Wetland Health and Importance Research Programme

10

Wetland Valuation Volume III
A Tool for the Assessment of the Livelihood Value of Wetlands

Author: J Turpie
Series Editor: H Malan

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WETLAND HEALTH AND IMPORTANCE RESEARCH PROGRAMME

10

WETLAND VALUATION. VOL III

A TOOL FOR THE ASSESSMENT OF THE LIVELIHOOD VALUE OF WETLANDS

Report to the
Water Research Commission

by

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PREFACE

This report is one of the outputs of the Wetland Health and Importance (WHI) research programme which was funded by the Water Research Commission. The WHI represents Phase II of the National Wetlands Research Programme and was formerly known as "Wetland Health and *Integrity*". Phase I, under the leadership of Professor Ellery, resulted in the "WET-Management" series of publications. Phase II, the WHI programme, was broadly aimed at assessing wetland environmental condition and socio-economic importance.

The full list of reports from this research programme is given below. All the reports, except one, are published as WRC reports with H. Malan as series editor. The findings of the study on the effect of wetland environmental condition, rehabilitation and creation on disease vectors were published as a review article in the journal Water SA (see under "miscellaneous").

An Excel database was created to house the biological sampling data from the Western Cape and is recorded on a CD provided at the back of Day and Malan (2010). The data were collected from mainly pans and seep wetlands over the period of 2007 to the end of 2008. Descriptions of each of the wetland sites are provided, as well as water quality data, plant and invertebrate species lists where collected.

An overview of the series

Tools and metrics for assessment of wetland environmental condition and socio-economic importance: handbook to the WHI research programme by E. Day and H. Malan. 2010. (This includes "*A critique of currently-available SA wetland assessment tools and recommendations for their future development"* by H. Malan as an appendix to the document).

Assessing wetland environmental condition using biota

Aquatic invertebrates as indicators of human impacts in South African wetlands by M. Bird. 2010.

The assessment of temporary wetlands during dry conditions by J. Day, E. Day, V. Ross-Gillespie and A. Ketley. 2010.

Development of a tool for assessment of the environmental condition of wetlands using macrophytes by F. Corry. 2010.

Broad-scale assessment of impacts and ecosystem services

A method for assessing cumulative impacts on wetland functions at the catchment or landscape scale by W. Ellery, S. Grenfell, M. Grenfell, C. Jaganath, H. Malan and D. Kotze. 2010.

Socio-economic and sustainability studies

Wetland valuation. Vol I: Wetland ecosystem services and their valuation: a review of current understanding and practice by Turpie, K. Lannas, N. Scovronick and A. Louw. 2010.

Wetland valuation. Vol II: Wetland valuation case studies by J. Turpie (Editor). 2010.

Wetland valuation. Vol III: A tool for the assessment of the livelihood value of wetlands by J. Turpie. 2010.

Wetland valuation. Vol IV: A protocol for the quantification and valuation of wetland ecosystem services by J. Turpie and M. Kleynhans. 2010.

WET-SustainableUse: A system for assessing the sustainability of wetland use by D. Kotze. 2010.

Assessment of the environmental condition, ecosystem service provision and sustainability of use of two wetlands in the Kamiesberg uplands by D. Kotze, H. Malan, W. Ellery, I. Samuels and L. Saul. 2010.

Miscellaneous

Wetlands and invertebrate disease hosts: are we asking for trouble? By H. Malan, C. Appleton, J. Day and J. Dini (Published in Water SA 35: (5) 2009 pp 753-768).

EXECUTIVE SUMMARY

INTRODUCTION

Millions of South Africans are directly dependent to some extent on natural systems to sustain their livelihoods, and wetlands are considered particularly valuable in terms of the variety and abundance of services they provide. Understanding the degree to which wetlands contribute to people's livelihoods may be vital in steering decisions that minimize negative impacts or enhance the benefits that wetlands have for communities, such as their contribution to household income. These could include water resource decision-making, conservation and development planning, or environmental impact assessment. The aim of this study was to develop a simple index for the assessment of a wetland's importance to people's livelihoods through understanding of the level of dependence of surrounding communities on the wetland. The tool outlines the way in which the index parameters are estimated at a rapid, intermediate, or comprehensive level, depending on the budgetary constraints or the level of confidence required. Since the index produces a result which is in comparable units, the results can be used to assess the relative importance of a wetland compared to others in the catchment or even nationally, and to rank, or prioritize, different wetlands in terms of management priorities. It would also be possible to apply the index when investigating the implications of different future scenarios (e.g. changes in wetland property rights, climate, and population density). The index developed here can be used in conjunction with existing South African indices such as WET-Health, WET-EcoServices and WET-SustainableUse.

HOW LOCAL COMMUNITIES BENEFIT FROM WETLANDS

Wetlands provide water storage, wild food and medicines and raw materials, as well as superior grazing and cropping areas. Communities living downstream of wetlands may also make use of aquatic ecosystem resources whose availability depends to some extent on the regulating services provided by the upstream wetland. In addition, wetland attributes may provide opportunities for cultural and religious activities, recreation and tourism. These services are described in detail in Volume I of this series. These services yield a number of benefits, of which the six major benefits are considered in this index. Four relate to the value obtained as direct and indirect income, or as direct and indirect cost savings, which is linked to the availability of resources. The fifth relates to how that income (or food security) is spread over time, which is related to seasonal dynamics or

the change in availability of natural resources relative to other sources of income or food. The sixth benefit relates to how the above income or benefits are spread among the community or broader society. In other words, it relates to the extent to which the wetland can provide a safety net for households that have suffered shocks.

FACTORS AFFECTING THE PROVISIONING VALUE OF WETLANDS

The value obtained from use of wetland resources relates to the demand as well as supply of these resources both from the wetlands as well as from surrounding habitats. The demand for wetland resources will be determined by socio-economic characteristics of the area, including the number of households, their level of income and their culture, and will potentially be limited by the type of control over the wetlands. Other factors such as access to markets and availability of substitutes for wetland resources will also influence demand. Access to natural resources, or property rights, affect the magnitude and distribution of benefits obtained, with values being potentially maximal under a controlled access situation, and the distribution of value (number of households benefitting) being greater under an open access situation. The value of the wetland may or may not be sustainable.

ASSESSING DEPENDENCE ON WETLANDS

An assessment of the livelihood value of wetlands should take the level of dependence on wetlands into account rather than just expressing their value as a proportion of household income. This would involve assessing the overall value obtained from wetlands in the context of the vulnerability of the community.

Assessing the degree to which people depend on wetlands for their livelihoods involves assessing the contribution that wetlands make to reducing the vulnerability of households to poverty, which is related to the alternatives available to the household. A household's vulnerability to poverty is related to its access to livelihood assets, which include natural resources. Poverty is most simply defined as the state of having little or no money and few or no material possessions. The vulnerability of a household or community can be defined as its susceptibility to stressors or changes and is determined by the combined strength of its physical, social, financial, human and natural capital assets.

ASSESSING THE LIVELIHOOD VALUE OF WETLANDS

It is important to distinguish between an assessment of the degree to which a community benefits from, or is dependent on a wetland, and the value of a wetland in terms of its contribution to a community. A wetland will have a greater livelihood value if it is used by many people who are highly dependent on it. This is a measure that can be attributed to the wetland itself, and which can be used to compare the relative importance of different wetlands to society in general. This study builds on lessons learned from other studies that have been applied in South Africa.

OVERVIEW OF THE WETLAND LIVELIHOOD VALUE INDEX AND ASSESSMENT PROCESS

The overall structure of the Wetland Livelihood Value Index is shown in Figure E1. A **Wetland Dependence Score** is computed, which describes the community's relationship with the wetland and is specific to the surrounding community, not the wetland. The Wetland Dependence Score incorporates two components in order to ascertain the level of dependence of surrounding communities on wetlands: one to assess the benefits derived from wetlands by the local community, and another to assess the vulnerability of that community to poverty. The **Wetland Livelihood Value Index (WLVI)** is computed on the basis of this score and the relative size of the wetland and its surrounding community (Figure E1). In other words, the WLVI is specific to one or more wetlands, rather than any particular community. Both aspects – the Wetland Dependence Score and the WLVI may be useful for different applications, depending on where the focus of the study lies.

The steps that need to be undertaken in the assessment process are as follows:

1. define the objectives and level of study;
2. define the study area boundaries and wetland dependent community;
3. describe habitats and provision of services;
4. score benefits derived from wetland(s);
5. assess vulnerability of local community;
6. assess current level of dependence on the wetland(s);
7. calculate Wetland Livelihood Value Index; and
8. assess sustainability of the community-wetland relationship.

