Annex 9.1. Technical guidelines field observation on the results of the medium resolution images resulting in the land cover data

MINISTRY OF ENVIRONMENT AND FORESTRY
DIRECTORATE GENERAL OF FORESTRY PLANOLOGY AND ENVIRONMENTAL GOVERNANCE

DIRECTORATE OF INVENTORY AND OBSERVATION OF FORESTRY RESOURCES

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TECHNICAL GUIDELINES

FIELD OBSERVATION ON THE RESULTS OF THE MEDIUM RESOLUTION IMAGES RESULTING IN THE LAND COVER DATA

PREFACE

The Technical Guidelines of the Field Observation on the Results of the Medium Resolution Images Resulting in the Land Cover Data is formulated as a reference and guidelines for officials to implement their field report based on the interpretation results in 2015.

The materials presented in this technical guideline are the elaboration on how to execute such activities, including: backgrounds and purposes, general guidelines, preparation and implementation of field observation, post field observation and reports.

Henceforth to be implemented with full responsibilities.

Jakarta, 3 September 2015

Director of Inventory and Observation of Forestry Resources

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CHAPTER I INTRODUCTION

1. Background

The Law No. 41 Year 1999 on the Forestry (UU 41) mandated that one of the aspects of forestry management is implemented with the activity of forestry planning. The activity of forestry planning is implemented through various activities, one of which is the forest inventory. The forest inventory itself is intended to know and acquire data and information on the resources, potentials of forestry natural resources, as well as its complete environment.

The formulation of UU 41 is then elaborated in details within the Forestry Ministry Regulations No. P.67/Menhut-II/2006. One of the types of data and information to be acquired from the field observation activities is the condition of land cover. The implementation of forest inventory itself can be applied through remote sensing and terrestrial survey. The remote sensing digital image data processing and analysis should be accompanied with the field observation to ensure the level of accuracy on the results of digital analysis data in a certain area. The inventory product will then be presented in the descriptive, numeric and map forms.

The activity of field observation is required to guarantee the quality of the analysis on land cover based on the remote sensing image data. The results of the field observation then can be utilized to calculate the level of accuracy of the inventory results and to improve the results of digital image. The level of accuracy on the digital image results can be calculated by comparing the results of remote sensing digital image with the real condition on the field.

Aside from the quality of the remote sensing digital image analysis results that should be maintained, the implementation of field observation is also required with the method that can be taken into accountability, as every executor of this activity will possess the same guidelines and standards of activities. Therefore, a Technical Guideline on Field Observation as a foundation to implement the activity of field observation on the land cover data based on the land cover imaging should be formulated.

Intention & Purpose

The field observation activity for the results of the land cover remote sensing is intended to acquire the actual condition of land/forest cover on the field, to improve the calibrated data of land cover and to measure the accuracy of the produced land cover data.

The field observation activity is intended:

a. To acquire the reality of the results of the implemented land cover remote sensing.

b. To collect additional data and information on the field that is impossible to be acquired from the remote sensing digital image, including the latest changes on the land cover that has yet to be detected by the utilized remote sensing image.

Coverage

The coverage of the Field Observation Activity for the Land Cover Remote Sensing Results include the activity phases as follows:

a. General requirements of field observation
    1) Definition
    2) Time of application
    3) Location
    4) Field observer
b. Preparation for the field observation
    1) Equipment preparation
    2) Coordination with related institutions
    3) Sample design
c. Implementation of field observation
    1) Search for sample location
    2) Observation of sample location
    3) Measurement of sample location
    4) Data recording
d. Post-field observation
    1) Recapitulation of field observation results
    2) Calculation of level of accuracy
    3) Improvement of remote sensing results
    4) Formulation of report
    5) Digital recording on the field observation results

Results

The results of this activity are:

a. Implementation report on the field observation activity
b. Digital document on the results of data collection on the field

CHAPTER II GENERAL REQUIREMENTS OF FIELD OBSERVATION

1. Time of Implementation

The field observation activity is implemented within fifteen (15) days, including the time to travel from and to the original location, coordination with related institutions, as well as the observation and measurement on the field.

2. Location of Field Observation

The field observation activity is implemented on the designated locations set by the executor, with the criteria of the representation of the land cover classes in the location of the observation, as well as its accessibility, after gaining approvals from:

a. Director of Inventory and Observation of Forestry Resources, for the field observation implemented by the Directorate of Inventory and Observation of Forestry Resources or its representatives.
b. Head of Forestry Area Stabilization Office, for the field observation conducted by BPKH.

