Water quality amelioration value of Fynbos Biome wetlands, South Africa

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Key Message: Wastewater treatment by the Fynbos Biome wetland reduces Nitrogen and Phosphorous content

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1. What is the problem?

There are large numbers of small wetlands in the Fynbos Biome of the Western Cape, South Africa, but their function and value has hitherto been unknown. As a result, many of these wetlands have been degraded or lost due to farming practices and other land use changes. Land uses in this area include dryland and irrigation cropping as well as rangelands and small settlements. Both wetlands and land use play a role in determining water quality emanating from subcatchments in the Fynbos biome. Irrigated lands (including orchards, vineyards, pastures, parks, and golf courses) and dryland agriculture were found to increase the concentrations of nitrogen (in ammonium, nitrates, and nitrites), probably due to the application of fertilizers in these areas, while wetlands had the opposite effect. As streamflows (flow of water in streams, rivers, etc., from land to ocean) enter wetlands, they slow down, with the result that suspended sediments settle out of the water column. (Turpie, 2010).

2. Which approach was taken?

The water treatment capacity of wetlands was valued using a replacement cost approach, which entailed quantifying the removal of pollutants by the wetlands in the area and estimating the equivalent cost of performing this service with man-made water treatment plants (Turpie et al., 2010).

3. What ecosystem services are considered, and how?

The natural vegetation of the Fynbos Biome (and the sampled landscape) is dominated by low shrub lands associated with fynbos (collection of shrubs) and renosterveld (this vegetation type is dominated by a species of plant called the Renosterbos) vegetation types, although much of it is degraded. Most renosterveld, which occurs on richer soils, has been converted to croplands, and the natural grazing capacity of the remaining fynbos areas is relatively low. Water-quality amelioration functions of wetlands benefit both the ecology and human users in downstream systems. For example, preventing contamination of downstream areas may protect fisheries from harmful pollutants or reduce the impact on human health, such as from extensive growth of algae or aquatic macrophytes in response to nutrient loading. Reduced sediment loads may reduce the frequency of dredging (and thus the cost) needed to prolong the lifespan of downstream impoundment (ibid).

4. What input was required?

The water treatment function was valued using the replacement cost method, based on water treatment costs of plants. The data, collected from 24 water treatment plants, included the total amount of water treated, the concentration of Nitrogen and Phosphorous before and after treatment, and the capital and operating costs of the plants. Multiple regression analysis was used to estimate the marginal cost of treatment per unit mass of N and P. It was assumed that any treatment service provided by the wetlands was fully demanded, in that it was always beneficial to downstream users, as opposed to a situation where there are few or no users downstream. As streamflows (flow of water in streams, rivers, etc., from land to ocean) enter wetlands, they slow down, with the result that suspended sediments settle out of the water column. Because many pollutants (e.g., metals and organic chemicals) attach strongly to suspended matter, this process is also important for reducing these materials in downstream systems.

The rates of removal of different substances from water treatment in the Western Cape suggested that an average of at least 33 mg of N is removed per liter of effluent. Based on above, the average cost of treatment was about USD 3.47 per kg of N removed (from total ammonium) (Turpie, 2010). On this basis, using only the removal of ammonium nitrogen to avoid double-counting, and assuming that removal of total P is correlated to that of N, the value of wetlands in the different sub catchments was estimated to have an average value of USD 1913 ha-1 per y-1, and the total value of wetlands in the study area was estimated to be $ 43.7 million (Turpie et al., 2010).

5. What was the policy uptake and what were the conditions for this effort to influence public management?

The study did not lead to any policy uptake but the significance of using wastewater treatment can be seen from the fact that it is being used in other parts of the world. For instance, the Nakivubo Swamp in Uganda provides not only wastewater purification of Kampala's sewage but also nutrient retention. The results of an economic evaluation comparing this natural effect with manmade solutions showed a high economic value between US$ 1 million and US$ 1.75 million a year, depending on the economic analysis method used ((Emerton, 2003).

References

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