Desiccation of the Gomoti River: Biophysical process and indigenous resource management in Northern Botswana

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Abstract

For at least 200 years, Gomoti River people and their neighbours lived interactively with the Okavango flood pulse system, travelling widely in dugout canoes, practicing flood recession agriculture, fishing, hunting, and collecting wild foods. Today they are wetlanders without wetlands. A major outflow channel of the eastern Okavango Delta in the 1930s, the Gomoti River rarely flows these days. This paper explores the Gomoti's demise, through the lenses first of science and second of Gomoti basin residents. Models developed over the past 20 years attribute the Gomoti's drying to a complex set of bio-hydrologic processes and feedback loops that begin with sedimentation and conclude with channel switching, peat fires, and purging of toxic salts. Such models essentially omit the long history of human habitation and ecological interaction with the delta. Local people, on the other hand, tell of deliberate and systematic management of channels and floodplains, and they argue this management kept the river healthy and flowing. The picture is confounded by colonial era interventions and by Botswana government policies partitioning the Gomoti and restricting access to its headwaters. We conclude with a model combining meso-scale scientific explanation with micro-scale indigenous constructions as a context for new thinking about Okavango Delta resource management.

Keywords: River desiccation; Flood pulse system; Indigenous natural resource management; Wetland process; Human ecology; Okavango Delta; Gomoti River

1. Introduction

As a flowing system, the Gomoti River in the eastern Okavango Delta is dying. Though its incised channel collects rainwater, the river has not been consistently linked to the Okavango flood pulse for 50 or more years. People, once dependent on Gomoti waters and wetlands for survival, have moved. Riparian and floodplain vegetation is being supplanted by drought-surviving species common to the arid eastern margins of the delta (Ringrose et al., 2005). Fish, waterbirds, and aquatic animals and invertebrates have migrated elsewhere.

Desiccation of the Gomoti is said to be the result of vegetation blockages leading to channel switching, particularly in its feeder channel, the Nqoga (Wilson, 1974; McCarthy et al., 1987). According to a widely cited hydrologic model (McCarthy et al., 1986; McCarthy, 1992), this process, occurring over decades, is critical to the delta's ecological well-being, and is the principal reason why the eastern distal rivers, such as the Gomoti, have ceased to flow regularly. Models explaining channel switching in the mid-delta assume the process at such a grand scale to be beyond human manipulation. In so doing, they minimize the ecological role of humans, at least at the local scale, despite their presence in the system for hundreds of years (IUCN, 1992). This paper argues that people—their movements, their exploitation of resources, their riparian and floodplain management—have long been part of the flood pulse system of the Gomoti and adjacent rivers and, perhaps by their absence, in the Gomoti's desiccation. Their current plight as wetlanders without wetlands challenges government planners and policy makers as well as "ecological purists" to reconceptualize the role of humans in the Okavango Delta's past and future. "Wetlanders" here means communities of peoples who live upon or beside water-dominated landscapes and depend to some degree upon them (Coles and Coles, 1989). A comparative global study of wetland human ecology identified "a wetland culture complex," inclusive of many of the elements of the Gomoti system, including mobility using canoes, emersion in riverine and floodplain resource extraction, and finely tuned adjustments to fluctuations in the environment including the ebb and flow of disease (Kiviat, 1991).

We begin with a discussion of methodology followed by brief background on the Okavango Delta and the Gomoti River. We then examine documentary evidence of the Gomoti's desiccation and provide a synopsis of a series of interventions that may have changed the Gomoti in colonial days as well as a summary of geopolitical changes since independence that have cordoned humanity from the Gomoti catchment. We then report on a survey of elders to ascertain what life was like in

"the old days" when the Gomoti's coupled human and natural flood pulse system last functioned. Finally, given the information at hand, we ponder what the deletion of indigenous humans from many discussions of change in the Okavango Delta might imply for current and future resource management.

2. Scale of analysis, methods and materials

This paper is about the human ecology of wetlanders (Young, 1974, 1989) and biophysical process in the outer reaches of an exotically supplied wetland system superimposed on a semi-arid landscape. Hydrologic and biotic processes in the Okavango operate at many scales from hippo movements, sedimentation of distributaries and development of mats of vegetation which close off *madiba* (sing. *lediba*) or oxbow lakes (McCarthy et al., 1998, 1992) to processes affecting the entire delta system, chief among them mid- and long-term climate cycles and tectonics (McCarthy et al., 1997; Gumbricht and McCarthy, 2003, pp. 181–196). Our analysis, at meso- and micro-scales, focuses on a single distal river with its associated floodplains and riparian features. The timeframe is 50–100 years.

To reconstruct the recent desiccation of the Gomoti, we began by reviewing the documentary record and map and aerial photo coverage. Inexplicably, despite its hydrologic importance into the first half of the 20th century and despite its human habitation for hundreds, if not thousands of years, there is little written about the Gomoti River. It is not mentioned in such early traveller's accounts as Livingstone (1852), Andersson (1856), Chapman (1861), and Baines (1864), though all likely passed its junctions with the Thamalakane River. The Gomoti first appears on Stigend's map based on detailed surveys between 1913 and 1922 (Stigend, 1923) and thereafter features in a few colonial documents, but less so than its neighbour, the Santantadibe (e.g., Brind, 1955; Ellenberger, 1931; Jeffares, 1938; Pole Evans, 1948). Peter A. Smith, a government botanist in the Okavango from the 1960s to the mid-1990s, wrote about the Gomoti and its plight in annual reports and memos (e.g., Smith, 1976, 1989, 1990, 1995, 1997), but, to our knowledge, the Gomoti is the subject of no previous scholarly research and we are certain it has no hydrometric record. Aerial photos exist for 1951, 1969, 1973, and 1983. Remote sensing imagery is available from the 1970s, but when a discernible ribbon of water in the Gomoti appears on images (e.g. 1984, 1989, 2000), without hydrometrics, it is impossible to determine either that the water is flowing or that it is flood-induced. Reconstruction of the Gomoti's desiccation has thus proven difficult.

The fresh body of evidence we present on Gomoti human ecology derives from a series of interviews in mid-2003 with elderly men and women and several younger men knowledgeable about the Gomoti and its history. It paints a picture of a system of indigenous resource management, part and parcel of the Okavango flood pulse system, and reveals how people have responded to political and institutional changes that have often been construed as "development" in the catchment of a dying river in semi-arid interior southern African (Chambers, 1979). Our sample of informants was relatively small ($n = 26$), male biased (23 of 26), and subject to the limitations of oral

historical evidence (Clark et al., 1980; Curtin, 1968; Schudson, 1995; Smith, 2002; Vansina, 1965). We were able to sift and validate the data to corroborate what is in print about the broad features of the human ecology of the Gomoti and adjacent catchments. A larger sample of elders would likely enrich but not substantially alter our conclusions.

3. The Okavango Delta

The Okavango Delta is a globally significant wetland in northwestern Botswana (Fig. 1). In an otherwise semi-arid landscape, where annual rainfall averages 450 mm falling principally in summer, where sandy riverbeds often never carry water, and where evapotranspiration exceeds rainfall by a factor of four, a 20,000 km^2 complex of perennial water courses and permanent and seasonal swamps spreads across the Kalahari sands to form a large alluvial fan—the Okavango Delta. Fed by rainfall in the Angolan highlands, the Okavango River and its tributaries find their way to the delta's edges along a shallow gradient (~1:5000) 6 months after Angola's rainy season. Except for the aquatic weed *Salvinia molesta*, the delta has miraculously escaped invasive species and with few exceptions is a "healthy ecosystem." (Naidu et al., 2000). A healthy ecosystem is one in which "ecological functions and processes

