Greener Journal of Social Sciences

ISSN: 2276-7800 Impact Factor 2012 (UJRI): 0.7863 ICV 2012: 5.99

Revisiting Indigenous Knowledge Systems for Sustainable Management of Natural Resources in Fast Track Resettlement Schemes. A Comparative Analysis of Indigenous Knowledge Systems Use In A1 Resettlement Schemes and Communal Areas in Chiredzi and Zaka Districts, Zimbabwe

By

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Research Article

Revisiting Indigenous Knowledge Systems for Sustainable Management of Natural Resources in Fast Track Resettlement Schemes. A Comparative Analysis of Indigenous Knowledge Systems Use In A1 Resettlement Schemes and Communal Areas in Chiredzi and Zaka Districts, Zimbabwe

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ABSTRACT

Natural resources play a critical role to societies. Many people in developing countries conform their livelihoods and life style to nature. However, natural resources in resettlement areas of Zimbabwe are increasingly becoming degraded despite their importance. The study sought to assess how the adoption of indigenous knowledge systems for natural resources management in A1 resettlement areas can reduce resource depletion. The study employed a quasi-experimental design in which communal areas of Zaka District and A1 resettlement areas of Chiredzi District were used as experimental groups. Focus Group Discussions (FGDs) and interviews were used to gather data from traditional leaders and the elderly. In addition, observations were made to complement data from FGDs and interviews. The study found that a variety of indigenous knowledge systems still exist in communal areas and natural resources protected by indigenous knowledge systems were well preserved. However, in A1 resettlement areas where indigenous knowledge systems have been eroded due to the dynamic social, economic and physical environment there is excessive environmental degradation. There is therefore need to adopt and strengthen the use of indigenous knowledge systems in A1 resettlement areas to curb environmental degradation.

Keywords: Indigenous knowledge systems, natural resources conservation, sustainable development.

INTRODUCTION AND BACKGROUND

Historically, there was mutual co-existence and balance between the indigenous people and the environment (Chiwandamira, 2000). This mutual co-existence and balance between men and his environment was based on indigenous knowledge systems (IKS) as well as on an effective traditional authority system. Local people developed conservation strategies that were effective for the conservation of natural resources. Thus local people used the environment in a sustainable manner through the use of indigenous knowledge systems. People were not only close to nature but part of it and acknowledged that their existence depended on the earth. People had access to both living and non-living resources but were only limited by their traditional beliefs, taboos and customs. As Warren (1991) puts it, traditional ways of common property resource has its tenets vested in traditional leadership, strongly aided beliefs, customs and taboos as well as folk tales to scare people away from mismanagement. Thus the indigenous knowledge systems helped people to live in harmony with the natural environment and they maintained sound ecological balance.

However, due to colonialism and modern Western thoughts, the indigenous knowledge systems which safeguard the exploitation of natural resources were now regarded as backward, superstitious and inimical to rapid growth. According to Goudie (1993) the abrupt decay of traditional authority over resource management as a result of colonial rule meant that the traditional rulers and user communities lost control of their rights over resources and survival techniques proven over generations. Due to colonialism there was dissolution of traditional authority and the management of the natural resources was now centralized, vesting ownership and responsibility over natural

resources in central government. Resources became inaccessible, limiting the people's livelihood options. The transfer of power of land management alienated people from managing their resources.

According to Bromley and Cernea (1988) natural resources degradation in developing countries actually originates in the dissolution of local institutional arrangements whose very purpose was to give rise to resource use patterns that were sustainable. Natural resource depletion emanates from the fact that the state is unable to manage natural resources effectively because of logistical limitations of staff and funding. Bromley and Cernea (1988) are advocating a return to common property regimes based on the utility of such regimes in sustainable resource management and the failure of state management.

In Zimbabwe, the government has tried to protect the indigenous knowledge systems through the enactment of the Traditional Leaders Act (Chapter 29.17) of 1999 which gives chiefs, headmen and village heads a role to play over the land and its natural resources. The Traditional Leaders Act provides for a customary and traditional way of managing the environment and resolving disputes arising from exploitation of natural resources. Thus the Traditional Leaders Act has managed to empower chiefs, headmen and village heads in communal areas to manage natural resources sustainably through the use of indigenous knowledge systems. In contrast, the traditional authority structure in A1 resettlement schemes consists of base commanders and village chairpersons who are not empowered by any act to manage natural resources. In the A1 resettlement areas the management of natural resources is thus the concern of the government through the Ministry of Environment and Tourism which implements the Environmental Management Act (EMA) Chapter 20.27 (Government of Zimbabwe, 2005). This legislative framework is silent about the role of traditional leadership in the management of resources. This difference in institutional arrangements characterising resettlement areas has meant the erosion of indigenous knowledge systems and the subsequent overexploitation of natural resources leading to natural resource depletion.

