

Appendix #3: Information gaps identified during the literature review and interviews

While there is some information regarding climate change impacts, there is a considerable lack of information specific to Madagascar (Benson et al., 2017; Cochrane et al., 2019; CPGU and BNCCC, 2017; García-Ruiz et al., 2017; IPCC, 2019; Oppenheimer et al., 2019; Rakotondrazafy et al., 2014; Serele et al., 2019). The categories of information needs that emerged from our interviews and literature review include:

- Climate information
 - Some areas do not have accurate climate or weather information at a fine enough scale (e.g. many places have regional weather data rather than local, so it is often inaccurate as there is a lot of variation over the region). In terms of long-term risks, finer scale information on which areas are at risk to floods, droughts, cyclones, relative SLR, etc. could be useful for planning specific projects.
 - Research on cyclones
 - There is a need for greater communication and interpretation of existing data at the regional and local level (i.e. translational science. How should users change behavior based on climate information?)
 - Impact modeling, especially for climate impacts at the local scale (e.g. for agricultural yields)
- Socio-economics and markets:
 - Improvements to carbon project methodologies in order to optimize mangrove management for carbon financing
 - Mapping of socio-economic vulnerabilities to help with spatial planning
 - Disaggregated data by gender and vulnerable groups
 - Impacts of climate change on livelihoods
 - Climate change economic impacts for each sector
- Impacts to key species:
 - Mangrove sedimentation rates
 - Phenology shifts
 - Range shifts – which species are likely to move? Which can adapt in place?
 - Adaptation rates – do adaptation rates match the pace of climate change?
 - Species interactions – as species respond to climate change in different ways and at different rates, how will this impact species interactions and ecosystem functioning?
- Baseline information:
 - Satellite imagery and ground-based hydrogeological data of water resources, including groundwater
 - Water demand
 - Land cover/vegetation
 - Soil hydrology and geomorphology
 - Indian Ocean circulation, tide gauges, wave buoys
 - Research on Madagascar's freshwater wetlands
 - Lack of institutional capacity to conduct research and assessment studies for specific sites for coastal management planning
 - Quantitative calculations on the benefits of forest conservation
- Early warning signs of critical transitions or catastrophic shifts:

- Models and tool development to determine thresholds and tipping points
 - Improved climate and weather forecasting
- Capacity building
 - Capacity building at the grassroots level rather than just higher levels of government.
 - Develop a robust way to deal with climate change in development projects
- Metrics to monitor success and outcomes of projects