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## Perceptions of Local People on the Use of Nyabarongo River Wetland and Its Conservation in Rwanda

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### ABSTRACT

This research presents a case study on perceptions of local people on the use of Nyabarongo river wetland and its conservation in Rwanda. It critically examines the potential implications of a shift in wetland use and management practices for local people and presents empirical data from a household survey, group discussions, and observations from transect walks. Results showed that the change in the use and management regime of Nyabarongo river wetland poses substantial loss for local people in terms of provision of resources, income, and access to the wetland, so that the majority of the participants are not happy with the current use of the wetland. Research concluded that there should be participation of all stakeholders, including local people, during policy development in order to shift from command-and-control toward local stakeholder integration in decision making.

### ARTICLE HISTORY

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Biodiversity; income; natural resources; policy; stakeholder; top-down approach

Rwandan wetlands cover about 10% of the surface area of Rwanda (Government of Rwanda [GoR] 2009). They have long been an important natural resource for local communities and originally were used for hunting, fishing, and cattle grazing (Cambrezy 1981). The exploitation of wetlands for agriculture is a recent phenomenon in Rwanda, in response to food and fodder shortages in the dry seasons and drought periods (Nabahungu and Visser 2013). Currently, wetlands are state property, targeted by the Government of Rwanda as a pilot area, in which the agricultural modernization and intensification policy are implemented (Ansoms et al. 2014).

This policy aims to improve the growth potential of the agricultural sector through the adoption of modern cropping and the promotion of market exchange through reinforced regional specialization (GoR 2004; GoR 2009). In some locations, the government has made wetlands available in concession to private investors (Veldman and Lankhorst 2011), while others are allocated to farmers grouped into officially recognized cooperatives, where farmers have to specialize in the production of one market-oriented high-value crop such as rice, sugarcane, and maize (GoR 2007).

A change in use and management of Nyabarongo river wetland started in 1997, when the Government of Rwanda leased around 3000 ha of its 10,000 ha to Madhivani group managing Kabuye Sugar Works factory, for sugarcane plantations (Ansoms 2009). At

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the beginning, the investor had to negotiate with local users of the wetland (Veldman and Lankhorst 2011). This process ended with the establishment of the new land law in 2005, where the informal users do not accumulate rights to wetlands (GoR 2005), and therefore had to leave for the profit of the investor to exploit it commercially.

Later in 2010, Ministerial order number 007/16.01 of July 15, 2010 (GoR 2010), transferred the wetland into a conserved area. The order specified that no activities or buildings are authorized on shores of rivers, except activities aimed at protecting shoreline or activities authorized by the Minister in charge of environment and when such activities are deemed not destructive to the environment, on the condition that a prior environmental impact assessment has been done. According to the same order, the land on the river shore within a distance of 10 m for big rivers is reserved for natural vegetation. Nonnative vegetation can be grown on this land for restoration of damaged land or if that vegetation is responsible for protecting the environment by stopping soil erosion or serving as habitats for biodiversity.

The transfer of Nyabarongo river wetland under state control and its conservation have been a surprise to local people (Veldman and Lankhorst 2011). Due to an exclusionary top-down approach (Lane 2001; Pretty and Smith 2004) used by the government without considering other important factors such as social, cultural, and political issues, with an impact on traditional ways of living (Hamilton et al. 2000), some of the people resisted leaving the land until there was intervention by the local government (Veldman and Lankhorst 2011). This study explored local people's perceptions about the changes in wetland status and how these changes affected their livelihoods.

## Literature Review

Wetlands include areas of marsh, fen, peat-land, and shallow water bodies (International Water Management Institute [IWMI] 2014), known to play an important role in regulation of both quantity and quality of water resources (Dugan 1990). Humans depend on the provisioning, regulating, supporting, and cultural ecosystem services provided by wetlands (Finlayson, D'Cruz, and Davidson 2005), especially small wetlands in agricultural landscapes (Blackwell and Pilgrins 2011). This is the reason why wetlands have been defined as multiple-value systems for humans (Mitsch and Gosslink 2000).

However, over the past decades, wetlands have been degraded so that the ecosystem services have been reduced as the wetlands have been converted into urban and agricultural use, as well as contaminated by industrial, urban, and agricultural wastes (Ricaurte et al. 2013). Particularly, in many tropical countries, the shift to agricultural intensification targeted wetlands for their high crop production and water supply to neighboring upslope farmland (Bagalwa 2005). Consequently, the surface area of wetlands has been reduced up to 50% since the 1950s in tropical regions (Junk 2002) and subtropical countries (Zedler and Kercher 2005).

