

National scoping on forest landscape restoration and tenure security

‘How to’ guide #2: Creating a tenure vulnerability index: Madagascar as a test case

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Key messages

- A literature review of customary tenure in Madagascar found that declines in the legitimacy of customary systems tended to be associated with socioeconomic changes linked to in-migration, proximity to major markets and accessibility.
- A newly developed tenure vulnerability map showed counter-intuitive results for two study sites in northern Madagascar: the site with the stronger customary system and higher perceptions of tenure security had a higher tenure vulnerability rating.
- The results may reflect a gold mining boom in the area. The stronger customary system has experienced a rapid increase in population density over the past decade. Yet, because the boom is recent, the customary system still retains local-level legitimacy.
- The map shows promise for identifying areas where local tenure systems are likely experiencing stress, but groundtruthing is needed to refine the approach.
- The analysis uses datasets that are publicly available and can easily be replicated for other countries.

Background

“Forest landscape restoration for improved livelihoods: Secure tenure to catalyse community action in Madagascar and Cameroon” is a participatory action research project funded by Germany’s Federal Ministry for Economic Cooperation and Development (BMZ). It develops tools that enable forest restoration (FLR) programme managers, practitioners and policymakers to improve understanding of community tenure systems. Our team conducted a literature review of customary tenure systems in Madagascar.

We found the operation of customary tenure systems varies considerably in Madagascar, as does the degree to which those systems can offer community members tenure security. Customary

governance systems (within which tenure systems are embedded) that still retain widespread legitimacy appear more likely to offer greater tenure security. For FLR projects, then, the type of customary tenure might be less relevant than the degree to which those systems retain widespread legitimacy. This assumes that customary tenure systems that retain widespread legitimacy are more likely to provide landholders with secure tenure. At the same time, it assumes that tenure is likely to be less secure in areas where customary systems are losing or have lost their legitimacy.

The literature review further revealed that declines in the legitimacy of customary systems were often linked to economic and social changes associated with three key factors: (a) high numbers of in-migrants; (b) proximity to major population centres;

and (c) proximity to national roads. In response, the project developed a tenure vulnerability map that uses a simple index based on publicly accessible datasets. In this way, researchers with basic Geographic Information System skills can replicate the map for other countries.

The analysis uses three indicators of tenure vulnerability: in-migration rates; proximity to major population centres; and proximity to national roads. However, reliable or recent data on in-migration

for Madagascar were unavailable. Instead, the analysis used population density change as a proxy for in-migration. This assumed that areas showing a positive change in population density over time were likely experiencing in-migration. If a change in population density is due solely to internal population growth, more population density would also be expected to increase tenure insecurity; this is due to increasing land values in response to likely increased demand for land.

