Elaboration of the Concept and Approach of GIS Application in Land Management under RLGM

PART 1
FINAL REPORT

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I. Introduction

The development of geospatial information technologies has significantly changed the approach to land management, which includes land use and spatial planning; management of our forests, protected areas, public spaces, among others; disaster management; and other land-related initiatives. The impact of these technologies, particularly the use of drone/satellite and remote sensing; Global Navigation Satellite System (GNSS) and Geographic Information System (GIS)for mapping and land surveys; use of other data collection tools; information integration; big data analytics and storage systems, among others, to manage land resources, has resulted to better means of data acquisition, data analysis and data visualization.

In particular, GIS helps in understanding numbers, patterns, relationships, and geographic context. The benefits of GIS-based available data include improved communication and efficiency as well as better management and decision making. Applied to land management, you need data to know to manage. GIS can show many different kinds of data on one map, such as streets, buildings, land use, types of ownership, boundaries of forest lands and protected areas, among others. This technology provided a platform for broader community participation and transparency in land management, especially because data gathering ideally starts at the communities. Good geospatial information enables implementation of a good land management system.

II. Rationale

The project, Responsible Land Governance in Mindanao (RLGM), emerged from lessons in implementing measures that promote sustainable rural development, while integrating climate-, conflict-, and gender-sensitivity in asset management. Once again, the experiences in land use and management recognize the increasing complexity of jurisdictional and land management issues due to the lack of land use and tenure information as well as maps and zoning definitions. Significant portions of public lands are characterized by open access and un-regulated economic activities.

In addition, capacity constraints exist for LGUs (especially for the 4th to 6th income class) to formulate, implement and enforce land use plans as prescribed by law. Data sharing among agencies remains problematic. Many policy and regulatory overlaps create uncertainty for LGUs and communities in land management.

The project will therefore address the above- mentioned issues in a multi-level approach working with national agencies on regulatory and policy issues with regard to public lands as well as the transparency and availability of geodata. At the same

time, efforts to localize improved land governance should be undertaken in cooperation with selected provinces, municipalities and cities.

The project will focus on Eastern Mindanao but will have a nationwide reach as far the support to national policy, technical guidelines and inter-agency cooperation is concerned. The intended results are:

1. A climate change, conflict and gender sensitive sustainable integrated area development approach is implemented by the Department of Environment and Natural Resources (DENR) in 2 regions of Mindanao.
2. Six (6) LGUs implement climate change, conflict and gender sensitive management principles for the respective zones in public lands together with the DENR, other mandated agencies, local communities, and where applicable indigenous peoples and indigenous cultural communities (IPs/ICCs).
3. X users in 2 regions in Mindanao have access to data of the DENR Information system on tenure instruments, land use, ancestral domains, planning and monitoring for public lands to the public.

III. Context and Objectives

III.1 Context

As land is a finite resource, there is a growing competition to access, use, own and manage it due to rapid population growth, urbanization, economic development, persistent insecurity of food, water and energy, and the effects of conflicts and disasters. Appropriate land use and land development is one of the most concrete ways to implement food security, social, economic and environmental programs and to harmonize these with sustainable development goals.

In recent years, an integrated ecosystems approach or 'ridge-to-reef' framework provided the basic principle for physical planning for development. The integration of climate change and disaster risk reduction into local land use and development plans is considered a major pillar of the country's adaptation plan.

To aid the land use planning and development processes, the use of GIS technologies to come up with base maps, thematic maps, proposed land use maps, zoning maps, among many others, was tapped by the national government agencies (NGAs) and local government units (LGUs) to aid them in managing the land resources within their jurisdictions.

Current projects and activities that utilizes GIS technologies are as follows:

- The **Philippine Geoportal Project** intends to hold and serve to the participating stakeholders all the base maps that NAMRIA produces and eventually all the fundamental and thematic datasets of the other data producing agencies. It will promote participation of various data producers and other stakeholders in terms of providing location and attribute information. The build-up of data content and Development of other GIS based applications will also be done in the succeeding phases of the Project.[1] The website: www.geoportal.gov.ph is used to find and access geospatial data and services.
- The DENR **One Control Map** is a list of various base maps produced within DENR (and in some instances may include other land agencies' base maps) as shown in some DENR Regional Offices and Provincial Environment and Natural Resources Office websites[2] and contains the following maps:
  - Administrative Map
  - Political Subdivision Map
  - CENRO Jurisdiction Map
  - Accessibility Map
  - River System Map
  - Forest Production and Protection Map
  - Land Classification Map
  - Land Cover Map (2015)
  - Slope Map
  - Contour Map
  - Data Elevation Model
  - Elevation Map
  - Soil Map
  - Geo-Hazard Map (Flooding Susceptability)
  - Geo-Hazard Map (Landslide Susceptibility)
  - Tenurial Instrument Map
  - Overlapping of Tenurial Instrument
  - Untenured Map
  - Watershed Map
- The Mines and Geosciences Bureau (MGB) Geohazard Web Portal[3] composed of maps that provides information on susceptibilities of certain barangay to landslide and flooding. There is an option to download specific geohazard maps. Their website may be found at: Geohazard Web Portal (mgb.gov.ph)
- The Land Use and Zoning Information Systems (LUZIS) is an information system (IS) designed to aid the Department of Human Settlement and Urban Development (DHSUD), formerly Housing and Land Use Regulatory Board (HLURB) in their data organization and monitoring function. With a GIS-based