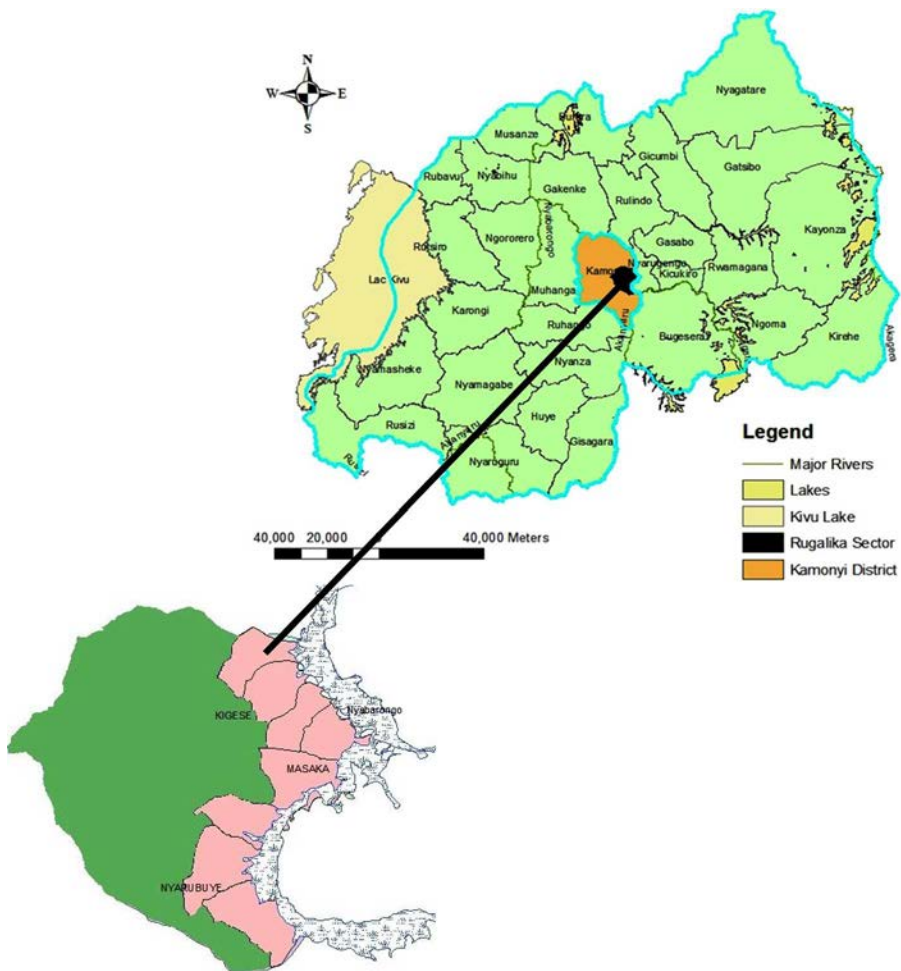
The rapid loss and degradation of wetlands threaten human well-being through biodiversity loss, as well as the loss of goods and services provided by such ecosystems (MEA 2005). Many attempts have been made to restore degraded wetlands by relying on understanding how ecosystems work (Cottet, Piégay, and Gudrun 2013). It is now well recognized that social criteria should also be defined for ecosystem preservation and restoration, where understanding the perceptions of local people and their opinions about ecological value is a critical part of the development of sustainable management plans and biodiversity conservation (Higgs 1997; Vining, Tyler, and Kweon 2000; Miller and Hobbs 2007).

This study investigated the perceptions of local people who previously exploited Nyabarongo river wetland for subsistence agriculture, on the wetland's current use for industrial production and its conservation status. The research aims to test the hypothesis that the change in use and management of Nyabarongo river wetland and its conservation had an impact on the local people living along the wetland. The main goal of the research was to contribute to the development of sustainable use of wetlands in Rwanda while respecting conservation strategies.

## Materials and Methods

### Area of Study

The study took place in eight cells located around Nyabarongo river wetland ( $2^{\circ}21'04''$  S and  $30^{\circ}21'27''$  E) in Rugalika Sector, Kamonyi district, Southern province (Figure 1). The



**Figure 1.** Area of study. (Adapted from data of the Centre for Geographic Information System–University of Rwanda.)

wetland covers around 10,000 ha, where 3000 ha of these is currently used for sugarcane plantations. The wetland provides important ecological services such as water filtration and storage, biological productivity, and wildlife habitat of birds such the Madagascar Squacco heron (*Aldeora idea*), Carrther's cisticola (*Cisticola carruthersi*), white-winged scrub-warbler (*Bradypterus carpalis*), Sharpe's pied-babbler (*Turdoides sharpie*), northern brown-throated weaver (*Ploceus castanops*), white-collared oliverback (*Nesocharis ansorgei*), and gray-crowned crane (*Balearica regulorum*) (Association for the Conservation of Nature in Rwanda [ACNR] 2004). Other wildlife known to inhabit the wetland include the Sitatunga (*Tragelaphus spekii*), crocodiles (*Crocodylus* sp.), and hippopotamus (*Hippopotamus* sp.). Papyrus (*Cyperus papyrus*) (IBA 2010) was the dominant plant prior to 2005.

### **Data Collection**

The field research was carried out in three main stages between October 2014 and January 2015 and involved both formal and informal survey methods, following the method of de Graaff (1996). Before each stage, the introduction, explanation, and purpose of research were given to participants in order to assure them that the information and data will be used for the research only and that confidentiality will be taken into consideration. This was done to encourage informants to feel safe and free to give the answers corresponding to their reality.

The first stage involved the focus-group discussion. According to Stewart and Shamdani (1990), the ideal number for discussion participants is between six and 12. In this research, nine participants from eight villages participated in two focus-group discussions, where each village had one participant, except one village with two participants as it had a large population size. Participants were selected purposively (Teddlie and Tashakkori 2008) and were given general questions (Durrance and Karen 2005). The basic criterion to be selected for group discussion was to be a resident of the area before and after Nyabarongo river wetland was transferred to ownership by the government, having land in the wetland, harvesting some natural resources, and/or realizing some other activities in the wetland.

