

**Sustainable Management of Biodiversity,
South Caucasus**

Assessing Forests for Ground-truthing

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Handbook – October 2012

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1 Background

Changes of the forest coverage and structure can be monitored through remote sensing based on high-resolution, multi-spectral satellite imagery. However, in order to achieve reliable accuracy, ground-truthing is indispensable. The number of reference points to be assessed depends on the desired accuracy and resolution.

This working paper is based on the example of a pilot study conducted in the regions of Zaqatala and Balakan, Azerbaijan. High-resolution satellite images from 1998, 2006 and 2011 were used to detect changes in forest vegetation cover for improving the forest management (largely for conservation purposes) in the region.

2 Method

According to the technical specifications of the forest monitoring system, initially 400 ground-truthing points were pre-selected along a grid. For each point, the ground teams had to fill in a specific form sheet (see Annex 1) covering various aspects of stand structures and other parameters to identify the respective forest type and condition.

5 Teams were trained to implement the ground-truthing assessment and were equipped with a GPS and a GPS camera. The ground truthing points were pre-selected by the consultant to be assessed by the teams between July and September 2012. The GPS coordinates of the sample point location and overview maps (Google maps showing the sample points) were provided to the teams prior to the field work. Each team consisted of two persons, at least one forester and a person with good knowledge of the local area. In addition, a supervisor from GIZ-SMBP coordinated the field work and collected the completed forms, translated them into English and sent the forms, data and pictures to the consultant.

In the form (see Annex 1) all information, estimates and measurements should be recorded within a preselected sample point. There are 200 samples points all over the Balakan region and as well 200 sample points in the Zaqatala region to cover all the different forest situations. The sample points have to be located by the teams in the field having knowledge of the place and by using the GPS device. The use of GPS is explained in a special training. The form had to be filled for all sample points during the field work and in addition 2 pictures must be taken per site.

The assessment sheet is divided into five main sections:

1. Information of location (GPS Way Point and GPS coordinates)
2. Specific information of sample point, physical stand parameters
3. Estimation of trees in sample point; numeric stand description
4. Stand description; verbal stand description and definition of forest type
5. Observations; special signs of interest not mentioned under 2, illegal activities, etc.

The completed assessment sheets were collected weekly by the GIZ coordinator, checked on completeness, translated into the English version and sent to the consultant. The coordinator also downloaded on a weekly basis all GPS data of the teams, including all pictures of the forest stands. Data analysis and findings (done by the consultant) will adjust the remote sensing application in detecting the forest types and finally the delineation of vegetation maps on the satellite images.¹

It is of utmost importance that all information filled in the form sheets must be reliable and taken in the field! The form is largely self-explanatory, though all teams received a careful instruction of how to fill them.

¹ Eventually, 222 sample points were found to be sufficient for achieving the desired accuracy and resolution of the forest analysis. Due to proximity to the state border with Dagestan and Georgia, as well as due to hazardous terrain, some areas were not accessible to the field teams.

3 How to fill in the form sheet

3.1 GPS Way Point No.

Fill in the waypoint number where you intent to implement the measurement. The point is given already to you on a list and you can see the point location already on the map.

3.2 GPS coordinate of selected point

Fill in the form the actual coordinates of the point where you do your measurement. When your GPS is making a sound you are very close to the GPS waypoint you wanted to go to. Do not move further, only look for a place where you can easily implement your measurement and observations. Press "Mark", then press "Enter". The coordinates are shown on the screen of the GPS. Enter the coordinates in the form accordingly (North and East readings).

