

Mangrove forest dynamism at Galle-Unawatuna in Sri Lanka: a case study based on high resolution remote sensing data

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Mangrove forests all over the world are threatened due to climate change and sustained anthropogenic pressure (1,2). The Galle-Unawatuna mangrove forest located on the Southern coast of Sri-Lanka is one of these dynamic systems. This makes its long-term monitoring important to understand the spatio-temporal species dynamism taking place here, as well as the underlying causes hereof. In the context of better understanding the dynamism of mangrove forests, a pioneering study started a long-term case study on this forest (3). It predicted a future dominance of *Bruguiera gymnorrhiza* (L.) that by a follow-up study could already be detected in the young vegetation layer (3,4). Additionally, this follow-up study added an elaborate future structural scenario for the Galle-Unawatuna mangrove forest (4). In this study, we will attempt to evaluate the current mangrove species distribution in the Galle-Unawatuna mangrove forest, in order to evaluate species patterns and dynamism during recent years, as well as to compare this to previous iterations of this case study. To achieve this, sequential GIS analyses will be performed on VHR, HR and moderate-resolution imagery in the form of Google Earth historic imagery, Corona declassified images and Landsat imagery. As the availability of the different types of recent satellite data is not yet fully known, exact methodology details cannot yet be provided. We will, however, attempt to perform these sequential analyses up until the most recent available imagery, ideally to assess vegetation differences between 2014 and 2022. For this, a ground-truth control will be performed by Nyandwi et al. (2022) (5). Afterwards, this study will combine the newly discovered knowledge together with that gathered during the previous iterations of this case study to get a holistic view on this systems' species dynamics. By doing all this, predictions made in the past will be verified and new predictions will be made in the form of a new structural scenario for future follow-up. Ultimately, we will continue this long-term case study in an attempt to contribute to the species dynamism knowledge that can eventually be used for the protection of this threatened system.

References

- (1) Nicholls R. J., Cazenave A. Sea-level rise and its impact on coastal zones. *Science* 328: 1517–1520 (2010).
- (2) Polidoro, B.A. et al. The Loss of Species: Mangrove Extinction Risk and Geographic Areas of global Concern. *PLoS ONE* 5(4): e10095 (2010).
- (3) Dahdouh-Guebas F., Verheyden A., De Genst W., Hettiarachchi S., Koedam N. Four decade vegetation dynamics in Sri Lankan mangroves as detected from sequential aerial photography: a case study in Galle. *Bulletin of Marine Science USA* 67(2): 741-759 (2000).
- (4) Satyanarayana B. et al. Long-term mangrove forest development in Sri Lanka: early predictions evaluated against outcomes using VHR remote sensing and VHR ground-truth data. *Marine Ecology Progress Series USA* 443: 51-63 (2011).
- (5) Nyandwi A. Vegetation succession in the mangroves of Unawatuna, Galle, Sri Lanka: comparisons of the current and historic vegetation structure and stratification. [Manuscript in preparation] (2022).

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