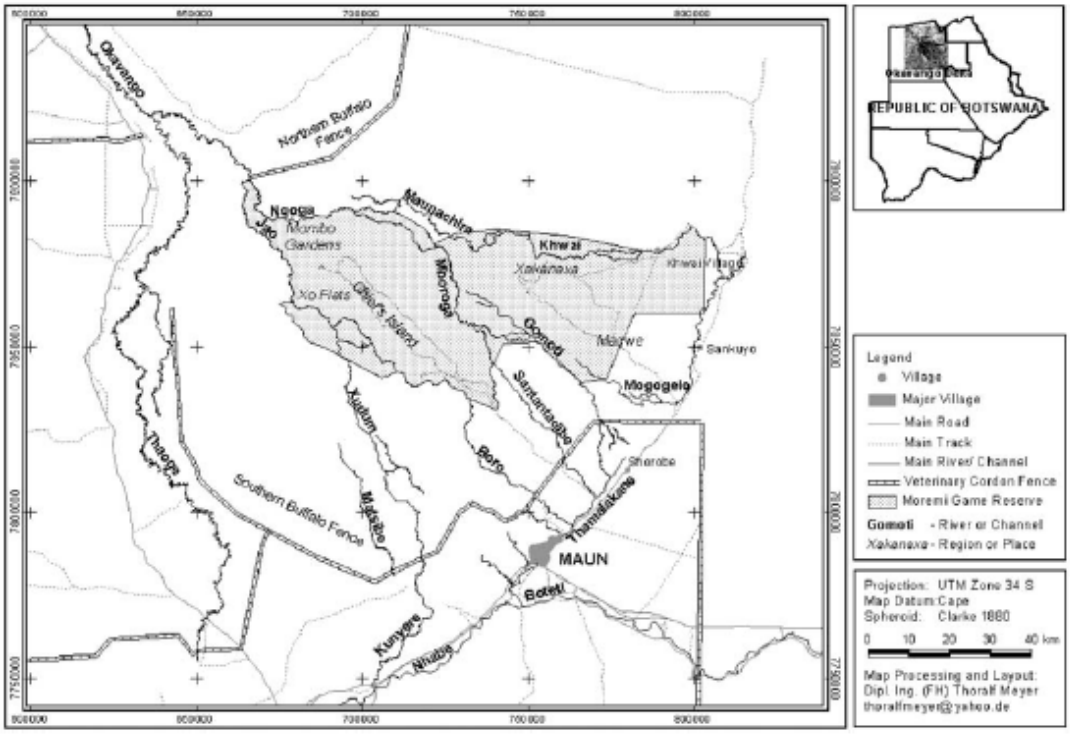

Fig. 1. Regional context of the Gomoti River.

are coupled with ecosystem services in mutually beneficial ways." (Fortmann et al., 2001, p. 74).

This complex of channels, swamps, reedbeds, open grassy floodplains, and islands has long been occupied by people fishing, hunting, collecting, practicing flood-recession agriculture, and moving often in response to the ecology of human and animal disease and a highly dynamic hydrologic and ecological system—a system that shrinks and swells in response not only to amounts of runoff from Angola but also to subtle tectonic movements in the crust beneath the delta, vegetation dynamics, hippos, fire, and other factors as yet poorly understood (Ellery and McCarthy, 1994; Tlou, 1985; Campbell, 1976, pp. 163–173). Over the past 50 years, the Okavango Delta appears to have been in a drying phase (Ringrose et al., 2003; see also Okavango Flood Website). This drying, together with government sedentarization programs, the establishment of Moremi Game Reserve (7% of the delta), and implementation of wildlife management areas (65% of the delta), has cordoned access for more than half the delta's 150,000 people, including those of the Gomoti.

4. The Gomoti River

As one of the three principal distributary outlet channels of the eastern Okavango system, the Gomoti River extends some 65 km from its source at the confluence with the Mboroga and Santantadibe rivers to the Thamalakane River (Fig. 2). Extremely low local relief between island interfluves and floodplains (2 m or less) make it

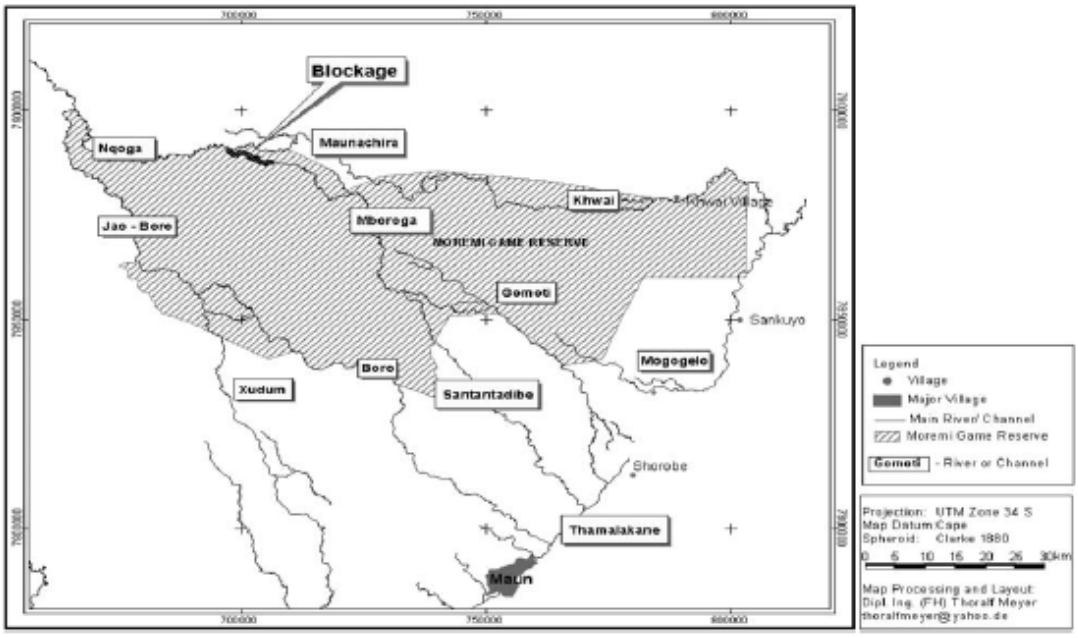

Fig. 2. Middle and distal Okavango rivers and channels.

difficult with the resolution of topographic data currently available to define precisely the Gomoti's catchment area. Kraatz (1983, p. 3) judged the combined Mboroga-Santantadibe-Gomoti catchments to be roughly 1100 km^2, of which the Gomoti is approximately one-third, or $360 \pm km^2$. The Gomoti, the Santantadibe, and the Boro feed the Thamalakane and Boteti rivers, which, in the past 125 years, have been the main outflows of the entire Okavango system. This outflow, a mere 2% of waters entering Botswana (Ellery and McCarthy, 1994), has been and still is the principal supply of surface and ground water to the district capital of Maun, Botswana's fastest growing "urban village" with a population of 43,776 (Govt. Botswana, 2001).

When first observed by Europeans in the early 20th century, the Gomoti and Santantadibe supplied all Thamalakane-Boteti flows. At the time, the Boro River, the present supplier, was dry at its mouth (Stigend, 1923). Because it still possesses some of the largest freshwater aquifers in the lower delta, Kumar and Bakaya (2003) believe the Gomoti's historic flood regime to have been extensive. In 1922 it was the major perennial river penetrating east of the delta, deriving its supply from the upstream Mboroga and Nqoga channels and their associated wetlands. Its dominance seems to have been sustained into the 1930s (Stigend, 1923; Govt. Botswana, 1987, p. 26). In 1937, Pole Evans (1948, p. 108), a botanist on a reconnaissance of Ngamiland, found the lower reaches of the Gomoti full. Since then, the Gomoti has been progressively drying (Fig. 3).

Although it has reached its mouth roughly once per decade from the mid-1940s to 2004 (apparently a function of above average rainfall followed by an average or better flood). In 2004, when both conditions prevailed, it flowed briefly to the Thamalakane, but in most years it contributes nothing to eastern Okavango Delta outflows. Documenting and explaining this change is difficult in the absence of a continuous hydrometric record, little mention of the Gomoti in grey literature, an incomplete understanding of the human agency in the system, and because contradictory hypotheses confound the picture.

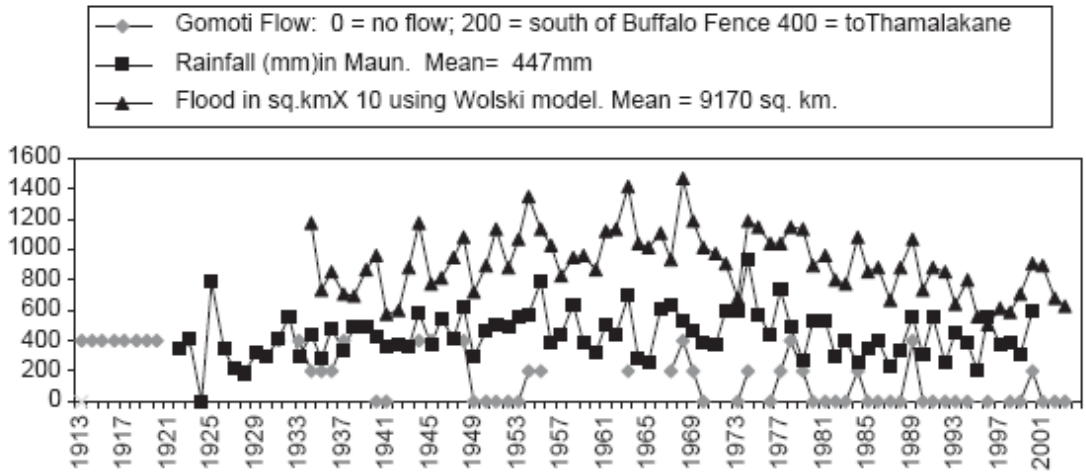

Fig. 3. Flow in the lower Gomoti River, rainfall in Maun, and flood size.

