Chapter 4

Forest inventory and estimation of carbon stock

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Preparing for the fieldwork

As described in the previous chapter, the first step of the vegetation classification exercise in the HCS process is to use satellite imagery to assign the vegetation to the different classes and identify potential HCS forest areas. The next step of the HCS assessment is to sample these classes in the field and assign them average carbon values by measuring vegetation within sample plots. This chapter explains how to select and set up the sample plots, conduct measurements, calculate above-ground carbon and finalise the vegetation classification. The intended audience is practitioners with a good knowledge of using statistical analysis to inform sampling techniques.

Community mapping and FPIC processes

Because field sampling activities will likely lead to direct interactions with community members, local communities should already be informed about the HCS Approach and process before the forest inventory begins. Ideally this should take part during the initial engagement with communities through the early stages of the process of Free Prior and Informed Consent (FPIC) described in Chapter 2 of this toolkit. Communities will also need to give consent to any sampling activities being carried out on their lands.

Participatory mapping and community engagement should have indicated areas that communities identify as important to maintain for their current and future livelihoods and socio-cultural needs. These can include both HCS forest areas, for instance those used for gathering non-timber forest products or hunting, as well as non-HCS areas such as small farms, gardens or agroforestry plots. Note that if these non-HCS areas are identified during the image-based classification or during the field sampling, but were not identified during the participatory mapping process, this could be an indicator that the participatory mapping/FPIC process was not sufficiently completed and that it needs to be revised before the HCS process can be finalised.

“Because field sampling activities will likely lead to direct interactions with community members, local communities should already be informed about the HCS Approach and process before the forest inventory begins”
Preparing for the fieldwork

Determining the number and type of sample plots

Field samples for HCS assessments focus on assessing the tree biomass within potential HCS forest classes. The largest proportion of field samples are distributed in those classes defined as young regenerating forest (YRF) and low density forest (LDF). Although scrub and open land are likely to contain very low levels of carbon, the HCS assessment process does seek to field sample a limited number of plots to confirm this assumption. Other classes such as existing plantation areas (e.g. oil palm, food crops), and enclave areas including community areas, peatlands, and HCV areas are generally not assessed as it is expected these areas are separately demarcated.

The appropriate number of samples to measure in each class is difficult to predict at the beginning of the field assessment unless locally available data on variability is available. In the absence of such data, enough field time should be budgeted to increase the sample size as necessary to achieve the precision targets, recognising that it is costly to return at a later date to the site to undertake further sampling.

The recommended precision targets for the HCS assessment are:

- Forest carbon stock inventories should be planned for the purposes of attaining carbon stock estimates at a 90% confidence interval of the total carbon stocks. An adaptive process may be needed to refine the sample size to achieve the 90% level of confidence.
- Variability within one vegetation class (for instance, within the High Density Forest category) may exceed the 90% precision target, provided that in the final analysis the classes are statistically different from one another.

The number of plots planned should be sufficient to meet the precision targets for each major class in each region. A simple equation for estimating the number of samples is:

\[
N = \frac{t^2 s^2}{E^2}
\]

where:

- \(N\) = samples to estimate mean to ± E
- \(t\) = t-value from student’s t-test table for 90% confidence interval
- \(s\) = standard deviation estimated based on existing data sets from similar forest types. Government forestry departments often have relevant data.
- \(E\) = probable error, expressed as a percentage of the estimated mean value

The resulting number should be rounded to the nearest whole number.

For example, to survey a HCS vegetation class with an estimated carbon stock level of 57 tonnes/hectare and an estimated standard deviation of 35 tonnes/ha with an allowable sample error of ±10% of the average carbon stock and with 90% confidence limits, the number of sample plots is calculated as follows:

\[
N = \frac{1.662^2 \times 35^2}{57^2} = 1.662 \times 35^2 / (57^2 \times 10^2) = 62.6
\]

Rounded to N=63
Equipment needed for the field work

Plot tree measurement data will be recorded manually in field books. An example of a field book layout is shown in the Appendix, along with an equipment list for an inventory team.