Two group discussions were organized in October and November 2014, on a Saturday afternoon (1:00–5:00 p.m.) at schools located near Nyabarongo river wetland. In order to capture perceptions of local people on the use of Nyabarongo river wetland and its conservation, a set of wetland photographs indicating various activities and natural resources generating an income, food, social benefits, and general use was presented to people and they were asked to assess each one and score its importance (Cottet, Piégay, and Gudrun 2013). Where visual information was insufficient to deduce the importance, the photograph was classified as unknown.

The second stage involved household surveys using predesigned survey forms (Durrance and Fisher 2005). Before beginning the household survey, the researcher conducted a pilot survey with 10 people selected randomly outside of the sample area to validate the household survey guide (Teddlie and Tashakkori 2008). Based on feedback from the participants of the pilot study, some modifications were made to the test survey and standardization techniques were done before conducting the full household survey (Nabahungu and Visser 2013). In total, 372 participants were selected randomly by using simple random sampling

without replacement, where every individual in the sampling had an equal and independent chance of being chosen for the study (Onwuegbuzie and Collins 2007).

The third stage entailed doing a transect walk in the study area in order to obtain physical data and to validate the data collected during the group discussions and household surveys (Nabahungu and Visser 2013). Two persons selected purposively who had been using Nyabarongo river wetland before and after its designation as a conserved area facilitated this stage. The meandering transects walks of 16 km around Nyabarongo River started from the north to the south of the wetland. A geographic positioning system (GPS) was used to map the walk and the resources observed at every 500 m.

### **Data Analysis**

Qualitative data analysis was used for the focus-group results, and a quantitative data analysis was used for the survey results (Abu-Taleb and Murad 1999). A thematic approach was used to analyze the focus-group data, while SPSS (Statistical Package for Social Sciences) was used for the survey analysis (Bryman and Cramer 1997). Analysis was undertaken separately for every subpopulation and for every location before it was undertaken for the overall group. The field observations from the transect walks were used to complement the information from the survey and focus-group discussion.

### **Results**

Prior to its status as public land and conserved area, Nyabarongo river wetland had been used by the local people (98.2%). The majority of them (72%) came from various regions of the country to the wetland seeking productive lands or jobs in lands located in and around the wetland since 1980s. The major activities realized in the wetland were agricultural (93.8%), focusing mainly on beans (88.3%), soy beans (7.6%), maize (2.1%), and sorghum and vegetables (2.0%). Cattle herding (3.5%), making bricks (1.9%), and fishing (0.8%) were practiced at a small scale. These activities were very important for the local people around the wetland. Agriculture was appreciated to be the source of food and money; cattle were appreciated to be the source of milk, meat, and money; and fishing was appreciated to be the source of fish meat and money.

The income generated from agriculture in the wetland depended on the size of the land and the number of plots in the wetland. Agricultural products were sold at local markets either by the local businessmen/businesswomen or by the people from Kigali town. Income was also generated from jobs, where people who do not own the land in or around Nyabarongo river wetland worked for others and got a wage of 500 Rwandan francs (Rwf) per day. The income generated from making bricks was not ranked as highly important, as one brick brought a price of only 5Rwf. The income generated from fishing was not estimated, as this activity was done by few people (0.8%) with the main purpose of getting fish meat for personal consumption.

Agriculture was the most commonly reported source of income for respondents (77.3%) in this study. The average of the income generated per day and per person was estimated at 325.5Rwf. However, even though agriculture was ranked high among the activities generating good income, local people (62.0%) recognized its negative effect on the wetland and on brick-making. In cultivating they had to clear land in the wetland by burning papyrus

and other grasses, and drain water, while for accessing good-quality clay they had to dig deep in the wetland.

Currently, the only major activity realized in Nyabarongo river wetland is the sugarcane plantation. Some people (12.1%), particularly women and youth, work as laborers for Kabuye Sugar Works or for those who still have plots in the wetland, where they are paid 900Rwf per day, a wage judged not enough to replace the income generated from previous activities and uses of the wetland. Only a few local people (3.5%) still have small plots at the edge of the wetland, where they are recommended to cultivate sugarcane and sell it to Kabuye Sugar works at a nonnegotiable price.

This job is not permanent, as for the majority of workers (81.3%), the maximum time is 1 month of employment in Kabuye Sugar Works. The time was not estimated for those people not working in the company; this depends on the agreement between the worker and the landowner. However, agronomists and team leaders may work for Kabuye Sugar Works for more than 1 month. Bricks are made outside of the wetland, where few people (2.9%) can find employment collecting clay and making bricks, where they earn 12Rwf per piece. The cost of bricks has increased compared to before the wetland was owned by the government but making them is done by few people (0.8%).

After the government transferred the wetland to public land, local people were not provided compensation for lost income and lost land. The majority of local people in this study, who lost the right to their land (86.4%), looked for other activities outside or in the wetland. Some (66.2%) took work as bricklayers or bricklayers' helpers, or work in stone mining; others (20.2%) found jobs in the sugarcane plantation. To compensate for food obtained from wetland activities, people (88.1%) exploit lands on the slopes of the hills around and out of the wetland. Some of them (1.8%) working permanently in the wetland, by negotiation with the agronomists in charge of the sugarcane plantations, are allowed to mix some crops such as soybeans, vegetables, and Irish and sweet potatoes with sugarcane.

The alternative activities found by local people are reported to be very challenging because the majority of the local people (90.0%) receive a wage from the sugarcane company that is not sufficient to support the family and because sometimes they are not paid on time. Bricklayers and bricklayers' helpers do not have permanent jobs in this activity. Respondents (83.2%) also reported that the crops harvested on the slopes of the hills do not produce and generate the same quantity as the quantity harvested in the wetland.