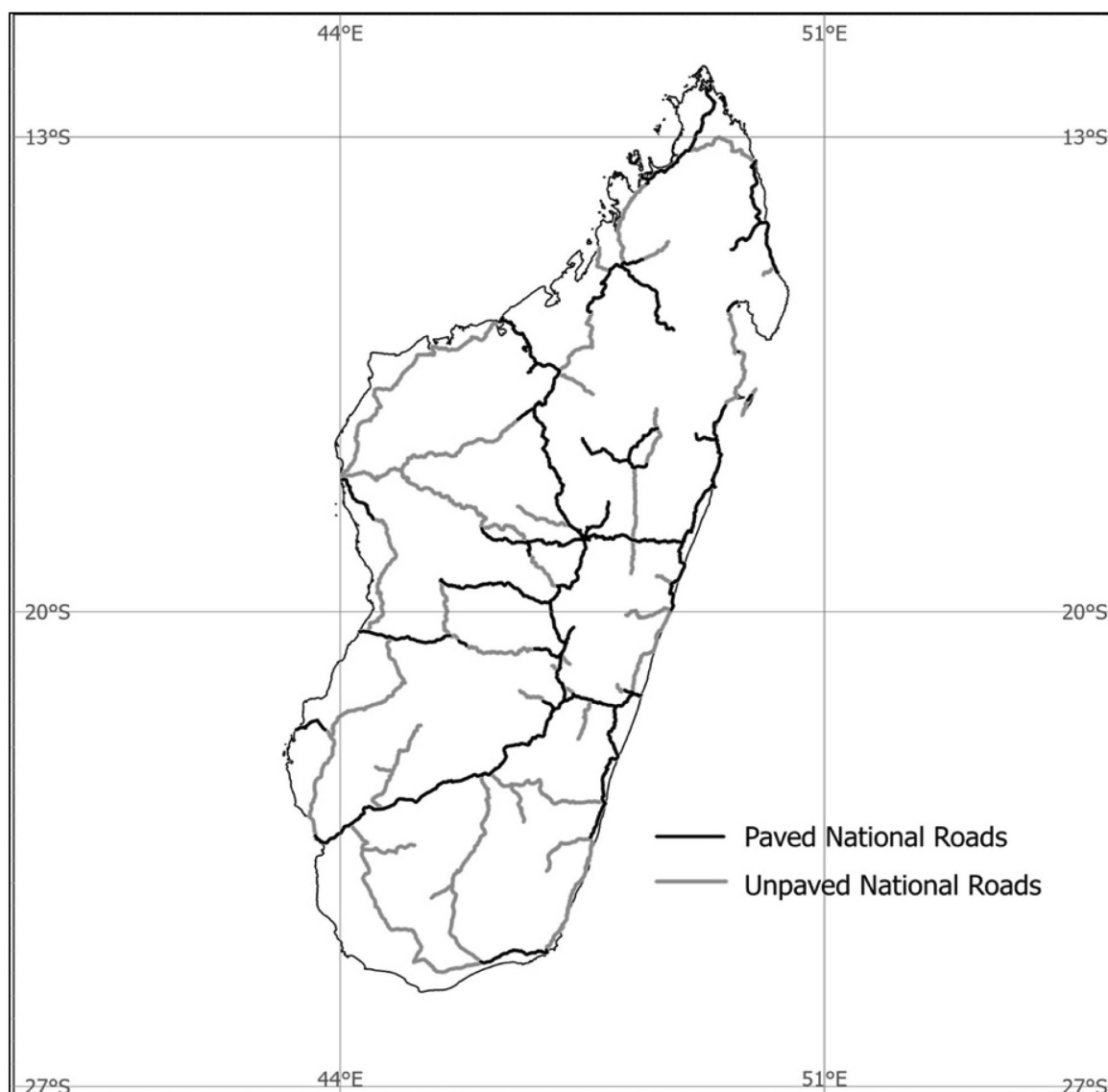


Figure 1. Madagascar's national road system

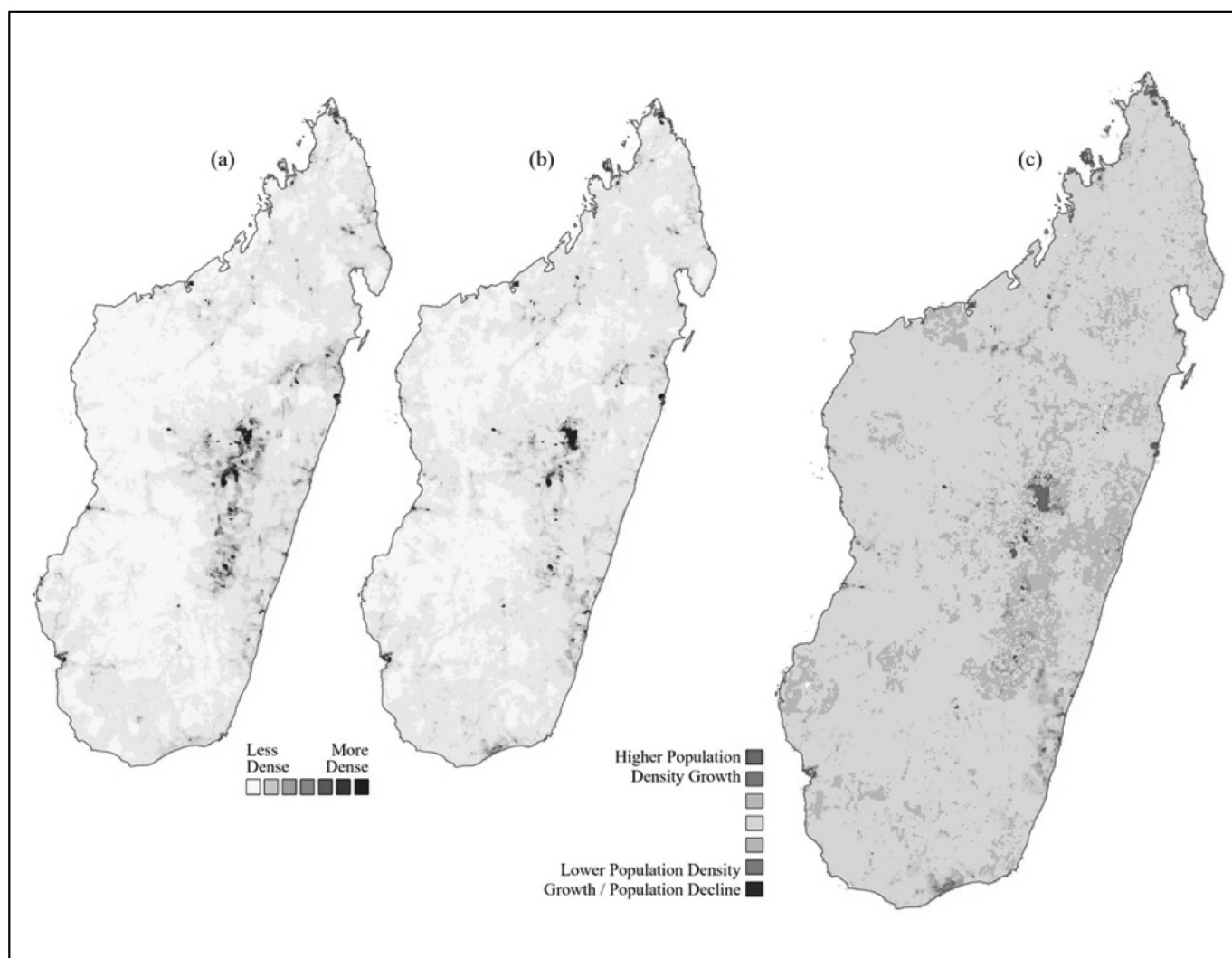


Figure 2. Population density and population density growth in Madagascar

Note: Map 2a shows the population density for 2000; Map 2b shows the population density for 2020; Map 2c shows the growth in population density between 2000 and 2020.

Tenure vulnerability indicators and data sources

Proximity to national roadways

Proximity to national roadways was the first indicator used to assess tenure vulnerability. A map was produced of all the national roadways in Madagascar, both paved and unpaved (Figure 1). The national commune shapefile was layered on top. A location query helped determine which communes had national roads running through them. A commune with at least one national road within its borders was assigned a 1. Those without a national route within their borders were assigned a 0.

Population density change

Population density change was the second indicator used to assess tenure vulnerability. The team sourced two national population density raster files at 1 km resolution (people/km², 30 arc seconds) from Worldpop.com: Spatial distribution of population density from the year 2000 (Figure 2a) and from 2020 (Figure 2b). The year 2000 raster file was subtracted from the 2020 raster file using the raster calculator function in ArcGIS Pro, producing a net change per square kilometre raster file (Figure 2c). A shapefile of Madagascar's communes was layered on top of the raster file and, using the shapefile, the raster file was split

