Development of Forest Monitoring Systems Methods and Forest Degradation Issues in Mozambique

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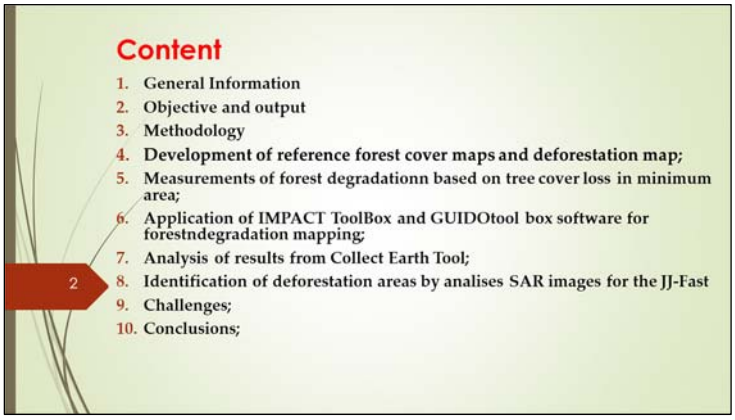
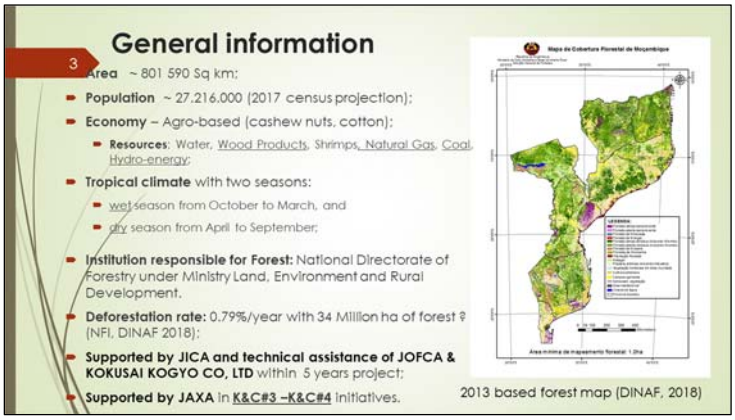
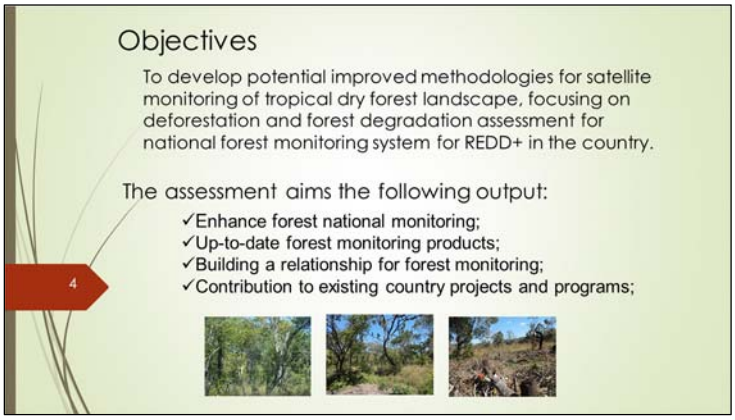
Before I start my presentation, I would like to thank FFPRI for inviting me to come and share our experience in Mozambique.