The change in use of the wetland had an impact on the income generated currently and the income generated from the activities realized in the wetland before it was transferred to public land. The income generated has been highly reduced for agriculture (from 84.4% to 18.6%), fishing, and domestic animals (from 0.5% to 0.3%). It remained constant for brickmaking (0.8%), although the location of brickmaking has changed. The average of the income generated from the activities realized in Nyabarongo river wetland per day and per person was also reduced from 325.5Rwf to 140.32Rwf.

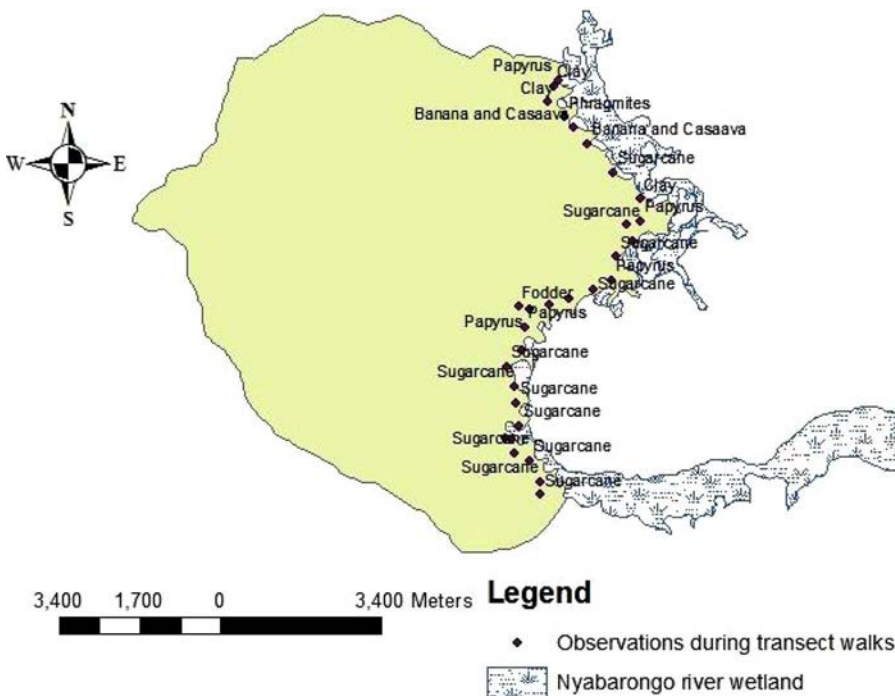
Water (66.7%), *Phragmites* sp. (16.4%), papyrus (10.5%), and clay (6.5%) were the most common natural resources harvested in Nyabarongo river wetland before being owned by the government. These natural resources were used in various activities such as cooking and washing (57.1%), brickmaking (9.4%), building (9.3%), fencing (7.0%), ceiling construction and making traditional plates (6.7%), making baskets and mats (6.6%), and ornamentation (3.9%). Prior to the wetland being designated as public, the income generated varied



depending on the location of the local market and the material itself. Papyrus (50.3%), *Phragmites* sp. (32.0%), and clay (0.8%) were ranked as top resources generating a considerable income. The average of the income generated from these natural resources harvested in Nyabarongo river wetland per day was estimated at 110.3 2Rwf per person.

With the new status of the wetland, papyrus is available mainly at the edge of the wetland, where water was not fully drained, and the area was not exploited as before. It is collected illegally in the remote areas of the wetland, which are hard for local leaders to control. It is then sold on the markets outside of Rugalika sector. *Phragmites* sp. is harvested at a small scale and is sold outside of Rugalika sector, while clay is controlled and owned by private individuals within a small area, where it is used for making bricks. Compared with the income generated before the wetland was put into public land, it has been reduced to 71.90Rwf per day and per person.

During the transect walks, GPS data collected from 31 sites indicated that sugarcane occupies the larger part of Nyabarongo river wetland. Sugarcane growing in the wetland was observed at 51.6% of the sample sites, followed by papyrus at 22.6%. *Phragmites* sp. and open clay pits and brickmaking were observed at 9.7% each, while banana and cassava cultivation in the wetland were observed at 6.5% and fodder collection was observed at 3.2% of sites sampled (Figure 2). Inside the wetland, some areas where people mixed young sugarcane with other crops such as soybeans, sweet potatoes, and eggplants were observed. These activities were located far from the immediate access of people, and were always surrounded by mature sugarcane, as they are not legally accepted by Kabuye Sugar Works. These crops are discretely harvested during the sugarcane weeding period.



**Figure 2.** Observations during transect walks. (Adapted from the Centre for Geographic Information System–University of Rwanda.)



Frequently, small groups of women and youth were observed working in the sugarcane planting, weeding, cutting, or packing sugarcane in vehicles. In the hills surrounding the wetland, there were mainly cassava plantations, and stone mining sites, where the majority of the people are working as an alternative job. Five stations (Cyarumanzi, Mukore, Mpungwe, Nzagwa, and Remera) where local people use traditional boats to carry passengers across Nyabarongo river wetland were observed.

Beyond the various activities and natural resources harvested in Nyabarongo river wetland, local people (89.3%) recognized some of the ecological importance of the wetland. They valued the wetland as the habitat of wild plants such as papyrus and animals, mainly crocodiles, fish, snakes, and birds, which are not found outside of the wetland. Others (4.1%) recognized that the wetland plays a role in flood control and water retention, and as a source of purified water, fodder for animals, and source of fish meat. However, 54.6% of the local people were not at all happy with the current use of the wetland, while 37.4% were happy to a little extent, 5.9% were happy to a moderate extent, and only 2.2% were happy to a large extent.

