DENR Administrative Order
No. 2023 - _____

SUBJECT: GUIDELINES ON THE INVENTORY OF STRUCTURES IN FORESTLANDS

Pursuant to Presidential Decree (P.D.) No. 705, as amended, otherwise known as the "Revised Forestry Code of the Philippines", Executive Order (E.O.) No. 192, series of 1987, "Providing for the Reorganization of the Department of Environment, Energy and Natural Resources, renaming it as the Department of Environment and Natural Resources, and For Other Purposes", E.O. No. 263, series of 1995, "Adopting Community-based Forest Management as the National Strategy to Ensure the Sustainable Development of the Country's Forestlands Resources and Providing Mechanisms for Its Implementation" as amended, R.A. No. 11038, known as the "Expanded National Integrated Protected Area System (ENIPAS) Act of 2018, R.A. No. 8371 known as the "The Indigenous Peoples' Rights Act (IPRA) of 1997, and other pertinent laws, rules, and regulations, the following guidelines and procedures on the inventory of structures in forestlands are hereby promulgated for the guidance and compliance of all concerned.

SECTION 1. Basic Policy. It is the policy of the state to protect and advance the right of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature.

SECTION 2. Objectives. This Order aims to provide guidance in the conduct of an inventory of structures in forestlands using Geographic Information System (GIS), with data from Unmanned Aerial Vehicle (UAV) photogrammetry and remote sensing, and in situ validation and information collection using open source tools for data collection.

SECTION 3. Scope and Coverage. This Order shall cover the inventory of all permanent structures within forestlands. It shall collect data on the structure's status, the type of material used in construction, the owner/ holder or any person responsible for the establishment of the structure, geographical location, and a photograph of the place, among others.

SECTION 4. Limitations. Temporary structures shall not be included in the inventory except for structures such as "Bahay Kubo" that are used for dwelling for an extended period of time. Areas that exhibit danger to the surveyors such as areas with conflicting jurisdiction, insurgencies, and/or gated-compound where entry is prohibited shall be marked as danger-zone and the overall lead shall decide whether to proceed with the aerial and ground surveys.

SECTION 5. Definition of Terms. As used in, and for the purpose of this guidelines, the following terms and phrases shall be understood to mean:

a) **Certified Ancestral Domain Title (CADT) -** refers to a title formally recognizing the rights of possession and ownership of Indigenous Cultural Communities/Indigenous Peoples (ICCs/IPs) over their ancestral domains identified and delineated in accordance with the IPRA law

b) Forestry Spatial Datasets (FSD) - refers to the datasets being managed by the forestry sector such as but not limited to forestry tenurial instruments, national greening program sites, critical and proclaimed watersheds, potential investment areas, production and protection forests, illegal logging hotspots, apprehensions and/or seizures, Lawin forest conservation areas, cutting permits, etc.

c) **Forestland -** includes public forests, permanent forest or forest reserves, and forest reservations.

d) **Geographic Information System (GIS) -** is the framework for gathering, managing, and analyzing spatial data to generate information, visualize patterns, and make better decisions.

e) **Open-Source Data Collection Tool (ODCT) -** refers to data collection tools that are made freely available and can be distributed and modified

f) **Remaining Initial Component of the NIPAS**- refers to all areas or islands in the Philippines proclaimed, designated, or set aside, pursuant to a law, presidential decree, presidential proclamation, or executive order as a national park, game refuge, bird and wildlife sanctuary, wilderness area, strict nature reserve, watershed, mangrove reserve, fish sanctuary, natural and historical landmark, protected and managed landscape/seascape as well as identified virgin forests before the effectivity of the NIPAS Act

g) **Quadcopter** - refers to RPAs with four propellers

h) **Remotely Piloted Aircraft (RPA) -** refers to any unmanned aircraft which is piloted from a remote station. It is also synonymous with aerial drones and unmanned aerial vehicles (UAVs).

i) **Permanent Structure -** all foreign objects, man-made in nature, unmovable, and which occupy space inside the forestland.

