

A RESOURCE BOOK ON PARTICIPATORY GEOGRAPHIC INFORMATION SYSTEM (PGIS) FOR LAND RIGHTS ADVOCATES

Volume 2





Founded in 1979, ANGOC is a regional association national and regional networks of civil society organizations (CSOs) in Asia actively engaged in food security, agrarian reform, sustainable agriculture, participatory governance and rural development. ANGOC network members and partners work in nine Asian countries with an effective reach of some 3,000 CSOs and community-based organizations (CBOs). ANGOC actively engages in joint field programs and policy debates with national governments, intergovernmental organizations (IGOs), and international financial institutions (IFIs). ANGOC is the convener of the Land Watch Asia (LWA) campaign. ANGOC is also a member of the International Land Coalition (ILC), the Global Land Tool Network (GLTN), Global Forum on Agricultural Research (GFAR), and the Indigenous Peoples' and Community Conserved Territories (ICCA) Consortium.

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PAFID is a social development organization which has been assisting Philippine indigenous communities to secure or recover traditional lands and waters since 1967. It forms institutional partnerships with indigenous communities to secure legal ownership over ancestral domains and to shape government policy over indigenous peoples' issues. PAFID works exclusively with the indigenous peoples' sector, specifically upon written or signed requests for assistance from indigenous communities or their representatives. PAFID envisions indigenous communities as responsible stewards of their resources.

As communities and individuals, they possess rights and responsibilities over the natural environment, cultural integrity, educational, and health systems that embody their indigenous knowledge and mores, employ socially and ecologically sound methods of managing and utilizing their natural resources for their own and national benefit for both present and future generations.

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**A RESOURCE BOOK ON PARTICIPATORY
GEOGRAPHIC INFORMATION SYSTEM (PGIS)
FOR LAND RIGHTS ADVOCATES**

Volume 2

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LIST OF ACRONYMS USED

| | |
|---------|---|
| ADSDPP | Ancestral Domain Sustainable Development and Protection Plan |
| AMAN | Indigenous Peoples' Alliance of the Archipelago (Indonesia) |
| ANGOC | Asian NGO Coalition for Agrarian Reform and Rural Development |
| AO | Administrative Order |
| BLGU | Barangay Local Government Unit |
| CADT | Certificate of Ancestral Domain Title |
| CBD | Convention on Biological Diversity |
| CENRO | Community Environment and Natural Resource Officer |
| CLOA | Certificate of Land Ownership Award |
| CLUP | Comprehensive Land Use Plan |
| CSO | Civil Society Organization |
| DAO | Department Administrative Order |
| DENR | Department of Environment and Natural Resources |
| EIA | Environmental Impact Assessment |
| EIS | Environmental Impact Statement |
| ENRO | Environment and Natural Resource Officer |
| ESIA | Environmental and Social Impact Assessment |
| FGD | focus group discussion |
| FLUP | Forest Land Use Plan |
| FPIC | free prior and informed consent |
| GINS | Global Indian Navigation System |
| GIS | Geographic Information System |
| GNSS | Global Navigation Satellite System |
| GLONASS | Global Orbiting Navigation Satellite System |
| GPS | Global Positioning System |
| ICCAs | Indigenous and Community Conserved Areas |
| ICC | Indigenous Cultural Community |

| | |
|--------|---|
| IEC | information, education, and communication |
| ILC | International Land Coalition |
| IPs | indigenous peoples |
| IPRA | Indigenous Peoples' Rights Act |
| IUCN | International Union for Conservation of Nature |
| LGU | local government unit |
| MPDO | Municipal Planning and Development Officer |
| NCIP | National Commission on Indigenous Peoples |
| NES | National Engagement Strategy |
| NGO | Non-Government Organization |
| NLUA | National Land Use Act |
| NOC | Notice of Coverage |
| PAFID | Philippine Association for Intercultural Development |
| PGIS | Participatory Geographic Information System |
| P3DM | Participatory 3D-Modelling |
| PRS 92 | Philippine Reference System of 1992 |
| PoWPa | Program of Work on Protected Areas |
| QGIS | Quantum Geographic Information System |
| QZSS | Quasi-Zenith Satellite System |
| RA | Republic Act |
| SBAS | Satellite-Based Augmentation System |
| TWG | Technical Working Group |
| UNDRIP | United Nations Declaration on the Rights of Indigenous Peoples |

FOREWORD

This resource book is the **second volume** publication on *Community Mapping and Participatory Geographic Information System (PGIS)* which aims to equip the users with the necessary knowledge, attitude and skills on this subject area. It is intended for land rights defenders, institutions advocating for land rights, development practitioners, and communities to defend their rights to land and the sustainable use of natural resources.

Inspired by the pioneering work of the Philippine Association for Intercultural Development, Inc. (PAFID) in PGIS mapping in the country, this publication is designed to impart the key concepts of community mapping and the basics of PGIS, with the view that the application of PGIS technology contributes to securing legal recognition of the indigenous communities over their traditional territories and resources.

This volume is designed to impart on the “how-tos” for the production of digital maps useful in advancing the land rights agenda of rural communities, particularly indigenous communities and smallholder farmers in Southeast Asia. The publication is divided into three major sections:

Chapter 1: Mapmaking Concepts, Principles and Practices discusses the art and science of mapmaking. It shows the types of maps, its uses, and the processes and tools needed to produce such maps for advocacy purposes.

Chapter 2: Presentation of Maps Using Google Earth Tour and Powerpoint highlights the means of presenting the finished maps to both the intended and wider audience utilizing tools available in this information age.

Chapter 3: Using Maps for Advocacy shows what needs to be done to ensure that the maps produced become powerful tools for advocating the cause of land rights defenders.

This resource book is not prescriptive but aims to contribute to the empowerment of communities in protecting and defending their right to land. As this resource book is a general guide on PGIS, readers need to be mindful of the legal procedures and requirements for the submission of community maps for registration and legal recognition. In the Philippines, the PGIS has been useful in establishing and enhancing the right to self-determination by the indigenous tribes over their ancestral domains, through the opportunity provided by the Indigenous People’s Rights Act (IPRA).

The examples used in this publication are outputs of the PAFID-organized four-day training course on “*GIS Tools for Development Workers: Advocacy, Agrarian Reform and Indigenous Peoples*” (18-21 April 2017; Quezon City, Philippines), as well as examples of communities who have actually generated and utilized maps in support of their advocacies.

At the same time, members of the International Land Coalition (ILC) have been working towards a common agenda in the Philippines through the National Engagement Strategy (NES) Platform. This resource book is part of the strategies of the Philippines NES to enhance the basic sectors’ capacities to demand and defend their rights and natural resources. It also contributes to the initiative of the Asian NGO Coalition (ANGOC) and Land Watch Asia campaign in sharing of experiences, approaches, and tools on enhancing tenurial security of the rural poor.

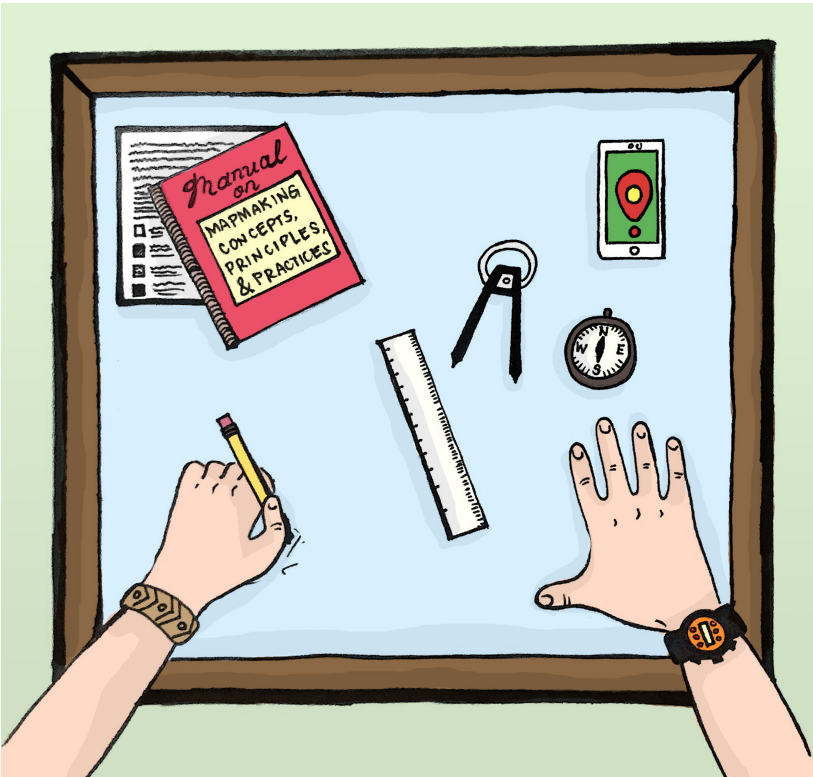
This resource book is a work-in-progress, and shall welcome feedback from practitioners to further enhance the information, the mapping methods and processes presented in the publication.

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CHAPTER 1: MAPMAKING CONCEPTS, PRINCIPLES, and PRACTICES



CHAPTER 1: MAPMAKING CONCEPTS, PRINCIPLES, and PRACTICES

Cartography is the science and art of map-making. Science because it concerns with the discovery and organization of knowledge using information system technologies such as Geographic Information System (GIS) which has the capability for capturing, managing, manipulating, and visualizing geographic information. It is an art because mapmaking requires imagination, creativity and innovation.

A map is a graphic representation or scale model of spatial concepts. It is a means for conveying geographic information easily understood by people, regardless of language or culture. A map is a powerful tool to visualize the situation. It helps us to locate where the problematic areas are and provide useful information as basis for policy formulation and development interventions that are tailor-fitted to the needs of the local people.

Map makers must learn the basic elements of a map, understand the planning process, and possess skills designing and production based on cartographic principles and participatory geographic information system (PGIS) tools.

| ELEMENTS OF A MAP | PREPARATION OF MAPMAKING AND CODE OF ETHICS |
|---|---|
| <ul style="list-style-type: none"> •Title •Orientation •Legend •Reference System •Vicinity Map •Publication •Citations | <ul style="list-style-type: none"> •Context •Target audience •Cartographic standard •Common practice and code of ethics |
| MAP DESIGNING | MAP PRODUCTION |
| <ul style="list-style-type: none"> •Geographic Reference System •Map Projections •Map Scale •Design Principles & Rules | <ul style="list-style-type: none"> • GPS Gamin Receiver • Quantum GIS Application • Individual Exercises <ol style="list-style-type: none"> 1. Data Capture& Saving 2. Closing CLOA 3. Map Overlay |

Figure 1. Basic knowledge and skills in mapmaking.

ELEMENTS OF A MAP

A map has the following cartographic elements as shown in red boxes in Figure 2:

- Title – clearly state what the map shows and where the map is located
- Orientation – must show North arrow
- Legend – be precise and clearly define categories and meaningful symbols
- Reference System – Datum + Projection + Coordinate System
- Scale – represents the ratio of the distance between the points on the Earth and the distance between the two corresponding points on the map

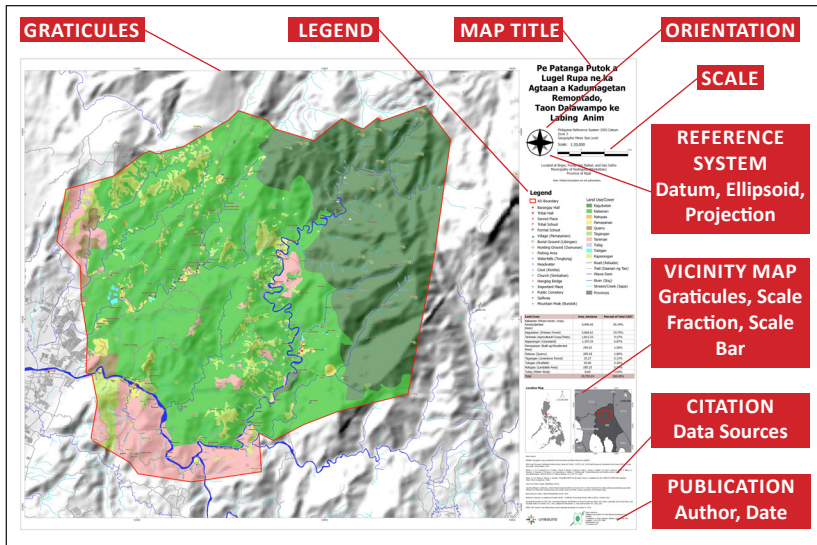


Figure 2. Cartographic elements of a map.

- Vicinity Map – indicating Graticules, Scale Fraction and Scale Bar
- Citations – indicating data sources both geographic and attribute data
- Publication – citing the author and date of map publication

PREPARATION FOR MAPMAKING

In preparation for making a map, it is important to consider the following factors, namely: (a) context, (b) target audience, (c) cartographic standard and common practice, and (d) cartographic code of ethics.

Context: Maps are made according to purpose and depending on the people’s needs, issues, and concerns. For land rights advocates, the purpose and content may be influenced by community context which usually revolves around land tenure issues and resources for IPs as shown in Figure 3.







| LAND TERRITORIES AND RESOURCES | |
|--|---|
| <p>Increase and decrease in land areas</p>  | <ul style="list-style-type: none"> • According to land use • According to customary land tenure |
| <p>Land tenure</p>  | <ul style="list-style-type: none"> • Percentage of people with customary land tenure • No. of people benefitting • With customary land tenure recognized by state • Those not recognized by state |
| <p>Conflict</p>  | <ul style="list-style-type: none"> • Areas of conflicts • Areas under control of state or corporations • Areas claimed by state but can be used by indigenous peoples |
| <p>Laws enacted affecting traditional land-use and land tenure and their effects</p> | <ul style="list-style-type: none"> • No. of communities or percentage of population affected • Lands converted to different land use |
| <p>Statutory and/or indigenous peoples' intervention on disaster prone areas</p> | <ul style="list-style-type: none"> • Increase or decrease of land areas prone to disaster |
| <p>State policies</p>  | <ul style="list-style-type: none"> • Increase or decrease in percentage of forest protected by state and/or indigenous peoples • Percentage or number of law passed/implemented recognizing the customary rights of people to their forest and its management |
| <p>Water</p>  | <ul style="list-style-type: none"> • Decrease or increase in number of water sources, water volume, quality, and portability of water for community use. • Incidences of water-related violence and tensions • List of flora and fauna of different uses and assessment on trends from historical information. |
| <p>Trends and changes in access to indigenous medicine</p> |  |

Figure 3. Land tenure issues and resources for indigenous peoples.

Adapted from CBMIS for Community Trainers and Organizers, TEBTEBBA Foundation

Target audience: The users will influence how a map should appear, both in content/substance and format. Target audience may include, among others, IP communities, government officials, and local executives.

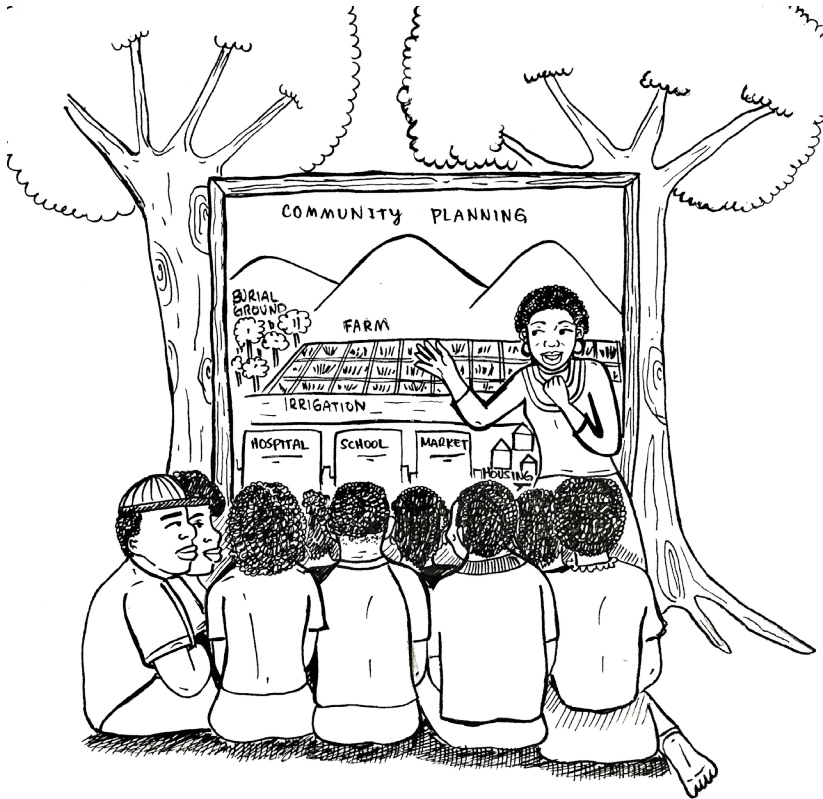


Figure 4. Indigenous peoples as the target audience of the map.

Participatory mapping can be used as a strategy for awareness raising, education and community organizing. The map can strengthen community's arguments for land rights advocacy during dialogue and negotiations with government officials and other stakeholders.



Figure 5. Participatory maps used as advocacy material during dialogues with government.

Participatory mapping can be used for visualization and the development of Ancestral Domain Sustainable Development Protection Plan (ADSDPP) for indigenous communities.

With the objectives in mind, the appropriate methodology that can be identified is PGIS Mapping through 3-D Modelling techniques combined with GIS Technology.

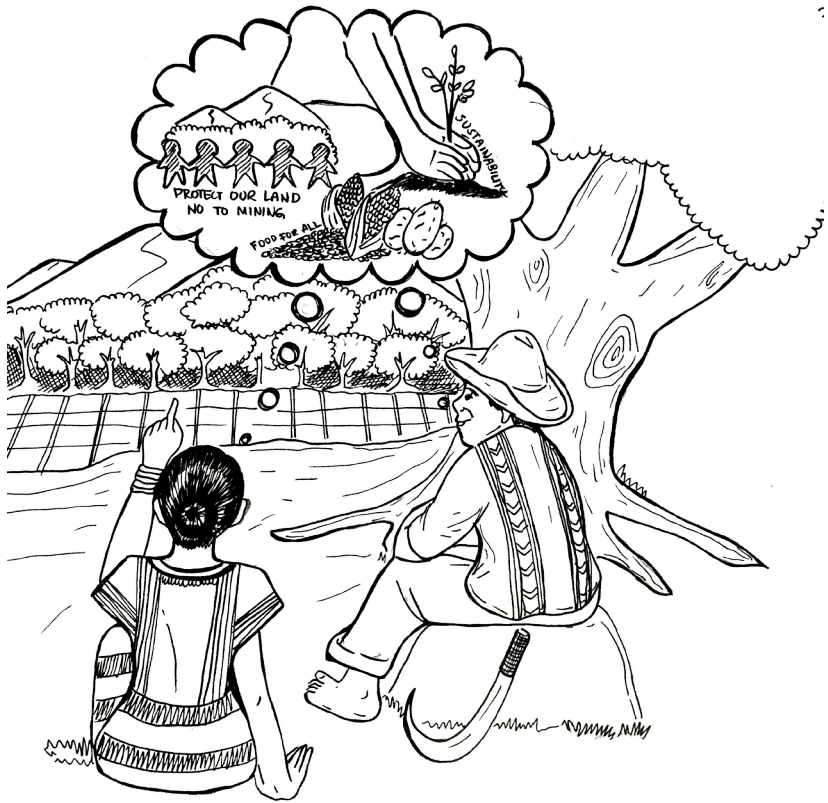


Figure 6. Participatory mapping as a tool for visualization and development of the indigenous community's ADSDPP.