In addition to institutional deficiency, the beneficiaries of the Fast Track Land Reform Programme were migrants drawn from various parts of the country. This created diverse cultural societies in resettlement areas leading to erosion of indigenous knowledge systems. Indigenous knowledge systems are defined by the International Labour Organisation (ILO) (1989) as the knowledge that is held and used by a people who identify themselves as indigenous of a place based on a combination of cultural distinctiveness and prior territorial occupancy relative to a more recently arrived population with its own distinct and subsequently dominant culture. From the above definition, it can be realised that the Fast Track Land Reform Programme created new societies with diverse cultures in new localities hence the erosion of indigenous knowledge systems.

Statement of the Problem

Natural resources are increasingly becoming degraded in the A1 resettlement areas of Ward 16 and 17 of Chiredzi District due to the fact that the state's natural resource institutions are unable to effectively manage natural resources. In addition, indigenous knowledge systems in the resettlement area have been eroded due to cultural diffusion. Beneficiaries of the Fast Track Land Reform Programme who occupied the A1 schemes in Ward 16 and 17 were migrants coming from diverse worlds hence the creation of a multi-cultural society.

Aim

To assess the efficacy of indigenous knowledge systems use in the management of natural resources

Objectives

1. To identify the indigenous knowledge systems in use for the management of natural resources in both communal and resettlement areas.
2. To assess the impact of the indigenous knowledge systems in the conservation of the natural resources.
3. To suggest ways of integrating indigenous knowledge systems and modern systems to curb natural resource degradation.

Justification of the Study

The study generates information on the types and impact of indigenous knowledge systems used for the management of natural resources in both communal and resettlement areas. The information is important to government agencies and other development organizations in devising strategies that promote sustainable use of natural resources that embrace the use of indigenous knowledge systems in natural resources management. Government and other organizations can intervene in introducing and cementing traditional norms, taboos and cultural beliefs that exist in a community for the management of natural resources.

Description of the Study Area

The study was carried out in Ward 16 and 17 of Chiredzi District and Ward 28 and 29 of Zaka District.

Chiredzi District

Ward 16 and 17 of Chiredzi District consist of former commercial farms which were occupied under the Fast Track Land Reform Programme. The wards consist of A1 resettlement schemes. The A1 resettlement model is a model under the Fast Track Land Reform Programme in which landless people were resettled in villages. Each household was allocated a residential plot and an arable holding of 5 hectares. In ward 16 and 17 of Chiredzi District people were resettled from diverse backgrounds under the land occupation movements led by war veterans. This created a multicultural society consisting of former commercial farm workers from Zimbabwe and other neighbouring countries and landless villagers from Zimbabwe's communal areas.

Zaka District

Ward 28 and 29 of Zaka District consist of communal areas. Communal areas of Zimbabwe formerly known as Tribal Trust Lands were created by the colonial administration during the colonial era to resettle the indigenous black people. In these areas communal farming is practiced and arable holdings are generally less than 2, 5 hectares. The areas are characterized by collectivised systems of tenure and natural resources fall under common property regimes. People share woodlands, grasslands and water resources. There is considerable pressure on the land because of increasing human population.

CONCEPTUAL FRAMEWORK

Hardin's Tragedy of the Commons

In 1968 Hardin devised the concept of the 'Tragedy of the commons' in which he argues that common property of the natural resources lead to overexploitation and to the degradation of the environment (Hardin, 1968). In Hardin, the tragedy of the commons is the tragedy of the quest for profit that leads to the exploitation of the natural resources beyond the limits of nature. Hardin has shown that common property is the basis of environmental degradation and that private property is crucial to rescue us from the disaster. As postulated by Uphoff (1986) when forests, water and other resources are held in common individuals have incentives to exploit the resources for private gain at co-holders' expense. Though Hardin recommended privatization of resources as the solution, it can introduce its own problems. Private management of natural resources can lead to overexploitation by individuals for profit maximization. This calls for other solutions. Similarly, Hardin in his thesis argues that the tragedy of the commons must be prevented by coercive laws and social arrangements that produce responsibility or something that mimic private property. Uphoff (1986) argues that where individual decisions would culminate in undesirable outcomes some form of collective action is needed. However, Olson (1965) asserted that the 'free rider' problem makes voluntary co-operation unlikely and advocates for social sanctions.

Hardin's tale has been used widely in modern approaches to environmental management. The most common response to his thesis was the introduction of state agents, whose decisions in regulating natural resources were backed by coercion to ensure compliance. However, these state agents' strategies of natural resources management are of limited effectiveness as officials face difficulties in mobilizing the legitimacy needed for efficient enforcement and cannot readily mobilize social support. This article advocates for the use of indigenous knowledge systems in natural resources management. Indigenous knowledge systems call for collective action and are associated with inherent mutual coercion developed over generations by local communities.

