

Environmental impacts of tourism development in the Okavango

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Tourism development in destination areas is often associated with negative environmental impacts if its management is poor as environmental damage arises if the number of tourists is large or the resource is overused. Overcrowding, misuse of natural resources, the construction of buildings and infrastructure, and other activities associated with tourism produce impacts on the environment (Ceballos-Lascurain, 1996). According to Ceballos-Lascurain (1996), in protected areas, tourism impacts are either direct or indirect. Direct impacts are caused by the presence of tourists, indirect impacts by the infrastructure created in connection with tourism activities. Because of its nature, Plog (1974) notes that 'tourism contains the seeds of its own destruction, tourism can kill tourism, destroying the very environmental attractions which visitors come to a location to experience'. Glasson *et al* (1995) also state that tourism is, by its very nature, an agent of change. However, some of the impacts of change may be controlled, regulated or directed. If properly managed, tourism has the potential of being a renewable industry, where resource integrity is maintained or even enhanced. If mismanaged, or allowed to expand with short-term goals and objectives, it has the capability of destroying the very resources upon which it is built.

The development of tourism in destination areas can also be explained through a model known as the Product Cycle (Butler 1980; Prossor 1994). This model assumes that environmental damage caused by tourism activities occur when a capacity threshold is reached in a destination area. That is, when the number of tourists approaches levels which strain the capability of the host area to provide a good visitor experience. The development of tourism in destination areas is often accompanied by a progressive metamorphosis of the destination environment. The product cycle describes tourism as a dynamic industry that is influenced by the changing tastes of the holiday-makers. It shows that there are environmental, physical, social and economic factors that limit a tourist destination area's capacity to absorb tourists and their associated facilities and institutions (Hall, 1995). If such factors are not taken into consideration, it is possible for tourism to damage the socio-economic, cultural and environmental fabric of the destination area. Butler (1980) and Prossor (1994) note that when the destination area is environmentally degraded and no longer attractive to tourists, it is abandoned with the hope to discover a fresh one elsewhere: the cycle starts all over again. The product cycle, therefore, provides a useful conceptual framework within which it is possible to study various forms of land use intensification and environmental quality in a tourist destination area.

The World Commission on Environment and Development (1987) and the Rio Summit of 1992 promoted the adoption of sustainable development in any economic development, such as tourism. The concept of sustainable development is hinged on three main concerns, these are: social equity, economic efficiency and ecological sustainability (Angelson *et al*, 1994). According to Serageldine (1993), economic efficiency aims at the optimal use of natural resources to meet human needs or to maximise human welfare within the constraints of the existing capital. Social equity advocates for the fairness and equal access to resources by all the user groups. This is aimed at ensuring equity in the distribution of costs, benefits, decision-making and management, a factor that is hoped will eradicate poverty. Ecological sustainability emphasises that the use of renewable natural resources should not be faster than the rate at which the natural process renews itself. This is assumed to be having the potential to preserve the ecological subsystems (Serageldine, 1993). As a result, if tourism is to contribute to sustainable development, it must be economically

viable, ecologically sensitive and culturally appropriate (Wall, 1997).

In Botswana, the rapid development of tourism since the late 1980s mostly has occurred in the northern parts of the country where a variety of wildlife species and beautiful savannah forests exist. The Okavango Delta, located in Ngamiland District, North-western Botswana is one of the country's leading tourist destination areas. Tourism has stimulated the development of a variety of allied infrastructure and facilities, such as hotels, lodges and camps, airport and airstrips, in the Okavango region. Through its backward linkages, wholesale and retail businesses have also been established, especially in Maun, to offer various goods to the tourist industry. Tared roads and other communication facilities have also been developed in Ngamiland District partly to facilitate tourism development. Tourism also provides employment opportunities to local communities in Ngamiland District and it is a significant source of foreign exchange for Botswana. Despite its positive socio-economic impacts however, the industry is beginning to have negative environmental impacts in the Okavango Delta.

The objective of this paper is to discuss these negative environmental impacts. The paper also suggests alternative strategies that can be adopted to minimise the problems. The aim of this study was primarily to provide baseline information on the ecological impacts of tourism in the Okavango Delta. As a result, the methods used for data collection were limited in that they mainly focused on observations, informal interviews and secondary sources. This means, a detailed ecological study using comprehensive scientific methods should be carried out to provide an elaborate picture on environmental impacts of tourism in the Okavango Delta.

