

## Invasive species survey techniques: Plant survey<sup>\*</sup>

The longer a non-indigenous species goes undetected once introduced to a new area, the less opportunity there will be to intervene if it becomes a problem: the options for its control will become fewer and any intervention will become more expensive. Therefore prevention and early detection activities are vital in protecting forest environments from non-indigenous and possibly invasive species.

The control and management of non-indigenous plant species can be considered as four phases:

1. **Planning** – identify land management goals (e.g. resource protection or conservation, production, etc.) and objectives.
2. **Inventory/survey** – determines which species are present and their distribution within the environment.
3. **Monitoring** – provides information on how species/populations are changing with time, their impact on the ecosystem and the impact of management practices. It also can allow for the detection of new invasive plant species/populations. Monitoring objectives define and constrain the objectives and methods for surveys because they require locating sample populations across the widest possible set of environments which define the habitat for a species.
4. **Management** – uses appropriate methods (e.g. physical, chemical, silvicultural, biological control methods) for eradication, suppression, containment, or restoration thereby reducing the distribution and impact of non-indigenous species.

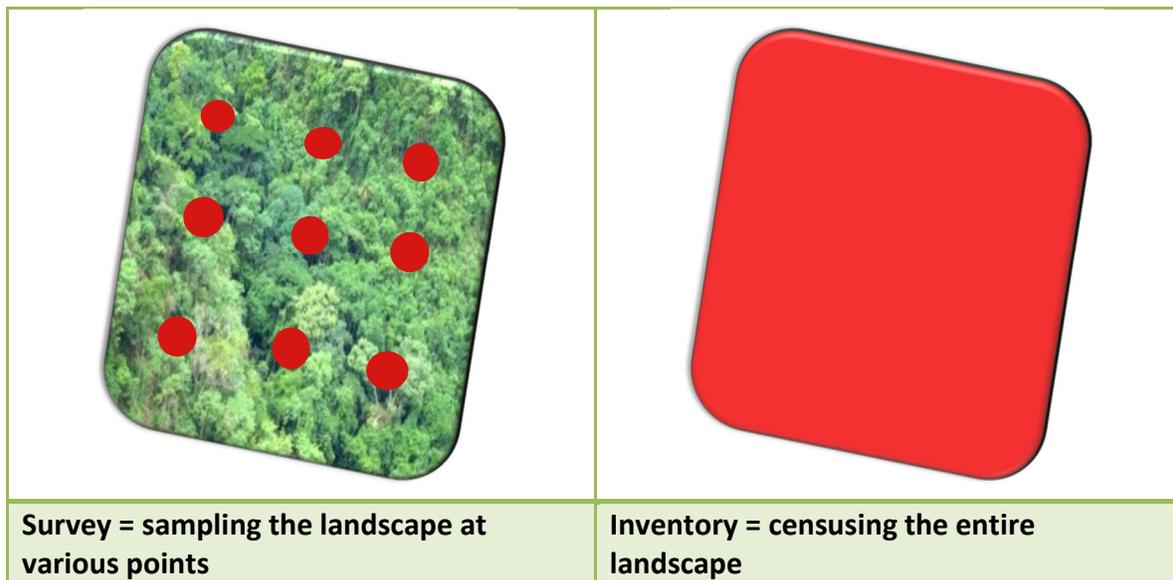
Here we focus on phase two, determining which species are present and where they are located within the environment.

Invasive plant inventories/surveys play an important role in forest management. An inventory/survey provides qualitative or quantitative information about the identity, location, and abundance of invasive plants within the management area, which is critical for making well-informed management decisions. The first step to managing invasive species is to know where the species are and where they are not. Knowing which invasive plant species are present in or near the management area, and where and to what extent their populations occur increases the ability to assess and prioritize invasive plant management, direct work efforts, and improve cost effectiveness. Inventories and surveys can be adapted for different purposes, use a wide range of methods, and vary in scales and level of detail (resolution). Many management areas are large and therefore can only be surveyed and not inventoried (Figure 1).