Objectives and Inputs

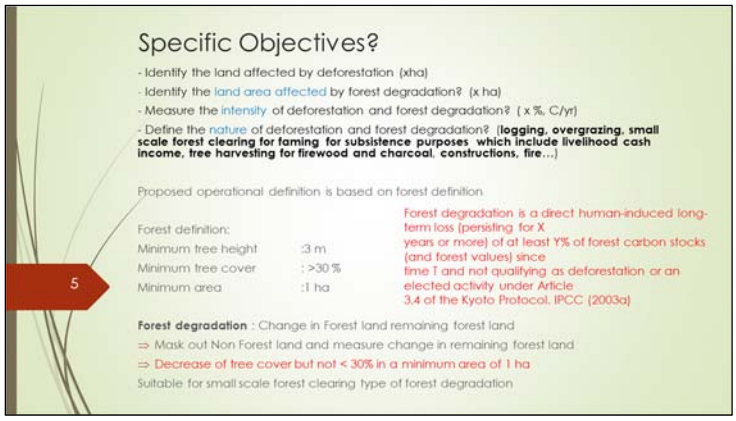




Mozambique is a small country with almost 800,000 sq km. Our recent forest national inventory showed the deforestation rate to be 0.79% and 39 million hectares of forest.

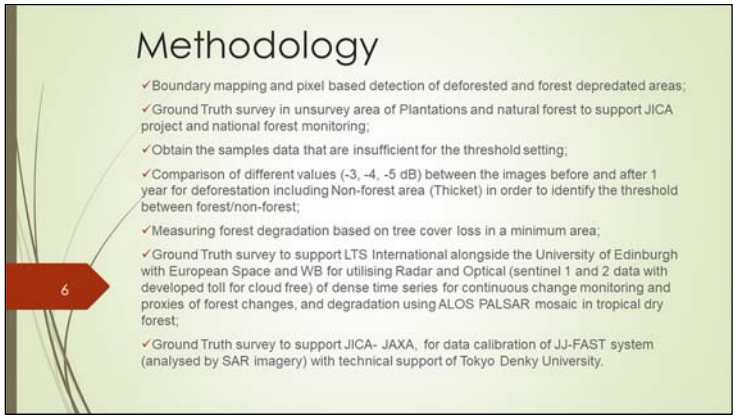


My objective is to show the development of potential improved methodologies for satellite monitoring of tropical dry forest and focusing on issues of deforestation and forest degradation in order to do assessment of monitoring of forest for REDD+. The aim of our output is enhancing national monitoring, updating forest monitoring, building relationship between forest management, and contributing to existing country project and other problems.



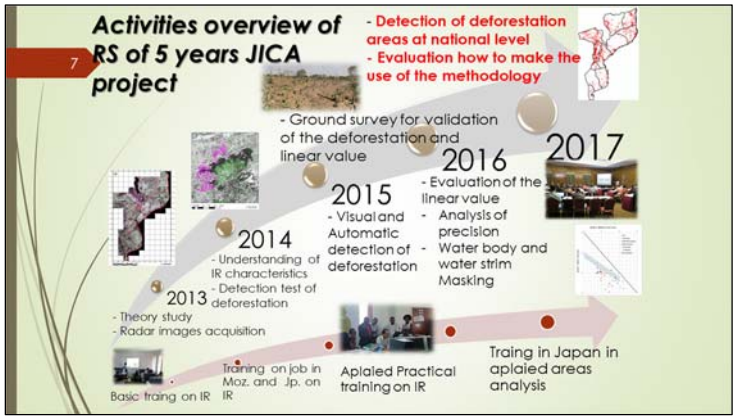
The specific objective is to differentiate the effects of deforestation, the land area affected by degradation, define the nature of deforestation looking at the drivers of deforestation. For that, we had to select among many definitions of forest degradation, and we picked up the IPCC definition.

