OAHU ARMY NATURAL RESOURCES PROGRAM
MONITORING PROGRAM

POINT INTERCEPT MONITORING OF UNDERSTORY VEGETATION IN ASSOCIATION WITH IPA CONTROL OF *MORELLA FAYA* AT PALIKEA: RESULTS OF BASELINE MONITORING, 2016

INTRODUCTION

Incision Point Application (IPA) herbicide treatment of problematic non-native trees allows staff to effectively treat numerous individuals over a large area in a relatively short amount of time, with very small doses of pesticides. *Morella faya* is common throughout Palikea, and due to its ecosystem altering characteristics, is on the Hawaii Noxious Weed List, and considered a high risk weed species (Division of Plant Industry 2003; Hawaii-Pacific Weed Risk Assessment 2009). Vegetation monitoring of Palikea MU in 2014 determined *M. faya* to be the second most frequently encountered non-native tree within the MU (45% frequency), after *Schinus terebinthifolius* (63% frequency) (OANRP 2014). Recommendations were made for partial canopy thinning/removal of this species, as it is one of the more easily managed canopy weeds, and has infrequent recruitment. Large *M. faya* trees were selectively treated using IPA on November 3-4, 2015 at Palikea, including approximately 116 trees within the MU fence, and 81 outside the fence (Figure 1). This was the first round of multiple selective treatments that may be conducted, pending further discussion of management strategies for this taxon at Palikea. Understory vegetation change in association IPA treatment of *M. faya* will be documented using point intercept monitoring of a subset of treated trees within Palikea MU. Initial baseline monitoring was conducted within the first few months (December 9 and 14, 2015, and January 6, 2016) following treatment, before substantial canopy reduction and any resulting understory response occurred. Subsequent monitoring of the same trees will occur after one year. Additional monitoring will occur as deemed relevant.

METHODS

Point intercept monitoring was used to assess percent cover of native and non-native taxa in the understory directly below treated *M. faya* trees within Palikea MU. All species "hit" at points along transects were recorded for understory vegetation. A 5 millimeter diameter, 6 foot tall pole was used to determine "hits" in the understory (live vegetation that touches the pole) along an outstretched measuring tape. Point intercepts were recorded at 25 randomly sampled treated trees every meter (m) along 5 m long transects in each cardinal direction from the tree, or alternatively, every 0.5 m along two 5 m long transects oriented North and South, or East and/or West or if slopes were too steep to the North or South (n = 500 points). Using two transects with more closely spaced point intercepts per tree was an effective attempt to expedite the data collection process, as monitoring took longer than expected using four transects with fewer point intercepts per tree. The same methods will be replicated in subsequent monitoring. Substrate in locations where no vegetation was intercepted in the understory was recorded as soil/leaf litter, rock, moss, etc. Trees were marked (with a combination of yellow and orange-black striped flagging) and tagged with unique identification numbers. Approximations of percent cover were obtained from the proportion of "hits" among all intercepts. The overall health (noted as healthy, moderate, poor, dead) of trees and defoliation ranking of 1 to 4 (1: 100%, 2: > 50%, 3: < 50%, and 4: 0% defoliation) as per Leary et al. (2013) were also documented to assess treatment efficacy. Hemispheric photographs