Why the Gomoti has become an ephemeral river depends on whom you talk to. Scientists and local people have quite different constructions of reality about its plight (Table 1). The notion of varying constructions of reality draws from postmodernist social constructionist theory, which asserts that perception of the world is not disembodied from human experience but rather is permeated by the history, culture, and values surrounding it (Lyotard, 1984; Schwandt, 2000). This also applies to science, as least in the minds of strong constructionists. They argue that scientists, whose job is to link evidence with hypotheses, are themselves neither autonomous nor disengaged. And therefore, "the vehicles by which social values and ideology are expressed in inquiry become subtly inscribed in theories, hypotheses, and models defining research programs" (Longino, 1993, p. 263). This view, in its most extreme form, is the antithesis of science and has understandably stirred a storm of rebuttal (e.g., Dawkins, 1998; Ehrlich and Ehrlich, 1996; Soulé and Lease, 1995). Particularly relevant to the matters at hand are the viewpoints of Attwell and Cotterill (2000) who argue that the current ethnocentric fascination with indigenous knowledge is "…largely a conservation cul-de-sac" (p. 571) and that postmodernist perspectives have left African conservation in disarray. Here we attempt neither to engage the extremes in this debate nor to exclude the relevance of indigenous management of the environment. Instead, as we shall explain below, the middle path we follow comes down, in the Gomoti's case, to scale, both temporal and spatial.

Science has at least three main lines of explanation. First, the Okavango has existed in an environment of extreme climatic oscillation over the last 50,000 years with rainfall varying from less than 150 mm to over 1000 mm per year (Thomas and Shaw, 1991). On a shorter time scale, there appear to be southern African rainfall cycles of about 80 years and 18–20 years, the latter perhaps associated with ENSO (Tyson et al., 2002; Nicholson, 2000). It is possible that the drying trend of the last 50 years is part of the longer of these cycles (Ringrose et al., 2003). Intra-annual rainfall variability is considerable and drought is an ever present hazard (Tyson and Preston-Whyte, 2000).

Table 1
Why has the Gomoti become ephemeral?

Scientific	Indigenous[a]	Blend[a]
1. Climate (Gumbricht and McCarthy, 2003; Ringrose et al., 2003 and others) • Short-term climate cycles • Long-term climate change 2. Tectonics (Thomas and Shaw, 1991 and others) 3. Sedimentation (McCarthy et al., 1986 and others)	1. No rainmakers 2. No access, no management 3. God's will/fate 4. Government and/or safari tour operators' interventions	Uncleared floating debris and a run of poor rains

Sources: [a]Field interviews, July 2003.

From year to year, the size of the area under the Okavango flood and the consequent flow patterns are related to the intensity, length, and total output of rains in the Angolan headwaters (Wolski et al., 2003). It stands to reason that in low flood years flow to distal rivers like the Gomoti might be diminished. For example, the main distal river today, the Boro, flowed weakly for less than 3 months in the small flood of 2003. However, as can be seen in Fig. 3, the Gomoti has failed through both big and small floods.

Second is the influence of tectonics on Okavango System. In the past thirty years science has come to understand more fully the role of tectonics in the delta's form and function. The Okavango Delta lies in a depression formed by tectonically induced surface collapses about 2 million years ago (Gumbricht and McCarthy, 2003). As such, structurally it is the southwestern terminus of the East African Rift system and continues to be an active tectonic zone (Thomas and Shaw, 1991; Reeves, 1972a, b; Scholz et al., 1976; Cooke, 1980). The most notable modern series of tremors, which shook the delta in 1952–1953, may be the reason the Jao-Boro system is now the pre-eminent provider of water to the lower delta (Wilson, 1974; Pike, 1970; Reeves, 1972a). In the past decade or so, waters of the Jao-Boro have been leaking southwestward into the Xudum apparently because of subtle movements along a fault terminating in the Xo flats (Gumbricht and McCarthy, 2003, p. 186). If tectonic activity is a driver of channel switching and if such activity is plausible in future, Ellery et al. (1995) conclude that predictive models are irrelevant because earth movements are currently unpredictable. McCarthy (1992), however, argues that such movements cannot be the principal cause of historically known shifts in water distribution.

A third explanation for channel shifting embraces the interaction of hydrologic and biotic process and proposes that the process is ecologically self-cleansing. To understand this hypothesis, which is widely enough cited to be considered conventional, requires extending spatial and temporal scales to include both the middle and lower delta channels over a span of 50–100 years. In the Gomoti case, this includes the upstream Mboroga and Nqoga channels (Fig. 2). McCarthy and others (McCarthy, 1992; McCarthy and Ellery, 1995, 1998) argue the primary distributaries of the mid-Okavango Delta carry the seeds of their own demise. Their sediment load aggrades at particular points. This then triggers vegetation responses, especially of papyrus, which sends rhizomes into the channel (Ellery et al., 1993, 1995; McCarthy et al., 1992). As channels constrict, they trap other vegetation, leading to blockages, avulsions, and ultimately channel switching. Gumbricht and McCarthy (2003, p. 192) liken this process to blood clotting in the human arterial system "demanding a bypass." The bypass enables the ex-channel, through evapotranspiration, peat fires, and ecological succession, to expunge accumulated toxic salts in the soils and groundwater and thus renew itself.

Upstream of the Gomoti, the Nqoga, the primary eastern delta feeder, was becoming blocked as early as the 1930s (McCarthy et al., 1987; McCarthy and Ellery, 1995; Wilson, 1974). This deprived the Mboroga and ultimately the Gomoti of an assured flow during most flood seasons. McCarthy and Ellery (1995, p. 135) write "…although channel failure may inconvenience human inhabitants of the

delta, the process is essential for the long term well being of the ecosystem." They hypothesize a predictable, ecologically equilibrious set of changes. After an interview with McCarthy, Pinnock (2003, p. 131) summarized the theory: "…the entire organism named Okavango renews itself."

To augment these scientific hypotheses, we wanted to discover what was on the minds of the 'inconvenienced human inhabitants,' and they were only too willing to offer their own explanations (Table 1). Some proposed that disappearance of rainmakers, once a prominent part of seasonal rhythms (Tlou, 1985, pp. 19–20), contributed to desiccation of the region. They note that as rainmakers faded in importance, the Gomoti too began failing. Too little rain, together with government restrictions on access of local people to the Gomoti and its upstream channels, worsened the situation. Without access, they could neither travel on the river nor engage in riparian management to keep the channels open. This explains the Gomoti's demise, they argue. Others blame activities of both the colonial and independence governments and safari operators, favouring particular channels by building dams and diversions and cutting bypasses. A few in our sample simply reverted to fate or "God's will" to explain the current reality of a dying Gomoti. Two informants, one a local government official, the other an ex-safari guide, both of whom straddled the worlds of the village and scientific positivism, offered this blended explanation (paraphrased): perhaps the run of dry years is partly to blame, but we might have had some flow nowadays if we were still managing the channels.

Each of these social constructions presents reality in the eyes of the beholders. We observe that some are more worthy of pursuit than others. In a paper trying to ferret out the biophysical and human ecological details of the Gomoti story, we choose to focus particularly on those that inform rather than inflame the tedious debate about the relevance of indigenous knowledge to African conservation. What is clear about the Gomoti is that human activities, interventions, and rights of access are an indisputable part of the story. What is not clear is how these have interplayed with natural processes and flow regimes. We found few sources that grant human manipulation of the system some credence and all consider human impacts to be modest or negligible (Potten, 1976; Govt. Botswana, 1991, 1987). This leads us to believe that hypotheses based purely on positivist analysis of natural processes may have the heuristic bias of minimizing or denying humanity's role in the Okavango. What follows is an attempt to address this bias.

