GLOBAL TREES CAMPAIGN

BRIEF 1

How to survey an area for threatened tree species

Credit: Li Xiaoya/FFI

> "The location of threatened species' populations is the most fundamental information required for their conservation" D. A. Keith (2000)

This Brief was written by Steven Brewer

Introduction

Protecting and monitoring a tree species cannot occur without first knowing where the population can be found and how many of its individuals remain. However, tree species under threat from extinction are often rare, poorly known and grow in areas that may be difficult to navigate. The purpose of this brief is to provide basic guidance on how to determine presence, distribution and/or population size of target threatened species within an area of interest.

Who is this guidance for?

Individuals in conservation organizations (NGOs, forest departments, protected-area managers, etc.) tasked with protection and conservation of a particular species. Specialised training is not required, but some basic skills (detailed on Page 3) should be present within the survey team.

The Global Trees Campaign is a partnership between:

FAUNA & FLORA INTERNATIONAL

BGCI Plants for the Planet

This brief was produced by Fauna & Flora International (FFI) as a contribution to the Global Trees Campaign

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Before you start

Two common mistakes made when conducting species surveys are (1) rushing out to the field before knowing exactly what kind of prior information and skills are needed, and (2) trying to do too much too soon, rather than taking a long-term view of what is trying to be accomplished. By following the step-by step guide below, you will be able to complete more efficient and effective surveys.

STEP 1: Determine the purpose of your survey

What is the primary purpose(s) of the survey? Is it to determine whether the species is present? Or is it to determine distribution and/or the abundance of that species?

STEP 2: Select your survey method

Your choice of method will depend on the primary purpose of your survey. Some methods focus effort on areas of high potential habitat for the target species whereas others take a more systematic approach. An appraisal of available survey methods is given in Pages 4-5.

STEP 3: Know your species in advance

All existing information about the target species should be collated and stored in one place, with backup copies stored elsewhere. This information can be gathered from published literature, reports and other studies, herbarium specimens and collections databases, as well as from local loggers, hunters, and villagers who use the species or spend time in habitats where they are found. If time is limited, at least make sure you have an idea of where to go (see 'Location'), when to go (see 'Phenology') and what to look for (see 'Identification issues').

LOCATION

What kind of environment preferences does the species have, if any? Start by examining how rainfall, geology/soils, topography, elevation, and environmental disturbances such as fire or storm damage helps or hurts populations of the species. Many herbarium specimens have GPS coordinates attached to them, helping you to determine locations and suitable habitats for fieldwork.

PHENOLOGY

What time of year does the species fruit, flower or drops its leaves (if it does so periodically)? This may help inform the timing of fieldwork – often, the quickest way to find a tree species growing in a mixed forest is to look for the fruits, flowers, or leaves of the target species.

IDENTIFICATION ISSUES

Are there any closely-related, or unrelated, tree species that might be mistaken for this species in the area? If so, how do you tell the differences? The best way to gather this information is from a botanist who specializes in the relevant plant family. Botanists can be found at herbaria (institutions that house plant specimens, data, and scientists). Other good sources include floras (books on the plants of a particular area).

STEP 4:
Make sure your team has the right skills

Your team should have the following skills

1) **Map Reading:**
   a) Looking at a topographic map and interpreting specific landscape features, for example what parts of the map show hilltops, slopes, streams, valleys etc.;
   b) Reading approximate latitude and longitude from a specific point on the map, or putting a marker on the map that matches the location of a given latitude and longitude.
2) **Navigation and use of a handheld GPS device:**
   a) Recording locations of trees on the GPS or re-locating a tree already recorded on the GPS;
   b) Following and laying-down "tracks" (records of where one walked) on the GPS device.
3) **Use of a compass:** Finding a tree if given an azimuth (compass direction in degrees) and walking along an azimuth.
4) **Use of a meter and DBH (Diameter at breast height) tapes:**
   a) Reading distances along a tape and estimating distances using a meter tape;
   b) Determining the width of a tree stem using a DBH tape.
5) **Plant identification:** identification of the species of interest is critical but does not necessarily require a botanist. Tree spotters who work for logging operations are the best immediate source for finding the target species, but anyone who spends large amounts of time in forests can readily pick up how to identify a particular species. When the identification of a tree is in doubt, see GTC Brief 2 for advice on how to collect voucher specimens.