3. Executor

The compositions of executors are:

a. Two (2) executors from the head office and one (1) from BPKH, or the other agencies for the Ministry of Environment and Forestry, or the services handling the issues of Environment and Forestry at the Provincial/Regency levels, for the activities conducted by the Directorate of Inventory and Observation of Forestry Resources
b. Two (2) executors from BKPH and one (1) from the other agencies for the Ministry of Environment and Forestry, or the regional officials (SKPD) handling the issues of Environment and Forestry at the District level, for the activities conducted by the Office of Forestry Area Stabilization (BKPH).

CHAPTER III PREPARATION FOR FIELD OBSERVATION

1. Equipment and Materials Preparation

The materials and field equipment to be prepared by every team are as follows:

a. Materials

1) Land cover data from the digital remote sensory image overlaid by the satellite image data equipped with the sample points planning. If possible, the digital data may be uploaded into the GPS;
2) Supporting data in the forms of Basic Thematic Forestry Map, Forest Area Map, as well as the Utilization Permit Map (if needed).

b. Field Equipment

1) GPS (Global Positioning System) equipment accompanied with the external and internal batteries;
2) Camera;
3) Measuring tape (20-30 meters);
4) Phi band tape (if available);
5) Laser distance meter (if available);
6) Compass;
7) Haga Hypsometer;
8) Binoculars (if available);
9) Writing utensils;
10) Other equipment if needed.

2. Preparation of recording equipment of the field observation results

a. Tally sheet
   1) Tally sheet for the land cover observation, with the format as attached to Tally Sheet 1;
   2) Tally sheet for the measurement of stands on the sample plots (tree diameter, tree height, range density, etc.) with the format as attached to Tally Sheet 2.
b. Digital recording tool for data recording as follows:
   1) Digital camera;
   2) GPS tracking route data;
   3) Other field observation results data (if needed).

3. Coordination with Related Institution

Coordination can be conducted with relevant institution such as BPKH/UPT or Satuan Kerja Perangkat Daerah (Regional Working Unit) which are in charge for environment and forestry management, in regional level (provincial / district), or other relevant government or non-government organization in which comprehensive and specific information on location checking is deemed necessary to be shared and government services (if necessary).

4. Sample Design

a. Sample is categorized as follows:

1) Sample point on land cover observation

The sample is designed to collect information of administrative area, topographic condition, soil condition, land coverage condition, and measurement of sample location;

2) Plot sample on stand dimension

The sample is designed to collect information on sample point on land cover observation added with measurement of stand dimension. Every plot sample is also applied as sample point.

b. Position, numbers, distribution, and sequence of sample is decided by the observer / researcher following below consideration:

1) Representation of land coverage level on each observation point;
2) Representation of ecosystem type on each land coverage level on the field observation location;
3) The existence of object which type is called in to doubt, or object covered by cloud on the interpretation image;
4) Affordability of the point, plot or transect sample.

c. Provision of designing point and plot sample is as follow:

1) Total number of point sample collected for one time field observation is no less than 30 points. Total number of point sample for forestry class is no less than 2 points for every level.
2) Every sample point should be applied on the point or line or polygon as homogeny as possible.
3) The number of plot sample for each dimensional measurement stand is no less than one plot for forestry class and one plot for bush class.

d. Consideration and provision for points a, b, and c is used to arrange route plan.

CHAPTER IV FIELD OBSERVATION IMPLEMENTATION

1. Search for Sample Location

The search for sample location is done by following the sample list which indicated coordinates and direction (navigation) of the route that has been set by considering accessibility of sample location. Should there be any coverage land level which is unreachable or cancelled, or shifted, the causal factors those should be recorded.

2. Observation

Observation is conducted on the following condition:

a. Governmental administrative area and forest management area.

b. Coverage Land Condition

1) Present condition

Observation object is the land cover which can be observed from several directions. In the other word, it can be observed form north, west, south, and east, or front side, left side, backside, and right side. Binocular cab be used to observed distant object.