5. Human activity in the Gomoti catchment

Though occupied for at least 30,000 years, the Okavango Delta has never been densely settled, especially since the tsetse fly, vector for both human and livestock sleeping sickness, has usually been a barrier to human settlement (Thomas and Shaw, 1991). Today, the majority of people of the Gomoti are BaYei whose ancestors arrived about 1750. By the mid-19th century they were scattered sparsely across a wide swath of the eastern and southeastern delta from the Khwai and Mogogelo Rivers to the Gomoti and Santantadibe (Tlou, 1985, pp. 12–14). Their

small settlements were dispersed over islands and floodplains near open shallow water, habitats similar to those of their Caprivi homeland. More than 40 place names (both BaYei and San/Banoka) along the Gomoti and Mboroga systems and adjacent islands and floodplains signify a long history of human activity in this watery landscape. After 1840, with the loss of their cattle to the Batawana, the Yei moved more deeply into the delta, "often spending the whole winter living on the islands, hunting, fishing, and collecting wild food" (Campbell, 1976, p. 167). In the early 20th century there were BaYei villages, with perhaps a few thousand inhabitants in total, on Chief's Island and at a place referred to as "Mombo Gardens" between the Nqoga and Jao Rivers, as well as Maqwe, near the present south gate of Moremi Game Reserve (Govt. Botswana, 1991, p. 106; Skjønsberg and Merafe, 1987, p. 10). As fishers, hunters, gatherers, travellers, and farmers, the BaYei brought fishing nets, traps and spears, hippo harpoons and animal and bird snares, canoes and rafts, and *molapo* (flood recession) farming, each a significant innovation for a life imbedded in the delta's synchronies (Tlou, 1985; Campbell, 1976; Petraglia, 2002). The tsetse-infested delta of the mid-to late 19th century, then again from about 1940 to the 1980s, was not as prohibitive for the BaYei as it was for their cattle-keeping neighbours.

Within their occupied areas they recognized exclusive rights to waters and lands for fishing, hunting, and ploughing. Along the waterways, food collection rights were specifically delineated, perhaps because more than 70% of their diet was comprised of gathered food (Campbell, 1976). Away from the water such rights were not so defined. Though the BaYei became clients of the Batawana in the 19th century, their land and water use rights were honoured (Campbell, 1976). Until the early 1960s, they thus had unfettered access to the delta's ample resources to sustain their lives.

Campbell (1976) and Tlou (1985, pp. 22–29) note that the people of the delta—especially the BaYei and River San (also known as Banoka), who engaged in collecting plants, fishing and hunting, flood recession agriculture, and water transport, possessed an intimate knowledge of the delta and its plants and animals, a knowledge well integrated with the functions of the environment. It is instructive to think of this lifeway as a coupled human and natural system in which a relationship was negotiated between the people, the distributary flood pulse system, and the natural resources of the delta and its distal rivers. Such a relationship, neither distinctive nor especially surprising, is characteristic of wetlanders both historically and at present (Coles and Coles, 1989; Janetski and Madsen, 1990; Kiviat, 1991; Kimmage and Adams, 1992; Drijver et al., 1995; Thomas, 1995, 1996).

Our survey fleshes out this flood pulse system as remembered by elders, born between 1900 and the 1940s, reflecting on life in the Gomoti from the early to the mid-20th century. This body of indigenous locationally specific knowledge is heretofore untapped for this part of the delta. We focus below on the implications of this knowledge of water transport and movement and river and swamp resource use and management, basing our results on narratives and information held by at least a majority of informants and plausible in the context of current historical and ethnographic knowledge (Table 2).

Table 2
Validity of selected variables from oral historical interviews

Category Variable	Frequency	Consistency	Documentary corroboration	Confidence level
Water transport				
Mokoro	High	High	High	High
Makawa	Mid	Mid	High	High
Resource use & management				
Swamp food	High	High	Mid	High
Fish	High	High	Mid	High
Swamp and veld products	High	High	Mid	High
River management				
Burning	High	High	Mid	High
Vegetation maintenance	High	High	Low	Mid
Diversion/channel scouring taboo	High	Mid	Nil	Mid
Work parties	Low	Low	Low	Low
Other				
Flood size	High	Mid	High	Mid
Rainmakers.	Mid	Mid	Mid	Mid
Flood extent	Low	Low	Nil	Low
Tools, techniques	Low	Low	Nil	Low
Govt. & tour operators' interventions	Low	Low	High	Low

Water transport

> We went by mokoro to hunt, to harvest sorghum. Mekoro were like our cars today. Women used to make beer. And we would slaughter animals. Selling beer and meat in Maun, one could manage to buy blankets, clothes. We did this mainly in winter and the journey might take a few days. (L. Moeze)

The eighteenth century BaYei travelled a long way for an extended period, walking or punting and paddling their canoes along waterways linking the Chobe-Linyanti and the Okavango until they settled on the rivers, islands, and margins of the delta (Tlou, 1985, p. 12). Given this history it is not surprising that water-borne travel has been a key element of their human ecology. All informants could themselves remember when dugout canoes (*mekoro*, sing. *mokoro*) were the "cars of the delta" and many spoke of long journeys, mostly in the era of their parents or their own childhoods (early to mid-20th century), to visit relatives, to hunt and fish, and to trade. They travelled to Xakanaxa, into the heart of present-day Moremi Game Reserve, to Jao and Seronga where kinspeople lived, to Sankuyo to which Shorobe was sometimes linked via the Mogogelo River, and as far as Gumare in the panhandle of the Okavango. Trips to Maun by *mokoro* to trade sorghum, brew beer, sell reeds and fish, buy goods in shops were common into the 1970s when, even if the Gomoti had little water, the upper Thamalakane backflowed to Makoba, a few kilometres downstream from the old Gomoti-Thamalakane junction (Peterman, 1989).

These narratives are by no means novel, for descriptions of wide scale travel by people using *mekoro* are reported in virtually all explorers' and early government officials' impressions of life in the delta. Our informants merely confirm that within living memory the Gomoti was a highway and reliable launch point for travel both up and downstream and that *mekoro* travel in the channels and swamps was so common as to be almost unworthy of note. In the late 1930s, Jeffares (1938, pp. 33–34) wrote that the Thamalakane River between the Gomoti and Maun, though extremely sluggish, was kept "more or less open" by constant *mekoro* traffic. Well used "mokoro trails" enabled interaction among villages at the southern edges of present day Moremi Game Reserve (Govt. Botswana, 1991, p. 106). Our informants believed sustained *mekoro* travel to be significant in monitoring and management and ultimately in sustaining the eastern delta channels.

Large rafts (*makawa*; sing. *lekawa*), an older mode of travel (mostly not within living memory), transported people and goods long distances (mentioned by many of our informants; see also Streitwolf (1911) quoted in Stigend (1923, p. 405) and Ellenberger, 1931; and a picture in Forrester et al. (1989, p. 40–41). Woven of papyrus and reeds and often several square meters in size, these rafts historically were a technological breakthrough (Tlou, 1972). They enabled people and their belongings to accomplish long journeys downstream in the wider channels and they were used for hippo hunting (Forrester et al., 1989, p. 40–41). Because of their size, they were hard to control. When they mired in a particular channel or simply reached their destination, they were abandoned. Though of unknown significance in the Gomoti, such abandonment may have contributed to blockages in the mid-delta, including the long-standing one in the Nqoga, which feeds the Gomoti. Wilson (1974, p. 139) writes: "In their formation neither the Thaoge nor Nqoga blockages were the unaided work of nature." Two of our informants described a smaller version of these rafts in common use into the 1950s. Guided by ropes, these were used to ferry people and goods across wide channels. When waterlogged or no longer useful, they too were abandoned along these channels.

Resource Use and Management

> *We ate tswii and tsita. We harvested reeds to build our fish traps. We laid our traps where the river was slowed by reeds. After trapping the fish, we would kill them and remove our traps. We ate all the fish. None were sold. Sometimes we dried them. We went hunting for wild animals…There was no hunger.* (R. Sechele)

Present dependence on processed foods from shops, such as maize meal and tinned meat, compares unfavourably, in the minds of many elders, with the good old days when people ate porridge from sorghum and millet rather than maize and had plenty of protein from small stock and fish. Indeed the food economy of the eastern delta was varied and sufficient throughout most years. In addition to harvests of sorghum *Sorghum vulgare*) and *lebelebele* or millet (*Pennisetum spicatum*) from flood recession farming, itself a finely tuned adaptation to the flood pulse, the BaYei were highly mobile fishers, hunters, and collectors.