Background of Tourism Development in Botswana and the Okavango Delta

Tourism development in the Okavango Delta and in Botswana is part of a global tourism trend. According to the World Tourism Organisation, WTO (1999) international arrivals throughout the world increased from 429 million people in 1989 to 625 million people in 1998. This represents an increase of 45.7% in the ten year period. In terms of receipts, they increased from US\$ 211 billion in 1989 to US\$ 445 billion in 1998. This also represents an increase of 101.4% in the same period. The growth of international tourism is attributed to higher standards of living in the west and improved modes of travel (Harrison 1995; McIntosh *et al* 1995 and Cebaloss-Lascrain 1996). Of the global tourist arrivals, approximately 4.0% visited Africa (WTO, 1999). International tourism, both for arrivals and receipts grew faster in developing countries, reflecting a wider distribution of tourism revenues in favour of the traditional and new, emerging tourism destination areas in developing countries (*ibid*).

The WTO (1999) states that Southern Africa is presently the fastest growing tourist destination in Africa, with increases of 17.1% and 10.5% for arrivals and receipts, respectively, between 1994 and 1995. The share of Southern Africa in total tourist arrivals in Africa increased from 13.5% in 1990 to 31% in 1995. The growth of tourism in Southern Africa can be attributed to the return of peace in the region after decades of liberation wars. Although Botswana was not involved in liberation or civil war, like most of her Southern African neighbours, the political instability in the region directly affected tourism development in the country. However, the establishment of democratic governments in South Africa, Namibia, Zimbabwe and Mozambique changed tourism development not only in Botswana but also in the whole of Southern Africa.

As shown in Table 1, Botswana is the third largest tourist destination in Southern Africa after South Africa and Zimbabwe. Tourist arrivals in Botswana increased from 644,000 in 1995 to 740,000 in 1998. This increase is also noted by the Department of Tourism, DOT (2001) which states that tourist arrivals in Botswana have grown considerably from 1994 to 1998 with an annual growth rate of almost 13% and a remarkable growth of 23% in 1997. According to the DOT, in 2000, Gaborone received the largest share of visitors (44.8%), Francistown (28.2%), Okavango Delta (12.1%), Kasane/Chobe (11.8%), Maun (10.6%) and Selebi-Phikwe (3.0%). The combined visitors to Maun and Okavango Delta stood at 22.1%. About 36,074 tourists visited

the Okavango Delta in 1995, this number increased to 49,556 in 1998 (DOT, 2000b). Most of the tourists that visit the Okavango Delta come from North America, Western Europe, Australia, New Zealand and South Africa (Mbaiwa, 2002).

Table 1: Regional trends in tourist arrivals and receipts

	1995	1996	1997	1998
Botswana Arrivals (000)	644	707	734	740
Share in Africa (%)	3.2	3.2	3.2	3.0
Receipts (%)	3.3	2/1	2/0	1.9
Namibia Arrivals (000)	399	405	502	510
Share in Africa (%)	2.0	1.9	2.2	2.0
Receipts (%)	3.8	3.4	3.7	3.5
South Africa Arrivals (000)	4 488	4 944	5 437	5 981
Share in Africa (%)	22.0	22.7	23.5	24.0
Receipts (%)	21.7	22.8	25.5	24.8
Zimbabwe Arrivals (000)	1 539	1 746	1 495	1 600
Share in Africa (%)	7.6	8.0	6.5	6.4
Receipts (%)	1.8	1.8	1.9	1.7

Source: World Tourism Organisation, WTO (1999)

The rapid growth of tourism in the Okavango Delta is credited for stimulating the development of a variety of allied infrastructure and facilities, such as hotels, lodges and camps, airport and airstrips, in the Okavango region. Through its backward linkages, wholesale and retail businesses have also been established, especially in Maun (the main town in the Okavango region), to offer various goods to the tourist industry. The improvements in the communication system has made northern Botswana especially, Maun in Ngamiland and Kasane in the Chobe, to be linked by both air and road network with other parts of Botswana and with other Southern African neighbours. For example, Maun and Kasane are linked through the air and road network with Johannesburg (South Africa), Windhoek (Namibia), and Victoria Falls (Zimbabwe). In addition to its economic contribution to the people of Ngamiland, tourism in the Okavango Delta and the Chobe has become a significant source of foreign exchange and contributes about 4.5% to Botswana's Gross Domestic Product, which is the second after diamonds. It employs about 10,000 people which constitute 4.5% of total employment in Botswana (BTDP, 1999).

