The economic impact of water hyacinth infestation on farmers:
Case of Lake Tana in Ethiopia

By : W. Van Oijstaeijen, H. Azadi, S. Van Passel (UAntwerpen); L. Janssens de Bisthoven (IRSNB, CEBioS); J. Hugé (ULB, IRSNB)

Key message

Local communities in rural areas often depend on the services provided by the ecosystem. Degradation of the ecosystem – in this case through invasive species – may threaten livelihoods and the environment of these communities. Putting an economic value on the impact of the water hyacinth infestation on the actors affected is crucial to proceed to informed, evidence-based decision making at the higher level. This suits in the transition towards the sustainable management of ecosystems, enhancing the quality of life for people, while safeguarding nature's resources. This study aims to investigate the impacts of water hyacinth infestation on the local farming communities in terms of the willingness to contribute in monetary terms as well as willingness to contribute days of labor to reduce or remove the infestation.

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Introduction

Lake Tana is the largest source of fresh water in Ethiopia and by extension the Horn of Africa. Moreover, it is the source for the Blue Nile river, which supplies 80% of the total water volume of the Nile river. Thus, Lake Tana contributes to the livelihood and well-being of an enormous number of people. It was recognized as a Biosphere Reserve by UNESCO, in order to conserve the wide array of ecosystem services the lake provides and to improve the livelihood of local communities (UNESCO, 2015). Since 2011, the lake is threatened by an invasion of the so-called world's worst aquatic weed "water hyacinth". The infestation spread rapidly, up to covering around 5400 ha in 2018 (Gezie et al., 2018).

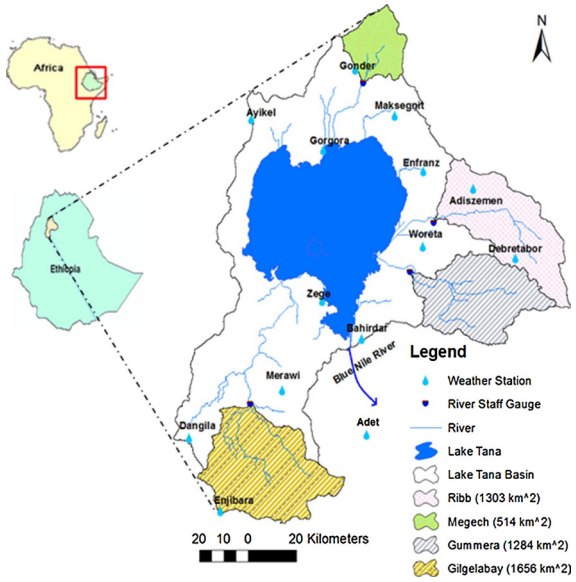


Fig. 1. Map of Lake Tana (Tegegne et al., 2017)

Beautiful flowers – what is the problem?

Fig. 2. Water hyacinth

The *Eichhornia crassipes* – or water hyacinth – is mostly known for its vibrant purple and violet flowers. The aquatic plant is also characterized by an extremely high reproduction rate and a tendency to form dense free-floating mats on the water surface. It originates from the Amazon basin in South America, but was introduced all over the world as a pond ornamental. In the absence of natural enemies and with favorable environmental conditions (temperature, water nutrient level, water acidity and etc.) water hyacinth populations can thrive and populations can double in area in just 5 days (Malik, 2007). Destructive water hyacinth infestations occur in Asia, USA, Australia and particularly in Africa. Inferring with local biodiversity, the weed affects the production of ecosystem services. Also, it has been recognized as the world's worst water weed and has garnered increasing international attention as an invasive species.According to climate change models, its distribution may expand into higher latitudes as temperatures rise, posing problems to formerly hyacinth free areas (Rahel and Olden, 2008). Thus, it leads to social, environmental and economic disturbances.

Water hyacinths affecting ecosystem services

Local communities strongly depend on Lake Tana. Through participative approaches, a (non-exhaustive) list of ecosystem services was identified and respondents were asked which services they ought relevant in their daily life in the Lake Tana Basin.
The pie chart illustrates the ecosystem services and their relative importance for the local communities. Among all the respondents, 98% described water hyacinth as an obstacle in receiving the full potential of these ecosystem services. Figures 4, 5 and 6 provide evidence of the water hyacinths impact.

