

Case study in the Philippines: Identifying missing areas of forests and other land with tree cover in the Philippines using PALSAR-2 Forest/Non-Forest map

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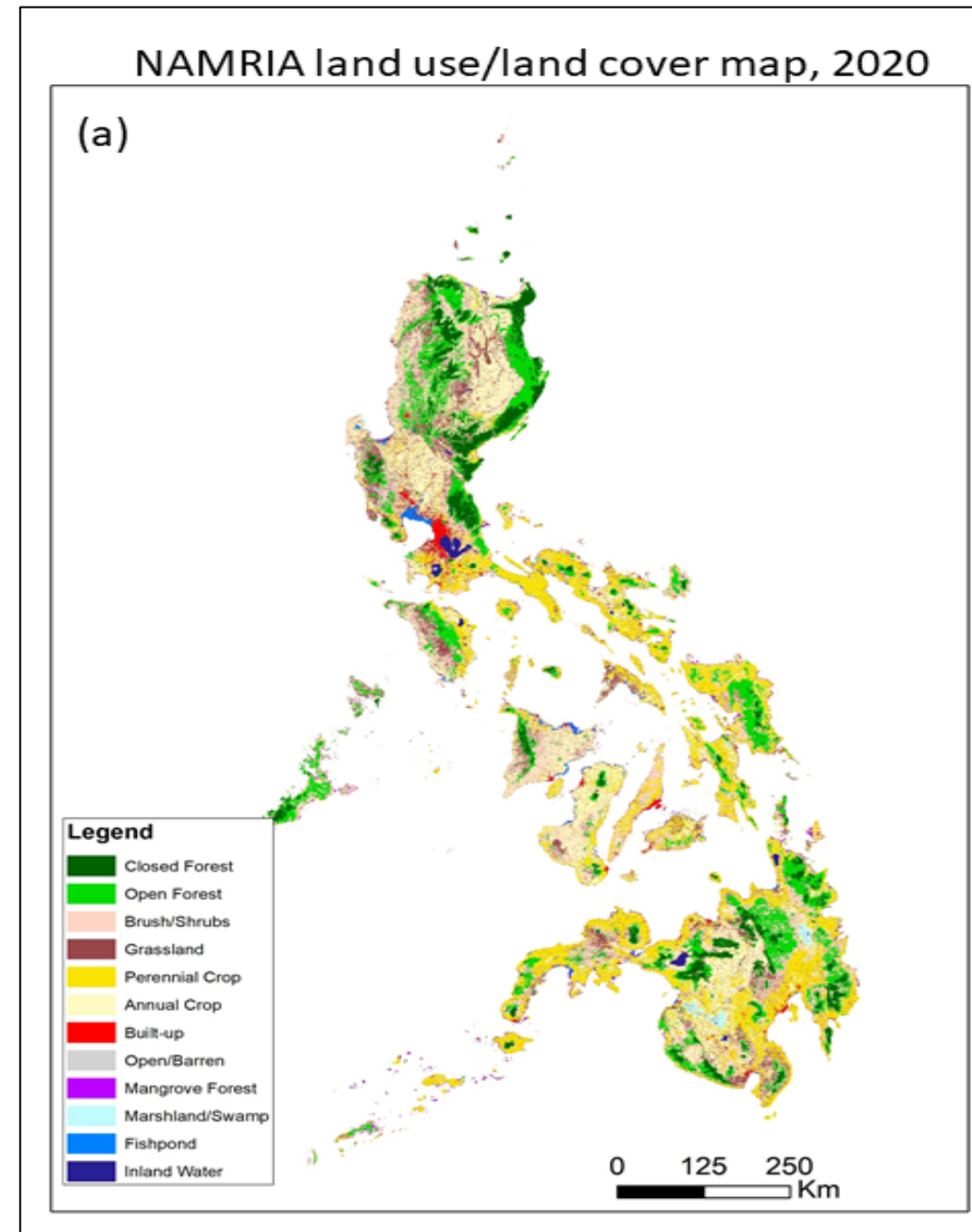


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Introduction

- Official land use/land cover map of the Philippines created by the National Mapping and Resources Information Authority (NAMRIA)
 - Produced through visual interpretation of Sentinel-2 satellite images, i.e., by manually labelling areas in the imagery according to the interpreted land use/land cover
 - Very accurate for large areas, but may overlook small areas (~0.5 hectares) that correspond to FAO's definition of "forest".
 - Does not include "other land with tree cover", i.e., trees outside forests, which are also important to monitor in the context of reporting to UNFCCC, FAO, etc.