Selecting the survey team

A single survey team is generally made up of between 6 – 8 people as follows:

<table>
<thead>
<tr>
<th>Position</th>
<th>No of persons</th>
<th>Description and role</th>
</tr>
</thead>
</table>
| Team Leader      | 1             | Graduate forester with inventory experience  
|                  |               | Responsible for team organisation and performance, in particular the following:  
|                  |               | • Navigating to transect starting point  
|                  |               | • Keeping field book  
|                  |               | • Operating GPS  
|                  |               | • Tree height measurement  
|                  |               | • Capturing plot photos  
|                  |               | • Data management and handover  
| Measuring        | 2             | Experienced technicians  
| Assistants       |               | Core role is to measure diameters, label trees, and identify species. It is essential that at least one of the two assistants is familiar with local tree species names  
| Plot cleaner     | 1             | Labourer responsible for cleaning vines and climbers off trees to be measured to enable easier diameter and height measurement  
| Hip chain operator | 1         | Role: Measuring transect length and location of plot center points along the transect  
| Compassman       | 1             | Role: Ensuring transect lines are cut on the correct pre-determined compass bearing  
| Line cutter      | 2             | Role: Clearing the transect line to enable rapid mobilisation to plot points  

The number of team members required will vary depending on their skill level and the conditions in the forest. The team leader will decide the composition of the team.

For efficient measurement the team needs to be able to mobilise to the measuring site quickly and spend a whole day working uninterrupted. Therefore logistical support in terms of local guides and suitable transport for the whole team is imperative.

Where access is difficult, it may be more efficient for teams to set up a camp, in which case camping equipment will need to be supplied and a cook should be added to the team.

For most surveys, multiple teams should be employed. A logistics manager should be appointed to ensure teams receive the necessary logistical support. A data manager should be appointed to carry out data entry and general data management. Joint training exercises should be held at the start of the inventory period to ensure all team leaders understand and implement procedures the same way.

“For efficient measurement the team needs to be able to mobilise to the measuring site quickly and spend a whole day working uninterrupted”
CHAPTER FOUR
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Setting up the plots

**Sampling design**
Plots can be located randomly or systematically within a class. Random sampling is a statistically more thorough and robust approach, but is generally slower than systematic sampling and can be more expensive. Systematic plot location is usually cheaper and easier to implement in the field, allowing a greater number of plots to be measured within a given time frame. Plots can be located along a grid formation, or completed along transect lines spaced evenly across the class without any bias. A combination of systematic and random sampling can also be used for increased accuracy.

The methods for setting up plots systematically and randomly are described below; both sampling designs are accepted in the HCS Approach.

Regardless of the sample design used, prior to the field work, a navigation plan should be established recording the sequence in which plots will be measured. The plan should describe:
- The initial access point providing easiest access to the first plot. The initial access points are normally located at convenient points along roads or other access ways.
- Co-ordinates of each plot (uploaded into GPS) in order of measurement.
- The compass bearing from one plot to the next plot
- The distance between plots

**Navigating and setting up systematically located plots using transects**
Field team leaders should be provided with instructions for each transect including:
- Map
- Starting point co-ordinates (uploaded into GPS devices). The start points of transects are normally located at convenient points along roads, rivers, canals or other access routes.
- Transect compass bearing
- Transect length in kilometres
- Number of plots to be measured

Transects should be set up according to the following steps:

1. Team navigates to the start point of the nominated transect line using a GPS device, and saves a waypoint at the exact location of the start point. Through recent experience Garmin GPS receivers are preferred, as they are single frequency and usually have no problems operating under heavy forest canopy. They are accurate up to five metres, which is suitable for this type of survey.

2. Place a pole at the start point. Label the pole with flagging tape. Record on the flagging tape the transect number and the compass bearing of the transect.

3. Traverse the land along the planned compass bearing. The transect should be located strictly along the planned compass bearing route. If the field team meets a significant obstacle such as a cliff or waterway, the survey team should detour around the obstacle if possible, and restart the survey at the nearest possible point along the transect route. Otherwise the survey team should simply terminate the survey work on the transect.