How do you measure DBH?

To measure the Diameter at breast height of larger trees, take readings (in cm) from a diameter tape wrapped around the tree stem (at 1.3 metres above the ground) or use an ordinary measuring tape and divide the girth by Pi (3.14).

DBH of saplings and small trees is typically measured using callipers.

STEP 5: Acquire field equipment

- GPS and extra batteries
- Compass
- Topographic Maps
- DBH Tape (optional for some methods)
- Weather-resistant field notebooks and mechanical pencils
- Meter Tape (optional for some methods)
- Binoculars for identifying tall trees (looking at leaves, flowers, fruits, etc. in the canopy)
- 10X or 15X Hand lens for examining plant material for identification
- Daypack for carrying equipment
- Knife or machete for cutting tree bark (aids in tree identification)
- Camera for recording plant features (optional)
- Field guide (if available) or notes for identification
- Food, water, and other personal gear

Available methods for your field survey

METHOD 1: Focused or Intuitive-Controlled Surveys

This method focuses the intensity of surveys on areas of high potential habitat for the target species, using the experience, field "intuition" and preparation of the surveyor to guide the survey.

ADVANTAGES:	DISADVANTAGES:
Enables you to cover most of the species' likely habitat without having to cover the entire survey area	Provides an incomplete survey; one cannot exclude the possibility that the target species occurs in areas not surveyed
Efficient and relatively low cost	Requires field experience in similar areas and habitats
May provide a preliminary estimate of population size of the target species	Requires information on (a) the survey area and (b) what constitutes suitable habitat for the target species to be prepared beforehand

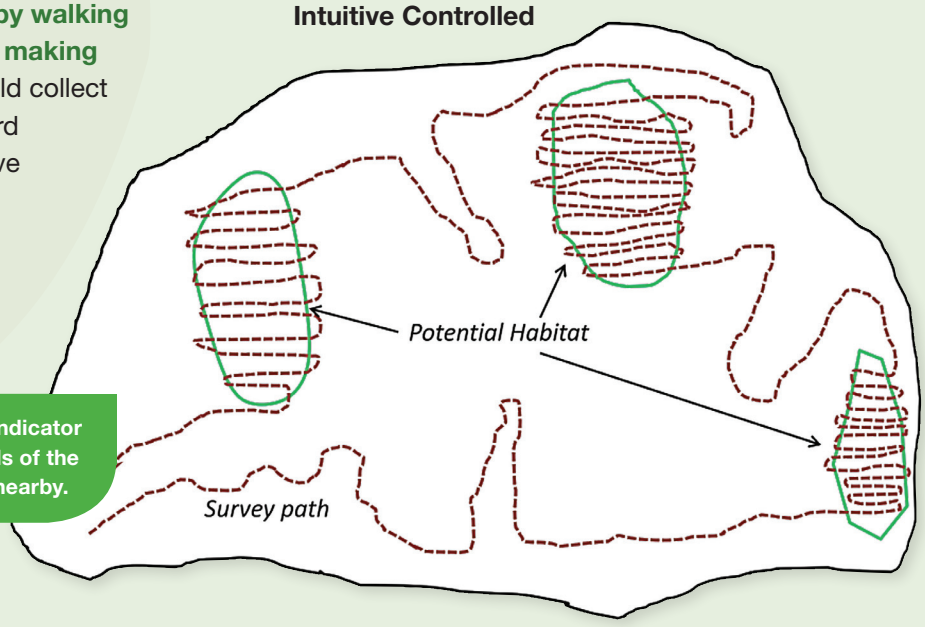
How this works in practice:

1. **Determine your areas of high-potential habitat by marking them on a map.** You can then plan survey routes based on locations of major landscape features/habitat types and logistical considerations such as time available, difficulty of the terrain, where to place campsites and number of personnel. Reconnaissance trips to the field may be necessary for planning.