2) Dynamics / Changes

The observation is done in the altered object, for example for land opening, mining, forest fires, or other alteration. The supporting information for the observation can be gathered from local citizens or authorities. That kind information is need to be cross checked with other sources. Dynamic observation cannot be applied to stable object.

c. Topographic Condition

Object of observation is the landscape appearance which can be categorized as follow:

1) Flatland
2) Bumpy land, when there is less than 50m height discrepancy in topographic condition.
3) Rolling land, when there are 50 up to 300 m discrepancy between the highest and the lowest level.
4) Mountainous, when the discrepancy of the highest and lowest level is more than 300m.

d. Material of Soil Formation

The object of observation is the material which forming the soil, which categorized as follow:

1) Source Rock
2) Coral
3) Sands
4) Clay

e. Drainage Condition

Object of observation is the ability of the material in channeling water which categorized as follow:

1) Good condition, when the soil forming material are able to absorbed water well (example : sands)
2) Average condition, when several part of the soil forming material are able to absorbed water.
3) Bad condition, when the soil forming material are not able to absorbed water well (example: source rock or clay)

f. Land Form

Object of observation is the main group of land type, which categorized as follow:

1) Marin, when the soil forming factor is sea (example: beach cliffs)
2) Alluvial, when the soil forming factor is material found on the lower land (example: alluvial land)
3) Fluvio-marine, when the soil forming factor is affected by the energy from river and sea (example: delta)
4) Volcanic, when the main soil forming factor is material resulted from volcano eruption(example: volcano)
5) Denudational, when the soil forming factor is wind or water which form has altered form its original form (example: canyon or karst)

g. Slope

Object which steepness level is categorized as follow:

1) 0-2%
2) 2-8%
3) 8-16%
4) 16-25%
5) 25-40%
6) >40%

3. Measurement

a. Sample Position

Measurement of sample point position is done using GPS. The result of coordinate sample location is stored in GPS and recorded in fa//y sheet/form of field observation.

b. Dimension of plot sample stand

Measurement of plot sample stand only be conducted on the plot sample with object on the category forest and bush. Plot measured is in the form of 0,25ha circle. Dimension measured on that plot are:

1) General information of the plot such as:
   a) Crown Density

Crown density measurement can be conducted with photographic approach. Photo shoot is taken from the camera where the lens is facing zenith (perpendicular to the top) in the three points with 10 m distance from the center of the plot. Each photo shoot points are separated by same distance / angle with other points. Illustration of the conduct of the photo shoot is shown in figure 2. The assessment in crown density is stated in percentage.

b) Stand Density

The following is formula of stand density:

$$p = N/A$$

p is stand density (stand / hectare), N is number of stand in the plot and A is plot width (0,25 ha)

2) Individual information of stand such as:

a) Stand Diameter

Measurement is conducted with phi band height is set on chest height(~1,3m)

b) Free height of the branches

Measurement on free height branch is refer to Technical Guide of Forest Inventory

c) Total height of the Stand

Measurement of total height is refer to Technical Guide of Forest Inventory

3) Other information (if necessary) can be included in remark column on tally sheet, for example is information on forest succession, ecosystem, the function of the area, etc.

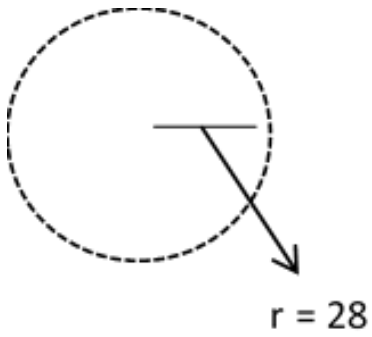

Figure 1 . Plot Sample Circular Diagram

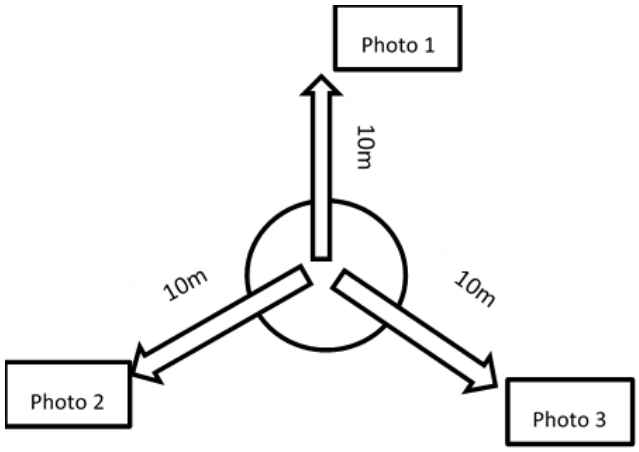

Figure 2. Photo shoot on the crown of the land for forestry and bush

4. Data Recording

The information of object of observation and measurement on the field is recorded / noted on the tally sheet of in the electronic recording device.

