



Early Detection of Invasive Plant Species Monitoring Plan

Standard Operating Procedure #19: Corridor Survey Data Analysis

Version 1.0 (7 June 2017)

Change History

New Version	Revision Date	Author	Changes Made	Justification
1.0	6/7/2017	J. Gross, A. Ainsworth	Developed.	Significant changes to draft ED narrative document.

Only changes in this specific SOP will be logged here. Version numbers will be incremented by a whole number (e.g., Version 1.3 to Version 2.0) when a change is made that significantly affects requirements or procedures. Version numbers will be incremented by decimals (e.g., Version 1.6 to Version 1.7) when there are minor modifications that do not affect requirements or procedures for publication in the series.

Purpose

This SOP describes how corridor survey data from the Pacific Island Network Early Detection of Invasive Species (ED) plan are analyzed. Analysis is aimed at

- 1) Categorizing, mapping, and describing the incipient species detected during the survey.
- 2) Summarizing species attributes (e.g., abundance, frequency, age class, reproductive status).
- 3) Exploring potential trends (e.g. new species records vs. distance from trailhead/populated area).
- 4) Providing continuity with previous survey efforts including updated status of prior detections (i.e., incipient species from previous survey now considered widespread and not included in current survey) and comparison of current target species list with prior target species lists.
- 5) Summarizing overall survey effort (e.g., worker hours, distance surveyed, time required to identify unknown species).

Categorizing, Mapping, and Describing Incipient Species

After species waypoints have been identified to the species taxonomic level, they are assigned to a record category ([0] not a new record and not a target species [1] new state record, [2] new island record, [3] new park record, [4] new unit record, [5] new locality record, [6] target species, [7] unknown species, [8] rare native species.), See SOP #8 “Conducting Corridor Surveys” for record descriptions. A species is assigned to the broadest category possible and only one category is assigned per species. For example, a new state record is assigned only to category 1, while it is still recognized that the species is also a new island record and new park record. For mapping purposes it may be desirable only to map one category at a time (Figure 1), but the presence of broader species records should be noted. When reporting total number of species detected per category, the broader categories above it will need to be included in the calculation. For example, the total number of new species found in the park will need to include all the species classified as new island records and new state records.



Figure 1. Example maps from 2014 HAVO Kahuku pilot study displaying the point detections for one record category per map. If totals were being calculated, the new park (HAVO) species records would also include the new island species records along with new state records if available.

In addition to mapped point detections, each species documented in category 1-3 should be described. Descriptions may include the process used to identify the new species, whether or not voucher specimens were collected and where they were sent, status of the species in other known locations, and management actions taken and/or intended actions.

Summarizing Species Attributes

Species attributes (Table 1) are summarized to provide additional details on the status and extent of incipient plant populations. Species attributes can be summarized across various defined areas including park, park unit, corridor, corridor segment, or high-risk sites. All attributes listed here may not be useful to every survey. The attribute and area selected to characterize incipient

populations will likely depend on the extent of the survey, the number of detections, and/or interests of the park staff.

Based on the certified presence/absence and abundance data, more detailed descriptive statistics (means, variances, confidence intervals, etc.) can be computed for early detection species richness and frequency with the corridor or high-risk sites. Early detection species richness will be calculated as the number of different species found per area. Various measurements of frequency are possible with these data. Detection frequency is the number of samples (i.e. segments) with detections per total samples for an area. High detection frequency in an area may warrant further exploration into possible non-native transportation mechanisms in the area. Species frequency is simply the number of detections per species and may be a useful measurement of abundance to describe the extent of an incipient population or populations. Family/Life form frequency is the number of species detected that are of the same life form or taxonomic family. Family/Life form frequency may be useful to track over time to help managers understand which plant families or life forms are more prone to establishment and invasion in an area. Corridor frequency may be useful after multiple surveys have been conducted. It is the number of detections occurring in the same area across multiple years. This measurement would help inform managers of ongoing problematic sites so that mitigating actions can be considered.