2. **Visit major habitats and landscape features (e.g., hill tops, slopes, valleys, etc.) *on the way to* high potential habitats,** in order to get a preliminary idea of whether or not the target species occurs in any type of habitat ***other than*** those believed to be of high potential. Focus on covering features that influence what kinds of plants grow there – i.e. anything that affects light, water availability and soils. These 'microhabitats' (disturbed areas, rock outcrops, moister areas, drier exposed areas, ravines, etc.) can be surveyed as opportunities arise.

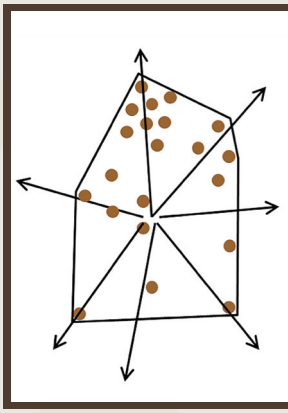
3. **Survey high-potential habitats by walking across all parts of them and by making complete tree counts.** You should collect basic data on each tree you record including its DBH and reproductive condition (see Data Collection on page 6).

Intuitive Controlled



TOP TIP The presence of seedlings is an indicator that one or more larger individuals of the species are or were somewhere nearby.

4. **Estimate abundance of the target species by assessing the extent of each sub-population (different patches of trees of the species).** Walk the approximate edges of patches and delimit a 'minimum convex polygon'. Then estimate the numbers of trees present inside each delimited patch. In this method, a surveyor walks through a patch of trees and simply gives a visual estimate of the number of trees within the area.



Minimum convex polygon

Drawn around the outside perimeter of the population or patch of trees by walking in 6-8 compass bearings from a point near an estimated center of the patch.
The trees farthest from the center are used to mark the outside boundaries of the patch. Not all tree locations have to be determined. The area of the polygon can be calculated with GIS software.

METHOD 2: Systematic & Complete

In this method, the surveyor walks systematically (regularly and evenly) through an entire area, locating all trees at or exceeding a minimum size class.

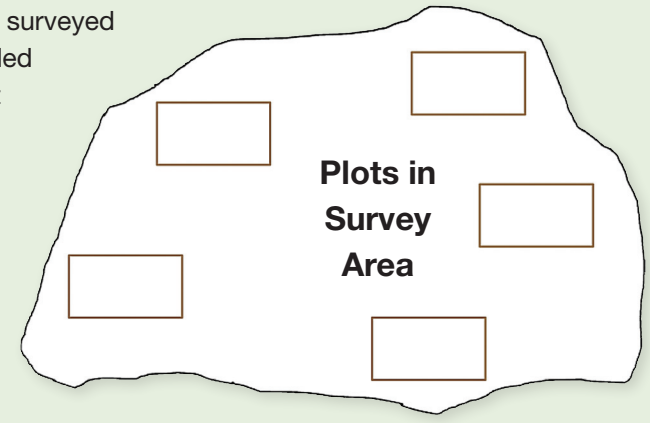
ADVANTAGES:	DISADVANTAGES:
Provides an accurate measure of population extent and abundance of the target species	Inefficient for very large areas (i.e. takes more time to complete for a given size of habitat)
Works well for species that are poorly known in habitat preferences or for generalist species that grow in many habitat types	Relatively expensive compared to focused surveys

How this works in practice: using plots and transects

Two common types of methods used for biological surveys are plots (square, rectangular or sometimes circular boundaries used to delimit areas) and transects (lines, or narrow strips of land of a set width, along which a surveyor walks). These methods can be used to:

- completely survey an entire area
- provide a representative sample(s) of larger areas
- survey species with no known habitat preferences and/or
- monitor tree populations over time.

