WETLANDS AND INDIGENOUS KNOWLEDGE IN THE HIGHLANDS OF WESTERN ETHIOPIA

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Abstract: Wetlands in the highlands of western Ethiopia are important natural resources that provide a range of goods and services to local communities. A perceived increase in the drainage and cultivation of these wetlands in the mid 1990s, however, prompted concerns of widespread wetland degradation and unsustainable levels of utilisation, with consequences for food and water security. Drawing upon participatory field research carried out in Illubabor zone, Ethiopia, this chapter discusses the contribution of indigenous knowledge (IK) to wetland management in the area, and assesses its implications for the sustainability of the wetland environment. The results of the research suggest that continuous wetland drainage and cultivation in Illubabor has been ongoing for at least 30 years and that indigenous management practices based on IK have evolved over time, through farmers' experience of the wetland environment. Contrary to initial concerns, these management practices appear to form the basis of sustainable wetland use strategies. It is suggested, however, that recent government initiatives that are not sensitive to indigenous wetland management practices may threaten the sustainability of the wetland system.

Keywords: indigenous knowledge, wetland management, sustainability, Ethiopia

1. INTRODUCTION

In many parts of the developing world, wetlands represent important natural resources in terms of their biodiversity, and the range of functions and products they provide for human populations (Dugan 1990; Hollis 1990; Denny 1994; Roggeri 1998). In arid and semi-arid environments, their capacity to act as natural reservoirs of moisture means they often play a critical role in ensuring food and livelihood security (Scoones 1990; Barbier 1993; Adams 1993; Silvius et al. 2000). This is particularly evident in the highlands of western Ethiopia, where almost every household

E. Wiegandt (ed.), Mountains: Sources of Water, Sources of Knowledge, 197–210.

relies upon wetlands for various products and services (Wood et al. 2002), but particularly for crop production. Increasing reliance on wetlands for food production in recent years has prompted concerns regarding the environmental sustainability of wetland use, and the ability of existing wetland management systems to continue to provide a range of functions and benefits in the long-term (Kebede Tato 1993; Wood 1996).

Drawing upon field research undertaken in western Ethiopia between 1996 and 1998, this chapter argues that these concerns are, for the most part, unfounded and that wetland use in the area is based on locally developed sustainable wetland management practices, rooted in an evolving indigenous knowledge of the wetland environment.

2. INDIGENOUS KNOWLEDGE

The last two decades have seen increasing recognition of the importance of community based natural resource management strategies in developing countries. Although previously blamed for destructive, inappropriate and opportunistic practices, a vast body of literature has emerged that suggests local people in developing countries possess the knowledge and skills to manage their natural resources and environment in a sustainable manner (Brokensha et al. 1980; Chambers 1983; Richards 1985; Warren 1991). The "local" or "indigenous" knowledge (IK) held by communities is regarded as a key component of sustainable natural resource management, since it continuously adapts and evolves over time in a specific location, culture or environment, in response to changing circumstances (Haverkort and Hiemstra 1999). Much research has drawn attention to the role of farmers as experimenters, a process regarded important as a means of generating new knowledge and contributing to adaptation and sustainability (Richards 1985; Millar 1993; Rhoades and Bebbington 1995; McCorkle and McClure 1995). Such is the perceived importance of IK among the international development community that "participation" with local communities and sensitivity to IK has now become a fundamental component of most NGO and state-based development initiatives.

There is, however, a risk of regarding IK as a panacea for rural development in developing countries. Although everyone possesses knowledge of their environment and livelihood system, knowledge is not distributed equally amongst a community. Differences inevitably occur as a result of gender, age, experience and profession (Swift 1979; Mundy and Compton 1995), and IK may simply be flawed or based on inaccurate observations. Moreover, possessing knowledge does not equate to actually applying it, and in many natural resource management strategies the application of knowledge often depends on more mundane issues such as access to credit and tools, and the availability of labour. Unless IK is able to adapt and overcome such issues, and evolve in response to any socioeconomic and environmental change, its presence alone does not guarantee a sustainable natural resource management system.

