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An Exploratory Analysis of the Social, Economic and Environmental Impacts on Wetlands: The Case of Shurugwi District, Midlands Province, Zimbabwe

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Abstract: The paper analyses the impacts of socio-economic and environmental factors on wetlands in Shurugwi district. Plant species and vegetation cover changes were used as indicators for determining wetland area shrinkage. Results reveal a negative relationship between economic activities, socio- political factors and wetland status. In 1980 wetlands occupied 220 hectares or 56.6 percent of the study area. By 2003 wetlands had declined to 43.4 percent representing an annual average decline of 0.6 percent. Desire by local communities to optimise family welfare decrease wetland protection effort. For wetlands to be effectively protected, sound environmental policies combined with continued per capita investment in social services must be put in place so as to raise the threshold of wetland protection effort. Increased knowledge of wetland attributes may also lead to increased opportunities for policy intervention.

Key words: Wetland decline, plant species, intervention policies, plant root constance, drought intensity

INTRODUCTION

Wetlands are areas of marsh, which are either permanent or temporary with water that is either static or flowing[23]. Wetlands have been classified internationally into marine, estuarine, riverine, palustrine and lucustrine systems. They either contain salt or fresh water[6]. The study will focus on vleis, locally known as dambos. Vleis in general are seasonally waterlogged grass covered depressions mostly found in river headwaters and along stream banks but can also occur independent of the drainage system[8]. The main vleis in Zimbabwe include floodplains, riverine systems, pans, swamps and artificial impoundments[11].

Wetlands are vital in ecosystem performance and functions as they provide products and possess attributes that are beneficial to almost all forms of life. They are home to many plants such as reeds, grasses, water lilies, sedges and trees. These plants inturn provide food, place of attachment and shelter for many species. Animals and humankind benefit from them through habitation, water provision, aquaculture and agriculture. Wetlands also serve as stopping points for migratory species especially birds and spawning fish[21]. Wetlands are also linked to other systems through cycles of energy and matter. In addition, they purify water by trapping nutrients like nitrogen and phosphorous, pathogenic bacteria, pesticides and heavy metals such as mercury. They act as groundwater recharge systems and regulate stream-flows[20].

Wetland ecosystems are dynamic in space and time as they are influenced by environmental changes around them[3]. Disturbance in wetland functions as life support systems has detrimental effects on them and the surrounding environment[2]. Moyo [19] asserts that in both urban and communal lands of Zimbabwe, population pressure and high demand for arable land continues to undermine wetland status and functions.

Purpose of the research: Approximately 13 percent of Southern African Development Community (SADC) countries is made up of wetlands, the majority of which are found in areas inhabited by about 60 percent of the population[8]. Environmental scarcity, due to high population densities, economic decline, internal and international conflicts and decline in per capita investment in social services, in some countries, have decreased wetland protection effort[7]. Wetlands are negatively associated with danger, dampness, disease and difficulty. Consequently they are likely to be converted to alternative uses such as cropland, dams, plantations of exotic trees, waste disposal sites and pastures[25]. High urbanisation rate and a correspondingly high demand for urban infrastructure has placed a great demand on

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available land resulting in competition between land-uses. For example, many wetlands have been reclaimed for construction of airports, sewage treatment plants or drained to control malaria[2]. It is against this background that the research was undertaken in order to examine the extent to which economic, socio- political and environmental characteristics of rural communities impact on wetland status in Shurugwi District. The research is premised on the belief that increased knowledge of wetland attributes may lead to increased opportunities for policy intervention.

The objectives of the research are to:

I) examine and assess socio-economic community level variables that impact on wetland status in Shurugwi district
ii) suggest policy interventions that promote sustainable utilization and management of wetlands.

Study Area: Shurugwi Communal Lands are centrally located in the Midlands Province of Zimbabwe. The district lies in Agro-ecological region III which receives an average annual rainfall of between 650-800mm. Rainfall is received between November and April of each year[17]. The mean altitude is 1 260 metres. Granite is the dominant parent rock. Soils derived from granite rock range from sandy to loamy textures[18]. There is slight to severe erosion. Severity of erosion is more pronounced in grazing areas. The main rivers, which drain the area are Tugwi, Muteveki and their sub-systems which include among others Chuni, Nyamakupfu, Gurudze and Zhovoringo. These rivers drain from the north west to the south east[5]. The vegetation type is bush savanna grassland with hyperrania, hypothelia and digitaria as the major grass types dotted with brachystegia, terminalia and julbernadia tree species[12]. Major human activities are subsistence to intensive cropping and animal farming. Cattle and goats form the backbone of the community's wealth[4].