Despite the contribution of tourism to the economy of the Okavango and Botswana, its rapid growth is creating problems of efficient policy implementation and monitoring of tourist activities by government bodies. Particular attention is paid to the Departments of Wildlife and National Parks, Tourism and the Tawana Land Board. The Department of Wildlife and National Parks is responsible for the management of wildlife resources both in protected areas such as Moremi Game Reserve and in communal areas. The Tawana Land Board is responsible for the land resources and the monitoring of tourism activities in areas under its control. The Department of Tourism is responsible for the overall tourism management not only in the Okavango Delta but in Botswana as a whole. The Department of Tourism has to work side by side with other government

ministries and departments in facilitating tourism development. While an institutional framework exists to foster a sustainable tourism development in the country, findings indicate that the rapid growth of tourism in the Okavango Delta is associated with poor policy implementation and the overall monitoring of tourism activities. As a result, negative environmental impacts of tourism in the Okavango Delta are beginning to be felt.

Environmental Impacts of Tourism

The lack of government awareness in tourism impacts prior to the late 1980s meant that the tourism industry in the Okavango Delta was left to its own devices. Government was during this time pre-occupied with more pressing development priorities such as health, education and infrastructure. Because of this approach, tourism in the Okavango Delta developed rapidly in a rather uncontrolled manner. Its explosive growth led to a proliferation of some tourist camps and lodges in environmental sensitive areas of the Okavango Delta. It is from this background that the lack of tourism management and the negative environmental impacts of tourism in the Okavango Delta can be understood. Findings indicate that some of the negative environmental impacts of tourism in the Okavango Delta include the following:

(i) The creation of illegal roads and the overcrowding of tourism facilities in environmental sensitive areas

The poor monitoring of tourism activities has resulted in the creation of illegal roads by tourist vehicles in some environmental sensitive areas such as the Xakanaxa in Moremi Game Reserve located within the Okavango Delta. The creation of illegal roads results in soil trampling which affects vegetation and the ecology of the delta. This reduces the scenic beauty of the Okavango Delta ecosystem. Roodt (1998) estimates that there are 178 tourist vehicles that use the Xakanaxa area every day in the tourist peak season. However, the number might be more if other additional vehicles supply trucks, official vehicles, research and filming vehicles are taken into consideration. Roodt (1998:6) further states that 'the actual number is closer to 250 or more vehicles per day during the busy season... I have personally counted 63 vehicles in the Xakanaxa camping site'.

The high number of tourist vehicles has resulted in the widening of roads between South Gate and Xakanaxa, and between Third Bridge and Xakanaxa in Moremi Game Reserve. In some cases roads have a width of twenty metres, resulting in destruction of the dryland ecology of the Okavango Basin. Government also does not have criteria in which vehicles visiting the Okavango Delta are categorized. As a result, both small and big trucks can be driven in any part of the Delta including the environmentally sensitive parts which should require either only small trucks or no trucks or tourists at all. Ceballos-Lascurain (1996) categorises tourism areas in protected areas into five main zones. He notes that environmentally sensitive areas should be dedicated to scientific research in which no tourists or vehicles should be allowed to visit them. The Department of Tourism, (2000a) does state that overutilisation of certain zones in conserved areas occur when such zones are used by all tourist groups, particularly in high tourism seasons. However, the creation of many illegal roads and trails also indicates failure by the Departments of Tourism, Wildlife and National Parks and the Tswana Land Board in implementing the country's rules and regulations in controlling tourist traffic and numbers in environmental sensitive and protected areas.

The creation of illegal roads is further exacerbated by the fact that tourist camps and lodges are generally concentrated within small areas in various parts of the Delta such as Xakanaxa, along the Boro River and in the panhandle area. The concentration of tourist facilities in the western part of the Xakanaxa triangle means that the various categories of tourist (high cost, mobile, self-drive and day visitors) become concentrated in a narrow part of the reserve between Xakanaxa and Third Bridge. This again shows failure to observe carrying capacity in environmental sensitive areas by the Departments of Tourism and Wildlife and National Parks. In the past,

attempts were made by government to determine carrying capacity in the Delta by the number of beds and rooms allowed in accommodation facilities (the three lodges at Xakanaxa have a total of 67 beds). However, this approach is ineffective in that the Departments of Tourism, Wildlife and National Parks and the Tawana Land Board fail to monitor whether operators observe this requirement. As a result, beds and rooms in some camps exceeded the prescribed numbers allowed by government. The concentration of camps and lodges with a small radius also shows failure by government to devise a proper management plan for tourism development in which the radius between each facility is determined based on the ecological impacts of such facilities in the Okavango Delta. This problem is exacerbated by the fact that in the past, no Environmental Impact Assessment was carried out to determine the possible impact of locating tourism facilities in the Okavango Delta. Allocation was carried out based on what operators preferred and the areas they wanted.