CHAPTER V POST FIELD OBSERVATION

1. Recapitulation of Field Observation Result

Recapitulation on Field observation Result can be conducted on the following information:

1. List of Point Sample (Table 5)
2. List of Plot Sample (Table 6)
3. Contingency Table (Table 1, 2, 3, and 4)
4. Form Sample Point (Form 1)
5. Form Plot Sample (Form 2)

2. Calculation of accuracy level

Calculation on accuracy level is based on the recapitulation on the field observation. The recapitulation is arranged in the following example:

a. General Calculation of Accuracy Level for All Classes

Example of Calculation:

		Interpretation Result of Land Cover								
		Primary Dry Forest	Secondary Dry Forest	Primary Swamp Forest	Primary Mangrove Forest	Plantation	Crop Forest	Bush	Open Land	Total Line
Field Observation of Land Cover	Primary Dry Forest	50	2	0		0	0	0	0	52
	Secondary Dry Forest	2	60	0		0	3	1	0	66
	Primary Swamp Forest	1	1	45		3	0	0	0	50
	Primary Mangrove Forest	0	0	2	40	0	0	0	1	43
	Plantation	0	0	0	0	45	5	1	2	53
	Crop Forest	0	1	0	0	3	70	2	1	77
	Bush	1	2	0	0	1	0	50	0	55
	Open Land	0		0	1	2	4	2	20	29
	Total Column	54	66	47	44	51	82	56	24	424

From the above contingency table (confusion matrix), the overall accuracy value for 8 land cover class is presented on the following example:

Overall accuracy (8 land cover class) = ((50+60+45+40+45+70+50+20)/424)*100% = 89,62%

b. General Calculation on accuracy level of Forestry Class

Example of Calculation

		Interpretation Result of Land Cover				
		Primary Dry Forest	Secondary Dry Forest	Primary Swamp Forest	Primary Mangrove Forest	Total Line
Field Observation of Land Cover	Primary Dry Forest	50	2	0	0	52
	Secondary Dry Forest	2	60	0	0	62
	Primary Swamp Forest	1	1	45	3	50
	Primary Mangrove Forest	0	0	2	40	42
	Total Column	53	63	47	43	206

Overall accuracy (forest classifications) = ((50+60+45+40)/206)*100% = 94,66%

c. General Calculation of Accuracy Level for Non Forestry Class

Example of Calculation

		Interpretation Result of Land Cover				
		Bush	Mixed Plantation	Residential	Water	Total Line
Field Observation of Land Cover	Bush	30	4	23	0	57
	Mixed Plantation	3	45	7	6	61
	Residential	7	0	19	5	31
	Water	0	0	2	40	42
	Total Column	49	49	49	111	258

Overall accuracy (Non Forestry- Non Forestry Class) = ((30+45+19+100)/258)*100% = 75,00%

d. General Calculation of Accuracy Level of Forestry and Non Forestry Class

Example of Calculation:

		Interpretation Result of Land Cover		
		Forest	Non Forest	Total Line
Field Observation on Land Cover	Forest	279	9	288
	Non Forest	13	123	136
	Total Column	292	132	424

Overall accuracy (forestry Class) = ((279+123)/424)*100% = 94,81%

Overall accuracy is the number which shows accuracy level of land cover map.

3. Expected Accuracy Level

Accuracy level of field observation result is expected to reach 85%, particularly for land cover on forestry and bush.

4. Improvement of Sensing Result

Procedure on improvement of sensing result will be explained in detail on Technical Guideline of Land Cover Interpretation

5. Report Formulation

Report is compiled as follow:

a. Preliminary report

   Preliminary report should be submitted no later than 7 days after the end of the Field observation. Preliminary report compiled in the following format (sample in Form 3):

   1) General description (time, location, observer, SPT, general method)
   2) Point sample report (code, coordinate, interpretation of closure class, on site closure class)
   3) Point sample distribution map

b. Final Report

   Final report should be submitted no later than 30 days after the end Field observation. Final report is compiled as follow:

   1) Introduction (time, location, observer, SPT)
   2) Description of checking area (based on tally sheet)
   3) Description of Field observation (method)
   4) Discussion (Problem and Analysis)
   5) Conclusion and Suggestion
   6) Appendixes
      a. Point Sample Table (Table 5)
      b. Plot Sample Table (Table 6)
      c. Point and Plot Sample Distribution Map
      d. Point Sample Form (Tally sheet)

6. Digital Data Recording of Field Observation Result

Digital data recording is presented in the following format:

a. GPS Tracking Route
b. Form Point Sample
c. Form Plot Sample
d. Coordinate Point Sample (Geodatabase Format)
e. Coordinate Sample Plot (Geodatabase Format)

CHAPTER VI CLOSING

This Technical Guideline is composed to be used in the relevant area in accordance to the benefit resulted from the aforementioned work.