by commune. The raster calculator was then used to report the average population change per commune. Communes with a positive population density change were assigned a 1, while those with a negative change were assigned a 0.

Proximity to a major population centre

A spatial dataset was created based on the population of the largest urban areas in Madagascar (greater than 25,000 inhabitants). A 35 km buffer was put around each of those urban areas. A point was added to communes that intersected with those 35 km buffers. The latter process was reproduced with urban areas with more than 50,000 inhabitants.

Tenure vulnerability index

Our team combined the three indicators to create a tenure vulnerability index for each commune. The index scores communes on land tenure vulnerability using a scale of 0 to 3: 0 (low), 1 (moderate), 2 (high), and 3 (very high).

Communes were assigned a score of 3 if they had a national road running through them, greater population density change than the national average, and were within 35 km of an urban area (defined by either more than 25,000 or more than 50,000 inhabitants). If two of the three indicators were present, the commune was given a score of 2. If one of the three indicators was present, the commune was given a score of 1. If no indicator was present, it received a score of 0.

Figures 3 and 4 show the distribution of tenure vulnerability for Madagascar and Diana Region, using cities with a population of more than 25,000 (Figure 3) and more than 50,000 (Figure 4).

Interpreting the map

The team hypothesizes that very high and high vulnerability areas on the map likely reflect areas undergoing more rapid social and economic change.