All participants in the focus-group discussion and 88.3% of respondents of the household surveys did not understand the reason why the wetland was put into public land and the reason why they have been prevented from cultivating in the wetland, yet it continues to be cultivated for sugarcane plantation. They expressed the desire to have rights to their lands, and then to cultivate sugarcane and sell it to Kabuye Sugar Works or get compensation for it. They argued that nowadays, the interest from the use of the wetland is profiting few people, while before this the interest was shared by many people. The majority of the people (91.6%) agreed that they should have been involved in policy development and in giving suggestions about the use of the wetland.

Respondents (78.6%) reported that the information about the policy change in Nyabarongo river wetland use came from the local authorities. This information was not well perceived, as 87.6% had a very negative perception of this information, 6.2% perceived it as negative, 4.6% perceived it well, and only 1.6% perceived it very well. If it happens that the local people get an opportunity, they wish they might continue to use the wetland for agriculture. Sugarcane (59.7%), rice (20.4%), maize (12.9%), and soybeans (7%) are the major crops they wish to cultivate, and the reasons why they prefer these crops are various. First, they are preferred and encouraged by the government (61.3%). Another reason is the assurance of the market (30.7%) and the income they received from cultivation before the wetland was transferred to public land (8%).

Although the current use of Nyabarongo river wetland is not highly appreciated by the majority of respondents, some of them (83.0%) recommended that to sustain its conservation, the Government of Rwanda should reinforce bamboo plantations around the Nyabarongo River in order to reduce landslide in the river, should create of a buffer zone between the wetland and lands on the slopes of the hills, and should reinforce terraces around the wetland in order to reduce the erosion from the land on the hills around the wetland. Others (12.2%) recommended not continuing the dumping of stones in the wetland when they are making roads facilitating the transportation of sugarcane and manure in the sugarcane plantation. About one-third of the respondents (33.8%) say conservation of Nyabarongo River wetland is pretty good due to its importance for them. Others (42.7%) replied that they would participate as long as the government would provide the salary and a guide on what to do and how to do it.

## Discussion

Our results indicated that the change in use and management regime of Nyabarongo river wetland poses substantial loss for local people in terms of provision of resources, income, and access to the wetland. The process of removing local people from their lands without compensation and their resistance to leaving the land has been documented elsewhere (Hamilton et al. 2000; Jim and Xu 2002; Brown 2003; Fu et al. 2004; Anthony 2007). The resultant socioeconomic impacts of this process identified in this study have also been documented in other locations (Garcia-Frapolli et al. 2009). The lease of the wetland to a private company is a common condition carried out by other governments in other nations, where supposedly inefficient or underutilized land of interest to local people has been privatized for wider benefit of the state with little if any consultation with local communities (German et al. 2014).

The reasons for the transfer of the wetland under state control are specified in the Rwandan agricultural policy that describes rural agriculture practices as inadequate for the future of Rwanda, justifying government intervention to manage the land and use it in an efficient, uniform manner (GoR 2004). Those who fail to comply with such plans, including the planting of specified crops that may only be grown in a given area, season, and combination, will lose their land (Huggins 2013). On the other hand, the choice of a commercial management is likely as much about the political preferences of the government as specific budgetary constraints (Crisafulli and Redmond 2012), where Rwanda has pursued a neoliberal vision of good governance in which privatization was one of the preferred policy instruments (Gross-Camp et al. 2015).

Change in wetland status may in some cases have placed economic efficiency and the national economy ahead of the needs of the local people at least in the short term. The top-down process used for delivering the information about the change in use of the wetland may have compromised sustainability of the desired policy outcome due to the lack of integration of the local community, and social and economic practices (Lawn 2008). In addition, separating the fundamental connections between the economy, society, and the environment may not be the most efficient approach as it may lead to assumptions that trade-offs can be made between these three sectors, where the capital earned replaces natural resources and the needs of the people (Neumayer 1999).

Even if the government of Rwanda describes rural agriculture practices as inefficient, the process of decision making about the new ways of using Nyabarongo river wetland should be a societal issue (Reichert et al. 2007), where stakeholders are involved as early as possible in order to avoid skepticism and resistance (Palomo et al. 2011). Decision making ignoring the needs of people is unfair (Campese et al. 2009), and conservation efforts without the inclusion of people are subject to failure (Vermeulen and Sheli 2007). Thus, it would be naive to place the blame on local people who are not ready to participate in conservation activities of Nyabarongo river wetland, because without understanding of the broader political climate in which decisions have occurred, personal engagement is likely limited (Gross-Camp et al. 2015).

To avoid failure in management and conservation, there should be a shift from command and control toward the integration of local people in decision making (Sherington and Martin 1997) and management (Emerson et al. 2009; Redpath et al. 2013). Due to its importance to people and their livelihoods, the sustainable use of Nyabarongo river

wetland may be efficiently considered as not absolutely limited to governmental activities and initiatives, but rather toward collaborative and joint management between people and state agencies establishing the wetland use policy (Wild and Mutebi 1997), where economy, society, and environment are considered collectively (Giddings, Hopwood, and O'Brien 2002). This process may be more successful due to the collaboration between people and state agencies over the use and management of natural resources through a process of negotiation leading to a mutually acceptable and adaptable agreement (Wild and Mutebi 1997).