Form 1
Observation on Land cover
Directorate General on Planology and Environmental Management
[DIRECTORATE INVENTORY AND OBSERVATION OF FOREST RESOURCES / OFFICE OF FORESTRY REGIONAL]

TGL SURVEY

SURVEYOR

KODE SAMPEL

LOKASI SAMPEL

PROVINSI

KAB / KOTA

KECAMATAN

DESA

UP-KEHUTANAN

KOORDINAT LOKASI SAMPEL

LINTANG / BUJUR: 0 ' " LU / LS; 0 ' " BT

UTM: mU; mS

ELEVASI: mDPL

INFORMASI PENUTUPAN LAHAN

KELAS (23)

VARIASI

KARAKTERISTIK FISIK LAPANGAN

TOPOGRAFIS: DATARAN; BERGELOMBANG (<50m); BERBUKIT (50-300m); BERGUNUNG (>300m)

MATERIAL TANAH: BATUAN INDUK; KARANG; PASIRAN; LEMPUNGAN

DRAINASE: BAIK; SEDANG; BURUK

BENTUK LAHAN: MARIN; ALUVIAL; FLUVIO-MARIN; VULKANIK; DENUDASIONAL

KELERENGAN: 0-2%; 2-8%; 8-16%; 16-25%; 25-40%; >40%

LOCATION SCETCH

Result A

FORM 1

OBSERVATION ON LAND COVER

Image Quotation

(Scale 1:100.000 point sample is included)

North

East

West

South

Form 2

DIRECTORATE GENERAL OF FORESTRY PLANOLOGY AND ENVIRONMENTAL GOVERNANCE

[DIRECTORATE OF INVENTORY AND OBSERVATION OF FORESTRY RESOURCES nn]

FIELD OBSERVATION LIST

MEASUREMENT ON STAND DIMENSION

ON FORESTRY AND BUSH LAND COVER

No. Plot Sample			
Location	Village	:	
	Subdistrict	:	
	District	:	
	Province	:	
Sample Coordinate			
Date of Survey			
Surveyor			
Land cover Type	a. Image	:	
	b. Field	:	
Vegetation Condition	Type of vegetation	:	
	Tree Stadium	:	Dominate by type: tree/sapling/poles/seeding
Elevation (m)			
Characters of Sample Location			
Slopeness			
Remark			

IMAGE QUOTATION WITH POINT SAMPLE

Form 2

Measurement of Stand Dimension

Photo of Forest Crown Density

Location: ……..^{0}…….’……”

Photo 1	Photo 2	Photo 3

Photo of Bush Density

Location: ……..^{0}…….’……”

Photo 1	Photo 2	Photo 3

Form 2

Stand Dimension Measurement

Result of Stand Dimension Measurement

No. Plot Sample: …….

Coordinate Location: ……..

No	Name of the Tree	Azimuth	dbh	dt	tbc	tt

Note:

dbh : chest height diameter (in cm)

dt : distance between tree and plot center (in m)

tbc : height of the tree without branches (in m)

tt : total tree height (in m)

Azimuth : azimuth angle of the tree from plot center (in m)

Form 3
Preliminary report
Directorate General on Planology and EnviroNmental Management
[DIRECTORATE INVENTORY AND OBSERVATION OF FOREST RESOURCES / OFFICE OF FORESTRY REGIONAL nn]

PRELIMINARY REPORT

FIELD OBSERVATION RESULT

ACTIVITY			
LOCATION	PROVINCE		
	DISTRICT / CITY		
TIME		s.d	
ASSIGNED OFFICER			
NAME	NIP	POSITION	SPT
IMAGE RANGE	PATH	ROW	

TOTAL POINT SAMPLE	
TOTAL PLOT SAMPLE	
GENERAL ACCURACY LEVEL	

Jakarta,

Officer;

5. ……..

6. ……..

Form 3
Preliminary report

REPORT ON POINT SAMPLE OBSERVATION ON LAND COVER

No	COORDINATE		CLOSURE CLASS	
	LATITUDE	LONGITUDE	INTERPRETATION	FIELD

Form 3

Preliminary report

Plot Sample and Point Sample Distribution Map