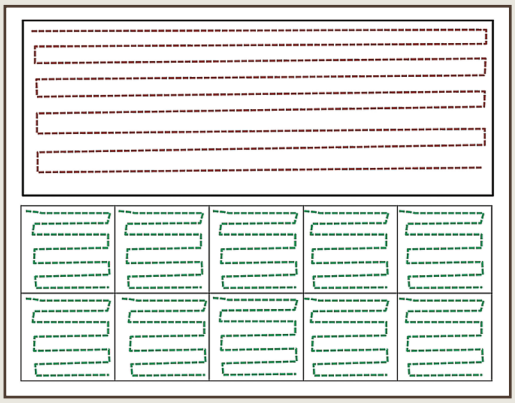
Plots are placed in different habitat types and are completely surveyed for the target species. Due to its complexity, it is recommended that the use of plots in this manner be guided by an ecologist experienced in plot studies.



Transects are used to cover large, heterogeneous areas in a rapid but more systematic manner than focused surveys. Transect surveys involve a team of 1-2 tree spotters and 1 data collector recording target trees. The team lays out a measuring tape and walks along the tape, recording where target trees are located along the tape to the nearest metre.

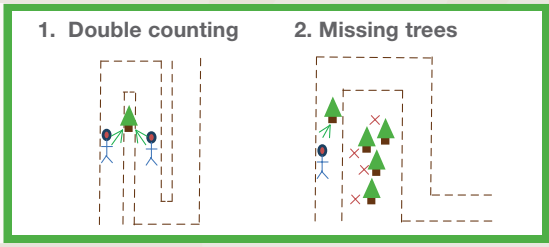
Transects may take several forms:

- evenly spaced within the entire survey area
- placed in at least one of each habitat type and/or topographic feature (e.g. on hills, slopes, valleys) in the survey area or
- in combination with focused surveys, concentrated in areas of suitable habitat for the target species. Combining transects with focused surveys is effective for finding target species that grow in very small patches (<5 individuals in a patch) or as widely-scattered individuals.



Transects should have a uniform width (and length if possible), to make data collection comparable among areas. For rapid surveys, transect widths should be no more than 4m in closed forests. In woodlands or open savannahs transects can be wider: as much as 50-100m. Transects can be curved, but the more so that they are, the less acceptable they become as a survey method.

TOP TIP



1. **Close together transects may cause you to 'double count' the same individual tree from adjacent lines. Avoid this by only collecting data on trees sighted *within the transect boundary.***
2. **On the other hand, transects that are too far apart may cause you to miss a large number of trees in the space in between them.**

Collecting and managing your data

The precise data you collect will depend on the survey method you employ. We suggest, as a minimum, that you record the data collector's name, the survey date and location (e.g. which site, plot or transect), the Map Datum you are using and the location and names of the trees you observe. You should also have a unique number associated with each individual tree and/or population and collect data on each tree's DBH and reproductive condition.

An example datasheet is provided that you may modify for your own purposes. Photo-documenting and taking notes on characteristics of individual trees are strongly encouraged; these can be written on the back of the sheet or in a separate notebook. This helps to document characteristics either not available in field guides or difficult to describe, and may serve as a reference for trees of questionable identity.