These steps are outlined in detail in the main report, together with data requirements and scoring guidelines. The way in which these steps are carried out depends on whether the assessment is carried out at a rapid, intermediate or comprehensive level. For a rapid assessment, the overall approach is to gather existing information on the study site and its population and context. For an intermediate assessment, this would be followed by a field trip involving key informant interviews and focus group discussions. For a comprehensive assessment, a second trip would be carried out, in which a household survey is used to obtain quantitative data on household activities and income.

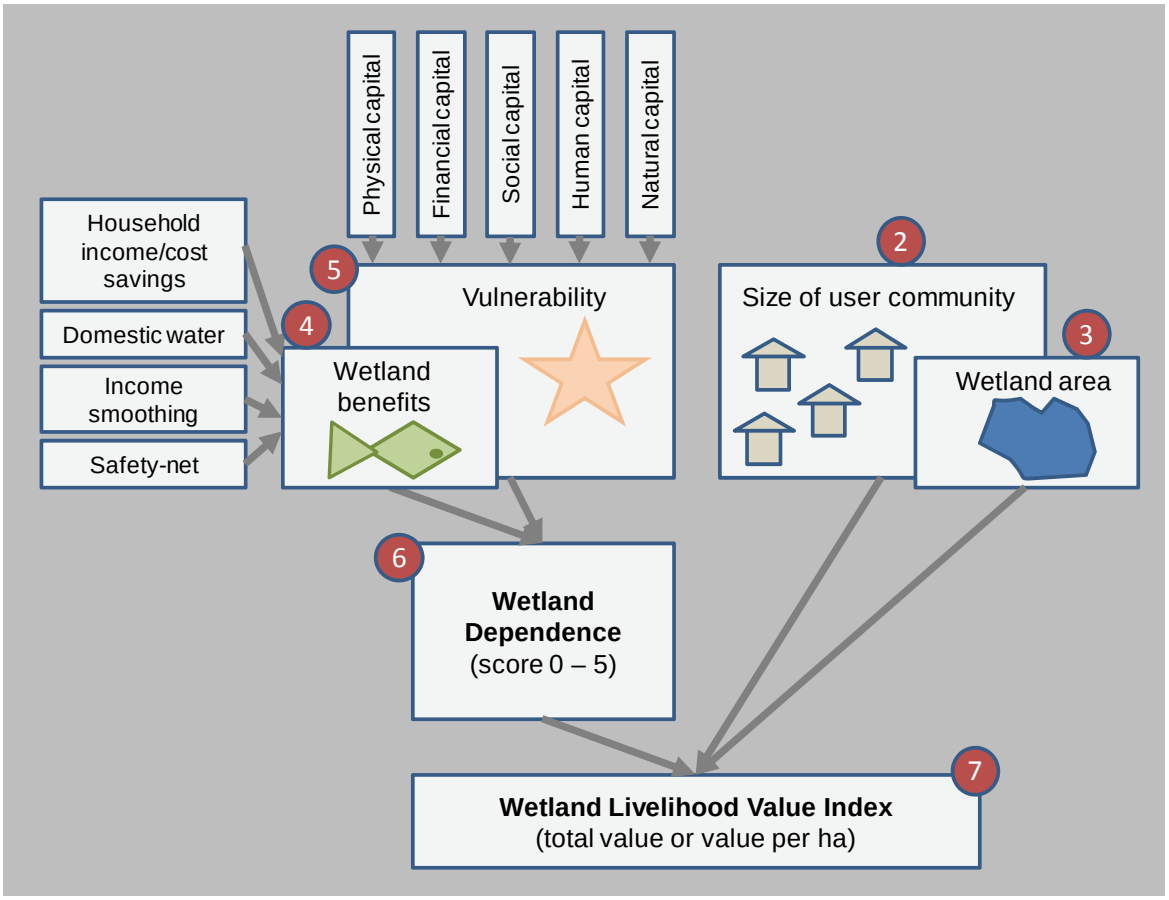

Figure E1: Overall structure of the Wetland Livelihood Index. Numbers in circles correspond to steps in the assessment process after step 1 (defining objectives and level of assessment).

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ABBREVIATIONS

A – area

D – demand

DFID – Department for International Development

DHE – dependent household equivalents

DWAF – Department of Water Affairs and Forestry

FEWS – Food Emergency Warning System

HDI – Human Development Index

HGM – hydrogeomorphic

hh – households

NR – natural resources

S – supply

1. INTRODUCTION

1.1 Rationale and aim

Millions of South Africans are directly dependent to some extent on natural systems to sustain their livelihoods. In addition to supporting agricultural activities such as grazing and cropping, natural ecosystems provide a source of wild foods, medicines and raw materials for both subsistence and commercial use. These resources add to people's livelihood security and are used either regularly for a range of basic living requirements (Shackleton *et al., 2*001) or as a fallback during times of need (Shackleton and Shackleton, 2006). Such dependence is predominantly in areas where there are easily accessible communal area resources in conjunction with limited economic options (Dovie *et al., 2*006). While most ecosystems provide value in this way, wetlands are considered particularly valuable in terms of the variety and abundance of services they provide. In particular, they provide added grazing potential relative to surrounding uplands, added fertility and soil moisture for cropping, an abundance of raw materials such as reeds, and fisheries. Some wetlands are also used as sources of wild foods, medicines and fuel wood (Schuyt, 2005, Turpie *et al., 1*999, Turpie *et al., 2*006). Wetlands may also be indirectly important to people's livelihoods, through their influence on downstream aquatic habitats and their role in recreational and cultural activities, and may also contribute to tourism activities that lead to business and employment opportunities in nearby communities.

Understanding the degree to which wetlands contribute to people's livelihoods, such as their contribution to household income, may be vital in steering decisions that minimize negative impacts or enhance the benefits that wetlands have for communities. These could include water resource decision-making, conservation and development planning, or environmental impact assessment. In some cases, a rapid assessment of several wetlands in a broad area is required. In other cases, more comprehensive assessments are required, at a more detailed scale.

The aim of this study was to develop a simple index for the assessment of a wetland's importance to people's livelihoods through understanding the level of dependence of surrounding communities on the wetland. The tool outlines the way in which the index parameters are estimated at a rapid, intermediate, or comprehensive level, depending on the budgetary constraints or the level of confidence required.

1.2 Who will use the Wetland Livelihood Value Index?

This metric is designed for use in a decision-making context such as development or conservation planning, strategic environmental assessment or environmental impact assessment. It is envisaged that the assessment be performed by an expert with a geography, social, or resource economics background and/or experience, in conjunction with a wetland expert and someone with basic GIS expertise. The method could easily be used for wetlands in most developing country contexts, and can be adapted for other types of habitats as well.

1.3 How will the results be used?

The way in which the Wetland Livelihood Value Index will be used will vary depending on the decision-making context and the entity who commissioned the assessment. It will usually be required to add strength to a social assessment of the relationship between the community and the wetland. If the level of dependency is found to be high, then it will create a case for protecting the use of the system or managing it sustainably. Since the index produces a result which is in comparable units, the results can be used to assess the relative importance of a wetland compared to others in the catchment or even nationally, and to rank, or prioritize, different wetlands in terms of management priorities.

The index produces a measure of the current livelihood value of the wetland. It would also be possible to apply the index when investigating the implications of different scenarios (e.g. changes in wetland property rights, climate and population density).

1.4 Relationship between the Wetland Livelihood Value Index and other wetland assessment tools

Indices have been developed in South Africa for the assessment of wetland environmental condition or “health” (WET-Health), provision of ecosystem services by wetlands (WET-EcoServices) and the sustainability of wetland use (WET-SustainableUse). Each of these tools can be used individually; however, there is some overlap. All of these are relevant to the assessment of the social value of a wetland, and are outlined below.

1.4.1 WET-Health

WET-Health (Macfarlane *et al., 2*008) is a tool which guides the rapid assessment of a wetland's environmental condition based on a site visit. This involves scoring a number of attributes connected to the geomorphology, hydrology and vegetation, and devising an overall score which gives a rating of environmental condition. WET-Health is useful when making decisions regarding wetland rehabilitation, as it identifies whether the wetland is beyond repair, whether rehabilitation would be beneficial, or whether intervention is unnecessary, as the wetland's functionality is still intact. Through this method, the cause of any wetland degradation is also identified, and this facilitates effective remediation of wetland damage. There is wide scope for the application of WET-Health as it can also be used in assessing the Present Ecological State of wetlands and thereby assist in determining the Ecological Reserve as laid out under the National Water Act.