Wide-ranging resource availability and use together with BaYei mobility meant that people almost never were hungry, even in dry seasons and dry years. Fishing nets were woven from *mokgotse* (*Sanseviera* spp.), reeds (*Phragmites australis*) were harvested for housing and fencing, traps, and basket traps were woven of *Grewi* (sp), hibiscus, and reeds. Men and boys trapped eels and lizards and hunted river otters and riverine antelope, such as red lechwe (*Kobus leche*) and sitatunga (*Tragelaphus spekii*). The BaYei were also known as courageous hippo hunters, digging pits along their riverbank pathways or harpooning them from trees or in the water in a risky operation involving several men (Campbell, 1976, pp. 168–169; Tlou, 1985, pp. 25–27). Snares were set to capture birds and smaller rodents. *Makhongara* and *tswii* (early and late stage tubers from water lilies) and other tubers such as *tsita* (bulrush), *koma* (papyrus), and palm fruit, wild berries, wild melon, and other foods and medicinals, collected mostly by women and children, were amply available in the permanent and seasonal swamps, islands, and river channels (Petraglia, 2002). *Mokolwane* palm (*Hyphaene petersiana*) was tapped for wine. Reeds (*Phragmites australis*), thatching grass (*moxa*—savanna grass—*Miscanthus* junceus, and *kwenyama*—cottonwood or flame grass—*Imperata cylindrica*), and water itself were all close at hand when the river flowed regularly.

Were any of these resources over-harvested in the memories of our informants? Quite the contrary, elders speak of "river health," of an interactive relationship between the river and the people. "This river really affects these life activities that I have talked about earlier. We depended upon this river, and we took care of it." (M. Zengoro). However, European and indigenous hunters responding to external demands for game products, significantly reduced populations of elephant, hippo, crocodile, and both species of rhinoceros in the first half of the 20th century (Campbell, 1976).

A taboo, expressed by many informants, tells the story another way. "My grandparents' generation used to say that the river is not supposed to be dug or diverted. If you dig or divert the water of a channel in another direction, they said you would have done *tama* (broken a taboo, such as feeding someone poison). Digging up the river was that bad." (S. Ngande). Although three elders spoke of digging wells in floodplains during droughts, the channel itself seems never to have been dredged, for it was perceived to possess a layer beneath the surface described as its "spinal chord."

Informants mentioned burning as a management technique, both in specific reference to vegetation-glutted channels (see below) and more broadly to encourage new growth of plants used in everyday life as well as to provide better access to channels and to attract animals for hunting. BaYei communities on the northern floodplains of the delta burned reeds and grasslands annually (Govt. Botswana, 1991, p. 106). "Even open lands were burned. After the rains there was a beautiful scene.... We burned because there was too much grass." (M. Zambo). The bush fires that rage through the Okavango Delta today are thought to be much more extensive than those of traditional times when chiefs controlled their timing and spatial distribution (Cassidy, 2003, p. 3).

River Management

> *The river is supposed to be controlled, just like someone who has a sick cow…When the cow is sick, you go to the veterinarian…. The ancestors knew they must, from time to time, go and check on the river to see if the situation is fine. If not, if the river is sick, the water has gone down, we have to go and cut grass/vegetation and burn it in that river. Yes, then the river remains healthy, in good condition, because its owners took care of it. We once took care of the river, being many in the river. Where possible we would straighten up so that the water will flow properly. This doesn't happen these days.* (L. Moeze)

Of significance to understanding how people interacted with the flood pulse system was a series of questions aimed at discovering what river and channel management might have been undertaken: *When navigating the river, what would people do when encountering floating vegetation mats? How would people respond? What other techniques do you remember being used or have you heard about in the "old days" in the management and use of the Gomoti River?*

Despite what many informants understood to be a changing river, they were quick to explain a pre-existing system of sustained vegetation and channel maintenance. Eighty percent offered narratives like the following:

> When our parents encountered a floating mat while travelling by mokoro, they would stop, cut that vegetation and throw it out of the river. When they found a Gomoti tree blockage, they would stop and cut it and throw it away from the river. The river channel used to be burnt in the dry season. They would burn vegetation, Gomoti tree branches, and other debris blocking the river (old mekoro, rafts, stuff from people who used to be there) carried along by the river. When they encountered floating vegetation, they would…carry these things and pile them up in one place to be burned. The next year, when the water comes, it will flow nicely…(D. Maphumo)

The "achieved meaning" in these narratives, we believe, is "Of course, we tried to manage the river; it was our lifeline." (Smith, 2002, p. 728)

Besides constant travel along the Gomoti and its channels and besides harvesting river and swamp vegetation such as papyrus rhizomes and *Phragmites*, as the narrative above indicates, the indigenous system included specific management interventions: physically pulling *matetemetso* (floating vegetation mats) out of the water, cutting reeds with sickles, cutting papyrus to open passages, cutting ma*qwaqwa or* Gomoti trees (*Ficus verruculosa*) and their branches along the banks, stacking cleared vegetation away from the river for later burning, and actual burning of vegetation in dry portions of channels before the new flood arrived. These substantial interventions, the informants believed, kept the waters flowing. There is little documentary corroboration of these techniques. However, Jeffares (1938, p. 23) observes: "It appears to me that in former years, when the local inhabitants were under more strict control of the chiefs, these impediments—reeds, papyrus, etc—were burnt to a larger extent annually than they have been in recent years. In fact, it may have been a custom."

Did chiefs actually organize river maintenance as Jeffares suggests? Our informants understood it to be a matter of scale. If a person encountered a small blockage, he might clear it on his own. The chief did not have to call a meeting for this to happen. "In the early days, our parents did not leave this situation alone. They went about removing these materials." (D. Maphumo). However, if the task seemed overwhelming, a work party would be organized. "In the past, when you found blockages in the middle of the river that could not be unblocked by two people, you would go and tell others at the village and then they would gather together and go out there to camp and open that place. It happened this way." (H. Zemwana). In 1931, a minor chief or "headman" called Motseakhumo, in response to appeals from Bechuanaland protectorate officials, raised parties of local labourers to clear the upper Gomoti of papyrus and floating mats (Wilson, 1974, p. 142).

> The Dying Gomoti
> *How could you be happy when your livelihood has been destroyed?*
> (J. Lesheto).

Not one informant failed to mention three interlocked tragedies in their lives: (1) the increasing desiccation of the Gomoti; (2) loss of access to the waters and resources of the Okavango Delta; and (3) the consequent down spiral in their subsistence system. Many referred to the situation using the metaphor of death. Others had a more nuanced view:

> The dry river now has affected all our natural resources in the area: wild animals, birds, all things. In the Gabamochaa area, [in the past]…one would meet a lot of animals right there anytime because there was water. Where there is water there will be motsaudi, mokhutshomo, mochaba, moxone, those trees that we lived by, trees that can't live without water. Now they are all dead and all that's left are the thorny trees of the desert. (D Maphomo).

As we note above, explanations vary: the coming of the white man, safari companies bagging the river with cement, the disappearance of rains and the rainmakers who called upon them, bunds and dredged channels of the 1930s, channelization of the Boro in the 1970s, the FAO flood recession agriculture project around Shorobe in the 1980s, abandoned rafts and *mekoro*, and others. Though these are the realities of people around Shorobe, most are neither the full story nor accord well with the longer-term, meso-scale biophysical processes described above.

On the other hand, a dominant theme of these narratives is the assertion that limitations on movement and access to the middle and upper Gomoti and its feeder channels (largely after 1960) have made a difference. This is a piece of the Gomoti story that by its omission stands starkly in relief. Without reed harvesting, clearing papyrus, clearing and harvesting reeds, thatch grass gathering, forays for riparian and swamp foods, channel maintenance, *mekoro* traffic, and burning, people argue the river has become moribund. "If we could still be engaging in the system of management of the early days of our parent's time, the river would still be flowing." (R. Sechele).

Could this possibly be true? Before answering this, we must first consider another set of interventions that further complicate the picture.

6. Modern interventions

The traditional human-ecologic system just described was intact in the gathering decades of the Bechuanaland Protectorate (1894 to the 1950s) when the Okavango Delta became the locus of a number of water diversion proposals aimed at sending waters southward (Potten, 1976; Wilson, 1974; Govt. Botswana, 1987; Clarke, 1973). Although most of the big diversions never happened, beginning in colonial times and extending virtually to the present, engineers and government officers have tampered in small but pervasive ways with the flow of rivers feeding the Gomoti as well as with the Gomoti and neighbouring Santantadibe. Far from being the pristine wilderness marketed to international tourists, the Okavango has been ubiquitously manipulated in the past 75 years (Table 3 and Fig. 4).