(ii) Noise pollution and the disturbance of wildlife species

Noise pollution from engine boats, small engine aircrafts, road vehicles and tourists is also a problem in the Okavango Delta. The noise is disturbing to hippo populations, nesting birds and other wildlife species. Roodt (1998) notes that ten years ago when there were fewer boats in the Xakanaxa area, the islands in the fringes of the Xakanaxa lagoon were favourite nesting spots but today only a few birds nest in the area. The increase in boat traffic in the Gedikwe/Xhobega area in Moremi Game Reserve has also shown a decreasing effect on the numbers of nesting sites over the last seven years (*ibid*).

Roodt (1998) states that a total of 32 power boats of which 26 belong to safari operators and six to government officials are currently licensed to use the Xakanaxa area. The fast movement of engine boats creates waves, which disturb nesting birds, mammals and reptiles which live in water. Crocodiles and hippos seek undisturbed areas and the presence of too many engine boats in the Okavango Delta disturbs these species. Roodt (1998) states that hippos, which were in large numbers seven years ago, have already moved out in the Xakanaxa lagoon. The disturbance of the animal habitats negatively impacts on the wildlife numbers of the delta. Previous studies (e.g. Ringrose and Perkins 1996, Perkins 1996) have shown that Botswana's wildlife species face a constant trend of decline.

While impacts of boats at Xakanaxa show the effects of tourism in the lower parts of the Okavango Delta, in the upper parts, that is, in the panhandle, engine boats are also causing noise pollution (NRP, 2001). The boat traffic in the area amounts to 15-20 boat passes a day in most parts of the river. There is an estimated 111 engine boats owned by the various tour operators in the area (*ibid*). According to Matthews (1982) and NRP (2001), noise pollution by motor boats and by people can disturb waterfowl, leading to higher infantile death rates in sensitive populations. However, Gall (1995) notes that water fowls in the Okavango Panhandle are not only disturbed by the wakes and noise from motor boats but also by the frequency of other more general boating and tourism related activities. For example, the fishermen in the panhandle area note that boat noise is disturbing fish at nesting sites (NRP, 2001). The problem of noise pollution in the Okavango Delta shows poor planning or failure to observe carrying capacity and also, the lack of management plans that recognise sustainable tourism development. The crowding of tourist facilities and the noise pollution generated in these areas suggests that the Okavango Delta is likely to be environmentally degraded in the near future if measures are not taken to address the problem.

The influx of tour operators in the Okavango Delta has also led to an increase in the number of small engine airplanes and establishment of airstrips in the area. There are about 23 privately owned airfields in and around the Okavango Delta registered with the Department of Civil Aviation. In addition, government has seven airstrips in the area, this excludes those operated by the Botswana Defence Force. Interviews with the Department of Civil Aviation (DCA) in Maun indicate that some of the airstrips owned by tourism operators are crowded and their construction was not necessary. However, the DCA notes that the problem was created by the zoning of the delta into

concession areas that are each allocated to different concessionaires who prefer separate and individual airstrips, rather than sharing with neighbours. Airstrips have a number of small engine aircrafts landing and taking off frequently, hence they are a source of noise pollution, which disturbs the animal and bird life. Small engine aircrafts are used to carry both tourists and supplies from Maun to the various camps and lodges in the Delta. Maun Airport which is used as a base has become one of the busiest airports in Botswana and Africa, especially during tourist peak seasons. According to the *Ngami Times* (2001: 1), 'Maun Airport is regarded as the second busiest international in Africa in terms of aircraft movements after the combined Johannesburg area airports of Johannesburg International, Lanseria, Rand and Grand Central'.

Based on aircraft movement data from the Maun Airport for 2000, the airport has an average of 256 aircrafts landing and taking off each day during the tourist peak seasons of April to October. In the non-tourist peak seasons of November to March, the figure is reduced to an average of 152 aircrafts landing and taking off each day. As shown in Table 2 a total of 40,246 aircraft movement were recorded at Maun Airport in 2000. Domestic aircrafts made 86.1% of the total movements, international movements made only 7.0% while non-commercial aircrafts make 6.9% of the total movements. However, these findings are likely to represent a low scenario as 2000 was a bad year for tourism development with few tourists visiting the Okavango Delta. This was because of the floods that made parts of Moremi Game Reserve closed for some time for tourists, crises in Zimbabwe as the country moved towards the parliamentary elections and political instability in the Caprivi Strip in Namibia.

