Evaluating the Impacts of Sea-Level Rise and Storm Surges on Seychelles' Critical Infrastructure

Harold Rice, Brett Rolf, Jacob Rumschlag, Daniel Xie
Advised by Avik Basu

SEAS SCHOOL FOR ENVIRONMENT AND SUSTAINABILITY UNIVERSITY OF MICHIGAN

United Nations Climate Change

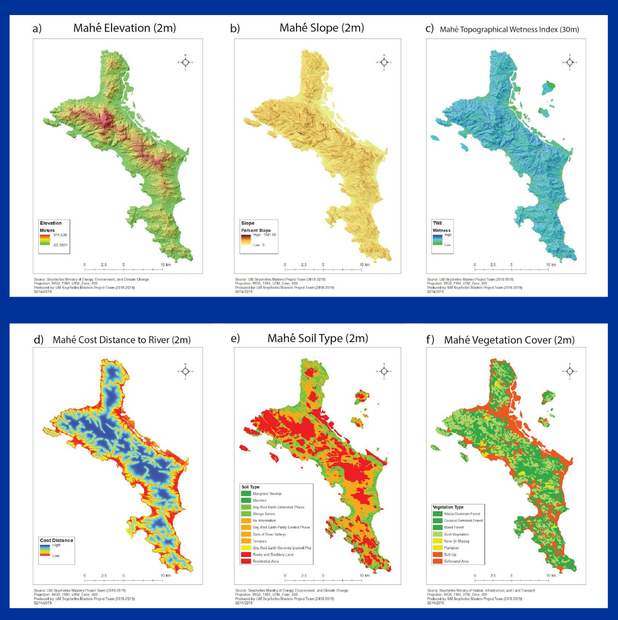
MINISTRY OF ENVIRONMENT, ENERGY AND CLIMATE CHANGE
Republic of Seychelles

Introduction

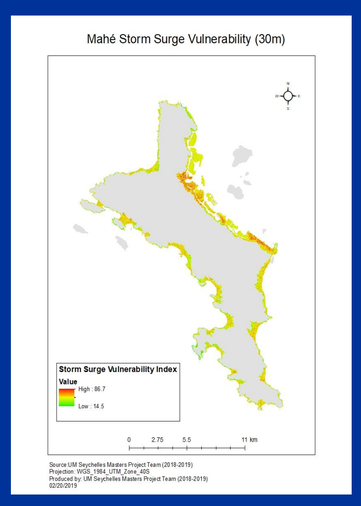
- Impacts of Sea Level Rise (SLR) and Storm Surge in the Indian Ocean region are relatively uncertain.
- This project is focused on the Seychelles, a small island developing state within the Indian Ocean region. In particular, Mahé, the central island, is studied
- This project aims to narrow two priority adaptation knowledge gaps for Indian ocean island countries in context of the Lima Adaptation Knowledge Initiative (LAKI): impacts of sea level rise and impacts of storm surges on the critical infrastructure.

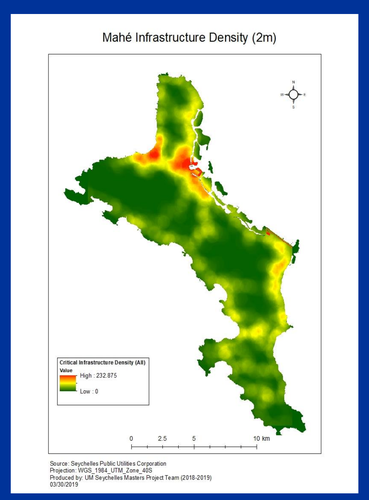
Methods

- Interviews were conducted with stakeholders in the Seychelles to identify infrastructure that is deemed "critical". Interviews also informed what adaptation strategies are already present and what further adaptation action is needed.
- Present rate of SLR was found using a regression of local sea level data. This scenario was compared to other scenarios found in existing literature on SLR.



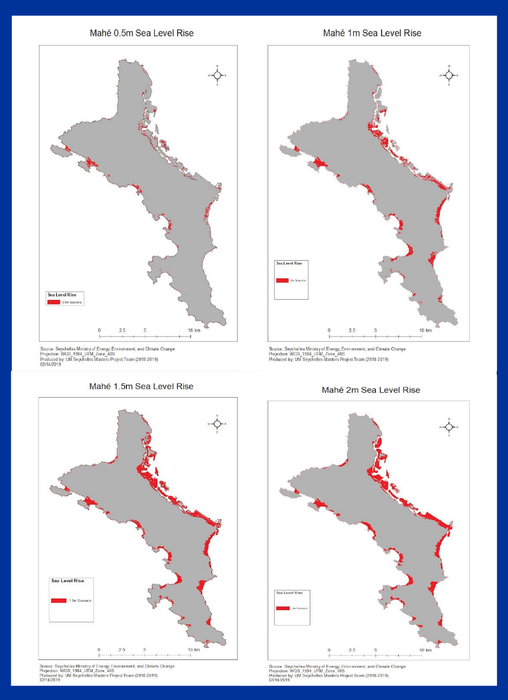
- Topographic and hydrologic data were used in a multi-criteria analysis to generate a storm surge vulnerability index. This index was used along with density of infrastructure data to generate a risk index.