Indigenous Knowledge Systems as a Concept in Natural Resources Management

Frankel and Chasin (1980) define indigenous knowledge systems as the knowledge that is generated and transmitted by communities in an effort to cope with their own agro-ecological and socio-economic environment. Indigenous knowledge systems are referred to as a body of knowledge and benefits built by a group of people and handed over to generations (Breemer, 1995). Indigenous knowledge systems include the knowledge of cultural beliefs, taboos, totems, indigenous agricultural practices and these were used to conserve and manage natural resources. Cultural taboos put restrictions on the use of plants, animals or areas and this help to curb the depletion of natural resources considered important for the continuation of large communities. Full utilization of indigenous

knowledge systems enables sustainable development and sustainable use of natural resources. Indigenous knowledge systems are important as the basis for sustainable advancement in the productive use of local resources hence indigenous knowledge systems play a critical role in sustainable development for the majority of rural people.

Indigenous Knowledge Systems versus Accountability and Responsibility of User Communities and Traditional Authority

Kiss (1990) cited in Gwazani and Murindagomo (2000) argues that indigenous knowledge systems are important in resource conservation because they built a sense of responsibility and accountability. The respect of traditional knowledge systems enhances the participation of local communities in resource conservation. Breemer (1995) argues that the respect of indigenous knowledge systems and the participation of local communities in resource conservation cater for the 'tragedy of the commons'. The participation of local communities helps to curb the 'free rider' problem because the natural resources will not be treated as an open access. In addition, indigenous knowledge systems give responsibility and accountability over natural resources conservation to the user communities.

Kiss (1900) cited in Gwazani and Murindagomo (2000) states that the local communities play a pivotal role since studies have shown that no amount of protection or law can prevent degradation once community participation has been sidelined. The participatory planning and implementation has proved as the best way of creating a sense of ownership in many conservation programmes. Lack of participation of local communities in resource conservation has brought much degradation and depletion of natural resources. People no longer regard wildlife as an asset but a liability. It becomes something of no value and not to be tolerated, poached and destroyed, hence degradation and subsequent extinction of natural resources. The respect of indigenous knowledge systems motivates the local people to employ methods that are sustainable in the conservation of natural resources.

Indigenous Knowledge Systems in Natural Resources Management

Wildlife Management

Redcliff (1987) states that traditional societies developed wildlife conservation strategies that helped to regulate exploitation of wildlife and ensure that communities had adequate natural resources available. These strategies were deliberately aimed at the preservation of resources for the benefit of the present and future generations and were deeply enshrined by traditional values. Wildlife was protected by a battery of taboos and customs which ensured its sustainable utilization. According to Mamimine and Mandivengerei (2001) all people belonged to clans which were and still are identified with a particular totem. These totems forbid each clan from killing certain types of wildlife species. Specific hunting periods were monitored and arranged by the chief or king. Some totems were derived from birds and this was aimed to avoid massive killing of birds thereby conserving wildlife as a natural resource. Female game animals were protected through the traditional law which states that to kill a female beast could result in double payment of killing a male animal without permission. These strategies emanated from people who had concern for their environment and its ecosystem, an attitude that enables traditional societies to conserve their resources without any written legislation.

Trees and Forest Management

According to Chenje (1998) trees and forests were protected through traditional taboos and customs. Some trees were not cut because of their cultural importance. Cutting green trees for firewood was a taboo. Only dry wood was collected for firewood and women who collected it exercised extreme caution because certain trees even when dry were sacred and were never used as fuel. Everyone knew the value of trees as primary sources of biodiversity and genetic resources and understood how their depletion would anger the ancestors and God resulting in punishing natural disasters such as drought.

Kurotwi (2003) indicated that certain forests were sacred and highly protected as though the scientific importance of preserving forests for the regulation of the hydrological cycle and exchange of gases and nutrients were known. Any human being risked disappearing for good if he/she tried to trespass into the area. Some traditional leaders were buried in these sacred forests and certain protocols had to be applied before any human encroachment could be allowed. Burial places were accorded special reverence because of their status as places where the dead who become spirits of the clan resided.

Water bodies

Norms and taboos protected water sources and the aquatic life in the water bodies. Pools were believed to be places where mermaids used to stay, so people were discouraged from venturing in such areas. Violation of resource exploitation regulatory norms did not only attract the sanctions of the spirits but were also punishable by the chief, headmen or other officials as they perceived any violation as likely to attract the wrath of the spirits against the community. This necessitated the supply of water throughout the year. The taboos set discouraged the unwarranted destruction of resources such as wetlands and cultural sites.

Soil Management

According to Graham (1991) a variety of traditional soil conservation measures were put in place to cope with acute shortage of soil due to erosion. The traditional people had a range of conservation techniques which included hillside terraces and sisal lines.

Hillside terraces

Hillside terraces consisted of small stone walls which hold pockets of earth in place. Where there are quite good supplies of soil the terraces will be more or less continuous along the hillside and where the earth is not deep enough, extra soil was added from nearby. Hillside terracing was used only on the steep slopes hence it was effective for conserving both soil and water. Indigenous people use the resources that are locally available to conserve their natural resources.

