

Remote sensing techniques for village identification: Improved electrification planning for Zambia

Alin Radu

Maseru, 24 January 2018



Reiner Lemoine Institut

Overview

- Not-for-profit research institute
- 100% owned by Reiner Lemoine Stiftung (RLS)
- Based in Berlin, established in 2010
- Managing director: Dr. Katrin Goldammer
- 25 research assistants + students
- Member of e.g. ARE, eurosolar, BNE



Reiner Lemoine
Founder of the Reiner Lemoine
Foundation

Mission

Scientific research for an energy transition
towards **100 % renewable energies**

About me

- Bachelor studies *Environmental Engineering* at Technical University of Civil Engineering Bucharest (2006 -2010)
- Master studies in *Tropical Hydrogeology and Environmental Engineering* at TU Darmstadt (2013 - 2016)
- Internship with Reiner Lemoine Institut (2017)

Overview

1. The problem
2. Remote sensing as a solution
3. Methods
4. Results
5. Conclusion

1. The problem

Zambia electrification status in 2016 (according to the World Bank):

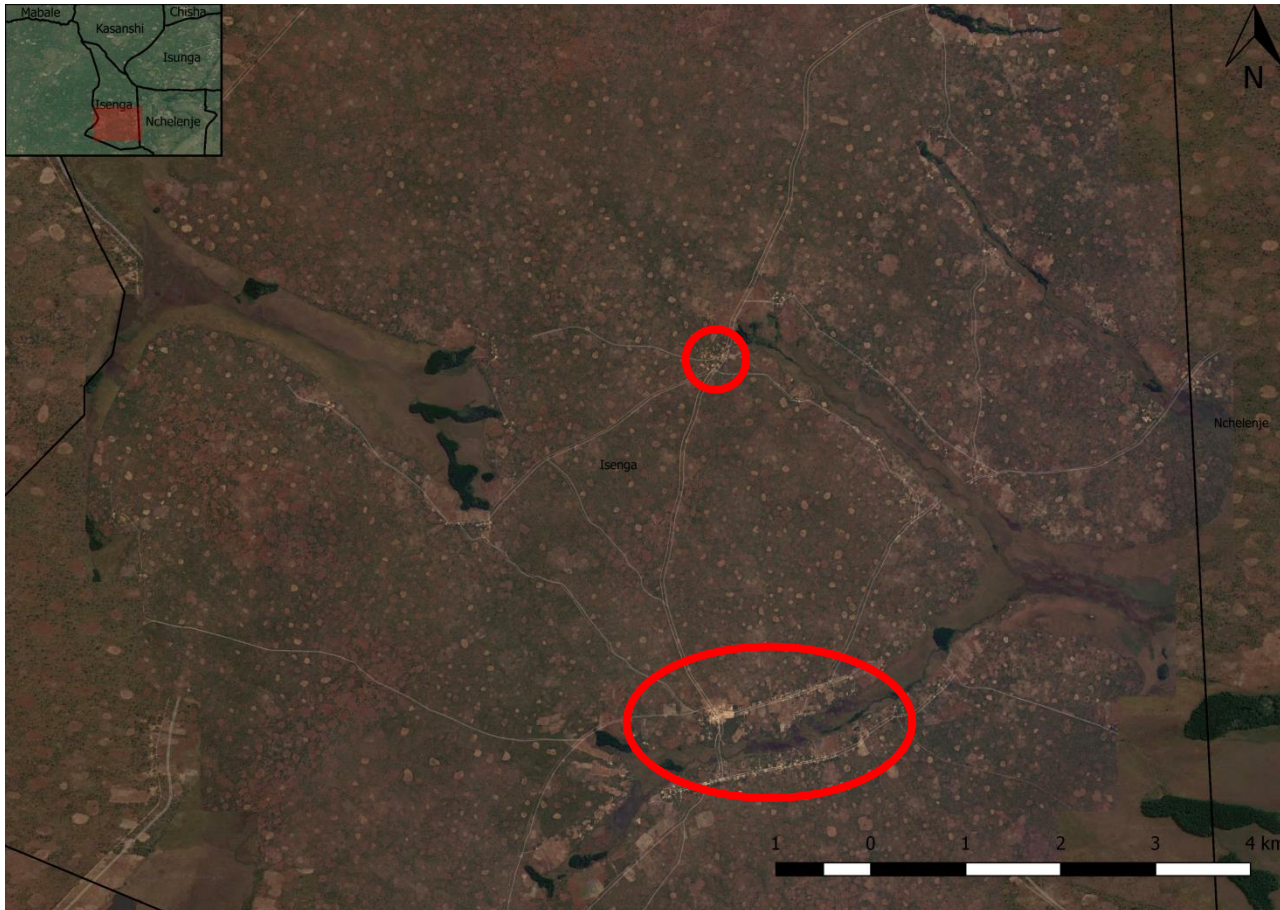
- Only 34% of the total population of 17 million has access to reliable electricity
- In rural areas (where almost 60% of the population lives), access rates are even lower: 6%
- In urban areas, the access rates are around 67%