WET-Health offers two levels of assessment, one more rapid than the other. For the assessments, an impact and indicator system is used. The wetland is first categorized into the different hydrogeomorphic (HGM) units and their associated catchments, and these are then assessed individually in terms of their hydrological, geomorphological and vegetation health by examining the extent, intensity and magnitude of impacts, of activities such as grazing or draining. The extent of the impact is measured by estimating the proportion the wetland that is affected. The intensity of the impact is determined by looking at the amount of alteration that occurs in the wetland due to various activities. The magnitude is then calculated as the combination of the intensity and the extent of the impact and is translated into an impact score. This is rated on a scale of 1 to 10, which can be translated into six health classes (A to F – compatible with the ecostatus categories used by DWAF). Threats to the wetland and its overall vulnerability are also assessed and expressed as a likely Trajectory of Change. The water quality module of WET-Health requires strengthening, however (H. Malan, 2009, pers. comm., University of Cape Town, Cape Town).

1.4.2 WET-EcoServices

WET-EcoServices (Kotze *et al., 2*008) scores wetlands in terms of their capacity to provide ecosystem services, as well as the opportunity to provide the service. Building on earlier wetland assessment tools, it examines a series of attributes of the wetland and its catchment and rates them on a five-point scale or a binary (yes/no) format, based on a site visit. A desktop method is also described.

WET-EcoServices considers each service from a supply and demand point of view. The scores reflect:

- **capacity** to provide the service (based on wetland attributes and location); and
- **opportunity** to provide the service (e.g. based on the characteristics of surrounding area and population).

First, the potential for the wetland to perform the service is evaluated based on current understanding or expert opinion of wetland characteristics and functioning. Second, the opportunity for the wetland to supply the services is evaluated. For example, the water quality services would not be actualized unless there were anthropogenic inputs in the catchment area or into the wetland. Moreover, this service would only be valuable if there were beneficiaries downstream. These kinds of factors are all taken into account in the index, which is in line with an economic valuation approach.

WET-EcoServices identifies which ecosystem services are likely to be supplied and need to be considered in the management of a wetland or in land-use decision processes, but is not designed to provide a single overall measure of the value or importance of a wetland, or to quantify (in monetary or other terms) the benefits supplied by a wetland. It only goes as far as to assist in assigning indices to these benefits for comparative purposes (Kotze *et al., 2*008). However, there are some problems with weighting and scaling that need to be improved in order for this tool to be more useful (see Volume I – Turpie *et al., 2*010).

1.4.3 WET-SustainableUse

WET-SustainableUse is an index developed by Kotze (2010), which provides a means of assessing the level of sustainability of use of a particular wetland. While it is recognized that sustainability comprises three dimensions, namely ecological, social and economic, the specific focus of WET-SustainableUse is on ecological sustainability. The tool focuses on the sustainability of the main types of wetland use in South Africa, namely:

- cultivation of wetlands, particularly small scale and non-mechanized cultivation;
- grazing of wetlands by livestock; and
- harvesting of wetland plants for crafts.

The framework includes consideration of how tenure, governance and other socio-economic factors might influence the sustainability of use, and it assists the user in placing the assessment in a broader socio-economic and institutional context.

There is some overlap between the WET-SustainableUse tool and the Wetland Livelihood Value Index described in this report, in that both require a good understanding of the extent of wetland use as well as institutional issues that affect access to resources. Indeed, understanding the supply-demand relationships for wetland resources and factors affecting access to these resources is important for assessing the sustainability of use as well as for assessing the level of dependence of a community on a wetland.

2. HOW LOCAL COMMUNITIES BENEFIT FROM WETLANDS

2.1 Introduction

Wetlands provide water storage, wild food and medicines and raw materials, as well as superior grazing and cropping areas. The direct use of these **provisioning services** yields a number of direct and indirect benefits. Communities living downstream of wetlands may also make use of aquatic ecosystem resources whose availability depends to some extent on the **regulating services** provided by the upstream wetland. In addition, wetlands provide **cultural services,** in that their attributes may provide opportunities for cultural and religious activities, recreation and tourism. These provide intangible benefits as well as tangible income. The classification of ecosystem services is summarized in Table 2.1 and described in more detail in Volume I (Turpie *et al., 2*010).

2.2 Provisioning services

2.2.1 Water for domestic use

Wetlands can provide a store of freshwater that can be used for domestic purposes including drinking, cooking, bathing and washing of clothes. For some communities this may save on the time required to fetch water from the nearest alternative source, or from purchasing water in some form.

2.2.2 Harvesting of wild foods and medicines

Many rural communities collect wild foods and medicines, some of which can be sourced in wetlands. In general, wetlands are probably not as important as surrounding terrestrial landscapes for these resources, but studies in Lesotho suggest that in some areas the service can be significant (Lannas and Turpie, 2010). In some areas, the water lilies *Nymphaea capensis, N. lotus* and *Zantedeschia aethiopica* growing in wetlands provide an important source of food (Pooley, 1980). Waterblommetjies, *Aponogeton distachyos* are also harvested from wetlands. Floodplain palms such as *Hyphaene natalensis* and *Phoenix reclinata* provide fruits and sap (Pooley, 1980, Turpie *et al., 1*999), and mammals and birds that use wetlands for feeding, breeding, or shelter may also be hunted (Begg, 1986).

Table 2.1: Types of services provided by inland wetlands (based on Turpie *et al., 2*010)

Types of Services		Description
Provisioning services	Water	Provision of water for livestock or domestic use
	Food, medicines	Production of wild foods and medicines
	Grazing	Production of grazing for livestock
	Raw materials	Production of fuel, craftwork materials, construction materials
	Genetic resources	Medicine, products for materials science, genes for resistance to plant pathogens and crop pests, ornamental species
Regulating services	Climate regulation	Carbon sequestration; wetlands are believed by some to be carbon sinks that contribute towards reducing carbon emissions, but the opposite may in fact be true
	Flow regulation	Flood attenuation; reduction of the amplitude and velocity of flood waters by wetlands, reducing downstream damage
		Groundwater recharge; wetlands are commonly thought to provide differential recharge to groundwater relative to surrounding vegetation types, and to contribute to dry season base flows
	Sediment retention	Retention of soil and fertility within an ecosystem
	Waste treatment	Breaking down of waste, detoxifying pollution; dilution and transport of pollutants
	Regulation of pests and pathogens	Change in ecosystem health affects the abundance or prevalence of malaria, bilharzia, liver fluke, black fly, invasive plants, etc.
	Refugia	Critical breeding, feeding or watering habitat for populations that are utilized elsewhere
Cultural services	Abundance, rarity and beauty of species, habitats and landscapes	Providing opportunities for : • cultural activities and heritage • spiritual and religious activities and wellbeing • social interaction • recreational use and enjoyment • research and education

Throughout southern Africa, wetlands are also an important source of fish, and support numerous small scale fisheries (Turpie *et al., 1*999). These multi-species fisheries are generally highly productive. In South Africa, however, the relative scarcity of large floodplain wetlands means that wetland fisheries do not have the same level of importance, apart from in a few of the larger systems such as the Pongola floodplain (see Merron and Weldrick, 1995). Nevertheless, even small catches may contribute to household livelihoods.

2.2.3 Harvesting of raw materials

Wetlands are well known for the provision of raw materials such as reeds, sedges, thatching grass and clay. Reeds such as *Phragmites australis* and *Phragmites*

mauritianus are used in construction, for example for ceilings or fences. Sedges such as *Cyperus latifolius, Cyperus papyrus, Cyperus sexangularis, Schoenoplectus corymbosus, Scirpus* spp. and *Juncus kraussii* are used for making mats (Pooley, 1980, Begg, 1986, Kotze *et al., 2*002; Pollard *et al., 2*007). These products are often sold to generate income. Grass species such as *Hyperthelia dissoluta* and *Cymbopogon* spp. are harvested for thatching (Pooley, 1980). Floodplain palms such as *Raphia australis, Hyphaene natalensis* and *Phoenix reclinata* provide wood and leaves for use in construction and crafts. In some areas, flowers such as arum lilies *Zantedeschia aethiopica* are harvested for sale.

2.2.4 Livestock grazing and watering

Wetlands are also commonly used as grazing areas, especially during the dry season, and usually have higher grazing potential than surrounding uplands. In Lesotho, for example, it was found that herders preferentially used the wetland areas within their range (Lannas and Turpie, 2010). Even in commercial farmlands in South Africa, wetlands provide an important grazing resource during the dry season (Palmer *et al., 2*002).