[1] https://www.namria.gov.ph/projects.aspx
[2] http://penroagnor.com/one-control-map/– example of One Control Map at DENR-PENRO Agusan del Norte
[3] https://lgsd.mgb.gov.ph/portal/apps/webappviewer/index.html?id=d67b4e332f624850bcfab90d0dbc06a3

and web portal framework, LUZIS can help various DHSUD components including its central office, their regional staff and the LGU planning unit in implementing and reporting the status of their CLUP and ZO. LUZIS is also designed to be interoperable with DHSUD's existing information system and other agency's (e.g. NAMRIA) data infrastructure making it easy to migrate existing data to LUZIS.[4]

These days, technology even improved and applications have been created to make interactive maps such as the Department of Science and Technology (DOST)-Philippine Institute of Volcanology and Seismology (PHIVOLCS) Fault Finder. It is capable to do proximity searches to active faults and may also be used to determine the location of active faults in an area and to measure the shortest distance between an active fault and a user's current location, which is determined by the gadget's tracking device. It may also be used to measure the shortest distance between an active fault and a specific site, which is identified by a user.[5]

Another example of an application is the HazardHunterPH[6], the country's one-stop shop for hazard assessment. It determines if a location is prone to seismic, volcanic, or hydrometeorologic hazards and generates hazard assessment reports. You can also see which critical facilities and areas in the Philippines are prone to different hazards. The hazard information used for assessment has been generated by government agencies.

NGAs and LGUs have also been embarking in using GIS technologies for parcel-based mapping for land survey and titling, planning, taxation, valuation, among others.

Technology-based Land Policies

The following are some of the technology-based policies issued by NGAs to keep abreast with technologies in mapping and surveying for land use planning and land management:

Table 1. List of Technology-based Policies

Year	Title of Land Policy/ Description	Institution
2007	CLUP GIS Guidebook: A Guide to Comprehensive Land Use Data Management) in the preparation of the Comprehensive Land Use Plans (CLUPs) using GIS technology to enable local planners to be capable of preparing their own CLUPs.	HLURB (now merged with the newly created DHSUD)
2015	LMB Memorandum Circular No. 2015-01, entitled "Guidelines on the Use of Real Time Kinematic (RTK)	Department of Environment and

[4] http://168.63.241.184/faq

[5] https://www.phivolcs.dost.gov.ph/index.php/information-tool/the-phivolcs-faultfinder

[6] https://hazardhunter.georisk.gov.ph/

	Global Navigation System (GNSS) in the Conduct of all Kinds of Lot Surveys with Tertiary Accuracy"	Natural Resources Land Management Bureau
2017	LMB Memorandum Circular (LMC) No. 2017-03, entitled "Adoption on the Alternative Adoption on the Alternative Use of Unmanned Aerial System (UAS) in the Conduct of Land Survey" Technical Bulletin No. 2017-02, entitled "Guidelines on the Use of Unmanned Aerial Systems in Support of Land Surveys"	Department of Environment and Natural Resources Land Management Bureau

Then HLURB also issued a new set of guidelines for the preparation and updating of CLUPs in 2012. Another greater challenge posed to LGUs would be how practicable and in what ways other mandated sectoral plans, e.g. FLUP, ADSDPP, PAMP could be harmonized in the CLUP.

RLGM recognize the importance of updating the CLUPs in improving governance of lands and management of natural resources, hence, is supporting the LGUs in terms of promoting the application of new approaches and processes in land use planning and harmonization of local plans.

III.2 Objectives

To increase transparency of government activities and enhance public awareness of land policies, RLGM aims to strengthen cooperation between national agencies and local governments for the exchange of information and data in relation to land use and land rights. Awareness-raising initiatives are designed to reach not only the target groups but also the wider public.

As a tool to support land management approaches, it is important to systematically introduce, create awareness and promote understanding of the use of GIS to stakeholders. To know what a community or a local government has, in terms of land area, its natural resources, how much of the land is allocated to agriculture, forestry, public parks, open and green spaces, urban land use, among others and to know where these all are, is a critical step towards understanding how GIS can be utilized for data integration, analysis and visualization to help in decision-making. In addition, the integration of remote sensing and GIS results in a product that helps decision-makers, NGAs, NGOs, community members and other RLGM partners to visualize information to better guide efficient land management. The use of GIS may be optimized by using a combination of remote sensing products (e.g. satellite image, aerial image, drone orthophoto) that depend on the resources, capabilities, purpose of its use and cost-effectivity. Capability in the use of GIS and remote sensing enables a certain unit of the

society to set appropriate policy directions and implement their own development programs.

Specifically, the objective of the consultancy is to systematically introduce, create awareness and promote understanding of the use of GIS as a tool to support land management approaches. Initially, it is being introduced to RLGM LGU partners and communities. The consultancy shall study the various audiences for these awareness campaign and the different levels of communication intervention that would be suitable for each audience.

Ultimately, the consultancy shall come up with a Communication Plan of how to raise awareness on the application of technology, such as GIS, data collection tools and remote sensing (UAV mapping) to better communicate the concept and applications of land management to various audiences.

IV. Methodology

To be able to come up with a Communications Plan, Figure 1 shows the implementing approaches to be undertaken.