SECTION 6. Inventory of Structures in Forestlands. The inventory of structures in forestlands shall be conducted to determine and account for the number of existing structures in forestland, the projection on how built-up areas progress in terms of expansion in the area per year, and the list of factors that may have contributed to the construction of built-up areas inside the forest.

6.1. Classification of Structures. Structures are classified into six (6) categories:

a. Structures within untenured Forestland and without reforestation projects, and not an initial component of NIPAS, CADT, and Proclaimed areas;
b. Structures within Forestland and Tenure;
c. Structures within Forestland and Reforestation Projects;

d. Structures within Forestland and within initial components of NIPAS;
e. Structures within Forestland and within CADT; and
f. Structures within Forestland and within proclaimed areas

6.2. Initial Data Requirements. The following are the minimum spatial data needed in the inventory of structures within forestlands:

a. Land cover map
b. Forestland using the replotted land classification maps
c. Tenure instruments
d. Ancestral land with Certificate of Ancestral Domain Title (CADT)
e. Legislated protected areas
f. Reforestation and Rehabilitation Projects (i.e National Greening Program (NGP), Integrated Natural Resources and Environmental Management Project (INREMP), and Forestland Management Project (FMP)
g. Proclaimed areas inside forestland (e.g. Areas proclaimed as school sites, experimental forests, military reservations, etc.)

6.3 Information Collection Requirements. The following is the minimum information required for the ground survey as shown in the questionnaire provided in the open-source data collection system.

a. Name of the surveyor
b. Type of material used in construction (brick, wood, mixed)
c. Vertical height in terms of no. of floors
d. Location whether inside a Tenure, Ancestral Domain, Protected Area, Proclaimed Area, or Rehabilitation projects
e. Inclusion in the management plan
f. Use (e.g. abandoned, residential, commercial, industrial, institutional, etc.
g. Type of tenurial instrument/ rehabilitation program (if applicable)
h. Tenure Holder (if applicable)
i. Geographical Location
j. Photograph of the place

All shapefiles shall use the Philippine Reference System (PRS) of 1992 projection.

SECTION 7. General Procedure in the Conduct of Inventory. The field validation will undergo the following three (3) main activities: The flowchart of the methodology is attached as Annex 1.

a. *Land Cover Analysis.* The first method involves the analysis of the Land Cover 2020 Map from Sentinel 2A (accuracy 10m) which shall give a general view of where the built-up areas are located. It shall involve overlaying the land cover map with existing tenure instruments, ancestral domain, protected areas, rehabilitation projects, and proclamation areas.

b. *Drone Image Analysis*. Once the area for field validation is selected from the above GIS analysis, flight planning shall commence to gather drone images (target accuracy 1m) from the area of interest. The orthomosaic images will be used to count and digitize the structure within a one-kilometer grid.

c. *Offline Data Collection Tool (ODCT)*. The last method is the gathering of information from the ground using the ODCT. It shall collect data on the structure's status, the type of material used in construction, the owner/ holder or any person responsible for the establishment of the structure, geographical location, and a photograph of the place.

SECTION 8. Roles and Responsibilities. The following offices shall have the following roles and responsibilities for the inventory of structures in forestlands:

8.1. Forest Management Bureau (FMB). The FMB shall conduct the initial analysis of the universe of the existing built-up areas per the Land Cover Map of NAMRIA and categorize the structures according to the classification of structures as per Section 6.1. of this Order. The FMB shall provide the analyzed data to Regional Offices in grids at a one-kilometer resolution. The FMB shall also design and provide the ODCT form to the CENRO/ Implementing PENRO.

a. Inventory using the NAMRIA Land Cover Map. The FMB shall provide the analysis of the Land Cover Map derived from Sentinel 2A (or whichever satellite that NAMRIA will use on the succeeding land cover maps) to the Regional Offices.

a.1. The FMB shall ensure that all data to be used are projected in PRS 1992 and export all classified built-up areas from the land cover that is within the forestland.

a.2. The FMB shall classify the structures as specified in Section 6.1.

b. Creation of the universe of the Inventory. Using the data derived from Section 7.1.a, the FMB shall create the initial universe of the inventory by analyzing the data in one-kilometer grids.

b.1. The Regional Offices shall reconcile the data not determined from Sentinel 2A (e.g. areas under canopy) and finalize this universe.

b.2 The finalized universe vetted by FMB and the RO shall be the basis for planning the three-year implementation of the inventory.