It has been remarked that where local people are working with various organizations at different levels (Folke, Colding, and Berkes 2003) and sharing management power and responsibilities (Shannon and Antypas 1997), the environmental decisions are perceived to be holistic, fair, considerate of a diversity of values and needs, and cognizant of the complexity of human and environmental interactions (Richards, Blackstock, and Carter 2004). Participatory processes in decision making can assist in the creation of trusting relationships between traditional societies and management planners (Hoverman et al. 2011), and modeling activities can contribute to better understanding of the different elements of the system and their interactions, including other stakeholders' concerns (Zorrilla et al. 2009).

In addition, participation contributes to rural development goals (Belshaw and Chambers 1973; Uphoff, Cohen, and Goldsmith 1979), if local end users adopt proposed solutions that emphasize the importance of local capacity building, knowledge ownership, and empowerment (Chambers 1994). A process that integrates stakeholders provides an opportunity for meetings and discussions among stakeholders from different organizational levels, enhancing the possibility for communication between different levels and organizations (Hirsch et al. 2010). In this perspective, outcomes and benefits are shared by the wider society instead of a small group (Sherington and Martin 1997). Promoting local community participation in the decision-making process can be a powerful strategy to enhance compliance with policies, which in turn contributes to more effective management and conservation of natural resources and biodiversity (Andrade and Rhodes 2012).

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## References

- Abu-Taleb, M. F., and M. M. Murad. 1999. Use of focus group and surveys to evaluate water conservation. *Journal of Water Resources Planning and Management* 125 (2):94–99. doi:10.1061/(asce)0733-9496(1999)125:2(94)
- Andrade, G. S. M., and J. R. Rhodes. 2012. Protected areas and local communities: An inevitable partnership toward successful conservation strategies? *Ecology and Society* 17 (4):14. doi:10.5751/es-05216-170414
- Ansoms, A. 2009. Privatization's bitter fruit: The case of Kabuye Sugar Works in Rwanda. In *L'Afrique des Grands Lacs: Annuaire 2008–2009*, ed. S. Marysse, F. Reyntjens, & S. Vandeginste, 259–72. Paris, France: L'Harmattan.

- Ansons, A., I. Wagemakers, M. M. Walker, and J. Murison. 2014. Land contestation at the micro-scale: Struggles for space in the African marshes. *World Development* 54:243–52. doi:10.1016/j.worlddev.2013.08.010
- Anthony, B. 2007. The dual nature of parks: Attitudes of neighboring communities towards Kruger National Park, South Africa. *Environmental Conservation* 34:236–45. doi:10.1017/s0376892907004018
- Association for the Conservation of Nature in Rwanda (ACNR). 2004. Conservation and sustainable use of wetlands in southeastern Rwanda. Kigali, Rwanda: Association for the Conservation of Nature in Rwanda.
- Bagalwa, M. 2005. The impact of land use on water quality of the Lwiro River, Democratic Republic of Congo, Central Africa. *African Journal of Aquatic Science* 31:137–43. doi:10.2989/16085910609503881
- Belshaw, D., and R. Chambers. 1973. A management systems approach to rural development. Discussion paper 161, Institute for Development Studies, University of Nairobi, Nairobi, Kenya.
- Blackwell, M. S. A., and E. S. Pilgrins. 2011. Ecosystem services delivered by small scale wetlands. *Hydrological Science Journal* 56:1467–84. doi:10.1080/02626667.2011.630317
- Brown, K. 2003. Integrating conservation and development: A case of institutional misfit. *Frontiers in Ecology and the Environment* 1 (9):479–87. doi:10.1890/1540-9295(2003)001[0479:icadac]2.0.co;2
- Bryman, A., and D. Cramer. 1997. *Quantitative data analysis with SPSS for windows*. London, UK: Routledge.
- Cambrezy, L. 1981. Conquête des marais au Rwanda et dynamique de population [Conquest of marshlands in Rwanda and population dynamics]. *Etudes Rurales* 83:45–67. doi:10.3406/rural.1981.2664
- Campese, J., T. Sunderland, T. Greiber, and G. Ovideo. 2009. *Rights based approaches: Exploring issues and opportunities for conservation*. Bogor, Indonesia: CIFOR and IUCN.
- Chambers, R. 1994. Participatory rural appraisal (PRA): Analysis of experience. *World Development* 22 (9):1253–68. doi:10.1016/0305-750x(94)90003-5
- Cottet, M., H. Piégay, and B. Gudrun. 2013. Does human perception of wetland aesthetics and healthiness relate to ecological functioning? *Journal of Environmental Management* 128:1012–22. doi:10.1016/j.jenvman.2013.06.056
- Crisafulli, P., and A. Redmond. 2012. *Rwanda Inc.: How a devastated nation became an economic model for the developing world*. New York, NY: Palgrave Macmillan.
- de Graaff, J. 1996. *The price of soil erosion: An economic evaluation of soil conservation and watershed development*. Mansholt Studies Vol. 3. Leiden, The Netherlands: Backhus.
- Dugan, P. J. 1990. *Wetland conservation: A review of current issues and required actions*. Gland, Switzerland: IUCN.
- Durrance, C. J., and K. F. Fisher. 2005. *How libraries and librarians help: A guide to identifying user-centered outcome*. Chicago, IL: American Library Association.
- Emerson, K., P. J. Orr, D. L. Keyes, and K. M. Mcknight. 2009. Evaluating conflicts resolution: Evaluating performance outcomes and contributing factors. *Conflict Resolution Quarterly* 27:27–64. doi:10.1002/crq.247
- Finlayson, C. M., R. D’Cruz, and N. C. Davidson. 2005. *Ecosystems and human well-being: Wetlands and water. Synthesis Millennium Ecosystem Assessment*. Washington, DC: World Resource Institute.
- Folke, C., J. Colding, and F. Berkes. 2003. Synthesis: Building resilience and adaptive capacity in socialecological systems. In *Navigating social-ecological systems: Building resilience for complexity and change*, ed. F. Berkes, J. Colding, and C. Folke, 352–87. Cambridge, UK: Cambridge University Press.
- Fu, B., K. Wang, Y. Lu, S. Liu, K. Ma, L. Chen, and G. Liu. 2004. Entangling the complexity of protected area management: The case of Wolong Biosphere Reserve, southwestern China. *Environmental Management* 33:788–98. doi:10.1007/s00267-004-0043-8
- Garcia-Frapolli, E., G. Ramos-Fernandes, E. Galicia, and A. Serrano. 2009. The complex reality of biodiversity conservation through natural protected area policy: Three cases studies from Yucatan Peninsula, Mexico. *Land Use Policy* 26:715–22. doi:10.1016/j.landusepol.2008.09.008