Among these many interventions, Charles F. Naus's meddling from 1932 to 1937 is not only remembered in Gomoti oral traditions but is also notable for its success in altering the Gomoti and Santantadibe systems. Naus was an engineer employed by the Bechuanaland Resident Commissioner to develop Ngamiland's waterways (Wilson, 1974, p. 142). His main objective was to increase flows to Maun by encouraging the Santantadibe at the expense of what he believed to be "a dying Gomoti." Our informants seem not to agree with the idea of a dying Gomoti at this time. Nor is it the impression of I.J. Pole Evans who also travelled in the 1930s. In 1937, he found the Gomoti flowing well during the flood season, though in places impeded by Gomoti figs (Pole Evans, 1948).

Naus tried to enhance Santantadibe flows by damming and ditching. His dams, bunds, and channel scouring apparently did shunt water to the Santantadibe briefly and he may have more profoundly changed the broader regional flow regime. Smith (1989) argued that Naus changed gradients enough to stem flooding across the floodplains of the middle Santantadibe and alter the interactive flow between the lower reaches of the Santantadibe and Gomoti. How much this may have contributed to the Gomoti's present desiccation cannot be estimated, especially given the upper channel blockages described above.

Equally important to the traditional human-ecological system of the Gomoti have been interventions in the form of regulations and laws partitioning the Gomoti catchment and limiting people's movements as well as their gathering, fishing, and hunting activities. Elders believe the "beginning of the end" was in the 1950s when the earliest hunting laws were enacted. By the 1960s the establishment of Moremi Game Reserve (1963–1966) and the implementation of provisions of the Wildlife Conservation Policy of 1986 and the Wildlife Conservation and National Parks Act of 1992 profoundly altered the lifeways of Gomoti people (Mbaiwa, 1999, 2005; Govt. Botswana, 1991).

That certain aspects of wildlife and biodiversity conservation have been achieved by these acts is beyond question. However, because they impose a "fences and fines"

Table 3
Selected interventions in the central and eastern Okavango Delta

Intervention (Numbers correspond to locations on Fig. 4)	Purpose	Date	Organization/ Agency	Place
1. Dam	Enhance river flow	1930s	Naus for govt.[a]	Santantadibe headwaters
2. Crosslink	Enhance river flow	1930s	Naus for govt.	Mboroga to Santantadibe
3. Dams, bunds, channelizing	Enhance flow	1930s	Naus for govt.	Mainstream of Santantadibe
4. Shortcut channels	Bypass mainstream meanders	1940s–1950s	WNLA[b]	Sepopa
5. Side channel	Access	1940s–1950s	WNLA	Seronga
6. Crosslink to Thaoge	Navigation?	1940s–1950s	WNLA	Etsatsa
7. Channel	Access	1940s–1950s	WNLA	Tekae
8. Crosslink	Navigation?	1940s–1950s	Local people or WNLA	Jao
9. Bypass-crosslink	Navigation, fire control?	1973	ARB[c]	Hamoga
10. Crosslinks	Navigation	1970s–1980s	DWA[d]	Didinga
11. Channel	Access	1980s	safari company	Nxaraga
12. Removal of vegetation blockages	Flow and navigation	1970s–1980s	DWA	Xigera, Xo, Nxaraga & elsewhere on Boro
13. Removal of vegetation blockages	Flow	1970s–1990s	DWA	Santantadibe
14. Dredging and channel bed alteration	Enhance flow	1972	Anglo-American	Lower Boro
15. Bunds, dams, sluice gates	*Melapo* enhancement	1980s	GTZ/Dept. Agric	Thamalakane and lower Gomoti

Source: Adapted from Smith (1995).

[a]Col. Charles F. Naus, an engineer working for the Protectorate from 1932 to 1937.

[b]Witwatersrand Native Labour Agency, a South African mine recruitment firm.

[c]Agricultural Research Bureau of the Department of Agriculture.

[d]Department of Water Affairs, Government of Botswana.

system that largely excludes human settlement, fishing, and veld product extraction, they alter the human agency in the catchment (Van der Haiden, 1991). In addition to Moremi, the Gomoti basin was partitioned into five Controlled Hunting Areas (CHAs) bounded on the south by a veterinary cordon fence (the southern buffalo fence) intended to be an impermeable barrier to movement and access (Fig. 5). It cannot be argued that these partitions were illegal or ill intended, for most of the exclosure took place on state lands and, in the case of Moremi, on tribal land granted to the government by the Batawana. What can be said is that, in the absence of people—their movements, their gathering and fishing, their farming and fishing,

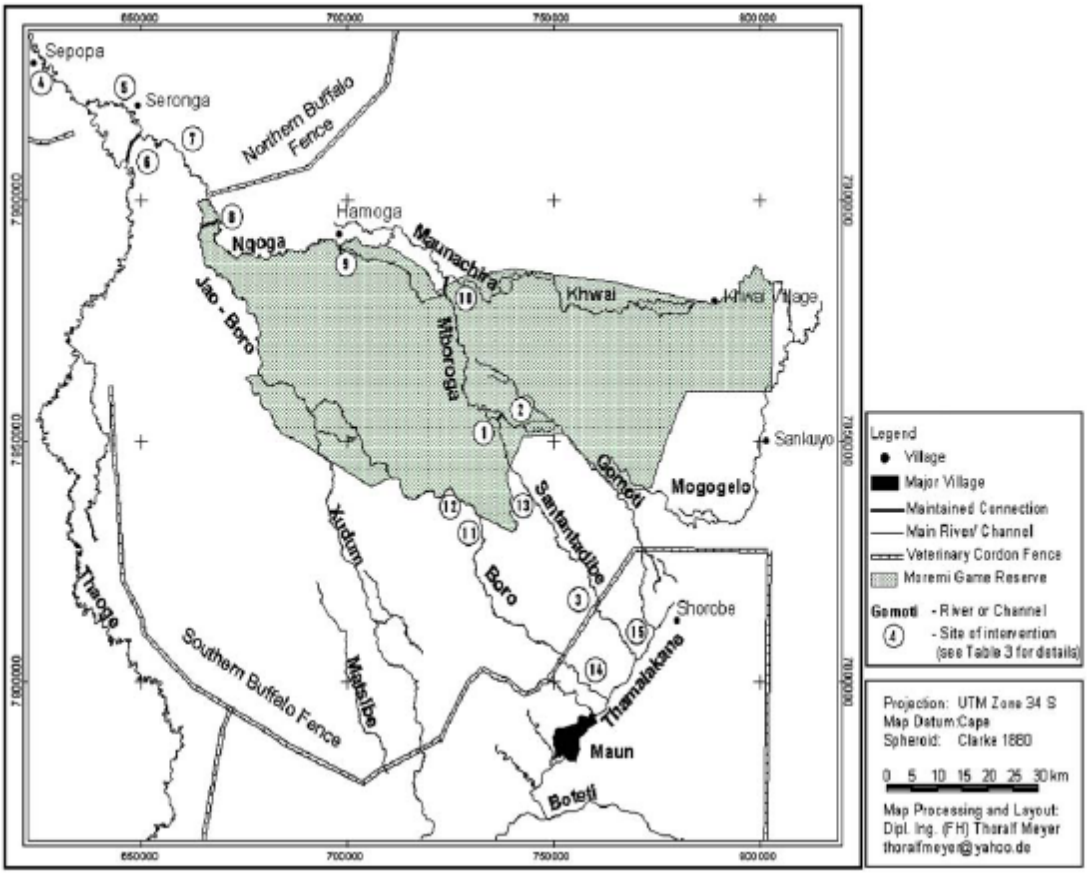

Fig. 4. Selected interventions in the central and eastern Okavango Delta.

their burning and channel management—land use and the resource management system have changed quite dramatically in the past half century.

Coincident with this set of regulations and laws has been Botswana's National Settlement Policy (Govt. Botswana, 1992) of providing services to rural citizens in central villages with at least 500 people, some of which were established or enlarged to accommodate people displaced by the above land use changes (Silitshena, 1994, pp. 243–278). This policy was meant to close the gap between the standards of living of urban and rural Batswana by providing villages with reliable water supplies, primary schools, and health facilities. They have been magnets of growth throughout Botswana. In the lower Gomoti, partitioning the catchment and its progressive desiccation accelerated this population shift. In the past 20 years people have moved from former settlements in the Gomoti catchment to Shorobe and Maun. Between 1981 and 2001, population declined in all but one census locality in the lower Gomoti (Table 4). In the same period, Shorobe's population increased from 539 to 955, while Maun surged from 14,925 to 43,776 (Govt. Botswana, 2001). The desiccation of the Gomoti thus impacted livelihoods to such an extent that the rural part of the catchment south of the buffalo fence is now largely depopulated.