MATERIALS AND METHODS

The study area has 9 wetlands. Wetland size was demarcated using soil moisture content, starting from the perceived centre of the vlei moving outwards. Vegetation type was used as proxy for soil moisture deficit in delimiting outer margins of each wetland. Shaw's 1984 categorization of plant root constant (RC) in determining soil moisture depth on a continuum ranging from 75mm to 200mm was used namely, permanent grassland (75mm), root crops e.g. potatoes (100mm), cereals like wheat (140mm) and woodlands (200mm). Plant growth is dependent upon a continuous supply of water. Where vegetation is unable to abstract water from the soil, without replenishment, the soil becomes depleted by vegetation demand, leading to soil moisture deficit (SMD). Vegetation ultimately wilts and eventually dries up.

Aerial photo interpretation (API) was carried out using aerial photograph series for the years between 1980 and 2003.This was done to ascertain vegetation changes and surface water cover on each of the 9 wetlands. Field measurements were made to calculate wetland area under crop cultivation, livestock grazing, residential and other uses. Questionnaires were used to solicit information pertaining to social, economic and environmental indicators that may have influenced changes in wetland status[15]. In addition, policy intervention and programme documents to safeguard wetland status were analysed.

RESULTS AND DISCUSSIONS

Land uses in shurugwi district: Figure 1 shows the various land uses in the study area.

Crop and livestock farming are the dominant economic activities. Farming activities on wetlands are both for social and economic gains.

Wetland size and status: Figure 2. shows percentage loss in wetland size and status between 1980 and 2003.

In the intervening periods 1980 - 1995 and 1995 - 2003 wetland loss was 5,1% and 8,1% respectively. Temporal variability is attributed to growing demand for land for residential, agricultural and other purposes due to growth in number of households post 1980 and a corresponding increase in livestock numbers. Decline in size for each wetland is shown in Figure 3.

Spatial and temporal variations in rates of wetland decline emerge when data is disaggregated per wetland. Wetlands 6, 7 and 8 which are located in areas with high population densities and soils favourable to agriculture show a progressive decline rate compared with wetland 9 located in areas where soils are unfavourable for cultivation and where human settlement is sparse. In the case of Wetland 1, low human impact and water falling down mountain slopes account for why the wetland does not dry during any part of the year[14]. With the exception of wetlands 1 and 3 the analysis shows that there was a progressive decline in size for each wetland from 1980 to 2003. The average annual wetland decline is 0.06 hectares.

Wetland loss is partly linked to economic development pressures as well as intervention failures[1]. The reduction in wetland size and status due to agriculture and other economic activities should be viewed as a survival strategy used by households to cushion themselves from ecological risks. While home

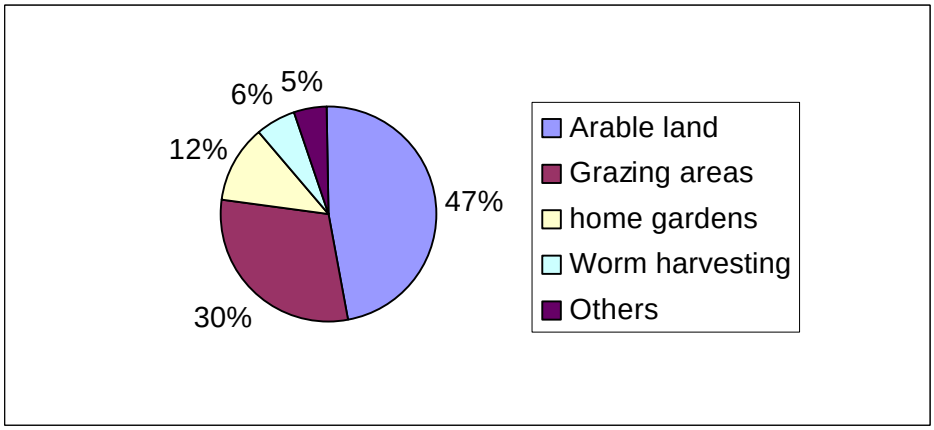

Fig. 1: Land uses in Shurugwi District

Table 1: Number of home gardens established monthly in 1980 and 2003

Years	Jan	Feb	Mar	April	May	June	July	August	Sept	Oct	Nov	Dec
1980	2	7	9	13	21	43	44	43	44	51	13	1
2003	9	17	33	37	54	67	68	68	79	97	32	6

Table 2: Dominant Crops and Fruit trees Grown 1980-2003

1980	Leafy vegetables, sweet potatoes, sugar cane, bananas, rice, bananas.
1995	Sweet potatoes, root and leafy vegetables, maize, rice and bananas.
2003	Leafy vegetables, maize, wheat, citrus fruits mango trees

gardens enhance household food security especially during the dry season (May – October) they have a deleterious effect on wetland size and status. Table 1 compares number of new gardens established in 1980 and 2003.