Sisal lines

Warren (1991) postulated that indigenous people used local techniques of planting sisal across the slopes to reduce erosion and runoff, so it was regarded as a water harvesting technique. The sisal was planted more carefully to avoid small rills forming between them and sisal was more effective when it followed a contour. According to Larson (1996) sisal lines also helped in replenishing falling water table and regenerated the barren, crusted earth because organic matter and seeds on the upslope side of the line and plants begin to grow.

Challenges Facing Indigenous Knowledge Systems in Resource Conservation

Despite the importance of indigenous knowledge systems in resource conservation, indigenous knowledge systems are facing challenges chief of which is the erosion of traditional customary systems of natural resource management and utilization. According to Mararike (1999) the problem with the indigenous knowledge systems is lack of systematic records and means of transmission to other sources making the system vulnerable to modernity and globalization. Thus modernization has dismissed indigenous knowledge systems as unsystematic and incapable of meeting management needs of the world.

Colonial and post-colonial government natural resources conservation institutions failed to appreciate the value of local people and the contribution they made to natural resource management. These institutions have adopted Western development paradigms which regard indigenous knowledge systems as backward and superstitious. Local knowledge and traditional practices are now not utilized in designing natural conservation programmes.

According to Warren (1991) indigenous knowledge has been marginalized because of globalization. Globalisation promotes modern ways of conserving and managing resources at the expense of indigenous knowledge systems. Globalisation postulates that distinct culture of indigenous people, their identity and traditional ways of managing their resources are backward and superstitious. Due to the globalisation process, top-down approaches to natural resources management have been implemented, instead of bottom up approaches which enhances local participation of indigenous people.

METHODOLOGY

Qualitative methodology was employed. According to Shank (2000) the qualitative methodology enables the researcher to conduct a systematic inquiry into meanings. The nature of this study demanded the qualitative methodology which has the capacity to penetrate the frames of meanings within which indigenous people operate and allow an understanding of how indigenous knowledge systems initiated by indigenous people are structured. The study utilized unstructured interviews to elicit information on indigenous knowledge systems in use as well as their

impact in natural resources conservation. Focus Group Discussions were held to increase insights and contextual understanding of indigenous knowledge systems. Focus groups comprised of traditional leaders and the elderly people. Observations were also made to validate some of the views that emerged during Focus Group Discussions and interviews.

FINDINGS AND DISCUSSIONS

Nature of Indigenous Knowledge Systems Used for Conservation of Natural Resources in Communal and Resettlement Areas

The nature of indigenous knowledge systems that still exist for the management of natural resources in both communal and resettlement areas was assessed (Table 1).

Table 1: Nature of Indigenous Knowledge Systems Used for Conservation of Natural Resources in Communal and A1 Resettlement Areas

Type of Natural Resource	Nature of Indigenous Knowledge Systems	
	Communal Areas	A1 Resettlement Areas
Wildlife	Totems, taboos, customs, fines	totems
Trees and Forests	Taboos and customs	-
Water resources	Taboos and customs	-
Soil	customs	-

Source: Survey Data 2013

Table 1 above shows that in the communal areas of Zaka District a variety of indigenous knowledge systems are still used for the management of natural resources. These include taboos, customs, totems and fines. However, in A1 resettlement areas of Chiredzi District only totems still exist for the management of natural resources.

Wildlife Conservation

From Table 1 above totems, taboos, customs and fines are still used for the management of wildlife in communal areas under study. During FGDs respondents commented that totems are widely used for the conservation of wild animals and birds.

“One cannot eat meat which stands as a totemic symbol of his/her clan. This leads to the decay of the tooth of the offender”, said one traditional leader.

Killing of wild animals which society hold in contempt such as hyenas, monkeys and also young ones of all species is a taboo. It is believed that killing of such animals causes drought which affects the whole community. People in communal areas are also socialized to shun the killing of ecologically rare species such as porcupines, pangolin and giraffe. Respondents remarked that pangolin (*haka*) is eaten only by the chief while the giraffe (*twiza*) is a royal animal and individuals are prohibited from killing it. Thus, taboos as forms of indigenous knowledge systems are used to protect these animals from depletion and possible extinction.

In addition, game animals living in sacred forests such as Gwehe and the sacred mountains such as Gondora, Biri and Romwe are preserved. These can only be killed by professional hunters after consultation with spirit mediums (Mhondoros) to ensure that no traditional ethos are transgressed as well as ensuring that hunters would meet no dangers in their hunting expedition. These hunters are released for their tour of duty during specific hunting periods which are designed by the chief. Respondents highlighted that animals killed in the sacred forests are either eaten during traditional ceremonies or shared by all households in a village.

