DEAD OR ALIVE? THE NYL FLOODPLAIN

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Abstract

Over the last five years, intensive studies were done on the Nyl floodplain. In this presentation I will attempt to give an overview of the work, its most important finding and give some ideas of the management of the system.

The Water Research Commission (WRC) sponsored project focussed on the catchment of the Nyl floodplain to evaluate the applicability of biomonitoring techniques currently used as part of the "River Health Programme" (RHP) on the system. These included the FAII (fish) and SASS5 (macro-invertebrates). For plants, the researchers took a whole new approach as it was certain that the RVI (riparian vegetation) would not be applicable, as it uses trees as a monitoring tool. A large part of the study focussed on the water quality of the system and included analyses of water and sediment to determine metals in the system and bacterial analyses. A small project was also initiated to evaluate the current status of frogs in the system and to develop a monitoring index for the use of amphibians as indicators of pollution.

Eighteen sampling points were monitored over the three-year sampling period, of which eight were used to sample fish, invertebrates, water and sediment, whilst the other were used for water and sediment sampling only.

Two additional projects (Master studies) were done on the system to determine the accumulation of metals in fish, invertebrates and plants in relation to the metal concentrations in the water and sediment.

The proposed management strategy and management plan for the catchment is the culmination of the various studies.

1. Introduction

The project that was done at Nylsvley (WRC Report 1258/01/06) forms the basis for this presentation. The idea was to test various biomonitoring indices currently used for the River Health Programme (RHP) and determine which was applicable for the Nyl floodplain. Various sites were selected, some on the floodplain and others in various streams feeding the Nyl River. The aim was to determine water quality parameters in the catchment of the floodplain. All the findings were then incorporated into a management framework which can be used to do future planning in the region.

As stated in the starter document of the RHP, the following was aimed to assist the users of the programme: "The monitoring programme is being designed to meet the information requirements of the primary users, namely water resources managers in the Department of Water Affairs and Forestry, tasked with the duty of ensuring the sustainable use and health of South Africa's aquatic ecosystems. These managers require information for the performance of a variety of management functions such as resource use planning, operations and control, including pollution control" (Hohls, 1996).

With this in mind, the RHP was started, focussing on rivers. This is not to say that the other water bodies or wetland types were not important, but a lot of expertise was available to have an immediate impact and furthermore, most of the water is found in our rivers. In hindsight, some may argue that the initial effort should have been on wetlands in the catchments (mountain regions in particular). These wetlands are critical in their functions: to retain water, attenuate floods, filter water and release water over an extended time into streams and rivers.

If one view the mission of the DWAF, it is clear that the mandate has far reaching implications when we manage systems: "The Department of Water Affairs and Forestry (DWAF) is the primary agency responsible for water resources management in South Africa. With respect to water quality its mission is to ensure the fitness of South Africa's surface water, groundwater and coastal marine resources, for water uses and for the protection of aquatic ecosystems, on a sustainable basis" (DWAF, 1986). The Department

therefore view aquatic ecosystems as a primary resource upon which development and other uses are based and sustained.

What is biomonitoring? Biological monitoring or biomonitoring is where the measurement of the condition of aquatic communities can be used to assess the condition of the associated ecosystem. In short, this means that the gathering of biological information in both the laboratory and the field for the purpose of making some sort of assessment, decision or in determining whether quality objectives are being met regarding an aquatic environment. Generally chemical data are biased towards short-term conditions that exist at the time a sample is collected. In contrast the biological communities that inhabit rivers continuously integrate and reflect the effects of chemical, biological and physical influences occurring over extended periods of time. When we then monitor the biological communities, it offers the researcher or manager a holistic ecosystem approach where the focus of the data gathered is on the ecological resource (Roux, 1997). What we therefore try to do is to monitor the effects of changing ecological conditions, or more correctly, trends of change over the sampling period.

Therefore the function of the indices (biological) is to disseminate results of a monitoring programme to a point where it can be of use to resource managers, conservationists and the general public. This will only be possible if the biological index integrates and summarises ecological data within a particular indicator group. The selected biological indices quantify the condition of aquatic ecosystems and the method to express the resulting information is usually numeric. For the RHP the appropriate indicators were tested and justified and then linked to measuring units, which were then used to index biological and ecological condition (Roux, 1997).

2. Discussion

With the pressures on the limited natural resources increasing, the aim of the Water Research Commission (WRC) project was to give some mitigating actions. These were done on a small component of the total Nyl floodplain catchment, as we focussed on the water quality, sediment, fish, macro-invertebrates and plants of the area. If this information is incorporated into an effective management strategy, the whole document must be rolled out in a much more comprehensive document.

