Peri-urban mangroves forests as filters and potential phytoremediators of domestic sewage in East Africa

Reporting

Project Information

PUMPSEA

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Project closed

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Final Report Summary - PUMPSEA (Peri-urban mangroves forests as filters and potential phytoremediators of domestic sewage in East Africa)

The PUMPSEA project addressed the worldwide threat of domestic wastewater discharge to sustainable

coastal development, which was identified as a critical issue by the Johannesburg World Summit for Sustainable Development, the European Union's Water Initiative and the African Convention on the Conservation of Nature and Natural Resources.

Peri-urban coastal areas of the developing world receive extensive amounts of untreated sewage, which is typically discharged into creeks lined by mangrove forests, which filter the wastewater limiting coastal sewage pollution. The main objective of PUMPSEA was to demonstrate the ecological and economical service that peri-urban mangroves provide and offer innovative solutions for the exploitation and management of this quality.

Two innovative approaches were analysed, namely the facilitation of filtration through the conservation and replanting of mangroves in areas severely exposed to sewage and the exploitation of mangrove wetlands for the treatment of domestic sewerage. Various representative areas were selected to serve as case studies and a multidisciplinary approach was implemented, including socioeconomic analysis, condition mapping, biogeochemistry, ecology, modelling, controlled experimentation, experimental optimisation of a trial wetland and governance assessment and implementation planning.

Firstly, field evidence was evaluated and the effects of sewage filtration were analysed, in terms of their biogeochemical, microbiological and food web impacts on the ecosystem. A very clear uptake of sewage derived nitrogen by primary producers was demonstrated, along with its integration and recycling by the system throughout the different trophic levels in the intertidal food web. The sewage impacted systems appeared to be more affected through the enhancement of benthic microalgae growth due to higher nutrients loads. It became evident that the systems coped well with sewage discharges through the uptake of nutrients by primary producers and by the adaptations of faunal species to the new conditions. Water transport of sewage components into and out of study areas was also analysed and the relationship between water quality and sewage exposure was investigated.

Secondly, peri-urban mangrove and mudflat areas were mapped using high resolution remote sensing and ground data. The maps were produced in appropriate resolutions to facilitate the study of various parameters and allow for the examination of management and implementation options. Furthermore, innovative mangrove sewage filtration technologies were experimentally developed. The sewage filtering capacity of several mangrove compartments was investigated and the impact of sewage exposure on the microorganisms in open waters and sediments was assessed. An ecological model, which helped to simulate the phenomenon and verify the mangrove system health, was also developed.

The socioeconomic aspects of mangrove filtration were assessed using a qualitative matrix on ecosystem goods and services as a function of sewage exposure. Finally, a strategic plan for the implementation of the project proposals was conceptualised and the project findings were transformed into appropriate governance guidelines. It was pointed out that mangroves could form an exploitable option of significant lower cost in comparison to conventional techniques.

The proposed mangrove wetland technology could have a significant impact on the global scale since these trees are endemic to all tropical coasts. Therefore, the project delivered unique findings towards the development of new sewage management policies. It was anticipated that these outcomes could assist

governance of peri-urban mangroves in general and be directly applied for the improvement of current conditions in East Africa. Finally, Integrated coastal zone management (ICZM) was also assisted by the production of exploitable environmental information of high resolution and direct application.

Related documents

Final Report - PUMPSEA (Peri-urban mangroves forests as filters and potential phytoremediators of domestic sewage in East Africa)

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