Objective of case study

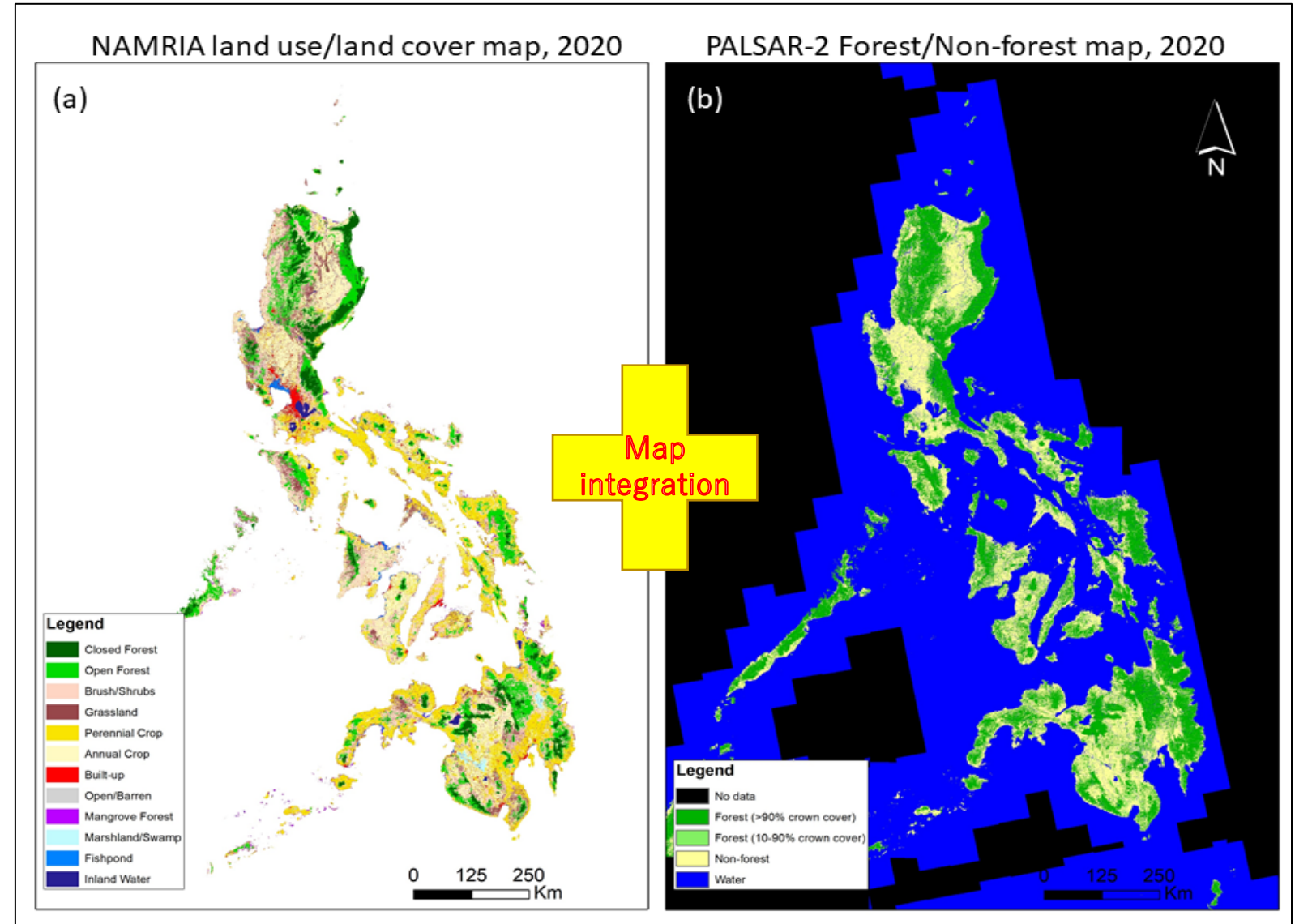
- **Objective:** Identify additional areas of “forest” and “other land with tree cover” (according to FAO definitions) using PALSAR-2 “Forest/Non-Forest map”
- **Approach:** Map overlay and integration using Geographic Information Systems.

FAO definitions

Forest: “Land spanning more than 0.5 ha with trees higher than 5 m and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use... (FAO, 2010).

Other land with tree cover: Land classified as Other land, spanning more than 0.5 ha with a canopy cover of more than 10 percent of trees able to reach a height of 5 m at maturity.

Explanatory notes 1. The difference between Forest and Other land with tree cover is the land use criteria... (FAO, 2010).