- German, L., A. Mandondo, G. Paumagarten, and J. Mwita. 2014. Shifting rights, property and authority in the forest frontier: “Stakes” for local land users and citizens. *Journal of Peasant Studies* 41 (1):51–78. doi:10.1080/03066150.2013.866554
- Giddings, B., B. Hopwood, and G. O’Brien. 2002. *Environmental, economy and society: Fitting them together into sustainable development*. Sustainable Cities Research Institute. Newcastle upon Tyne, UK: John Wiley & Sons, Ltd and ERP Environment.
- Government of Rwanda. 2004. *Strategic plan for agricultural transformation in Rwanda*. Kigali, Rwanda: Ministry of Agriculture and Animal Resources.
- Government of Rwanda. 2005. *Organic law determining the use and management of land in Rwanda (N°08/2005 of 14/07/2005)*. Kigali, Rwanda: Official Gazette of the Republic of Rwanda.
- Government of Rwanda. 2007. *Economic development and poverty reduction strategy 2008–2012*. Kigali, Rwanda: Ministry of Finance and Economic Planning.
- Government of Rwanda. 2009. *Strategic plan for the transformation of agriculture in Rwanda—Phase II (PSTA II)—Final report*. Kigali, Rwanda: Ministry of Agriculture and Animal Resources.
- Government of Rwanda. 2010. *Ministerial order N°007/16.01 of 15/07/2010 determining the length of land on shores of lakes and rivers transferred to public property*. Kigali, Rwanda: Government of Rwanda.
- Gross-Camp, D. N., M. Adrian, M. Shawn, and B. Kebede. 2015. The privatization of the Nyungwe National Park Buffer Zone and implications for adjacent communities. *Society & Natural Resources* 28 (3):296–311. doi:10.1080/08941920.2014.948246
- Hamilton, A., A. Cunningham, D. Byarugaba, and F. Kayanja. 2000. Conservation in a region of political instability: Bwindi Impenetrable Forest, Uganda. *Conservation Biology* 14 (6):1722–25. doi:10.1111/j.1523-1739.2000.99452.x
- Higgs, E. S. (1997). What is good ecological restoration? *Conservation Biology* 11:338–48. doi:10.1046/j.1523-1739.1997.95311.x
- Hirsch, D., G. Abrami, R. Giordano, S. Liersch, N. Matin, and M. Schlüter. 2010. Participatory research for adaptive water management in a transition country—A case study from Uzbekistan. *Ecology and Society* 15 (3):23.
- Hoverman, S., H. Ross, T. Chan, and B. Powell. 2011. Social learning through participatory integrated catchment risk assessment in the Solomon Islands. *Ecology and Society* 16 (2):17.
- Huggins, C. 2013. Consolidating land, consolidating control: State-facilitated agricultural investment through the green revolution in Rwanda. Working paper no.16, The Land Deal Politics Initiative, Brighton, UK.
- Important Bird, and Biodiversity Areas. 2010. Factsheet, RW004 Nyabarongo Wetland. September 9. [www.birdlife.org/datazone/sitefactsheet.php?id=6776](http://www.birdlife.org/datazone/sitefactsheet.php?id=6776)
- International Water Management Institute. 2014. *Wetlands and people*. Colombo, Sri Lanka: IWMI.
- Jim, C., and S. Xu. 2002. Stifled stakeholders and subdued participation: Interpreting local responses toward Shimentai Nature Reserve in South China. *Environmental Management* 30:327–41. doi:10.1007/s00267-002-2623-9
- Junk, W. J. 2002. Long-term environmental trends and the future of tropical wetlands. *Environmental Conservation* 29:414–35. doi:10.1017/s0376892902000310
- Lane, M. B. 2001. Affirming new directions in planning theory: Comanagement of protected areas. *Society & Natural Resources* 14:657–71. doi:10.1080/08941920118212
- Lawn, P. 2008. Macroeconomic policy, growth and biodiversity conservation. *Conservation Biology* 22:1418–23. doi:10.1111/j.1523-1739.2008.01092.x
- MEA (Millennium Ecosystem Assessment). 2005. *Ecosystems and human well-being: Synthesis*. Washington, DC: Island Press.
- Miller, J. R., and R. J. Hobbs. 2007. Habitat restoration: Do we know what we are doing? *Restoration Ecology* 15:382–90. doi:10.1111/j.1526-100x.2007.00234.x
- Mitsch, W. J., and J. G. Gosselink. 2000. The value of wetlands: Importance of scale and landscape setting. *Ecological Economics* 35:25–33. doi:10.1016/s0921-8009(00)00165-8
- Nabahungu, N. L., and S. M. Visser. 2013. Farmer’s knowledge and perception of agricultural wetland management in Rwanda. *Land Degradation & Development* 24:363–74. doi:10.1002/ldr.1133