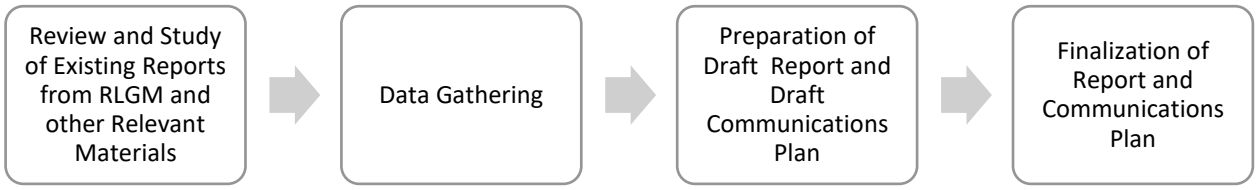

Figure 1. Methodology

The following methodology has been undertaken in close coordination with the RLGM Technical Advisor on GIS:

IV.1 Review and Study of Existing Reports from RLGM and other Relevant Materials

Review and study of reading materials on land management approaches and use of technology in land management which also includes existing reports from the RLGM experience on the ground. This includes the activity reports, research studies, brochures and e-learning resources that RLGM currently has which may be used to develop communication materials.

An important aspect is also the review and familiarization of the RLGM Strategic Communication Framework and Plan because this is where the Communication Plan for this consultancy will be anchored.

IV.2 Data Gathering

Gathering of data thru Focus Group Discussions (FGDs), Key Informant Interviews (KIIs) and consultations meetings with RLGM Technical Advisers and Staff and also with members/representatives of the LGUs, NGAs, NGOs, other partners and the communities to pick out lessons/experiences that may help in providing inputs for the report and Communications Plan. The data gathering covers RLGM partners in Regions 10, 11 and 13.

A set of questions was prepared for the RLGM Technical Advisers and Staff. A survey questionnaire was also prepared for the representatives from LGUs, NGA, NGOs and other RLGM partners and communities.

V. Results and Findings

V.1 RLGM GIS-Related Activities

To learn more about RLGM and its activities, a review of its activities was undertaken. Table 2 shows the list of GIS-related activities in RLGM areas in Regions 10 and 13.

Table 2. RLGM GIS-Related Activities

RLGM Area	Activities	Description
A. Region 10		
Balingasag, Misamis Oriental	Orientation on pilot testing of dialogue process for establishing platform for addressing overlapping land claims and land tenure October 14, 16, 23 and 30, 2020	The Municipality of Balingasag is on the process of updating its Comprehensive LandUse Plan (CLUP) for the LGU to prepare and aligned its land -uses with the current development status of the municipality. The updating of the CLUP involves series of processes/stages. Part of the process are the following: • Organization of the GIS-UAV Mapping Team; • Data needs/maps assessment; and • Preparation/development and/or updating of maps. To be able to come-up with maps (base maps/thematic maps), there is a need to equip the GIS team with the needed skills on Quantum Geo-Information Systems (QGIS). The output of the QGIS Tutorial will serve as input for the updating of the CLUP.

RLGM Area	Activities	Description
	Unmanned Aerial Vehicle (UAV) – Based Mapping Training January 28-30, 2020	The Municipality of Balingasag is on the process of updating its Comprehensive Land-Use Plan (CLUP) for the LGU to prepare and aligned its land -uses with the current development status of the municipality. The updating of the CLUP involves series of processes/stages. Part of the process are the following: • Organization of the GIS-UAV Mapping Team; • Data needs/maps assessment; • Preparation/development and/or updating of maps. To be able to come-up with maps (base maps/thematic maps), there is a need to equip the GIS-UAV team with the needed skills on Quantum Geo-Information Systems (QGIS) and Unmanned Aerial Vehicle (UAV) Mapping. The output of the UAV Mapping will serve as input for GIS Mapping and will serve as basis for the updating of the CLUP, hence this proposal. Participants: Around 31 (21 males, 10 females) participants participated by 15 offices (national and local offices) namely: Balingasag Water District (BWD), Philippine National Police (PNP), Municipal Disaster Risk Reduction Office (MDRRO), Tourism Office, Municipal Planning & Development Office (MPDO), Mayor's Office, Municipal Treasury Office, Municipal Engineering Office (MEO), Bureau of Fire & Protection (BFP), Business & Licencing Office, Rural Health Unit (RHU) and Minergy Power Corporation (MPC)-Balingasag Power Station (BPS), Municipal Assessors' Office and Municipal Agriculture Office.
	Workshop on Community Profiling and Digital Data Gathering Tools Aerial Mapping for Maps updating to be used in CLUP preparation	A transition from traditional community mapping (literally drawing their area) into digitized mapping technology – use of drones/UAV. Images gathered/captured by the UAV, processed and printed for actual plotting – accuracy of plotted areas, e.g. farms, protected area zones, other land uses is high. The plotted map will then be digitized by the GIS experts of the LGUs as the official maps incorporated in their local plan,s e.g. CLUP, BDP, etc. the involvement of the local stakeholders. Hence, conflicting boundaries and overlapping claims would somehow be addressed at the ground.
	QGIS Online Tutorial	The Municipality of Balingasag is on the process of updating its Comprehensive LandUse Plan (CLUP) for the LGU to prepare and aligned its land -uses with the current