2.2.5 Cropping

Because of their relatively high soil moisture and nutrient levels, wetlands often provide premium locations for cropping compared with surrounding landscapes, and are thus favoured places for cultivation, particularly in the drawdown period and dry season (Kotze *et al., 2*002; Turpie *et al., 2*006). The net income that arises from the additional productivity is the value derived from cropping in wetlands (Turpie *et al., 2*006). It must be borne in mind however, that cultivation of wetlands displaces any value associated with the natural habitats that have been replaced by that cultivation.

2.3 Regulating services

Wetlands perform several functions which are classed as regulating services. Of these, the services of particular relevance to rural communities are those that affect downstream water supply. Many wetlands have the capacity to reduce excessive sediment and nutrient loads that result from catchment activities. This can have direct benefits in that people potentially do not have to spend as much money/time/firewood in purifying water for direct consumption. It also potentially prevents a loss of biodiversity in downstream

aquatic ecosystems that might have occurred in the absence of these services, as a result of deterioration in water quality (increased nutrients and turbidity). Thus downstream communities benefit from wetlands because potential damage to their resource base is averted. The value of the wetland to these communities is the additional benefit obtained from downstream aquatic ecosystems relative to the benefit that would have been possible without the wetland.

2.4 Cultural services

2.4.1 Recreational, cultural and religious use

Natural habitats often provide opportunities for relaxation and spiritual upliftment through provision of sites for recreation, or for cultural and religious ceremonies. Where they provide suitable habitat, such as pools which can be used for baptism, they may be used for cultural and religious use. However, these intangible benefits are not considered further here, as they do not contribute directly to household livelihoods *per se*.

2.4.2 Tourism use

The landscape and biodiversity attributes of wetlands often lend themselves to tourism activities such as game viewing, birding, frogging and hunting, and because of their aesthetic qualities, they are frequently the site of housing and tourism infrastructural developments in which property prices include a premium paid for this location. If local rural communities benefit from these tourism activities then the extent to which this benefit can be attributed to the wetland would constitute an indirect benefit of the wetland to them.

2.5 Types of benefits

2.5.1 Introduction

Wetlands produce a number of benefits, which can be roughly grouped into six types (Fig. 2.1). Four types, *viz.* direct and indirect income, direct and indirect cost savings, relate to benefits to household net income through increasing gross income or saving costs, and are linked to the availability of resources. The fifth relates to how that income (or food security) is spread over time, which is related to seasonal dynamics or the change in availability of natural resources relative to other sources of income or food. The sixth benefit relates to how the above income or benefits are spread among the

community or broader society, which relates to the property rights associated with the use of the wetland. Each of these benefits is discussed in more detail below.

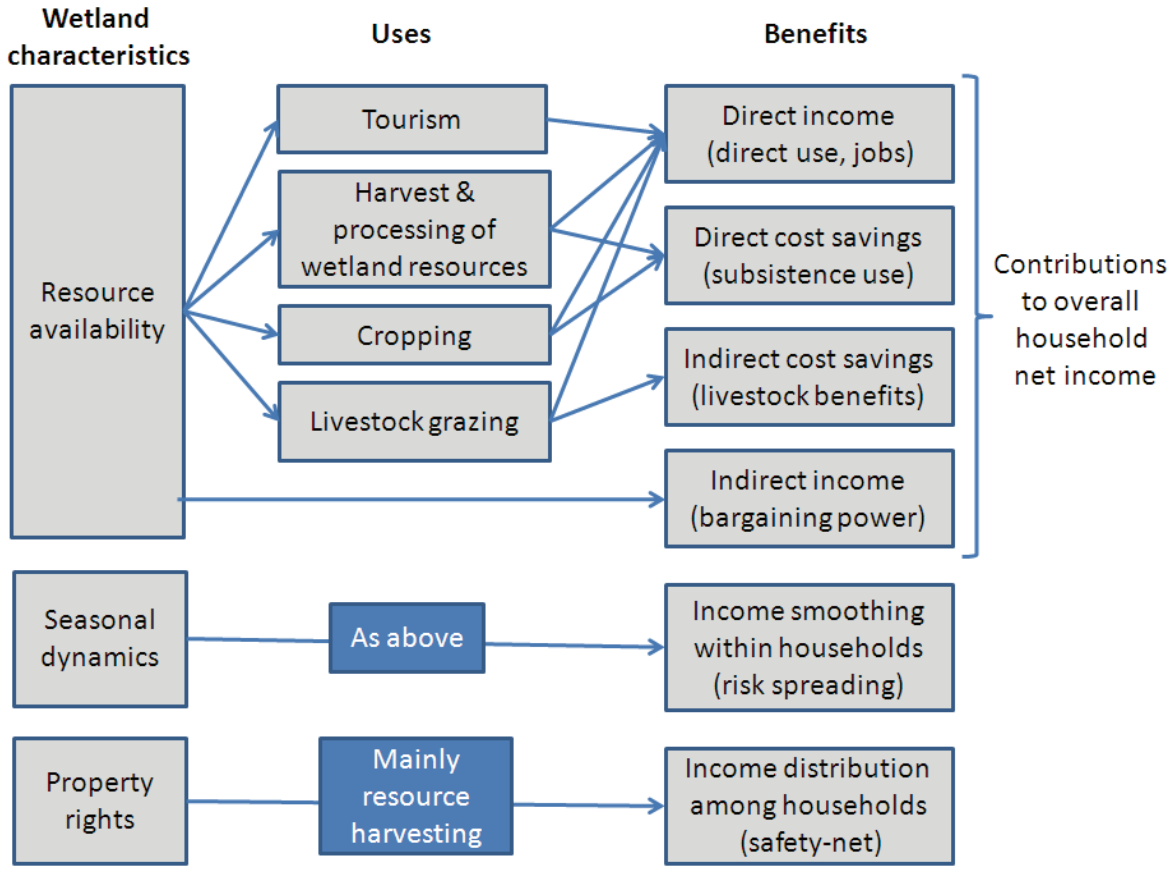


Figure 2.1: Main types of livelihood benefits accruing to communities from wetlands.

2.5.2 Direct income

Harvesting of natural resources, cropping, livestock grazing and employment in tourism all contribute to the cash income generated by the household. Wetland resources are often harvested and are sold, either locally or further afield, or are used to produce a variety of products such as mats, baskets and brooms which may be sold for cash. Similarly, surplus production in cropping and livestock systems is used to generate income, part of which can be attributed to the wetland.

2.5.3 Direct cost savings (subsistence use)

Water, foods, medicines and raw materials may be collected by households for their own use (or used *in situ*), saving the household money by obviating the need to purchase these items, or in the case of water, saving the extra time involved in obtaining water from

the next best source. Household labour time is used in these activities and if the opportunity cost of this labour is low, the behaviour is worthwhile. The opportunity cost of labour will be low when there are few alternative forms of income available, and particularly during periods when labour is not required for other activities such as agriculture. The subsistence value of these products can be valued in terms of their market price, where markets exist, or in terms of the cost of the next best substitute. Thus medicinal plants can be valued in terms of commercially available medicines, and thatch in terms of commercial roofing materials.

2.5.4 Indirect cost savings

Where households use wetlands for grazing, part of the indirect value associated with livestock can also be attributed to the input provided by the wetland grazing. In many areas, livestock provide milk for sale or consumption, manure for the fertilization of fields, and draught power for ploughing. Draught animals may also provide rental income or benefits in terms of the sharing of resources among households. In addition, cattle are often kept as a form of investment, especially where access to banking is limited, but also as part of a cultural tradition linked to the payment of dowries etc. The return to investment in the conventional sense is often low, but the investment pays off in terms of access to cash. In remote areas (and some peri-urban areas), capital loans come at a high price. Thus, cattle provide the opportunity to source cash without having to pay exorbitant interest rates.

2.5.5 Indirect contribution to household income

Where wetlands provide opportunities for self-employment, be it farming, fishing, or resource harvesting and processing, this raises the opportunity cost of labour in other sectors. This means that people have a better starting point in the wage bargaining process, since they have a fallback option. The degree to which this can occur depends on the nature of access as well as the availability of jobs in other sectors. Wetlands with relatively easy access to resources would offer the greatest value in this regard.