3. ILLUBABOR AND ITS WETLAND RESOURCES

Illubabor zone (Figure 1) remains one of Ethiopia's most fertile and least exploited regions. It has a total area of approximately 16,555 km^2 and lies between longitudes 33°47′ and 36°52′ east and latitudes 7°05′ and 8°45′ north. The zone has a warm temperate climate, atypical of conditions in the rest of the country, with a mean average temperature of 20.7°C and rainfall in excess of 1,800 mm per annum (Solomon Abate 1994). The undulating topography of the landscape, which ranges between 1,400 and 2,000 m above sea level, combined with the climatic conditions produces an environment characterized by steep-sided river valleys and flat, waterlogged valley bottoms. The accumulation of runoff, poor drainage and a high groundwater table in these valley bottoms promote the formation of permanent and seasonal swamp-like wetlands, ranging in size from less than 10 to more than 300 ha. Government reports suggest wetlands account for between 1.6–5 percent of the total land area of the zone (Afework Hailu et al. 2000).

The most recent government census, carried out in 1994, estimated the population of Illubabor to be 847,048 persons (CSA, 1997). Estimates for 1998 put this figure at 960,431 (of which 91 percent live in rural areas), making Illubabor one of the most sparsely populated areas in highland Ethiopia, with an average of 58 pers/km^2 (Government of Ethiopia 1998). The dominant ethnic groups, who account for 90 percent of the population within the zone, are the Oromo, who settled in the area after their invasion and expansion during the eighteenth century. The remaining 10 percent is composed of Amhara, Tigrayan, Gurage, Mocha and Keffa peoples. The majority of the population relies on agriculture as a means of subsistence and approximately 38 percent of Illubabor's land area is under cultivation. Maize constitutes the major cereal crop and staple food (38.3 percent of total food production), whilst smaller quantities of tef (*Eragrostis tef*), barley and sorghum are also cultivated.

Illubabor's wetlands are important natural resources for local communities. They represent a vital source of water throughout the year in an area which receives half of its annual rainfall between June and August and only 5 percent during the dry season months of December, January and February. The abundance of water in the wetlands supports the growth of dense sedge vegetation known locally as *cheffe* (*Cyperus latifolius*), which is traditionally harvested by local communities for use as a roofing and craft material. Medicinal plants such as *balawarante* (*Hygrophila auriculata*), a treatment for skin diseases, are also collected (Zerihun Woldu 2000). Although it is difficult to trace the origins of wetland cultivation in the western highlands, the small-scale cultivation of wetland margins has traditionally been practiced by the Oromo population, in response to food shortages on the uplands (McCann 1995; Tafesse Asres 1996). At some stage during the last hundred years, wetland cultivation has extended dramatically to include the intensive cultivation of maize in whole wetlands.

Figure 1: The Location of Illubabor Zone in Ethiopia.

Recurring food shortages on the uplands have been the principal reason for the spread of wetland agriculture throughout Illubabor. In the Menelik and Haile Selassie eras (1913–1974) Ilubabor's feudal landlords distributed wetland plots among peasant farmers and instructed them to cultivate maize in years of famine and drought. Following the overthrow of the Haile Selassie government by the Derg[1] (1974–1991), wetland cultivation was intensified in order to meet regional targets of food self-sufficiency and farmers who failed to cultivate their wetland plots risked the reallocation of their land to the landless or those who were willing to expand into wetland cultivation (Afework Hailu 1998). The expansion of coffee farming on the uplands, growth of the market economy and an influx of settlers from the north during the Derg era, also increased the pressure to produce food supplies from wetlands. In the post-Derg era (1991–present) the Oromiya Bureau of Agriculture has generally encouraged the cultivation of wetlands to meet food production targets.

The increase in wetland agriculture in Illubabor has prompted concerns regarding the environmental sustainability of the wetland system. Reports from Illubabor during the mid 1990s suggested that wetlands were beginning to exhibit signs of over-use and degradation, characterized by falling water tables, soil erosion and the disappearance of *cheffe* vegetation (Kebede Tato 1993; Butcher and Wood 1995; Wood 1996). Under such conditions, wetlands are unable to provide their full range of functions and benefits, and this has implications for food and water security for local communities. In addressing such concerns, the Ethiopian Wetlands Research Programme (EWRP), between 1996 and 2000, embarked upon an extensive program of interdisciplinary research in Illubabor Zone, exploring the functioning of wetlands, and the motivating forces and management practices contributing to sustainable and unsustainable use.