Cartographic standards common practice:

- a. Generalization is the process of reducing certain details in a map in a meaningful way. Maps contain a certain level of detail depending upon its scale and purpose. It is important that geometric and attribute accuracy as well as the presentation quality of the map must be maintained.
- b. Graphic Variables refer to the different graphic characters or symbols that may render different perceptions to the map readers which can affect the map design in terms of choosing Font Size, Value, Texture, Color, Orientation, and Shape.

- c. Methods and Types of Map-users will influence the way maps will be projected. Basically, there are three types of maps: (1) General Purpose Maps, (2) Thematic Maps, and (3) Topographic Maps.

Cartographic Code of Ethics:

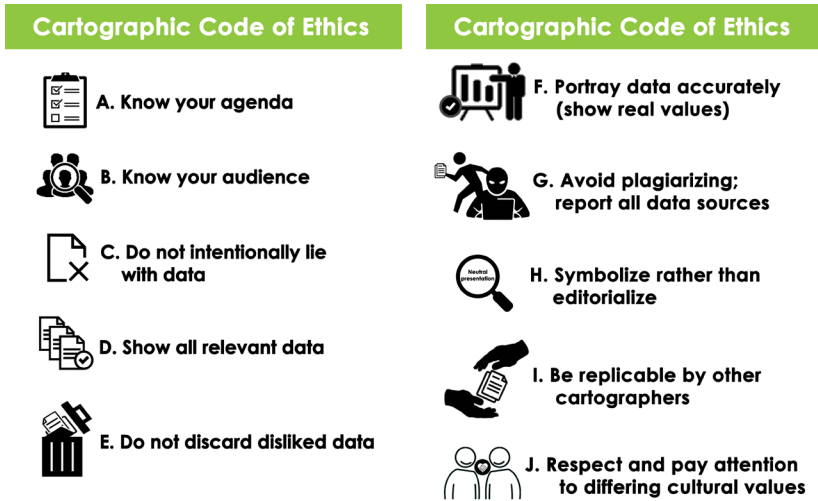


Figure 7. Cartographic code of ethics.

Source: Dodge, M., *Cartographic Principle: Map Design*

MAP PRODUCTION

Spatial Data Collection

Map production starts with data collection from their source either a questionnaire or input from an electronic device.

Data capture is the conversion of geographic coordinate data (through field survey using Global Navigation Satellite System (GNSS) device or smartphones with GPS capability) into a computer-readable format.

What is GPS and GNSS?

The wider application of GIS has been accompanied by the development of enabling technologies such as the Global Positioning System (GPS), a satellite-based navigation system made up of a network of satellites that orbit the Earth and send a signal to GPS receivers such as the Garmin Oregon 650, giving a precise location, speed and altitude.

- More than 24 satellites
- 4-12 satellites are always visible above the horizon
- Worldwide coverage
- 24 hours continuous operation

- Radio signal:
 - L1 1575.42 MHz channel
 - L2 1227.6 MHz channel

- Services:
 - L1: public, open
 - L2: military, encrypted

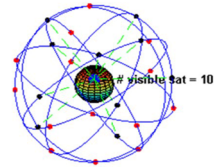


Figure 8. Network of satellites orbiting the Earth.
Source: PAFID (Zingapan, K., 2017)



Figure 9. Global position system receivers.

Since 1983, GPS technology has revolutionized field mapping. Inexpensive GPS receivers can provide reasonably accurate information about the latitude, longitude and altitude of the user's position at anytime and anywhere in the world. GPS methods have been integrated in many applications areas such as forestry, geology and

community development. GPS technology has been widely used worldwide for community mapping, useful for land use planning, and management of natural resources.

Today, the GPS system provides critical positioning capabilities to military, civilians and commercial users. The US government created the system, maintains it, and makes it freely accessible to anyone with a GPS receiver.

Incidentally, the Global Navigation Satellite System (GNSS) was developed by other nations for military services and civilians. The GNSS is essentially a satellite system used to pinpoint the geographic location of a user's receiver across the globe. Hence, there are now more satellites available and enabling positions to be fixed more quickly and accurately other than the GPS developed by the US military.

At present, there are at least six GNSS systems currently in operation. These are the: i) US Global Positioning System (GPS); (ii) Russian Federation's Global Orbiting Navigation Satellite System (GLONASS); (iii) Europe's Galileo; (iv) China's BeiDou Navigation Satellite System now known as Compass; (v) India's Global Indian Navigation System (GINS), and (vi) Japan's Quasi-Zenith Satellite System (QZSS).



Figure 10. Global Navigation Satellite System.
Source: PAFID (Zingapan, K., 2017)

Each of the GNSS system employs a constellation of orbiting satellites working in conjunction with a network of ground stations. GNSS precision varies depending on what particular technologies are being used.

How a typical hand-held GPS works

1. GPS is based on triangulation from satellites. The GPS

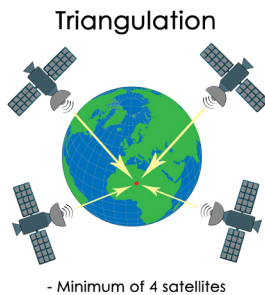


Figure 11. Triangulation of satellites.

adhere to the principle of *triangulation* to locate the user through calculations involving information from a number of satellites. Each satellite transmits coded signals at precise intervals. The receiver converts signal information into position, velocity, and time estimates.

2. GPS receivers measure distance from satellite using travel time of radio signals.
3. To measure travel time, GPS needs precision and accurate timing.
4. Along with distance, the receiver must know exactly where the satellites are in space. Satellite location, high orbits and careful monitoring are the key to get accurate location expressed in Latitude and Longitude.
5. Users must correct any delays the signal experiences as it travels through the atmosphere. A Satellite-Based Augmentation Systems (SBAS) can transmit corrections and integrity data for GPS/GNSS system to improve accuracy to 15 meters.

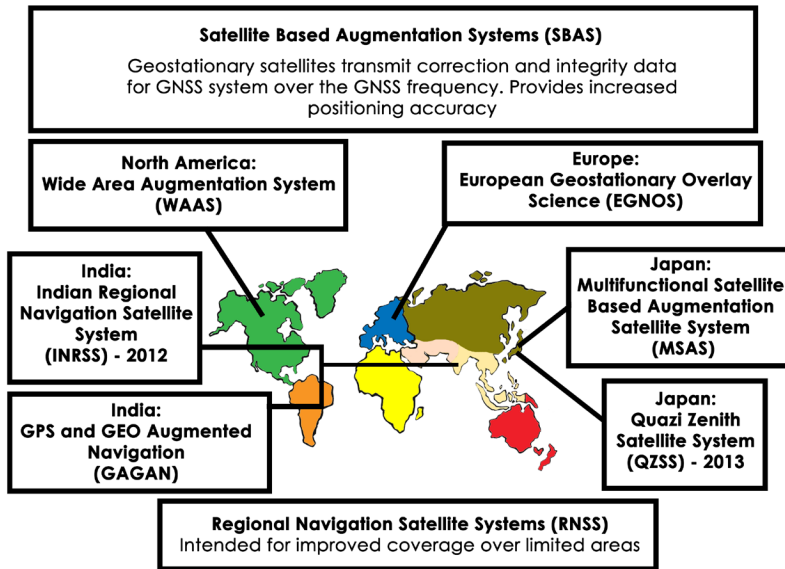


Figure 12. Satellite-based Augmentation Systems.

GPS/GNSS Data Capture using Garmin GPS Receiver: An Example

1. Turn-on the GPS Garmin receiver.
2. The datums and grid preferences can be reached from the main menu by selecting the navigation setup options.
3. Set the navigation datum, the navigation grid, and the user units.
 - For GPS navigation and geophysical use, a datum (such as WGS 84) which is a model of the Earth is used as reference point from which the receiver can measure things.
 - The GPS defines a three-dimensional model that “describes mathematically the shape of the Earth, the location of the center and the location on the surface that represents the starting point for measuring” (DePriest, 2013).
4. In the Application Drawer, select the Satellite icon to open the Satellite Page and wait for the GPS receiver to acquire four or more satellites. Once it finds a position lock, the display will change to show a location (expressed

in degrees Longitude and degrees Latitude), an accuracy estimate, and an elevation.

Once the GPS has a position lock, numbers appear on the top pane of the satellite page (see Figure 13).

- The string of numbers on the top left corner is the GPS measurement for the Latitude of the location, expressed in degrees-minutes-seconds.
- The series of numbers below the Latitude is the GPS measurement for Longitude of the location, also expressed in degrees-minutes-seconds.

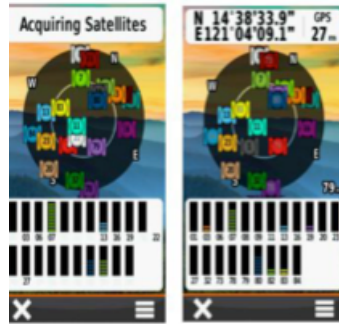


Figure 13. GPS receiver screen showing the satellite page.

5. The number on the upper right corner is an accuracy assessment of the GPS measurement. The number indicates the size of a circle (radius) inside of which the true position lies. A smaller circle indicates a more accurate measurement. Good survey conditions will give an accuracy of 10 meters or less. If possible, wait until the number for GPS accuracy falls to 10 meters or lower before starting the data capture.
6. Capturing locational information in the field is usually done using Waypoints. Mark your waypoints in the Waypoints Page of the GPS receiver, assign a unique name, and click Done.
7. Repeat steps 4 to 6 whenever a data will be captured in specific locations until all spatial data are generated.

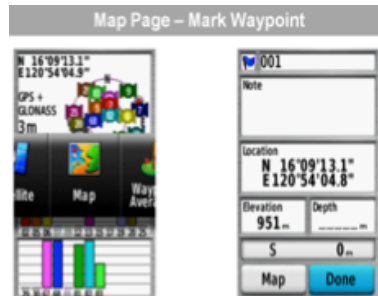



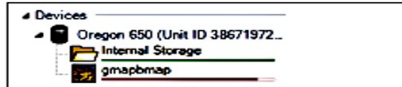


Figure 14. GPS receiver screen showing GPS measurements.

How to download, view and save GPS/GNSS data

Download GPS Data to Computer

1. Plug the GPS receiver in a USB port on the computer
2. Open Garmin in BaseCamp 
3. In the left-hand panel under Devices, select the folder named Internal Storage
4. In the left-hand pane; under Internal Storage, look for the GPS waypoints and tracks you wish to export.
 - Use the Pan and Zoom  buttons to move around the map view
 - To select, click on the Select  button and draw a box surrounding all waypoints and tracks you wish to export
 - For multiple selections, hold down the Ctrl key and click on the names of the GPS waypoints and tracks to be exported



Export as a Garmin GDB file as backup copy of your GPS survey

5. Click on File> Export> Export Selection
 - Select a folder to store your GPS data
 - In the panel for File name, type a name for your survey data
 - In save as type, ensure that Garmin GPS Database Files (*.gdb) is selected
 - Click on Save

Export as a GPS exchange Format (*.gpx) file for viewing in Quantum GIS


6. Ensure that the waypoints and tracks to be exported are still selected
 - Click on File> Export> Export Selection
 - Select the folder for your GPS data archive
 - In the panel for File name, type a name for your survey data
 - In Save as type, ensure that GPS exchange Format (*.gpx) is selected
 - Click on Save

Export as a KML 2.2 Document v2 [*.kml] to view your survey in Google Earth

7. Ensure that the waypoints and tracks to be exported are still selected
 - Click on File> Export> Export Selection

- Select the folder for your GPS data archive
 - In the panel for File name, type a name for your survey data
 - In Save as type, ensure that KML 2.2 Document, v2 (*.kml) is selected
 - Click on save
8. If you wish to export all data inside the GPS receiver, click on File> Export> Internal Storage

View GPS Data in Garmin BaseCamp and Google Earth

9. In the left-hand panel under Internal Storage, right-click on the GPS data you wish to view
- Select Show on Map
 - Use the mouse wheel to zoom in and zoom out of the map
 - Use the Navigation buttons  to pan, zoom and select on the map shown
10. In the left-hand panel for Internal Storage, right-click on the GPS data you wish to view
11. Select Open
- This opens the Properties Page which shows the data for each GPS feature
12. Open Google Earth
- Ensure that the computer is connected to the Internet
 - In Google Earth, click on File> Open and browse to the folder of your GPS data archive
 - Select the KML file for your GPS survey
 - Use the mouse wheel to zoom in and zoom out of the map. Press and hold the Shift key to rotate the view. Press and hold the Ctrl key to tilt the view and show the elevation profile.
 - To reset the view, type 'R' on the keyboard.

MAP DESIGNING

If *Cartography* is the science and art of mapmaking, *Geodesy* is the science of accurately measuring and understanding the Earth's geometric shape, orientation in space, and gravity field. In map designing, the users must bear in mind the following principles as shown in Figure 15.

| 1. GEOGRAPHIC REFERENCE SYSTEM | 2. MAP PROJECTION |
|--|---|
| <ul style="list-style-type: none"> • Maps have a reference grid or coordinate system • Maps have a reference starting point or datum. | <ul style="list-style-type: none"> • Maps are a flat model of a spherical Earth • Objects of the Earth's surface are distorted when a map is projected on a flat surface. |
| 3. MAP SCALE | 4. DESIGN PRINCIPLES AND RULES |
| <ul style="list-style-type: none"> • Maps have strong bearing on GIS analysis • Maps Scale have 3 types: <ol style="list-style-type: none"> 1. Fractional Scale 2. Graphic Scale 3. Verbal Scale | <ul style="list-style-type: none"> • Simplicity • Proximity • Alignment • Repetition • Contrast |

Figure 15. Principles of map designing.

1. Geographic Reference System (GRS)

- The first important spatial concept in mapping technology is to communicate and locate objects using spatial reference system which has the following characteristics: (a) stability, (b) the ability to show points, lines and areas, and (c) the ability to measure length, size and shape (Dale and McLaughlin, 1988).
- GRS has three categories namely: (a) geographical coordinate system, (b) rectangular system, and (c) non-coordinate system.
 - Geographic coordinate systems** – the coordinates of any location on the Earth surface can be defined by latitude and longitude. Lines of longitude, commonly called meridians, are drawn from pole to pole as shown in Figure 16.

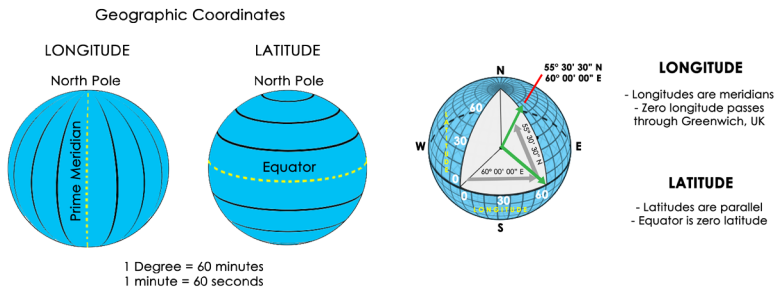


Figure 16. Geographic coordinates system.

Source: PAFID (Zingapan, K., 2017)

The starting point for these lines is called the *prime meridian* that runs through Greenwich, England.

Greenwich meridian – the longitude of reference, i.e., 0° east or west. It passes through the English town of Greenwich, a suburb of London. Basically, the prime meridian is the starting or zero point for angular measurements, east and west. The lines of latitude lie at right angles to lines of longitude, and run parallel to one another. That is, each line of latitude represents the circle rounding the globe.

Greenwich

Latitude

Longitude

Figure 17. Greenwich meridian.

Source: *Geographic Grid* (M. Anji Reddy, 2008)

- b. Rectangular coordinate systems** – most of the spatial data available using GIS are in two-dimensional form. This coordinate referencing system to locate any object point is called rectangular coordinate system.
- c. Non-coordinate systems** – this GRS provides spatial references using a descriptive code rather than a coordinate, such as, postal codes, which are numeric in nature (e.g. UK and Canada postal codes).
 - Maps have a reference starting point otherwise known as a datum.
 - Datums are based on a model of the Earth called a reference ellipsoid and enable all the various

projections in a GIS work together to give an accurate picture of the Earth.

- Datums are a reference surface that is defined by:
 - i. Ellipsoid – described by its origin and coordinate system
 - ii. Survey – a survey of points and lines tying the ellipsoid to point on Earth (e.g. WGS 1984 Datum; Luzon 1911 Datum; Everest 1830 Datum)
- Maps have a reference grid — a geographic data model that represents information as an array of uniform square cells.
- Each grid cell has a numeric value that refers to the actual value of a geographic phenomenon at that location (e.g., population density or temperature) or it indicates a class or category (e.g., the enumeration area identifier or soil type).
- The reference grid helps the user navigate the map and links the spherical earth to the map projection.
- GIS is grid-based technology with the following functionalities as shown in Table 1.

Table 1. GIS functionalities.

| Function Type | Where it operates | What it is used for |
|---------------|--|--|
| Local | On individual grid cells | To change cell values based on user definition or the value of corresponding grid cells on other layers. |
| Focal | On a specifically targeted grid cell | To return a value (such as an average) based on the values of neighbouring grid cells. |
| Zonal | On grid cells in specifically identified regions | To calculate values based on analysis of specified regions that are not necessarily connected. |
| Block | On square blocks of grid cells | To return a value for the identified block (for example, a 4x4 block of cells) on an output grid |
| Global | On the entire grid | To highlight hard-to-find features and spot general trends by moving through the entire grid |
| Specialty | On specified grid cells | To perform high-end statistical analysis or create models for moving surfaces (such as water or pollution) |

Source: DeMers, M., *GIS for Dummies*

2. Map Projection

- Maps are a flat model of a spherical Earth as shown in Figure 18.
- In principle, objects of the Earth's surface are distorted when a map is projected on a flat surface either in size, shape or in relative location (Maling, 1980)
- The globe is in 3D and a flat surface is in 2D. All 2D maps have some “distortion”.
- Distortions of areas could lead to incorrect measurements. Hence, map projections are needed so that areas can be preserved.

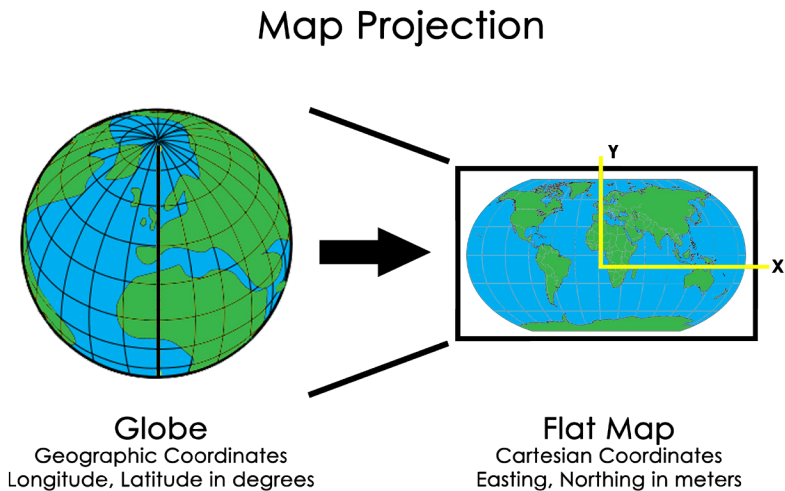


Figure 18. Map Projection.