8.2. Regional Office (RO) and Provincial Environment and Natural Resources Office (PENRO) Composite Team. The Composite Team shall carry out the first pass of ground validation of the inventory through the conduct of drone surveys.

a. **Creation of RO-PENRO Composite Team.** The DENR Regional Office shall organize Ground Validation Composite Teams which shall be composed of the following technical personnel through the issuance of a Special Order:

Overall Lead:	Chief, Enforcement Division
Members:	Chief, License, Patents, and Deeds Division
	Chief, Planning & Management Division
	One (1) Technical Staff from all technical divisions

Sub-Teams for the Drone and ODCT surveys

Lead (Drone):	PENR Officer
Members:	One (1) technical staff from Enforcement Division
	One (1) technical staff from Licenses, Patents, and Deeds Division
	One (1) technical staff from Planning & Management Division

b. **Aerial validation using drones.** The RO-PENRO Composite Team shall be responsible for validating the areas classified as built-up using UAVs.

b.1. *Responsible Office.* The RO-PENRO Composite Team shall conduct the planning of drone flight validation by prioritizing areas within forestland in the order provided by Section 5.1 and the one-km grid.

b.2. *Drone Survey.* The existing Protocol on the Use of Quadcopter Remotely Piloted Aircraft (RPA) in the Monitoring and Assessment of Forestry, Environment, and Natural Resources Programs and Projects is hereby adopted as the official methodology from pre-flight, in-flight, and post-flight operations, as well as the image processing of the aerial photographs acquired in the drone survey.

b.3. *GIS Analysis from Acquired Images from Drone.* The orthomosaic images from the drone survey shall be used to digitize the structures within a one-kilometer grid. An identification per structure shall be added as an attribute following the format [Grid ID_Structure ID].

b.4. *Timeline for Aerial Validation.* The one-km grid is not fully covered with settlements. The efficiency of the drone survey will depend on well-thought flight planning considering the terrain and weather.

b.4.1. *Drone Flight*. As standard, a fully-charged battery of a drone can cover 10 hectares on a 15-minute flight.

b.4.2 *Image Processing.* The images of a 15-minute flight can be mosaicked in two (2) hours.

b.4.3 *Digitizing Structures.* An orthomosaic image at a one-kilometer grid is estimated to be digitized for one (1) hour.

b.4.4 *Average time for a one-kilometer grid.* The estimated average time from the first drone flight to the creation of the digitized feature of the structures is one (1) day.

b.4. *Submission of output for the ODCT Survey*. The RO-PENRO Composite Team shall provide the output of the drone survey to the Implementing PENRO-CENRO Composite Team in Section 7.3 for the ODCT Survey once a province-wide validation is completed. The submission will be

through a Memorandum that includes the shapefile in PRS 1992 projection and the Keyhole Markup Language (kml) file in World Geodetic Systems (WGS) 1984 projection as attachments.

b.5. *Areas Restricted to Drone Surveys*. Drone surveys cannot be operated within a 10-kilometer radius of the airport. Hence, no drone surveys shall be conducted and only the inventory using an ODCT Survey be performed for grids located in these areas.

b.6. *Alternate for Drone Surveys.* The use of google street view is advisable to support drone surveys. However, it is only limited to the counting of structures along the streets where the google street view profile has been captured.

