

Exploring Nighttime Lights, MODIS Global Land Cover and Socio-economic Datasets for Electrification Coverage and Poverty Mapping Studies

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This study is a preliminary work that explores satellite-based data such as nighttime lights from the Visible Infrared Imaging Radiometer Suite (VIIRS) Day/Night Band (DNB) produced by the Earth Observations Group (EOG) at NOAA/NCEI and MODIS Land Cover Type product (MCD12Q1) as well as a core local poverty indicator from the Community-Based Monitoring System (CBMS) for their potential for electrification coverage and poverty mapping studies. By doing an overlay analysis of the VIIRS-DNB and MCD12Q1 data, it was found out that about 94.21% of built-up areas in the Philippines are lit areas or with access to electricity. This percentage is similar to the value reported by the World Bank for "Access to electricity, urban (% of urban population)" for the Philippines which is at 94.94% in year 2013. It was observed also that: unlit built-up pixels were those located near bodies of water (e.g., rivers) mostly in sandy areas and in bare soil areas; small patches of built-up areas tend to have unlit pixel nearby; and unlit pixels are not observed near large (well-defined) patches of built-up areas (e.g., Metro Manila). Finally, a series of maps were produced showing the spatial distribution of lit and unlit areas per province and the corresponding proportion of households with income below the poverty threshold" (POVP). While it is expected to see low and high POVPs for well-lit and low-lit areas, respectively, the said maps demonstrate how even in well-lit municipalities, high POVP still exists. On the other hand, there were some municipalities with relatively low proportion of lit areas but with low POVP. This initial study will become a springboard for succeeding studies for energy infrastructure support for poverty alleviation.



1. INTRODUCTION

Remote sensing data has been used by research studies to derive socioeconomic and energy-related variables. For instance, nighttime light satellite images provide potential possibilities to quantify such variables and its correlation with human activity [1] and poverty incidences [2]. Meanwhile, land cover data such as MCD12Q1 is essential as human modifications to land use/cover have significant implications to sustainable land management [3]. The Community-Based Monitoring System (CBMS) is an "organized process of data collection and processing at the local level and of integration of data in local planning, program implementation and impact monitoring" [4].

The objective of this study is to explore VIIRS-DNB, MCD12Q1 and CBMS data to:

1. Estimate the extent of electrification coverage in the Philippines
2. Determine characteristics of built-up areas (derived from MCD12Q1) which are detected as unlit areas (based on VIIRS-DNB)
3. Show municipal-level spatial distribution of POVPs per province and their corresponding lit areas.

