive pest is highly damaging, a common sentiment is that eradication costs are too high and not worth the effort. Part of this sentiment stems from the fact that upfront costs of eradication can be high relative to the perceived damages when the invasion is first discovered. Recent successful efforts indicate that insect eradication in many instances is a viable, feasible, and beneficial option (Simberloff, 2003).

LFA eradication effort on Maui

Little Fire Ant (LFA) on Maui were first detected in Waihee in September 2009. An inter-agency taskforce comprised of Maui County, MISC, HDOA, USGS, UH, and HAL was able to successfully contain the infestation and reduce the population to undetectable levels. (Vanderwoude et al. 2010). The last known detection in Waihee was June 2017 (Mahnken, 2021).

Since 2009, no additional incursions of LFA on Maui were detected until December 2013, LFA arrived on a hapuu log from the Big Island. Then beginning in 2014, new LFA infestations were popping up at a rate of nearly 2-3 per year through 2020.

To combat LFA on Maui, newly discovered infested areas are surveyed to determine the extent of the infestation. Then based on where LFA are found, infested areas are treated on the ground and in the trees (every 6 weeks) with a regimen of non-toxic growth regulator followed by toxic baits for one full year. After one year, the area is surveyed and if the infestation is significantly reduced then the treated area is reduced to target “hot spots”. The hotspots are treated twice over three months then the area is

surveyed again. Treatment and surveying are continued every 3 months until LFA can no longer be detected after which time the area will be surveyed 12 times over 5 years. After 5 years, if LFA are not detected, the area will be declared eradicated (Mahnken, 2021). Regarding the eradication effort in Kauai, Montgomery, et al (2021) remarked that the final surveillance phase would benefit from improvements in detection methods.

Currently there are 18 known locations on Maui where LFA have been detected and treated. At five locations, LFA has been declared eradicated. At eight locations, LFA are no longer detected and will continue to be monitored until they can be declared eradicated.[1] At five locations on 25 acres, LFA have been contained and are being treated for "hotspots." (Mahnken, 2021, 2023). Nahiku at 174.7 acres is the largest of the treated areas. An overview of the eradication effort and results from the economic analysis are summarized here.

LFA eradication effort in Nahiku, Maui

LFA was discovered in Nahiku in September 2014 when Maui Invasive Species Committee (MISC) field crews were conducting a *Miconia* eradication effort. Immediately following, surveys and ground crews were deployed, and treatments began and continued during 2014 to 2019. The dense vegetation and difficult terrain, however, made it nearly impossible for ground crews to penetrate to the interior so the most infested areas eluded treatment. During 2019, MISC scientists and crew undertook a plan to begin aerial treatments. They formulated baits, developed and tested delivery technologies, and conducted extensive ground surveys. The team obtained special use permits and by October 2019, the aerial treatments began. During 2019 and 2022, helicopters were flown 22 days with aerial treatments (on 20 days) pinpointing the locations where LFA were detected or suspected. The treated area and boundaries comprised 174.7 acres. By April 2023, the latest targeted survey detected no LFA. Treatments have since been discontinued. In October 2023, the MISC team will conduct another full site survey. If LFA are not detected, the Nahiku site will be monitored annually for 5 years. If LFA are not detected during that time, LFA will be declared eradicated.

Economic costs and benefit of LFA eradication at Nahiku

We estimate the cost of the aerial operations to be $485,709 and the cost of follow-up monitoring to be $461,874 for a 9-year total cost of $947,583 when completed in 2027. Details can be found in Table 2.

To quantify the benefits, we estimated the hypothetical avoided cost of continuing ground treatments. Ground treatment would be needed to prevent LFA from spreading outside the area and prevent stings

[1] Current protocol is 5 years.

to people and animals living within the Nahiku area. We estimate the cost of ground treatment to be $70,829 per year or $1,416,578 over 20 years. Details appear in Table 1

We estimated the net benefit of the Nahiku eradication effort to be $1,416,578 - $947,583 = $468.995. Details are shown in Tables 2 and 3. We estimated the benefit-cost ratio to be $1,416,578/$947,583 ⇒ 1.49:1. This result is displayed in Table 4

Table 1. Hypothetical cost of BMP ground treatment at Nahiku (in the absence of aerial operations

	Cost for survey and ground treatment	**Quantity**	**Amount**
	Cost per FTE (2018)	$375	
	Salary inflation from 2018 to 2023	21%	
	Cost per FTE (2023) = $375 x 1.21	$454	
	Ground treatment crew (FTE) = 3.5 x $454	3.5	$1,589
	Screening technician (FTE) = 4 x $454	4	$1,816
	Screen once, treat ten times per year = $1,816 + 10 x $1,589	10	$17,707
F	Treat and screen 4 locations	4	$70,829
B	**20 years of BMP ground treatment, F x 20 = B**	**20**	$1,416,578

Table 2. Estimated cost of Nahiku aerial operations, ground treatment and monitoring

	Operations 2019-2022	**Quantity**	**Amount**
	Helicopter for 70.5 hours, 22 days, 4 years 2019-2022		$85,129
	Cost per FTE (2023)	$454.03	
	Aerial Crew (FTE)	155	$70,375
	Material aerial op (gallons, bait)	6,322	$198,708
	Cost to screen each vial	$6.50	
	Vials with ants %	50%	
	Screening cost (vials per survey)	5,034	$16,361
	Survey crew (FTE)	171	$77,639
	Ground treatment (bait cost, gallons)	277	$5,261
	Ground treatment crew (FTE)	71	$32,236
E	**Nahiku treatment cost, 4 years**		**$485,709**

	Annual Survey 2023-2027	**Quantity**	**Amount**
	Years	5	
	Cost to screen each vial	$6.50	
	Vials with ants %	50%	
	Screening cost (vials per survey)	4534	$73,678
	Cost per FTE	$454.03	
	Survey crew (FTE)	171	$388,197
A	**Nahiku monitoring cost, 5 years**		**$461,874**

Table 3. Estimated total cost of Nahiku aerial operations, ground treatment, and monitoring

	Total cost 2019-2027	**Amount**
E	Nahiku treatment cost, 4 years	$485,709
A	Nahiku monitoring cost, 5 years	$461,874
C	**Total cost 9 years, E + A = C**	**$947,583**

Table 4. Estimated net benefits from Nahiku aerial operations, ground treatment, and monitoring

	Net Benefit summary	**Amount**
B	Benefit (avoided cost, 2019-2038)	$1,416,578
C	Cost (expenditure, 2019-2027)	$947,583
N	**Net benefit, B - C = N**	**$468,995**
R	**B:C ratio, B/C = R**	**1.49:1**

Remarks

The net benefit of the Nahiku eradication is estimated to be $468,995 with a B:C ratio of 1.49:1 over 20 years. The eradication effort is still in progress and much of the expenditure data has yet to be compiled. As such these estimates are preliminary and subject to change pending receipt of additional data.

Additional benefits to the eradication effort include reduced number of stings and reduced risk of LFA spread due to the significantly reduced numbers of LFA a result of the intense and widespread treatments. These values were not estimated but are a potential source of future work.