Eco-Service Quantification of Ecologically Engineered Urban Wetlands in Ait Campus

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This research qualified two wetland eco-services é wastewater treatment benefits and carbon sequestration service of ecologically engineered urban wetlands on AIT campus. Relationships between nutrient loading (N, P) concentrations, microphytes, macrophytes and zooplankton density in eco-engineered AIT wetlands were established. The effect of wetland macrophytes in polishing wetland water quality was realized. Macrophytes, mangroves and algae were found to be most promising technology to sequester CO2.

Macrophytes (water lily, lotus, Victoria amazonia) introduction in AIT wetlands improved wetland water quality; reduced e-coli count from 1300MPN/100ml to 700MPN/100ml whilst N and P concentrations decreased to 0.08mg/l and 0.19 mg/l. Spirulina bloom in the AIT wetlands specially FP has sustained remarkable improvement, where the spirulina amount lessen from 98% to < 1%. High N and P concentrations (3.4mg/l and 0.8mg/l) influence cyanobacteria (spirulina sp) dominance in urban wetlands.

This research study demonstrated that Cyanobacteria (which, being bacteria, are ecologically more resilient and invasive microphytes, than other taxa, e.g. green microalgae), can be controlled and effectively eliminated in urban wetlands. Their invasions, frequently and incorrectly called “blue-green algal” blooms, are well-known detrimental phenomena both in rural and urban environments. The control can be exercised through an approach of an ecologically engineered introduction of diverse macrophytes with a broad variety of properties (emergent wetland plants of diverse speciation). The approach follows a basic ecological principle that diversity of ecological habitats/niches characterized by different environmental conditions inevitably leads to a corresponding species diversity. Increased concentration of microalgal feeders, rotifers (Rotifera) was observed in the AIT fountain pond, resulting from diversification of habitats/niches provided by macrophyte plants. Size of Spirulina frequently poses a major problem for potential microscopic predators. Depending of a number of factors, length of entire Spirulina spiral may potentially reach hundreds of micrometers. In case of the macrophyte-free Chiang Rak pond/canal system the length of the entire spiral was very high (5-6 spiral units, 200-300 μm) and this prevented predation, hence only low concentration (abundance) of rotifers was observed (20-50 individuals per L), and only one species (Brachyonis sp.), in contrast to much higher abundance and species diversity in the AIT Fountain pond/canal system after eco-engineered macrophyte introduction.

The STELLA model output of AIT wetland hydrology indicated that water volumes of the studied wetlands (hydraulically closed systems) without wastewater seepage fluctuated (70 to 80%) throughout the dry and rainy seasons (Figure 4.14). Pond volume (water level changed in pond as a function of time) depends upon rate of evapotranspiration, amount of precipitation and some extent water pump in and out. However, water volume of wetland with continuous wastewater seepage fluctuated insignificantly throughout the dry and rainy seasons: pond volumes varied by 15 to 25% only. This finding suggests that in the framework of AIT

Eco-campus the hydraulically closed ponds and canals with the introduction of wastewater can be sustainable and stable water bodies where drying-up over the dry season are not a threat.

Wetland macrophytes and mangrove sequestration was estimated as 33.4% and 47.1% of %C respectively whereas as microalgae secluded 0.5 kg CO2 d-1. In spite of high CO2 emissions, approximately 6246 tons C equ.yr -1 of greenhouse gas discharge on AIT campus; wetlands are discovered as important ecological control system to lower these emissions.

Upgrading urban wetlands through ecological-engineering approach with macrophytes introduction boost their eco-service diversification and easy and sustainable approach to better urban wetland water resources especially the polluted ones.