8.3. Implementing PENRO and Community Environment and Natural Resources Office (CENRO) Validation Team. The Validation Team shall carry out the second pass of ground validation of the inventory through the conduct of offline data collection surveys.

a. **Creation of Implementing PENRO/CENRO Validation Team.** The concerned implementing PENRO or CENRO shall organize a validation team which shall be led by the CENR Officer/ Implementing PENR Officer and assisted by three (3) technical staff from ED, LPDD, and PMD through the issuance of a Special Order:

b. **Validation using ODCT.** The Validation Team shall be responsible for gathering first-hand information about structures from the records of tenure instruments, CADTs, the initial component of NIPAS, reforestation and rehabilitation projects, and proclaimed areas and collecting information from the ground using an ODCT.

b.1. *Responsible Office.* The Validation Team shall gather information using ODCT by prioritizing data collection in ODCT in the order specified in Section 5.1.

b.2. *ODCT Survey.* ODCT forms are digital forms that can be installed on Android devices that require no internet connection during the survey. The ODCT blank forms shall be provided by the FMB to the Validation Team. The data requirements included in the ODCT forms are specified in Section 6.3 and the user interface of an ODCT can be found in Annex 2 and 3, respectively.

b.3. *Timeline for Ground Validation.* The one-km grid is not fully covered with settlements. The efficiency of the drone survey will depend on well-thought information, education, and communication (IEC) dissemination of the project to the community involved. The weather and terrain shall also be taken into consideration.

b.3.1 *IEC.* It is advised that an IEC be conducted in one day for each concerned municipality.

b.3.1 *ODCT Survey.* It is estimated to traverse (4) grids surveyed in one (1) day.

b.3.2. *Updating the digitized data.* It is estimated to update (2) grids in one (1) day.

b.4.4 *Average time for a one-kilometer grid.* The estimated average time from the IEC to the creation of the updated digitized feature of the structures is one-half (1/2) of a day.

a.4. *Submission of the output of the ODCT Survey.* The CENRO/Implementing PENRO validation team shall submit the gathered information to the RO-PENRO Composite Team once a municipality/city-wide validation is completed. The submission will be through a Memorandum that includes the updated shapefile in PRS 1992 projection and the Keyhole Markup Language (kml) file in the World Geodetic Systems (WGS) 1984 projection with information gathered from the ground as attachments.

a.5. *Areas not captured in the drone surveys*. Additional locations of structures found during the in-situ validation shall be tagged and submitted to the RO-PENRO Composite Team as well.

SECTION 9. Reporting and Integration of the Inventory in the Forestry Spatial Dataset Portal and the DENR Control Map. The output of the inventory will form part of the forestry spatial datasets. The Geospatial Data Management Team (GDMT) of the FMB shall be responsible for conducting the quality assurance and quality control of the submitted data.

9.1 Progress Report. The RO-PENRO Composite Team shall submit a progress report semi-annually through a memorandum every 30th of March and 30th of September which details their accomplishment from July to December and January to June, respectively. This shall include shapefiles and kml files of accomplished provinces. The merged validation data from the drone and the ODCT surveys shall be submitted to FMB duly signed by the Regional Executive Director (RED). If the survey for a particular province is still ongoing at the time of reporting, the RO-PENRO Composite team shall include the percentage of accomplishment and target completion in writing and there is no need to submit incomplete data yet.

9.2 Final Report. The RO-PENRO Composite Team shall submit the final report through a memorandum at the end of three (3) years which details their accomplishment of the inventory of structures using the most recent land cover. This shall include shapefiles and kml files of all accomplished provinces. The merged validation data from the drone and the ODCT surveys shall be submitted to FMB duly signed by the Regional Executive Director (RED).

SECTION 10. Roll-out and Capacity Building. The FMB-DENR shall provide capacity-building activities to the DENR Field Offices to ensure that the activities in the field shall be conducted correctly and efficiently relative to the operations stated herewith.

SECTION 11. Inventory of Structures. Within three (3) years of the effectiveness of this Order, the DENR FMB and the RO shall complete the initial inventory of structures in forestlands based on the available NAMRIA land cover maps. The succeeding round of inventory activities shall be conducted every five (5) years based on the availability of the NAMRIA Land Cover Map and shall be completed within three (3) years thereafter.

SECTION 12. Separability Clause. If any provision of this Order shall be held invalid or unconstitutional, the other portions or provisions hereof which are not affected shall continue in full force and effect.

SECTION 13. Repealing Clause. All Orders and other similar issuances, which are inconsistent herewith are hereby repealed, superseded, or amended accordingly.