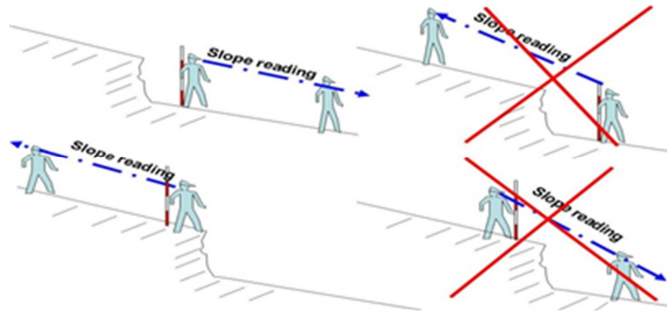
3.3 Aspect

The slope aspect is identified as the general direction for the area covered by the sample area. It is recorded in general directions according to the table below. If the aspect cannot be identified it should be marked with NN.

| N | NE | E | SE | S | SW | W | NW |
|------------------|-----------------|-------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 337.5° -22.5° | 22.5°- 67.5° | 67.5° - 112.5° | 112.5° - 157.5° | 157.5° - 202.5° | 202.5° - 247.5° | 247.5° - 292.5° | 292.5° - 337.5° |

3.4 Slope

The slope is measured with the clinometer, and recorded in $^{\circ}$ (degree).



3.5 Age (from to / average age)

In natural forest in the Caucasus the estimation of the average age has to be based on the experience of the forest engineer only. It is assumed that the determination of the average age is a rough estimate and not an accurate measurement.

Indicate the age spectrum (age of younger trees to age of oldest trees.)

3.6 Altitude

Record the measurement from your GPS device in meters.

3.7 Pasture intensity

Estimate! For example, "middle" means that here you found cow dung and tracks of animals.

3.8 Crown cover

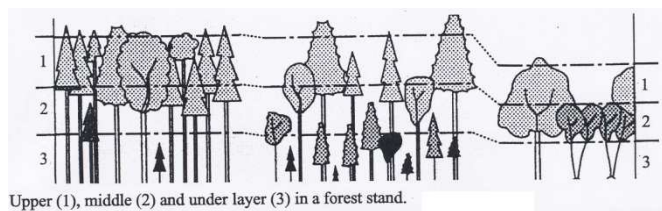
Estimate! Imagine the sun would shine directly over the stand, and then estimate how much sun can reach the ground.

3.9 Natural regeneration

Here only consider tree species (no bushes or other vegetation) from 50 cm height with a DBH (diameter in breast height) of up to 5 cm. Trees having a DBH of more than 5 cm are already considered as young trees but should not be seen any longer as natural regeneration.

3.10 Issue of different tree layers

In natural forest you mainly have several layers in contrast to plantations where you only find a single storey. See also the following picture which explains the different layers.



You easily will recognize the different layers.

| | |
|---------------|---|
| Single storey | Regular forest of more or less even age, with one major storey/layer and only few understorey trees, little to no bush vegetation below the tree storey |
|---------------|---|

| | |
|------------|---|
| Two storey | Two regular tree storeys with crown height for different layers distinct, due to silvicultural measures or different growth habits of trees |
|------------|---|

| | |
|--------------|---|
| Multi storey | More than two storeys of tree crowns due to uneven age of the forest stand. |
|--------------|---|

3.11 Health Situation

| | |
|-----------|---|
| very good | Present trees grow under prevailing site conditions extremely favourable, straight stem, long trunk with no or less branches, extremely valuable timber |
|-----------|---|

| | |
|------|---|
| good | Present trees grow under prevailing site conditions well and healthy, no major diseases to be expected, trees would form the natural vegetation on the site without human influence |
|------|---|

| | |
|--------|---|
| middle | Present trees grow under prevailing site conditions good, some minor diseases might occur, serious calamities not expected, trees will need silvicultural attention to produce expected volume and quality, trees would not necessarily form the natural vegetation on the site without human influence |
|--------|---|

| | |
|-----|--|
| bad | Present trees grow under prevailing site conditions, diseases and damages visible, in some cases serious calamities have occurred. |
|-----|--|

3.12 Estimation of trees in sample point

Record all trees in the 10 m radius which are bigger than 20 cm DBH, indicate the tree number, species name and the DBH (rough estimate only). You will use a simple rope. Remember, this is a fast sampling method, not an inventory! It is only meant to indicate the bigger trees which mainly will reflect different colour spectrums in the satellite image. Also roughly estimate the average height of the different tree species. In the 5 m radius only specify and count the different tree species as well as in the 1 m radius.

3.13 Stand description

Here you try to assess the type of the forest around the sample point. For this you need to identify a maximum of 3 species.