Source: PAFID, Zingapan, K., 2017)

- There are many types of “Map projections” to try and preserve some of the following:
 - a. Area (e.g. Lambert Azimuthal)
 - b. Angles and bearings (e.g. Mercator projection)
 - c. Shapes and Sizes (e.g. Robinson)
 - d. Distance and Direction (e.g. Sinusoidal)
- To transfer the image of the Earth and its irregularities on to the plane surface of a map, three factors are involved namely:

- a. **Geoid** is a rendition of an irregular spheroidal shape. The variations in gravity are accounted for at this level. The observations made on the geoid are then transferred to a regular geometric reference surface.
 - b. **Ellipsoid or a datum with ellipsoid.** Many countries and organizations have calculated a variety of ellipsoids over the years mainly due to different observations on the geoid from different points upon the Earth.
 - c. **Projection** is the geographical relationships of the ellipsoid, still in a three-dimensional form, are transformed into two-dimensional plane of a map.
- Majority of projections are based upon cones, cylinders and planes as shown in Figure 19.

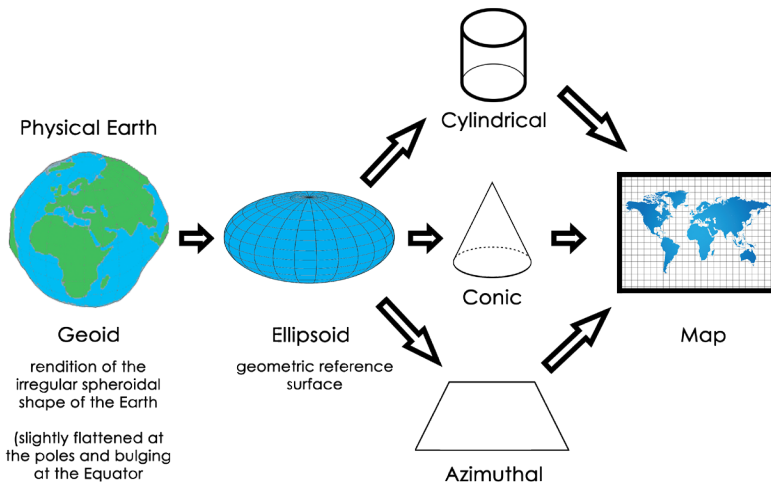


Figure 19. Cones, cylinders, and planes as bases of the majority of projections.
 Source: *Geoid - Ellipsoid - Projection - Relationship* (M. Anji Reddy, 2008)

- Each of these formats have advantages and disadvantages in terms of distortions and accuracy. Every flat map misrepresents the surface of the Earth in some way.
- As a general rule, parts of a map can show one or more, but never all of the following: true shapes, true directions, true distances, and true areas.

3. Map Scale

- Map scale is the ratio between the reduced depiction on the map and the geographical features in the real world.
- Map scales are the ratio of the distance between two points on the map and the corresponding distance on the ground.
- The scale may be expressed in three ways and the pictorial representation are:
 - a. **Fractional scale:** If two points are 1 km apart in the field, they may be represented on the map as separated by some fraction.

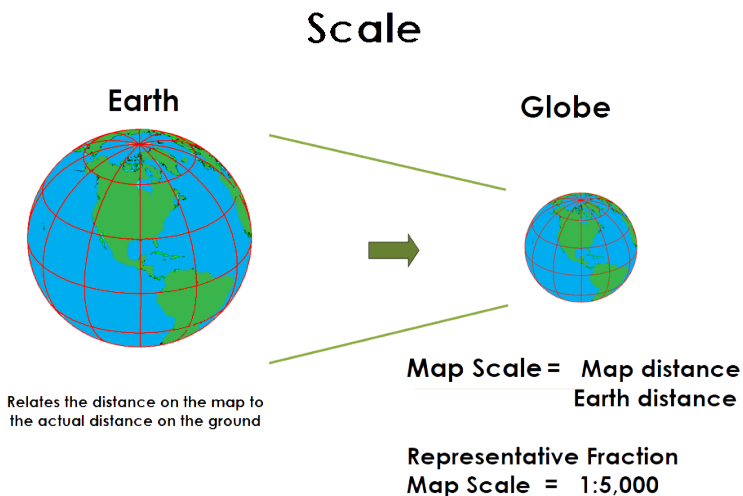


Figure 20. Map scale.

Source: PAFID (Zingapan, K., 2017)

- b. **Graphic scale:** This scale is a line printed on the map and divided into units that are equivalent to some distance.
 - c. **Verbal scale:** This is an expression in common speech such as “four centimeters to a kilometer” and “an inch to a mile”. This common method of expressing a scale has the advantage of being easily understood by most map users.
- To calculate scale, use the following formula: map scale = map distance/Earth distance

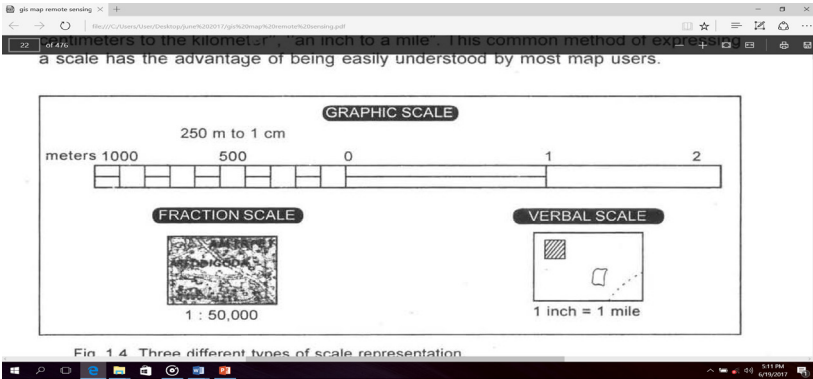


Figure 21. Graphic scale

Source: Three Different Types of Scale (M. Anji Reddy, 2008)

- Remember to convert everything into the same units. Then convert back to what you were asked.
- Map scale has a huge impact on GIS analysis.
- Maps are broadly classified on the basis of two criteria namely:
 - a. **Scale**
 - Small-scale maps cover large areas with little detail e.g. A world map. Scale - 1:250 000
 - Large-scale maps cover small areas with lots of detail e.g. A map of Toronto. Scale - 1:50 000
 - b. **Contents and purpose** in terms of thematic contents
 - Physical maps considered as small-scale maps, or cultural map
 - Thematic maps like vegetation maps, transportation maps, land use land cover maps, and remotely sensed imagery

4. Design Principles and Rules

Table 2. Design principles and rules

| Design Principles | Rules |
|-------------------|--|
| Simplicity | <ul style="list-style-type: none">• Harmonious arrangement• Balance presentation, no space is wasted• Observe neatness• Achieving visual hierarchy• Be legible using 1-2 fonts only unless necessary |
| Proximity | <ul style="list-style-type: none">• When objects are near one another, they become a visual unit.• Proximity's basic purpose is organization• Good use of proximity produces good white space• Limit number of visual units on page• Don't stick things in corners and middle• Avoid leaving exactly equal amounts of white space between objects unless part of a subset• Allow no confusion about what goes with what• Don't create relationships between things that are not related |
| Alignment | <ul style="list-style-type: none">• Alignment helps tie together the elements that make up a page• Avoid mixing text alignments on same page• Always choose centered alignments consciously, never by default• Always find something else on the page to align each new element with |
| Repetition | <ul style="list-style-type: none">• Find existing repetitions and strengthen them; avoid overdoing it• Unifies piece• Keeps reader's eye on the page |
| Contrast | <ul style="list-style-type: none">• Keep contrast in mind• Creates interesting page. Adds to organization. Must support intended focus, not create new ones.• Avoid using two typefaces that are similar. If they are not exactly the same, they should be different. Don't mix brown text with black titles |

Source: Dodge, M., *Cartographic Principle: Map Design*

USING AVAILABLE OPEN SOURCE GIS SOFTWARE

In the past, the cost of GIS Software often discourages land rights defenders from digitizing critical spatial information. Today, various open source GIS software are available for free for land rights defenders allowing them to develop GIS databases of the maps of their community partners. One of the more popular open source GIS software is Quantum GIS (QGIS).

What is QGIS?

Quantum GIS (QGIS) is a user friendly Open Source Geographic Information System (GIS) that runs on Linux, Unix, Mac OSX, and Windows. QGIS supports vector, raster, and database formats. It lets the user to browse and create map data on their computer. It supports many common spatial data formats (e.g. ESRI shapefile, geotiff). QGIS supports plug-ins to do things like display tracks from the GPS units. QGIS is a free downloadable Open Source software.

QGIS is an operating system designed to capture, store, manage, manipulate, visualize, model, analyze, and display spatial data. It is an enabling tool that support GIS as an integrating technology that provides a platform for studying spatial relationships. It makes connections between activities based on geographic proximity that had often been unrecognized. Lastly, it offers new insights and explanations that are vital to understanding and managing resources (Goodchild and Kemp, 1990; Cowen, 1990).

Database management and data processing of spatial information can now be easily processed using QGIS.

Data Base Management refers to unique issues in the maintenance of spatial data such as technical error or level of accuracy, input, and storing data; retrieving data; and metadata. Data management is one of the key issues in determining the usability of spatial data. The application of QGIS software has been used by PAFID for many years.

Another important operation is *Data Processing* which is the restructuring of data to increase their usefulness and add values for particular purpose. It involves calculation, analysis, comparison, data manipulation, sorting, searching, and transformation of data. Some of its important functions are summarizing, computing averages, graphing, creating charts and visualizing data. When answering questions that may not be explicitly stated in the data, this is called data analysis.

Relevance of QGIS

QGIS is used for solving complex planning and management problems because it has the ability to investigate in terms of: (a) **Locations** – “where”, overlaps; (b) **Quantities** – “what”, lengths and areas, most and least; (c) **Distances** – scoping, proximity; (d) **Distributions or densities** – clustering, hotspots; (e) **Discern Patterns** – correlation, causality, random; (f) **Trends** – monitoring change or behavior through time, movement; and (g) **Models** – “what if”, scenarios, decision support systems. Hence, the QGIS can be applied in different fields, to wit:

- Medicine – origin case of GIS analysis
- Navigation – airplanes, cars, shipping
- Hazards – risk, vulnerability
- Networks – streets, electricity, transport
- Land-use planning and land management
- Conservation
- Natural resources management – one of the first applications and driver of the development of modern GIS

Many governments in different countries across the globe are maintaining huge geographic database for analysis and make such information open to public use.

QGIS can process geographic data from a variety of sources and integrate it into a map project which is interactive. On the computer screen, map users can data capture from the field using GPS Garmin receiver that provide spatial location. It can scan a map in any direction, zoom in or out, and change the nature of the information contained in the map. It organizes geographic data so that the user reading a map can select necessary data for a specific project or task. A thematic map has a table of contents that allows the reader to add layers of information to a base map of real-world locations.

An important skill that land defenders should possess is the ability to validate the veracity of the tenurial instruments issued to them.

Conflicts arise among various claimants regarding the actual location of the awarded lands. Often, the lack of spatial information exacerbates conflicts among stakeholders on ground. Hence, it is important that basic sectors have the ability to verify the information indicated in the formal instruments, for instance, the Certificate of Land Ownership Award (CLOA)¹, they have received from the government.

One way of validation is by plotting the lot description of a CLOA Transfer Certificate Title (TCT)² in a map using GIS.

Plotting CLOA

The following exercise was based on the actual CLOA. However, for security reasons, some elements of the map were replaced with fictitious names.

EXERCISE: CLOA TCT

Objective: To plot a CLOA TCT lot description

Research

1. Study the CLOA TCT document
2. Find the general area where the CLOA is located:
 - Province
 - Municipality
3. Find the name of the “Tie Point”
 - The “Tie Point” is a named *muhon* or geodetic monument used to locate the CLOA TCT boundary corner marked “1” or Corner “1”. Tie Points are often Bureau of Land Location Monuments (BLLM), Barrio Boundary Monuments (BBM), Municipal Boundary Monuments (MBM), PRS92 monuments, and others. These monuments are often named with Cadastre Numbers.

¹ A CLOA is a tenurial instrument issued by the Department of Agrarian Reform (DAR) to landless farmers.

² TCT is a document issued by the Registry of Deeds (ROD) that will process the generation of CLOA. It contains the geophysical location, measurement, registration number, and name of the owner of the land to whom its ownership was transferred to from the Republic of the Philippines.

4. Find the technical description of the “Tie Line” that connects Corner “1” of the CLOA to the “Tie Point” or named *muhon*:
 - Bearing in degrees, for example, N25°25’W
 - Distance in meters
5. Find the technical description of the CLOA boundary lines connecting the CLOA boundary corners:
 - Bearing in degrees
 - Distance in meters

PPCS-TM Zone or Projection Number

Refer to Annex 7 of DENR Memorandum Circular 2010-16 Manual on Land Surveys.

- Note the province where the CLOA TCT is located
- Check the PPCS-TM Zone for the CLOA TCT technical description

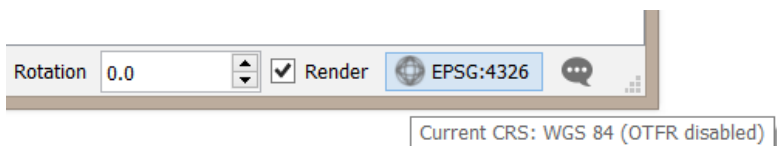
PRS92 Certification of Tie Point Coordinates

Go to the DENR Regional Office Land Management Service and request a PRS92 Certification for the CLOA TCT “Tie Point”. The Certification must show the following (sample attached):

- The name of the “Tie Point”
- The PRS92 coordinates of the “Tie Point” expressed as longitude and latitude in degrees, minutes, and seconds; and ellipsoidal height or height above the PRS92 ellipsoid (HAE) in meters
- The PRS92 coordinates of the “Tie Point” expressed as eastings and northings in meters; and geoidal height or mean sea level (MSL) in meters
- Certificate data and place; and name and signature of certifying officer

QGIS Settings

1. Open Quantum GIS. In the lower right corner, click on the Coordinate Reference System (CRS) icon



2. Set the following:
 - Check the box next to ‘Enable on the fly’ CRS transformation
 - Next to ‘Filter’, type PRS92
 - From the research, select the correct PPCS-TM Zone for the CLOA TCT, for example, PRS92 / Philippines zone 4 (EPSG: 4324)
 - Click OK

3. In the main menu, click on Settings > Options and select the Digitizing tab
4. Set the following:
 - Feature creation*
 - Uncheck the box next to 'Suppress attributes pop-up windows after each created feature'
 - Rubberband*
 - Line width = 1
 - Snapping*
 - Default snap mode: To vertex
 - Default snapping tolerance: 50 pixels
 - Search radius for vertex edits: 10 pixels
 - Vertex markers*
 - Check the box next to 'Show markers only for selected features'
5. In the main menu, click on Settings > Snapping Options
 - Set the Snapping mode to All layers
 - Check the box next to 'Enable topological editing'
 - Click OK
6. Ensure that the following Plugins are installed:
 - Azimuth and Distance version 0.9.3
 - QuickMapServices
7. Save your QGIS file by clicking on Project> Save in the main menu

Prepare the traverse import text file

1. Refer to the PRS92 Certification of Tie Point Coordinates
 - It is important for land rights defenders to possess the CLOA TCT as it provides the coordinates of the location of the awarded land. It must also be ensured that the document is validated by the government seal (see Annex A for a sample Certification of Tie Point Coordinates).
 - Note the coordinates for the Tie Point of the CLOA TCT (see Figure 24):

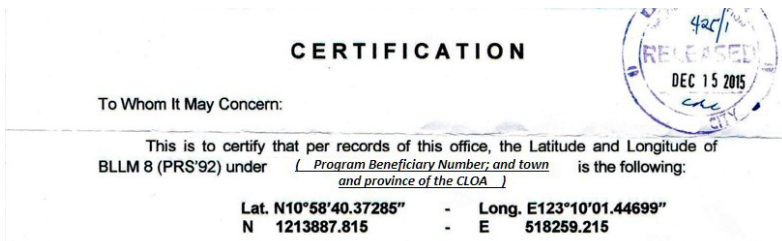


Figure 24. Portion of the PRS92 Certification of Tie Point Coordinates showing the coordinates of the CLOA TCT.

2. Following is a sample lot technical description of a CLOA TCT :

TECHNICAL DESCRIPTION

Tie Line From BLLM No. 8, (*Cadastre Number; and the town and province of the CLOA*)
 to Corner "1" of TCT No. (*Transfer of Certificate Title Number*)

0 - 1 **N25°25'W** **1305.31**

| LINES | BEARINGS | DISTANCES |
|-------|----------|-----------|
| 1 - 2 | N19°03'E | 66.84 |
| 2 - 3 | N34°37'E | 138.97 |
| 3 - 4 | S75°25'E | 228.00 |
| 4 - 5 | S15°32'W | 189.36 |
| 5 - 1 | N77°03'W | 277.80 |

Figure 25. Sample lot technical description of a CLOA TCT.

- Type the technical description of the “Tie Line” and CLOA boundary lines in an Excel file using the following columns:

| Tie Line and Boundary Lines | North Or South | Bearing Degrees, | Bearing Minutes, | Bearing Seconds, | East Or West | Distance, meters |
|-----------------------------|----------------|------------------|------------------|------------------|--------------|------------------|
|-----------------------------|----------------|------------------|------------------|------------------|--------------|------------------|

| | | | | | | |
|---|---|----|----|---|---|---------|
| “Tie Line” : “Tie Point” to Corner “1” | | | | | | |
| 0-1 | N | 25 | 25 | 0 | E | 1305.31 |
| 1-2 | N | 19 | 3 | 0 | E | 66.84 |
| 2-3 | N | 34 | 37 | 0 | E | 138.97 |
| 3-4 | S | 75 | 25 | 0 | E | 228 |
| 4-5 | S | 15 | 32 | 0 | W | 189.36 |
| 5-1 | N | 77 | 3 | 0 | W | 277.8 |

- Below is a sample of the traverse format used by the QGIS Azimuth Distance Calculator Plugin:

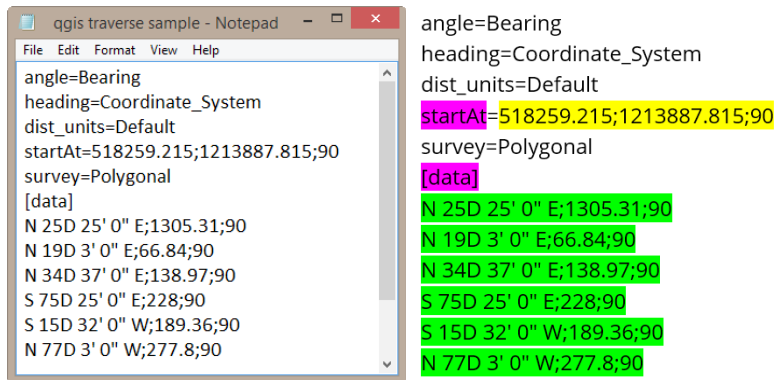


Figure 26. Sample traverse format used by the QGIS Azimuth Distance Calculator Plugin.