- Neumayer, E. 1999. *Weak versus strong sustainability: Exploring the limits of two opposing paradigms*. Cheltenham, UK: Elgar.
- Onwuegbuzie, A. J., and M. T. Collins. 2007. A typology of mixed methods sampling design in social science research. *Qualitative Report* 12 (2):281–316.
- Palomo, I., B. Martin-Lopez, C. Lopez-Santiago, and C. Montes. 2011. Participatory scenario planning for protected areas management under the ecosystem in services framework: The Donana socio-ecological system in southwestern Spain. *Ecology and Society* 16:23.
- Pretty, J., and D. Smith. 2004. Social capital in biodiversity conservation and management. *Conservation Biology* 18 (3):631–38. doi:[10.1111/j.1523-1739.2004.00126.x](https://doi.org/10.1111/j.1523-1739.2004.00126.x)
- Redpath, S. M., J. Youn, A. Evely, W. M. Adams, W. J. Sutherland, A. Whitehouse, A. Amar, R. A. Lambert, J. D. C. Linnell, A. Watt, and R. J. Gutierrez. 2013. Understanding and managing conservation conflicts. *Trends in Ecology & Evolution* 28 (2):100–9. doi:[10.1016/j.tree.2012.08.021](https://doi.org/10.1016/j.tree.2012.08.021)
- Reichert, P., M. Borsuk, M. Hostman, S. Schweizer, C. Sporri, K. Tockner, and B. Truffer. 2007. Concepts of decision support for river rehabilitation. *Environmental Modelling & Software* 22:188–201. doi:[10.1016/j.envsoft.2005.07.017](https://doi.org/10.1016/j.envsoft.2005.07.017)
- Ricaurte, L. F., K. M. Wantzen, E. Agudelo, B. Betancourt, and J. Jukka. 2013. Participatory rural appraisal of ecosystem services of wetlands in the Amazonian Piedmont of Colombia: Elements for a sustainable management concept. *Wetlands Ecology and Management* 22:343–61. doi:[10.1007/s11273-013-9333-3](https://doi.org/10.1007/s11273-013-9333-3)
- Richards, C., K. L. Blackstock, and C. E. Carter. 2004. *Practical approaches to participation*. SERG policy brief No.1. Aberdeen, UK: Macauley Land Use Research Institute.
- Shannon, M. A., and A. R. Antypas. 1997. Open institutions: Uncertainty and ambiguity in 21st-century forestry. In *Creating a forestry for the 21st century: The science of ecosystem management*, ed. K. A. Kohm and J. F. Franklin, 437–45. Washington, DC: Island Press.
- Sherington, J., and A. Martin. 1997. Participatory research methods: Implementation, effectiveness and institutional context. *Agricultural Systems* 55:195–216. doi:[10.1016/s0308-521x\(97\)00007-3](https://doi.org/10.1016/s0308-521x(97)00007-3)
- Stewart, D. W., and P. N. Shamdani. 1990. *Focus groups discussion: Theory and practices*. London, UK: Sage.
- Teddlie, C. B., and A. Tashakkori. 2008. *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in social and behavior sciences*. Thousand Oaks, CA: Sage.
- Uphoff, N., J. Cohen, and A. Goldsmith. 1979. *Feasibility and application of rural development participation: A state of the art paper*. Ithaca, NY: Cornell University Press.
- Veldman, M., and M. Lankhorst. 2011. *Socio-economic impact of commercial exploitation of Rwandan marshes: A case study of sugarcane production in rural Kigali*. Kigali, Rwanda: Coalition RCN–Justice and Democracy.
- Vermeulen, S., and D. Sheli. 2007. Partnerships for tropical conservation. *Oryx* 41 (4):434–40. doi:[10.1017/s0030605307001056](https://doi.org/10.1017/s0030605307001056)
- Vining, J., E. Tyler, and B.-S. Kweon. 2000. Public values, opinions, and emotions in restoration controversies. In *Restoring Nature. Perspectives from the Social Sciences and Humanities*, eds. P. H. Gobster and R. B. Hull 143–61. Washington, DC: Island press.
- Wild, G. R., and J. Mutebi. 1997. Bwindi impenetrable forest, Uganda: Conservation through collaborative management. *Nature and Resources* 33 (4):1–45.
- Zedler, J. B., and S. Kercher. 2005. Wetland resources: Status, trends, ecosystem services and restorability. *Annual Review of Environment and Resources* 30:39–74. doi:[10.1146/annurev.energy.30.050504.144248](https://doi.org/10.1146/annurev.energy.30.050504.144248)
- Zorrilla, P., G. Carmona, Á. De la Hera, C. Varela-Ortega, P. Martínez-Santos, J. Bromley, and H. Jorgen Henriksen. 2009. Evaluation of bayesian networks as a tool for participatory water resources management: Application to the upper Guadiana Basin in Spain. *Ecology and Society* 15 (3):12.