TECHNICAL BRIEF

August 2017
The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

Tested method to quantify costs and benefits of aquatic ecosystem service changes developed

A Water Research Commission (WRC) study has been completed on evidence-based approach to measuring the costs and benefits of changes in aquatic ecosystem services.

Background

The cumulative effect of catchment-wide aquatic environmental ecosystem degradation presents a hazard to human well-being and economy.

The degradation effects result from various water and land use practices, which impact water resources and the aquatic ecosystem services they provide. Various economic sectors and humans bear the resulting risks directly, and especially poor communities who are reliant of aquatic ecosystem services for their livelihood.

Management of these risks requires a clear understanding of the relationships between human well-being, socio-economic development, ecological degradation, and evidence-based analysis thereof. The aim of the project was to provide practical and affordable evidence-based analysis of the effects and impacts of environmental degradation on water resources, ecosystems, and socio-economic development and to use this evidence to secure aquatic ecosystem services.

Ecosystem service valuation was performed and thereafter an integrated bio-economic model was developed. This model demonstrated the relationships between the environment and the economy by using production functions where monitoring indicators are used as inputs into the production of ecosystem services.

The model provided evidence of the magnitude and trajectory that various drivers have on the health of the ecosystem. Two case studies, namely the Apies/Pienaar River system and Zaalklap Wetland in the Olifants River Water Management Area were used to demonstrate application on the relationships between the degraded water resources and socio-economic development.

However, this brief is focused on previously degraded Zaalklap wetland which has been since rehabilitated.

Study area

The rehabilitated Zaalklap wetland in the Olifants River catchment.

An Integrated Bio-Economic Model was developed to quantify the ecosystem services provided by system in relation to river health. The Integrated Bio-Economic Model brings together a wide range of multidisciplinary concepts and data. This allows the model to determine the relationship between the environment and the economy.

This model uses production functions where the monitoring indicators are used as inputs into the production of ecosystem services. This approach differentiates it from most other bio-economic models and allows for marginal impact assessments to be performed.

The Zaalklap wetland is situated 15 km east of Emalahleni in Mpumalanga. The wetland is in the Olifants Water Management Area located within the B20G Quaternary Catchment. The wetland is a moderate sized (135 ha)

naturally unchannelled valley bottom wetland system located along the Grootspruit River.

The Zaalklap wetland is heavily impacted by a variety of sources and as a result many of the ecosystem services delivered by the wetland such as water purification and water provisioning have been compromised.

Results

The Zaalklap wetland produces valuable wetland ecosystem services and, through these production activities, is a valuable component of ecological infrastructure.

The value of the provisioning and cultural services delivered by the Zaalklap wetland is estimated at R21 300/ha/annum (or R2.9 million per year for the 135 ha Zaalklap wetland); and the value of the regulating services delivered by the wetland, excluding water purification and waste assimilation, is R22 940/ha/annum (or R3.1 million per year).

The water purification and waste assimilation service of the Zaalklap wetland has a value ranging between R20 000 – R85 000/ha/annum or R2.6-R11.4 million per year. This is based on monitoring data of the CSIR taken within less than a season after rehabilitation and this value could therefore likely be expected to increase as the rehabilitated wetlands stabilise and mature.

This demonstrates that the Zaalklap wetland's water purification and waste assimilation ecosystem service is possibly larger than the other wetland ecosystem services values based on the Olifants WRCS estimates of other wetland ecosystem services together.

The production of ecosystem services relates closely to wetlands' inherent 'asset' value, which is also referred to as "ecological infrastructure". Based on the estimates done in this study, the asset (or ecological infrastructure) value of the Zaalklap wetland ranges between R501-R763 million, of which the water purification and waste assimilation service contributes R130-R560 million.

Thus, by rehabilitating the Zaalklap wetland at a cost of R1.7 million, we have been able to produce between R130-R560 million on the natural asset balance sheet of South Africa.

It must be noted that the value of wetland regulating services identified here, although represented in a financial currency, does not indicate the "price" of the ecological infrastructure but rather indicates in a common currency the value it provides in economic terms.

The price of ecological infrastructure would be a much larger number as the services provided are done so into perpetuity and there is an additional insurance value attached to that. Additionally, the value identified has been done so on a local level, identifying direct benefits provided by the study wetlands.

This does not consider the cumulative benefits provided by the addition of the study wetlands at a regional or catchment scale. The interlinked nature of ecosystems results in the footprint of the study wetlands being far greater than just the direct surroundings and thus their value has likely been underestimated.

Conclusions and recommendations

The results therefore strongly support investment in wetland rehabilitation in general and for wetland rehabilitation in mine-water affected areas specifically. It also demonstrates that wetland rehabilitation may form a very important part of wetland impact mitigation strategie.

The development of Integrated Bio-Economic Model was based on close cooperation with the Department of Water and Sanitation. However, it still needs to be tested under more diverse scenarios, before it is built into licensing or authorisation.

Related project:
Evidence-based approach to measuring the costs and benefits of changes in aquatic ecosystem services
(**Report No. TT 726/17**). Contact Publications at Tel: (012) 761 9300;
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