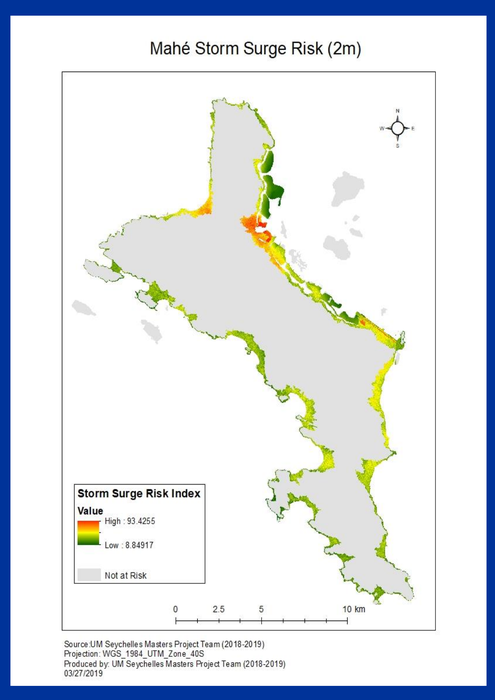




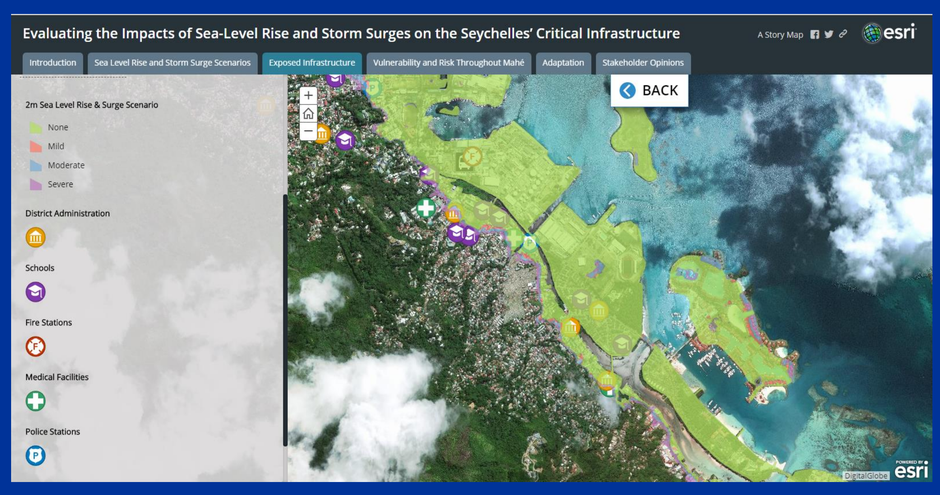
Results

- "[P]eople still need to be sensitized about the effect of climate change because until we really understand that, and we really see the damage that can cause, then it's difficult for you to convince somebody that you really need to adapt…"





Top: *(Left))* Maps of four possible SLR by 2100 scenarios
(Right) Storm Surge Risk Index created by adding the vulnerability index with infrastructure density
Bottom: SLR Scenario and Storm Surge data were uploaded into an ESRI story map for improved accessibility to all persons



https://arcg.is/1rW1uD

Conclusions

- Even at mild projections of SLR, coastal infrastructure is expected to be exposed to flooding by 2100. Meanwhile, Victoria, and the Southwest Coast of Mahé scored high both in the storm surge vulnerability index and risk index.
- Interviews have indicated lack of education and regulation of development are major barriers to adaptation action.
- Story maps can be an effective tool for conveying the consequences of climate change to all audiences. They can also be useful for starting discussion on more strategic coastal development.

Bibliography

- Caldwell, P. C., Merrifield M. A., & Thompson P. R. 2015: Sea level measured by tide gauges from global oceans — the Joint Archive for Sea Level holdings (NCEI Accession 0019568), Version 5.5, NOAA National Centers for Environmental Information, Dataset.
- Chang Seng, D. & Guillande, R. 2008: Disaster risk profile of the Republic of Seychelles. United Nations Development Programme.
- Horton, B., Rahmstorf, S., Engelhart, S., & Kemp, A. 2014: Expert assessment of sea-level rise by AD 2100 and AD 2300. Quaternary Science Reviews, 84: 1-6.
- Iwamura, T., Possingham, H., Chades, I., Minton, C., Murray, N., Rogers, D., Treml, E., & Fuller, R. 2013: Migratory connectivity magnifies the consequences of habitat loss from sea-level rise for shorebird populations. Proc. R. Soc. 280(1761).
- Mendez, J. et al. 2013: Analysis of sea level rise and coastal flooding in the Seychelles islands due to climate change. Current scenario and future projections for 2025, 2050 and 2100. Republic of Seychelles.
- Pradhan, B. 2009: Flood susceptible mapping and risk area delineation using logistic regression, GIS and remote sensing. Journal of Spatial Hydrology, 9(2).