In such areas, customary tenure systems are more likely to be under pressure. However, areas with very high or high tenure vulnerability may not (yet) be areas with high tenure insecurity. This is because of a likely lag time between when a tenure system comes under pressure and when it ceases to have widespread legitimacy.

Moreover, given the poor quality of Madagascar's road system, the map may not adequately reflect the situation in villages and towns not located on or within a few kilometres of a well-maintained paved road. Such communities would have limited access to markets. Additionally, even in communes with national roads, some settlements may be cut off from the outside world if roads become impassable due to mud or rivers in flood stage.

The map for Diana Region shows the area around one of the study sites, Ambatoben'Anjavy, has a very high to high tenure vulnerability. Conversely, tenure vulnerability ranges from moderate to high in Sadjoavato, the other study site. This is counter-intuitive to field results, which found that most respondents in both areas tended to perceive their tenure as being very secure or secure. Moreover, field results indicated the customary tenure system remained more functional in Ambatoben'Anjavy than in Sadjoavato.

As noted, tenure vulnerability refers to the likelihood that the tenure system is under pressure. Conversely, tenure security relates to landholders' perceptions of retaining access to particular land parcels. One explanation for the mapping results relates to a recent gold mining boom in the area around Ambatoben'Anjavy, which has led to substantial in-migration. Thus, increased population density over the past decade has been unusually rapid. Yet, because the boom is relatively recent, the customary system still retains local-level legitimacy. If the road to Antsiranana, the nearest large town, is improved, the area will become even more attractive to in-migrants and pressure on the local tenure system is likely to continue.

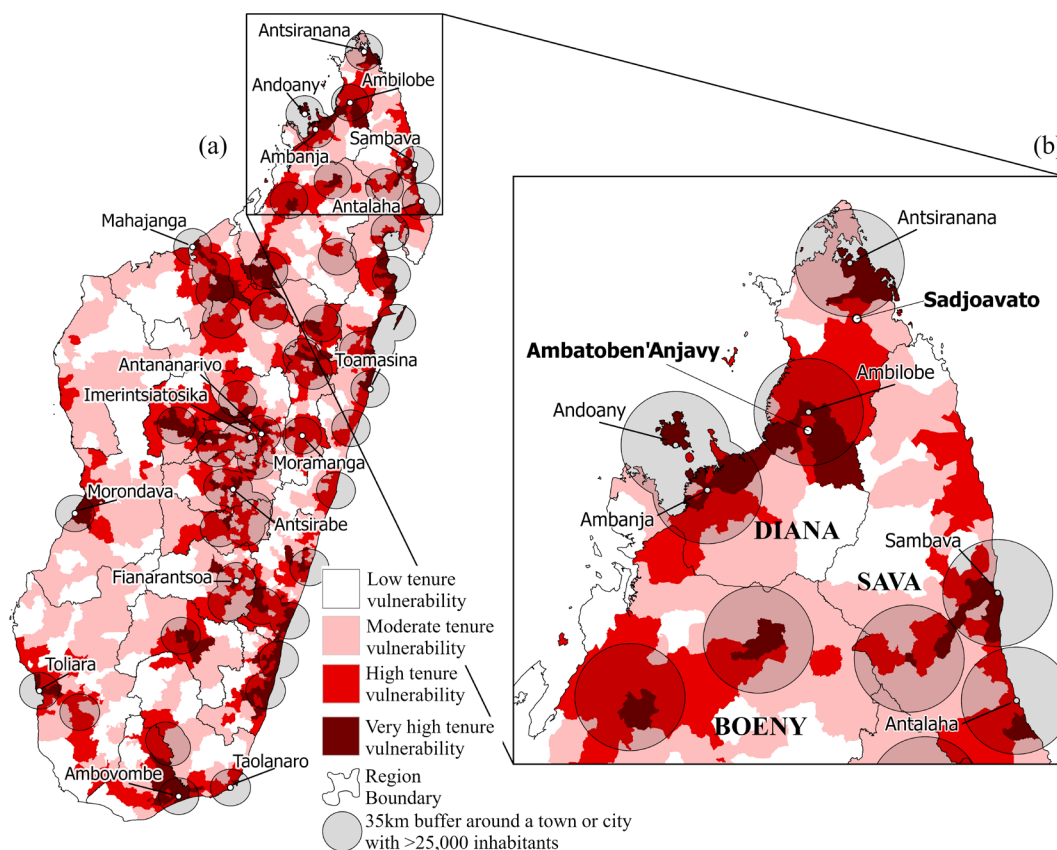


Figure 3. Distribution of tenure vulnerability in Madagascar using a 35 km buffer for cities with a population of more than 25,000

