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RESEARCH ARTICLE

COMBINED EFFECTS OF CLIMATE CHANGE AND ANTHROPOGENIC ACTIVITIES ON WETLANDS WATER QUALITY

***George Maeti**

Department of Environmental Health, National University of Lesotho. Roma, 180 Lesotho

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ABSTRACT

Abstract: Wetlands in the highlands, especially palustrine wetlands, are renowned with supply of water of good quality to streams, however, with observed extreme variation in climatic conditions- notably surging high temperatures and decline in precipitation, these wetlands' function is threatened. The **objectives** of this study were to observe changes in vegetation cover across the wetland within two seasons- summer and winter, and to monitor water release during each season, aligning this with climatic variation. **Methodology**: quadrants of $1m^2$ were utilized for estimation of vegetation species richness across the wetland while water level in the river was measured with the aid of staff installed in the stream. The **observation** was that, within the study period, during the return of the second summer, vegetation cover had not fully recovered, but rather lost as a result of a combination of factors- overgrazing by animals that keep invading the wetland, and lack of rains in the summer season. It was then **recommended** that, with the more expected dry summers, more stringent laws be applied regarding wise-use of these wetlands, and wetland management strategies be re-visited in order to curb their degradation. In **conclusion**, climate variations do play a role in degradation of palustrine wetlands, and best management practices would minimize their degradation, while observing their protection against uncontrolled anthropogenic activities.

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INTRODUCTION

Lesotho has a total area of 30 344 km^2, and of this area, at least 0.6% is covered with wetlands. Palustrine wetlands are located in the highlands of the country, 2 000m asl. The world is faced with challenges of excessive warming and decreasing precipitation, a phenomenon named global warming. The IPCC [1] report has shown that green house gases have increased by a magnitude of 30 to 145%, with temperatures soaring by 0.3 to 0.6°C. Projections have shown that global mean surface temperature will increase by 1°C to 6°C beyond those of 1990. Lesotho is one of the countries that are hit with high temperatures and low precipitation, with prolonged summers contributing to nutrient regeneration [2]. The country's communities rely on natural resources for livelihoods, and, erratic rains would impact negatively on their welfare, as projected [3]. She is known to supply the neighbouring countries with clean water, thus adding to improvement of the communities livelihoods. Rivers in the highlands are remarkably sustaining the dams on which Lesotho ensures provision of royalties from their water. Palustrine wetlands, situated in the highlands of the country, are known to sustain water supply to water bodies fed by them, even during dry seasons.

According to [4], studies carried out on the highlands wetlands indicate that water entering wetlands from groundwater discharge is stored within the organic and clay soils before being released over a long period of time. They are known to retain water as they do so to nutrients and other contaminants that may pass through these wetlands. Wetlands are now significantly targeted as sinks for greenhouse gases [5], a process that counteracts the global climate change. As a means of ensuring sustenance of wetland functions, they are periodically monitored. Wetland monitoring is an aspect that guides towards proper conservation and wise-use of such wetlands resources [6]. These wetlands are facing unregulated grazing since no administrative structures ensure that rotational grazing takes place.

STUDY AREA

Location: Mokhotlong is a district in the North of the country, characterised with cold, snowy dry winters and warm, wet summers. Winters range between -6°C and -8.5°C [7] in winter, with occasional snow. Wetlands in this area feed tributaries that join major Senqu River, and preliminary analysis shows water storage and release between dry and wet periods over the year of approximately 120 mm in the Khubelu catchment. In general, wetlands are used for animal grazing

and watering. These animals use wetlands as grazing land in summer and these wetlands are no-go areas in winter, the period when animals will be at "metebong" from winter to autumn. For all villages interviewed, the chief is the manager of wetlands in the region, and is the one who decides how they are to be used, without involvement of herders. There has been a little training on management of wetlands given to the herders, and this was a long time ago (according to villagers). There are no grazing associations in these villages except Lichecheng. Khubelu River seems to be the major source of water for domestic purposes, such that there is no alternate source for services like baptism; ritual & recreational swimming; ritual cleansing and fishing, but with regard to Maloraneng, there is a network of pipes for water supply with the help of Lets'eng mine. Villagers are using wetland resources solely for personal consumption and purposes; they are not selling the water. Women are the group which lacks knowledge on state of wetlands because they only see them as grazing land, but most of the men have observed that wetlands around their area are facing threats due to overgrazing, and have reduced in size.