SECTION 14. Effectivity. This Order shall take effect fifteen (15) days after its publication in the newspaper of general circulation and acknowledgment of the Office of the National Administrative Registry (ONAR) of the UP Law Center.

MARIA ANTONIA YULO LOYZAGA
Secretary

Annex 1: Flowchart

Annex 2: Sample Data Requirements

Inventory of Structures in Forestland

Inventory of Structures in Forestland

Team Number

- ◯ 1
- ◯ 2

Surveyor's Name

- Abegail
- Elise
- Carlyn
- Harold
- Pinky

Surveyor's Name

- Angelo
- Charles
- Dennis
- Edward
- Hubert
- Roland

Is this a compound?

- ◯ Yes
- ◯ No

How many structures are there in the compound?

Record current location of structure

For structures in one compound, record the approximate center.

latitude (x.y °)

longitude (x.y °)

altitude (m)

accuracy (m)

Use camera to take photo of the structure

For structures in one compound, take photo of the compound in one shoot.

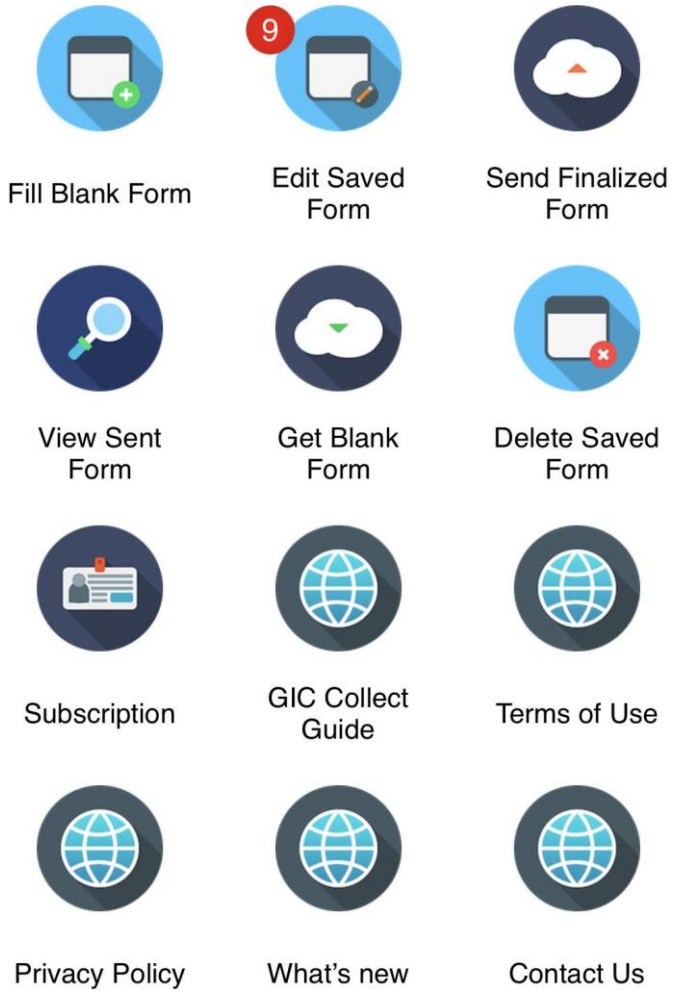
Click here to upload file. (< 5MB)

Materials used in construction

- ☐ Concrete
- ☐ Wood
- ☐ Mixed

Name of Owner (if known)

Annex 3: Interface Data Collection in ODCT



The homepage of the ODCT in a mobile application is shown in the image above. The steps in filling out the questionnaire are as follows:

1. Download the questionnaire with the "Get Blank Form" icon. Make sure to do this before going to an area without an internet connection.
2. Once downloaded, it will automatically be transferred in the "Fill Blank Form" icon and the surveyor can now answer the form. Repeat until necessary.
3. Forms answered without the internet are automatically saved in the edit saved form. If you want to make some changes to the answer, do it here.
4. Once finalized and ready for sending, you can view the finalized form in "Send Finalized Form". Make sure that you are now connected to the internet.
5. To assure that forms are successfully sent, please view the "View Sent Form".