4. RESEARCH METHODS

One key area of EWRP's research focused on the role and significance of local communities and their IK in the design and implementation of wetland management practices. Investigations of farmers' wetland knowledge and the application of this knowledge in wetland management strategies were regarded as critical to a wider understanding of the dynamics of

[1] Derg: The government of Ethiopia between 1974 and 1991 in which power was initially shared by a military committee and later centralised into the hands of President Mengistu Haile Mariam.

wetland use, and ultimately wetland sustainability throughout the area. This research, undertaken between 1996 and 1998, focused on five wetlands typical of those found within Illubabor in terms of hydrological regime and geomorphological characteristics. All were less than 20 ha in size and four were undergoing maize cultivation at the time of the study (Table 1).

Table 1: Characteristics of the Study Wetlands.

	Bake chora	**Tulube**	**Dizi**	**Anger**	**Supe**
Altitude (m)	1,700	1,680	1,560	1,640	1,720
Size (ha)	8	8	4	16	10
Hydrological classification	small headwater	small headwater	small mid-valley	small mid-valley	small headwater
Drainage	artificial drainage	Inter-mittent channel	natural stream & artificial drainage	natural stream & artificial drainage	artificial drainage
Main water source	springs/ runoff	springs/ runoff	Inflow stream	inflow stream	springs/ runoff
Hydrological conditions	low water table throughout year	high water table throughout year	low water table throughout year	spatially variable water table	spatially variable water table
Land use	maize and tef cultivation/ abandoned plots/*cheffe* collection	abandoned wetland/ grazing	maize cultivation	maize cultivation/ abandoned plots/ grazing/ *cheffe* collection	maize & sugar cane cultivation/ *cheffe* collection
Periods of cultivation	c1900 to present	1960s–1989	1950s–1976, 1991 to present	1949–present	1930s to present

A program of meetings with farmers from each of these wetlands was established, in which a range of Participatory Rural Appraisal (PRA) tools were employed in a total of 26 field sessions. Tools, such as resource mapping, seasonal diagrams, transect walks and Venn diagrams (Chambers 1992; IIRR 1996; Grenier 1998) were utilized at each site, facilitating a high level of interaction between the research team and the wetland users. These sessions facilitated the exchange of information on topics ranging from seasonal hydrological and vegetation changes in each wetland, to the past and present sources of wetland management know-ledge and techniques. Concurrently, a hydrological monitoring program was undertaken to establish the seasonal hydrological characteristics of the wetlands, enabling comparisons of wetland knowledge and hydrological reality to be made (Dixon 2003).

5. WETLAND KNOWLEDGE AND WETLAND MANAGEMENT PRACTICES

The results from the PRA sessions suggest that wetland management in Illubabor zone is indigenous in nature, having developed through a process of observation, trial and error, and the intergenerational accumulation of information. Those involved in wetland management (mostly farmers) demonstrated a detailed understanding of the wetland environment and the impact of human intervention in the wetlands. Their management practices, which attempt to balance community needs with environmental sustainability, are based on this body of IK.

Critically, farmers were found to possess extensive knowledge of the wetland hydrological system, particularly spatial and temporal variability of the wetland water table. Water is almost universally recognized by farmers as fundamental to the functioning and survival of wetlands, and some suggested that excessive drainage rendered wetlands "lifeless" and "just like bleeding a person to death". Using seasonal diagrams, farmers demonstrated an in-depth knowledge of the seasonal patterns of rainfall around their wetland, the seasonal variations in water table elevation, and the relationship between both. When compared to the data from hydrological investigations (Dixon 2002), farmers' knowledge was found to be remarkably accurate. For example, the comparison between actual rainfall and perceived rainfall outlined in Figure 2, indicates that whilst there is some discrepancy between the perceived quantity of rainfall and actual recorded levels, farmers' knowledge of the trend in rainfall during a typical year remains accurate. Similarly whilst farmers' perceptions of the wetland water table height during the year appear higher than those actually measured the seasonal trends of both are similar (Figure 3). The anomalous weather conditions (an extended dry season) during the 1997–1998 season, arguably accounts for the difference between farmers' knowledge (which was indicative of average conditions) and the water table data for that year.