METHODOLOGY

Quantitative and qualitative methods were employed. Under qualitative method, a questionnaire was developed as a tool to gather information on how communities utilise wetlands, and whether any wise-use, conservation and protection programmes have been introduced to them. Quantitative methods included survey of the wetlands in the Phapong catchment, with close monitoring. More focus was on vegetation cover that is expected to attenuate floods, as it traps sediments and pollutants. Quadrats of $1m^2$ were used as ecological tools to determine vegetation species variation in the wetland. Water levels were also measured using a staff metre that is already installed in the stream that is fed by this wetland.

RESULTS AND DISCUSSION

Water yield in the stream: The first summer month of the study measured 50m on the staff metre installed in the stream, followed by 40m in the second month which marked the first winter month of the year. The third month of the study was dry up until the 11^{th} month of the study, after which the first rains were then experienced. In the 11^{th} month the staff read 46m, then 30m in the last month. From this, it can be ascertained that the wetland is not able to release water into the stream in winter, as it would be expected to. Absence of water in the stream despite other streams on the other side of the region having water after early summer rains showed that there was no subsurface flow from groundwater from Khubelu wetlands.

Vegetation cover: *Ranunculus meyeri* in Figure 1 dominated the wetland vegetation, covering 50% of the wetland. Ranunculus is drought-tolerant, making it vulnerable to overgrazing by the local animals. It was followed by *Harplocarpha nervosa in* Figure 2, which covered 30%. It dominated the inundated sections of the wetland since it is a water-loving species. 20% was covered by Scirpus species, in Figure 2. The other vegetation observed was Lobelia species and Oxalis depressa as shown in Figure 3. Vegetation diminished quite shortly after the rains stopped, with the remaining one showing signs of wilting even though it was still summer (the warm and rainy season). Vegetation wilted quite quickly just after the summer rains stopped, posing a threat of erosion. Vegetation cover has been associated with factors like fires, intensity of animal grazing, nutrient availability and soil properties [8]. Consequently, type of vegetation determines depth of water inundation and hence the water table of such a wetland [9]. All these point to importance of vegetation cover, its density and distribution towards the wetland's function especially water chemistry [11]. In the absence of organic matter, due to soil erosion after exposure after overgrazing pollutants are easily leached into streams, threatening their water quality.

Figure 1. Ranunculus meyeri

Figure 2. Harplocarpha nervosa & Scirpus

Figure 3. Lobelia species Oxalis depressa

Animal invasion: Animal grazing within the wetland was uncontrolled, giving no time for the vegetation to grow, even

after the dry winter season. It could also be ascertained that, with dry spells, ice rats easily invade the wetlands.

