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BORROW PITS REHABILITATION, A GEM FOR THE PROMOTION OF LIVESTOCK AND WILDLIFE POTENTIALS IN ASALS

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Abstract

This study explored the potential of surface runoff water collection into borrow pits with an aim to promote livestock and wildlife potentials in Laikipia County, where the Rumuruti –Maralal bitumen road passes. Survey data on livestock and wildlife water demands; Cooks method for determination of surface runoff water collection potential, borrow pits locations, and their capacities were determined while area meteorological data and literature review enriched them. The results from the above were computed, which helped to determine the would-be benefits of water collection in the borrow pits. The study has demonstrated the greater potential that borrows pits rehabilitation. Water collected in them can highly support livestock and wildlife production. This study recommends the replication of this practice in other ASALs areas to help exploit their full potential.

Key terms: Borrow pits, livestock, surface runoff, water scarcity.

1.0 INTRODUCTION

Arid and Semi-Arid Lands (ASALs) occupy more than 40 per cent of the world's land, which translates to approximately 5.17 billion hectares (Biazin & Sterk, 2013). Arid zones cover 13.1 per cent, while semi-arid zones cover 27.7 per cent (Kisingani, 2015). Approximately 89 per cent of the land mass in Kenya is classified as ASALs (Government of Kenya, 2004). It includes Northern and Eastern regions, which support up to 20 per cent of the country's population (Ngigi, 2003a). These regions are characterized by water scarcity in terms of both quality and quantity (Government of Kenya, 2005). This water limitation can be attributed to: low and erratic rainfall, which typically ranges from 250-750 mm per annum, high temperatures resulting in high rates of evaporation and poor water harvesting and management strategies (Ngigi, 2003b). Nyangito et al. (2008) estimated that approximately 30 per cent – 40 per cent of Kenya's ASALs are quickly being degraded and that another 2 per cent have completely been lost in the desert.

Rapid and fast road construction across Kenya has increased demand for stones, murram, and limestone, among other raw materials. These have led to increased quarry and borrow pits that have the potential to become sustainable water storage facilities (Shisiali, 2017). Borrow pits supply the materials for the construction of road embankments, which can be gravel/aggregates, silica sands, laterite sands, or calcite, depending on the local location. Borrow pits can be valuable assets in terms of local water security. Therefore, as soon as the pits are no longer used for mining building materials, the excavated structure can become an important and valuable water supply source. NETIP (2019) advocates for the rehabilitation of exhausted material sites (borrow pits) into water sources for community use. More specifically, for rainwater harvesting to improve water availability, rather than backfilling the pits or leaving them unattended, borrowed pits can be systematically converted into sources of domestic, livestock, wildlife and off-season irrigation water (Steenbergen, 2017).

2.0 LITERATURE REVIEW

The concept of water harvesting is believed to have started 4000 years ago in the Middle East (Oweis et al., 2012). Globally, there has been an increased interest in water harvesting, particularly in arid and semi-arid areas, due to the growing scarcity and inter-sectoral competition for water among diverse uses (Kerr & Panager, 2001; Sameer & Jones, 2010). In some regions of sub-Saharan Africa, the traditional techniques of water harvesting like the "Caag" and the "Gawan" systems in Somalia, "Hafirs" in Sudan and the 'Zay' system in West Africa have also been reported by Oweis et al., (2012). Harvesting, collecting and diverting runoff water for productive usage is widespread across the world (Africa Development Bank, 2007). In arid and semi-arid regions, rainwater harvesting has been used for many years (Ngigi et al., 2005). Road runoff harvesting has been practised in Kenya with impressive results, as observed by Nissen-Petersen (2010); Shaxson and Barber (2003); Malesu et al. (2006); Ngigi (2003b) and Kubbinga (2012).

Livestock demand for water is estimated to increase from 335 to 491 million cubic meters per day over 20 years (Aklilu & Wekesa, 2001). The demand for water to meet agricultural and livestock requirements is expected to continue to grow significantly (Aklilu & Wekesa, 2001). Kenya is rich in wildlife resources, with over 25,000 known animal species. ASALs is home to more than 90 per cent of wild game that sustains the tourist industry and contains most of the protected areas, such as game reserves and national parks (Mortimore, 2009). The availability of water resources partially determines wildlife occurrence and concentration. Future livestock development prospects within the ASALs will also depend mainly on water availability. Rainfall variability has an important bearing on livestock production. Aklilu and Wekesa (2001)

record that during the 1999–2000 droughts, the country lost about 26 per cent of its livestock. This kind of loss can be abated with a comprehensive surface water collection in borrow pits developed during road construction. On the understanding of rain harvesting potentials, especially those collected from the developed roads, this study aimed at promoting water collection into borrow pits with the aim of unleashing the potentials of livestock and wildlife in the study area.