Methodology Used

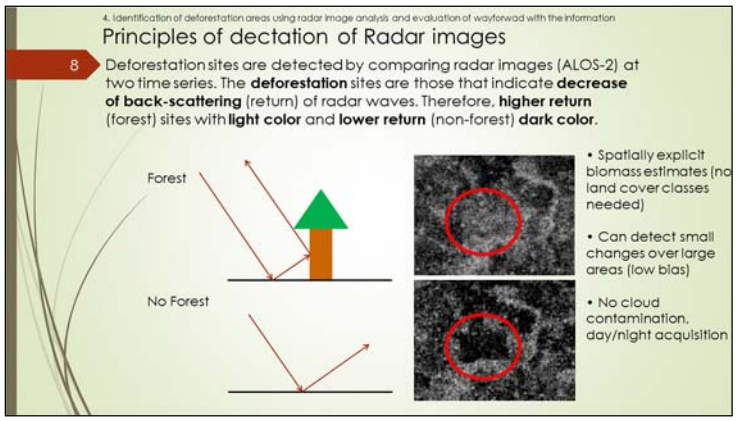


In terms of methodology, we followed boundary mapping and pixel-based detection, and did lot of Ground Truth survey test of all of methodologies in order to find the best threshold. We also did support of institutions like Tokyo Denki University[1] and to improve the JJ-FAST[2] methodology. We were also supported by the LTS International[3] alongside Edinburgh University[4] and European Space[5].

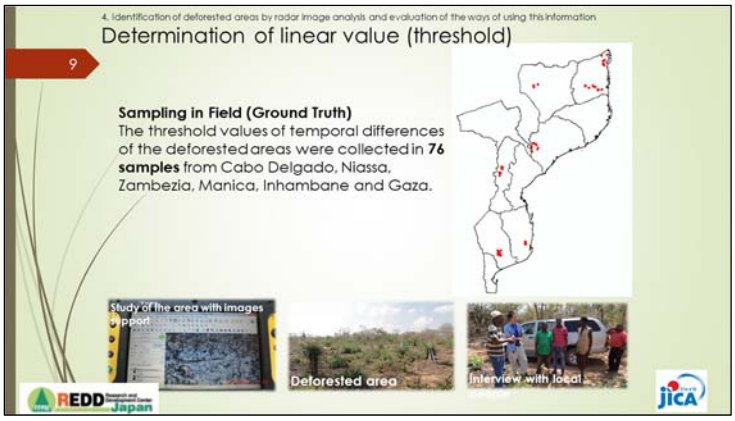
[1] https://www.dendai.ac.jp/en/
[2] https://www.eorc.jaxa.jp/jjfast/
[3] https://www.ltsi.co.uk/
[4] https://www.ed.ac.uk/
[5] https://www.esa.int/ESA



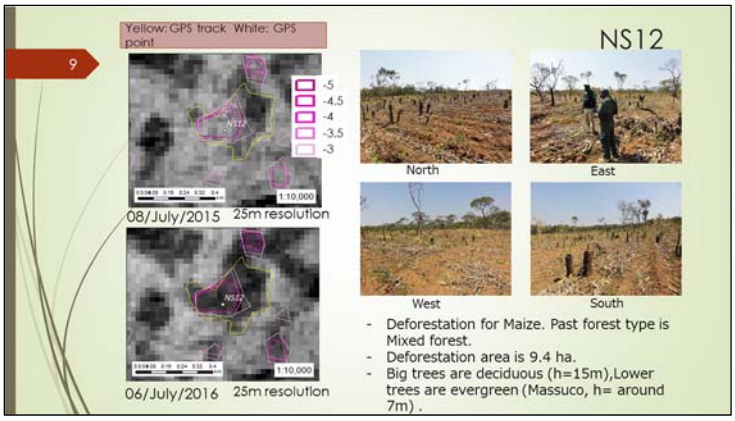
In terms of remote sensing activities, everything started from the theory to understand radar images acquisition. We went to the understanding of the constituents of the infrared, visual and automatic detections, Ground Truth for validation and evaluation of the linear value. We did all this work during job training exercises.