1. The problem

Lack of information:

- The existence of unmapped settlements in Zambia
- The lack of detailed information on the location and spatial distribution of villages
- Low resolution of population density maps in the region (WorldPop, Nightlights)
- Poor infrastructure makes the locations difficult to assess through site visits

1. The problem



Unmapped settlements in Isenga ward, Northern Province, Zambia (GE)

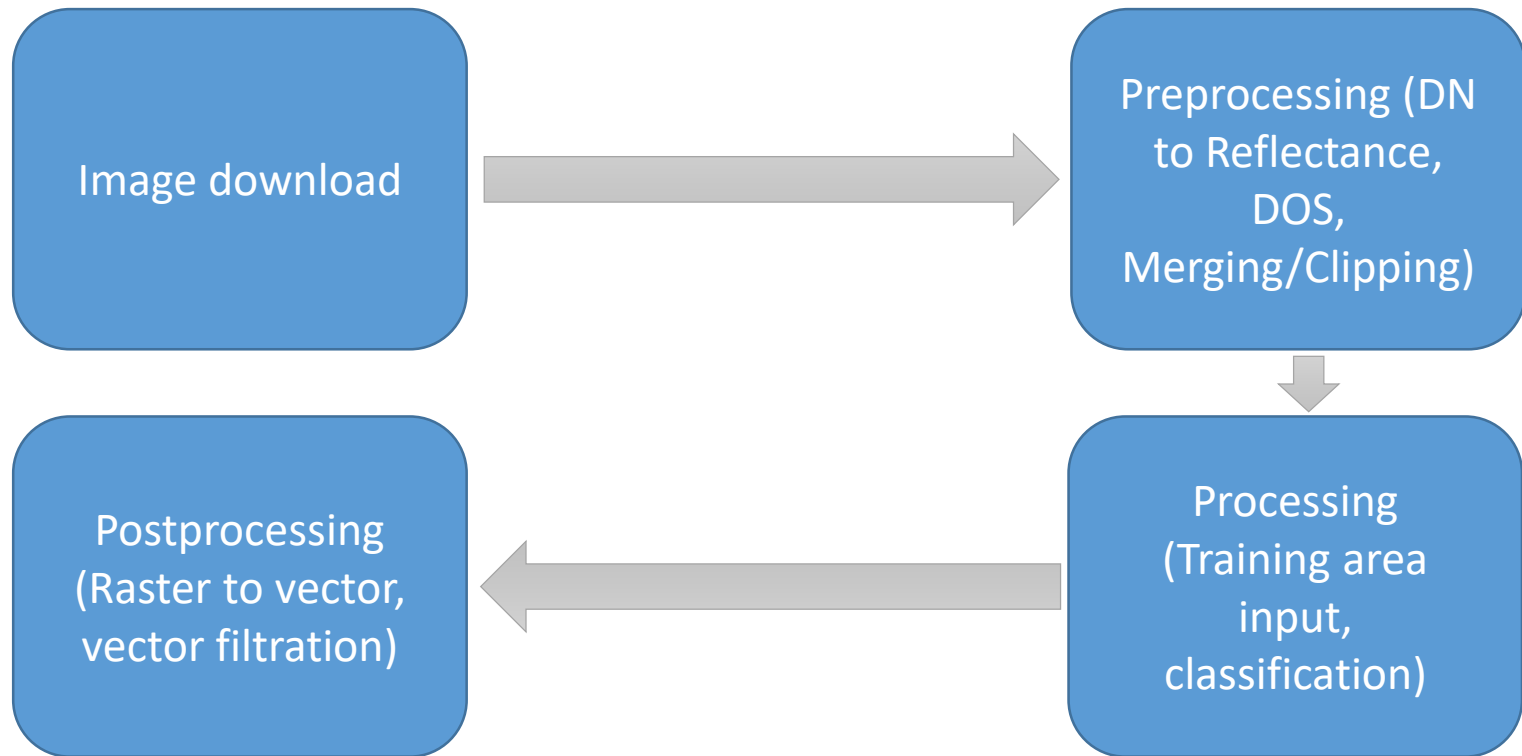
3. Methods

Software and data used

- Open Source Software: QGIS with SCP plugin (algorithm: Minimum Distance Classifier)
- Free Satellite Imagery from ESA: Sentinel-2 Images