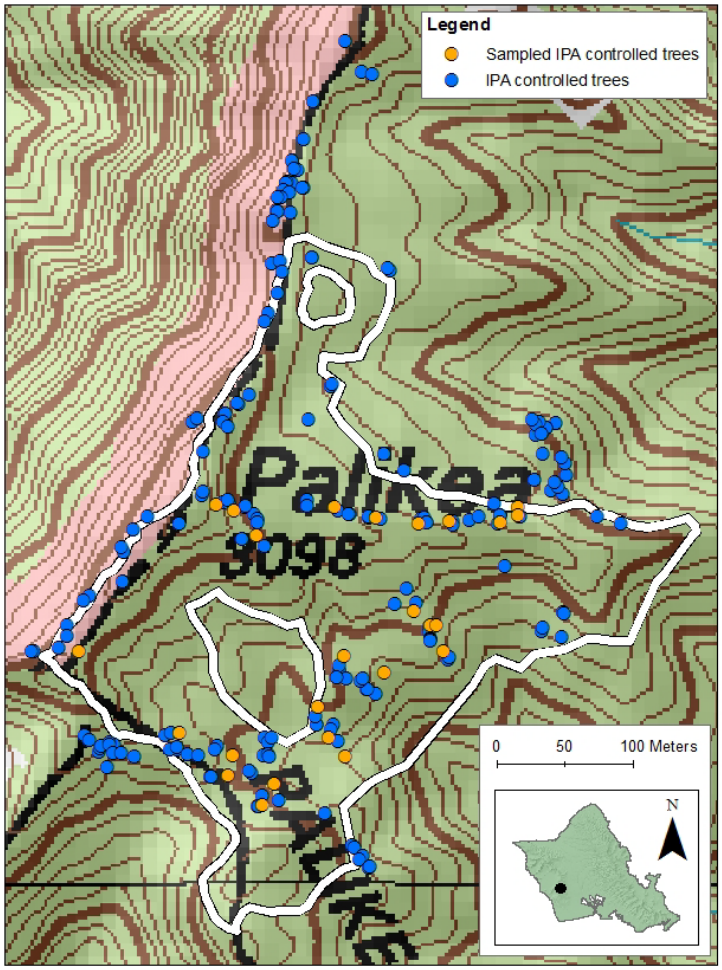

Figure 1. Location of IPA controlled *Morella faya* at Palikea, including locations of trees sampled for monitoring associated understory vegetation response.

(medium effect level) were taken of the canopy on the south-facing side of each sampled tree to document canopy openness. Photographs were taken at 2 m above ground level, aimed 180° from the forest floor. Gap Light Analyzer (GLA), Version 2.0 software (Frazer et al. 1999) was used to analyze percent canopy openness, using the hemispheric canopy photographs.

RESULTS

Understory vegetation cover beneath the sampled IPA controlled *M. faya* trees at Palikea included 47.6% native taxa, 44% non-native taxa, and 26.6% non-vegetated area (Table 1). The most prevalent non-native taxa were *Clidemia hirta* (15.6%), *Morella faya* (6.8%, consisting primarily of portions of the sampled trees), *Rubus rosifolius* (6.4%), and *Blechnum appendiculatum* (6.2%) (Table 2). Predominant native taxa included *Nephrolepis exaltata* subsp. *hawaiiensis* (10.8%), *Dicranopteris linearis* (8.6%), and *Cibotium chamissoi* (5.2%).

Most sampled *M. faya* trees were beginning to show signs of declining health (5 healthy, 15 moderate, 5 poor), wherein leaves were browning and/or beginning to defoliate. All trees had some degree of defoliation, with a median ranking of 3 (< 50% defoliation). Mean canopy openness was 17.7%.

Table 1. Baseline percent cover of native and non-native vegetation in the understory below IPA treated *Morella faya* at Palikea MU.

	Cover (%)
Native	47.6
Non-native	44
Non-vegetated	26.6

Table 2. Baseline percent cover of native and non-native taxa in the understory below IPA treated trees at Palikea MU. Native taxa in boldface

