# Mangrove response to projected relative sea-level rise in Vietnam

Van Tran Thi[1,2,3], Nick Wilson[4], Katrien Quisthoudt[1], Xuan-Tuan Le[5], Minh-Loc Le[6], Farid Dahdouh-Guebas[1,2], and Nico Koedam[1]

[1] Laboratory of Plant Biology and Nature Management, Vrije Universiteit Brussel, Pleinlaan, 2, B-1050 Brussels, Belgium
E-mail: ttran1@vub.ac.be

[2] Laboratory of Systems Ecology and Resource Management, Université Libre de Bruxelles, Av. F. D. Roosevelt 50, B-1050, Brussels, Belgium

[3] Institute of Meteorology, Hydrology and Climate Change, 23/62 Nguyen Chi Thanh, Hanoi, Vietnam

[4] Centre for Sustainable Rural Development, 19/9 Kim Dong, Hanoi, Vietnam

[5] Mangrove Ecosystem Research Centre, Hanoi National University of Education, 136 Xuan Thuy, Hanoi, Vietnam

[6] Ca Mau Forestry Department, 49A Hung Vuong, Ca Mau city, Vietnam

Mangrove ecosystems occur in the transitional zone between marine and terrestrial environments and are threatened by climate change. Based on available evidence, relative sea-level rise induced by climate change may be the greatest threat to mangroves (Gilman *et al*., 2008). Based on the understanding that mangroves respond passively to changes in hydro-geomorphic processes and conditions, including changes in relative sea-level, a predictive model for site-specific mangrove response to changes in relative sea-level was described by Gilman *et al.* (2007) with a caveat on suitable temporal and spatial scales. The predictions based on the mean sea-level change rate relative to the mangrove surface, the mangrove's physiographic setting (slope of the land adjacent to the mangrove, slope of the mangrove, and presence of obstacles to landward migration), and erosion or accretion rate of the mangrove seaward margin (Gilman *et al*., 2007).

In Vietnam, Hai Phong and Ca Mau is located in the two lowest-lying river deltas namely Red River and Mekong River Deltas. In a rapid assessment, Carew-Reid (2007) stated that 360ha and 9690ha of mangrove forest in Hai Phong and Ca Mau, respectively, will be affected by 1m sea-level rise inundation. Recently, the Ministry of Natural Resources and Environment predicted that by the end of the 21$^{st}$ century, average sea-level in the study areas is projected to rise 49-64cm and 59-82cm in Hai Phong and Ca Mau respectively (MONRE, 2012).

In this study, the predictive model for site-specific mangrove response to changes in relative sea-level was applied. Mangrove transects were constructed including species composition, mean sea level, slope of the mangrove, and presence of obstacles to landward migration. Together with detected changes on long-term mangrove shoreline, vertical sedimentation and mean sea-level (cf. Tran Thi *et al*., 2014), these were used to predict mangrove response to sea level rise scenarios. The results will be integrated in advanced planning for coastal zone management in Hai Phong and Ca Mau to respond to climate change and sea-level rise.

## References

Carew-Reid J. 2007. Rapid assessment of the extent and impact of sea level rise in Viet Nam. Climate Change Discussion Paper 1, International Centre for Environmental Management, Brisbane, Australia.

Gilman E., J.C. Ellison, and R. Coleman. 2007. Assessment of mangrove response to projected relative sea-level rise and recent historical reconstruction of shoreline position. Environmental Monitoring and Assessment 124:115-130.

Gilman E.L., J.C. Ellison, N.C. Duke, and C. Field. 2008. Threats to mangroves from climate change and adaptation options: A review. Aquatic Botany 89(2):237-250.

MONRE (Ministry of Natural Resources and Environment). 2012. Climate change, sea level rise scenarios for Vietnam. Hanoi, Vietnam. 23p.

Tran Thi V., A. Tien Thi Xuan, H. Phan Nguyen, F. Dahdouh-Guebas, and N. Koedam. 2014. Application of remote sensing and GIS for detection of long-term mangrove shoreline changes in Mui Ca Mau, Vietnam. Biogeosciences 11:3781-3795.