4. Plot centre-points should be located systematically every 100 metres along the transect. For plots located on a boundary between HCS classes, the pragmatic approach is to classify the plot by its predominant type of vegetation cover, taking into account the remote sensing classification as well. In cases of extreme boundary issues, for instance where dense forest borders bare land, the plot should be noted as ‘not measured’.

Note that plot locations do not require adjustment for slope along the transect line, provided the plot locations are accurately measured by GPS. Hip chains should only be used to measure distances between plots in flat terrain.

Plots should not be moved for any reason. If a plot cannot be measured due to safety reasons, such as extreme slope, or hanging tree limbs, or if it is within a watercourse (river or stream), it should be noted as “not measured”, and the sampling should resume at the next plot centre point. The observation should also be marked on the plot map and brought to the company’s attention.
Navigating and setting up plots without transects

Random plot locations are generated using GIS software, whereas systematic plots are typically located using a grid formation. Plots should be set up according to the following steps:

1. Navigate to the initial access point using GPS.
2. Traverse the land to the plot center point using GPS to navigate.
3. Identify the actual plot location using GPS.

As stated above, plots should not be moved for any reason. If a plot cannot be measured due to safety reasons it should be noted as “not measured”, and the sampling should resume at the subsequent plot centre point.

Sample plot size and shape

The same kind of plot is used for random, systematic and transect sampling. The recommended sample plot design is two concentric circles from a centre point with a total area of 500m² or 0.05ha. Circular plots are preferred to rectangular plots to minimise the potential error due to slope factors and physical obstacles which might skew plot boundary lines.

Plot demarcation

1. Place a pole at the centre of the plot. Label the pole with flagging tape. Record the plot ID on the flagging tape. Standing trees should not be used as plot markers.
2. Capture the GPS waypoint at the centre point of the plot and write the waypoint number in the field book. Waypoint numbers should be the running number produced by the GPS. Do not edit this number.
3. From the centre point, the first sub plot is measured by using a measurement tape or pre-measured rope that can be firmly pulled to a horizontal distance of 5.64m. A second sub plot is then established by measuring a horizontal distance of 12.61m with a firmly-pulled measurement tape or premeasured rope. Where a pre-measured rope is used, it is important that an inelastic rope is used to limit errors resulting from stretching the rope.
4. The following identification information should be recorded in the field book for all plots:
   • Concession name
   • Date
   • Field team leader name
   • Transect and plot number
   • GPS waypoint number for plot centre point
   • HCS class in plot based on generic definitions provided
   • Soil/underfoot conditions, e.g. organic/peat soil, mineral soil, marine clay soil, standing water
   • General description of the plot and surrounding area, including evidence of fire, logging, and other human activity e.g. rubber or other agriculture crops.

All photos: Courtesy TFT ©
Vegetation measurement

The focus of vegetation measurement is on large plant species which usually comprise the large majority of above ground biomass. The other forest carbon pools are not measured because they are either relatively small in size (e.g. forest understory) or are difficult and expensive to assess (e.g. below ground biomass, deadwood, soil organic matter).

Large plant species are defined as those having a diameter at breast height (DBH) greater than or equal to 5cm. This includes both tree and non-tree species. Breast height for the DBH measurement is defined as 1.3 metres.

Large plant species (referred to as ‘trees’ for simplicity, but they may include non-tree species such as some palm species) are measured through the following steps:

1. **Identification of “In” trees**: An “in” tree is defined as a tree where the centre of the tree stem at DBH is within the boundaries of the plot. Trees on the edge of the plot will be checked using a nylon rope marked at the correct plot radii.

2. **Flagging tape**: Each tree shall be labelled with flagging tape. The label should indicate the tree number as recorded in the field book.

3. **DBH measurement**: All trees greater or equal to 15cm DBH shall be measured in the large plot. In addition to the large trees, all trees greater than or equal to 5cm and less than 15cm DBH shall be measured in the small plot.