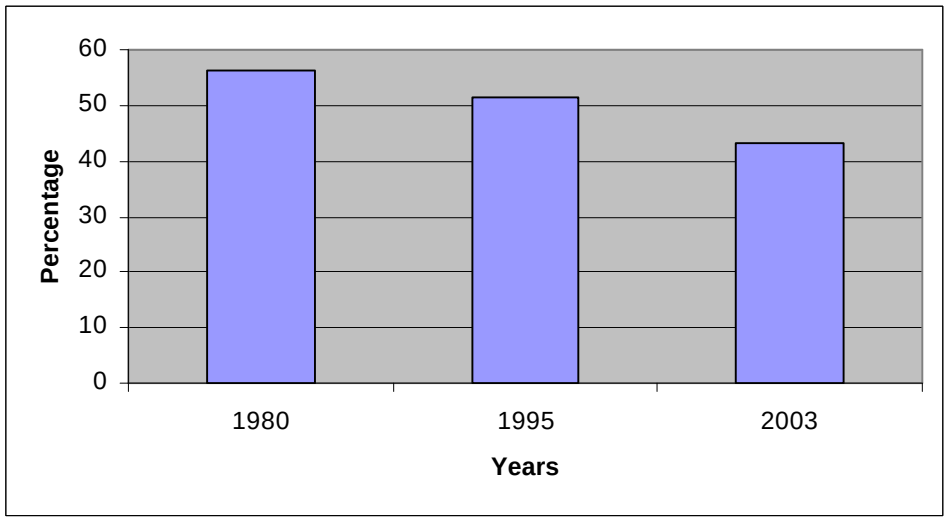

Fig. 2: Wetland Decline (percentage) 1980-2003.

Growth in population post 1980, high drought incidence rates, national and economic developmental challenges resulted in many gardens being established on the fringes and within wetlands. Wetlands are exploited more during the dry months (May – October). Households take advantage of the wetlands' moist conditions to grow a variety of vegetables and root crops for sale or for own consumption. Table 2 shows the changes in dominant crops grown and fruit trees planted over the period under study.

Change in range of crops grown between 1980 and 2003 reflects corresponding change in water tables in the