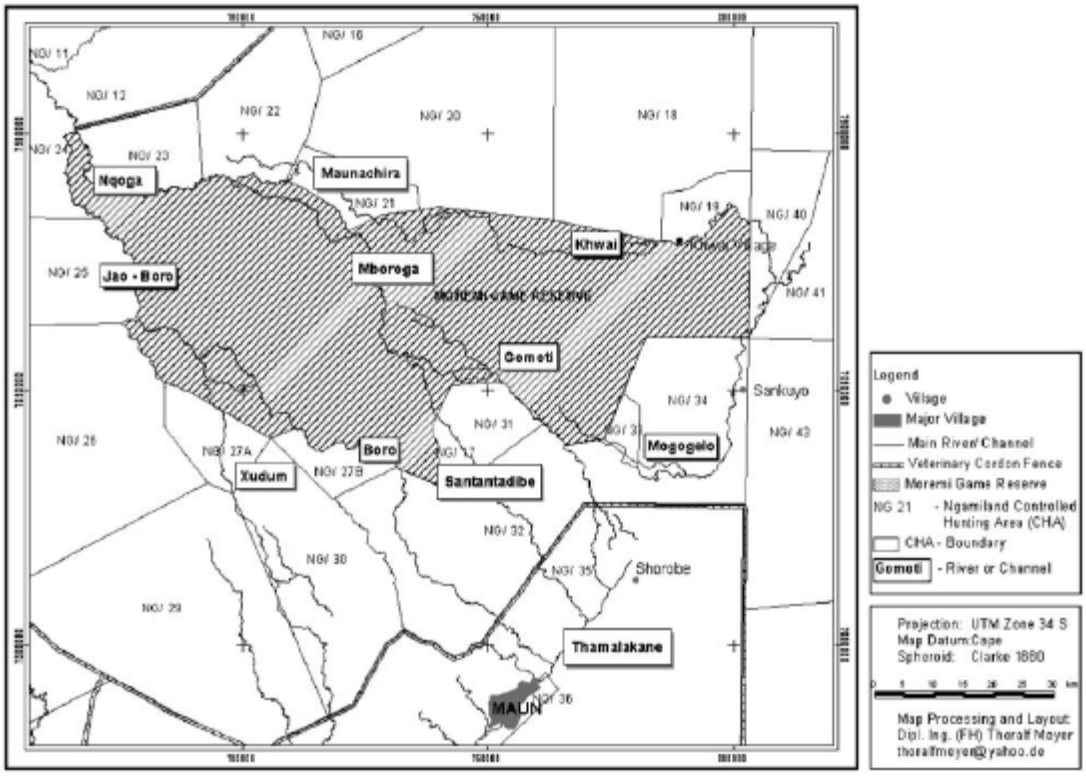

Fig. 5. Gomoti and adjacent basins: protected areas.

Table 4
Lower Gomoti basin population 1981–2001

Locality	1981	1991	2001
Shorobe Village	539	758	955
Xabe	78	126	49
Shokomokwa	86	118	79
Gabamocha	109	89	23
Xuxau	125	252	69
Makoba	59	51	41
Mochaba	82	105	151

Source:Kgathi, 2004, p. 33. Data from Government of Botswana, Central Statistics Office, Population Censuses of 1981, 1991, 2001.

These interventions constrained movement from the distal parts of the delta to its interior, which in turn altered the food economy contributing to food insecurity, prompted over-harvesting of certain veld products (thatching grass, palm, and reeds), and prohibited traditional river management (especially channel clearing and burning). Depopulation of the lower Gomoti, with its accompanying influx to towns and villages, has forced people to become increasingly dependent on government

relief programmes with consequent rising levels of poverty. While none of these problems could ever be resolved by turning the clock back to 1940, to the elders we interviewed, "life was sweet" in those days and it is not today.

7. Conclusions

> *Overall, despite large inputs of labour and funds, it would be difficult to prove that man made more than small scale, short-term changes in the Okavango's water regime. There have been major changes in the hydrological regime over the past 100 years, but nature, in the form of erosion and deposition, plant succession, earthquakes, or perhaps even Coriolis Effect, and not man, appears to be responsible.* (Potten, 1976, p. 71).

Potten's view, though written almost 30 years ago, is the prevailing thinking about the Okavango. Using the Gomoti, we have tried to offer a more nuanced picture by examining indigenous management strategies in their historical and ecological context. In trying to reconstruct the Gomoti's trajectory from a perennial to an ephemeral river, we discovered a hydrographic record with many gaps. What elders recount about the Gomoti's flows, floods, and desiccation roughly parallels the sparse data on record. The oldest informants remember the Gomoti before it began to sputter and many tell of diminishing flow, which most date from the 1950s. Science tells us the demise likely began two or three decades earlier. Elders also revealed a body of largely unrecorded traditional management techniques for sustaining access to the river and swamps.

This project tapped into what is presumed to be only part of this reservoir of indigenous understandings and knowledge about how to use and take best advantage of the flood pulse system, of which the Gomoti was part. Elders remember, perhaps through rose coloured glasses, a life better than now, a life that synchronized with the once ample waters of the southeastern delta. And they recount manipulating this system "to keep it healthy" for their use and transportation.

Could this have been true? Though it is difficult to weigh the significance of their small but frequent deliberate and culturally imbedded interventions against what scientists see as powerful bio-hydrologic processes, one must remember that indigenous travellers and resource managers did their work and synchronized it with the dynamics of the Okavango over a long span of time. Rather than answer the question definitively, which at this point is impossible and appears to be partly a matter of scale, we put forth a model of how meso- and micro-scale changes in both the natural and human systems may have interactively functioned (Fig. 6). The intent here is to frame future research in the anticipation that it will better account for humanity's long history in the Okavango and to invite policy makers to blend indigenous knowledge and modern technology more effectively.

As Potten's epigraph at the head of this section suggests and as the corpus of research by McCarthy and colleagues argues, meso-scale processes operating over decades to centuries are likely beyond the technology assumed here of sickles, hoes, axes, and fire. Similarly, with the possible exception of Naus's meddling near the

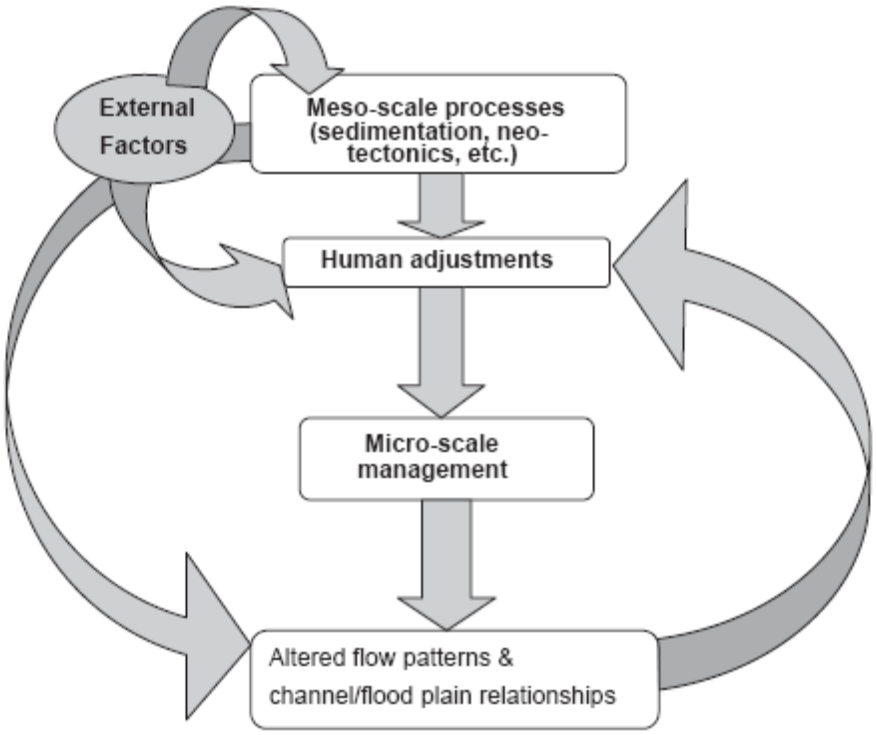

Fig. 6. A model of meso- and micro-scale changes over about 100 years.

head of the Santantadibe River, most modern interventions have also proven feeble against natural forces at work upstream.