3. Results

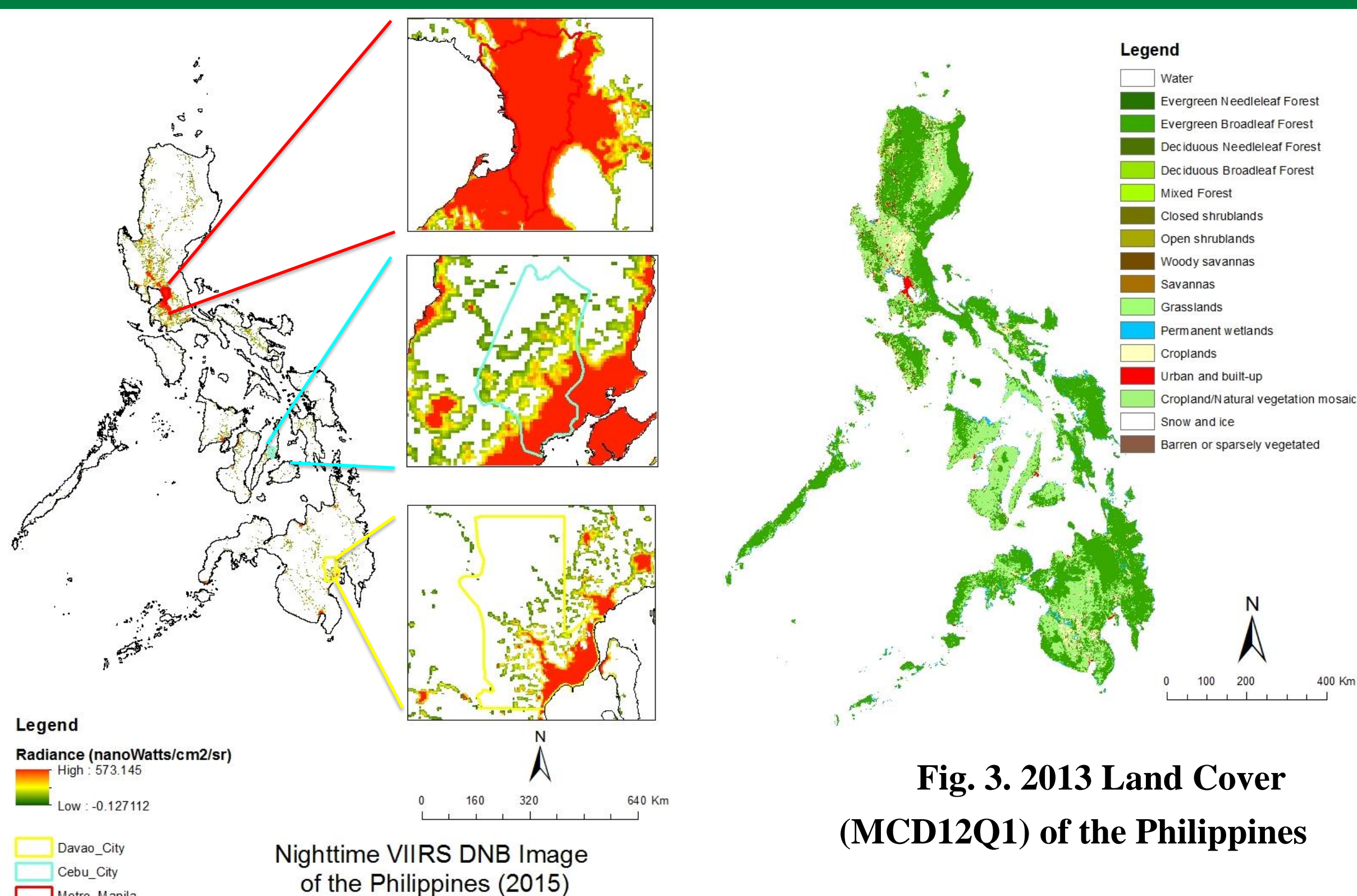


Fig. 3. 2013 Land Cover (MCD12Q1) of the Philippines

Fig. 2. Nightlight at Metro Manila (top), Cebu City (Middle) and Davao City (bottom)