- Use a text editor like Notepad to reformat the technical description for the Azimuth Distance Calculator Plugin. Copy the coordinates of the "Tie Point" (Corner 0) in the line after 'startAt='

startAt=TiePoint-X-Easting; TiePoint-Y-Northing;90
 for example,
 startAt=518259.215; 1213887.815;90

- The lot descriptions are also reformatted and inserted under [data] as below:

[data]
 NorthOrSouth Bearing-DegreesD Bearing-Minutes'
 Bearing-Second" EastOrWest;Distance;90

for example,
 [data]
 N 25D 25' 0" E;1305.31;90

In the Excel file for the technical description of the Tie Line and Boundary Lines, the CONCATENATE function can be used to reformat the technical description, as below:

=CONCATENATE(NorthOrSouth," ",
 Bearing-Degrees,"D ",Bearing-Minutes,"' ",Bearing-Seconds,"''"
 ",EastOrWest,";",Distance,";90")

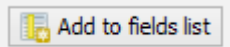
- Alternatively, use the Excel file 'QGIS traverse calculator template' to reformat the entries for:
 - startAt
 - [data]

- Copy-paste the entries into the Notepad file 'QGIS traverse blank form' and 'Save-As' the TCT traverse data to a new text file before closing Notepad. Ensure that no blank spaces follow the entries.

Create an empty polygon shapefile

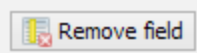


- In QGIS, click on the New Shapefile Layer and use the following settings:
 - Type : Polygon
 - Check that the Selected CRS is the PRS92 PPCS-TM Zone of the CLOA TCT for example, EPSG:3124, PRS92 / Philippines zone 4
 - Below New field, add 8 new fields one after another using the settings below. Click on the 'Add to fields list' button




to add each New field :

| Name | Type | Length | Precision |
|---------------|----------------|--------|-----------|
| Name | Text data | 200 | |
| SurveyPlan | Text data | 50 | |
| LotNumber | Text data | 100 | |
| ClaimNo | Text data | 100 | |
| TCTNo | Text data | 100 | |
| TiePoint-Name | Text data | 100 | |
| AreaSQM | Decimal number | 20 | 15 |



For mistakes, use the Remove field button

- When done, click OK
 - Next to File name, type a file name
 - Next to Save as type, ensure that ESRI Shapefile is selected
 - Click OK
- In the Layers panel, select the new empty polygon shapefile and click on the Toggle Editing button 
 - Click on Plugins> Topography> Azimuth and distance

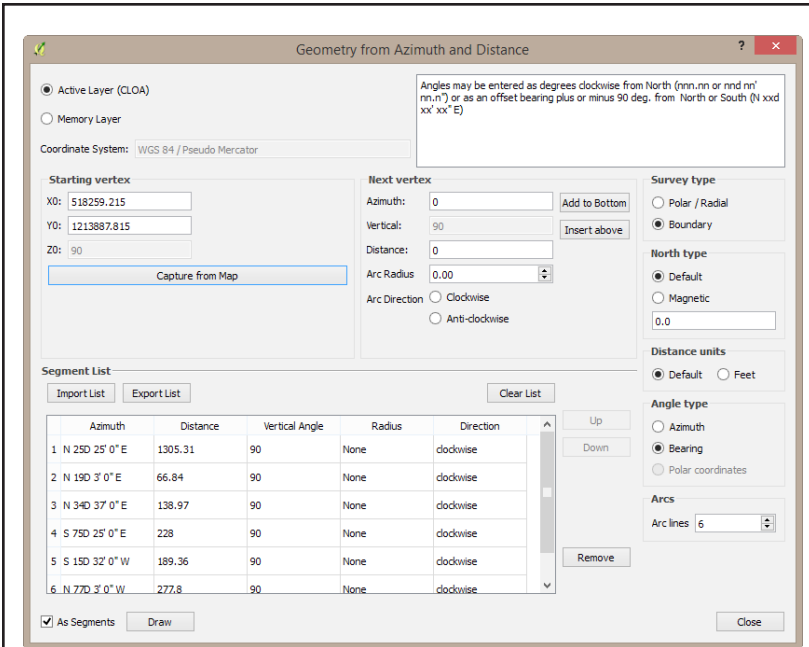
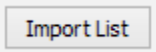
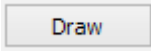


Figure 27. Command box showing the Azimuth and Distance.

4. In the Azimuth and distance plugin, click on the Import List button






- Select the Notepad file of the reformatted CLOA lot technical description and click Open
- Check on the box next to 'As Segments'
- Below 'Survey type', check that 'Boundary' is selected
- Next to Arc Direction, select 'Clockwise'
- Below 'North type', select 'Default'
- Below 'Distance units', select 'Default'
- Below Angle type', select 'Bearing'



- Click on the Draw button
- Fill up the data for the TCT in the pop-up form and click OK
- Close the Azimuth and Distance plugin

5. Click on Settings> Snapping Options and use the following settings:

- Layer selection : Advanced
- Ensure the box next to the CLOA polygon layer is checked
- Set the snap mode to vertex
- Check that tolerance is set to 50 pixels
- Check that 'Enable topological editing' is enabled
- Check that 'Enable snapping on intersection' is enabled
- Click Ok

6. On the Attributes toolbar, click on the 'Select Features' button  and select the CLOA lot
7. On the Digitizing toolbar, click on the Node tool 
 - Click the Node tool on the CLOA polygon until the Vertex editor pane is displayed. Use the Node tool or the Vertex Editor pane to select the nodes or vertices of the CLOA polygon.
 - In the Vertex Editor pane, note the coordinates for the "Tie Point" or Corner 0 and the CLOA Corner "1" which are entered in row 0 and row 1, respectively
 - In the Vertex Editor pane, select Corner 0 and press 'Delete' on the keyboard to delete the Tie Point
 - Check that the coordinates for the CLOA TCT Corner "1" are now displayed in row 0 of the Vertex Editor pane
 - In the Map Navigation toolbar, click on the 'Pan' and 'Zoom In' buttons to zoom in on TCT Corner "1" which should now be displayed as row 0 in the Vertex Editor pane.
 - On the Digitizing toolbar, click on the Node tool  and click on the CLOA polygon until the Vertex Editor pane is again displayed
 - In the Vertex Editor pane, check that the coordinates in the last row are identical to the coordinates of CLOA Corner "1"
 - In the Vertex Editor pane, select the second-to-the-last row and press 'Delete' on the keyboard to delete the point (see Figure 28):

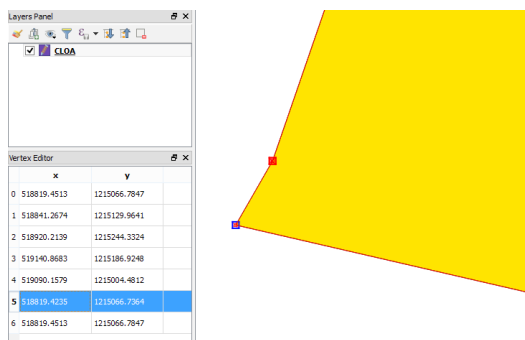






Figure 28. QGIS workspace showing the Vertex Editor pane.

- Once finished, click on the Save edits button  to save your edits

Calculate the area of the CLOA TCT

1. Right-click on the polygon layer and select 'Open Attribute Table'
 - Click on the Field Calculator button 
 - Check 'Update existing field' and in the box below, select

AreaSQM

- Under the Search box, click Geometry and double-click on area
- Click OK
- Click on the Save edits button  to save your edits, then click on Toggle Editing button  to close the editing session

2. Click on Web> QuickMapServices>Google and select Google Satellite

3. Use the Print Composer to create a CLOA map and save your QGIS document before closing QGIS.

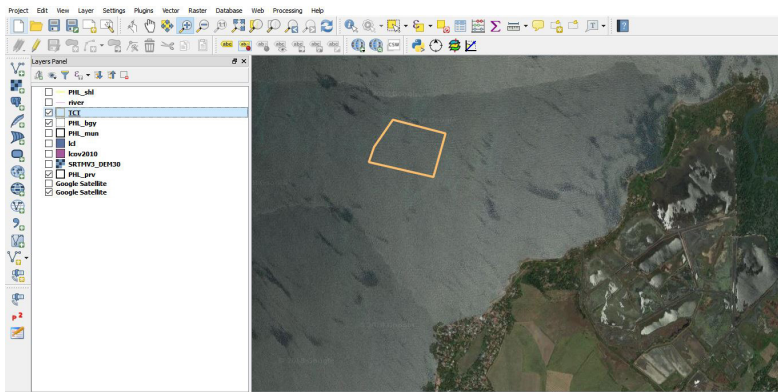


Figure 29. Overlaying the plotted polygon in the Google Satellite Imagery.

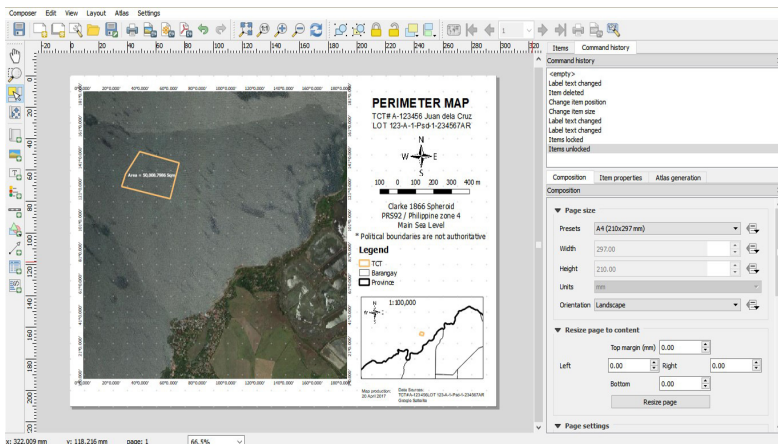


Figure 30. Creating the CLOA map in the 'Print Composer'.

Data Output – refers to the method used to visually display analysis performed using GIS. Output can take many forms such as text, sound, tables of data, graphs, commands, etc. Depending on the form of output required, the data can be transmitted by a range of devices for presentation.

Digital Map Production is a graphic representation or scale model of spatial concepts. It is a means for conveying geographic information. Figure 31 shows a sample Perimeter Map produced by Ms. Naungayan during a four-day GIS Training last April 16-19, 2017 held at Brentwood Suite in Quezon City. The GIS Training was jointly organized by PAFID and ANGOC.

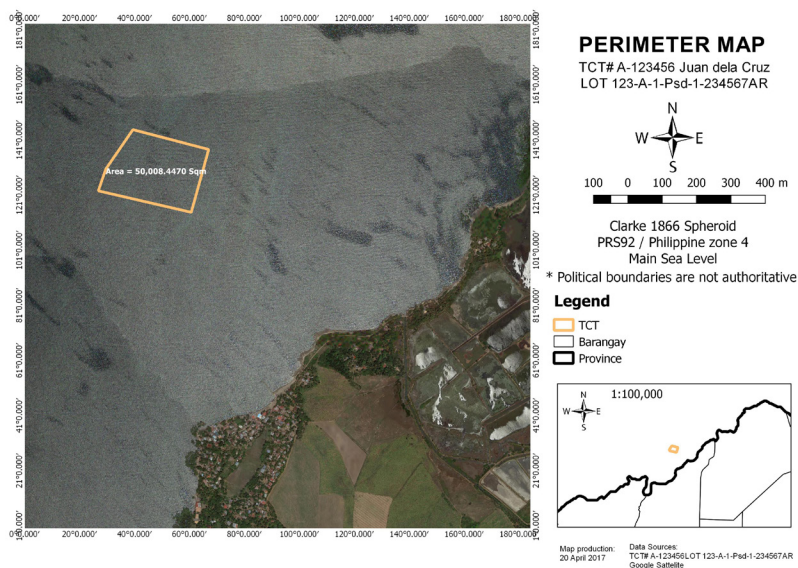


Figure 31. Sample Perimeter Map.

It is important that the output map be shown and validated with the farmer owners, and check whether the actual location of the CLOA is consistent with the coordinates indicated in the TCT.

In the example above, the CLOA is erroneously located in the ocean instead on land, showing an erroneous survey.

Rhind (1977) enumerated several good reasons for computer map production, to wit:

- To make existing maps more at a quicker pace.
- To make existing maps at a cheaper rate.
- To make maps for specific user needs.
- To make map production possible in situations where skilled staff are unavailable.
- To allow experimentation with different graphical representations of the same data.
- To facilitate map making and updating when the data are already in digital form.
- To facilitate analysis of data that demand interaction between statistical analysis and mapping.
- To minimize the use of the printed map as a data store and thereby to minimize the effects of classification and generalization on the quality of the data.
- To create maps like the 3-D type.
- To create maps in which selection and generalization procedures are explicitly defined and consistently executed.
- Introduction of automation can lead to a review of the whole map-making process, which can also lead to savings and improvements.

Source: (M. Anji Reddy, 2008)

Moreover, converting the analog map to digital form is either by manual digitization or by scanning. Manual digitization is the commonly used technique for including analog data in a digital database.

A case of local map production by the Subanen community in Bayog, Zamboanga del Norte, Philippines

Introduction

Just like most Indigenous communities in Mindanao, the Subanen community in the Municipality of Bayog, Zamboanga Del Norte faces numerous challenges that threaten the integrity of their environment. Illegal gold mining activities in the town of Bayog have been going on for the past 45 years and small-scale miners have illegally claimed hundreds of hectares of lands, leading to tremendous environment pollution. The illegal miners used cyanide, nitric acid, and other hazardous chemicals including mercury to process the gold ore. Tons of cyanide and mercury-laden mine wastes flow out freely from shallow ponds dug by the illegal miners damaging hundreds of hectares of fertile farmlands. What was even worse was the fact that the unabated illegal mining activities resulted into over 100 tunnels, which crisscrossed beneath the surface of the gold-rich mountains in the Subanen Ancestral Domain.

In 2006, in order to safeguard what remains of their traditional lands, the tribe submitted the application for a Certificate of Ancestral Domain Claim (CADC) covering land located in this town to the National Commission on Indigenous People's (NCIP). The application covered 22 barangays in Bayog: Dimalinao, Boboan, Depore, Pulangbato, Dipili, Kahayagan, Liba, Conacon, Bantal, Boboan, Deporehan, Sigacad, Balukbuhan, Matin-ao, Datagan, Camp Blessing, Kanipaan, Bonbonan, Depase, Matun-og, Baking and Canoayan. The Subanen knew that the road ahead would not



Figure 22. Map showing the Municipality of Bayog, Zamboanga Del Norte, Philippines.

be easy and they will have to respond to the challenges posed by those who had vested interests over their lands.

To strengthen their advocacy for the recognition of their rights over their ancestral domains, the Subanen elders needed to produce evidence. The Subanen also needed to inform the public of the dangers posed by the illegal mining activities of the various ecosystems in the municipality.

Mapping their Territory

With assistance from PAFID, the community constructed a Participatory 3D-Model. Through the P3DM, community members were able to generate spatial information on the extents of their traditional territory, their traditional management zones and land-uses of the Subanen domain. Furthermore, they were able to analyze and show the impacts of the illegal mining activities in their ancestral lands.



While the P3DM provided an excellent venue for the Subanen community to generate, analyze and present the state of their territory, the spatial information produced by the P3DM needed to be digitized and to be further analyzed in order for the Subanen to produce data and maps critical to

their advocacy. Hence, it was decided that a training on the use of Quantum GIS an Open Source GIS Software would be conducted. Participants representing the villages in the domain claim would be nominated by the community. Initially, the trainees doubted their ability to cope with the demands of the training. They cited their limited educational status and their unfamiliarity with computers and GIS software. Furthermore, they shared the notion that mapping is the exclusive domain of professional engineers and that ordinary folks have no business trying it.

The community nominated five Subanen participants; two NGO participants along with two NCIP trainees joined them. All participants had varying levels of familiarity with information technology as well as educational attainment. The training took a total of 12 days which were broken down into three separate sessions to enable the participants to examine and validate their work with the community using the P3DM. Participants learned how to transfer the information from the P3DM to a digital image and the use of the on-screen digitizing utility of Quantum GIS. Furthermore, they were trained on the basics of map production including Geographic projection and Map layout.

Results

After nearly a month, the Subanen participants were able to produce a complete map layout of their Ancestral Domain. The map had spatial information and thematic layers including hydrology, road networks, management zones, risk areas, the perimeter of the ancestral domain claim, the proposed no-go zones, land-use and land cover. In a General Assembly, the map was later presented to the community members for final editing and validation. With minimal edits and comments, the map was resoundingly approved and endorsed by the community and formally adopted as the accurate and proper representation of their ancestral domains. Copies of the map were formally submitted to the Office of the Mayor, the DENR and other concerned agencies.

In 2015, the Subanen community was invited to participate and present their experience in PGIS in the Regional Conference of

the Catholic Aid for Overseas Development (CAFOD). Copies of their map were prominently displayed in the conference.

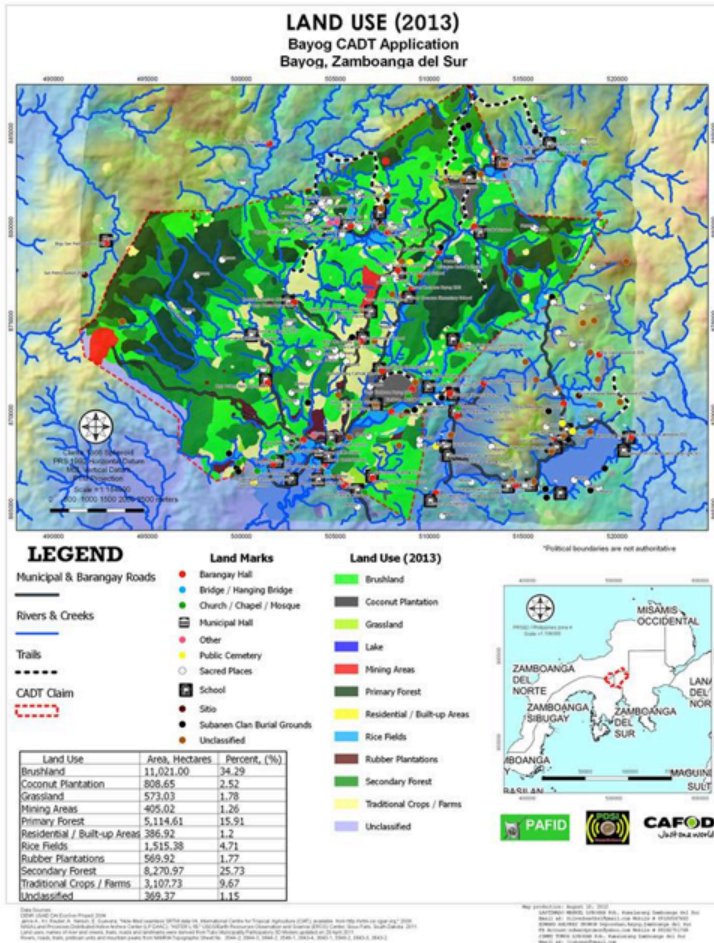


Figure 23. Land Use Map of the Bayog CADT area.