Farmers were also able to elaborate on the consequences of any deviations from the normal hydrological regime, particularly the effects of flooding or drought. As one farmer from Supe wetland recalled:

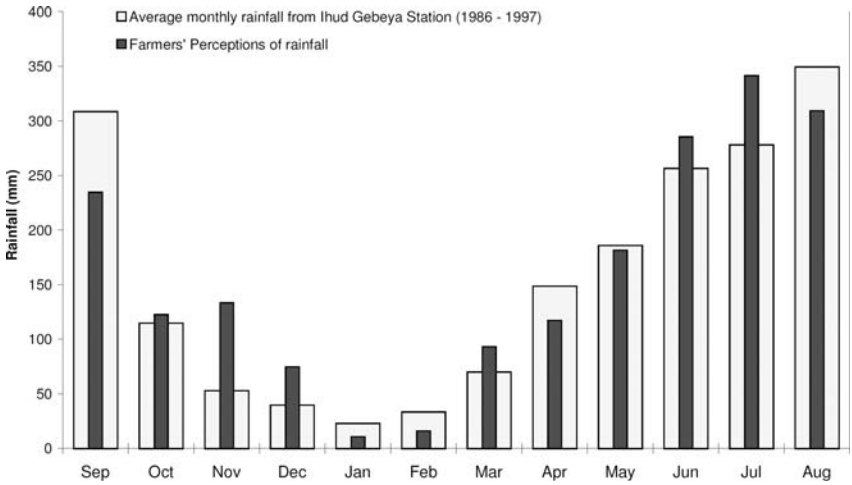

Figure 2: Farmers' Perceptions of Rainfall in Bake Chora Wetland Compared to Rainfall Data.

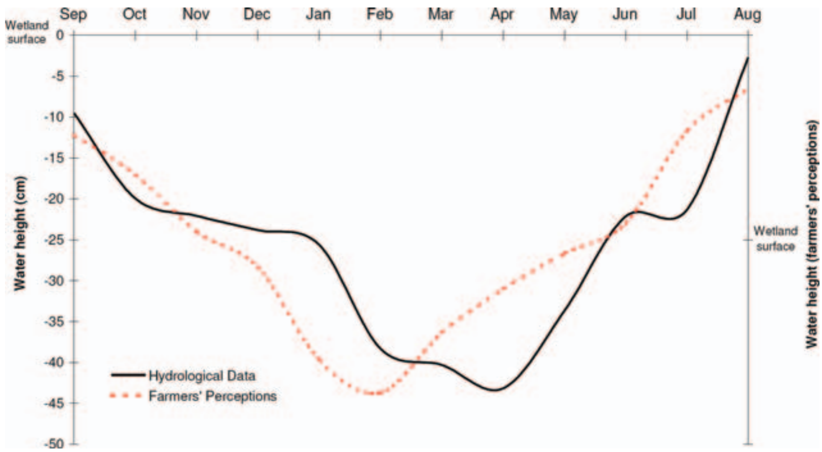

Figure 3: Farmers' Perceptions of the Water Table Elevation in Bake Chora Wetland Compared to Hydrological Data.

"Last year the rainfall in October and November was much heavier than usual. As a result, the upland crops suffered and the coffee was washed away. The wetland was also flooded but it didn't really matter because the harvest was over by then."

Supe farmer (April 15, 1998)

Similarly, knowledge of the spatial variability of hydrological conditions within wetlands was well understood by most farmers, for example:

> *"The lower part of the wetland is always wetter. When we try to drain this area we can't dig it properly. When there's excess rainfall, the bottom becomes wet first and the moisture spreads upwards towards the head of the wetland."*
>
> Supe farmer (April 15, 1998)

Farmers demonstrated an understanding of soil moisture conditions and the need to maintain it at a specific level that facilitates growth, whilst also avoiding waterlogging at the crop root zone. Using their knowledge of the hydrological regime and its spatial and temporal variability, they design and excavate drainage networks that are specifically adapted to hydrological conditions. For example, where excessive waterlogging occurs, permanent drainage ditches up to 1 m in depth and width, are excavated in close proximity to one another. In intermittently flooded areas, shallower ditches are excavated, often when and where necessary. It is also common practice for drainage ditches to be cleared of weeds during the growing season, in order to maintain optimum drainage conditions. Such practices were found to be common to all the sites studied, although the farmers of Bake Chora wetland have, in addition, developed a system of ditch blocking in order to regulate soil moisture conditions in the wetland. The blocking of ditches using soil or crop residue (Figure 4) is employed during the rainy season (June to September), prior to the sowing of maize, as a means of re-flooding drained wetland areas so that the soil fertility and soil structure are more conducive to crop growth. Conversely, where waterlogged conditions prevail, either at the beginning of the growing season (November to December) or as a result of heavy rain, farmers in Dizi and Bake Chora recalled how they remove invasive vegetation or sediment that accumulates in the drains, thereby improving drainage conditions.