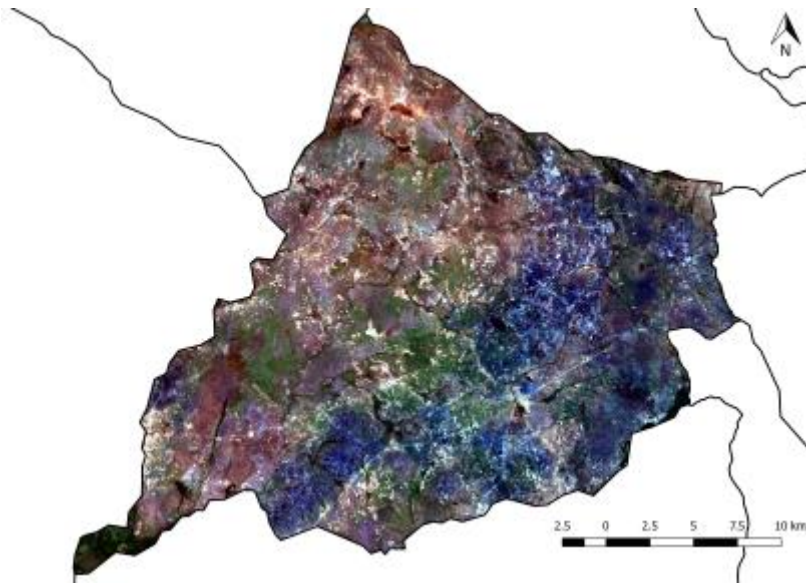
3. Methods

How it works

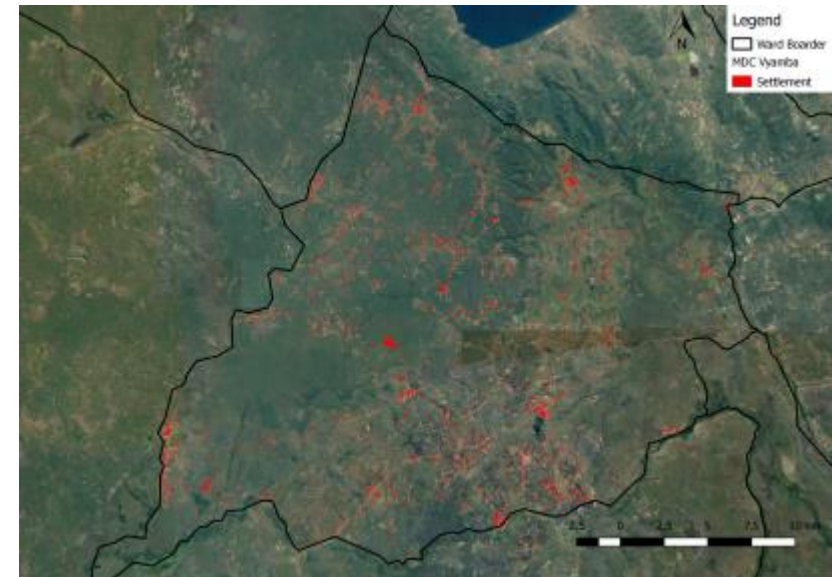


4. Results

Example of a good classification result