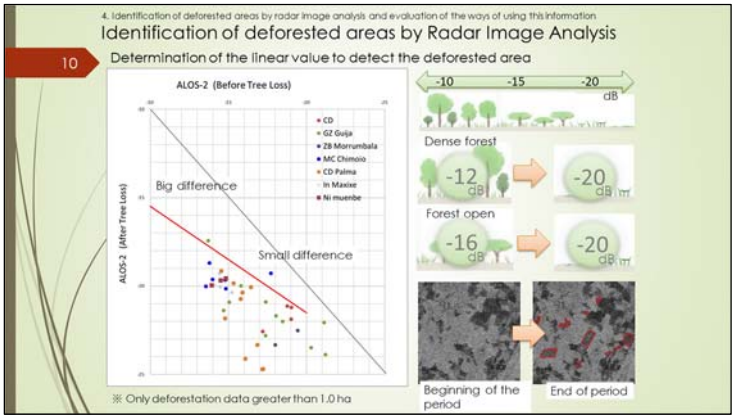


For those one of familiar with what it mean by the issue of reflectance of forests in order to detect the change. Here I just wrote a small picture of decrease of deforestation by doing plantation. The deforestation sites are those that indicate decrease of back-scattering of radar waves. Therefore, higher return sites with light color and lower return with dark color

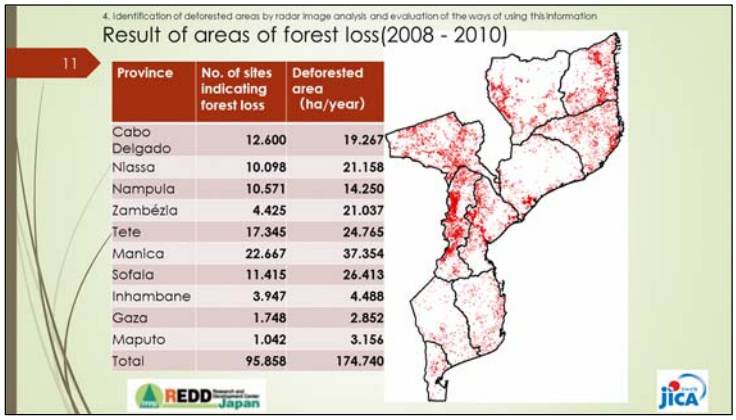


To get the results, we had to do field ground survey which considered 76 samples within 6 provinces as you can see in red.

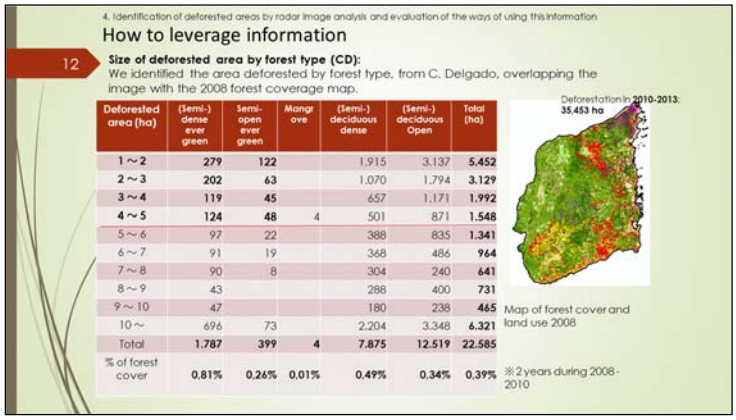


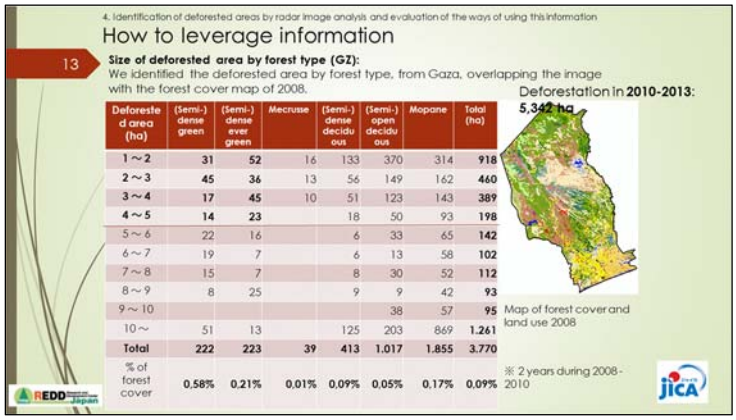


In the field, we identified the deforested area, and then with GPS we tried to work around the deforested area.