Methods: Map overlay and integration

NAMRIA-2020
land-use/
land cover class

PALSAR-FNF
class

FAO category, based on different
combinations of NAMRIA-2020
and PALSAR-FNF classes

"Open forest", "Closed forest",
"Mangrove"

ALOS-FNF = "Forest" or "Non-forest"

PALSAR-FNF = "Forest"

"Forest"

"Brush/Shrubs"

PALSAR-FNF = "Non-forest"

"Other wooded land"

"Perennial Crop", "Annual Crop",
"Built-up"

PALSAR-FNF = "Forest"

"Other land with tree cover"

PALSAR-FNF = "Non-forest"

"Other land"

"Grassland", "Marshland",
"Open/Barren", "Fishpond",
"Inland Water"

PALSAR-FNF = "Non-forest"

PALSAR-FNF = "Forest"

"Forest"

Results

- Identified additional 5.937 ± 0.217 Mha of forest areas, mainly small forest patches in areas mapped as “Brush/shrub”, “Grassland”, or “Marshland/swamp” by NAMRIA.
- Identified 4.294 ± 0.258 Mha of land corresponding to FAO’s definition of “Other land with tree cover” that were previously unreported.
- Estimated additional 145,480 GgCO₂/year of carbon sinks in these identified areas of “Forest” and “Other land with tree cover”, based on IPCC Guidelines for National GHG inventories.

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Better monitoring of forests according to FAO’s definitions through map integration: Significance and limitations in the context of global environmental goals

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ABSTRACT

National monitoring of forests is essential for tracking progress towards various global environmental goals, including those of the Kunming-Montreal Global Biodiversity Framework and the Paris Agreement. Inconsistent national definitions of “forest”, however, can complicate the tracking of global progress towards achieving these goals. The FAO’s (Food and Agricultural Organization of the UN) definition of “Forest” is well-known and broad enough to be applicable globally, but it is difficult for countries to produce national forest maps according to this definition using only a single source of remote sensing data. Here, we developed an approach to integrate multiple existing land use/land cover (LULC) maps and generate an integrated map of forests and “Other land with tree cover” that is more consistent with FAO definitions. The proposed approach is based on merging thematic information from the global “PALSAR-2 Forest/Non-forest map”, a global forest/non-forest map, with that of a national map containing more detailed LULC classes. By applying the map integration approach at the national level in the Philippines as a case study, we identified 5.937 ± 0.217 Mha of “Missing forest” that were not included in the country’s national LULC map, mainly forest patches in areas that were predominantly “Brush/shrub”, “Grassland”, or “Marshland/swamp” lands. We also identified 4.294 ± 0.258 Mha of land corresponding to FAO’s definition of “Other land with tree cover” that were previously unmapped; specifically, patches of tree cover on predominantly agricultural and urban lands. Based on these additional areas of “Forest” and “Other land with tree cover” identified, we further estimated an additional 145,480 GgCO₂/year of carbon sinks. Our approach is generalizable enough to potentially be applied in other countries for more standardized forest and ecosystem services monitoring.

1. Introduction

Forests provide a wide range of benefits, or “ecosystem services”, including habitat for native species (Sodhi et al., 2010), carbon sequestration and storage (Ameray et al., 2021), food/wood/water provisioning (Naime et al., 2020), and mitigation of climate-related hazards like flooding and landslides (Debele et al., 2019; Johnson et al., 2022). In addition, forests play a crucial role in maintaining biodiversity (CBD) “Kunming-Montreal Global Biodiversity Framework”, the UN Framework Convention on Climate Change’s (UNFCCC) “Paris Agreement” (UNFCCC, 2016), and the “UN Sustainable Development Goals” (SDGs) (United Nations, 2015) (Table 1). To support these ongoing global initiatives, countries are requested to regularly monitor their forests and other natural ecosystems, and report the results to the international organizations responsible for