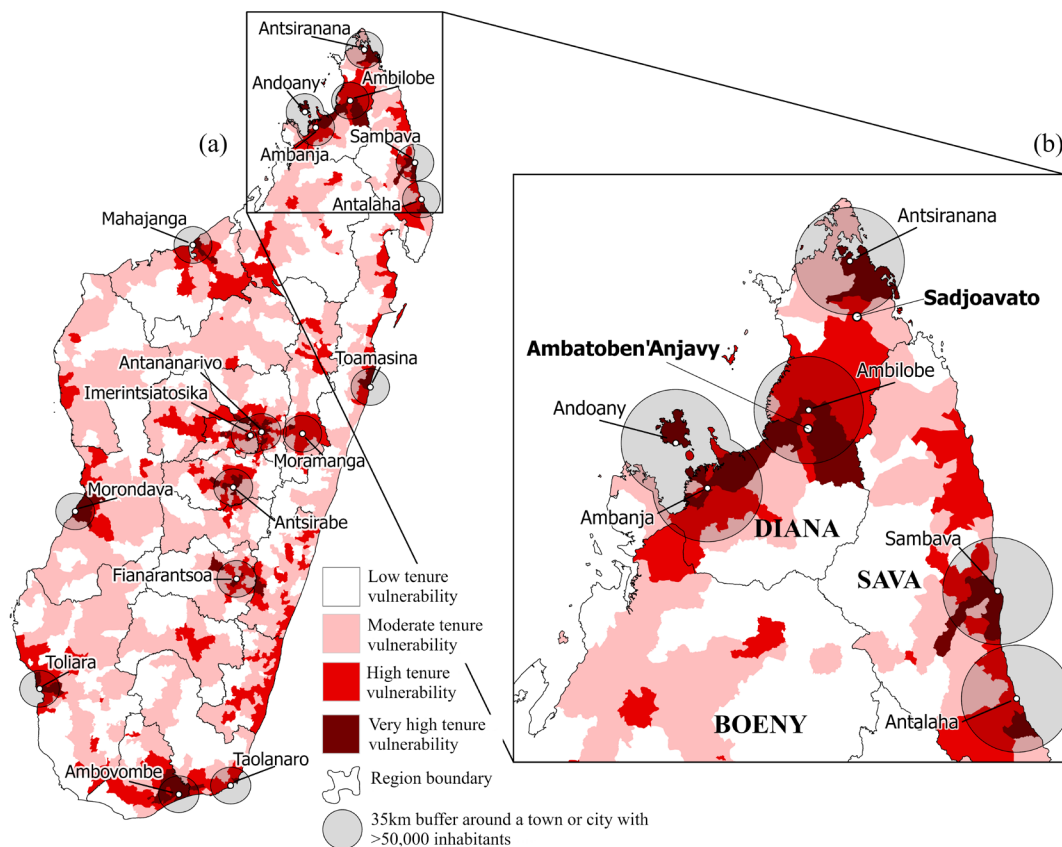


Figure 4. Distribution of tenure vulnerability in Madagascar using a 35 km buffer for cities with a population of more than 50,000



Sunset in Ambatoben'Anjavy village. Photo by Rebecca McLain

Refinements to consider

Account for road quality

Major stretches of Madagascar's primary national road system are riddled with potholes. Travelling between cities thus often takes much longer than expected. To refine the map, it would be helpful to rank the road systems based on local knowledge of conditions. Ideally, the ranking would distinguish between portions of the roads in good and poor condition.

Groundtruth throughout Madagascar

Based on fieldwork, the analysis can provide some plausible explanations for the rankings of Sadjoavato and Ambatoben'Anjavy communes.

However, it would be useful to solicit input from people who know land tenure systems in different regions of Madagascar to evaluate how well the index captures tenure vulnerability elsewhere.

Conclusion

The index used in this pilot appears promising as a tool for developing coarse scale tenure vulnerability maps at national and sub-national levels. The index, which relies on datasets that are readily available on the internet, is relatively simple and thus can be easily replicated by researchers with basic Geographic Information Skills. The method is applicable to other African contexts where variability exists in the legitimacy of customary tenure systems.



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