Table 2: Aircraft movement at Maun International Airport, 2000

Description	Total Movements	Percentage
Commercial		
International	2,846	7.0
Domestic	34,666	86.1
Non-Commercial	2,786	6.9
Totals	40,246	100.0

Source: Department of Civil Aviation, DCA (2001)

As shown in Table 2, most of the aircraft movements were domestic flights made by small engine aircrafts. These aircrafts fly into the delta either transporting tourists or carry supplies as already noted. At present, there are roughly eight privately owned air companies with a total of 44 small engine aircrafts operating in the Okavango Delta. Although much research and evidence is needed to provide detailed information on the negative impacts of noise pollution caused by small aircrafts to wildlife in the Okavango Delta, informal interviews with operators and government officials indicate concern about the effects of aircraft and the noise they cause in the Delta. They noted that the presence of too many aircraft in the Okavango Delta, which in most cases fly at very low altitudes, cause a disturbance to the wild animals and nesting birds. The problem of noise pollution and the disturbance of wildlife in the Okavango Delta also suggests that tourism carrying capacities should be observed if tourism in the wetland is to be ecological sustainable.

(iii) Impacts on the sanitation system and water resources

The high volume of tourists visiting the Okavango Delta has reached levels where the amount of garbage generated has increased and is beginning to negatively impact on the environment (Masundire *et al* 1998, DOT 2000a). As already noted, about 50,000 or more tourists visit the

Delta every year. However, waste generated in tourism facilities is poorly managed. The problem of waste in the Delta is characterised by failure to dispose of waste following proper waste disposal procedures in tourist camps. The DOT (2000a) states that the large number of tourism enterprises licenses that have been issued for mobile safari operators results in most of the mobile operators sites permanently occupied and solidly booked. This has led to mobile operators spilling over to public campsites, and occupying these sites with more people than permitted, thus exceeding carrying capacities and the design capabilities of ablution blocks (*ibid*). This negatively impacts on the sanitation systems and the environment in the area. The result has been poor waste disposal in camping sites in the Okavango Delta. Littering especially plastic bags, pieces of paper, cans and bottles are a common sight along the roads and on campsites in the Okavango Delta.

The proliferation of high-cost tourist lodges and camps in the Okavango Delta, each with its septic tank for wastewater collection, is likely to increase the potential for groundwater pollution. The overcrowding of the tourist lodges and camps in specific areas exacerbates this problem. Septic tanks for waste from showers and toilets in some camps are not constructed following any environmental standards, and in some camps such tanks do not exist except for “pit latrines”, a factor also noted by McCarthy *et al* (1994). In addition to the failure to dispose waste (both grey and black water) in accommodation facilities, there is also a problem in some camps of domestic waste that is disposed into the Delta. The procedure is that operators in safari camps and lodges should collect their waste and dispose of it in designated dumping sites and sewages in Maun or engage the North-West District Council to do it on their behalf. However, failure to implement regulations by government has resulted in nothing of this sort being observed by operators.

McCarthy *et al* (1994) state that many tourist camps in the Okavango Delta rely on borehole water to supply camp needs, and moreover discharge waste and sewage effluent into the ground water. This situation creates the potential for the contamination of drinking water supplies. The water table in the Okavango Delta is high and the soils are sandy with a high permeability. Pollutants can thus travel much greater distances into the soils. According to McCarthy *et al* (1994), the water table in the Okavango Delta is usually less than one metre below the surface during flood seasons. As a result, discharge of effluent into ground water is unavoidable. NRP (2000) states that blue-green algae has been recorded in the Okavango system, and these can be toxic under bloom conditions. The report further notes that the potential for groundwater contamination with nitrates from septic tank drainage in areas where groundwater is close to the surface (10 metres or less), and contamination by fecal bacteria and possibly viable pathogens could occur if septic tanks are situated in areas where groundwater is at one metre or less beneath the surface. This scenario suggests that water pollution might be possible in areas around tourist camps and lodges in the Okavango Delta.

(iv) Impacts caused by Bushfires

Bush fires are a problem in the Okavango Delta. Although there are several causes to bushfires (e.g. lightning), human activities are also a cause of the fires. Interviews with some of the workers in the Okavango Delta revealed that tour operators burn the veld just before the rainy season (November – March) so that green grass should grow when the rain finally comes. It is assumed that when the burnt area finally grows some grass, it attracts wild animals such as springboks, zebra, impalas, kudus and wildebeest. The presence of such wildlife animals in these areas therefore provides an opportunity for tourists to see some of the animals they have paid to see at closer range and take good pictures. However, bush fires can be a problem since they destroy property such as tourist camps in the Delta where the same tourists often get accommodated.