Data Collectors Name: **Jose Castello**				Date: **30/11/2013**	
Location of survey: **Threatened Tree National Park**				Map Datum: **WGS1984**	
Transect Number: **2**					
Transect Begins: **16.184120; -88.924030**					
Transect Ends: **16.184280; -88.923901**					
Tree Species	Latitude	Longitude	Point ID	DBH (cm)	Reproductive Condition
Dalbergia stevensonii	**16.184116**	**-88.924026**	**001**	**20**	**Not-reproductive**
D. stevensonii	**16.184110**	**-88.924026**	**002**	**15**	**Not-reproductive**
Quiina schippii	**16.184110**	**-88.924020**	**003**	**29**	**In flower**
D. stevensonii	**16.184101**	**-88.924021**	**004**	**40**	**Not-reproductive**
Q. schippii	**16.184111**	**-88.924019**	**005**	**23**	**Fruiting**

What Next?

Data collected in the field should be transferred from data sheets onto a computer for basic data analysis. By analysing your survey data you may be able to answer key questions such as:

- **Where does the target species occur?**
- **How large is/are the population(s) of the target species?**
- **What is the population structure of the species (e.g. the relative number of mature trees, saplings and seedlings)?**
- **Does the target species occur in specific habitat types or topographic/geological features in the landscape?**

Products from basic data analysis may include:

(1) A topographic map of tree locations, produced by plotting coordinates by hand or in GIS software (usually very basic software is included with your GPS).

(2) Basic statistics on abundance, location, and habitat for your target species. These may include:

- Total number of stems
- Maximum, minimum and average DBH
- % of trees in each category of reproduction
- Elevation range of the species

(3) Minimum convex polygons, or the total area, covered by the overall population or by each cluster (sub-population) of individual trees.

Using your data

Survey data can be used to support a number of longer-term conservation actions for your target species including:

- Identifying priority locations for long-term monitoring and patrolling (see GTC Brief 3 for advice on Monitoring)
- Identifying 'mother trees' for future seed collection (see GTC Brief 5 for advice on Seed Collection).
- Identifying suitable habitat types and locations for planting (see GTC Brief 9 for advice on reinforcing wild populations of threatened trees).
- Using the data to predict the locations of other populations in un-surveyed areas. This requires the expertise of someone familiar with regression models and GIS statistics.
- Sharing the data with other scientists and conservation organisations. Data can contribute to national, regional or global Red List assessments or can be used to inform conservation action plans for the species.

Analysing data on the location of tree species will help you identify and revisit priority sites for regular monitoring. Credit: Zhao Xingfeng/FFI

Selected references and further guidance

References and further guidance on some of the methods described in this brief are provided below.

Guidance on map reading:

National Wildfire Coordinating Group – Reading Topographic Maps and Making Calculations: **http://bit.ly/gtc_ref_1a**

National Geographic – Basic Map & GPS skills: **http://bit.ly/gtc_ref_1b**

Guidance on navigation & use of a handheld GPS

GARMIN GPS guide for beginners: **http://bit.ly/gtc_ref_1c**

Guidance on how to use a compass

Black Owl Outdoors – Video – How to Use a Compass and Map: **http://bit.ly/gtc_ref_1d**

National Wildfire Coordinating Group – Using a Compass and Clinometer: **http://bit.ly/gtc_ref_1e**

Guidance on sampling design

Condit, R. (1998). *Tropical Forest Census Plots.* Springer-Verlag, Berlin: **http://bit.ly/gtc_ref_1f**

Keith, D.A. (2000). Sampling designs, field techniques and analytical methods for systematic plant population survey. *Ecological Management & Restoration,* 1: 125–139.

Newton, A.C. (2007). *Forest Ecology and Conservation: A Handbook of Techniques.* Oxford University Press, UK.

Guidance on measuring trees

Washington State University Extension – Lesson 6: Measuring Trees: **http://bit.ly/gtc_ref_1g**

Husch, B., Beers, T.W. and Kershaw, J.A. (2003). *Forest mensuration.* Wiley, New York.

Guidance on analysing survey data

Kindt, R and Coe, R. (2005). Tree diversity analysis. A manual and software for common statistical methods for ecological and biodiversity studies. Nairobi: World Agroforestry Centre (ICRAF): **http://bit.ly/gtc_ref_1h**

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