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<sup>\*</sup> Information from this presentation has been adapted from materials available from a variety of sources including: US Fish and Wildlife Service ([www.fws.gov/invasives/staffTrainingModule/index.html](http://www.fws.gov/invasives/staffTrainingModule/index.html)), Centre for Invasive Plant Species Management ([www.weedcenter.org/management/index.html](http://www.weedcenter.org/management/index.html))

More detailed inventories/surveys that identify ecological or anthropogenic associations with invasive plant occurrence can provide baseline data for developing monitoring programmes. Quantifying invasive plant status in a management area can help justify funding or support other requests.



**Figure 1. The difference between plant surveys and inventories**

Things to consider before developing and carrying out surveys include:

- What is your objective?
- How will the data be used?
- How much precision is needed for the data?
- What are your constraints?

**Survey objectives.** Objectives for surveys may be to detect new invaders early, to locate the maximum number of species, to locate the most populations of a single (known) species, or to gather landscape-level data.

**Use of data.** Determining how you will use the data will dictate the survey methods considered. Maps created from inventory/survey data are valuable references that document invasive plant population status and management activities. Maps can also be used in education and outreach efforts for the public, policy makers or other personnel. Survey data should reflect the spatial distribution of the target species populations over the landscape. Such data can then be used in combination with environmental data, to create probability maps of target species occurrence for the entire area of interest.

**Precision of data.** More intensive surveys will be needed in order to provide high precision of data.

**Constraints.** Sampling for invasive species is time-consuming and thus costly. The type of landscape you are surveying may dictate which methods you use and how long it will take, i.e. if the forest is difficult to navigate it will be difficult to survey by foot and will take longer. Topography, accessibility, size, and susceptibility of an area to invasion can determine the search or sample area. There may also be constraints in regards to the availability of survey method technology (e.g. map and compass versus GPS) and transportation options (e.g. bicycles, helicopter/plane, by foot, ATV, animal).

In general, inventories and surveys fall into two different categories based on their overall purpose:

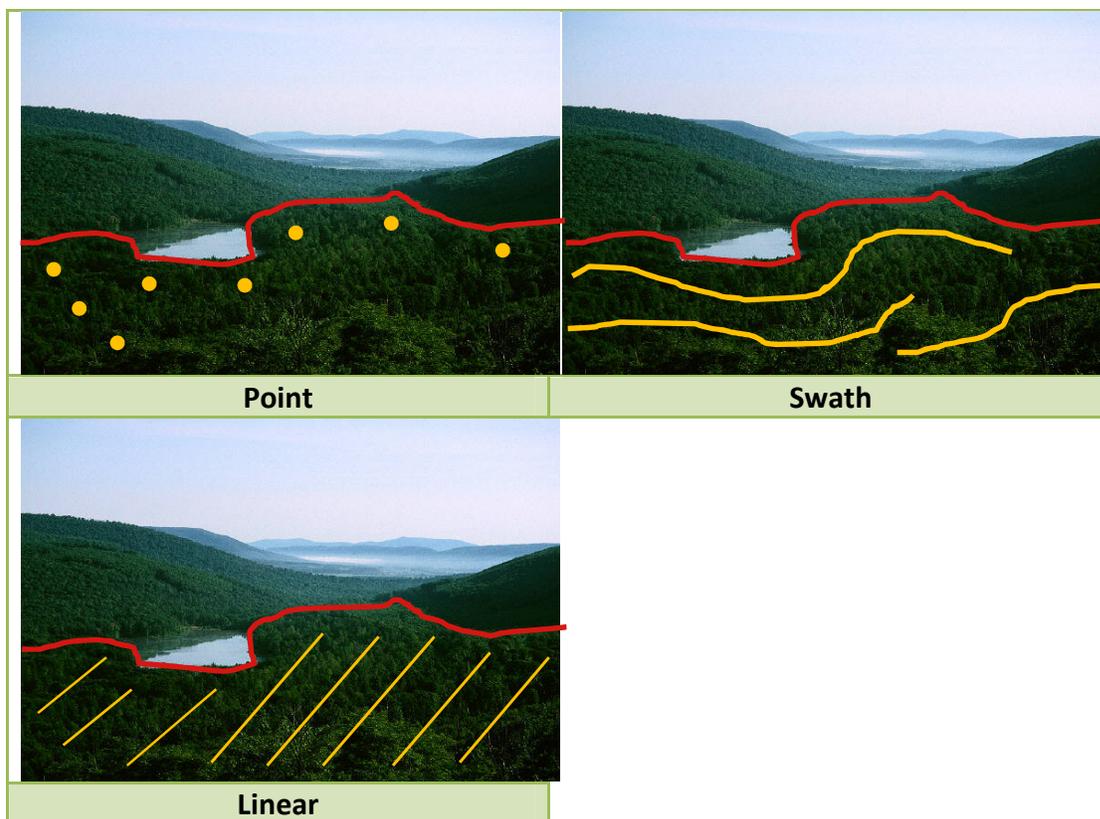
- those that document the distribution and abundance of invasive plant populations for making management decisions (i.e. exploratory and reconnaissance);
- those that attempt to further understanding of invasive plant populations or plant communities (i.e. extensive and intensive) (Table 1).