Lessons learned

The Bayog experience clearly showed that ordinary folks can learn basic GIS and will be able to create a simple spatial database and generate maps. Critical factors include that the training is properly designed and the trainers have the proper patience, understanding of the situation and fortitude to conduct the capacity building activity.

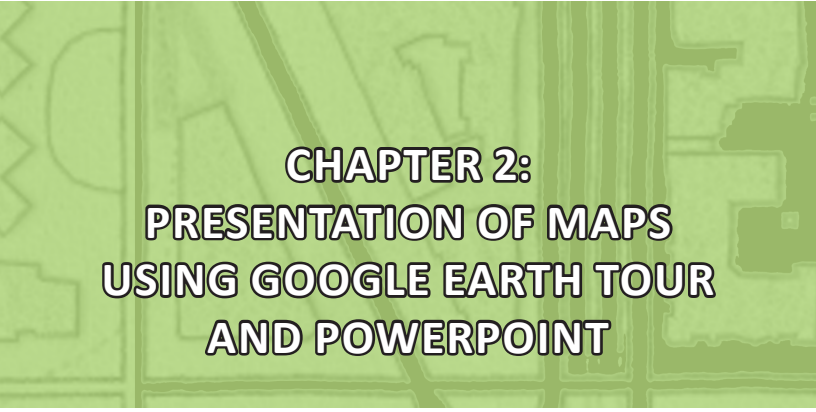
The spread of social media such as Facebook into the rural areas has proven to be very effective breaking barriers and enabled ordinary people to remove their fears of digital technology. This is especially true with the younger generation who are very eager to learn and expand their knowledge in the field of ICT.

The use of the P3DM, along with the upscaling into Quantum GIS, is very sound illustration on the convergence of various PGIS tools and methodologies that can empower the people and increase their capacity to advocate and engage the more powerful sectors of society.

The whole PGIS exercise has enabled the Subanen to learn new technologies to strengthen their advocacy and has shown the greater public that they are able to adapt new technologies and learn skills that are more complicated. This has resulted into a very noticeable increase in local pride that is clearly shown in their engagements with the government and other sectors of society. They now proudly declare that they are mappers and that they have GIS practitioners in their ranks. ■

CHAPTER 2: PRESENTATION OF MAPS USING GOOGLE EARTH TOUR AND POWERPOINT





CHAPTER 2: PRESENTATION OF MAPS USING GOOGLE EARTH TOUR AND POWERPOINT

With today's technology, advocacy has been evolving creatively and conveniently through the use of different medium. In terms of mapmaking, GIS data can be presented in a more innovative, mobile, and visually compelling form using Google Earth and Microsoft Powerpoint Presentation.

Aside from their user-friendly attributes, both software programs offer basic functions that can be utilized in presenting maps. In terms of availability and accessibility, Google Earth application is downloadable online while Microsoft Powerpoint Presentation is accessible in desktops and laptops that have preinstalled Microsoft Office products. Google Earth is popular among mapmakers since it has advantages over some mapmaking methods. Google Earth gives instant up-to-date map data with three-dimensional visuals that are extremely detailed. It is available on a wide array of devices and in 45 languages. Lastly, Google Earth and Microsoft Powerpoint Presentation can be embedded in webpages.

Using Google Earth in presenting advocacy map

Google Earth is a well-established, free desktop application that allows users to easily access all information from a three-dimensional map of the world. The kind of information that users can obtain from Google Earth varies, among others, from coordinates, elevation, and

street view of a certain location which also includes photos, videos, audio, and weather information. These features are utilized by users to create visualizations as a compressed video file or guided tour.

However, the technological barrier across countries affects the quality of images and/or videos that can be viewed in Google Earth. Most developed countries offer more detailed image projections unlike other countries that have not obtained certain advancements in GIS.

Google Earth is suited for advocacy maps simply because it has a *history imagery* feature. Historical imagery is used to see and analyze the changes happened and/or made over time to a certain location especially when observing the effects of a natural disaster or the evident changes in the landscapes. In addition, Google Earth allows users to render files that can be exported through different social networking sites (SNS).

For advanced features such as GIS data import, it is recommended to use Google Earth Pro.

1. Features and uses of Google Earth

Using Google Earth is relatively simple and easy to navigate. Imagine creating a tour around a specific location. A tour consists of 'Placemarks' or the points of interest (the user can add supplementary information about the placemark). These Placemarks are either added manually by the user or generated by Google Earth using 'Geocoding' or importing a list of addresses that determine the Placemarks – allowing the user to create a route to connect all the generated Placemarks which will compose the 'tour.' The tour can be rendered as an audiovisual file.

2. Workspace of Google Earth

On the left side of the workspace, a 'Search bar' is located underneath the 'Menu bar'. The 'Search bar' is used to locate coordinates, states, provinces, cities, and addresses. At the middle upper part of the workspace, the 'Toolbar' can be found and it contains the essential features in creating a tour. Some of the features include placemarks,

polygon, path, image overlay, and record a tour, among others. On the right side of the workspace, the user can find two navigational compass and a 'Zoom' tool. The first compass with an eye icon (Eye altitude) in the middle is used for scouting around the location, while the second compass is used for moving from one location to another. This compass guides the user in navigating through the map. The 'Zoom' tool is used to view a more detailed image projection or to zoom out the map. On the bottom part of the workspace, image date, elevation, and coordinates of the location can be found (See Figure 32). More Google Earth tools and features will be tackled in the next sections.

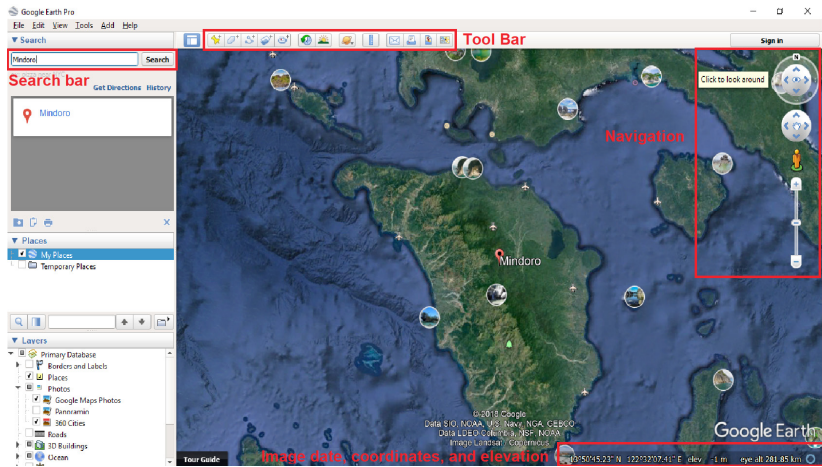


Figure 32: Interface of Google Earth.

3. Historical Imagery

Historical Imagery is a useful tool for advocacy maps especially when forwarding political, social, and environmental issues. This feature allows users to view changes in specific landscape overtime. For example, one can use historical imagery to view the mining activities in Mindoro¹ within a certain timeframe.

¹ For the purpose of this Manual, Mindoro will be used as an example to demonstrate the procedures. Mindoro is located at the southwestern coast of Luzon Island, Philippines and is part of Region IV-B. The province is divided into Occidental Mindoro and Oriental Mindoro. Mindoro is the home of several Mangyan groups and is the cradle of Mt. Halcon and Mt. Basco.

Step 1: In the ‘Search’ text box in the upper left-hand corner, enter ‘Mindoro’ and click ‘Search’ (see Figure 33).

Step 2: After viewing the area, click ‘Show historical imagery’ button in the upper middle area of the screen just above the map (see Figure 33).

Step 3: A scroll bar will appear on the top left of the screen in the map window which will be used to scroll through imagery obtained from specific dates within the preferred timeframe (see Figure 33).

Step 4: Use the imagery to observe, for example, the changes brought about mining activities in Mindoro.

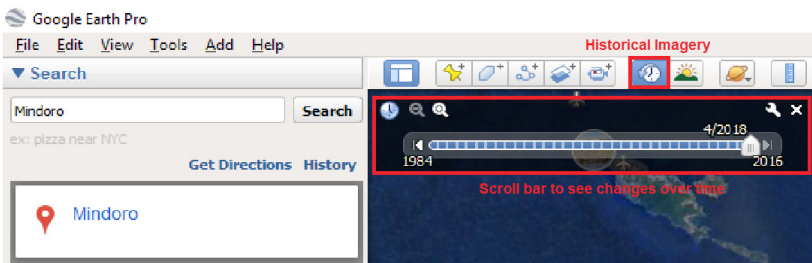


Figure 33: Historical imagery and scroll bar.

4. Creating a Google Earth tour

In creating a guided tour, the following steps are essential to navigate the user accordingly to the chosen point of interest. For the first step, adding placemarks will determine the places to navigate to while embedding information will give context to the added placemarks. Once the placemarks are added along with their information, creating the route will stitch the tour together. To export the finished output, simply record the tour and save.

5. Adding placemark

Placemarks represent points of interest in the tour. Placemarks are vital since they give description of each location which makes up the totality of the tour. Name of placemarks can be edited by the user according to the purpose of the tour.

Step 1: In the 'Search' text box in the upper left-hand corner, enter 'Mindoro' and click 'Search'.

Step 2: Next, click 'Add Placemark button' in the toolbar on the upper middle side of the screen.

Step 3: In the 'Google Earth new placemark' window, select 'Name field' and type 'Point A' (this serves as sample name for the first target placemark); leave the other options as their defaults (see Figure 34).

Step 4: Leaving the window open, position the placemark over the target area. A yellow pin will appear, then drag it to position the 'Point A' placemark (see Figure 34).

Step 5: Click 'OK' to create the placemark.

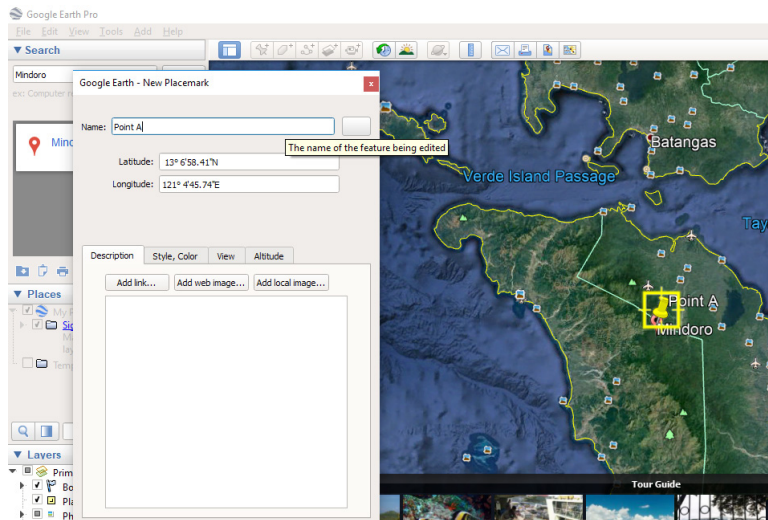


Figure 34. Adding placemark.

NOTE TO THE USER: To change the name, right click on the pin and select 'Rename'. The location can only be modified when the 'Edit Placemark window' is open (see figure 35). To edit placemark, right click on the pin in the map or in the side bar and choose 'Properties' (see Figure 36.1). To select a symbol for placemark, click 'Icon' just on the right side of 'Name field' (see Figure 36.2).

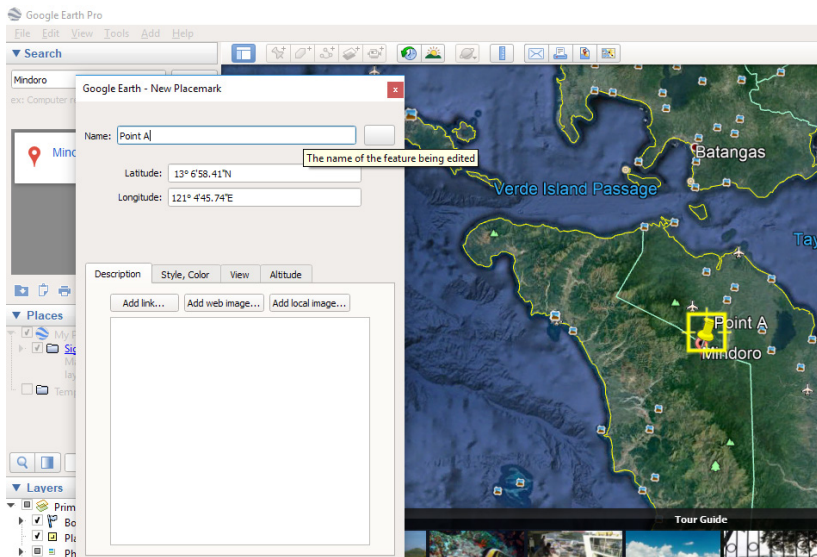


Figure 35. Editing placemark name.

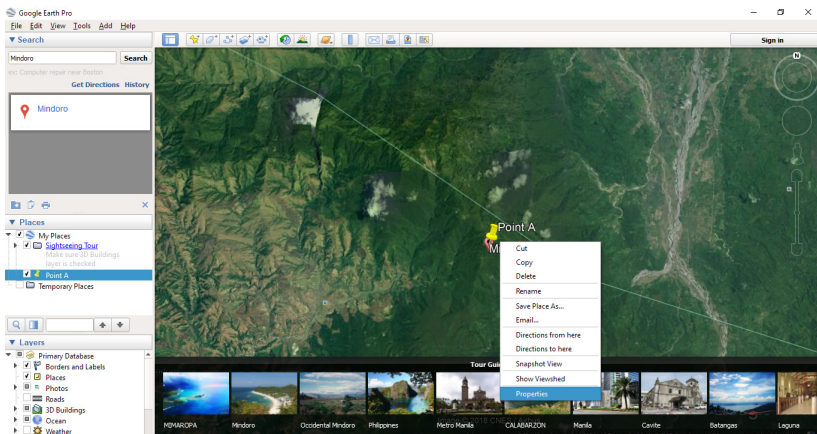


Figure 36.1. Editing placemark properties.

6. Placemark description

The viewer navigating through the tour/map can see displayed information about the placemark by simply clicking the pin. Adding information on the placemark gives context to the viewer about what the tour is all about.

Step 1: To add description, right-click the placemark and choose 'Properties'.

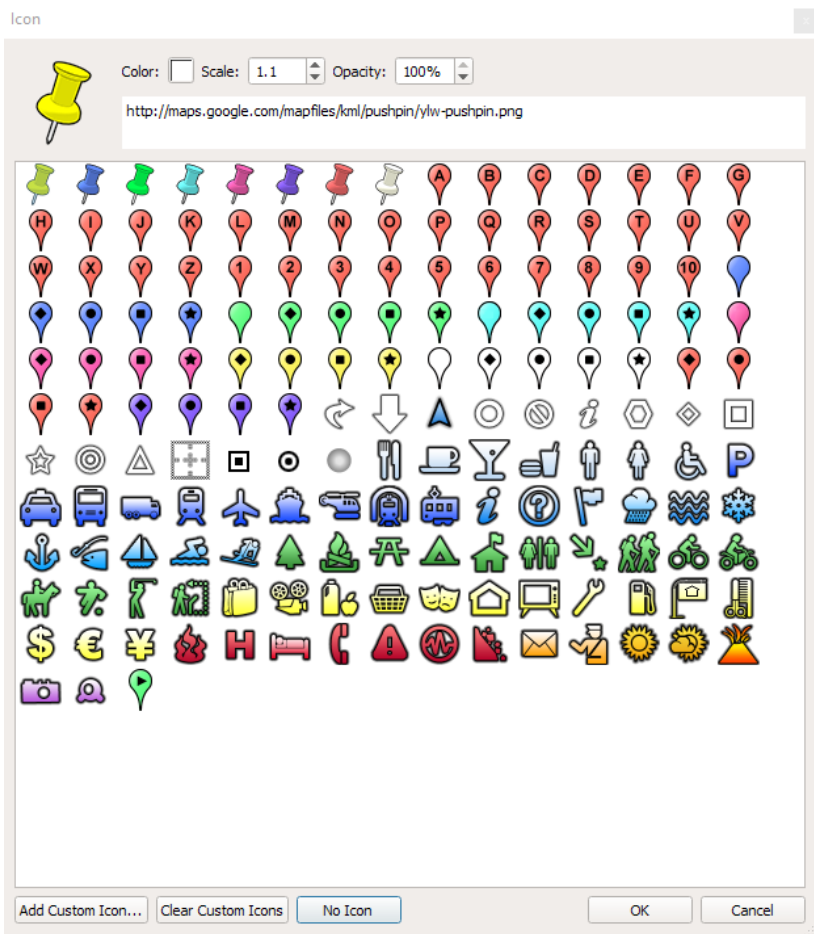


Figure 36.2. Pin Icons.

Step 2: In the 'Edit Placemark window'. click inside the description box and type description/information for 'Point A' (See Figure 37).

Step 3: An image can be added by selecting the 'Add web image button' and paste the URL/Link of the selected image.

7. Embedding information from the computer

Google Earth offers different options for adding images directly from the user's computer. Inserting an image as a different object appears differently from linked images since the image appears to be 'floating' above the Earth's surface. To organize the placemarks and

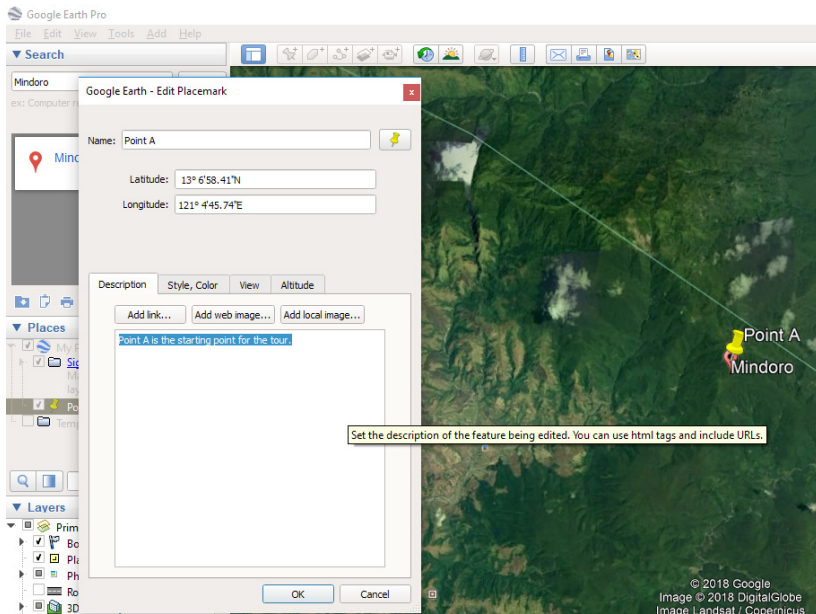


Figure 37. Adding description on placemark.

images, there is an option to create folder to help keep track of the files. The default name of the folder is 'My Places'. This folder collates placemarks, images, and, routes for the tour.

Step 1: Double click on the created 'Point A' placemark. Google Earth will zoom into the view showing 'Point A' placemark on the map. Alternately zoom in and out using '+' and '-'.

Step 2: Add image by clicking on the 'Add' menu and select 'Photo' (see figure 38).

Step 3: Once the 'New photo overlay window' opens, enter the image name. Adjust the image if necessary (see figure 39).