Rebuking animals living in sacred forests and sacred mountains is also a taboo.

“At times ancestral spirits in sacred areas such as Romwe Mountain, Biri Mountain and Gondora Mountain manifest themselves in form of animals and if anyone rebuke them he/she can be transformed into an animal or the spirit mediums may unleash a series of misfortune to the offender”, said one village head.

Female game animals are protected through the traditional law which prohibits the killing of female beast. Respondents highlighted that anyone who kill a female beast could be arrested and tried in the traditional court

presided by the chief. To this end it can be realised that wildlife resources in Zaka District are common property resources which are managed by the community collectively. The community has devised indigenous knowledge systems aimed at the preservation of wildlife resources for the benefit of the present and future generation. This confirms Redcliff's (1987) assertion that traditional societies developed wildlife conservation strategies that helped to regulate exploitation of wildlife.

In contrast, only totems are used for the preservation of wildlife in A1 resettlement areas of Chiredzi District, particularly ward 16 and 17 hence their rampant exploitation. Respondents argued that people in ward 16 and 17 A1 resettlement areas of Chiredzi District come from diverse backgrounds.

"Some people who were resettled in this area are former commercial farm workers from neighbouring countries such as Malawi, Mozambique and Zambia who do not appreciate Zimbabwean culture. This has made it difficult to continue with our Zimbabwean customs and traditions for natural resources management", said one elderly woman who was resettled from Zaka.

Thus cultural diversity in A1 resettlement areas has resulted in the erosion of traditional customs and norms for wildlife management leading to over exploitation. Atteh (1991) defined indigenous knowledge systems as technical insights of wisdom gained and developed by people in a particular locality through years of careful observation and experimentation with the phenomena around them. This means that indigenous knowledge systems are embodied in culture and cultural diversity in the A1 resettlement areas has caused the erosion of indigenous knowledge systems.

Trees and Forest Management

Trees

In communal areas of Zaka District some trees are not cut because of their cultural importance. Trees like the *parinari curatellifolia* (*muhacha*), *sclerocarya birrea* (*marula*, *mupfura*), *strychnos spinosa* (*mutamba*), *adansonia digitata* (*baobab*, *muvuyu*), *Uapaca kirkiana* (*wild loquat*, *Mushuku*), *ficus sur* (*muwonde*), *cordatum syzygium* (*mukute*), *tamarinds indica* (*mubhubhunu/munyamharadza*) and *gardenia globiflora* (*Chizhuzhu*) are sacred and have to be preserved for the well being of individual households and the entire community.

Respondents indicated that trees termed *tamarinds indica* (*mubhubhunu/munyamharadza*) are not cut because their use in the homes as firewood would bring family brokering or feuds. Cutting *gardenia globiflora* (*Chizhuzhu*) is a taboo since this tree is used in the fencing of graveyards to prevent them from witches. *Parinari curatellifolia* (*muhacha*) tree is spared for food and rain making ceremonies (*mukwerere*). Rain making ceremonies are important in bringing rainfall. It is under this tree that the communal people gather to pray to ancestors for rain and other needs.

Indigenous fruit trees including *ficus sur* (*muwonde/mukuyu*), *sclerocarya birrea* (*marula*, *mupfura*), *cordatum syzygium* (*mukute*) and *strychnos spinosa* (*mutamba*) are preserved to provide a wide range of fruits at different times of the year. Respondents commented that these trees also conserve water and indicate the level of the water table. The *sclerocarya birrea* (*marula*, *mupfura*) tree is preserved because it bears fruits that are consumed by villagers known as *marula* (*mapfura*) and it is used to brew a traditional beer known as 'mukumbi'. This type of beer is used to persuade spirit mediums in rainmaking ceremonies in times of drought and even in times of harvesting.

Uapaca kirkiana (*wild loquat*, *Mushuku*) and *parinari curatellifolia* (*muhacha*) trees are also used for the predication of the expected amount of rainfall in a particular season and hence the type of crops farmers should prepare to plant. A lot of wild loquats (*mashuku*) are an indication of high amount of rainfall and means farmers should prepare to plant crops that tolerate high rainfall. A lot of *parinari* (*hacha*) is an indication of little rainfall which means that farmers should prepare to grow drought resistant crops such as rapoko and sorghum. These trees are highly regarded in the communal areas of Zaka District where they are selectively retained in the fields.

Eating of unripe fruits is forbidden. According to one respondent

"We are not allowed to harvest unripe fruits. We are also forbidden from selling wild fruits or even mushroom since this will anger the spirit mediums (mhondoro) resulting in misfortunes of drought to the whole community", said one respondent during a FGDs.

This ensures preservation of seeds hence the continuity and completion of lifecycles of various fruit trees. This observed scenario is a clear indication of the utility of indigenous knowledge systems in the conservation of trees and forests.