2.5.6 Income smoothing through risk spreading

Natural resources often provide opportunities for the diversification of household livelihoods, so that households can engage in multiple activities. This diversification is a risk spreading strategy that has the effect of maintaining a more steady income (income

smoothing) on a seasonal or inter-annual basis than would be possible if the household relied solely on one activity, such as agriculture. This improves a household long-term resilience to adverse trends or sudden shocks (Campbell, 1990). Diversified livelihoods are not in themselves an indicator of relative poverty, however, since among rural communities wealthier households also tend to increase their portfolio, albeit for different reasons (Béné *et al., 2*000).

2.5.7 Income distribution through safety-net function

Since wetlands contain resources that can be relatively easily harvested and processed without requiring any major investment, they can provide an important role as a fallback option for households that have suffered shocks such as the permanent or temporary loss of their means of survival in other activities or sectors. The degree to which this function can be performed depends on the nature of access. Wetlands with open access offer the greatest value in this regard, as discussed further below.

3. FACTORS AFFECTING THE PROVISIONING VALUE OF WETLANDS

3.1 Demand for and supply of natural resources

The demand for natural resources in rural landscapes is strongly linked to household income (Shackleton and Shackleton, 2006, Gordon and Turpie *in prep*.) and aggregate demand of the total population. It also depends on the socio-economic context, for example, the availability of alternative sources of income and of substitutes. For example, where electricity is available for wealthier households, this is likely to reduce the overall demand for fuel wood. Where alternative materials such as bricks or corrugated iron are available for house construction, demand for raw materials such as reeds is expected to decrease with increasing wealth. Where there is ready access to markets, richer households will tend to replace sleeping mats with beds. However, where access to markets is limited, richer household may become the buyers of natural resources that are harvested by poorer households (Gordon and Turpie *in prep*.). The demand for resources may also be influenced by cultural norms and may shift in response to changing fashions and preferences, and as a result of various market forces.

Demand for resources will also be influenced by the time it would take to access the resources. Here the opportunity cost of labour time comes into play, if time can be more productively spent in alternative activities.

Linked to the above, the demand for resources from a particular wetland of interest will be linked to the availability of similar resources in the overall landscape. For example, if suitable thatching grasses are available generally, then the use of the wetland for this material might be relatively unimportant. Similarly, if the wetland of interest is one of several within range of the households, then it might be of lower value than a single wetland in the landscape.

The above point raises the issue of the relative scarcity of resources demanded by households in the community. If thatching grass or grazing is a scarce resource in a highly populated area, then the wetland might be a valuable provider of this resource even if it can also be obtained from the surrounding landscape. This will be influenced by the ratio of user population to wetland area.

Of course, the supply of wetland resources will be determined to a large extent by the type of wetland and the way it is used. Some types of wetlands provide more in the way

of sedges and fish, whereas others might be better for grazing (Kotze *et al., 2*008). The supply of these resources is also linked to the amount of use allowed under the existing system of control, with resources more likely to be depleted under situations of open access. This is discussed further below.

The extent of landuse within a wetland will also determine how much of the natural resource base remains available to users. For example, 50% of the wetland might be modified through agricultural practices, or the whole wetland might be grazed, affecting the availability of grasses. Another scenario might be the damming of a wetland, which effectively transforms it into another type of wetland. Linked to this, the health or environmental condition of a wetland also determines the resources it can deliver. Apart from the extent of landuse, wetland condition is affected by excessive inputs of nutrients and sediments, as well as modifications of freshwater inflow or outflow.

3.2 Access to natural resources (property rights)

Wetlands are part of the natural capital potentially accessible to communities. Access may be controlled to different degrees, and depends on the type and strength of property rights or control systems. Control systems may be regulated by government, co-management arrangements between communities and the mandated management authority, or traditional or informal property rights systems.

Different types of access confer different types of benefit. For example, private property rights or strong communal rights systems allow for the maximization of value through sustainable use under the right conditions (non-poverty, non-slow-growing resources). Open access leads to a “tragedy of the commons” situation (Hardin, 1968) in which the level of harvesting effort increases until the value of the resource rent[1] is completely dissipated and participants only just cover their costs. In addition, it means that the resource stocks are depleted to a much lower level than might be the case under private ownership, a situation which is risky from a resource management and conservation perspective. However, open access systems are better from a social perspective, in that they lead to a more equitable distribution of wealth. Open access resources provide a safety-net function in that disenfranchised families who have suffered shocks such as bereavement or unemployment can fall back on these resources for their survival. In addition, the fact that wetlands offer natural capital which provides a fallback source of

[1]The surplus available after accounting for the costs of production including a reasonable return to capital

income, means that workers are placed in a better bargaining position in wage labour markets (Béné, 2003). In assessing the influence of property rights on wetland value, it is important to distinguish between the *de jure* property rights and *de facto* property rights. Control systems are often different in reality from what they are designed to be. Following the confusion created by Hardin (1968) by his choice of the word “commons”, it is also important to distinguish between common property rights (where a resource is managed by or on behalf of a group of people) and open access (where there is no control).

3.3 Sustainability of use

Usually, the decision maker is concerned not only with current value but also with the medium to long term value of natural resources. This means it is necessary to assess the level of sustainability of the utilization of the wetland, and that some sort of sustainability measure should be used to adjust the assessment of current value in order to evaluate the wetland’s potential worth over the longer term. This is particularly important when considering alternative management scenarios in order to meet some management objective, be it conservation, economic output, or equitable distribution of income from natural resources.

4. ASSESSING DEPENDENCE ON WETLANDS

4.1 Defining dependence

Many studies have expressed the value of wetlands to local communities in terms of direct and indirect income as a proportion of overall income. For example, Lannas and Turpie (2010) valued the benefits that communities around Letseng-la-Letsie wetland (rural Lesotho) and Mfuleni wetland (Cape Town, South Africa) derived from these wetlands as a proportion of their household income. At the Lesotho site, a large proportion of the community gained a small proportion of their income from the wetland, whereas at Mfuleni, a small proportion of the community gained the majority of their income from the wetland. However, this was not sufficient to determine the relative level of dependence of these communities on the wetlands. Thus, valuation studies do not necessarily provide an adequate measure of the true livelihood value of wetlands.

Measures of community dependence on wetlands would not necessarily be correlated with wetland value, since not all of the benefits (such as income distribution – the degree to which benefits are spread among the community vs. retained by a few individuals) are measurable in monetary terms. Moreover, in some situations, income generated from wetlands might be inversely correlated with income distribution.

An assessment of the livelihood value of wetlands should take the level of dependence on wetlands into account rather than merely expressing their value as a proportion of household income. This involves assessing the overall value obtained from wetlands in the context of the vulnerability of the community to poverty, as discussed below.

Assessing the degree to which people depend on wetlands for their livelihoods involves assessing the contribution that wetlands make in reducing the vulnerability of households to poverty, which is related to the alternatives available to those households. For the same amount of income derived, a household with fewer alternatives will be more dependent on that income. These more vulnerable households would be more dependent on the natural resource base. A household's vulnerability to poverty is related to its access to livelihood assets, which include natural resources. This relationship needs to be understood in order to fully understand dependence on wetlands. The concepts of poverty, vulnerability and livelihood assets are explained below.

4.2 Understanding poverty and vulnerability

Poverty is most simply defined as the state of having little or no money and few or no material possessions, and is influenced by geographical location, age, gender, class, ethnicity, community structure and social agents and politics, all of which can influence overall vulnerability (Philip and Rayhan, 2004).

Poverty can be measured in absolute or relative terms. In assessing poverty, it is important to first choose a representative indicator of wellbeing (Coudouel *et al., 2*002). A reference point such as a poverty line is necessary for comparison and to determine when communities would be considered poor. A poverty line can be defined as "the monetary cost to a given person, at a given place and time, of a reference level of welfare" (Philip and Rayhan, 2004). Poverty lines can be estimated using the equivalent expenditure method or the food energy intake method. The measures that are used, need to be applicable across the community, and easily assessable. Absolute poverty measures would involve measuring the number of people living below specified living conditions (Philip and Rayhan, 2004). This often involves measures of nutrition and *per capita* income below a set poverty line. Relative poverty measures compare the lower sectors of society with upper sector counterparts. Another possible measure of poverty is to measure the absence of services and the lack of human capital (skills) in an area (Simkins, 2002).

Poverty measures have moved away from simple measures of income to composite indices (Sen, 1999, UNDP, 2000; Narayan *et al., 2*000; World Bank, 2000; Hulme and Shepherd, 2003). There are two approaches to assessing poverty levels, which can be described as welfarist and non-welfarist approaches (Duclos, 2002). A welfarist method looks at overall living standards and uses simple measures such as income and consumption to measure poverty as described above. A problem with the traditional welfarist approach is that household sizes vary and prices change across space and time. Poverty may not therefore be determined strictly in terms of income and may incorporate deprivation and insecurity (Rakodi, 1999). A non-welfarist index takes a more multi-dimensional view of poverty and would incorporate measures of a community's access to services such as health, education, nutrition, literacy, shelter and interaction with others.