RLGM Area	Activities	Description
	Oct 14, 16, 23, 30, 2020	development status of the municipality. The updating of the CLUP involves series of processes/stages. Part of the process are the following: • Organization of the GIS-UAV Mapping Team; • Data needs/maps assessment; • Preparation/development and/or updating of maps. To be able to come-up with maps (base maps/thematic maps), there is a need to equip the GIS team with the needed skills on Quantum Geo-Information Systems (QGIS). The output of the QGIS Tutorial will serve as input for the updating of the CLUP.
	Assessment WS of existing plans and capacity needs of planning offices in selected LGUs in Mis. Or. November 19-21, 2019	The land-use related plans identified by the participants as needed to be harmonized are: • Comprehensive Land Use Plan (CLUP) • Forest Land Use Plan (FLUP) • Watershed Management Plan (WMP) • Integrated Coastal Resource Management Plan (ICMP) • Protected Area Management Plan (PAMP) • Ancestral Domain Sustainable Development and Protection Plan (ADSDPP) although they said that "interfacing" is term commonly use when talking of ADSDPP Participants: C/MPDCs and ENROs from LGUs of Misamis Oriental - Gingoog City, Magsaysay, Talisayan, Medina, Balingasag and Agusan del Sur - San Francisco and Rosario
Gingoog City	Unmanned Aerial Vehicle (UAV)-Based Mapping Workshop January 22-24, 2021	Municipality of Gingoog City is on the process of updating its Comprehensive Land-Use Plan (CLUP) that will align its land uses with the current development status of the municipality. The workshop would help them on updating their maps (base maps/thematic maps). Participants learned the operationalization of the UAV technology in surveys & mapping application Participants: MPDO Gingoog
Bukidnon	Conflict Sensitivity & Do-No-Harm Training for Community-Based Forest Management	RLGM developed e-learning courses for Conflict sensitivity, which includes Conflict Sensitivity Approaches (CSA) such as Do No Harm and Non-Violent Communication.

RLGM Area	Activities	Description
	(CBFM) leaders in Bukidnon	
	Online Course on Dialogue on Land May-June 2020	
	Online Tutorial on Data Collection Tools	At the onset of the pandemic, a virtual training was conducted for the partners in Regions 11 and 13, from May-June 2020 and July-August 2020, respectively. These were participated by the NGO (local & international), academe, DENR XI/XIII, GIZ colleagues, LGUs of San Francisco & Rosario including the PGAS-Environment Department. This is part of the Capacity Development strategies of RLGM wherein a pool of local/available expert was created in order to sustain local manpower for periodic local planning.
B. Region 13		
Butuan City	Conflict sensitivity and Do No Harm training for dialogue core group	RLGM developed e-learning courses for Conflict sensitivity, which includes Conflict Sensitivity Approaches (CSA) such as Do No Harm and Non-Violent Communication.
Agusan del Sur	Aerial Mapping for the Digital Community Mapping Workshop in 3 Brgys in Agusan Marsh Wildlife Sanctuary	A transition from traditional community mapping (literally drawing their area) into digitized mapping technology – use of drones/UAV. Images gathered/captured by the UAV, processed and printed for actual plotting – accuracy of plotted areas e.g. farms, protected area zones, other land uses is high. The plotted map will then be digitized by the GIS experts of the LGUs as the official maps incorporated in their local plans e.g. CLUP, BDP, etc. the involvement of the local stakeholders. Hence, conflicting boundaries and overlapping claims would somehow be addressed at the ground.
	AMWS PAMP Updating + Consultation Workshop	To address a periodic management plan that is updated and responsive to the current situation and needs of the area.
	Digitalized Community Mapping for Agusan Marsh Wildlife Sanctuary Part 2	A follow-up preparatory activity of RLGM on the conduct of the AMWS Digitized Community Mapping #2 and as response to the AMWS PASu request. This is in cooperation with the local community stakeholders under the Barangays of Novele and Tagbayagan in Rosario, AdS and Barangay

RLGM Area	Activities	Description
	February 26-28, 2020	Caimpugan in San Francisco, AdS. Significantly, the local communities are partly within the Protected Area's marshland and peatland. Participants: At least fifty (50) participants from the six (6) Barangays of San Francisco and Rosarion, namely: Novele, Tagbayagan, Caimpugan, Ebro, Buenasuerte, New Visayas, from the AMWS PASu Office and from the Provincial Government of Agusan del Sur. These were composed of the BLGU council members including a Barangay Captain from Tagbayagan, Bantay Danao, Women Group, IPMR, CADT holder, GIS, MPDO and PENRO LGU.
	The Youth Photo and Video Training February 19-21, 2020	Preparatory activity of RLGM and support to AMWS PASu through the AMWS youth stakeholders, on awareness-raising and education campaigns on the principles of sustainable land use and available information. And, presently, link to one of the most effective /commonly used tool for effective communication – social media. Participants: 27 youths from the five (5) out of six (6) LGUs of AMWS, namely: San Francisco, Rosario, Bunawan, La Paz, Loreto, from the Province of Agusan del Sur, from the San Francisco Colleges and the AMWS PASu Office, 13 males and 15 females with an average age of 23 years old (13 youngest and 32 oldest).
	Digitalized Community Mapping for Agusan Marsh Wildlife Sanctuary October 29-21, 2019	To address conversion of marsh area into agricultural uses, the Protected Area Management Office of Agusan Marsh Wildlife Sanctuary, in collaboration with the GIZ-RLGM, DENR-Caraga Region CDD-PABES, and the Provincial Government of Agusan del Sur PENRO-LGU, had conducted aerial surveys using unmanned aerial vehicle within the pilot sites in the municipalities of San Francisco and Rosario. With the target area of more or less 6,000 hectares to be surveyed, about 80% was accomplished and plotted in a map which then served as working document for the digitalized community mapping. Community mapping process: • Aerial mapping for vegetation cover • Community mapping - Action plans, drafting of Policies, and Incorporation to PAMP & LGU + PLGU plans