Similar findings by Tacheba (2001) points out that fires in the Okavango region occur mainly in Wildlife Management Areas and in communal areas. These fires are located along river channels and mainly occur between the months of August and October. From this information, the cause of veld fires in the Okavango Delta can, therefore, not be associated with lightning as they occur in the dry season, but to human activities. Although Tacheba does not record the number of fires that occurred in the region, he notes that information obtained from Landsat Satellite Imagery shows that there has been an increase of such fires in 2001 when

compared to those of 2000. While Tacheba associates fires with local community activities such as *molapo* (floodplain) crop cultivation as farmers burn dry plant remains from the previous season, he also notes that camp keepers around the Delta burn the veld just before the raining season with the hope that fresh grass may grow to attract animals for their tourist clients to see. The effects of bush fires are not only on tourism property but on the wildlife species as well: fire destroys the vegetation which animals feed on and can, of course, also kill them.

(v) The Expansion of Illegal Settlements

Tourism development is associated with the expansion of illegal settlements in the south-western parts of the Okavango Delta. An example of such a settlement is Thabazimbi, a squatter settlement that has been developed by workers who are working for Gunn's Camp, Bush Camp and Sametsi Camp along the Boro River. Safari workers in these camps are not provided with accommodation, as is the case with other camps in the Delta. The result has, therefore, been the development of a squatter settlement.

The expansion of illegal settlements in the Okavango Delta is likely to have long-term ecological effects in the area. Illegal settlements result in the introduction of socio-economic activities such as crop and livestock farming. Findings indicate that most communities in Botswana, including those that previously did not practice any agricultural farming, are beginning to do so. Mbaiwa (1999) notes that Basarwa communities of Khwai and Mababe in the south eastern parts of the Okavango Delta previously did not practice farming. However, they are beginning to engage in agricultural activities such as crop and livestock farming. The Basarwa community of Ditshiping in the southern parts of the Delta was also found to be involved in crop and livestock farming (Mbaiwa, 2002).

According to Campbell (1997), most of southern and eastern Botswana was endowed with a variety of wildlife. However, such wildlife species have since disappeared, mainly because of the growth of the human population and the introduction of socio-economic activities such as crop and livestock farming. The Schwelle Region in northern Kgalagadi had boreholes and cattle farming introduced to it after Botswana's independence in 1966 to promote the country's beef production. Perkins and Ringrose (1996) note that the various wildlife species which used to exist in this region have since been wiped out by the introduction of activities such as cattle farming. This, therefore, suggests that if illegal settlements are allowed to spread in the Okavango Delta, there are likely to be serious ecological problems in the area in future.

(vi) The Introduction of Invasive Species

The human encroachment and movement of people as well as tourists has also lead to the introduction of invasive and unwanted species in the Okavango Delta. One such species is *Salvinia molesta* or Kariba weed or *Motshimbamo* as it is locally known in the Okavango Delta. *Salvinia molesta* is a small, free-floating fern with roots trailing in the water and a narrow rhizome. The Kariba weed reproduces vegetatively by fragmentation of the main rhizome and regenerates easily. This weed is indigenous to South America, however, it has become widely distributed in tropical areas such as in India, Malaysia and Australia. In Africa, it was first discovered in Zimbabwe in Lake Kariba (hence also called the Kariba weed). The weed was later found in Zambia, Zaire, Angola, Mozambique, Namibia (eastern Caprivi Strip), South Africa and Botswana. *Salvinia molesta* was first reported in Southern Africa in 1948 in the Zambezi River. In Botswana, it was first reported in the 1950s in the Kwando/Linyanti/Chobe River systems. In 1986, it was found in the Okavango Delta and Moremi Wildlife Reserve where it is mostly concentrated in the Xakanaxa, Badumatau, Abaquo, Xini and in the Khwai River system.

The negative environmental effects of the Kariba weed or *Salvinia molesta* are such that the weed forms thick impenetrable mats which over time develop into floating islands. According to Forno (1992) this has the capacity to cause severe ecological alterations, of which the most significant are that it takes over the water surface, prevents sunlight from reaching other water plants and stifles plant competition. The weed also removes nutrients from the water, decreases

the oxygen content of the water (in some instances as high as 30%), destroys fish life and creates undesirable sediment and debris along river beds. This could eventually cause the Okavango Delta to become smaller and smaller, in effect shrinking its size.