4. **Height measurement**: Depending on the eventual allometric equation used, it may also be necessary to measure tree heights. Tree heights should be measured using clinometers in the following way:
   - Two operators measure 10 metres from the base of the tree using a clinometer.
   - At 10 metres, one measurement in percent is taken to the base of the tree. The operator at the tree can help by pushing trees and shrubs out of the sight line of the clinometer and by using a high-visibility vest to indicate the bottom of the tree.
   - Another measurement in percent is taken at the top of the merchantable height of the tree. Merchantable height is the point at which the main bole of the tree transitions into the crown, or where the first major branch occurs.
   - The sum of the two measurements (to the bottom and to the top of the merchantable bole) is divided by 10 to give the bole length in metres (e.g. 15% down plus 110% up equals 125%, for a bole height of 12.5m).

Knowing the total bole height, it is then possible to estimate the length and corresponding quality of the different sections along the bole.

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“The focus of vegetation measurement is on large plant species which usually comprise the large majority of above ground biomass”

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**TABLE: DIAMETER MEASUREMENT METHOD**

<table>
<thead>
<tr>
<th>Tree Form</th>
<th>Measurement Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well formed tree</td>
<td>Stem diameter is measured at 1.3m above ground from the uphill side of the tree</td>
</tr>
<tr>
<td>Tree forks below 1.3m</td>
<td>The diameter of each stem is measured separately at 1.3m above ground from the</td>
</tr>
<tr>
<td></td>
<td>uphill side of the tree</td>
</tr>
<tr>
<td>Tree has large deformity at 1.3m</td>
<td>The stem diameter is measured at 0.5m above the point where the deformity terminates</td>
</tr>
<tr>
<td>Buttressing occurs above 1.3m</td>
<td>The stem diameter is measured at 0.5m above the point where the buttressing terminates</td>
</tr>
</tbody>
</table>
5. **Species**: All trees measured in the plot should be identified by their genus and preferably to their species name. This is because this information may be needed in the allometric equation, and to be able to describe forest composition and structure in a general way. As stated above, botanists or foresters with local expertise should ideally be part of the field team; local names can be noted in the field book and translated to species names later on. If certain species cannot be identified even by their local name, then photographs and botanical samples should be collected and marked so that identification can be done by experts at a later date.

The figure on the right illustrates the plot design.

“All trees measured in the plot should be identified by their genus and preferably to their species name”

---

**Figure 2: HCS Inventory Plot Layout**

<table>
<thead>
<tr>
<th>PLOT</th>
<th>PLOT RADIUS (m)</th>
<th>PLOT SAMPLE AREA (m²)</th>
<th>TREE DBH MEASURED (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUB PLOT</td>
<td>5.64</td>
<td>100</td>
<td>5 – 14.9</td>
</tr>
<tr>
<td>LARGE PLOT</td>
<td>12.61</td>
<td>500</td>
<td>15 up</td>
</tr>
</tbody>
</table>

**Trees DBH 5–14.9 cm**
- Measured
- Not Measured

**Trees DBH 15 cm up**
- Measured
- Not Measured
- Plot Centre

**Figure 3: Diameter Measurement Method**

**Note**: Minor corrections were made to this diagram on 13.04.2015 in order to match the text
Plot photographs

For all plots in the forest, five digital photographs should be taken at the centre of the plot. Four photos will be orientated in the north, south, east and west directions, with one photo pointing directly up to show the canopy density. The photographs should illustrate the basic structure and density of the vegetation at each plot. The GPS tracking function should be kept on at all times during field measurement to enable the photos to be geo-referenced.

The images below show how land cover ground photos compare to the pixels from the satellite images. Sky and canopy photos illustrate the density of ground cover.

Satellite images are from Landsat 8, with an RGB combination of 6,4,2.

“The GPS tracking function should be kept on at all times during field measurement to enable the photos to be geo-referenced”
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Scrub

Young Regenerating Forest
Plot photographs

**FIGURE 4**: SAMPLE SATELLITE IMAGES AND CORRESPONDING FIELD PHOTOGRAPHS (CANOPY, NORTH-FACING, SOUTH-FACING, EAST-FACING, WEST-FACING)

Low Density Forest (LDF)
Data entry and management

Team leaders should download GPS track and waypoint data to personal computers in Ozi/Garmin format every evening where practical to do so. In addition to data and photographs, team leaders should write a short two to three paragraph description of forest conditions and other relevant comments for each transect.