RLGM Area	Activities	Description
		• Harmonization of plans (PAMP and CLUP)
C. Other Activities		
	Test Flight of VTOL fixed wing drone (Quantum Trinity F90+)	In the past, COSERAM program helped maximize the utilization of the drones thru trainings and mapping (gathering of geographic data) in the field with its partners. However, it only had the multi-rotor drone as the tool for these activities. Multi-rotors remain useful on smaller projects and for applications requiring hover functionality for imagery. But in cases of large areas for land use planning, the RLGM project opted for a system upgrade. A fixed wing drone with VTOL (vertical take-off and landing) feature that does not require open and relatively soft take-off and landing area, that could cover larger sites in a single flight, capture better quality photos faster even in higher altitude, and a reason for lesser time in the field due to stronger wind resistance, needless multiple changing of batteries and take-off location.
	Digitalization in Land Management: an online tutorial on data collection tools October 8, 12, 14, 15, 2020	During the pandemic and having started the aerial mapping and data collection tools, RLGM thought of making an online tutorial. To fortify it, RLGM included the experiences in Barangay Kapatagan in Mount Apo Natural Park aerial mapping and the support to the formulation of the Barangay Kapatagan Development Plan back in 2018 under the COSERAM Program.

To summarize, RLGM supports the increasing use of GIS in land management towards responsible use of land and management of natural resources. Thus, the project established the GIS set up which supports Data Capture, Data Management and Data Visualization. And to strengthen this, capability-building activities have been implemented such as QGIS tutorials and training on data acquisition tools such as UAVs or drones. Much of the assistance that RLGM provides to LGUs is on the updating of CLUPs. Thus, the drone technology helps in providing for a base map where initial mapping and planning begins. Currently, RLGM has a Consultant on drone mapping going around its partner LGUs to train them on how to operate drone and how to process drone data to be able to come up with an imagery that shall be used to support GIS operation in generating various thematic maps.

It is to be noted that both the GIS software and the drone data processing software translates to cost if proprietary software is procured. There are free and open source software (FOSS) for both GIS and the drone processing software. QGIS is a highly

recommended open source GIS software where training materials can also be found online. While, for drone data processing, there is the OpenDroneMap. Going open source gives lower class LGUs the opportunity to be able to undertake mapping activities that produces the local plans even if resources are at a low.

V.2 Result of Questionnaires and Key Informant Interviews (KIIs)

Inputs from the questionnaires gathered from the RLGM Technical Advisers are as follows:

- The possible key messages that may be used to inform the public on GIS application to land management:
  a. **Social cohesion.** The use of GIS technology can aid the dialogue process on the ground and help clarify issues of overlapping claims. Should be noted that data placed on GIS should be conflict-sensitive.
  b. **Sustainable land use.** GIS technology can show differences between planned and actual land use. This will contribute to resolving the conflicts and facilitate developing options for a more sustainable, gender-sensitive, conflict sensitive and climate resilient land use.
  c. **Community participation in development.** GIS data can help stakeholders achieve collective understanding on the realities thus help in facilitating collaborative management and encourage strong commitment from the communities.
  d. **Efficiency of processes.** Public access to the GIS data and technologies can hasten various processes communities has to undergo (e.g., CADT claims, CBFM, etc.) reduce the burden or cost on the part of rights holders or the communities. This also helps duty bearers or government agencies effectively discharge their duties.
  e. **Data ownership and data protection.** It should be also noted that data placed on the wrong hands can also be detrimental to the communities. Data accessed by interest groups who may have environmentally destructive intentions may be dangerous. This should be taken into consideration to provide for safety measures to protect communities.
  f. Capacity-building. Almost all sectors of the society recognize the importance of GIS to land management and seeks not only understanding of the said technology but developing of the skill set to be able to use it for other applications that will benefit the management of land in their areas of jurisdiction.

- The key take-aways (main issues and concerns and lessons) in the RLGM areas:

a. Land management agencies (DENR, NCIP, DAR) are all "target driven". This has affected land management as they overlap over the same piece of land just to make sure that they reach their targets. This also brought conflict to the communities who may claim their rights according to the different land policies.
b. Agencies are not very keen on sharing data with other agencies due to trust issues. This also affects the LGUs and communities.
c. There has been lack of GIS capacities (e.g. skills) and resources (e.g., equipment and technologies) on some agencies and LGUs.
d. The issues on tenure (against individual ownership, against common title) are still unresolved at the policy level and therefore even more problematic at the ground level.
e. Dialogue at the community level has a positive impact not only on resolving land conflict but also a tool for strengthening community cohesion and strong community participation in the planning and collaborative management of land.
f. There is a clamor at the community level for agencies to recognize community agreements by specific agencies in resolution of land conflict and in in recognition of land claims and land management approaches .