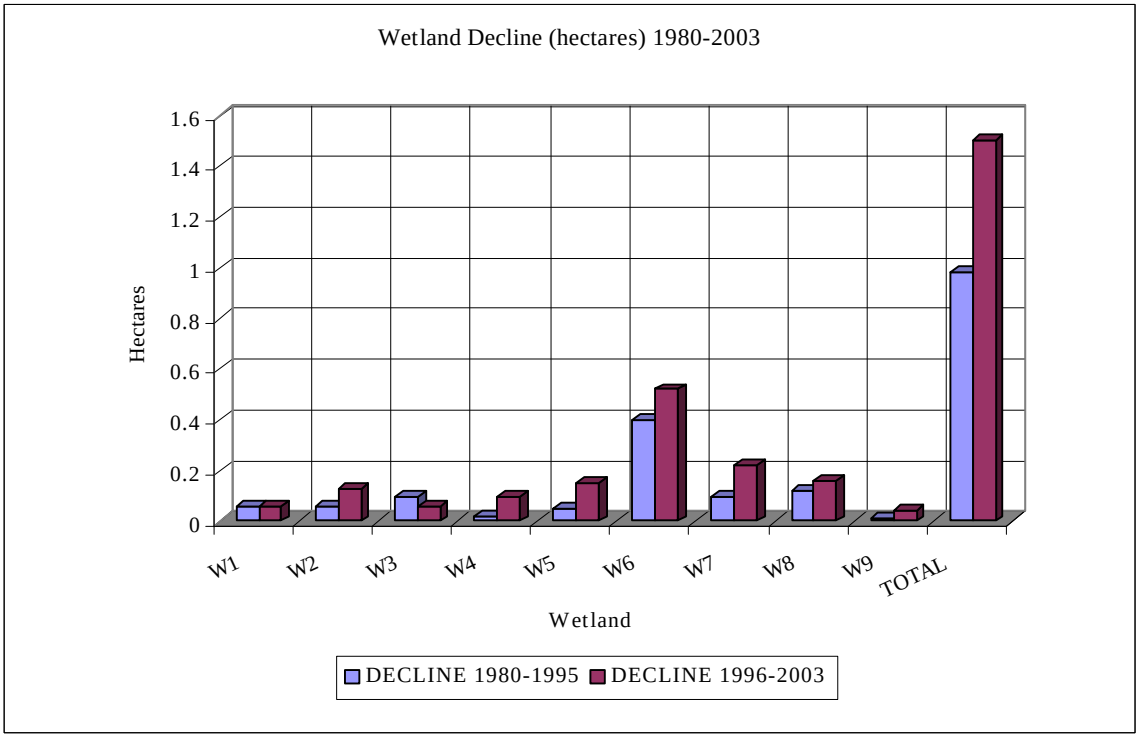

Fig. 3: Wetland Decline (hectares) 1980 –2003.

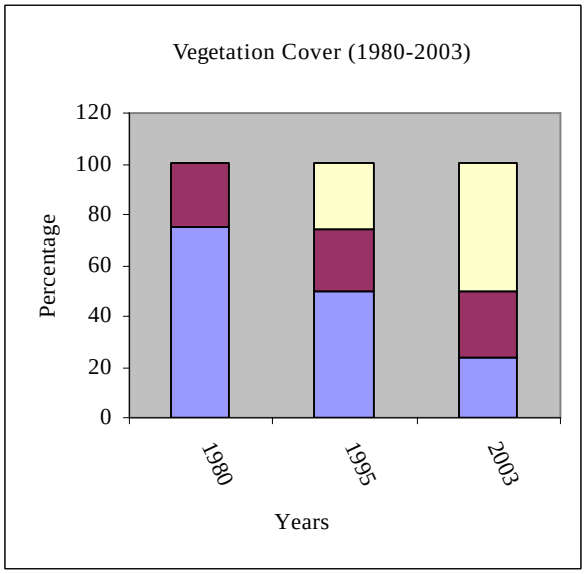

Fig. 4: Decline in Vegetation Cover Intensity

wetlands. In 1980 crops and vegetables more tolerant to high soil water levels were grown. Such crops have generally shallow root systems. Overtime however as wetland water tables receded crops and trees with long root systems able to extract water from deep down the ground, progressively replaced types and varieties grown in 1980.

Before 1980 there was a deliberate policy by the colonial government to discourage high levels of agricultural production in communal areas. Agriculture remained underdeveloped and operated at subsistence levels. The white commercial farming sector provided a substantial proportion of food staples[13]. Ironically it is these restrictive policies that helped wetlands to retain their natural status.

In 1980 when the agriculture marketing sector was liberalised a sizable number of communal farmers turned to intensive crop production. Availability of markets especially at the newly established Growth Points and Service Centres motivated households to grow a variety of crops. Because of their fertile soils and abundant water supply especially during the dry season wetlands were targeted for market gardening activities[24]. Besides the impact of agricultural activities, wetland surfaces were also exposed to high rates of evapo-transpiration due to wide spread alluvial gold panning and earthworm harvesting.

Large herds of livestock that water and graze in the wetlands pause an additional threat. The recommended livestock carrying capacity is 1 livestock to 10 hectares but the present livestock carrying capacity is one livestock to 0.6 hectares[16]. Despite the community's standing regulations on common property resource use and management, individuals tended to increase livestock numbers at the expense of the environmental carrying