The United Nations compiled the Human Development Index (HDI), a composite measure of poverty that now includes measures of life expectancy, income, education,

access to clean drinking water and 'voice' (representation in decision-making processes; Philip and Rayhan, 2004).

Vulnerability is strongly related to poverty (Baluch and Hoddinot, 2000) and vulnerability assessments focus on the dynamic nature of poverty and the reasons for its persistence. It can also be viewed as the probability that a household or community will fall into poverty over a certain time-span (Philip and Rayhan, 2004).

The vulnerability of a household or community can be defined as its susceptibility to stressors or changes, and is determined by the combined strength of its physical, social, financial, human and natural capital assets (this classification of assets is discussed later in Section 4.3). A community that has a weak asset base would be particularly vulnerable. Vulnerability tends to be defined with respect to a minimum level of livelihood security (Sinha and Lipton, 1999), and is linked to ideas of defencelessness or a lack of means to mitigate or cope with negative situations without incurring losses (Chambers, 1989). It may be related to the diversity of income sources and the variability of income sources over time (Adger, 1999). For Davies (1996), vulnerability is a balance between the sensitivity and resilience of a livelihood system. Poor communities are likely to be more vulnerable to shock, and the plight of vulnerable groups is part of standard poverty analyses (Hoogeveen *et al., 2*003).

A community's level of vulnerability would determine the degree of impact that changes in wetland health would have on community wellbeing under different scenarios. For example, the same change might have a bigger impact on a more vulnerable community.

One way of measuring this is to assess how capable a person is of leading a certain lifestyle compared to another. A person's capacity to generate a specific livelihood is strongly determined by the resources he/she has access to (Bebbington, 1999). Communities may face a transition from livelihoods based heavily on natural resources to a situation where they combine a variety of assets, income sources and product and labour markets.

The most common method of quantifying vulnerability is by using a set or composite of proxy indicators (Moss *et al., 2*001; Kaly and Pratt, 2000). The USAID Food Emergency Warning System (FEWS) programme has used indices to measure vulnerability to food insecurity in different regions throughout Africa. However, Luers *et al.* (2003) caution

against a composite indicator approach because even the simplest system is complex, and they suggest focussing on the main variables of concern instead.

4.3 Livelihood assets as indicators of vulnerability

In response to a global policy emphasis on poverty alleviation in the late 1990s, several organizations such as DFID, Oxfam and Care developed *sustainable livelihoods* approaches in order to guide development and monitoring programmes. These approaches encompass all aspects of poverty alleviation, including education, health, financial services, security and natural resources. The premise underlying this approach is that a *livelihood*, which comprises the capabilities, assets and activities required for a means of living, is *sustainable* when it can cope with and recover from stresses and shocks and can be maintained or enhanced without undermining the natural resource base (DFID, 1999). Therefore, the Sustainable Livelihoods Framework is potentially useful in assessing vulnerability. It considers the influence of livelihood assets (in the form of five types of capital, described below), the vulnerability context and policy and institutional context on livelihood strategies and outcomes (Figure 4.1).

The vulnerability context refers to trends, shocks and seasonal variations that are usually beyond people's control, but which fundamentally affect livelihoods. Shocks can include economic factors, human health problems, natural catastrophes, war, or agricultural disease. Population changes and resource, technological, macro-economic and political trends can also affect people's vulnerability.

The assets available are often largely determined by external political and economic agents, especially in the case of Natural Capital. In other words, people's livelihood outcomes are influenced by their access to the five types of capital assets, the way that these assets are used to help shape people's livelihoods and meet their needs, whether people are able to expand their asset base by making use of available institutions and access to markets, and the potential of people to not only generate an income but to improve their overall situation (Bebbington, 1999).

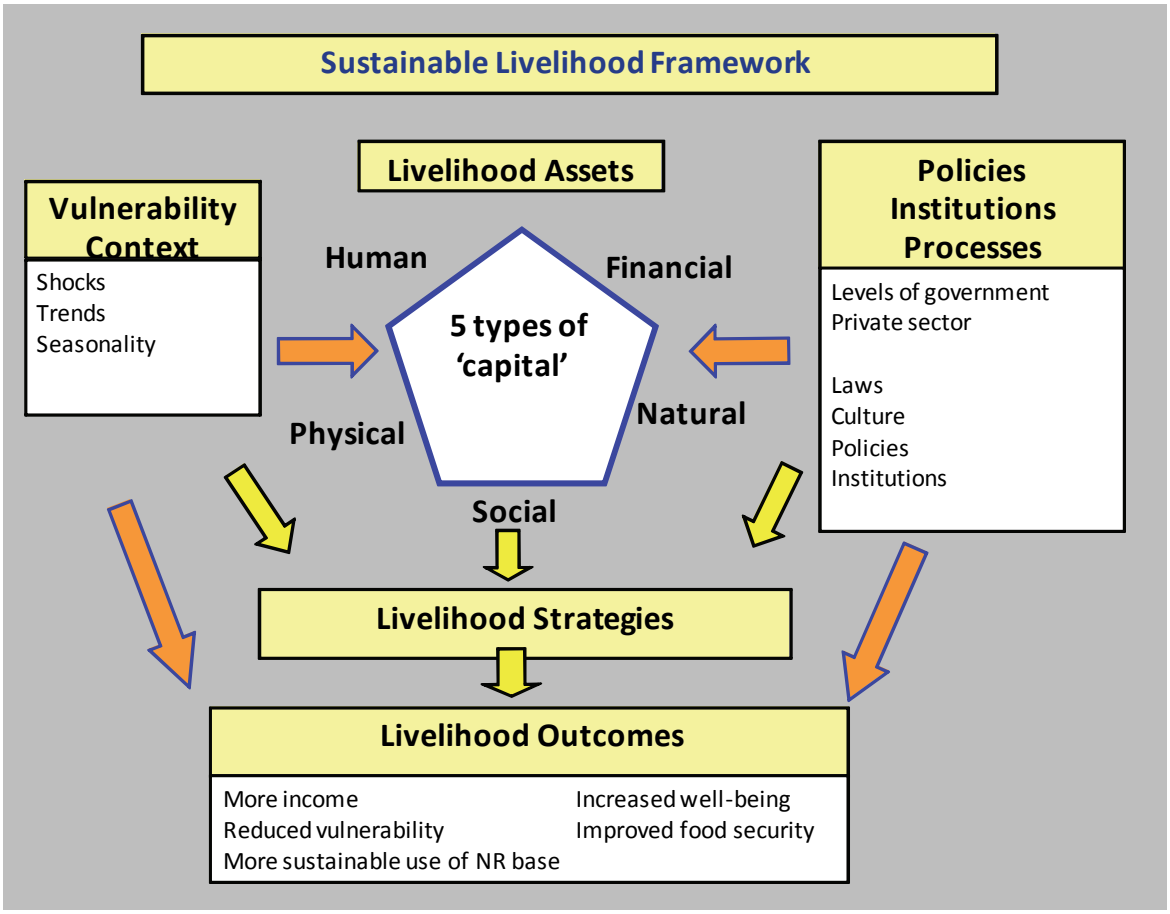


Figure 4.1: The Sustainable Livelihood Framework (DFID, 1999). NR = natural resource.

The capital asset base is central to determining people's livelihood outcomes. The five types of capital are described below.

- **Human Capital** describes the levels of skills, knowledge, ability to work and level of health.
- **Social Capital** describes the strength of networks and connectedness, membership in groups and exchange relationships.

Social capital is an important consideration in assessing people's livelihoods, as it incorporates the interaction between different actors in communities such as markets, the state and civil society (Bebbington, 1999). The ability of a community to operate effectively is strongly linked to the cohesion formed from household and inter-household relationships (Moser, 1998). Social capital is different to human capital in that it has public good characteristics (Giorgas, 2000). In other words, benefits of social capital are more likely to benefit all members of a community, whereas any investment in human

capital usually benefits only the individual. Cultures that place greater emphasis on the family and are collectivist in nature are more likely to utilize social capital. In contrast, cultures that have an individualistic focus are more likely to under-invest in social capital (Coleman, 1988).