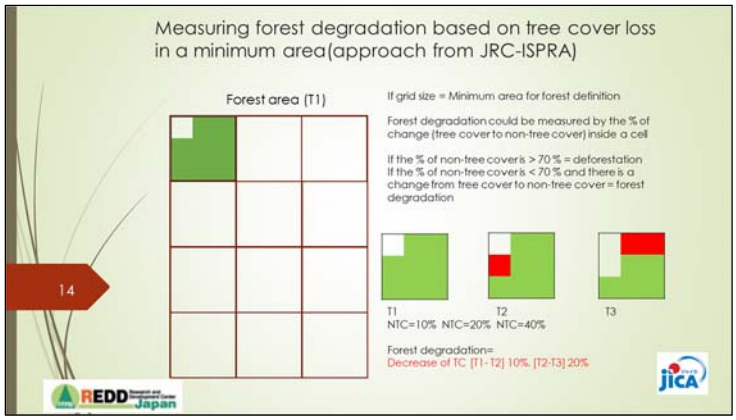


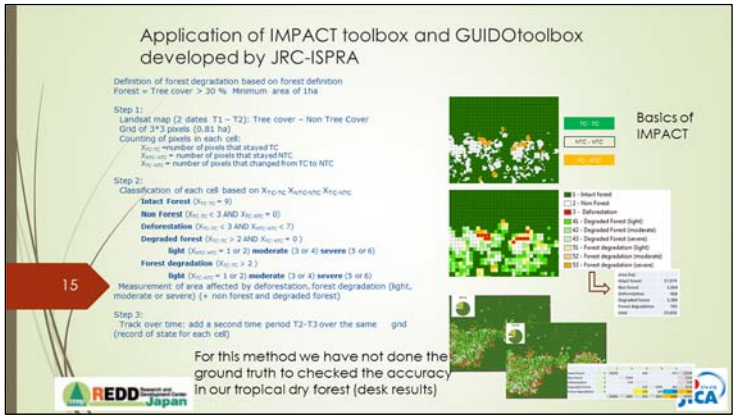
Then back in the office we found the threshold and did statistical analysis to find the linear value of the deforestation area in Mozambique using 2008-2010 information of Mozambique.





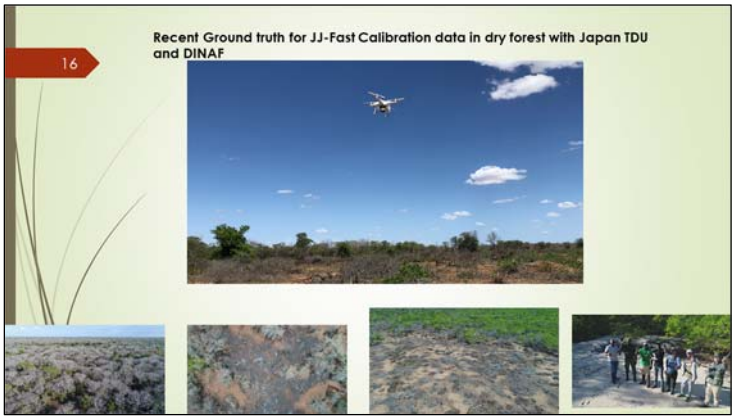
For that, we had to align with wall to wall map to see the activity data in order to ascertain what contributes to forest deforestation. In the analysis of the target area, we found that shifting cultivation is the major contributor among many drivers of deforestation in Mozambique.