In the A1 resettlement schemes of Chiredzi District there is massive deforestation as people clear land for cultivation. Wild fruit trees such as *parinari curatellifolia* (*muhacha*), *sclerocarya birrea* (*marula*, *mupfura*), *strychnos*

spinosa (mutamba), *adansonia digitata* (baobab, muvuyu), *Uapaca kirkiana* (wild loquat, Mushuku), *ficus sur* (muwonde), *cordatum syzygium* (mukute) and sacred trees such as tamarinds indica (mubhubhunu/munyamharadza) and *gardenia globiflora* (Chizhuzhu) are not spared as they are not protected by taboos and customs.

"We cut down all tree species when we clear land for cultivation because these trees harbour pests and diseases which attack our crops especially cotton. Even the Agricultural Extension officers encourage us to cut down all trees on arable land", said one resettled farmer.

This situation relates to Lopes (1996) who argues that traditional values thus taboos which safeguard the exploitation of natural resources are now regarded as backward, superstitious and inimical to rapid growth. Thus, all tree species in arable land in the A1 resettlement area are cut due to the Western development paradigm that they harbour pests. This leads to massive deforestation possible extinction of some tree species.

Forests

In communal areas of Zaka District certain areas of forests such as Chikondorwana forest are prohibited as it is believed that they are guarded by lion clan spirits (mhondoro). These sacred grooves are called *rambakutemwa*. Traditional leaders and spirit mediums also forbid tree cutting in the sacred mountains. If anyone trespasses into the sacred forests and sacred mountains he/she will be attacked by navigational hallucinations (*Chadzimira*). In the Gwehe sacred forest people are not allowed to pass through or cut down poles and even to harvest non-timber products such as stinkbugs (*harurwa*) since it is believed that if one pass through it he/she will be killed by a weird man called Gwehe who is believed that he owns the forest. Chiefs are buried in these sacred forests.

In communal areas under study cutting green trees for firewood is a taboo. Only dry wood is collected for fire wood and people who collect it should exercise extreme caution because certain trees are sacred and are never used for fuel.

Non-compliance to the conservation of trees that have value to the community attracts penalties that are set by traditional leaders. Some of the penalties highlighted by the headmen are as follows:

- If a person cut down a wild fruit tree without permission from the chief or headmen he or she will pay a US\$20, 00 fine to the Chief or the village head.
- If one cut down a green tree he will plant a woodlot.
- If one causes veld fires he/she will pay a fine of US\$100, brew 100 litres of traditional beer and slaughter a male goat for cleansing purposes.

The above position is in line with Hardin's (1968) proposition that the tragedy of the commons can be averted by coercive laws and social arrangements that produce responsibility. The issue of penalties administered by the traditional leaders is a form of coercive action while traditional authority structures are social arrangements that produce responsibility.

In communal areas burial places such as Bomero, Dekeza and Bota graveyards are accorded special reverence because of their status as places where the dead who become spirits of the clan resided. They are held to be sacred and the extraction of resources from such areas constitutes gross destruction of their sacral significance and can attract secular, political and religious censure. Ancestral spirits are believed to unleash divine visitations (misfortunes) upon those who in their extraction and utilization of resources violate the rules of the land.

However, in A1 resettlement areas of Chiredzi District there are no taboos and customs set for the protection of trees and forests. In addition, the traditional authority system that exist in resettlement areas of Chiredzi District differs from that in the communal areas of Zaka District making it difficult to enforce traditional customs or introduce rules and regulations for the governance of trees and forests. Instead of the headmen and village heads the authority system in A1 resettlement schemes of Chiredzi District consists of base commanders and village chairpersons. Chiefs, headmen and village heads are empowered by the Traditional Leaders Act (Chapter 29:17) of 1999 which gives them power to ensure control over cultivation, overgrazing, indiscriminate destruction of flora and fauna and generally preventing the degradation, abuse or misuse of land and natural resources in their areas. In contrast, base commanders and village chairpersons are not empowered by any Act of Parliament to control land and its natural resources hence overexploitation of trees and forests.

Water bodies

In communal areas under study water bodies are protected by taboos and customs. Some pools such as Dapo in Chekero village, Chizhou in Bomero village, Madyavanhu and Mutaurewamai in Gondora Mountain are believed to have water mermaids and people are prohibited from fishing in the pools. Black items are also not allowed at the pools because it is believed that items with charcoal could anger the water mermaids leading to the drying of the pools. People should use traditional cups (gourds and calabashes) when fetching water from the pools. Anyone who tries to fetch water using any metal bowl or anything with charcoal would disappear from the area and would not be seen again. Washing or bathing in these pools is also prohibited. It is believed that if anyone washes or bath in these pools his/her clothes would disappear.