Taxa	Cover (%)	Taxa	Cover (%)
Clidemia hirta	15.6	*Melinis minutiflora*	0.6
Nephrolepis exaltata* subsp. *hawaiiensis	10.8	***Peperomia membranacea***	0.6
Dicranopteris linearis	8.6	***Asplenium caudatum***	0.4
Morella faya	6.8	***Cheirodendron trigynum***	0.4
Rubus rosifolius	6.4	*Cyclosorus parasiticus*	0.4
Blechnum appendiculatum	6.2	***Diplopterygium pinnatum***	0.4
Cibotium chamissoi	5.2	***Doodia kunthiana***	0.4
Ehrharta stipoides	4.8	***Dryopteris sandwicensis***	0.4
Microlepia strigosa	4.2	***Elaphoglossum aemulum***	0.4
Passiflora suberosa	3.8	***Nephrolepis cordifolia***	0.4
Paspalum conjugatum	3.2	***Sphenomeris chinensis***	0.4
Dianella sandwicensis	3.0	*Youngia japonica*	0.4
Psidium cattleianum	2.8	***Antidesma platyphyllum***	0.2
Asplenium macraei	2.2	***Athyrium microphyllum***	0.2
Dryopteris glabra	2.2	***Broussaisia arguta***	0.2
Asplenium contiguum	2.0	***Carex wahuensis***	0.2
Diplazium sandwichianum	1.8	***Coprosma foliosa***	0.2
Metrosideros polymorpha	1.8	*Cyclosorus dentatus*	0.2
Alyxia stellata	1.6	***Cyrtandra waianaeensis***	0.2
Kadua acuminata	1.2	***Elaphoglossum alatum***	0.2
Elaphoglossum paleaceum	1.0	***Melicope oahuensis***	0.2
Freycinetia arborea	1.0	***Pipturis albidus***	0.2
Elaphoglossum crassifolium	0.8	***Vaccinium reticulatum***	0.2
Pittosporum confertiflorum	0.8	***Viola chamissoniana* subsp. *tracheliifolia***	0.2
Deparia petersenii	0.6	***Wikstroemia oahuensis* var. *oahuensis***	0.2
Kadua affinis	0.6		

DISCUSSION

Vegetation monitoring of understory response to IPA control of *M. faya* will provide useful information regarding the extent to which native and non-native cover changes in association with large scale removal of this prevalent canopy species. While data collected from a control group consisting of untreated *M. faya* would have been ideal for use in interpreting change as a direct result of IPA treatment, it was impractical for this project, given the initial plans for subsequent treatment of all *M. faya* in the MU. Results of on-going MU monitoring at Palikea will provide supplemental data that may be used in comparison with any understory vegetation changes at sampled IPA treated trees. E.g., if understory cover changes below sampled trees differs from those on an MU scale (excluding plots with treated *M. faya*), there may be greater confidence that the observed changes at IPA controlled trees are in response to the treatment rather than to other unrelated factors occurring throughout the MU. Vegetation monitoring for Palikea MU in 2014 had similar results to those reported here, with native and non-native understory and non-vegetated cover approximately 10% lower than the baseline cover beneath the sampled IPA treated

trees (OANRP 2014). Identical results were not expected, as the sampled areas associated with this project are not necessarily representative of the entire MU.

Though many trees were beginning to show signs of declining health and some degree of defoliation, it is not believed that there was time for any substantial change in understory cover in response to changing light levels during the one to two months' time between treatment and baseline vegetation monitoring. Dying trees retain dead leaves for some time, such that changes in light levels are not immediate. Anecdotal observations several months after baseline monitoring occurred suggest canopy defoliation is well underway, and differences in canopy openness, and possibly in understory cover, are expected for the subsequent monitoring one year post-treatment (Figure 2).

Figure 2. Photograph of Palikea showing defoliation in association with IPA treated *Morella faya* and *Cryptomeria japonica*, March 31, 2016.

Monitoring was intended to take one to two days to complete, however three days were necessary for completion. Locating random pre-selected trees was more time consuming than anticipated, as the initial GIS accuracy was somewhat poor. Subsequent re-monitoring is anticipated to require less field time, due to the installation of flagging and tags, and higher accuracy GIS data taken for each sampled tree during baseline monitoring. Efforts should be made to streamline the sampling process for future IPA monitoring projects.

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