Although there is no information and evidence to account for the spread of the Kariba weed between continents and countries, it is possible that tourism or human movements may be responsible for its distribution between Southern Africa and South America. The general trend in human movements between continents and countries was, until World War II, concentrated mainly along water ways such as river channels through the use of boats. Forno (1992) notes that in the Okavango Delta, boats and other forms of water transportation are the major means of spreading *Salvinia molesta* in water bodies. Wild animals such as hippos and other large aquatic reptiles such as crocodiles can also spread Kariba weed.

The Zambezi River as a major water way transportation route in Southern and Central Africa might have played a significant role in the distribution of *Salvinia molesta* in the region. It has been used by travelers, traders, slave traders, missionaries and hunters before and during the colonial period. It provided a link between Southern and Central Africa on the one hand with the Americas and Asia and Europe on the other. Through the Chobe and the Linyanti River systems, the Zambezi River provided a link to Botswana's Okavango Delta and Chobe regions. The Okavango Delta and the Chobe regions are known for a variety of wildlife species which in the past were hunted to obtain wildlife products for sale overseas (Mbaiwa, 1999). With the democratization and the establishment of self-government in the region, there were two main important tourist destinations in the Zambezi River: Victoria Falls in the upstream and the Kariba Dam in the downstream. Human movements through the use of boats along the Zambezi River and the Chobe-Linyanti Rivers remain central in explaining the spread of *Salvinia molesta* in the Okavango Basin. These movements have increased with the growth of tourism in Southern Africa. As a result, the use of tourist boats in the Okavango-Kwando-Linyati-Chobe and Zambezi River systems as well as that of mobile safari vehicles from East Africa to Southern Africa can be attributed to the spread of the Kariba weed in the region. Once Kariba weed is in the water, animals such as hippos and boats easily transport the weed from one place to the other.

The Government of Botswana has since introduced weevil (*Cyrtobagous salviniae*) as a biological measure to control the Kariba weed. The weevil is also indigenous to South America. It only eats *Salvinia molesta* and can only breed on it. It lays its eggs underneath the plant and its larvae then burrow into the plant's rhizome, causing the plant to collapse from within. Other forms of *Salvinia molesta* control include blocking water inflows, pumping water from infested lagoons, building fences to divert animal movement, re-routing tourist boats and roads and manually removing weeds by raking and burning. While government reports indicate that the programme of controlling the weed is likely to become successful, the plant still exists in isolated pockets and will probably continue to do so. Local communities in the Okavango Delta like those of Khwai Village and tourist safari lodge and camp managers state that the weed appears to be uncontrollable. For example, some of the pools in the Xakanaxa and Khwai areas are currently covered with *Salvinia molesta*; interviews with safari managers in these areas indicate that hippos have as a result re-located elsewhere, hence reducing the value of their tourism facilities. Therefore, *Salvinia molesta* poses a serious threat not only to the future survival of the Okavango Delta, but of tourism as well. It has the potential to destroy the ecology of the Okavango Delta as well as the growing tourism industry in the area and also affect the socio-economic livelihoods of the people of Ngamiland District who are directly or indirectly depending on the Okavango River and Delta.

Conclusion

Since tourism in the Okavango Delta is beginning to negatively impact on the environment, sustainable measures on tourism activities should be adopted. This suggests that the principles of ecological sustainability should be observed. It has already been noted that ecological sustainability

stresses the need to preserve the integrity of ecological subsystems viewed as critical for the overall stability of the global ecosystem. Failure to observe tourism carrying capacity in tourism areas such as the Xakanaxa in Moremi Game Reserve and along the Boro River has led to the overcrowding of tourist facilities and tourist activities. This has then led to the creation of illegal roads and the destruction of the dryland Okavango ecology. The increase in boating activities in the Xakanaxa has also resulted in the re-location of aquatic species such as hippos in pools in the area. In order to address this problem, planners should design management plans that observe tourism carrying capacity and recognize Social Impact Assessment and Environmental Impact Assessment when locating tourism facilities and tourism activities in environmental sensitive areas. This approach is largely ignored in the Okavango Delta when tourism facilities as well as activities are carried out. Re-location of some of the tourist facilities particularly camps and lodges at Xakanaxa and along the Boro River to reduce tourists activities the area is also advised. This should be able to reduce the creation of illegal trails and the destruction of the Okavango Delta ecology. The re-location of some tourist activities at Xakanaxa, along the Boro River and in the panhandle coupled with measures of setting limits to tourist numbers visiting specific areas should reduce pressure on natural resources.