- Target audience and the level of information needed:

Table 3. Type of Audience and Level of Information Needed

Type of Audience	Level of Information Needed
Sectoral (women, youth, IP, etc.)	High (frequent, creative & "readily" available)
Barangay, LGU, PLGU	High/ owners/ (frequent, periodic, updated, localized) Data on the land claims, land-use, classification, policies and other data
Regional & National	High/ responsive to current needs/ legislated All land related Data gathered by other agencies for harmonization and resolution of conflict (or prevention) at the onset
Communities	All data including all interests over the land they and claim

- The possible communication approaches that may be utilized to ensure that the information generated by GIS on land management are better disseminated and understood from the community level to the higher level (decision-makers):
    a. For decision makers - data that is processed into policy reviews and research papers that is based on the actual realities on the ground.
    b. For communities - direct sharing of common data from all agencies to the communities.
    c. For all - video (instructional, sharing lessons and experiences, showcase of pilot areas and applications) on social-media, radio, and television (to some extent)

Other take-aways from Key Informant interviews (KIIs) are the following:

- The respondents were all aware of GIS technologies, its application to land management and its benefits.
- Focus of the Communication Plan should be the communities. Efforts to cascade information should be done for the communities. And if communication materials are intended for communities, always better to use their local language for ease of understanding.
- The basic communication tool should be more graphic, like poster and fliers, colorful and interesting, and not too wordy. This shall be supported by information shared thru FB pages, for wider range.
- It is good to note that there are IPs being trained to get coordinates using their mobile phones to get positions of for example, almasiga, a species categorized as "vulnerable" by the International Union for Conservation of Nature (IUCN) due to illegal logging, destructive methods of resin tapping, and land-use change. They also understand maps more because of this.

- From what has been gathered from KIIs, questionnaires and other secondary data sources, the following are the key messages that needs to be communicated to various audiences of land management:

Table 4. What Needs to Be Communicated

Type of Audience	What Needs to be Communicated	Content/Message
Sectoral (women, youth, IP, etc.)	What are the training opportunities to be able to use GIS, drones and other data collection tools?	• The RLGM thru its partners, can announce schedules of training activities.
	What are the land management issues and concerns?	• Some of the issues and concerns of the sectors include the following[7]: - Presence of boundary conflict (e.g. overlapping land claims, etc.) - How to resolve land conflicts - Lack of education/awareness on the functions & definition on Peatland, Marshland, PA - Timber poaching - Kaingin/Clearing - Wildlife hunting - Lack of local tourism - Land conversion - Presence of flooding, erosion and peat fire - Others
	What are the experiences of the sectors in land management where GIS plays a support role?	• An example is teaching IPs how to get coordinates using phone (mobile GPS) for the inventory of almasiga. • Community mapping, where a drone is used to generate base map to help Obu-Manuvu in their Ancestral Domains Sustainable Development and Protection Plan (ADSDPP) updating and enhancement.
Barangay, LGU, PLGU	What are training opportunities to improve technical skills on GIS, use	• The RLGM thru its partners, can provide training activities for this.

[7] From RLGM documentation reports

Type of Audience	What Needs to be Communicated	Content/Message
	of drones for mapping and use of other data collection tools?	• May also connect with the LGU or land agencies (e.g. NAMRIA, DHSUD, etc.) to get access to training opportunities.
	What are the applications of GIS (in relation to land management)?	• Participatory mapping and planning • Addressing overlapping land claims • Land use planning and land management • Identification of land for socialized housing and evacuation centers • Geo-hazard mapping (flooding, landslide, liquefaction, storm surge, active faults) • Mapping of health concerns like dengue, malaria or water-borne diseases to identify necessary interventions by barangay or LGU. • Preparation of other local plans such as Shelter Plan, Forest Land Use Plan, Coastal and Marine Management Plan, etc.
	How to get access to GIS data?	• Access to data thru Memorandum of Agreement and other instruments for government-to-government projects and activities (most of the time access of national geospatial data thru LGUs). • Thru the Freedom of Information mechanism where Filipino citizens may request any information about any government transaction and operation. • Thru the Philippine Geoportal (GeoPH) where one may access geospatial data and services. • Thru PhilGIS, a simple, single-access portal of free Philippine geospatial data.
Regional & National Government Agencies	Training programs (online platform or face-to-face)	• Land agencies such as NAMRIA and DHSUD provides GIS trainings to LGUs, local government offices and others.

Type of Audience	What Needs to be Communicated	Content/Message
	How to get access to GIS data?	• Access to data thru Memorandum of Agreement and other instruments for government-to-government projects and activities (most of the time access of national geospatial data thru LGUs). • Thru the Freedom of Information mechanism where Filipino citizens may request any information about any government transaction and operation. • Thru the Philippine Geoportal (GeoPH) where one may access geospatial data and services. • Thru PhilGIS, a simple, single-access portal of free Philippine geospatial data.
	How to address land management issue and concerns?	• Communicating and sharing experiences (success story, accomplishments, etc.) of partners - communities, government offices, non-government offices and others on how a particular land management issue have been resolved with the use of GIS or how GIS helped in identifying and analyzing problems. Example is an article on "DENR, RLGM completes digitalized community map to enhance protection and better management of Agusan Marsh Wildlife Sanctuary"[8].
	What are the various policies on the use of GIS, use of drones and other data gathering tools that aides land management?	• CLUP GIS Guidebook: A Guide to Comprehensive Land Use Data Management) in the preparation of the Comprehensive Land Use Plans (CLUPs) using GIS technology to enable local planners to be capable of preparing their own CLUPs. • LMB Memorandum Circular No. 2015-01, entitled "Guidelines on the Use of Real Time Kinematic (RTK) Global Navigation System (GNSS) in the Conduct of all Kinds of Lot Surveys with Tertiary Accuracy"