Species 1 is the dominant tree species of the forest type which should have at least 40% of all species. **Species 2** and **3** should not have more than 30% each. In many cases you will have as well species which are not mentioned under 1, 2 or 3: then group these species in the field "other broadleaf or coniferous trees" (the percentage should not be more than 10% each; mention their species names in the form sheet).

3.14 Forest Type

Try to describe a forest type most appropriate for the sample area and the very close surroundings (max. 1 ha) of the sample point. This estimate may differ from your estimate within the sample plot!

Possible forest types you may identify are:

Pterocarya Type (with other mixture; for example: *Pterocarya-Juglans-Carpinus*)

Quercus Type

Fagus orientalis Type

Carpinus Type

Acer Type

Juglans Type

Castanea sativa Type

Alnus Type

Juniperus Type

Betula Type

Populus Type

Robinia Type

Albizia Type

Ulmus Type

Platanus Type

Other forest types may occur during the field work!

3.15 Remarks and observations

Please note here special observations, for example, the sighting of illegal activities in term of timber utilisation or cutting of branches for sheep or cattle, etc.

Do not forget to take two pictures from the sample plot before leaving to the next sample point. Note that the camera has to be switched on at least 15 minutes before taking a picture!!

ANNEX – Form sheet

| | | | | |
|---|---|---|--|---|
| Project Region: | | Date: | Team Nr. | |
| GPS Way Point No. | GPS Coordinate of selected point North East | | other suitable GPS Coordinate North East | |
| Aspect in ° | Slope in ° | Age (from to/ average age) | | Altitude |
| Pasture intensity | None <input type="checkbox"/> | Middle <input type="checkbox"/> | Heavy <input type="checkbox"/> | Overgrazed <input type="checkbox"/> |
| Crown cover | 0% - 10% <input type="checkbox"/> | 10% - 30% <input type="checkbox"/> | 30% - 50% <input type="checkbox"/> | > 50% <input type="checkbox"/> |
| Natural regeneration cover | none to 5% <input type="checkbox"/> | 6% - 25% <input type="checkbox"/> | 26 - 50 % <input type="checkbox"/> | > 50% <input type="checkbox"/> |
| Natural forest <input type="checkbox"/> | Plantation <input type="checkbox"/> | | Floodplain /Riverine forest <input type="checkbox"/> | |
| single story stand <input type="checkbox"/> | two stories <input type="checkbox"/> | | multi story <input type="checkbox"/> | |
| Health situation | Bad <input type="checkbox"/> | Middle <input type="checkbox"/> | Good <input type="checkbox"/> | Very good <input type="checkbox"/> |
| Signs of damages | Windfall <input type="checkbox"/> | Insects <input type="checkbox"/> | Fungus <input type="checkbox"/> | other <input type="checkbox"/> |
| Do you see in vicinity around sample point small forest openings not covered by trees | | 0 - 100 m ² <input type="checkbox"/> | 100 - 500 m ² <input type="checkbox"/> | more than 500 m ² <input type="checkbox"/> |
| Estimation of trees in sample point | | | Stand Description (area of about 1 ha) | |
| Radius 10 m: DBH bigger than 20 cm | | | Species: | |
| No. | Name of Species | DBH | Average height (m) | |
| 1 | | | | 1: % |
| 2 | | | | 2: % |
| 3 | | | | 3: % |
| 4 | | | | 4: other broadleaf: % |
| 5 | | | | Which species do you recognize? |
| 6 | | | | |
| 7 | | | | 5: other conifers: % |
| 8 | | | | Which species do you recognize? |
| 9 | | | | |
| 10 | | | | Type of Forest: |
| Radius 5 m: DBH 5 cm to 20 cm | | Remarks /Observations (signs of cutting in last years, others) | | |
| Species | Count | | | |
| | | | | |
| | | | | |
| | | | | |
| Radius 1 m: 50 cm height up to 4.9 cm DBH | | | | |
| Species | Count | | | |
| | | | | |
| | | | | |
| | | | | |
| Signature/Team leader | | | | |

Please do not forget to take two pictures of this sample point before signing