Completed field books, GPS data, and photos should be delivered to the Inventory Data Manager who will enter the plot data into a spreadsheet and compile all information into a logical format for handover to the GIS team. Team leaders should check data entered if there is any inconsistency.

“As well as data and photographs, team leaders should write a short two to three paragraph description of forest conditions and other relevant comments”
Deriving average carbon stock per vegetation class

Once the data is entered, each plot is then analysed to provide estimates of stems per hectare and carbon stocks as follows.

**Stems per hectare**

The average number of stems per hectare is calculated from the plot size. The equation used is:

\[
\text{Stems per ha} = \frac{\text{Count of trees in the plot}}{\text{Plot size in ha}}
\]

**Carbon content**

The HCS assessment process uses allometric equations to estimate biomass. Allometric equations help estimate characteristics of a tree that are difficult to measure by instead measuring correlated attributes of the same tree. For instance, diameter at breast height can be measured and then used to determine the biomass of the entire plant above ground.

Many allometric equations exist around the world; some are specific to one forest type or tree species, while others are more generic to cover a broader range of situations. Allometric equations are typically developed from large samples to improve accuracy, although it is important to recognise that the equations have usually been generated for non-degraded forests and that they might not be appropriate for degraded forests where the growing environment has been substantially altered. A useful list of allometric equations can be found at: http://www.globallometree.org/. The Scientific Advisory Committee of the HCS Approach Steering Group will advise on a list of approved allometric equations for different regions of interest, and welcomes advice and input on this topic.

It should be noted that:

- The specific gravity measures the dry density of the wood. If the species is known, the specific gravity as noted in the World Agroforestry Centre’s (WAC) Wood Density Database (http://db.worldagroforestry.org/wd) should be used, averaged to the genus level if only the genus is known. Otherwise, a default value of 0.55 ton / green m\(^3\) for tropical tree species and 0.247 ton / green m\(^3\) for palm species should be used, based on average values provided by Inter-governmental Panel on Climate Change (2006), Guidelines for National Greenhouse Gas Inventories, Volume 4. Agriculture, Forestry and Other Land Use and the WAC wood density database.

- The carbon conversion factor estimates the carbon component of the vegetation biomass. This can be derived for specific forest types, or the IPCC standard value of 0.47 can be used.

- The equation for estimating tree carbon mass per ha is:

\[
\text{Total Carbon (ton/ha)} = \sum \left(\frac{\text{Tree Carbon}}{\text{Plot size in ha}}\right)
\]

- Separate calculations of volume will need to be made when estimating tree volume in sub-plots because the plot size will differ between the main and subplot.

Following completion of processing of raw data and estimation of carbon stocks per vegetation class, an ANOVA test should be applied to determine whether there are significant differences in the carbon estimates per class. This should be followed by a Scheffé pairwise multiple comparisons test to determine which groups are significantly different.

The results can be placed into the table format below.

<table>
<thead>
<tr>
<th>Land cover</th>
<th>Number of plots</th>
<th>Stems per Hectare</th>
<th>Basal Area</th>
<th>Average Carbon Stocks</th>
<th>Standard error of the mean</th>
<th>Confidence limits (90%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Land</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scrub</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Young Regenerating Forest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Density Forest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium Density Forest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Density Forest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Finalising the classification

Once field work is complete, field data is used to compare and revise the vegetation classification using manual “heads up” visual interpretation. In particular, the following data is used:

Aerial Survey Results:
- If an aerial survey was conducted, a database of geo-referenced aerial photos can be compiled into a *.gdb file for each region. The database is loaded into GIS, enabling photos to be viewed and compared with the results of the classification.
- Written observations collected during the aerial survey.

Forest Inventory Results:
- The forest inventory described in this chapter produces a database of inventory plot points, each with a value of carbon stock per hectare. The plot points are stratified into carbon classes as required and overlaid onto the imagery.
- The forest inventory produces a database of geo-referenced plot photos (five photos per plot) compiled into a *.gdb file for each region. The database is loaded into GIS, enabling photos to be viewed and compared with the results of the classification.
- Species mix e.g. prevalence of pioneer species such as Macaranga spp., existence of planted trees (rubber, fruit trees).
- Diameter distribution, in particular the prevalence of larger diameter trees (DBH 30cm and up).
- If height data is collected, structural indices indicating the percentage of species by height classes can be calculated.
- Description of the type and stage of development such as pioneer forest, regenerating heavily degraded forest, degraded forest, primary forest. Forest development, successional, and or maturity indices may also be calculated, which will help define conservation and management plans.
- Descriptions of plots and transects recorded by inventory teams in the field.