The management of the hydrology in each wetland is intrinsically linked to knowledge of soil and vegetation changes in the wetlands. Farmers in each of the study wetlands were found to make decisions on whether to drain and cultivate based on the color and depth of soils. Shallow soils are not considered suitable for crop cultivation and are associated with poor fertility and moisture retention, hence they are left uncultivated. Soils are also classified as dark (*beyo guracha*) or grey (*beyo daleti*). The former is considered to be a more fertile soil with a greater moisture holding capacity than the latter, which is associated with over-cultivated soils. Where shallow *beyo guracha* soils overlay *beyo daleti* subsoils, however, farmers avoid cultivation and instead reserve such areas for the regeneration of *cheffe* vegetation. Although farmers acknowledge that repeated drainage and cultivation can cause the conversion of *beyo guracha* to *beyo daleti*, resulting in lower crop yields, they are also aware that the fertility of the soils is constantly being improved by the input of sediment from the catchment via runoff and flooding. The system of ditch blocking outlined above is indicative of the application of this knowledge.

The grazing of cattle in the wetlands is also regarded by farmers as an important means of providing a nutrient input, although farmers are also aware that intensive grazing leads to soil compaction, erosion and destruction of the natural vegetation. In most cases, farmers prohibit grazing in cultivated wetlands because of the threat of degradation. In Bake Chora wetland in particular, where wetland agriculture has been sustained for over 80 years with little sign of degradation, cattle are not given access to the wetland even after the harvesting of crops.

The relationship between *cheffe* and the wetland water table is also well understood by farmers, who regard it as both a hindrance to effective drainage and cultivation, but at the same time the key to wetland regeneration. The growth of *cheffe* is associated with waterlogged conditions, hence its presence is used by farmers as an indicator of the return of natural wetland characteristics, e.g., a high water table and increased soil fertility, following drainage. Similarly, farmers regard the growth of wetland plants such as *inchinne* (*Triumfetta pilosa*) and *tuffo guracha* (*Asteraceae*) as indicators of recovering soil fertility, whilst *Kemete* (*leersia hexandra*) indicates declining fertility.

From their knowledge of soil, water and vegetation in the wetlands, farmers have effectively developed "indicators of sustainability", that range from changes in soil moisture and color, to the colonization of specific vegetation. Based on these indicators, adaptive management mechanisms that prevent wetland degradation from occurring appear to be in place, such as, for example, when farmers block ditches or restrict cattle access to restore soil moisture and fertility. Indeed, one of the key mechanisms that prevents degradation and promotes the environmental wetland sustainability is the periodic abandonment of wetland plots, which encourages the regeneration of *cheffe*, the wetland water table and soil fertility. Farmers understand that this contributes to the maintenance of water table levels throughout each wetland as a whole, and in Bake Chora in particular, an area of *cheffe* is always reserved at the head of the wetland as a means of regulating water supply but also as a source of roofing material.

Figure 4: Ditch Blocking as a Means of Regulating Soil Moisture in the Wetlands.

6. AN EVOLVING KNOWLEDGE SYSTEM

The study has confirmed that wetland drainage and cultivation practiced in these wetlands is not undertaken haphazardly. Wetland farmers actively acquire knowledge of wetland processes and functions over time, they apply this knowledge, and demonstrate a capacity to modify their practices in response to environmental change, albeit on a small-scale. Although the study did not identify any examples of farmers engaging in formal experimentation, the farmers themselves were keen to point out that wetland use has undergone a gradual process of refinement, and drainage and cultivation practices have evolved over time. The case below of one farmer at Dizi wetland typifies this process:

> *"Here half of the maize is yellow and half is healthy. Before two years there was no difference between them, but last year I lost the whole yield. This year I have a drain down the middle because I thought there was too much water in the soil, but the result has been half good and half bad. I dug the drain through the middle because another farmer told me that the source of water for that area of the wetland was under an avocado tree on the valley side. Next year I will drain along the left side where the valley sides meet the wetland and this should solve the problem. Maybe I will also block the middle ditch which I made this year. The ideal depth of these ditches should be about knee height".*
>
> Dizi farmer (April 26, 1998)

The extent of the evolution of management practices does, however, vary among wetlands. In the *kebele* (community) of Bake Chora, farmers identified a local religious teacher as the main source of knowledge and instigator of a more intensive form of wetland drainage and cultivation than traditionally practiced. Hence, wetland farming knowledge and practices were already well developed when first applied. Elsewhere, farmers report that it was upon instructions from landlords during the Haile Selassie era that they initially held meetings amongst themselves to discuss the requirements of drainage and cultivation. In effect, their first attempts at complete wetland drainage and cultivation simply represented a transfer of upland farming practices into a new environment. In both scenarios, however, there is little doubt that the knowledge and practices of wetland drainage and cultivation has evolved through the acquisition of new knowledge and experience.