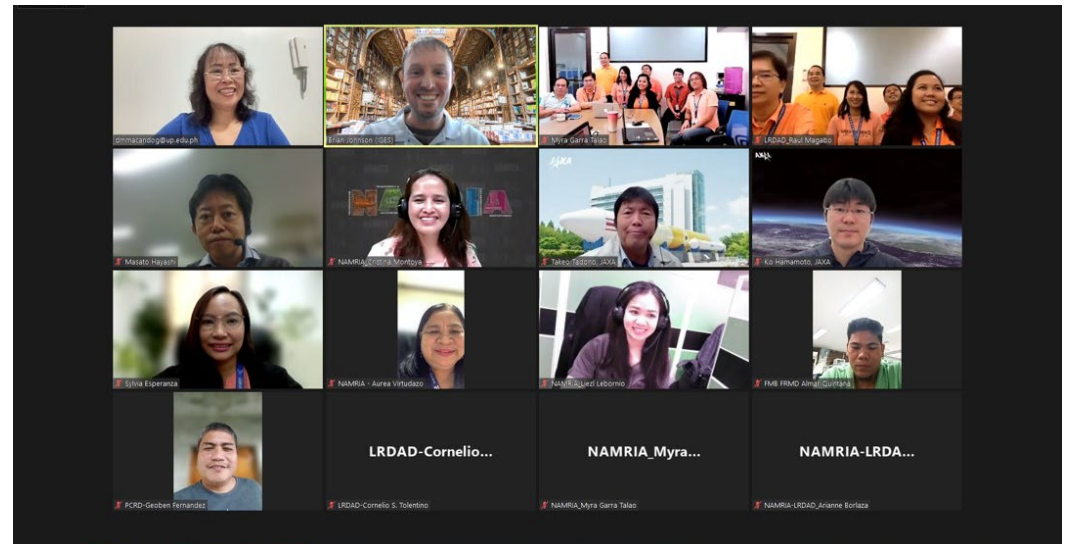
Feedback from Philippine government

- Presented results to Philippine government to get feedback on case study, and on the potential for using JAXA's PALSAR-1/-2 data for forest monitoring, national GHG inventory, etc.
- Meeting with Forest Management Bureau (in September 2023)
- Meeting with National Mapping and Resources Information Authority (in November 2023)

Meeting with Forest Management Bureau (September 2023)



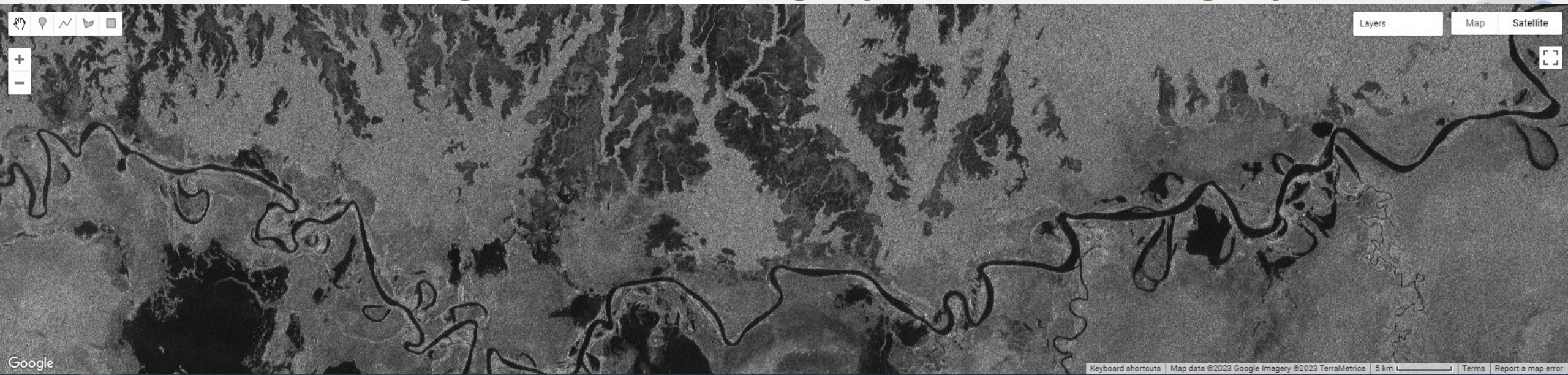
Meeting with National Mapping and Resources Information Authority (November 2023)



Feedback from Philippine government and lessons learned

- Feedback on case study
 - Officials said other international studies also found higher forest area estimates in the Philippines, so there might be a need to rethink their mapping approach.
 - Useful to have area estimates of “other land with tree cover”, as there are no official statistics exist on this.
- Feedback on the potential for using PALSAR-1/-2 images
 - Philippine government previously used JAXA imagery for producing their national land cover map of the year 2010.
 - Visual and near infrared images from JAXA’s ALOS-1 satellite
 - Very interested in using PALSAR-2 data for monitoring forests and other land use/land cover.
 - However, they haven’t used this type of imagery (synthetic aperture radar imagery), before.
Need for capacity building and detailed guidance on how to visually interpret and process these types of images.
 - Officials also stressed that it is critical for JAXA to keep providing this data continuously available in the future.

Visualizing PALSAR-2 imagery vs. visible imagery



Lessons learned

- **About the usefulness of the case study:** It was a good way to familiarize government officials with PALSAR-2 data (through the PALSAR-2 Forest/Non-forest map) and get their initial interest.
- **About how to make changes in national reporting of forest cover (and other land with tree cover):**
 - The path is not necessarily direct, and can require going through several agencies.
 - We first approached the Forest Management Bureau, but were told that they fully rely on data from NAMRIA. So, to help the Forest Management Bureau in reporting forest area statistics, we first need to cooperate with NAMRIA.
 - It requires follow-up with capacity building efforts, to enable the government agencies to really understand the data and how to use it for their own for national land use/land cover mapping.
 - We haven't accomplished it yet, so...we hope these lessons will help achieve the goal. 😊

THANK YOU!