Table 1. List of recommended summary statistics for early detection species attributes.

Attribute	Summary Statistics	Area
Species		Park, park unit, park special ecological area, corridor, corridor type, standardized length of corridor segment (e.g. 5 meters).
Richness	Count of species or life forms per area.	
Frequency	Detection Frequency: number of detections (e.g. corridor segments with detections) per total number of segments in an area. Species Frequency: number of records per species or life form per area (also a measurement of abundance). Family/Life form Frequency: number of different species detected per taxonomic plant family or life form. Corridor/Area Frequency: number of different surveys (i.e. years) an undocumented species was detected per area.	
Abundance	Species and/or life form groupings abundance class when detected (% cover or density class) per area.	
Age/Size	Count of species with one or more adult individual per area.	
Phenology	Count of species with one or more fruiting/flowering individual per area.	

Categorical data for abundance (number of individuals or percent cover class), size/age class, and phenology of species records can also be used to compute descriptive statistics at the species or group (life form) level. A separate status estimate will be reported for each category for each species with their associated error. Depending on the attribute, these statistics are aggregated across all species, grouped by life form (i.e., tree, shrub, fern, herbaceous), and/or individual species.

Exploring Trends

Depending upon availability of data and size of park, it may be possible to examine trends in the early detection data. For instance, because humans are presumably transporting non-native species along the survey corridors, new species detections would be expected to increase as human activity increases. Using data from the 2014 early detection pilot study at Kahuku, several

approaches were employed to explore trends between detections and human activity. An issue that was identified during this process was the difficulty in obtaining an accurate proxy for human activity. First, we attempted to use road type (highway, public road, park staff road, etc.) as a proxy for human activity but these categories did not provide an appreciable measure of activity and the datasets available were questionable in accuracy. Secondly, we attempted to use distance from trailhead, or in this case, distance from park entrance, as a proxy of human activity. However, this method requires that all access paths (authorized and unauthorized) are documented. The West Kahuku Unit contained a number of new species detections that were considerable distances from the park entrance. However, field inspection revealed numerous unauthorized ATV trails entering the park from an adjacent residential area. These unauthorized trails would also need to be included and mapped in order to accurately measure distance from “park entrance.” Finally, we tried using distance from (nearest) park boundary. We found that 11 of the 17 (65%) new detections for Kahuku occurred within 300 m of the park boundary (Figure 2). The other 6 detections occurred along the main public access roads of Kahuku. Distance from boundary is not as precise as distance along the corridor; however, it takes into account the unauthorized human activity in West Kahuku. If measurement of corridor use is available and accurate in future surveys, it may be necessary to divide corridors into small, equal length segments (e.g. 5 m) in order compensate for unequal sampling of corridor types.

After repeated surveys in the same area, it may be possible to measure the frequency with which new species are detected along specific corridors or sections of corridors. Corridors showing consistent or increasing detections over time would warrant additional examination into the causation.