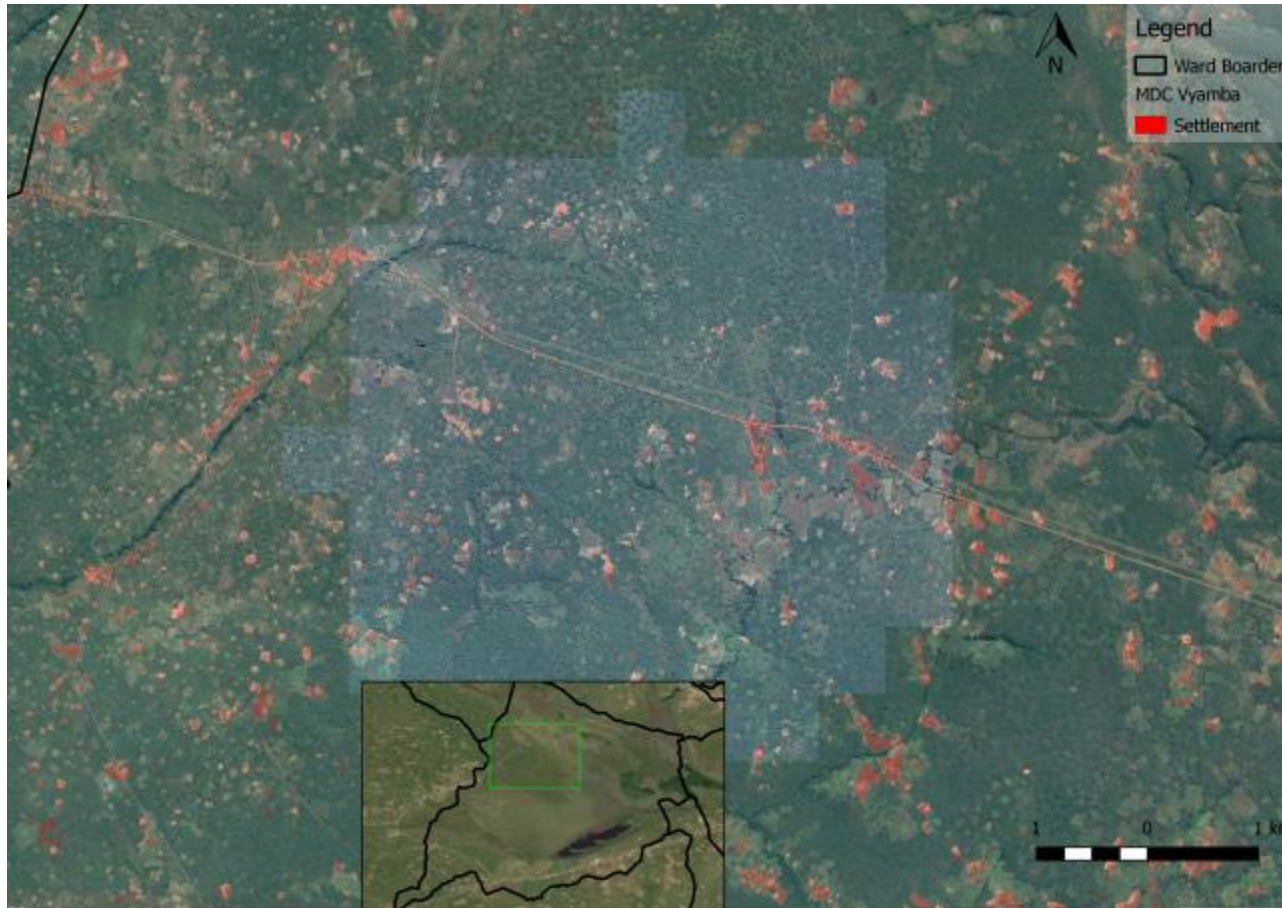


Vyamba RGB Sentinel-2



Vyamba Detected Settlements
(Classification and GE)

4. Results



Detailed view of a small area in Vyamba ward
(Classification and GE)