Step 4: Once adjustments has been made, select preferred image then click 'OK'.

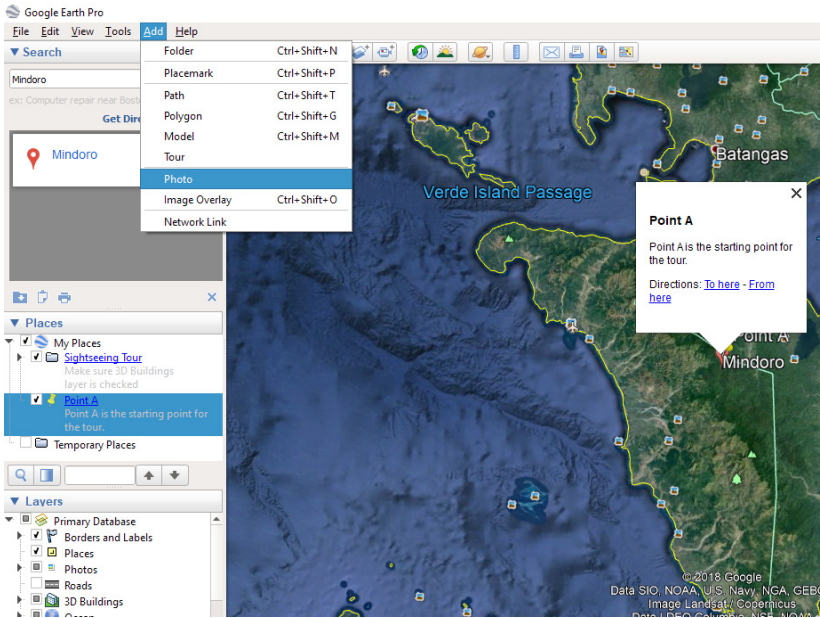


Figure 38. Adding photo on placemark straight from computer.

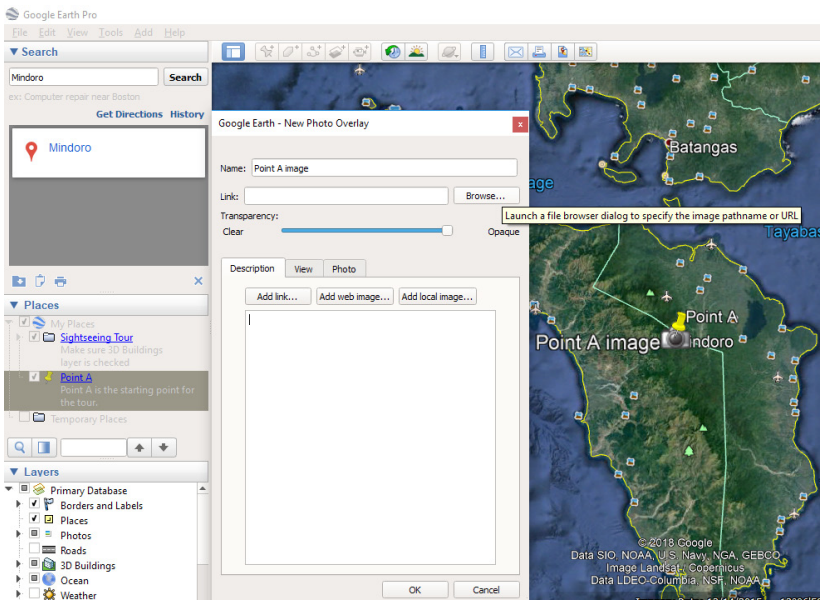


Figure 39. Browsing image file from computer.

NOTE TO THE USER: To keep a placemark and the supplementary images together and separate from other placemarks, create a subfolder under 'My Places'. To create a new folder, click on the 'Add' menu and choose 'Folder'. Once the 'New folder window' opens, rename the folder to 'Sightseeing Tour' (this serves as sample name of the subfolder for 'My Places' folder) (see Figure 40). When the new folder is created, drag 'Point A' placemark and its supplementary image into the folder.

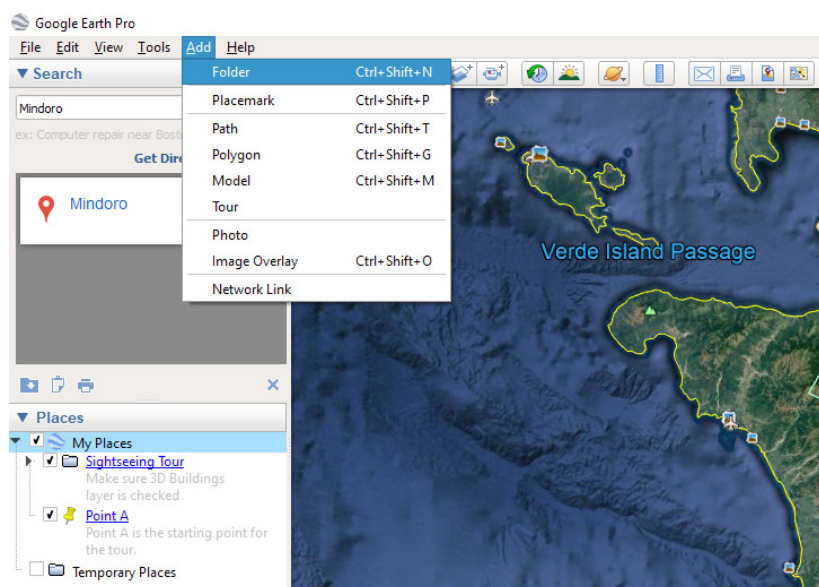


Figure 40. Creating subfolders to organize images and description per placemark.

In creating a tour, the user will need to add more placemarks. For example, the user will add 'Point B' placemark and 'Point C' placemark. This time, these placemarks will be added via 'Geocoding'. 'Geocoding' converts tabular data such as street addresses or longitude and latitude coordinates into georeferenced points which can be easily mapped.

Using longitude and latitude coordinates

Step 1: On the menu bar, click 'File' then 'Import' (see Figure 41).

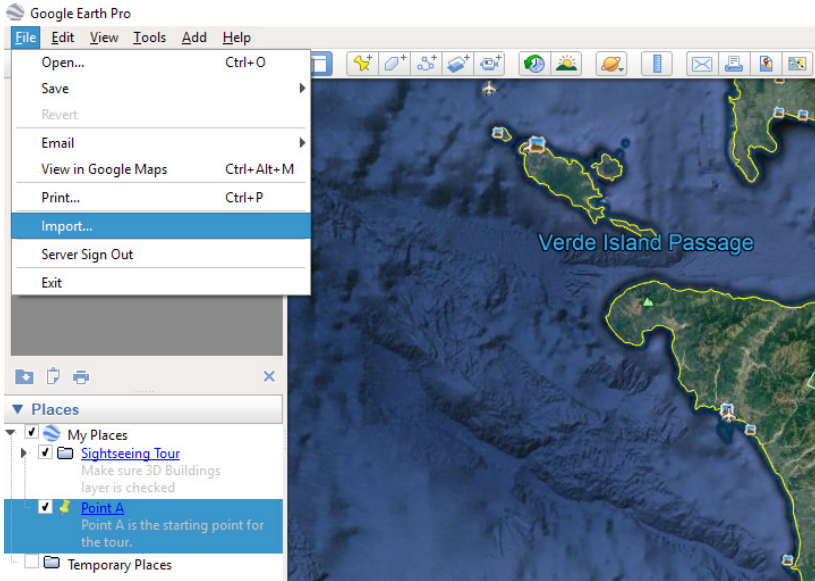


Figure 41. Importing CSV file for 'Geocoding'.

Step 2: Browse for the CSV file to be imported and click 'Open'.

Step 3: Once a box appeared, choose 'Delimited' located next to 'Field Type'.

Step 4: Choose 'Comma' then use the 'Preview pane' to ensure that imported data are correct and click 'Next'.

Step 5: Uncheck the box which indicates "This dataset does not contain latitude/longitude information."

Step 6: Select the fields in your spreadsheet that contain the 'Latitude and Longitude data' (see figure 42.1) and click 'Next'.
Optional: Specify the type of each field in your dataset.

| A | B | C | D |
|-------------|-----------------|------------------|------------------|
| Name | Latitude | Longitude | Elevation |
| Point A | 13.233471 | 121.004838 | 3451.45 |
| Point B | 13.308212 | 121.076505 | 105.93 |
| Point C | 13.398408 | 121.128078 | 22.46 |

Figure 42.1. Sample CSV file which contains the coordinates

Step 7: Click ‘Finish’. Google Earth begins geocoding your data.

Step 8: To add description and image, simply repeat process in ‘Placemark Description’.

NOTE TO THE USER: When entering longitude and latitude values, formats varies from DD MM SS.SSS degrees minutes and decimal seconds, DD.DDDD decimal degrees, DD MM.MMMM degrees and decimal minutes. Users can also use N, S, E, and W to specify directions.

Using street addresses

Step 1: On the menu bar, click ‘File’ then ‘Import’.

Step 2: Browse for the CSV file to be imported and click ‘Open’.

| | A | B | C | D | E | F | G | H |
|----|-------|----------------------------|-------------------------------|------------------|-------|-------|---------|----------|
| 1 | Code | Business | Address | City | State | Zip | Integer | Float |
| 2 | WBIS1 | Taxi 9000 | 3750 East Rosser Avenue | Bismarck | ND | 58501 | 3 | 0.5 |
| 3 | WBNA1 | UPS Supply Chain Solutions | 516 Ligon Drive | Nashville | TN | 37204 | 4 | 1.333333 |
| 4 | WCGI1 | Kelly Transportation | 41 N Sprigg Street | Cape Girardeau | MO | 63701 | 1 | 0.2 |
| 5 | WCID1 | Velocity Express | 640 63rd Avenue SW | Cedar Rapids | IA | 52404 | 4 | 1 |
| 6 | WCLE1 | UPS Supply Chain Solutions | 55 Andrews Circle | Brecksville | OH | 44141 | 5 | 1 |
| 7 | WCOS1 | UPS Supply Chain Solutions | 802 W Garden of the Gods Road | Colorado Springs | CO | 80907 | 8 | 2 |
| 8 | WCYS1 | Security Armored Express | 1719 Pacific Avenue | Cheyenne | WY | 82007 | 6 | 2 |
| 9 | WDCA1 | UPS Supply Chain Solutions | 13878 Park Center Road | Herndon | VA | 20171 | 7 | 1.75 |
| 10 | WDEN1 | UPS Supply Chain Solutions | 4401 East 46th Avenue | Denver | CO | 80216 | 8 | 1.6 |
| 11 | WEGU1 | Aero United | 1380 West 2nd Avenue | Eugene | OR | 97402 | 5 | 1.666667 |
| 12 | WHNL1 | UPS Supply Chain Solutions | 449 Cooke Street | Honolulu | HI | 96813 | 9 | 2.25 |
| 13 | WJNU1 | Juneau Couriers | 10155 Jensine Street | Juneau | AK | 99801 | 9 | 1.8 |

Figure 42.2. Sample CSV file which contains the street addresses (Retrieved from Google Earth).

Step 3: Once a box appears, choose ‘Delimited’ located next to ‘Field Type’.

Step 4: Choose ‘Comma’ then use the ‘Preview pane’ to ensure that imported data are correct and click ‘Next’.

Step 5: Check the box which indicates “This dataset does not contain latitude/longitude information.”

Step 6: Select “Addresses are broken into multiple fields.”

Step 7: Review the names to ensure the encoded data are correct under 'Select Address Field(s)' then click 'Next'.

Step 8: Check the list of fields and the type of data selected for each then click 'Back'.

Step 9: Click 'Finish'. Google Earth begins to geocode the data.

Step 10: To use a style template, click 'Yes' then select 'OK'.

NOTE TO THE USER: Address data appear as icon in the 3D viewer and their properties can be edited. *Users can only import addresses located within the United States, United Kingdom, Canada, France, Italy, Germany, and Spain.*

8. Create a route

In creating a tour, the goal is to form a route that connects all placemarks. On the other hand, the 'Direction tool' is used to navigate user from one placemark to another by car, bike, walking, or public transit. Likewise, it can be changed according to the user's preference in navigating the tour.

Step 1: Go to 'Point A' placemark. Above the map, click Add Path. To add a shape, click Add Polygon. To make a path or polygon into a 3D object, click 'Altitude'.

Step 2: A "New Path" or "New Polygon" dialogue will pop up. Move the dialog box away before moving on to the next step.

Step 3: To draw the line or shape, click a start point on the map which in this case, 'Point A' placemark and drag.

Step 4: Click an endpoint to 'Point B' placemark. Then, enter description and properties and click 'OK'.

Step 5: Repeat process in creating routes from 'Point B' to 'Point C' and so on.

NOTE TO THE USER: To measure distance and elevation of the placemarks, visit this link: <https://support.google.com/earth/answer/148134>

9. Record an animated tour

For the last step, record a tour that goes through the created route in Google Earth's 3D environment. An audio can also be added to the recorded tour.

Step 1: In the 'Layers panel', turn on the preferred layers to be featured on the tour (e.g. 3D building, ocean, roads, weather, ocean, etc.) (see figure 43).

Step 2: Click 'Add' then select 'Tour' (see Figure 44), or in the bar above the globe, click 'Record'.

Step 3: To start recording, go to the lower left corner in the media player and click 'Record/ Stop' (see figure 45).

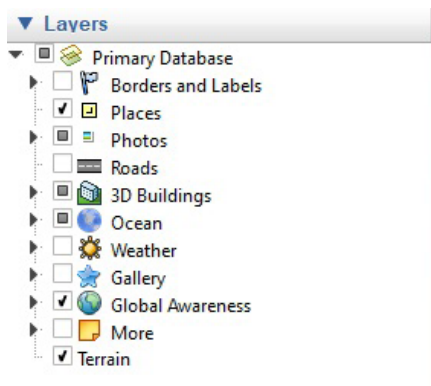


Figure 43. Layers panel.

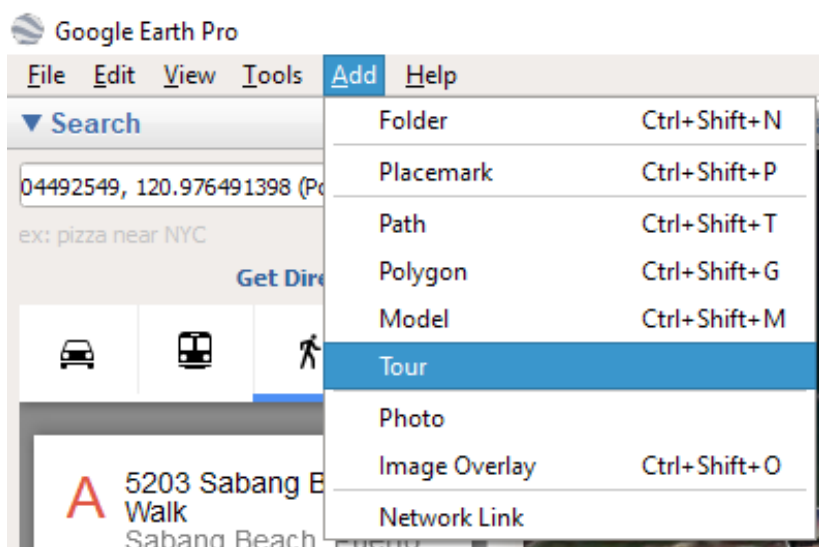


Figure 44. Add 'Tour' option in the 'Menu Bar'.

Step 4: To record audio, click Microphone (See Figure 45).

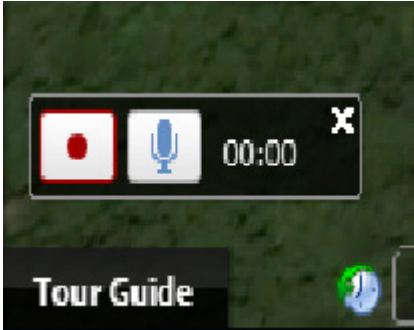


Figure 45. 'Record,' 'Stop,' and 'Microphone' icon located at the lower left bottom of the map.

Step 5: Navigate to each placemark on the route or go to the left-hand panel under 'My Places' and click a placemark to go to that location. Start from 'Point A' then to 'Point B' and so on.

Step 6: When you finish recording, click 'Record/Stop'. In the lower right corner, a media player will appear, and your tour will start playing.

Step 7: To save the tour, in the media player, click Save (see Figure 46). In the box that opens, enter a title in the "Name" field.

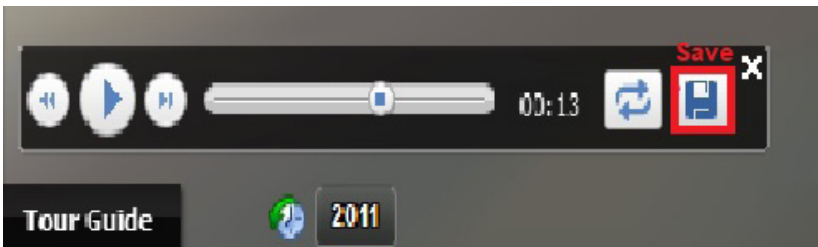


Figure 46. Once the tour is completed, save the tour under 'My Places'.

Step 8: To add more information about the tour, use the 'Description' and 'View tabs'. Click 'OK'.

NOTE TO THE USER: The tour is saved in KMZ file but later can be converted to an AVI file which can be uploaded in the web.

Presenting dynamic maps using Microsoft Powerpoint Presentation

Another innovative way in presenting advocacy maps is through a Powerpoint presentation. Powerpoint presentation animates static images from QGIS and converts them into a dynamic map. In using dynamic maps, each layer is dissected to emphasize information or legends depicted in the map such as watershed, mining tenement, forest, among others.

Adding a dynamic map into a Powerpoint slide

Step 1: Upon opening a PowerPoint file, click the dropdown menu on the Powerpoint ribbon then select 'More Commands' to customize the quick access toolbar (see figures 47 and 48).

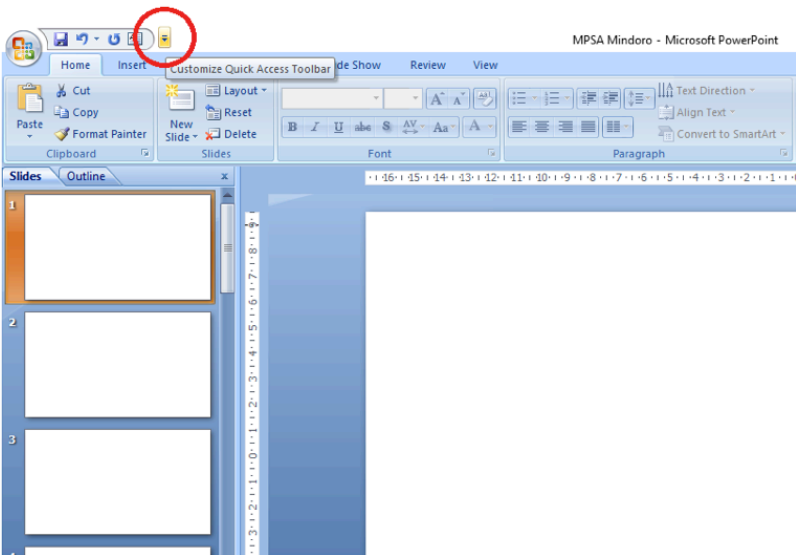


Figure 47. Dropdown menu to customize quick access toolbar.