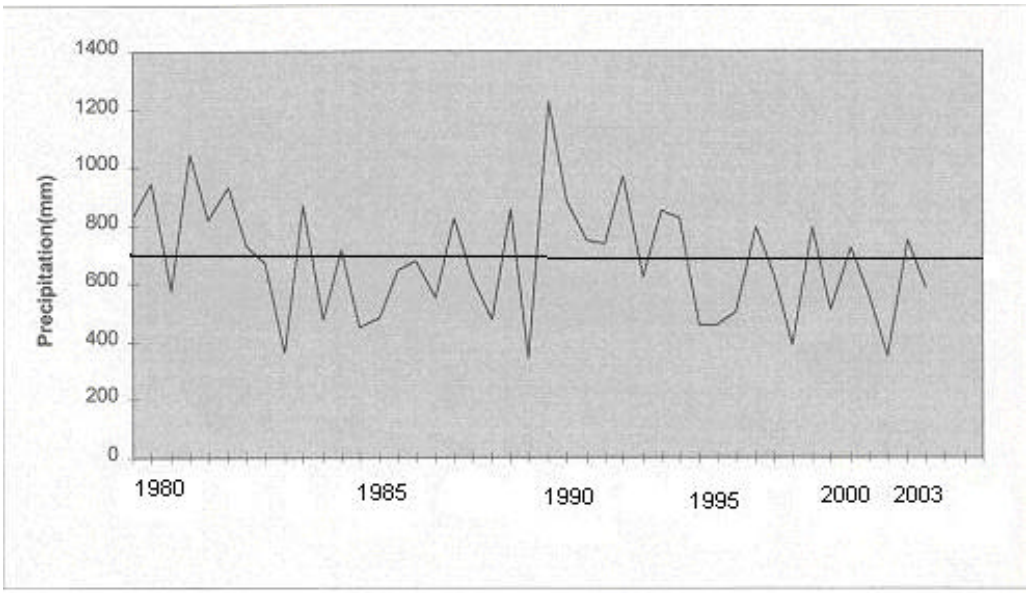

Fig. 5: 1980 – 2003 Annual Rainfall Pattern for Shurugwi[17]

capacity since livestock are perceived as having both an economic and social value. The district has livestock far beyond its carrying capacity resulting in competition between land uses thereby exerting pressure on wetlands. There are perceptible changes in vegetation cover intensity between 1980 and 2003 as shown in Figure 4.

Aerial photo interpretation shows that in 1980 vegetation cover intensity ranged between 75-100%. In 1995 and 2003 vegetation cover intensity had decreased to between 50 - 74% and 25- 49% respectively. The rate of wetland vegetation loss was caused by increase in cultivated areas and livestock numbers. Sections of the wetland which were once colonised by reeds are now dominated by hyperrania, hypothelia and digitaria as the major grass types interspaced with julbernardia globiflora (munondo), brachstegia spiciformis (musasa), strychnos (mutamba) and mukute tree species, indicative of wetland ecosystem change and adjustment to prevailing conditions.

Climatic changes have a confounding effect on wetland change and status[25]. Rainfall received in Shurugwi District fluctuates between a mean of 700 mm and an upper limit of 1200mm. Figure 5 shows the annual rainfall pattern for Shurungwi (1980 - 2003).

Variability of rainfall and decline to amounts short of the climatically expected amount has significantly played a part in reducing wetland size. To determine the effect of drought on wetland status, monthly drought intensity (Y) was calculated using the formula below:

$$Y = \frac{\sum_{t=1}^{D}[(E_t - M_t) - (MMD)_t]}{\sum_{t=1}^{D}(MMD)_t}$$

where

- Et = effective rainfall = $(R_t -_1\text{-}M_{t-1})\ W_t + R_t$ (M_t is the mean monthly rainfall, W_t is the carry–over factor, (t = 1, ….12) and R_t are the monthly rainfalls)
- $(MMD)_t$ = monthly mean deficit (t = 1, 2,…., 12) and D = drought duration in months.
- The severity index = Y*D[22].

The results show that September and October are the driest months. Eight of the 9 wetlands dry out during that time of the year.

Conclusion: Policy failures include haphazard settlements particularly those arising from illegal allocation of land, inability to enforce livestock carrying capacities, competing and overlapping mandates between Rural District Councils, Ward Councillors and Chiefs, growing unemployment (70%) and de-industrialization. Lack of non-farm employment has created great demand for land including land in the wetlands.

Wetlands in Shurugwi district are declining both in size and degrading in quality due to a number of factors. These include inter alia; frequent occurrence of drought, (1982-1983; 1991-1994; 1996 -1997; 2001-2003), high population densities, unregulated livestock sizes and encroachment of agricultural activities on wetlands. There

is need for effective management and restoration of wetland ecosystem through policy dialogue on water, food and the environment. Policy interventions could include equitable distribution of productive resources, carefully planned resettlement, poverty alleviation, investment in social services, expansion of off-farm employment, regulation and enforcement of conservation policies. In particular, there is need to provide sustainable livelihoods for vulnerable and marginalized groups.

Policy intervention through pieces of legislation could be a critical instrument in the management and preservation of wetlands. However, good laws are no proxy for good environmental ethics and outcomes[9]. Improvements in the law are no guarantee that at the operational level, sustainable use of wetlands has permeated majority decision – making processes. A good example of wantom destruction of resources is the contentious post –2002 fast track land redistribution programme where policy lapses, volatile political situations, ethno-political decisions and pronouncements operated at variance with objectives of sustainable development[10].

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