When we look at wetland preservation, one can ask the following question: What is happening today?

It is important to determine the importance of criteria in the management of wetlands. Under most conditions when one analyses the specific situation the following two key issues arise:

- Whether wetlands should be conserved for environmental benefits.
- Whether the wetlands should be used for development activities.

From these two scenarios it is clear that there is indeed a conflict faced in many natural resource management problems. Many people are not against development, but it is the issue to find a balance. If we do not have development strategies at regional level, how can we determine how many golf estates can be allowed in the southern Cape?

2.1 Conservation / Preservation

Throughout the developing world, governments, donor agencies and non-governmental organisations have promoted the establishment of marine reserves, wildlife sanctuaries and protected areas to preserve biodiversity and to prevent environmental degradation from development activities. This is the basis of the lobby to protect and if no clear strategies or guidelines exist, the “greenies” and the developers will clash when any new proposal is put on the table. The end result is a negative environment that will exist between the different groups, always leading to confrontation.

In this strategy, conservation standards will be listed in an effort to preserve the environment for future generations. An important aspect in this sphere is the establishment of protected areas. When these protected areas are formed, it is important that these reserves exhibits multiple objectives and involves stakeholders with diverse interests. The new trend is to have parks with zoned areas for different uses: wilderness areas, game viewing, accommodation, high impact areas and areas were local communities can harvest materials and/or game.

We know with the industrial development and expansion of populations all over the world, trees and wetlands were transformed into valued commodities through processes such as deforestation and filling of wetlands. If we are concerned about biodiveristy issues, protection and sustainable utilisation of resources and the well being of people, a strategy must be formulated to direct managers, developers and political decision makers. One of the problems we have today is that the development of critical areas are

placed under a management system based on protected area development principles while non-critical areas are left open to traditional economic development systems – can be conflicting, with negative results to the environment and critical resources such as water.

In many cases development is viewed as: “a decision to invest or develop, using traditional economic development systems that is based purely on the satisfaction of cost–benefit criteria”. It can be viewed in the following manner: “there is an inherent weakness of this valuation approach, as it normally under-values and un-prices resources and does not highlight environmental degradation”.

The buzz words to remedy the problems are sustainable development and this is generally aimed to manage on an environmentally responsible manner for the development in unprotected and protected areas. Unfortunately, budgetary and institutional constraints in practice led to the situation where the focus of sustainable development programmes of the management of protected areas is biased towards development.

- In reality, where development is concentrated in unprotected areas, it is generally unsustainable. Investments in unprotected areas are justified only on the grounds of the financial viability because there is a market for a given activity.
- Furthermore, social, economic and ecological pressures on unprotected areas have increased and it is not reflected in traditional economic analysis, which can lead to system failure.

It is therefore true that the valuation of unprotected areas does not generally include the non-use (passive use) part of environmental benefits in evaluating the total cost and benefits of development and in many instances the argument on conservation versus conversion for development is currently raging. Although it seems like similar terms, the allocation of land for conservation or conversion for development is fundamentally different in protected and unprotected areas. In protected areas, conservation is prioritised, whereas in unprotected areas, conservation is largely neglected.

In the argument for development in protected areas, pure conservation has been identified as a threat to human welfare. In this case, the exclusion of local people is highlighted, thus denying rights to resources and undermining livelihoods. On the other hand, where development activities have dominated in unprotected areas, they have undermined both environmental conservation as well as livelihoods. In these instances, development is often identified as the problem – the main cause for biodiversity loss in a strictly sustainable sense.

In the recent past the way of thinking towards conservation has shifted, reflecting contemporary discourses on conservation and development. Three conservation paradigms have been identified:

- The classic approach.
  - Classic approach considers local people as a direct threat to biodiversity.
- The populist approach.
  - Populist approach considers participation and empowerment of local people key to find solutions for more sustainable use of biodiversity.
- The neo-liberal approach.
  - Neo-liberal approach considers institutional, market and policy failures as the main causes for biodiversity loss.

3. Findings of the WRC Project

- When evaluating the floodplain, it is critical to include the whole floodplain and all its tributaries in a conservation area.
- All catchments must be included, as the system is relatively small, with a small catchment. The result is that any impact, although small to the observer can have a huge result in the rest of the system.
- One of the question we asked at a meeting in Modimolle (formerly known as Nylstroom) was: Is there a conservation strategy for the region? Although we didn’t receive a definite yes or no, it was evident that no such document exists for the Waterberg District Municipality (Municipality under which the floodplain falls). This just emphasised the need for a strong conservation plan and the work from the WRC study will give invaluable information to strengthen the strategy. We only came up with a framework document that covers the few aspects we studied, but if this is linked to all the other information available, managers and planners can formulate a very strong “management tool”.

