Hydrological classification of mangrove forests: a tool for successful mangrove rehabilitation

Marjolein van Huijgevoort (1), Anne van Loon (2), Bram te Brake (3), and Roel Dijksma (3)
(1) University of Aberdeen, Aberdeen, United Kingdom, (2) University of Birmingham, Birmingham, United Kingdom, (3) Wageningen University, Wageningen, The Netherlands

Mangrove forests are very valuable for coastal protection, ecosystem functioning and supporting livelihoods of coastal communities. Nevertheless, the size, number and ecological quality of mangrove forests are declining worldwide due to human influence like logging, aquaculture, and coastal development. To restore mangrove forests, rehabilitation projects are necessary. Unfortunately, many of these projects fail, because the hydrological conditions are not taken into account. This is understandable because hydrological conditions in mangrove forests are highly variable in time and space. To increase the success rate of rehabilitation projects a hydrological classification, which links hydrological site characteristics, such as inundation duration, to common mangrove species, could be a useful tool. This study investigates the potential of such a classification at a number of locations with natural and disturbed hydrological conditions. The hydrological classification has been developed from field data of two natural sites in Vietnam based on an existing classification (Watson, 1928). For all sites, data of water levels in the open water and at various locations across the mangrove forest were collected, and the vegetation composition at the measurement locations was determined during various field campaigns. From the water level data, the tidal regime, tidal frequency, and duration of inundation in minutes per day and minutes per inundation were derived. Testing has shown that, because of the irregular tidal regime and the effect of stagnant water due to (micro-)topography, tidal regime and frequency are not representative for the hydrological conditions determining mangrove species distribution. Duration of inundation in minutes per day and minutes per inundation are, however, both crucial factors for mangrove zonation and are therefore essential in a hydrological classification for mangroves. Six distinct classes were distinguished that are linked to the occurrence of mangrove species common in Southeast Asia. This classification was then tested for several sites, natural and disturbed, in Indonesia. Validation of the classification in the natural sites showed that classes derived from the classification were very similar to the expected classes based on the observed vegetation for the different sites. Application of the classification to disturbed sites learned that within abandoned shrimp ponds large differences exist in hydrological suitability for mangrove species. Therefore, the classification can give important information about which species to plant at which location if reforestation is desired, but also about how the restore the hydrology to natural conditions to improve natural regeneration. Since the hydrological classification needs relatively little data, i.e. good results can already be obtained using water levels for a period of only one tidal cycle, it can be a very useful tool in improving the effectiveness of mangrove rehabilitation projects.

Watson, J.G., 1928. Mangrove forests of the Malay Peninsula. Malayan Forest Records No. 6, Forest Department, Federated Malay States, Kuala Lumpur.