Step2: Once the 'Powerpoint Options' tab appeared, choose 'All Commands' in the dropdown menu (see figure 48).

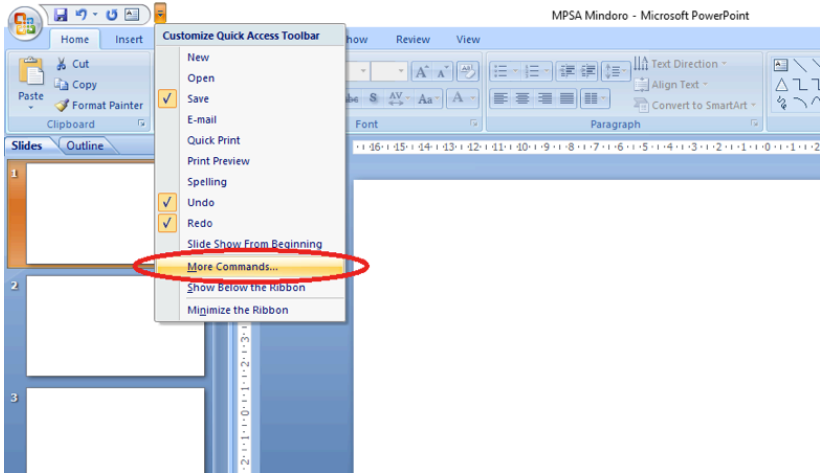


Figure 48. 'More commands' under the customize quick access toolbar.

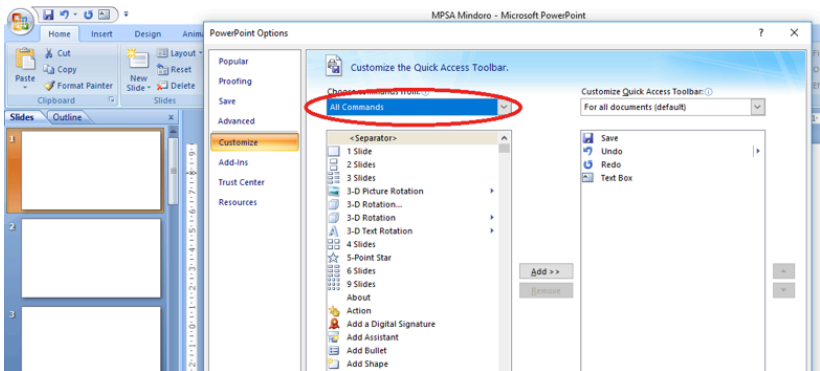


Figure 49. 'All commands' display all available functions that can be displayed in the quick access toolbar.

Step 3: Under 'All Commands', find the 'Set Transparent Color', click 'Add' then 'OK' (see Figures 50 and 51).

Step 4: To copy the map layer from the QGIS software, click 'Project' on the menu bar then select 'Save as image'.

Step 5: Open and copy the saved map layer image that will be featured in the presentation.

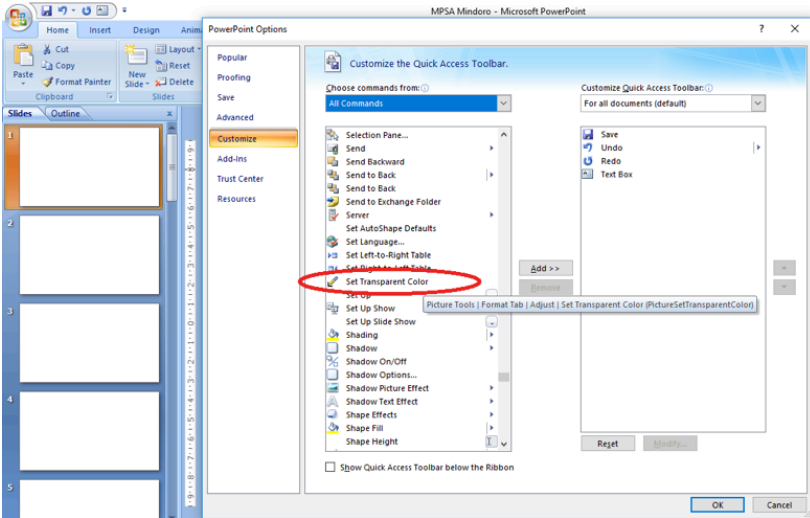


Figure 50. 'Set transparent color' makes the image overlays.

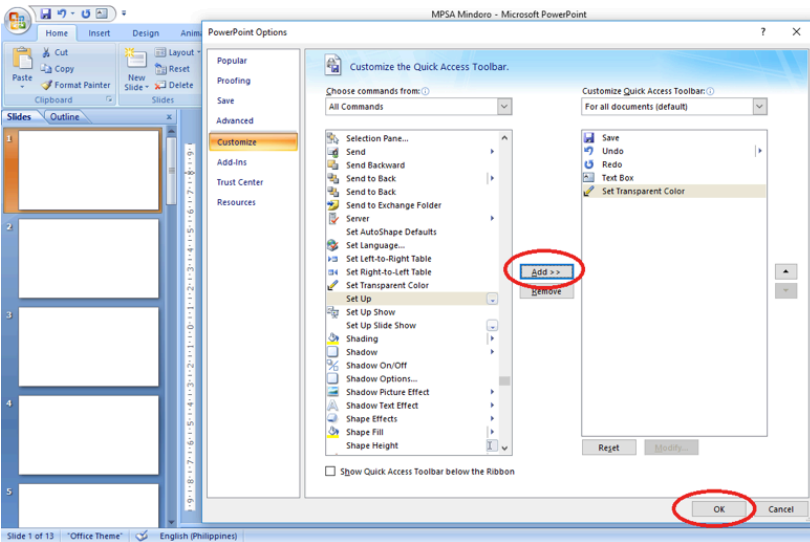


Figure 51. Select 'Add' then 'OK' to add the function into the quick access toolbar.

Step 6: Go to the Powerpoint slide to paste the map layer image then select the figure (see Figure 52).

Step 7: Click 'Set Transparent Color' command located on the Powerpoint ribbon (see Figure 53).

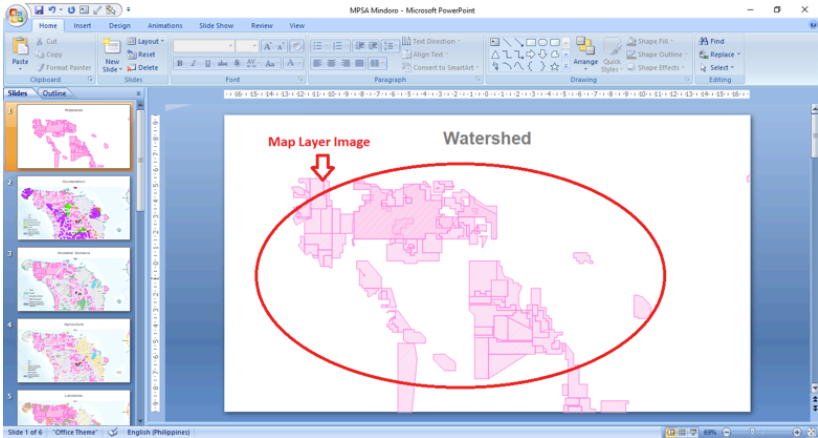


Figure 52. Pasted map layer image from QGIS.

Step 8: Apply the command to the map layer image by clicking the image (see Figure 55).

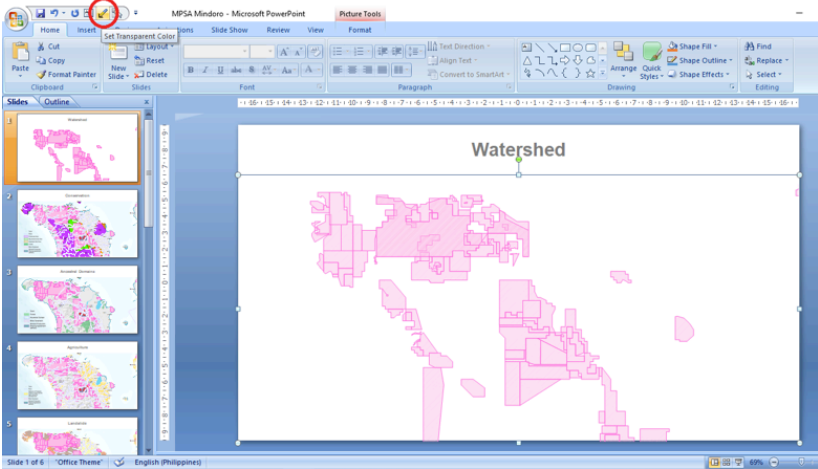


Figure 53. Showing the 'Set Transparent Color' command to remove the background of the map layer image.

Step 9: Repeat the processes until all overlays are incorporated into the slide.

Step 10: To edit the order of the map layer images on the slide, click the 'Format' button on the Powerpoint ribbon then select 'Selection Pane' (see Figure 54).

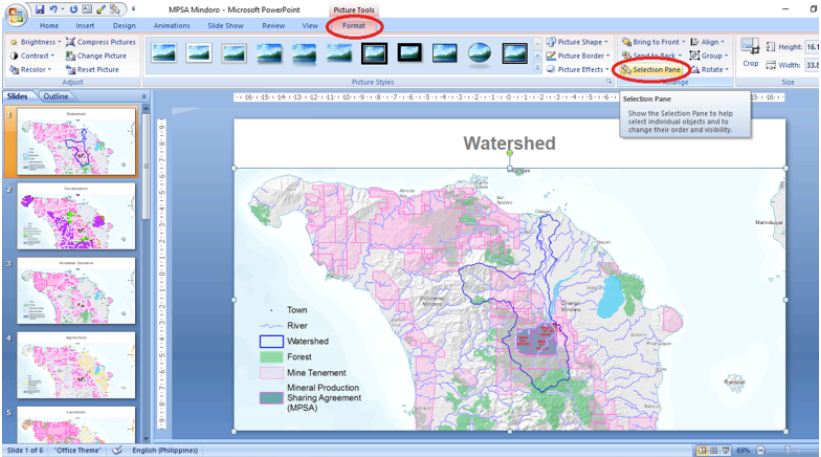


Figure 54. Under format, user can open the 'Selection Pane' to easily navigate and edit each map layer image.

Step 11: Once the 'Selection Pane' is opened, the 'Selection and visibility' tab will appear on the right side of the screen, then the user can select the visibility of the images on the slide as well as edit their arrangement (see Figure 55).

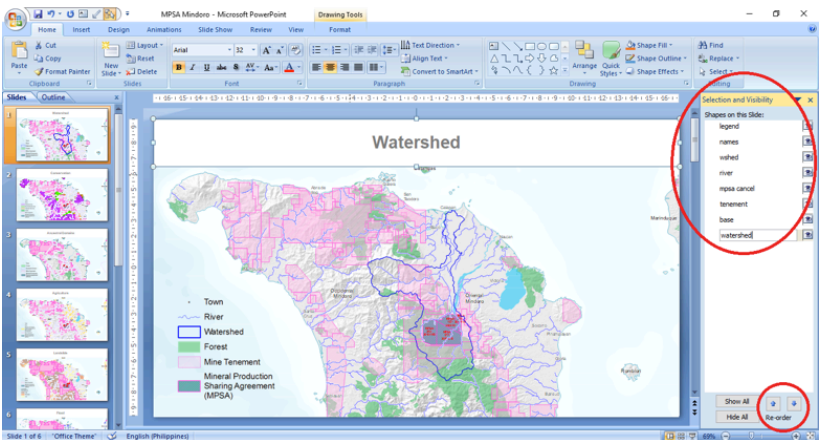


Figure 55. In the 'Selection and Visibility' window, user can re-arrange order of the layers, edit their visibility, and rename them.

Step 12: When presenting, user may apply animations for each image to emphasize the layers. To add transition to the images on the slide, simply click the map image layer under the 'Selection and visibility' tab'. Once the image is selected, go to 'Animations' then click the desired animation type (see Figure 56).

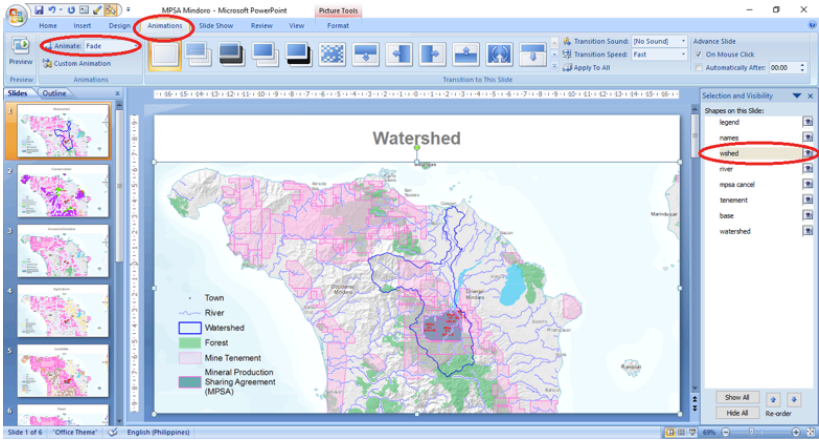


Figure 56. Animations can emphasize each layer during presentation.

NOTE TO THE USER: To activate the map and make it dynamic, click the 'Slideshow' button.

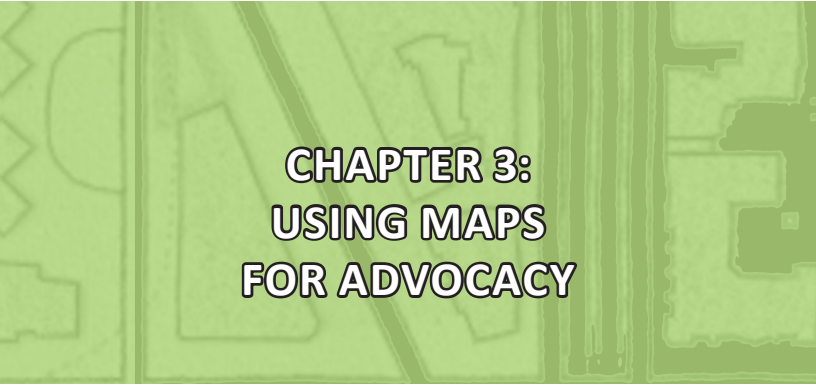
Figure 57 is an example of an advocacy map showing the overlaps of mining tenements with forests, watersheds, and river systems in Mindoro. The map illustrates mining tenements sitting above forests and watersheds. It also shows how forests and communities will be affected by the mine tailings and other wastes through water tributaries that lead to the lowland areas. The map strongly bespeaks these mining operations as illegal since the areas should be protected against mining under the National Integrated Protected Areas System (NIPAS) Law.



Figure 57. A map of Mindoro showing overlaps of mining tenements with forests, watershed, and river systems.

CHAPTER 3: USING MAPS FOR ADVOCACY





CHAPTER 3: USING MAPS FOR ADVOCACY

In today's complex world, land rights defenders all over the world confront immense challenges in advocating their causes. Foremost of which is the ability to effectively share data and clearly communicate their message to policy makers and the public at large, given the wide array of available information in different mediums that are accessible to anyone at any given time. One strategy that may address this issue is the use of spatial data, carefully composed into advocacy maps. Maps can be a simple, yet powerful, means for communicating and sharing information and advocating a cause.

Developing Advocacy Maps

Land rights defenders often face very complex problems that require a thorough understanding of the various factors and issues that affect communities and threaten their land security. The volume of information that is generated in the course of addressing land conflicts often overwhelms advocates, which sometimes makes it very difficult to articulate a clear statement and position. Hence, it is very important to be systematic in the collection of data, its analysis and the formulation of an advocacy statement. The following steps are important in developing an advocacy map for land rights defenders:

Steps

- Identify the sectors, affected ecosystems, issues, and themes;
- State the campaign message or advocacy statement;
- List the data needed;
- Collate and organize map data;
- Communicate the message; and,
- Validate the output map with the concerned group or community.

Identifying the Affected Ecosystem, Sectors, and Issues

At the onset of the mapping activity, the main issue/s that will be addressed must be clearly identified and defined. Local communities are often confronted by multiple issues arising from a land conflict caused by an investment or a project initiated by an adverse party. For instance, indigenous communities affected by a mining development face displacement, environmental destruction, damage to livelihood or agricultural areas, among other issues. The adverse effects may also be faced by a number of sectors. This is usually the case as large-scale investment projects cover a wide area and its impacts affect a wider landscape. Hence, a major mining activity may have an impact on downstream communities as it affects the sources of water and the agricultural areas. Moreover, the mining activity will also affect the integrity of the biodiversity and of any environmentally-critical area within the immediate coverage of the investment. In this case, issues raised by environmental advocates will become an integral part of the coverage of the advocacy map.

The Campaign Message

Once the involved sectors, the affected ecosystem, and issues to be addressed are clearly identified, the main campaign message should be clearly stated. Ranking the impacts of the multiple issues caused by the development project faced by the sectors is a good way of creating a hierarchy of the problems; it will also help in crafting the main advocacy message. In many instances, the negative effect on all

of the sectors would embody the main message. This will be common to most sectors and would have the highest impact on those affected by it. In the case of mining, the damage caused to the environment would be the issue that cuts across all sectors and ecosystems. The immediate effects particular to a sector, for example, could include: (1) land tenure and local communities; (2) loss and contamination of water which affects the agricultural sector; and, (3) damage to environmentally-critical areas for environmentalists.

Required Data

The extent and type of information needed to develop the advocacy map will be based on the issues and impacts that were earlier identified. In many instances, it would depend on the availability of data and the community's capacity to secure, and in many instances, generate the spatial data critical to the advocacy work. A checklist of the minimum required data, its format and possible sources will be helpful in systematizing the gathering data for the advocacy maps.

| Data/Layer | Format | Source |
|--|----------|-----------------------|
| Certificate of Ancestral Domain (CADT) | Hardcopy | NCIP-ADO, AnthroWatch |
| CADT | Shp. | LandMark |
| Land Cover Data | Shp. | NAMRIA |
| Watersheds | Shp. | DENR-BMB |
| Protected Areas | Shp. | DENR-BMB |
| CADT Zoning Map | Hardcopy | NCIP-Planning |
| CADT Zoning Map | Shp. | PAFID |
| Groundwater flow | Shp. | BSWM |
| NPAAD | Shp. | BSWM |
| Rice Production Statistics | Doc. | DA/PSA |
| Forest Cover Statistics | Doc./xls | DENR-FMB |
| Mining tenement | PDF. | DENR-MGB |
| Mining Tenement | Shp. | MICC |

Formulating the Message

A community workshop, wherein all of the concerned and affected sectors are represented, should be conducted to formulate the message. Focus Group Discussions (FGDs) shall be conducted for each sector wherein the spatial information representing their particular ecosystem, issues and themes shall be presented and analyzed. After the FGDs, each sector shall have their own sectoral statement. A plenary session shall be conducted in order to synthesize all reports and come up with the main advocacy statement for the map.

Organizing the Map

Once all the required information has been collected, the group shall develop several maps wherein the various ecosystems and sectoral themes are represented. The advocacy map will have the agreed sub-themes, which are represented as individual plates or sections in the main map. For instance, the map could be divided into six subsections. These sub-sections of the advocacy map shall contain the main message and the agreed sectoral thematic layers, which represent the particular issue that affects the concerned sector.