It must be noted that revision of vegetation class boundaries is not aimed at matching individual plot carbon figures. Revisions are only made where both of the following conditions apply:
- Inventory plots show a clear bias in classification, i.e. contiguous groups of plots with carbon values well outside the vegetation class range.
- Re-analysis of imagery justifies revision of vegetation class boundaries.

Any such revisions should be well documented and justified so that external reviewers assessing the quality of the HCS process can understand why any changes were made.

The final classification will result in a map of indicative HCS forest areas, including an average carbon value for each vegetation class, as well as a physical description of the vegetation in each class. The second half of this toolkit explains Phase Two, which involves making decisions about the importance of small isolated patches and integrating the potential HCS forest areas with High Conservation Value areas, areas important for community needs, riparian zones, peatlands, and other relevant categories of land in order to create the final development and conservation plan.

“Phase Two... involves integrating the potential HCS forest areas with High Conservation Value areas, areas important for community needs, riparian zones, peatlands, and other relevant categories of land in order to create the final development and conservation plan”
Appendix: Inventory Field Form and Inventory Equipment List

Field Book Layout:

<table>
<thead>
<tr>
<th>Estate / concession name:</th>
<th>Field Team Leader:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line / Plot:</td>
<td>Waypoint No:</td>
<td></td>
</tr>
<tr>
<td>Land Cover:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tree</th>
<th>DBH</th>
<th>Species or local name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Etc</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

General description of the plot and surrounding area: e.g. Evidence of fire, Mature rubber trees outside plot

Inventory Team Recommended Equipment List:

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>No.</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS</td>
<td>Garmin GPS MAP 60, 62 or 64</td>
<td>1</td>
<td>64s is recommended</td>
</tr>
<tr>
<td>Batteries</td>
<td>AA</td>
<td>1 box</td>
<td>Spare batteries for GPS and camera</td>
</tr>
<tr>
<td>Camera</td>
<td>Digital camera</td>
<td>1</td>
<td>–</td>
</tr>
<tr>
<td>Tapes</td>
<td>Diameter tapes – 5m</td>
<td>1</td>
<td>Coated fiberglass</td>
</tr>
<tr>
<td></td>
<td>Diameter tapes – 1.8m</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50m tape - TajimaYSR-50</td>
<td>1</td>
<td>Coated fiberglass</td>
</tr>
<tr>
<td></td>
<td>20m tape - TajimaYSR-20</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Flagging tape</td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Hip chain</td>
<td>Chainman II with belt</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Thread</td>
<td>Hip Chain Thread</td>
<td>3 km</td>
<td></td>
</tr>
<tr>
<td>Compass</td>
<td>SILVA® Starter Type 1-2-3</td>
<td>1</td>
<td>Suunto is an alternative</td>
</tr>
<tr>
<td>First aid kits</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Backpack</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Pencils and pens</td>
<td></td>
<td>1 box</td>
<td>For writing on the tree label</td>
</tr>
<tr>
<td>Waterproof permanent boardmarker</td>
<td></td>
<td>1 box</td>
<td></td>
</tr>
<tr>
<td>1 KENKO box cutter</td>
<td></td>
<td>2</td>
<td>For cutting tree labels</td>
</tr>
<tr>
<td>1 ruler 30cm</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Stapler and staples</td>
<td></td>
<td>2</td>
<td>For attaching label to tree</td>
</tr>
<tr>
<td>Field books</td>
<td></td>
<td>4</td>
<td>All weather waterproof notepads</td>
</tr>
<tr>
<td>Ziplock type plastic bags</td>
<td></td>
<td></td>
<td>For keeping mobiles, maps etc. dry</td>
</tr>
</tbody>
</table>