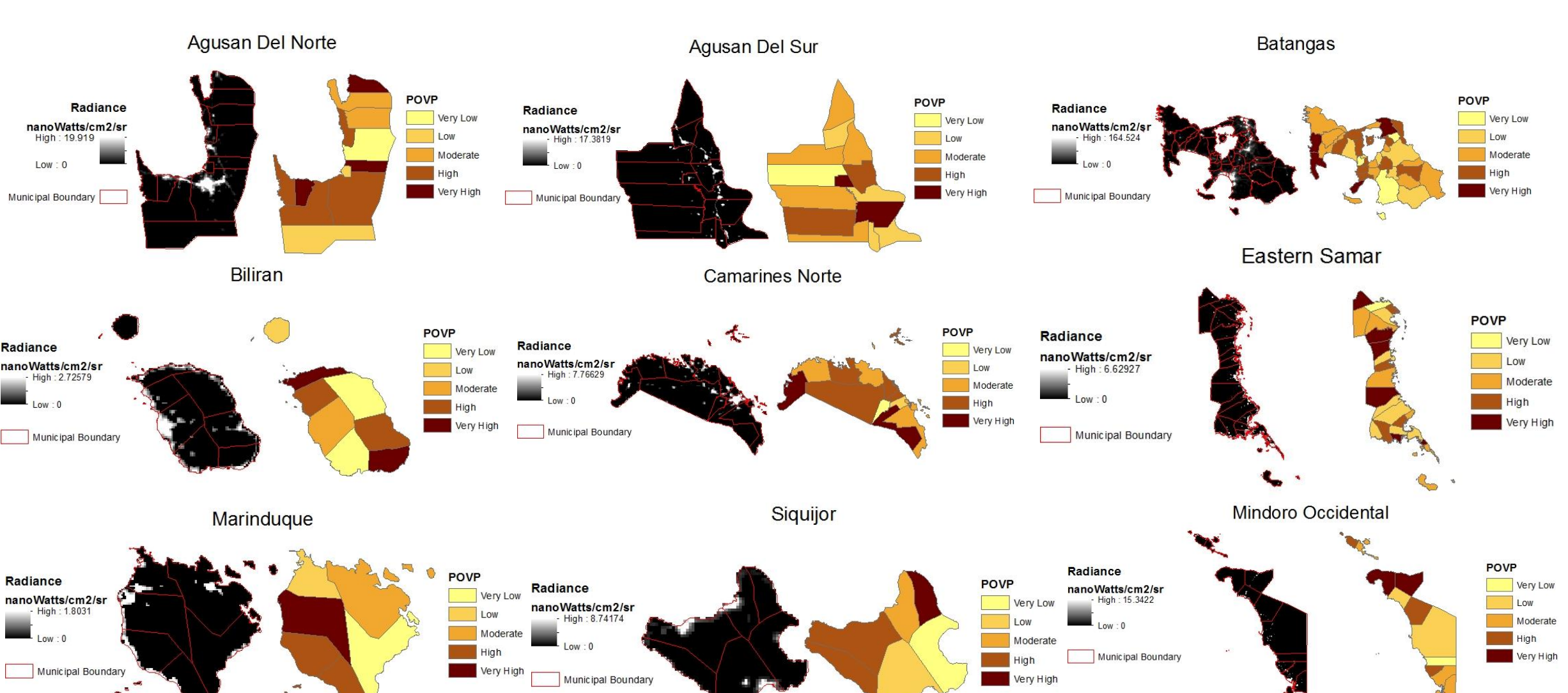


Fig. 4. Spatial distribution of nightlight and POVP in selected Philippine provinces