Social capital is a complex issue and is difficult to quantify with simple indicators (Stone, 2001; Franke, 2005). Some indicators which may be used to assess social capital are the level of unity within a community, the amount of associational activity, links with other groups such as NGOs and the presence of established institutions such as schools, markets and courts (Rakodi, 1999). Where detailed data collection is possible, Zukewich and Norris (2005) suggest investigating:

1. participation in social groups;
2. social support (in the form of unpaid help) between households;
3. social networks as indicated by frequency of contact with friends, relatives, neighbours or work colleagues; and
4. civic participation in terms of engagement in civic action and voting.

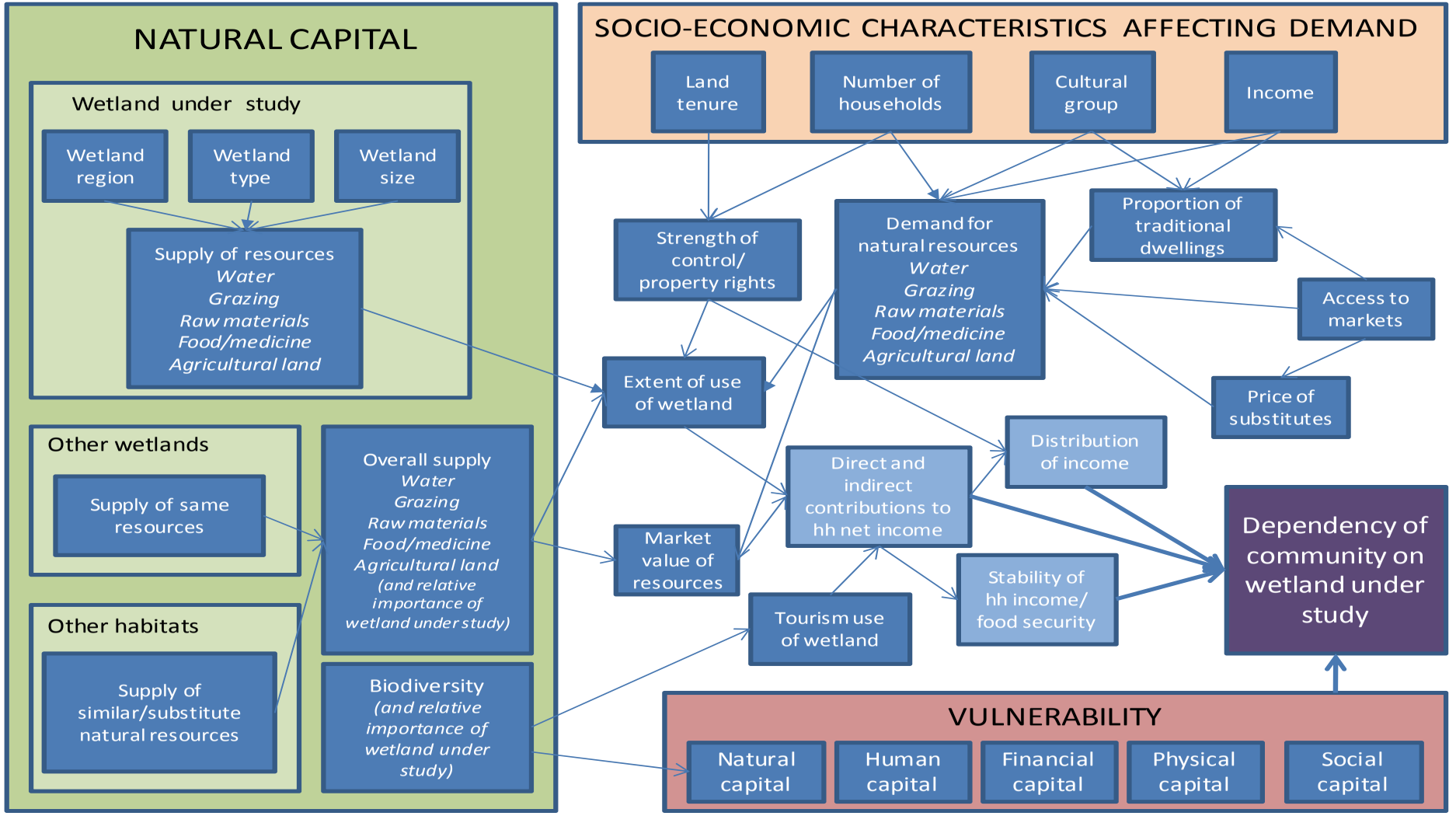
- **Financial Capital** refers to the available stocks of, and regular inflows of, money.
- **Physical Capital** is the infrastructure, utilities, energy, technologies, access to information and tools and equipment.
- **Natural Capital** comprises the natural resource stocks, public goods such as biodiversity, air quality, and divisible goods such as land and trees.

Natural Capital is a key asset to households that depend on resource-based activities (farming, fishing etc.). However, it is important to note that all livelihood outcomes depend on the continued functioning of complex ecosystems.

4.4 Summary of factors affecting dependence on wetlands

The relationships described above and the ways in which they can be used to describe dependency on wetlands are summarized in Figure 4.2. The wetland(s) of interest form part of the natural resource base, which is one of the forms of natural capital that households in the study area have access to. The wetland characteristics will determine exactly how the wetlands contribute to this natural capital. The overall level of resources, together with the levels of other forms of capital, determines the level of vulnerability of households to poverty. The demand for wetland resources will be determined by socio-economic characteristics of the area, including the number of households, their level of

income and their culture, and will potentially be limited by the type of control over the wetlands. Other factors such as access to markets and substitutes for wetland resources will also influence demand. The supply of and demand for resources will influence their overall value to households, and other benefits might be obtained indirectly, e.g. through tourism activity associated with the wetlands. The benefits obtained relative to the vulnerability of the households will determine the degree to which households are dependent on the wetlands.



Note: hh = household

Figure 4.2: Links between natural capital, socio-economic characteristics and vulnerability of local communities to poverty in determining their level of dependence on wetlands

5. ASSESSING THE LIVELIHOOD VALUE OF WETLANDS

It is important to distinguish between an assessment of the degree to which a community benefits from or is dependent on a wetland, and the value of a wetland in terms of its contribution to a community. A wetland will have a greater livelihood value if it is used by many people who are highly dependent on it. This is a measure that can be attributed to the wetland itself, and which can be used to compare the relative importance of different wetlands to society in general.

This approach was taken by Joubert (2001), who rated stretches of the Olifants River in terms of the degree to which communities relied on them as a source of potable water, for livestock watering, subsistence harvests, irrigation water and for other socio-cultural uses. To do this, the catchment was grouped into zones based on land-use, and stakeholders were divided into four groups: subsistence farmers, intensive farmers, ecotourism practitioners and managers of formal conservation areas. Surveys were carried out at 40 sites. The levels of reliance, or dependence, of the communities on a healthy riverine ecosystem as defined in the study, are summarized as follows:

- Reliance Class I (critical): where communities or stakeholders rely absolutely on the river for their livelihood and should the resource quality of the river deteriorate, it would adversely influence these communities;
- Reliance Class II (high): where the communities or stakeholders use the river but alternatives exist;
- Reliance Class III (medium to low): where communities or stakeholders only marginally rely on the river for their wellbeing; and
- Reliance Class IV (very low) where communities or stakeholders do not rely on the riverine resources.

Sections of river were subjectively classified into one of the above reliance (dependency) classes based on an assessment of the duration (e.g. short term or permanent) and extent (e.g. very low, high, critical) of use of rivers for each of five utilization categories (potable water, livestock watering, fishing, plant harvesting and irrigation water). The study produced a map in which the Olifants River and its tributaries were graded in terms of the level of reliance of the adjacent communities, and as such probably provides the first such spatial assessment of this nature in South Africa. Joubert's (2001) sociological study provides a useful and viable example of a metric of dependence (~ reliance) on natural resources, as well as an example of such an index being applied at a broad scale. However, one criticism of Joubert's (2001) classification of rivers in terms of Reliance

Classes is that it is not scaled in terms of the numbers of stakeholders involved, nor does it take the size of the area of influence (i.e. the river reach) into account. Thus a section of river upon which three households are absolutely reliant is scored the same as one upon which 30 000 households are absolutely reliant. Another potential criticism is the way in which the temporal component is taken into consideration, as a short term use may be equally critical for survival as a longer-term type of use.

The Wetland Livelihood Value Index developed in this study has a similar intention in terms of classifying aquatic ecosystems with respect to the degree to which they support local livelihoods, and builds on the lessons learned from Joubert (2001), as well as on the considerations described in the preceding sections.