**Table 1. Comparison of the general survey types**

Exploratory	Reconnaissance	Extensive	Intensive
Sparse information	Some info known	More detailed information	Gather most information
Fast and efficient search	Detect new populations	Identify correlations between landscape and weeds	Baseline for future monitoring
Create basic map	Obtain more gross information		Understand ecology
			Extrapolate data using modelling

Surveys may be ground based (i.e. by foot, animals (horses), bicycles, ATV, etc.), aerial based or carried out through remote sensing.

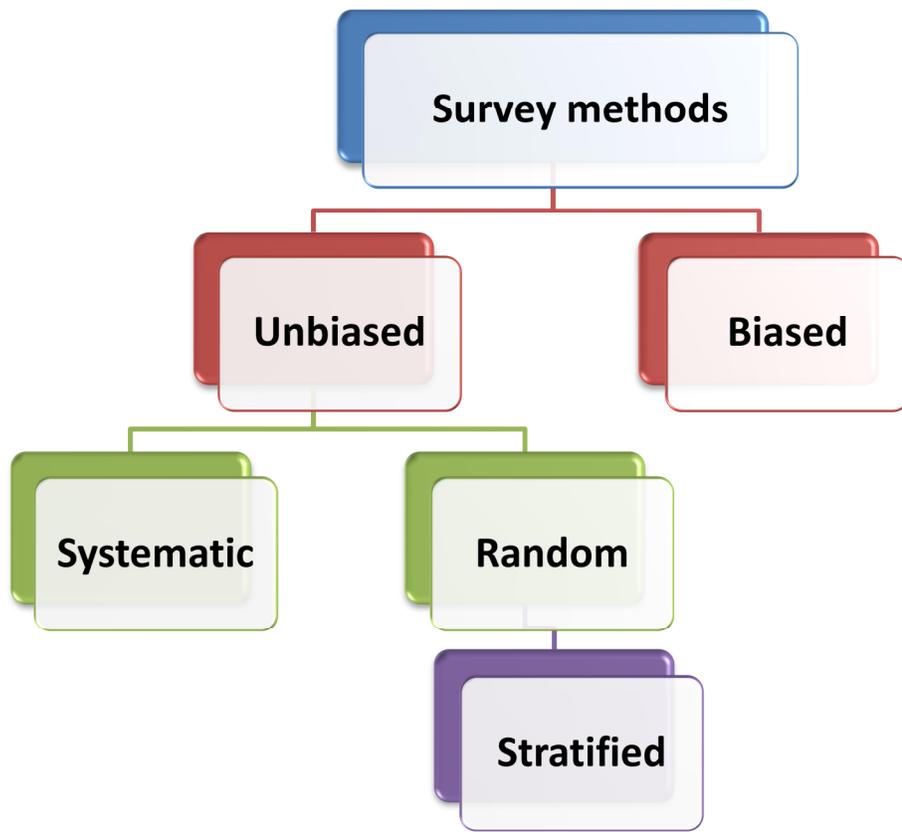
A variety of sampling methods can be used to gather data including point, swath and linear, each with their own advantages and disadvantages (Figure 2). Choosing a method will depend on the situation and the goals of the survey.