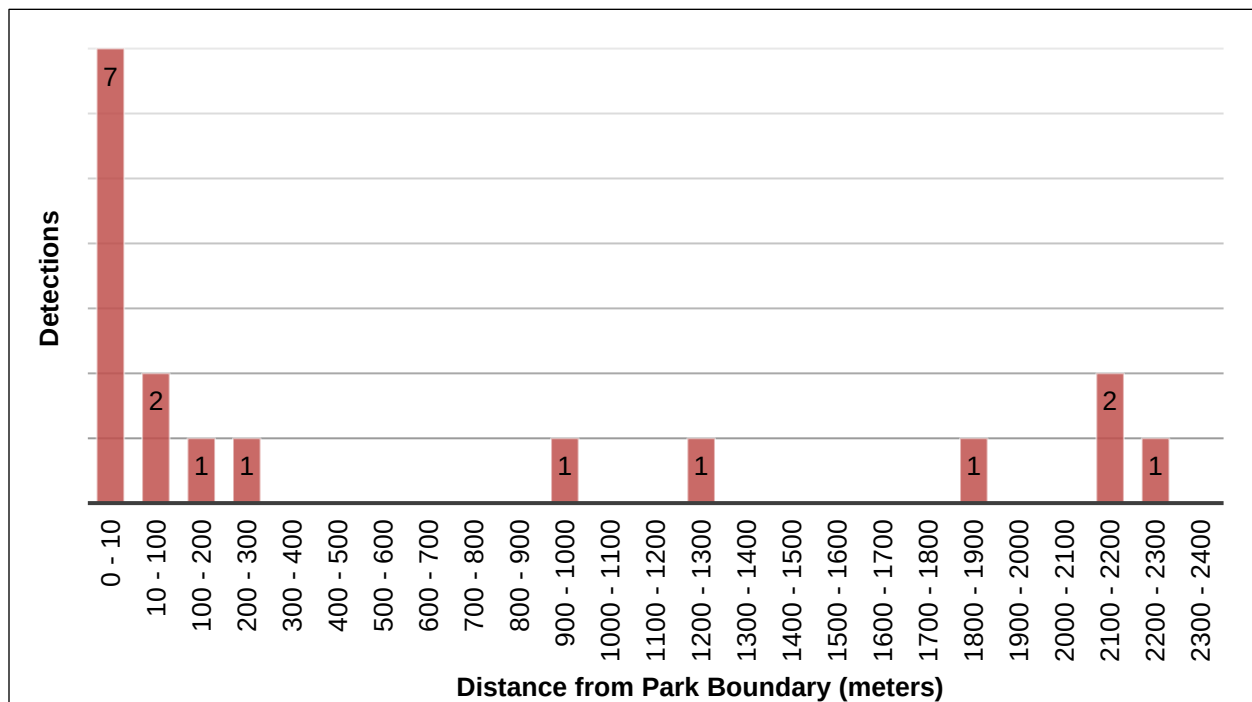


Figure 2. Count of New Kahuku Detections (record categories 1-4) grouped by distance from park boundary. These 17 records represent 15 different species.

Previous Reports

If one or more previous early detection reports are available for the survey area, the current report will need to include relevant information that provides continuity with the previous reports. For instance, were the new non-native records from prior reports eradicated from the area, or have there been more detections of the plant elsewhere? Likewise, prior target species lists should be examined for differences. For example, how many new target species are there from the last time the survey was conducted? Finally, if a species was on a previous target list and not present on the current list was it eradicated, or has the population increased to a level that is now considered unmanageable by the park?

Efforts

Survey effort is an import component of the ED plan because 1) these surveys do not have a set sampling area, may vary from year to year, and the amount of corridor surveyed will influence the number of detections recorded, 2) corridors that are void of detections could not be determined without tracking which corridors were surveyed, and 3) future surveys will utilize previous efforts to estimate resources and worker hours required. Some examples of statistics used to track efforts include: mapped location and total length of corridors surveyed, the types of corridors surveyed (paved road, dirt road, trail, etc.), and worker days for field and office completion (Table 2). See Appendix C for example efforts based on 2014-2016 pilot studies.

Table 1. List of recommended effort statistics.

Effort Statistic	Description
Corridor	
Sampling Area	Mapped location of all surveying conducted. Total length of corridors surveyed. Count and/or size of high-risk sites surveyed (parking lots, residential areas).
Type	Count, length, and or size of each corridor type.
Usage	How often the corridor is used by park staff or the public, if available.
Worker Hours	
Survey	Worker hours surveying, total number of people surveying, distance surveyed by corridor or high-risk site, park section and/or park.
Office	Worker hours identifying unknown species, total number of unknown species, uploading evidence to park-specific NPSpecies.
Non-Survey Field Time	Worker hours during survey days in which crew were not actively surveying (includes travel, miscellaneous prep, etc.).