- How will this data fit into the strategy? My personal view is that it will fit well into such a strategy. As we have recommended, a task team must be formed to ensure that the long-term conservation goals and the development strategies envisaged for the region are meshed into a well designed and formulated document.
- What about areas where poor management activities are in place? That is one of the more critical issues we have experienced. It is usually twofold, one is related to not enough knowledge and expertise to understand the problem and the second is the lack of a coordinated strategy for the area.

3.1 What are the main problems impacting on the floodplain?

At the start of the project, it was assumed that water quality is the main problem impacting on the system. Lower bird numbers, low frog and fish numbers where all "linked" to pollution. This assumption was made after the fish kill in 1999, resulting from a poison and sewerage spillage and a subsequent water quality study in the immediate vicinity of the sewerage works and Nylsvley Nature Reserve downstream of it.

During the recent study we included various water sampling points (18 in total) throughout the total catchment of the Nyl floodplain (Figure 1). These were selected at the source of various small tributaries to ensure that we get a picture of the "unpolluted" headwaters. From the study it was clear that the host of parameters (80 nutrients and metals) tested for, no significant increase was observed between the source of the tributaries and the last site sampled at Makopane (Potgietersrus). We even did a limited pesticide scan and no specific problems were detected in the 10 samples tested. This left us with the question, what are the major threats for the floodplain?

Habitat destruction as a collective term can be put forward as the major issue that needs attention in management and planning strategies. In most catchments today, development is placing a huge strain on the existing natural resources and water is one that is seriously threatened. What is the main factors having an impact on the Nyl floodplain?

Dams and weirs are one of the most influential negative impacts in the system. Most of the tributaries are fragmented by many low dames and weirs and in all instances there is no structure designed to allow migration of aquatic organisms and none of the structures can let water out, once the level has dropped below the overflow. Many of the structures are used for storage water for irrigation or livestock, but when a small river such as the Tobiasspruit has 15 dams and weirs in a 15 km stretch, it is clear that something is wrong. On one property, 8 large impoundments were observed during an aerial survey, taking most of the normal runoff out of the river. In the catchment of this river, large exotic plantations of black wattle are present and the natural grassland typical of the Waterberg foothills was transformed. Very little runoff was observed after the flush floods during the rains, indicating that the sponge areas are not functioning. The collective impact of the thirsty exotic trees and the large number of impoundments have transformed the perennial river into a seasonal flush flood gutter.

On the floodplain itself, a network of canals and berms have diverted the water away from the floodplain. During low flow periods, water still destined for the floodplain is channelled into these canals and water is stored in a few large impoundments on the floodplain itself. Aquatic fauna can migrate during high flood events, but little migration was observed during the low flow periods. This impacted on the biomass production (fish, frogs) that in previous years attracted large numbers of fish-eating birds to the area. It was these congregations that led to the declaration of the Nylsvley Nature Reserve as a Ramsar site in the 90's. Local birders have reported a decline in numbers of certain species of 80-90% over the last 10-12 years. Yes, the diversity previously found is still there, but the numbers is much lower. There was talk that the Ramsar site can lose it status, if the problems related to the drop in bird numbers are not addressed!

Another culprit in the reduced flow and modified flow patterns is the construction of roads and the railway across the floodplain. Again, we need the infrastructure, but the designs are very poor. From the aerial survey, it was evident that the floodplain upstream of these barriers are much wider where the water is blocked by the roads or the railway, narrowing just downstream of the structure, again widening at the next point of constraint. Too few culverts were placed to ensure an unrestricted flow as possible. These constrictions favour predatory fish such as Barbel (*Clarias gariepinus*), who use the few culverts to consume large numbers of migrating fish. The numbers of these fish able to spawn are reduced and over time the total biomass on the flood plain is reduced, leading to less food for the fish-eating birds.