The blockages of the Nqoga-Mboroga channels feeding the Gomoti thus do seem inescapable if one expects to restore flows along exactly the same channels. But, as the model suggests, this is not the way the linked natural and human system seems to have worked. Instead, the indigenous part of the system was adaptive and could adjust to mid-range dynamics in the Okavango. People responded by moving and changing *mekoro* routes, then by engaging in purposeful management of small arteries and adjacent floodplains to keep the water coming, if not fully downstream in the old channels, at least along pathways that would enhance access over the few square kilometres individuals and villages might require. In other words, humans worked with, rather than against, the sedimentation-vegetation-blockage-avulsion sequences. Remember that gradients are slight. A small measure of intervention (such as clearing mats or cutting Gomoti figs) could thus favour particular paths in the avulsion process. Then mobile and inherently knowledgeable people with a long delta history and tried and tested resource management strategies would make further adjustments, such as changing settlement sites, opening new *molapo* fields, and following fresh *mekoro* routes, enabling them to continue to fish and collect and flourish.

Although the model looks tidy, on the ground it certainly was not, because individuals rather than institutions made most of the decisions and their adaptations would surely have ebbed and flowed as lesser and greater floods and rainy seasons as well as other "external" factors such as fire, tremors, sleeping sickness, and hippos

impacted the overall system. This is consistent with what "new ecology" theorists believe: that "the biophysical environment is inherently more unstable than is usually recognized in traditional systems models and that human interactions add an even greater dynamic flux…" (Dunning et al., 2002, p. 279). Seen through the eyes of new ecologists, the model of McCarthy and colleagues, which begins with sedimentation and ends with toxic cleansing, may seem a bit too equilibrious, but again this could be more a matter of the assumed time frame and scale. In the long long run, as Ringrose et al. (2003) and Gumbricht and McCarthy (2003) indeed show, the Okavango system *is* unstable.

In the Gomoti's case, the years of sedimentation and vegetation blockages in the upstream feeders coincide with people being essentially closed out and unable to respond to changes. Had mobility been possible, had peoples' movements and micro-level management been sustained, it is possible their current plight would be less severe, and current policy issues would be differently framed. Instead of the central government being asked to unblock channels and even to cut bypasses (as is now the case), perhaps local people and the government would be engaging in dialogue on seasonality of access to Moremi Game Reserve, regimes of prescribed burning, monitoring fish and reed and water lily productivity and setting reasonable extraction limits, and exploring other indigenous management strategies to assure *mekoro* passage both for tourists and local people. In all of this, the long-term impacts of low technology disturbance would be the context for rethinking policy and management. Exclosure would be a matter of last resort.

This model is a first tack at reframing research on complex and dynamic human-environment interrelationships in the Okavango. With little archival and hydrological evidence, more oral traditional, archaeological, palaeo-botanical, geomorphological, and other proxy data will be necessary to fill gaps. For example, where exactly were BaYei settlements in 1900? In 1940? How many people lived there? Can traces of these settlements, their channel access, and their *melapo* be found? Do the distributions of species collected (e.g. thatching grass, reeds, *mokolwane* palms) reveal anything of the impacts of humans many decades ago? Can elders and others provide further insight about the ubiquity and details of channel clearing and burning? These are merely suggestive of possible lines of attack for anthropologists, archaeologists, botanists, and geomorpologists.

Underlying such research is the assumption that for at least two centuries the Okavango has not operated as a pristine "natural system," for it has a long history of indigenous use and management. Beyond all else, what the Gomoti story reveals is that this once coupled human and natural flood pulse system has been uncoupled, much to the detriment of a wetland people, who now are bereft of the former breadth of their sustenance, leaving them largely dependent on an unpredictable formal sector and the government to survive.

Acknowledgements

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Appendix); members of the Tebelopele Community Trust, who kindly helped identify and locate elders and facilitate field work; People and Nature Trust, which partially supported field work; and the Harry Oppenheimer Okavango Research Centre where the senior author was based at the time of the study. We are grateful also to Hannelore Bendsen, Jonathan HaBarad, Donald Kgathi, Mike Murray-Hudson, Sue Ringrose, Piotr Wolski, K.C. Naidu, and Kebabonye Thamaku and three anonymous reviewers, who provided assistance and critique of earlier drafts of this paper, and to Thoralf Meyer for producing the maps.

Appendix A. Supplementary data

The online version of this article contains additional supplementary data. Please visit doi:10.1016/j.jaridenv.2005.02.001.

Selection procedure for informants

Elders were nominated by ward representatives, (5 males, 3 females) of the Tebelopele Community Trust in Shorobe. We asked for up to 4 nominees for each of 8 wards. Nomination criteria were: 1) familiarity through travel on the Gomoti and its feeder channels and wetlands; 2) experience in use of the natural resources of the wetland and riparian habitats; 3) age at least 50; and 4) sufficient mental acuity and hearing to participate in interviews. Among the 28 nominees, we found 5 incapable or unavailable. The informants we interviewed represent a geographical cross-section of elder people in the lower Gomoti basin. Interviews were conducted in Setswana, audio-recorded, then transcribed and translated by two assistants who cross-checked each other's work. The male bias reflects the criterion of travel in the Gomoti and beyond, which historically involved men more than women. Though more elder women in the sample may have provided further information on swamp and riparian wild food and other veld product collection, male informants spoke knowledgeably about these activities. The bell-shaped age distribution was fortuitous (Table 5). The eldest person in the sample, Setlobosha Matabele, was born about 1900.

Table 5
Dates of birth of informants

Date of birth	No.
1900–1910	4
1911–1920	5
1921–1930	8
1931–1940	4
1941–1950	2

Interviews of this sort contain a jumble of true and false, reliable and unreliable, verifiable and unverifiable information and are often possessed of internal and external contradictions. We therefore scrutinized the findings with care (Smith, 2002, p. 712). Using principles developed by Thompson (1988, pp. 240–241), we assessed each interview for internal consistency, cross-checked findings with archival and published sources, and tried to understand verifiable data in the fullest possible historical and ethnographic contexts (using Tlou, 1985; Campbell, 1976; and various of Peter A. Smith's unpublished papers in the Harry Oppenheimer Okavango Research Centre Library). As Richard Smith (2002, p. 728) has noted, oral sources inherently contain complex codes and are framed in "achieved meaning," which may be obscure to the interviewer. Given the limited time available for this project, we used these oral data conservatively, gingerly side-stepping interesting, even plausible, explanations that were rare in the data set and impossible to corroborate.

Informants

Name and Date of Birth	Gender	Date of Interview	Location
Manja Samaira (1903)	M	24 June 2003	Shorobe
Masisi Nsabela (1917)	M	24 June 2003	Nxale
R. Mase (1917)	M	24 June 2003	Nxale
Modua Zambo (1930)	M	3 July 2003	Shukumukwa
Gaolathwe Thinya (1923)	M	3 July 2003	Shukumukwa
Magazine Ngoma (1920)	M	3 July 2003	Shukumukwa
Karonda Mohinda (1914)	M	3 July 2003	Shorobe
Thousand Kgari (1913)	M	3 July 2003	Shorobe
Mareja Moeze (1901)	M	4 July 2003	Shorobe
Lentswe Ramagapu (1935)	M	4 July 2003	Shorobe
Fanabi Moduwa (1907)	M	4 July 2003	Shorobe
Jakoba Lesheto (1930?)	M	4 July 2003	Mochaba
Stephen Setimela (1936)	M	4 July 2003	Mochaba
Mambukushu Zengoro (1921)	M	7 July 2003	Nxanxana
Sebitwane Ngande (1921)	M	7 July 2003	Nxanxana
Ramasimo Sechele (1925)	M	7 July 2003	Nxanxana
Chendo Samothware (1928)	M	9 July 2003	Matsaudi
Gaethuse Samajwa (1937)	F	10 July 2003	Matsaudi
Shoze Matebele (1937)	F	10 July 2003	Matsaudi
Letumo Tenego (1947)	F	10 July 2003	Matsaudi
Matekane Fanabi (1922)	M	10 July 2003	Gabamocha
Setlobosha Matabele (c.1900)	M	10 July 2003	Gabamocha
Gaseitsiwe Gakelona (1947)	M	11 July 2003	Shorobe
Leganang Moeze (1955)	M	11 July 2003	Shorobe
Dash Maphomo (1957)	M	11 July 2003	Gabamocha
Harsh Zemwana (1964)	M	11 July 2003	Shorobe

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