In communal areas of Zaka District, people are also restricted from the use of wetlands for any development activities except for the burial of children under 5 years. Wetlands like Gokota and wetlands along Matedzi River are protected areas. It is believed that if anyone tempts with the wetlands he/she would be taken by the water spirits. The chief, the headmen and the village heads are there to continue educating people in their areas concerning these taboos especially to the young generation in this area who claim that taboos do not exist. Thus, traditional leaders in the form of chiefs, headmen and kraal heads are instrumental in reinforcing what may appear to be purely religious beliefs and in so doing safeguard water and aquatic life from unsustainable exploitation.

However, in A1 resettlement areas of Chiredzi District there are no taboos and customs for the management of water resources. The management and conservation of water resources in A1 resettlement areas of Chiredzi District is the concern of the Environmental Management Agency (EMA) and the Zimbabwe National Water Authority both of which are government agencies which employ Western scientific practices in environmental management and conservation. Thus, there is lack of local institutional arrangements for the management of water resources. This is in line with Murinda and Moyo's (1994) assertion that government resource conservation institutions have fallen into the Western development paradigm and cannot utilize local knowledge and traditional practices in designing natural resources conservation strategies. This situation coupled with the failure of government institutions to enforce rules and regulations that limit the wanton destruction of water resources has turned the water resources in the area into open access. Wetlands, which should be left undisturbed, are used for the cultivation of sugarcane and rice.

Soil Management

In communal areas of Zaka District village headmen emphasise the digging of contour ridges. Every household that own a portion of land for farming dig contour ridges. Individuals are not permitted to burn grass in contour ridges or to feed cattle or any livestock in contour ridges. Anyone caught breaking the rule is sent to the village court presided by the chief where he/she may be asked to pay a fine to the chief, the headmen or the village head.

Farmers also use organic matter and livestock manure to increase soil fertility. In addition, they use crop rotation and fallowing as soil conservation techniques. The cats-tail grass is used to predict the return of soil fertility after fallowing.

In communal areas of Zaka District traditional leaders are responsible for identifying grazing areas. Thus, traditional leaders allocate grazing lands for cattle and the indigenous people term them 'sendere' where cattle, goats and other domesticated animals graze and this reduce soil erosion. Thus, traditional leaders are the traditional practitioners who are believed to have above average knowledge on the characteristics of the land in communal areas of Zaka District.

In the A1 resettlement areas of Chiredzi farmers use artificial fertilizers such as ammonium nitrate, compound D, gypsum and others to increase soil fertility. In addition, they practice monoculture, that is, they grow cotton on the same piece of land year after year. These practices reduce soil fertility and expose the soil to the agents of denudation.

Furthermore, there are no pieces of land set aside for grazing purposes in the A1 resettlement areas of Chiredzi because there are no customs which guide soil conservation.

"Initially there were some pieces of land that were set aside for grazing purposes by the government and the war veterans who were responsible for beneficiary selection. However, these have since been sold to landless people by the war veteran leaders. We now graze our animals along river valleys or in mountains as the grazing land is now under cultivation", said one resettled farmer.

Grazing animals in ecologically sensitive areas such as along river courses and mountains result in soil erosion. Thus, lack of proper traditional authority structures in the A1 resettlement schemes of Chiredzi District has resulted in the erosion of traditional soil conservation techniques.

The Impact of Indigenous Knowledge Systems in the Conservation of Natural Resources

Wildlife

In communal areas of Zaka District taboos, customs and fines protect some wildlife species from over exploitation. Wildlife species such as baboons and monkeys are found in large numbers in the whole community. However, some protected animals such as the pangolin and the giraffe could only be found in sacred forests such as the Gwehe Forest and sacred mountains such as Gondora, Biri and Romwe. These sacred areas were rich in wildlife species. This observation concurs with Breemer (1995) who noted that the respect of indigenous knowledge systems and the participation of local communities in resource conservation cater for the tragedy of the commons. However, in A1 resettlement areas of Chiredzi District there are now very few wildlife species.

"In this area, commercial game ranching was practiced by the white commercial farmers. Thus when we occupied this area in the year 2000 there were a variety of animal species. These were however killed by the resettled farmers through indiscriminate hunting. Now you cannot see even a baboon", said one farmer who was resettled in Ruware Ranch.

Respondents commented that people kill baboons and monkeys in protection of their crops. This observed scenario is in line with Hardin (1968) who argued that the primary cause of the ongoing process of environmental degradation is the common property of the natural resources. Wildlife resources in the A1 resettlement areas of Chiredzi District are held in common hence individuals have incentives to exploit the wildlife resources for private gains at co-holders' expense.

There was also indiscriminate killing of wildlife through snares in and around Ruware Conservancy. Though the conservancy is still privately owned the officials are failing to efficiently enforce the rules and regulations governing the exploitation of wildlife resources. People slip away into the conservancy at night and indiscriminately kill animals leading to depletion of animal species.