[8] RLGM Strategic Communication Framework and Plan (p. 53)

Type of Audience	What Needs to be Communicated	Content/Message
		• LMB Memorandum Circular (LMC) No. 2017-03, entitled, "Adoption on the Alternative Adoption on the Alternative Use of Unmanned Aerial System (UAS) in the Conduct of Land Survey" • Technical Bulletin No. 2017-02, entitled "Guidelines on the Use of Unmanned Aerial Systems in Support of Land Surveys"
Communities	What is GIS?	• Refers to Geographic Information System which combines the geographic location, information about a location and a system that stores all information and location. It is a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information; that is, data identified according to location. [9] • GIS allows us to view, understand, question, interpret, and visualize our world in ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts.[10]
	What can we do with GIS?	• Mapping where things are and mapping qualitative information. (*Pagmapa ng mga lokasyon ng mga totoong katangian at pag-alam ng kanilang relasyong spatial.)* • Mapping quantitative information*. (Pagmapa kung saan ang may pinakamaliit o pinakamalaki, para malaman kung aling lugar ang nakatugon sa pamantayan o para makita ang mga relasyon.)* • Mapping of densities. *(Pagmapa ng mga densidad para malaman ang mga konsentrasyon o dami na nanormalize ng sukat o bilang.)* • Finding what is inside or nearby. *(Pag-alam kung ano ang nasa loob ng isang lokasyon o ano ang mga malapit dito.)*

[9] Definition from United States Geological Survey
[10] Definition from Esri

Type of Audience	What Needs to be Communicated	Content/Message
		• Mapping change. *(Pagmapa ng pagbabago sa isang lokasyon para alam kung ano ang aasahan sa kinabukasan, magpasya sa kung ano ang gagawin at suriin ang resulta ng isang aksyon o polisiya.)*[11]
	How does GIS technology help in land management?	• How GIS helps in the land use planning and decision-making? - GIS finds its use in urban planning as an analytical and modeling tool. It is useful in monitoring of an area or conducting a feasibility study of a location for a specific purpose, e.g. ascertaining the suitability of a location for the construction of a bridge or dam. Feasibility study of even smaller structures like schools and hospitals is essential and can be easily conducted with the help of GIS.[12] - GIS is not just a capturing and analyzing tool but a valuable asset in spatial modeling, decision making and a lot of other disciplines. - It allows cities to analyze trends and visualize the impact of historic changes and future plans. It gives cities the tools to identify needs and problem areas. [13] • How is GIS used in the field of wildlife conservation?[14] - Tracking animals to understand their migration patterns - Map biodiversity to gain a deeper understanding of where these ecosystems are located in the world - Habitat suitability modeling that will guide conservationists when, where and how to set up protective measures, and restoration - Manage species inventories and support researchers with their projects

[11] From RLGM module on Introduction to GIS
[12] https://www.gislounge.com/gis-urban-planning/
[13] https://www.govpilot.com/blog/ways-gis-helps-cities-make-decisions
[14] GIS for Wildlife Conservation. https://storymaps.arcgis.com/stories/389a2c6548194effa10b7ccef6b3e82d

Type of Audience	What Needs to be Communicated	Content/Message
		- Raise awareness of the importance of conservation that will reach decision-making bodies through the use of maps - Advance science and the understanding of how conservation impacts the environment. • How is GIS used in environmental management?[15] - GIS can be used most effectively for environmental data analysis and planning. It allows better viewing and understanding physical features and the relationships that influence in a given critical environmental condition. Factors, such as steepness of slopes, aspects, and vegetation, can be viewed and overlaid to determine various environmental parameters and impact analysis.
	What are the benefits of GIS?	• The use of GIS technology can aid the dialogue process on the ground and help clarify issues of overlapping claims. • GIS Technology can show differences between planned and actual land use. This will contribute to resolving the conflicts and facilitate developing options for a more sustainable, gender-sensitive, conflict sensitive and climate resilient land use. • GIS data can help stakeholders achieve collective understanding on the realities thus help in facilitating collaborative management and encourage strong commitment from the communities. • Public access to the GIS data and technologies can hasten various processes communities has to undergo (CADT claims, CBFM, etc.) reduce the burden or cost on the part of rights holders or the communities. This also helps duty bearers or government agencies effectively discharge their duties.