3.0 METHODOLOGY

This study was conducted between Rumuruti and Suguta Mar Mar area of Laikipia county in a 740km2 area. The Rumuruti-Suguta Mar Mar road was the epicentre of the study, with a radius of 5km on either side assumed to be the longest distance livestock and wildlife could roam and drink water from established borrow pits. The study employed a set of methodologies for data collection; these included personal questionnaires, site visits, observation and computation, cooks methods for surface water collection calculations and literature reviews on related materials and information. To determine the respective water demands for livestock and wildlife, the following assumptions were used:

1. **The household size** in the study area (Laikipia North)-5 persons (Kenya National Bureau of Statistics-2019 KPHC). (CGL, 2018).
2. **Households with livestock:** 45.8 per cent (CGL, 2018).
3. **1 LSU (Livestock Unit)-50 l/day** (MWIS (2015).
4. **Average household livestock size in the pastoral zone:** 28 tropical livestock units (TLU) (21 cattle, 28 goats and 21 sheep) – (MOALF, 2016).
5. **Average daily water consumption:** for cattle 25-41 l, shoats 4.4-5.25l (Ward, 2019).

The questionnaires and site observations guided the determination of the types of livestock frequently stocked, their watering patterns, determination of water sources, the location of borrow pits and their capacities. Cook's methods helped to compute the surface runoff flow rate in the area in relation to the available collection points, which are the borrow pits. On the other hand, the literature review helped compute the study's livestock and wildlife populations. Additionally, essential information on their daily water consumption was availed, which was key in determining annual water demands for livestock and wildlife.

4.0 RESULTS AND FINDINGS

Six water sources were identified in this study area, whereby 83 per cent of the respondents said they are sourcing their water from borrow pits, 6 per cent sourced from between community well and rain collection, and 3 per cent from both river and hand well sources. A total of fourteen borrow pits were studied, whereby nine collected water and the other five didn't. In terms of water usage, domestic purposes scored 52 per cent, followed by wildlife use at 24 per cent, livestock use at 22 per cent, and irrigation and other usages trailed at 1 per cent. These demands, especially for livestock and wildlife, are crucial because they are factors of production that determine the study area's usability in terms of human life support.

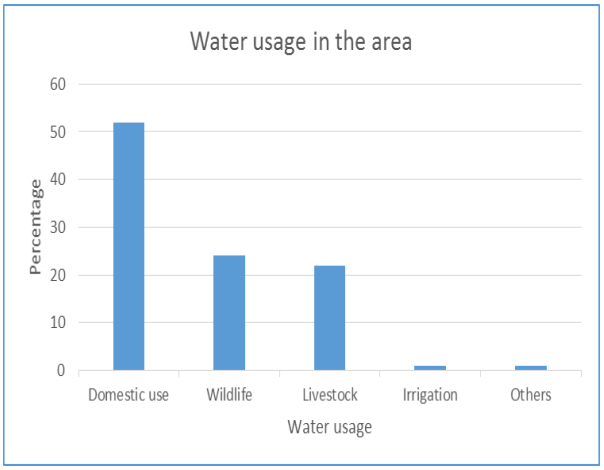

Figure 1: Water usage in the Area

Figure 2: Livestock Watering in One of the Borrow Pits

The calculated annual livestock and wildlife water demands in the study area were 1,361,394m3 and 680,652m3, respectively. These were against the available borrow pits storage capacities of 1,237,157m3. The average surface runoff computed was 3mm/s during the rainy season. Various meteorological factors affecting runoff in the study area ranged from relief, and type of precipitation, which averaged 415.22mm for the last five years (CGL, 2018). This is a result of the area being on the leeward side of the hydrological cycle of the area. Rainfall duration also determines the amount of runoff generated for collection. Temperature also does determine the amount of surface runoff available for collection in the borrow pits. The high temperatures around will trigger a high level of evaporation of runoff water both on the land surface and those collected into the borrow pits. To curb this, proper management of the collected water in the borrow pits should be undertaken mainly by planting trees around them. This is in agreement with special protection measures of borrow pits as advocated by (Steenbergen, 2017).

The provision of enough quality water is essential for good livestock husbandry. Water makes up 80 per cent of the blood, regulates body temperature and is important for organ functions such as digestion, waste removal and the absorption of nutrients. Although a scarce resource in ASALs, understanding daily livestock watering needs is key when determining the carrying capacity of habitat as well as water supply

provisions (Ward, 2019). On their part, wildlife is known to contribute to a greater portion of tourist attraction in their areas of habitation. Countries like Kenya have tourism as one of the main foreign exchange-earners. They cannot survive well without a reliable water supply (Kiteme, 2002). Water supply is a crucial element that's needed for wildlife existence, mainly for their food digestion, cooling and body growth.

5.0 CONCLUSION AND RECOMMENDATION

Conclusion: The study area was observed to experience unreliable water sources for livestock and wildlife use. Alternative water sources, such as those stored in borrow pits, can revitalize the economic potential of livestock and wildlife in the area. Water collection activities can be highly improved by proper management of existing borrow pits, proper storm drain training, and making additional water collection points on the downside parts of the culverts. This practice can be replicated elsewhere with local economic potentials, especially in livestock production and improved wildlife management.

Recommendation: The economic and social benefits of green buildings should be lauded as much as the environmental ones. Such a move should involve all stakeholders, especially building industry investors.

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