2. Methodology

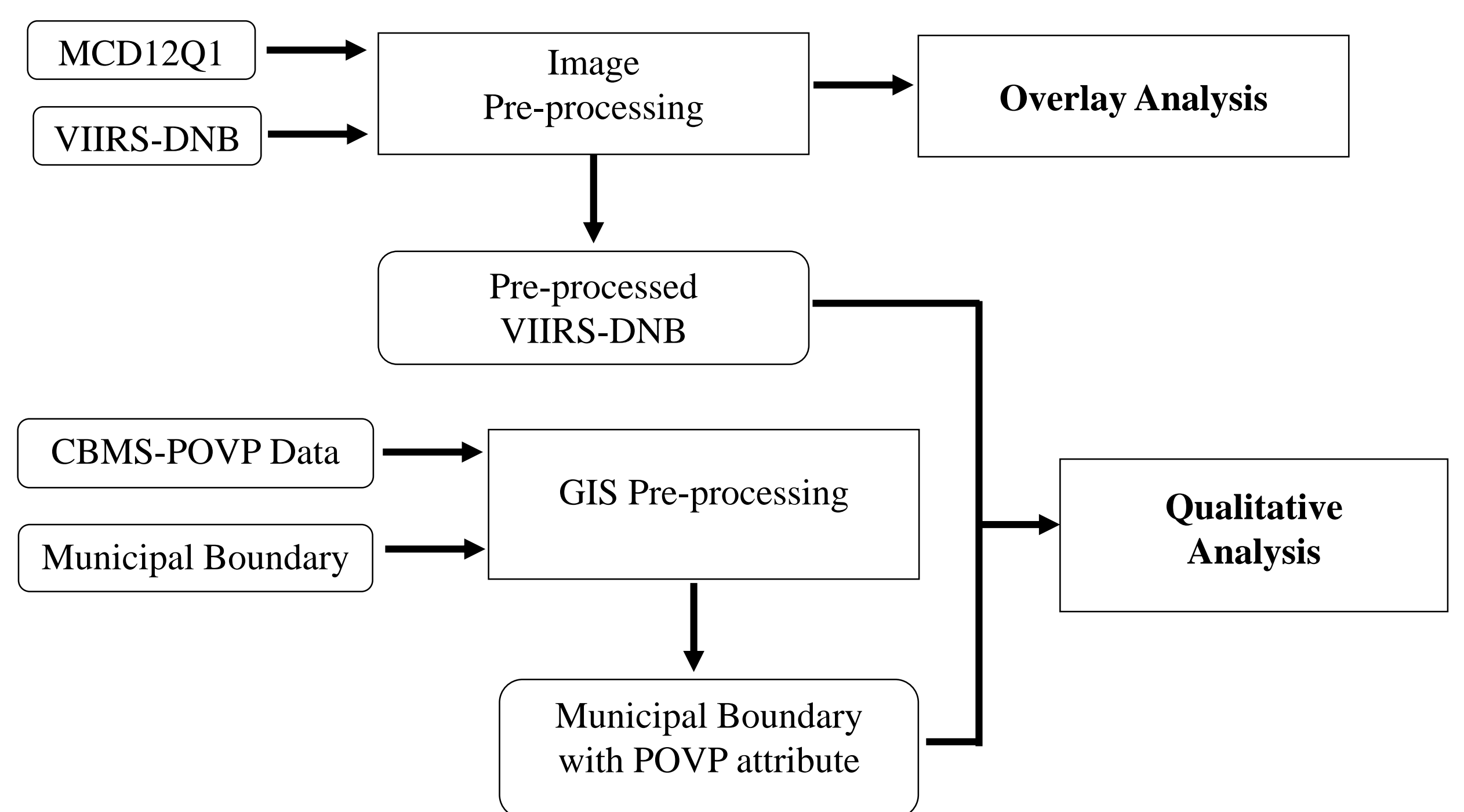


Fig. 1. Methodology of the Study

MCD12Q1 and VIIRS-DNB data were pre-processed by re-projecting them to a common projection (UTM 51N) and then clipped to include only areas within the Philippines and extract built-up areas from MCD12Q1. An overlay analysis was done to these datasets to determine lit and unlit pixels for electrification coverage assessment in built-up areas. CBMS-POVP Data was inputted as an attribute to the vector data for the municipal boundary of selected provinces in the Philippines. A qualitative analysis was done with the pre-processed VIIRS-DNB and Municipal Boundary with POVP attribute to characterize poverty level with access to electricity.

4. Remarks

- The overlay analysis has estimated that 94.21% of built-up areas in the Philippines are lit areas or with access to electricity. This percentage is similar to the value reported by the World Bank for "Access to electricity, urban (% of urban population)" for the country which is at 94.94% in year 2013 [5].
- It was observed that generally, unlit built-up areas were located near bodies of water (e.g., rivers) mostly in sandy areas; also in bare soil areas. Moreover, small patches of built-up areas tend to have unlit pixel nearby and unlit pixels are not observed near large and well-defined patches of built-up areas.
- This study has explored a global land cover, nightlight and CBMS datasets to determine the extent of electrification coverage in the Philippines and investigated locations of unlit built-up areas.

5. References

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