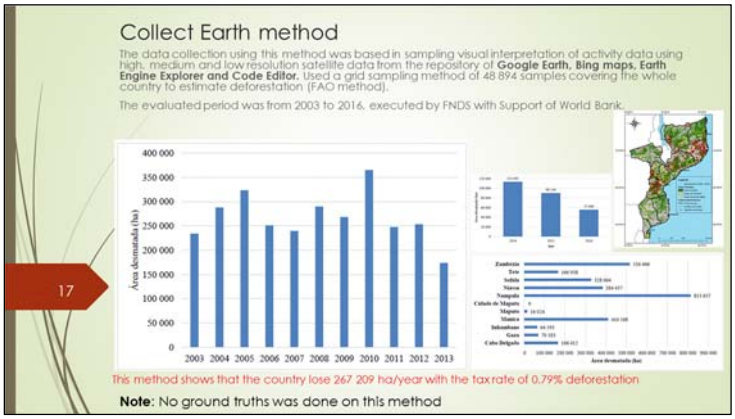


We used another method developed by JRC in Ispra[6], Italy, which consist of grid interpretation using pixel 3x3, where we identified how many pixels changed/not changed within the interval of less than 70% or greater than 70% which has deforestation and forest degradation. The methodology is applied using the IMPACT tool and GUIDOS. We were not familiar with these tools, but we tried to use it to ascertain their precision. Unfortunately, we did not get financial source to go to the field to recheck this, so it remained as one of the challenges.

[6] https://ec.europa.eu/jrc/en/about/jrc-site/ispra



Recently, we had another Ground Truth to support JJ-FAST method developed by Tokyo Denki University in order to improve the system. This is because our major driver of deforestation is shifting cultivation in a very small area. We would like to see this method reflecting those small areas in order to evaluate the deforestation. We went to the field and left some instruments there to measure soil humidity and trees.

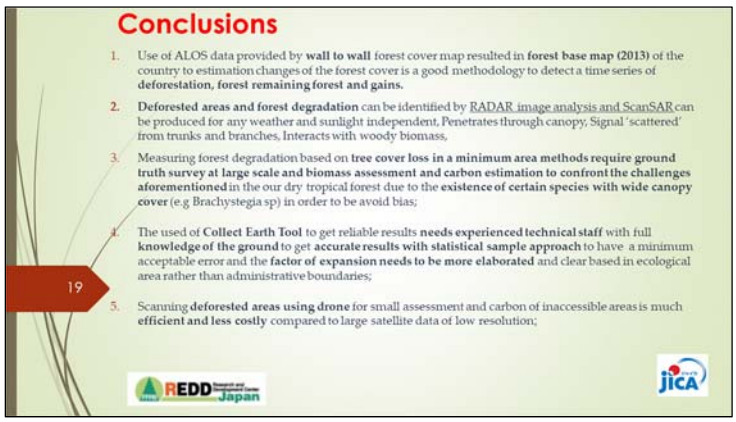


We used Collect Earth method extensively. This is a less costly method, which has a huge bunch of satellite data from Google Earth, Bing Map, Earth Engine Explorer, and Code Editor Repository. Using this method which is a statistical grid interpretation, we found that within the interval of 2003 and 2015, 2010 was the major year of deforestation. But we found that this deforestation is decreasing after 2014.

Key Challenges Faced

In terms of challenges, we found more challenge in degradations compared to deforestation. We see the issues of long-term effects; exclusion of deforestation; loss of the carbon stocks; and the issue of how to measure green gas inventory using those tools. We have seen that the provision of technology like unnamed aerial vehicles or drone platforms to acquire both LiDAR and VHSR image is needed to support this kind of information. Lastly, for small areas, we found drone is efficient at detecting changes in forest at low cost.

Conclusion



In conclusion, we found wall to wall as the best method to produce a deforestation map. We also found that to compare deforestation and forest degradation using RADAR and ScanSAR is possible, but it needs support of the Ground Truth. Collect Earth also needs a Ground Truth survey and it requires a good knowledge by the technicians who are doing this interpretation. Otherwise, they can misunderstand, say, crops with land use and call it as deforestation. Lastly, scanning of deforested area using drone is a good method for inaccessible areas compared to satellite data with low resolution.