7. INDIGENOUS KNOWLEDGE AND SUSTAINABLE WETLAND MANAGEMENT

By demonstrating extensive knowledge of wetland processes, adopting indicators of sustainability, and actively modifying knowledge and practices in response to change, farmers arguably possess important prerequisites for the sustainable management of these wetlands. Whilst it is spurious to base an assessment of sustainability solely on farmers' oral histories and observations, the research did ascertain that all study wetlands have undergone drainage and cultivation for at least 30 years, and, despite farmer reports of degradation during the first seasons of cultivation, crops have subsequently been produced annually. Any further degradation appears to have been mitigated by wetland management practices. Hence it can be suggested that, contrary to initial concerns of widespread wetland loss that precipitated the EWRP study, farmers' wetland management strategies have largely been sustainable.

One key problem highlighted by farmers, however, is that despite crop production continuing year after year, and the wetland hydrology continuing to support production, the level of crop production does not regularly meet the aspirations of farmers. Whilst most possess knowledge of practices and technologies that could sustain crop production at higher than current levels, they recognize there is a problem of operationalizing and applying their knowledge to fulfill their management aims. The application of wetland knowledge is, it seems, restricted by a range of spatially and temporally variable constraints such as unpredictable weather, geological barriers to drainage, the need to retain areas of *cheffe* in the wetlands for construction material, and individual socioeconomic status. The latter is perhaps the most influential factor, since it determines the extent to which wetlands are utilized (Solomon Mulugeta 2004). Wealthy farmers can afford to hire labor, and buy cattle and farming equipment, whilst poorer farmers struggle to manage drainage and cultivation in their wetland plots. Ironically, it is the lack of resources available to poorer farmers that may ultimately lead to the abandonment of wetland plots, the subsequent retention of water and *cheffe* in the wetlands, and overall conditions of environmental sustainability.

Wetland farmers, therefore, regard access to resources rather than lack of knowledge as the limiting factor in their wetland management system. This raises a further question, not unlike the one prompted by the original research: could wetland management remain sustainable if these resource constraints were removed and each farmer was able to apply his knowledge? In fact, these very scenarios have become increasingly common since the establishment of the government Wetlands Task Force in Illubabor in 1999 in response to drought and growing food security problems (UNDP 1999). In a policy echoing those of the Derg era, farmers have been instructed to bring all wetlands into cultivation year after year, and in some instances abandoned wetland plots have been redistributed to those either willing, or having the capacity to cultivate. Critically, the importance of preserving *cheffe* vegetation in wetlands has not been recognized by the Wetlands Task Force, and although most farmers are also keen to see an increase in crop production and the redistribution of abandoned land to those who can cultivate effectively, they are in conflict with the government over this issue.

8. CONCLUSION

In addressing initial concerns that wetland drainage and cultivation in Illubabor is unsustainable, leading to widespread degradation, the research outlined here draws attention to the sustainability of a locally developed system of wetland management. Those farmers involved in wetland management have, over a relatively short time, developed extensive and accurate knowledge of the wetland environment and its dynamics. Experience and the acquisition and evolution of knowledge have produced a repertoire of wetland management practices which, in several cases, has facilitated annual crop production in the wetlands for over 50 years, with little apparent environmental degradation. Critical to the success of these management practices has been farmers' understanding and adoption of plant, soil and hydrological indicators of sustainability, which periodically determine either the implementation of regenerative practices or the resumption of drainage and cultivation.

From the farmers' point of view, the major limitation to this wetland management system is the lack of capacity to apply their knowledge and practices. Whilst food production from wetlands could increase if farmers had access to more resources, there is some doubt whether environmental sustainability could be maintained, since it is the abandonment and preservation of natural vegetation that keeps degradation in check. Whether farmers would continue to incorporate such restorative practices under scenarios of intensification, remains to be seen. Given more recent pressure to intensify wetland use emanating from the Wetlands Task Force, this would appear unlikely, unless the government recognizes the value of indigenous practices, or if intensification in wetland use stimulates the indigenous development of new regulatory mechanisms that ensure sustainability.