Environmental problems caused by tourism development in the Okavango Delta can also be minimised if responsible government bodies are provided with the necessary equipment and political support. These government bodies include the Departments of Tourism, Wildlife and National Parks, the Tawana Land Board (and to some extent, Waste Management). Findings indicate that poor monitoring of tourism activities and policy implementation has been associated with lack of equipment and trained personnel to effectively manage tourism development. The tourism industry, therefore, is almost left to its own devices and as much of its activities are not closely checked this has resulted in negative environmental impacts. Trained personnel and equipment, especially vehicles, should be provided to these government bodies to afford them the opportunity to effectively ensure a sustainable tourism industry in the Okavango Delta.

The failure to follow proper waste management guidelines in environmentally sensitive areas by operators in the Okavango Delta should be addressed. Mention has been made that waste from toilets and showers is not disposed of following prescribed guidelines. The design of some tourism facilities was also done without environmental consideration. This problem can be addressed if government takes the initiative to monitor tourism activities in the Delta and ensure that all operators respect the rules and regulations. For example, domestic waste, especially litter, is supposed to be disposed in Maun at a designated dumping site. However, failure to ensure this regulation has meant that operators have failed to adhere to it. Botswana's environmental standards on waste disposal and management specific for the Okavango Delta should be assessed and made appropriate for the wetlands. Regulations on the design of toilet facilities and the disposal of domestic waste should be designed to prevent soil and water pollution. Waste should be collected and be deposited at specific chosen dumping sites away from environmental sensitive areas of the Okavango Delta.

Some mobile tour operators, especially those coming from outside Botswana, are known to be operating without licenses for the Delta. Although the Department of Tourism has in the past attempted to address this problem, it is noted to be still persisting. DOT (2001) noted that mobile tour operators are partly responsible for over crowding tourist facilities especially in the Xakanaxa area. While DOT is preparing guidelines on which operators should operate, it is recommended that government should in future consider making it mandatory for any tourist or visitor into the Okavango Delta to be accompanied by professional guides. Although this appears not feasible in the near future due to the shortage of guides, if implemented, it will create job opportunities for the majority of the people in Ngamiland District and Botswana as a whole. It will also reduce environmental problems caused by tourists, especially illegal road driving in the Okavango Delta.

Since there has been an increase in tourist numbers and tourism facilities in the Okavango Delta in the last two decades, efforts should be made to determine carrying capacities to prevent environmental degradation of the wetlands. The use of room and bed numbers to control tourist numbers is ineffective. So too is the high-cost low volume tourism approach. As a result, these

approaches need to be revisited to promote a sustainable tourism industry in the Delta.

The tourism industry in Botswana has expanded tremendously in the last two decades. At independence in 1966, it was almost non-existent and insignificantly made any contribution to the country's Gross Domestic Product, however, by 1997 had grown to be the second largest revenue earner (after diamonds) for Botswana contributing 4.5% to the GDP (BTDP, 1999). The current poor monitoring of tourism activities by government however indicates that government can no longer cope with its demands. As a result, there is need to assess its decentralisation to other bodies, a scenario that necessitates the establishment of a Tourism Board in Botswana. Its successful implementation should direct and monitor the development of tourism as well as the utilisation of tourism products such as wildlife and veld products in the Delta. The various stakeholders in the tourism sector should compose the membership of the Board. Particular attention should be given to the local people in tourism areas such as the Okavango Basin, tour operators or HATAB, the Department of Wildlife and National Parks, the Department of Tourism, the Land Boards and Non-Governmental Organisations.

The control of new settlement expansion in Okavango Delta should also be carried out. However, the rights of local communities living in tourism and wildlife designated areas should be recognised because these areas are a part of their ancestral land. This suggests that government should recognise the already existing settlements in tourism and wildlife areas and find ways of making them more viable to new developments such as tourism. This also means that settlements in tourism and wildlife areas need to be provided with the necessary social facilities such as clean water supplies, communication (e.g. good roads and telephones), health facilities (e.g. clinics) and shopping facilities (e.g. grocery and clothing shops), rather than being forced to relocate in less favourable environments as is the case with the Khwai settlement. However, care should be taken to avoid the expansion of illegal squatter settlements in the Okavango Delta as demonstrated by Thabazimbi. That is, government should not allow any new settlements developing in the Okavango Delta.

Finally, the promotion of community-based tourism and the establishment of small-scale tourism activities can be another alternative in which major environmental impacts in the Okavango Delta can be controlled. Cater (1991) notes that small-scale activities have little impacts on the environment as opposed to large-scale tourism facilities. The idea of community-based tourism is appropriate for the Okavango Delta since it is based on the principles of eco-tourism and sustainable development. Eco-tourism promotes environmental sustainability and community development. That is the way future tourism in the Okavango Delta should go.

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