Birmingham water science leads ecological survival battle

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Scientists at the University of Birmingham have developed tools to help restore vital eco-systems found in tropical mangrove forests around the world.

Hydrology experts at the University worked with counterparts in the Netherlands to test methods for measuring water levels in mangrove restoration projects. They then developed recommendations to help boost the likelihood of success for such projects.

The team, which included scientists from Wageningen University and Eijkelkamp Soil & Water conducted fieldwork in three mangrove regions in south-east Asia: Can Gio and Ca Mau, in Vietnam and Mahakam, in Indonesia.

Their research demonstrated that using local water level data in restoration projects is a potentially powerful tool to help reinstate valuable vegetation and trees. The team developed a restoration 'toolkit' of procedures that should help ecologists to get the most out of restoration projects.

University of Birmingham Water Science Lecturer Dr Anne Van Loon said: "Mangrove restoration projects often fail because hydrological conditions are disregarded. We have developed a simple, but robust, toolkit to determine hydrological suitability for mangrove species and guide restoration practice.

"Mangrove forests are valuable coastal ecosystems in tropical coastal regions around the world, but increased pressures in these regions, such as logging, aquaculture and coastal development threaten their existence."

"They have a vital role to play in tropical countries for coastal protection, ecosystem functioning and supporting the livelihoods of coastal communities. Restoration projects have been set up but there is little scientific support to guide the restoration practice.

"Successful restoration often comes down to a particular site's conditions being suitable for mangrove survival. Our research gives mangrove restorations practitioners the scientific background and practical tools to take these site conditions into account."

Dr Van Loon, from the University's School of Geography, Earth and Environmental Sciences and The Birmingham Institute of Forest Research (BIFoR), added that salinity, soil conditions and hydrology were all important factors in determining a project's chances of success, but hydrology was often overlooked in mangrove restoration, making it an important reason for failure.

Mangrove seedlings, for example, are often planted in the mudflat zone, which is too wet for growth. Mangrove vegetation fails to recover in abandoned shrimp ponds because of impaired water flow. Restoring the hydrology of impounded mangrove areas has proven to lead to successful restoration in Florida, Costa Rica, the Philippines and Thailand, but mangrove organisations need more useful tools to take hydrology into account in their restoration projects.

Carrying out field work in south-east Asia, the team measured water levels and the composition of vegetation species composition to place sites into hydrological classes.

This showed that in some locations hydrological conditions had been restored enough for mangrove vegetation to establish. In some locations, water conditions were too wet for any mangrove species to grow, whether natural or planted. The team also measured the effect that removal of obstructions such as dams would have on the hydrology and found that failure of planting could have been prevented.

Based on this research the scientists developed the toolkit of measures to improve the effectiveness of mangrove restoration projects. This included recommendations to measure water levels over a minimum period of 30 days to observe the impact of tidal cycles, as well as calculating the movement of water across a restoration site.

Professor Rob MacKenzie, Director of Birmingham Institute of Forest Research (BIFoR), said: "This innovative study is a great example of how the University of Birmingham is working internationally with colleagues to produce high-quality research with a global impact. The team's work will be of immense value in the battle to restore tropical mangrove forests around the world."

More information: Anne F. Van Loon et al. Hydrological Classification, a Practical Tool for Mangrove Restoration, *PLOS ONE* (2016). DOI: 10.1371/journal.pone.0150302

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