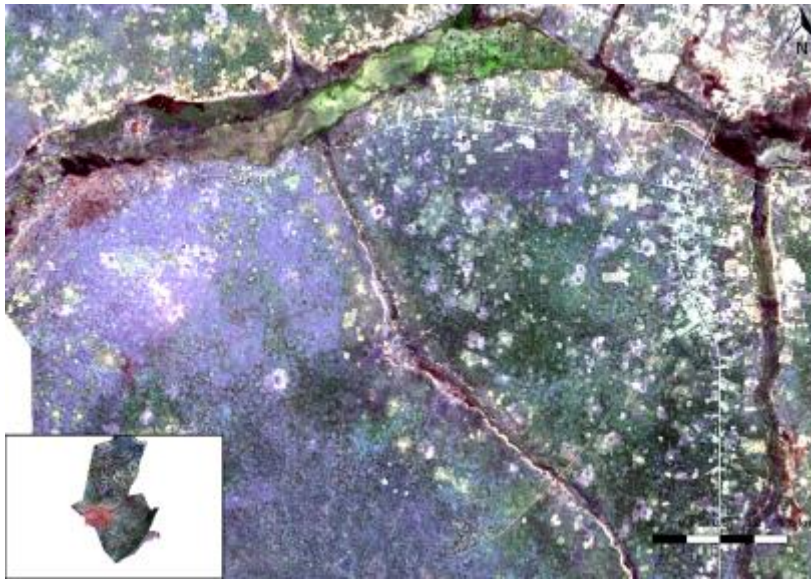
4. Results



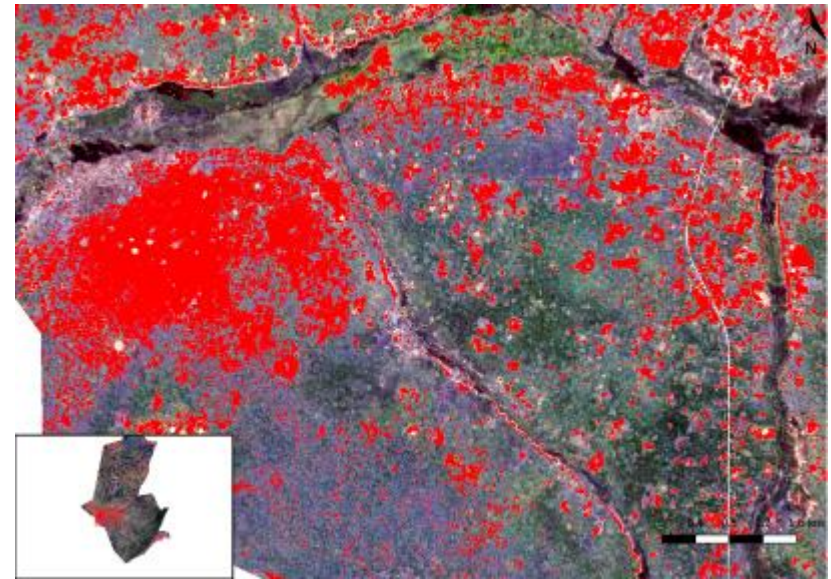
Detailed view of a small area in Chisela ward
(Classification and GE)

4. Results

Example – overestimated builtup area



Zoom Malalo Ward S2 RGB



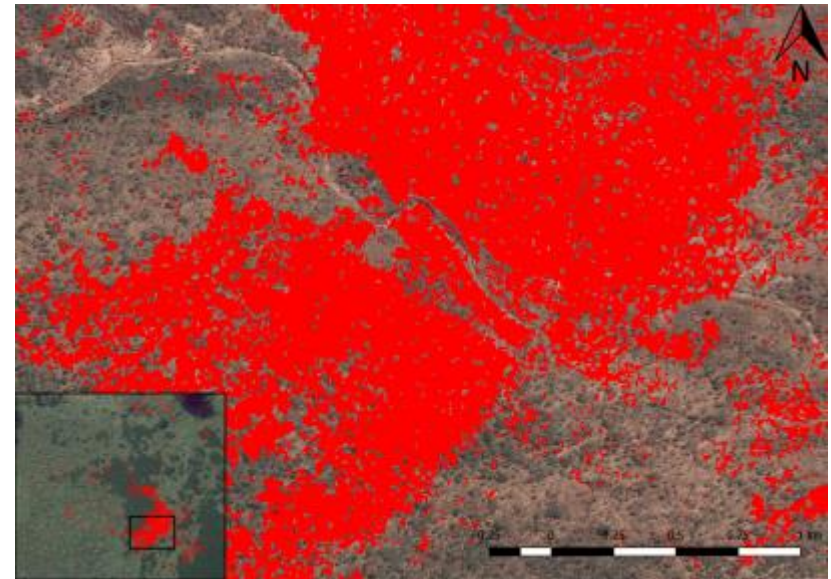
Zoom Malalo Ward Classification

4. Results

Example – overestimated builtup area



Zoom Nsumbu Ward Classification (GE View)



Zoom Nsumbu Ward (classification on GE)

5. Conclusions

- Remote sensing (specifically the use of Sentinel-2 images) is a good tool for locating and identifying settlements
- It offers accurate results, however it is dependent on the landscape
- It cannot account for the height and surface area of buildings, therefore population assessment might not be accurate
- In total, a number of 23 wards were classified, with a total area of approximately 16,000 km² and a total population of approximately 136,000 inhabitants (according to citypopulation.de)
- The total surface area of pixels classified as built up areas is 89 km²

5. Conclusions

Analysis of medium resolution (10m) images with Minimum Distance Classifier for village identification

Advantages:

- Low costs
- Fast
- Easy updating

Disadvantages:

- Accuracy depends on land cover
- Not sufficient for an accurate population assessment

Thank you!
Kea leboha!