[15] https://www.geospatialworld.net/blogs/managing-the-environment-using-gis/

Type of Audience	What Needs to be Communicated	Content/Message
	What are the applications of GIS?	• Participatory mapping and planning • Addressing overlapping land claims • Land use planning and land management • Identification of land for socialized housing and evacuation centers • Geo-hazard mapping (flooding, landslide, liquefaction, storm surge, active faults) • Mapping of health concerns like dengue, malaria or water-borne diseases to identify necessary interventions by barangay or LGU. • Preparation of other local plans such as Shelter Plan, Forest Land Use Plan, Coastal and Marine Management Plan, etc.
	What is sketch mapping?	• Traditionally, sketch mapping is the simplest mapping method that is known to be the mapping tool for community mapping activities. Drawn maps were being used as a basemaps as the stakeholders/community (primarily the one who lives in the area) would draw and pinpoint identified locations/areas adding their known information on a map. It does not use consistent scale or geo-referencing rather show salient features and positions of the land.
	What are aerial and satellite images?	• Aerial images are photos of the Earth's surface taken from an airplane and recently, unmanned aerial vehicle (UAV) or drone at different distances from Earth. Satellite images are digitally produced representations of Earth taken from orbiting sensing devices on satellites.
	What are the differences of aerial and satellite images?	• Satellite images generally cover a much wider area and therefore have larger scale scientific applications. Aerial images, which are taken at a lower altitude and thus cover a smaller amount of area, with extremely high resolutions, suitable for engineering surveys and similar projects.

Type of Audience	What Needs to be Communicated	Content/Message
	What are the advantages of using drones for mapping?	• Drones are capable of quick data collection times and excellent positional accuracy that could produce clearer and much updated maps that can be presented in 2D and 3D that could be used in community land use planning. It would help people involved to understand maps easier and enable the community to show and demonstrate their plans and prepositions together with various national agencies about their land.
	How to get access to GIS data?	• Access to data thru Memorandum of Agreement and other instruments for government-to-government projects and activities (most of the time access of national geospatial data thru LGUs). • Thru the Freedom of Information mechanism where Filipino citizens may request any information about any government transaction and operation. • Thru the Philippine Geoportal (GeoPH) where one may access geospatial data and services.

Other contents that may be helpful to technical people includes modules, training materials, lecture notes on GIS, UAVs or other data collection tools. Some of the examples are the following:

Table 5. Other Technical Contents

Technical Contents	Sources
Data Collection Tools	
Data Collection Tool (KoBo Toolbox)	• RLGM Module
Geographic Information Systems	
Basic GIS Training - Data Capture - Data Management - Data Visualization	• RLGM Module
Unmanned Aerial Systems (UAS)	
Introduction to UAV	• RLGM Module
Aerial Mapping Activity Checklist	• RLGM Module
Drone / UAV Rules and Regulation	• RLGM Module • Civic Aviation Authority of the Philippines (https://www.youtube.com/watch?v=va3I4S7HgDg) • How to be a certified drone pilot (http://landrightsph.org/resources/how-to-be-a-certified-drone-pilot/) • How to apply for a drone pilot license & RPA Operator Certificate in the Philippines (https://philippinedronenetwork.com.ph/how-to-apply-for-drone-pilot-license-in-the-philippines/)
Flight Planning and Operations	• RLGM Modules
Image Processing and Visualization	• RLGM Modules
Post-Processing	• RLGM Module

There may also be other existing materials (e.g. video, brochures, briefers, training manuals) from other sources (e.g. NAMRIA, training institutions, etc.) that can be used to inform, educate and communicate the use of technologies for land management.

There are also free online courses (e.g. QGIS Training Manual, DJI Guides video tutorials, etc.) that may be tapped to understand the capabilities of these technologies which aides in understanding more about land management.

V.3 Limitations on Data Gathering

With the current situation of the pandemic, with the delta variant of the COVID-19 virus spreading even in the rural areas of the country, stricter restrictions have been imposed particularly on face-to-face gathering. The RLGM Technical Advisers deems that the FGDs and interviews are better done face-to-face, but do recognize that it might not be suitable at this time. The least that can be done is to undertake it through an online video conferencing platform which too has its limitations. The challenge on virtual communications are the fluctuating net connections and power interruptions in the rural areas. As many have adopted the Work-from-Home arrangement because of the rising positive COVID-19 cases, even FGDs are no longer that feasible. Also, at this time, it is also difficult to reach members of the communities as most of them also do not have access to the internet.

Because of these limitations, best effort has been exerted on conducting the data gathering through KIIs and survey questionnaires. Although this approach was not too successful, insights of partners on the ground working directly with communities were documented.

Refer to the draft Communications Plan (Part 2) for details.

VI. Recommendations

Hereunder are some of the recommendations to effectively communicate land management issues and concerns through the application of GIS technologies:

1. As there is already a Strategic Communications Framework and a Communications Plan for the RLGM Project, it will be practical to put this to good use to communicate the goals, objectives, and also the accomplishments and gains of the Project.

2. The RLGM should have an in-house Communication Specialist/Officer to implement the Communications Plan. The role of Communications Specialist/Officer in these times have become more significant, especially with the popularization of social media and limitation in mobility caused by the pandemic. Production of IEC materials before is seen as a once-in-a-year activity. These days, the opportunity to communicate messages, comes not once in a blue moon, it has become more frequent and social media content management has become almost a requirement for most development projects.

3. In effect, because GIS is an integral tool to the RLGM activities, application of the technology, as well as understanding of land management itself, and issues and

concerns related to it, would be more widely understood with a communications strategy in place.

4. The attached Communications Plan shall aide the RLGM Project in widening the reach of their key messages, particularly on communicating land management thru GIS technologies, not just in their areas of coverage but the entire country.