Local Validation

The draft map containing the basic local information, sectoral layer with spatial data showing their issues and the main advocacy message, which is a result of the agreements in the plenary, will then be presented to community members for validation. The map and all of its elements should be thoroughly discussed to ensure its familiarity and comprehension of all sectoral representatives concerned. If a consensus is reached that the map represents both the sectoral as well as collective aspirations of the group, a resolution should be drafted to legitimize the map. Once this is done, the map may be finalized for publication.

Communicating the message

Armed with supporting data and a powerful visual tool such as the map, the message shall be communicated clearly and objectively to the intended audiences: (a) first is the target of the advocacy i.e. the policymakers and the purveyors of development aggression (the mining, logging or other such companies engaged in extractive practices); and, (b) second is the general public who should be made aware that, even though they are not directly affected by this particular advocacy or situation; they are part of the larger ecosystem and should be concerned as well; not to mention that a similar case may happen or may already be happening in their backyard.

Ensuring credibility of your data

Land rights defenders face opponents who possess economic and political power and are often the perpetrators of development aggression and land grabbing against local and indigenous communities. Thus, it can be expected that very serious challenges will be mounted at every opportunity against the advocacy position of the affected communities and its supporters. Hence, it is very important to ensure the credibility of any information that is generated in any advocacy mapping initiative.

The following pointers are necessary in the process of developing an advocacy map:

- Data sources have been published and officially acknowledged.
- Data sources are available in the Public Domain.
- Data sources are cross-referenced or triangulated; at least three sources should mention/indicate the same spatial information before it is included.

The Tampakan Advocacy Map

Advocacy maps provide an excellent opportunity for communities to tell their stories and document the critical changes that they observe in their environment in a given period.

The development of the Tampakan advocacy map is an initiative that enabled the local community and support groups to effectively articulate to the public and policy makers their opposition to Sagittarius Mines, Inc. in Tampakan, South Cotabato, Philippines.

Background

The Tampakan Copper-Gold Project is reportedly the seventh largest undeveloped copper mine in the world. When operational, it will be one of the largest copper-gold mines in Southeast Asia. Owned by Glencore-Xstrata, with the Australian company Indophil holding a minority stake, the mine is operated by its local subsidiary, Sagittarius Mines, Inc. (SMI). The final overall mine area is estimated at around 10,000 hectares, falling within the boundaries of four provinces (South Cotabato, Sarangani, Davao del Sur and Sultan Kudarat). The area is mostly forested and includes a substantial portion of the ancestral domain of an indigenous community – the Bla'ans. The mine's open pit of some 500 hectares would be dug to a depth of 785 meters, while the topsoil stockpile would cover an area of five hectares and the pit ore stockpile would be 49 hectares.

The company's Environmental Impact Assessment (EIA) estimated that 5,000 people, mostly indigenous, would be directly affected and would require resettlement. The mining project will directly affect five watersheds, around 4,000 hectares of old-growth forest, and five ancestral domains.

“The Tampakan project has caused the murder and harassment of too many indigenous leaders who oppose it. For communities, the human rights violations and threats are one of the reasons

for their opposition to the development of the mines, second to their displacement and the impacts to their ancestral domains,” Alyansa Tigil Mina (ATM), a non-governmental organization supporting the communities in their struggle against SMI, alleged in an emailed statement.

As of May 2014, the Tampakan project was officially on “downscaled status”, after undergoing an 80 percent reduction in its programmed funds and staffing for 2014. It is not suspended nor abandoned. Glencore/Xstrata has indicated that they are pushing for their target of commercial operations by 2019. They have also committed themselves to pursuing completion of all their regulatory requirements, including securing consent from indigenous peoples and working on the local ban on open-pit mining.

Developing a Map to Articulate the Peoples Advocacy against the Tampakan Mining Project

The Social Action Center of the Marbel Diocese initiated the generation of spatial data critical to understanding the impact of the proposed mining operations of SMI in Tampakan. In order to challenge or refute the flood of supposedly credible information on the benefits and minimal impacts of the SMI project, the anti-mining advocates agreed to build a “Participatory 3D model” (P3DM) of the whole impact area, including a mock-up of the facilities of the proposed SMI mining project.

All critical information including the spatial data, as well as the schematic diagrams of the proposed mining facilities, were carefully analyzed and reproduced to scale. Spatial information composed of available data layers on protected areas, land cover, land tenure and cultural information from the affected indigenous communities were overlaid in the P3DM.

Local and international experts, along with community members and CSO partners, then collectively analyzed all the information generated and consolidated in the P3DM. The collective analysis was used to generate the consensus “Advocacy Position” of the anti-mining advocates. These were

later presented in a Provincial Consultation in Marbel, South Cotabato.

On 23 September 2009, international and local experts critiqued the Environmental and Social Impact Assessment (ESIA) of the Tampakan Mine Project in a public forum held at the South Cotabato Gymnasium and Cultural Center.

The Social Action Center of the Marbel Diocese and the Office of the Governor co-organized the activity to bring together the SMI/Xstrata consultants and experts from the anti-mining groups to present to the people how the Tampakan mining project will actually impact the people and environment.

During consultation, the SMI/Xstrata consultants explained the merits of the mining operation and the supposed benefits it will give to the host communities. In response, Clive Wicks and Filipino experts, Atty. Ipat Luna and Kail Zingapan of Philippine Association for Intercultural Development (PAFID), presented their evaluation and discussed the real risks of the project that seemed to be covered up in the massive Environmental Impact Statement (EIS) and Environmental Impact Assessment (EIA) documents.

The anti-mining advocates argued that the Tampakan mine development, which covers an area of approximately 10,000 hectares, will have a devastating effect on the environment. The development will cut down almost 4,000 hectares of forests, including old growth forests. It will contaminate the water source of communities on six rivers with arsenic and acid mine drainage. The Mal river will be the worst affected as many streams in its catchment will be destroyed and replaced by the tailings dam. This will have a severe impact to numerous downstream communities as the Mal River, the region's biggest river system, is the main source of irrigation for the agricultural sector in the neighboring province of Davao del Sur.

Kail Zingapan, who worked with local indigenous communities to produce an impressive 3-D map of the Koronadal Valley and the Tampakan watersheds, explained what the mining project would mean for the affected communities.

In presenting the “People’s Map”, Zingapan asserted: “This is the People’s Map, we did not invent this. The people pointed out to us where their lands are located and we plotted them on the map. We showed them the outcome and they saw that the mine development area covers their ancestral lands; it seems not all of them were consulted or correctly informed of the risks by SMI”.

People were shocked as Zingapan placed the supposed mine tailings dam area on top of the hill and the fresh water dam right where Mal River is located. “This is your land where you live and get your food and everyday needs. It is up to you now if you want to see this land devastated and taken away from you,” she said in the Visayan dialect.

Environmental lawyer Ipat Luna, on the other hand, explained her legal evaluation of the EIS, “The EIS inadequately sets out the direct losses to be caused by the project and has gaps in terms of other legal permits and compliance.”

She further added, “The Stakeholders’ Development Framework fails to appreciate the unique cultural identity of the B’laan and merely enumerates standard social development interventions.”

After the presentation of SMI’s EIA and its subsequent critique, Bishop Dinualdo Gutierrez of the Diocese of Marbel said: “No mining project will ever be good for us. Let us continue to support the South Cotabato Environmental Code that bans open pit mining.” The Bishop further reiterated that there is no need for the Sangguniang Panlalawigan (Provincial Council) to review the said code.

Alyansa Tigil Mina (ATM) National Coordinator Jaybee Garganera said, “Unlike SMI/Xstrata who are here to get the approval of the people to mine their lands, the experts and non- governmental organizations are here because the communities requested our help. We are here also because we believe that the claimed benefits of this mining project are clearly outweighed by the impacts it will bring to water, agriculture, forests, biodiversity and communities.”

After the presentation of the mining opposites, SMI/Xstrata consultants found it hard to convince the people that their project will not impact negatively on many lives.

After two hours of open forum, Governor Arthur Pingoy, Jr. concluded and assured the people: “As the governor of this province, I will implement the (Provincial Environmental Code) Ordinance. There will be no open-pit mining in the province unless there is an order from the Courts. I am duty bound to implement the Ordinance.” He added that the forum was primarily organized to allow the Sangguniang Panlalawigan to arrive at an informed decision in reviewing the provision of the Provincial Environment Code banning open pit mining.

More than 6,000 people went to listen and ask questions at the forum. Most of them were able to go inside, while some people stayed outside due to lack of space. They were still able to follow the proceedings as a big screen was set-up and broadcast what was happening inside. Information on the Tampakan P3DM has been digitized and put in a GIS making further widespread dissemination possible.

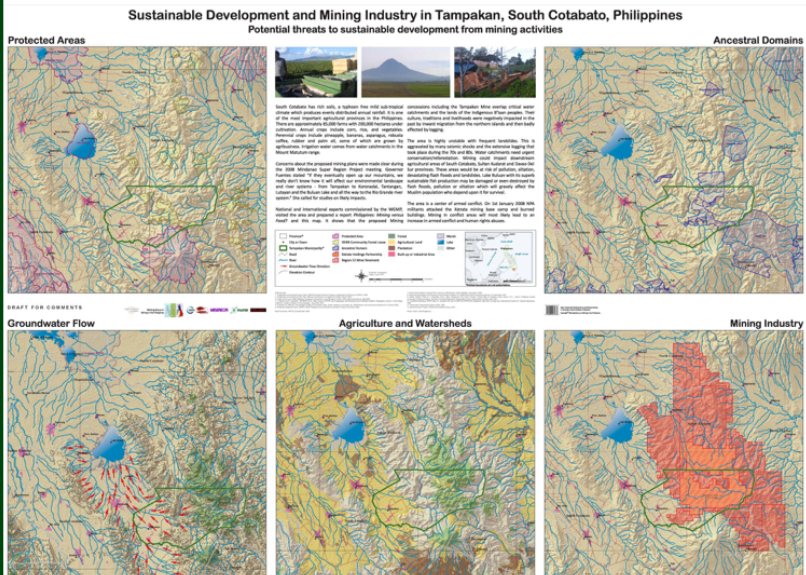


Figure 58. A map showing the mining industry in Tampakan, South Cotabato, Philippines, and its potential threats to sustainable development.

To view further examples of maps used for advocacy, visit the following:

- Using P3DM for advocacy (<https://www.youtube.com/watch?v=q7Lfrpn6VsU>)
- Anti-mining advocacy maps (<http://www.piplinks.org/maps.html>)

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ANNEXES

Annex A
Sample PRS92 Certification of Tie Point Coordinates



Republic of the Philippines
Department of Environment and Natural Resources
**OFFICE OF THE ASSISTANT REGIONAL DIRECTOR FOR
TECHNICAL SERVICES**

(contains the regional office details)

CERTIFICATION



To Whom It May Concern:

This is to certify that per records of this office, the Latitude and Longitude of
BLLM 8 (PRS'92) under *(contains the program beneficiary number
and location [town and province] of CLOA)* is the following:

Lat. N10°58'40.37285" - Long. E123°10'01.44699"
N 1213887.815 - E 518259.215

This certification is issued per letter request of _____ *(Name, Date)*
_____ for reference purposes only.

Issued this : *(contains the date and location the request was issued)*

Aggregate Surveys and Correction Section

Noted By:

For and in the absence of the
ARD for Technical Services:

Enforcement Division

Surveys/Aggregate 2015

Annex B
Annex 7 of DENR Memorandum Circular 2010-16
Manual on Land Surveys

**DENR Memorandum Circular 2010-16 Manual on Land Surveys
Annex VII
pages 15-16**

Annex VII. PPCS-TM Zone Assignment of Provinces

The assignment of provinces into the map projection zones of the PPCS-TM shall be as follows:

| Province | PPCS-TM Zone |
|---|--------------|
| a. Cordillera Administrative Region (CAR) | |
| 1) Abra | Zone No. III |
| 2) Benguet | Zone No. III |
| 3) Ifugao | Zone No. III |
| 4) Mountain Province (Bontoc) | Zone No. III |
| 5) Kalinga | Zone No. III |
| 6) Apayao | Zone No. III |
| b. National Capital Region (NCR) | |
| 1) Metro Manila | Zone No. III |
| c. Region No. I Northwestern Luzon | |
| 1) Ilocos Norte | Zone No. III |
| 2) Ilocos Sur | Zone No. III |
| 3) La Union | Zone No. III |
| 4) Pangasinan | Zone No. III |
| d. Region No. II Northeastern Luzon | |
| 1) Batanes | Zone No. III |
| 2) Cagayan | Zone No. III |
| 3) Isabela | Zone No. III |
| 3a) Municipalities West of 122° E Longitude | Zone No. III |
| 3b) Municipalities East of 122° E Longitude | Zone No. IV |
| 4) Nueva Vizcaya | Zone No. III |
| 5) Quirino | Zone No. III |
| e. Region No. III Central Luzon | |
| 1) Bataan | Zone No. III |
| 2) Bulacan | Zone No. III |
| 3) Nueva Ecija | Zone No. III |

| | |
|---|--------------|
| 4) Pampanga | Zone No. III |
| 5) Tarlac | Zone No. III |
| 6) Zambales | Zone No. III |
| f. Region No. IV Southern Tagalog | |
| 1). Aurora | Zone No. III |
| 2.) Batangas | Zone No. III |
| 3) Cavite | Zone No. III |
| 4) Laguna | Zone No. III |
| 5) Marinduque | Zone No. III |
| 6) Occidental Mindoro | Zone No. III |
| 7) Oriental Mindoro | Zone No. III |
| 8) Palawan | |
| Palawan Central Meridian 118° 30' E | Zone I |
| 9) Quezon Province | |
| 9a) Municipalities East of 122° E Longitude | Zone No. IV |
| 9b) Municipalities West of 122° E Longitude | Zone No. III |
| 9c) Polillo Islands | Zone No. III |
| 10) Rizal | Zone No. III |
| 11) Romblon | Zone No. IV |
| g. Region No. V Bicol | |
| 1) Albay | Zone No. IV |
| 2) Camarines Norte | Zone No. IV |
| 3) Camarines Sur | Zone No. IV |
| 4) Catanduanes | Zone No. IV |
| 5) Masbate | Zone No. IV |
| 6) Sorsogon | Zone No. IV |
| h. Region No. VI Western Visayas | |
| 1) Aklan | Zone No. IV |
| 2) Antique | Zone No. IV |
| 3) Capiz | Zone No. IV |
| 4) Ilo-ilo | Zone No. IV |
| 5) Negros Occidental | Zone No. IV |
| 6) Guimaras | Zone No. IV |
| i. Region No. VII Central Visayas | |
| 1) Bohol | Zone No. V |
| 2) Cebu | Zone No. IV |
| a. Camotes Islands | Zone No. V |
| 3) Negros Oriental | Zone No. IV |
| 4) Siquijor | Zone No. IV |
| j. Region No. VIII Eastern Visayas | |

| | |
|--|--------------|
| 1) Eastern Samar | Zone No. V |
| 2) Leyte | Zone No. V |
| 3) Northern Samar | Zone No. V |
| 4) Samar (Western Samar) | Zone No. V |
| 5) Southern Leyte | Zone No. V |
| 6) Biliran | Zone No. V |
| k. Region No. IX Western Mindanao | |
| 1) Zamboanga Del Norte | Zone No. IV |
| 2) Zamboanga Del Sur | Zone No. IV |
| 3) Zamboanga Sibugay | Zone No. IV |
| l. Region No. X Northern Mindanao | |
| 1) Bukidnon | Zone No. V |
| 2) Camiguin | Zone No. V |
| 3) Lanao Del Norte | Zone No. V |
| 4) Misamis Occidental | Zone No. IV |
| 5) Misamis Oriental | Zone No. V |
| m. Region No. XI Southern Mindanao | |
| 1) Compostela Valley | Zone No. V |
| 2) Davao Del Norte | Zone No. V |
| 3) Davao Del Sur | Zone No. V |
| 4) Davao Oriental | Zone No. V |
| n. Region XII Central Mindanao | |
| 2) North Cotabato | Zone No. V |
| 3) Sarangani | Zone No. V |
| 3) South Cotabato | Zone No. V |
| 4) Sultan Kudarat | Zone No. V |
| o. Region No. XIII (Caraga) | |
| 1) Agusan Del Norte | Zone No. V |
| 2) Agusan Del Sur | Zone No. V |
| 3) Dinagat Islands | Zone No. V |
| 4) Surigao Del Norte | Zone No. V |
| 5) Surigao Del Sur | Zone No. V |
| p. Autonomous Region of Muslim Mindanao (ARMM) | |
| 1) Basilan | Zone No. IV |
| 2) Lanao Del Sur | Zone No. V |
| 3) Maguindanao | Zone No. V |
| 5) Tawi-tawi | Zone No. III |
| 6) Sulu | Zone No. III |



As the overseas development agency of the Catholic Church in Germany, MISEREOR works in partnership with all people of goodwill to promote development, fight worldwide poverty, liberate people from injustice, exercise solidarity with the poor and persecuted, and help create “One World.”

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The **National Engagement Strategy (NES)** was initiated as a response to the need for the International Land Coalition (ILC) to engage in selected countries in a focused, coherent, and coordinated manner that emerged from past lessons. ILC

has been a development partner of Philippine CSOs engaged in promoting asset reform and pointing out the deficiencies of policies in current land and resource rights.

ILC NES in the Philippines synergizes the efforts of the members with other stakeholders such as government and international organisations in building on previous efforts to increase and strengthen access to and control of land and other natural resources in rural sectors.

Website: ilc-nes.ph



Land Watch Asia (LWA) is a regional campaign to ensure that access to land, agrarian reform and sustainable development for the rural poor are addressed in national and regional development agenda. The campaign involves civil society organizations in seven (7) countries—Bangladesh, Cambodia, India, Indonesia, Nepal, Pakistan, and the

Philippines. LWA aims to take stock of significant changes in the policy and legal environments; undertake strategic national and regional advocacy activities on access to land; jointly develop approaches and tools; and encourage the sharing of experiences on coalition-building and actions on land rights issues. ANGOCC is the regional convenor of LWA.

Asian NGO Coalition for Agrarian Reform and Rural Development

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The International Land Coalition (ILC) is a global alliance of civil society and intergovernmental organizations working together to put people at the center of land governance. The shared goal of ILC’s members is to realize land governance for and with people at country level, respond to the needs and protect the rights of women, men and communities who live on and from the land.

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This resource book is the **second volume** publication on *Community Mapping and Participatory Geographic Information System (PGIS)* which aims to equip the users with the necessary knowledge, attitude and skills on this subject area. It is intended for land rights defenders, institutions advocating for land rights, development practitioners, and communities to defend their rights to land and the sustainable use of natural resources.

Inspired by the pioneering work of the Philippine Association for Intercultural Development, Inc. (PAFID) in PGIS mapping in the country, this publication is designed to impart the key concepts of community mapping and the basics of PGIS, with the view that the application of PGIS technology contributes to securing legal recognition of the indigenous communities over their traditional territories and resources.

This volume is designed to impart on the “how-tos” for the production of digital maps useful in advancing the land rights agenda of rural communities, particularly indigenous communities and smallholder farmers in Southeast Asia.