**Figure 2. Comparison of different sampling methods. Red line and below denotes the management area, yellow markings denote the different types of sampling methods.**

Survey methods can be categorized into biased and unbiased (Figure 3). An example of a biased survey method would be a transect sampling along a chosen area (i.e. roadways, riparian areas). This method would be appropriate when looking for specific species that you know grow in certain areas. It would also be a good method for early detection of new (known) invaders and to find the most populations of a single species.

Unbiased survey methods are best for developing an understanding of weed distribution across the landscape. They are good to find most populations of a different species. Unbiased methods are further divided into systematic (grid sampling) and random (point, swath, stratified) methods. An example of a stratified method would be to survey a line perpendicular road or trail, a targeted transect or contour transect.



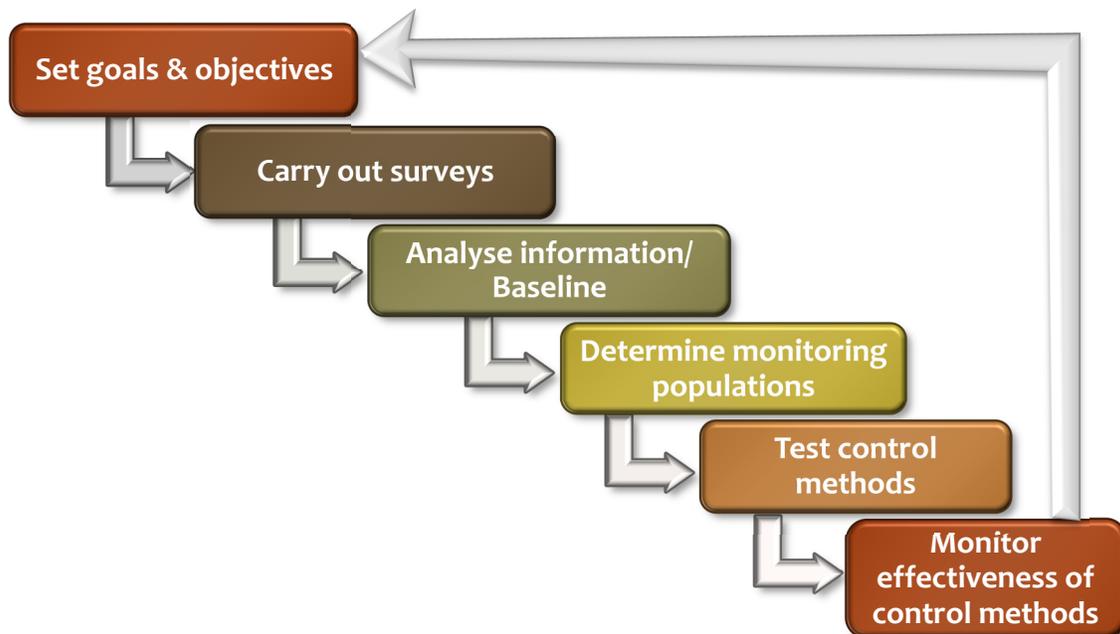
**Figure 3. Classification of survey methods**

Data to collect during an invasive plant survey includes general and environmental information as well as specifics on plant species (Table 2). The general information will help to develop a monitoring programme. Recording the information on plants will help determine the status of native as well as non-indigenous species and will also be valuable to start a monitoring programme. The environmental information will help to predict other areas where the non-indigenous or weed species could possibly occur.

**Table 2. Data to collect during an invasive plant survey**

General	Plant	Environment
Name of examiner	Weed density	Disturbance
Date of survey	Weed percent cover	Habitat
Area surveyed	Weed status	Slope
Type of survey	Native species	Aspect
Plant name (Latin, common, code)		Elevation
Infested area (presence)		
Canopy cover of infestation		
Property ownership		
Source of data		
Hydrologic unit		
Location (latitude/longitude, quad number & name)		

Managing invasive species involves many steps from determining the goals of the plan all the way to the application of control methods and monitoring their effectiveness to achieve goals and objectives (Figure 4).



**Figure 4. Summary of the invasive species management process**