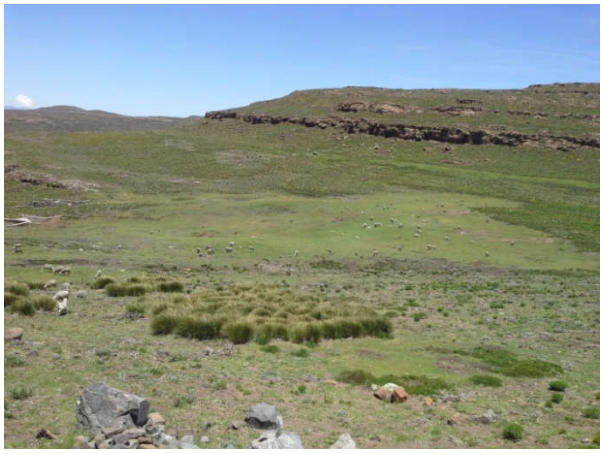

Figure 4. Animal invasion in winter

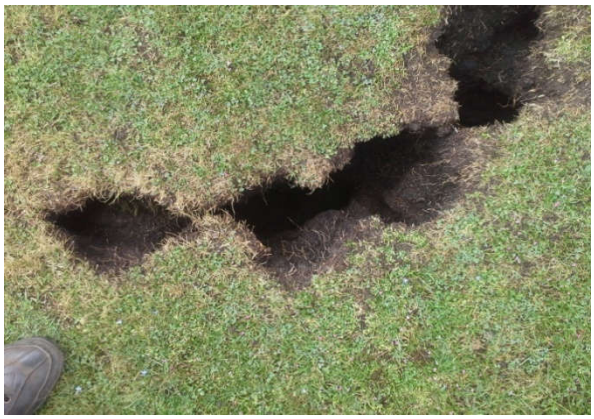

Figure 5. A 15 cm deep furrow forming after another month

With invasion of southern African ice rats *Otomys sloggetti robertsi* in the wetland, foraging [10] causes some tracks that end up speeding soil erosion as furrows are gradually formed. The ice rats are more habitable in dry wetlands than moist ones.

Recommendations: Further education on wetland wise-use is an integral part in conservation of these resources. Wetlands have to be prioritised at national level, in order to ensure they keep providing forage and clean water to the communities.

Conclusions

Wetlands seem to be not wisely used by communities, and are exposed to over-harvesting and overgrazing. Wetlands that are exposed to uncontrolled animal grazing seem to be vulnerable to effects of extreme variations in climatic conditions. These being high temperatures that scotch the soil and render them easily eroded, especially when this is followed by precipitation. Ice rats, on the other hand, create furrows that gradually develop into gullies, forming channels that erode soil (onto which nutrients and contaminants are trapped) into the nearby streams. In conclusion, extremes in climatic variations, together with animal invasion, lead to loss of wetland habitats and soil, causing pollution of the nearby streams.

Acknowledgements

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REFERENCES

[1] IPCC, 2., 2014. *Climate Change 2014: Synthesis Report,* Geneva: IPCC.

[2] Reddy, K. R., DeLaune, R. & Craft, C. B., 2010. *Nutrients in wetlands: Implications to water quality under changing climatic conditions.,* U.S.: U.S. Environmental Protection Agency.

[3] Bates, B., Kundzewics, Z., Wu, S. & Palutikof, J., 2008. *Climate Change and Water. Technical Paper of the Intergovernmental Panel on Climate Change,* Geneva: IPCC Secretariat.

[4] DWA, 2005. *Lesotho National Wetlands Management Programme,* Maseru: Government of Lesotho.

[5] Mitsch, W., 1994. *Global wetlands - old world and new.* Amsterdam: Elsevier.

[6] Davidson, T., Kiehl, K. & Hoffmann, C., 2000. Guidelines for monitoring of wetland functioning. *EcoSys Bd,* Volume 8, pp. 5-50.

[7] LMS, 2013. *Climate of Lesotho | Lesotho Meteorological Services.* [Online] Available at: http://www.lesmet.org.ls/cimatology/climate-lesotho [Accessed 14 4 2017].

[8] Hammersmark, C., Rains, M., Wickland, A. & Mount, J., 2009. "Vegetation and Water-Table Relationships in a Hydrologically Restored Riparian Meadow". *Wetlands,* Volume 29, pp. 785-797.

[9] Alaghmand, S., Beecham, S. & Hassanli, A., 2014. Impacts of Vegetation Cover on Surface-Groundwater Flows and Solute Interactions in a Semi-Arid Saline Floodplain: A Case Study of the Lower Murray River, Australia. *Environmental Processes,* 24 April, Volume 1, pp. 59-71.

[10] Grab, S., 2012. On the burrowing impacts of ice rats Otomys sloggetti robertsi at a wetland fringe in the Afro-alpine zone, Lesotho. *South African Geographical Journal,* 10 April, 94(1), pp. 75-84.

[11] Castelli, R.M., Castelli, R., Chambers, J. & Tausch, R., 2000. Soil-plant relations along a soil-water gradient in great basin riparian meadows. *Wetlands,* Volume 20, pp. 251-266.

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