Trees and Forests

Trees

The study observed that there is massive deforestation in communal areas of Zaka District due to overcrowding, clearing land for cultivation and cutting trees for firewood. However, wild fruit trees such as *parinari curatellifolia* (muhacha), *sclerocarya birrea* (marula, mupfura), *strychnos spinosa* (mutamba), *adansonia digitata* (baobab, muvuyu), *Uapaca kirkiana* (wild loquat, Mushuku), *figus sur* (muwonde) and *cordatum syzygium* (mukute) are left out even in fields cleared for arable farming. Tree species such as *tamarinds indica* (mubhubhunu/munyamharadza) and *gardenia globiflora* (Chizhuzhu) are also left out. This confirms the assertion that indigenous knowledge systems play a pivotal role in the conservation of natural resources in communal areas.

In addition, there is a variety of tree species in the sacred forest such as Gwehe Forest and the sacred mountains such as Biri Gondora and Romwe. This is because people are afraid of trespassing into the sacred areas because of taboos and customs which protect the forests. This confirms Mangetane and Asibey's (2001) arguments that today's sacred grooves which constitute the rare islands of biodiversity in the background of deforested rural areas were conserved through indigenous knowledge systems.

In contrast, people in A1 resettlement areas of Chiredzi attach no value to trees that bear wild fruits and they are indiscriminately cut down as people clear land for cultivation.

"This area was a dense forest characterized by a variety of tree species but these have been cleared for a variety of purposes", said one resettled farmer in Eaglemont Ranch.

There are also no sacred forests hence there is excessive extraction of the forest resources resulting in rampant deforestation.

Water Resources

In communal areas of Zaka District water sources which are protected by taboos and customs are unpolluted. Sacred pools such as Dapo, Chizhou, Madyavanhu and Mutaurewamai supply clean water in the community throughout the year. Thus indigenous knowledge systems play a significant role in averting the 'tragedy of the commons'.

In resettlement areas of Chiredzi District, there are no taboos and customs set for the management of water sources. This has resulted in overexploitation of water and aquatic resources such as fish. For example, fish stocks in Ruware, Mafuta, George Mayer, Stirup and Eaglemont Dams have been heavily depleted because of the use of fishing nets. Lack of proper traditional authority structures in A1 resettlement areas has turned the water resources into 'open access'. Water bodies in A1 resettlement areas of Chiredzi District are now exploited for a variety of purposes which include irrigation and domestic purposes. Community activities such as washing, bathing and provision of drinking water for livestock have resulted in water pollution (Plate 1).

Plate 1: The Polluted Ruware Dam

Water pollution in A1 resettlement areas of Chiredzi District means scarcity of clean water supply. Thus, people in A1 resettlement areas are utilizing dirty water. This is a time bomb since the utilization of dirty water causes the spread of water borne diseases such as bilharzias. To this end, it becomes prudent to argue that freedom in the commons brings ruin to all. These findings confirm Hardin's (1968) assertion that the inherent logic of the commons generates tragedy.

Soil Management

Indigenous soil management systems such as stone terracing, fallowing and use of organic matter and livestock manure as well as crop rotation have managed to reduce soil erosion in the communal areas of Zaka District. In addition, the allocation of grazing land (sendere) as a pasture management system reduces overgrazing and also ensures the continuous supply of fodder for domesticated animals in Zaka's communal areas. These findings reveal that indigenous pasture management systems can cater for the tragedy of pastures open to all. Traditional leaders in Zaka District have managed to curd the problem of overgrazing through the allocation and subsequent management of grazing lands (sendere).

Failure to adopt indigenous knowledge systems for soil management has resulted in soil erosion in the A1 resettlement area of Chiredzi District (Plate 2).

Plate 2: Gully erosion in Eaglemont A1 resettlement scheme

Soil erosion has resulted in loss of agricultural land as well as siltation of dams as sediments in the catchment areas of dams are washed into the dams (Plate 3).

Plate 3: The Silted Matanda Dam

Some dams such as Matanda dam, Muchacha Dam and Matongo dam have dried up due to siltation. Livestock are getting stuck in the mud of drying dams such as Matanda, Muchacha and Matongo. This observed situation calls for what Hardin (1968) termed mutual coercion agreed upon by the majority of the people affected to avert the wanton destruction of water sources in A1 resettlement areas.

CONCLUSION

In communal areas of Zaka District the use of indigenous knowledge systems has been of paramount importance to the conservation of wildlife, trees and forests, water and soil resources. This has been so despite the influence of modernisation and globalisation. However, A1 resettlement areas of Chiredzi are facing a myriad of challenges chief among them being cultural diversity and lack of proper local institutional arrangements for the management of natural resources. In addition, government institutions for the management of natural resources are facing problems in implementing the rules that govern natural resources usage. Therefore, traditional authority structures in A1

resettlement areas need to be restructured and strengthened to facilitate the use of indigenous knowledge systems. Traditional norms in A1 resettlement areas can incorporate modern technology in order to accommodate the ever-changing social, economic and physical environment characterizing the areas.

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