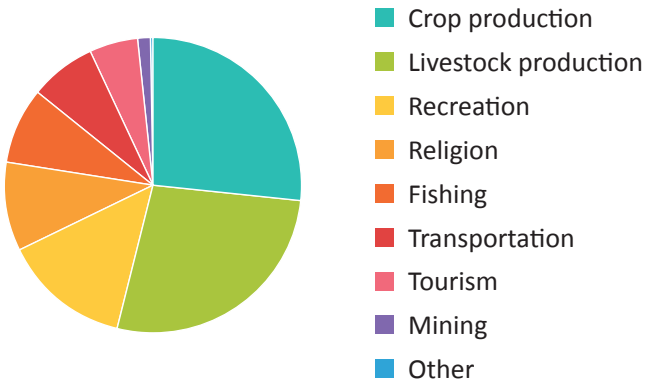


Fig. 3. Oversight of ecosystem services around Lake Tana

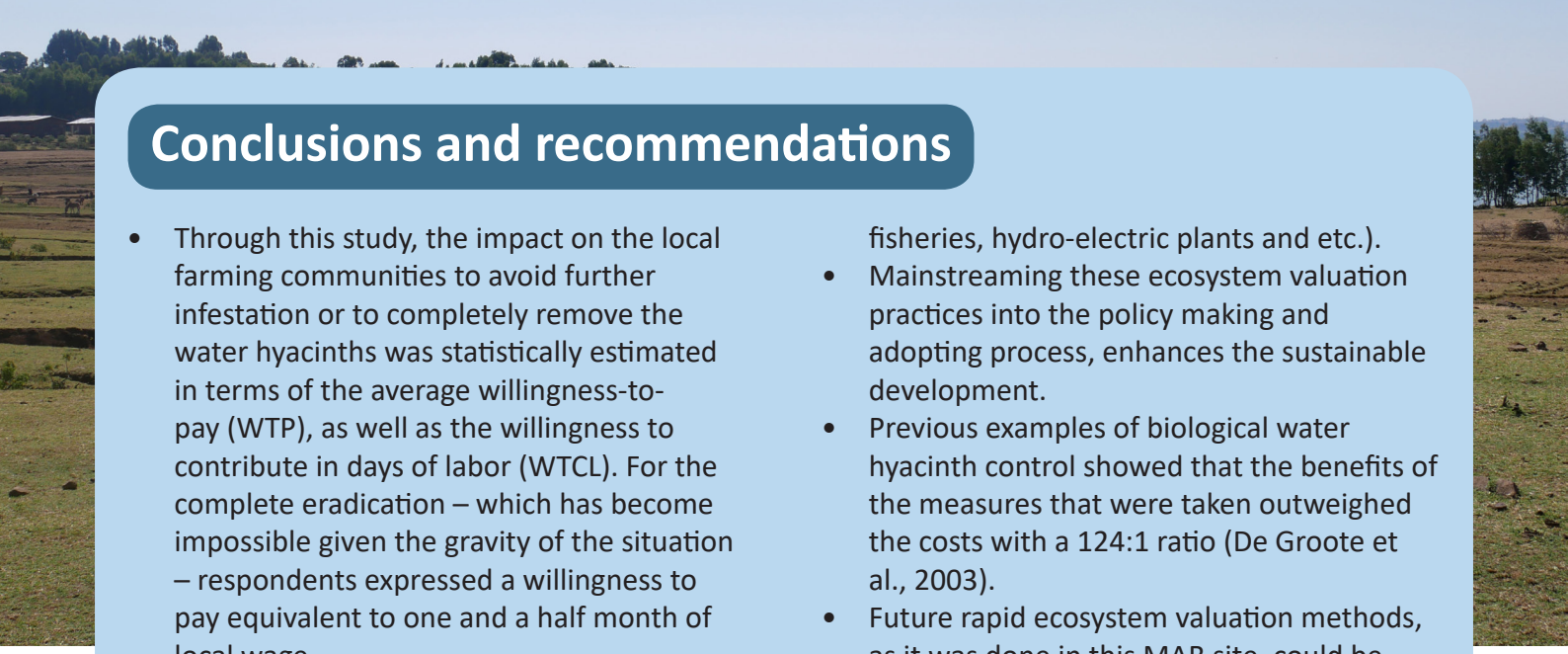
Fig. 4. Inaccessibility of the lake

The infestation of water hyacinth on Lake Tana is a 'public good', characterized by non-rivalry and non-excludability. The control or eradication of the infestation is thus a public good as well. To determine what the economic value of a water hyacinth free Lake Tana is, the impact of the infestation on all the stakeholders needs to be assessed. In a contingent valuation study, respondents state their willingness to pay for a hypothetically created market.

Fig. 5. Obstruction of irrigation canals

Fig. 6. Invading wetlands/farming areas

In order to protect ecosystem services, the ecosystem should be properly managed. In recent years, environmental degradation, population growth and urbanization in the region have put additional stress on the Lake Tana Biosphere Reserve. Managing properly entails the integration of informed decision-making procedures. These require an interdisciplinary systems approach on problems. Often, when non-marketable goods and services are involved, the economic valuation is not thoroughly assessed because of the resource-intensive practices to stick value to these items. Nevertheless, having sense of the economic impact of the water hyacinth infestation could provide potential justification for governmental interventions.



Conclusions and recommendations

- Through this study, the impact on the local farming communities to avoid further infestation or to completely remove the water hyacinths was statistically estimated in terms of the average willingness-to-pay (WTP), as well as the willingness to contribute in days of labor (WTCL). For the complete eradication – which has become impossible given the gravity of the situation – respondents expressed a willingness to pay equivalent to one and a half month of local wage.
- The benefit of eradication for the local farming communities is only part of the total benefits. Further research could elaborate on the impact of the water hyacinth infestation on other stakeholders (e.g. fisheries, hydro-electric plants and etc.).
- Mainstreaming these ecosystem valuation practices into the policy making and adopting process, enhances the sustainable development.
- Previous examples of biological water hyacinth control showed that the benefits of the measures that were taken outweighed the costs with a 124:1 ratio (De Groote et al., 2003).
- Future rapid ecosystem valuation methods, as it was done in this MAB site, could be valuable to ensure faster action and the proactive management of ecosystem services, beneficial for the natural resources and consequently human's sustained survival.

The EVAMAB project

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Sources of images

Figure 1	Tegegne, G., Park, D. K., & Kim, Y. O. (2017). Comparison of hydrological models for the assessment of water resources in a data-scarce region, the Upper Blue Nile River Basin. Journal of Hydrology-Regional Studies, 14, 49-66. doi:10.1016/j.ejrh.2017.10.002
Figures 2, 4, 5, 6 + cover pictures	Wito Van Oijstaeijen

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Contact
Steven Van Passel
Professor Environmental Economics, Faculty of Business and Economics, Department of Engineering Management, University of Antwerp, Belgium
Steven.VanPassel@uantwerpen.be

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