4. Conclusions

The question is: why is biodiversity important? One can answer that with a simple definition of biodiversity – "*Biodiversity, or biological integrity, is the totality of the variety of living organisms, the genetic differences among them and the communities and ecosystems in which they occur. It is the 'natural wealth' of the earth, which supplies all our food and much of our shelter and raw materials. However, without adequate protection, it will diminish and make all of us poorer*" (Le Roux, 2002). The importance of our commitment towards environmental protection was echoed by President Thabo Mbeki when he briefed the World Economic Forum. He stated the following role that Africa has to play: "*Africa has an important role to play with regard to the critical issue of the protection of the global environment. The African development strategy should indicate: - how these environmental assets can be turned into tradable goods and – what investments should be made to ensure that these environmental resources are not destroyed*".

It is clear that we have a definite role to play. Proper planning, education and awareness are the key to this goal that we all have.

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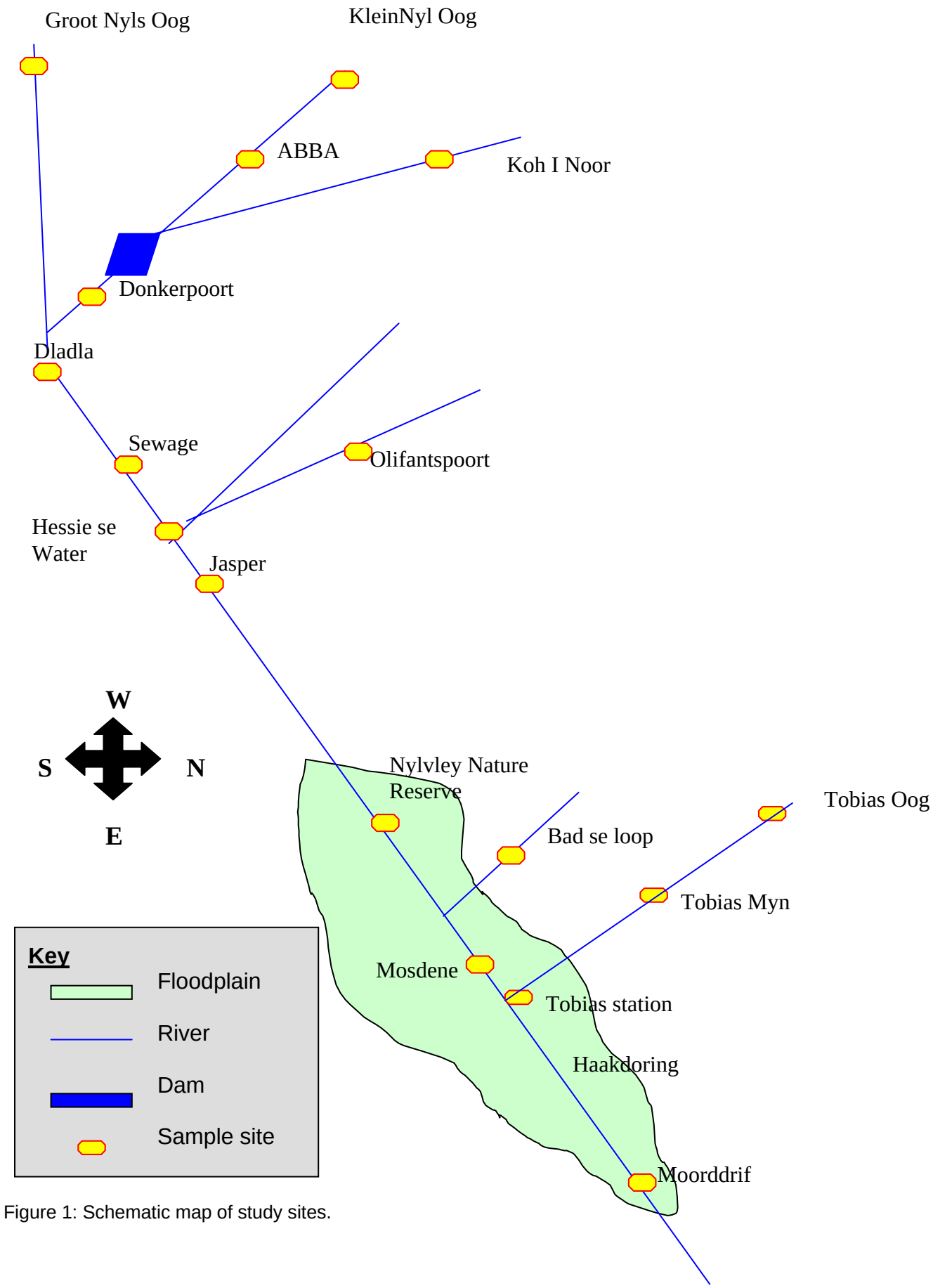

Figure 1: Schematic map of study sites.