6. OVERVIEW OF THE WETLAND LIVELIHOOD VALUE INDEX AND ASSESSMENT PROCESS

6.1 Structure of the Wetland Livelihood Value Index

The overall structure of the Wetland Livelihood Value Index is shown in Figure 6.1. A **Wetland Dependence Score** is computed, which describes the community's relationship with the wetland and is specific to the surrounding community, not the wetland. The Wetland Dependence Score incorporates two components to in order to ascertain the level of dependence of surrounding communities on wetlands: one to assess the benefits derived from wetlands by the local community, and another to assess the vulnerability of that community to poverty (Figure 6.1).

The **Wetland Livelihood Value Index** (WLVI) is computed on the basis of this score and the relative size of the wetland and its surrounding community (Figure 6.1). In other words, the WLVI is specific to one or more wetlands, rather than to any particular community. Both aspects – the Wetland Dependence Score and the WLVI – may be useful for different applications, depending on where the focus of the study lies.

Wetland benefits are grouped into four types for scoring purposes, rather than the three groupings (contribution to household income, risk spreading and safety-net) discussed earlier in section 2.5,. Thus contribution to domestic water supply is considered separately from other benefits that contribute either directly (e.g. through sale of resources) or indirectly towards a household's overall net income (Figure 6.1). Contribution to domestic water supply could be considered as one of these indirect benefits, since it affects labour time and other costs of alternative water supplies, but it is considered separately here, because of its important health implications.

6.2 Steps in the assessment process

The following steps need to be undertaken in the assessment process (refer to Figure 6.1):

1. define objectives and level of study;
2. define study area boundaries and wetland community;
3. describe habitats and provision of services;
4. score benefits derived from wetland(s);
5. assess vulnerability of local community;

6. assess current level of dependence on wetland(s) (i.e. calculate Wetland Dependence Score);
7. calculate Wetland Livelihood Value Index; and
8. assess sustainability of community-wetland relationship.

These steps are outlined in more detail below.

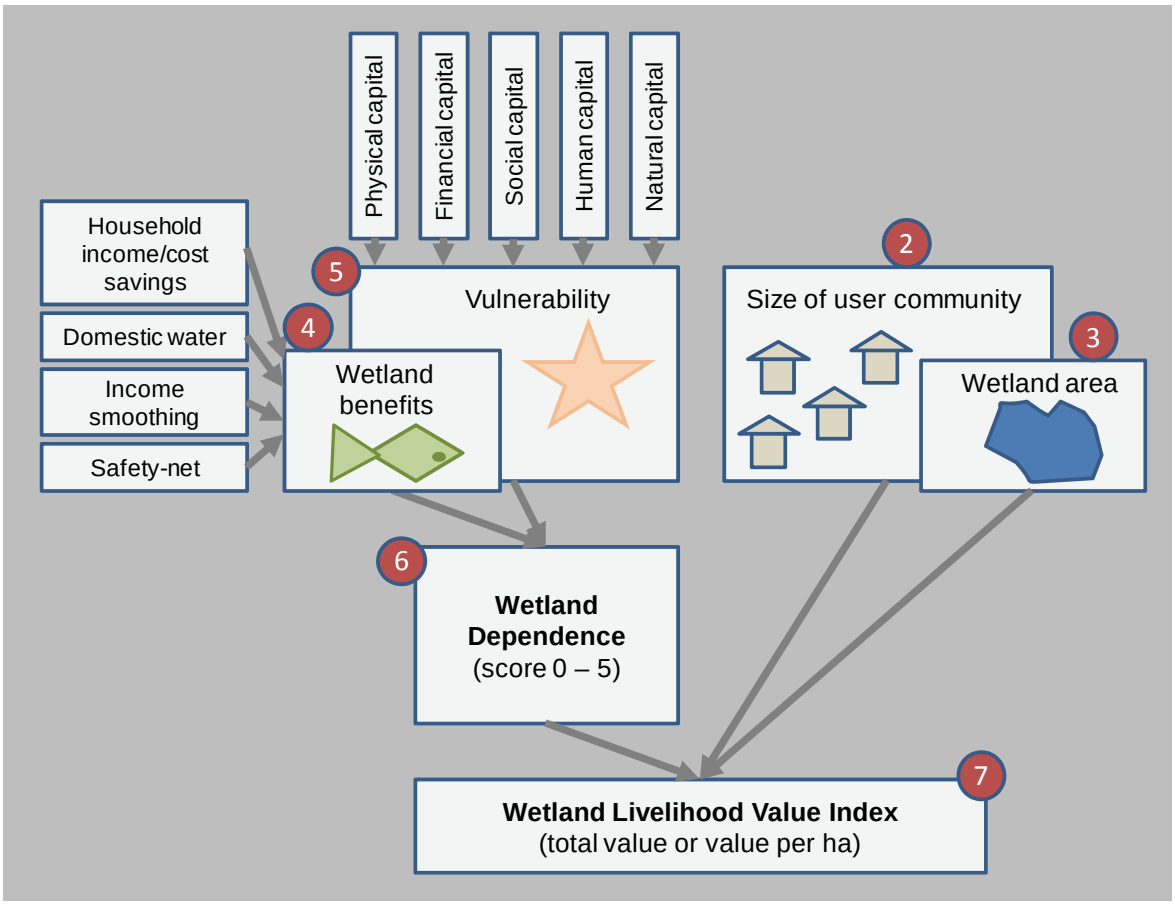


Figure 6.1: Overall structure of the Wetland Livelihood Value Index. Numbers in circles correspond to steps in the assessment process after step 1 (defining objectives and level of assessment).

7. ASSESSMENT METHOD

7.1 Step 1: Define the objectives and level of assessment

The way in which these steps are carried out depends on whether the assessment is at a rapid, intermediate, or comprehensive level, as outlined in Table 7.1. For a rapid assessment, the overall approach is to gather existing information on the study site and its population and context. For an intermediate assessment, this would be followed by a field trip involving key informant interviews and focus group discussions. For a comprehensive assessment, a second trip would be carried out in which a household survey is used to obtain quantitative data on household activities and income (Table 7.1).

The level of the analysis, in conjunction with the amount of data available, determines the confidence level of the results. The type of question being addressed or the objective of the study will in turn determine the level of confidence required.

Table 7.1: Outline of methods used to estimate each score for different levels of study. Rapid = desktop. Intermediate and Comprehensive assessments involve time in the field

Component	Rapid	Intermediate	Comprehensive
Assessment of wetland benefits	Guidelines based on geographic and socio-economic characteristics of the community	Key informant and/or focus group discussions	Key informant and/or focus group discussions and household surveys
Assessment of vulnerability	Scoring guidelines based on results of a desktop analysis of geographical and census data	Desktop assessments may be augmented by stakeholder input on the asset base, such as social and natural capital	Estimate of financial capital can be informed by household survey data

The social survey methods required for intermediate and comprehensive assessment are well documented in the literature (e.g. Fowler, 1984; Carruthers and Chambers, 1981; Chambers, 1994; Turpie *et al., 1*999; Kaplowitz and Hoehn, 2001; Lannas and Turpie, 2010) and will not be described in detail here. The information required to inform each of the scores (described below) will determine the survey design. This report will concentrate on the way in which information obtained at a desktop level or from the field is used to score the parameters of the index.

Note that for individual wetlands or small scale study areas, the intermediate methodology is likely to be both more cost effective and reliable than the rapid method.

The rapid method is only recommended for broad scale problems that would make site visits unviable.

The level of the study will be related to the objectives or the motivation for the study. It is important that these be properly considered at the outset. Typical applications include:

- conservation and development planning;
- water resource classification or water allocation (setting the environmental reserve);
- development of management plans and conservation strategies (e.g. incentive measures);
- project appraisal, including environmental impact assessment; and
- socio-economic baseline studies for monitoring purposes.

Examples of possible study objectives include, to:

- provide justification for the conservation of a particular wetland;
- describe the trade-offs involved in water resource classification and setting the environmental reserve;
- establish the priority status of different wetlands for conservation or management attention;
- understand potential socio-economic versus conservation conflicts to guide management decision-making or policy;
- understand the level of dependence on natural resources in order to guide development programmes and policy;
- understand how different management strategies or institutional arrangements influence the degree to which wetlands benefit communities; and
- understand how different development strategies affect community dependence on natural resources.

The relationship between study purpose, scale and the level of rigour required is described for valuation studies in Volume IV (Turpie and Kleynhans, 2010). For example, regional scale conservation planning studies might only require a rough estimate of relative livelihood value, whereas a study comparing different development options at a local scale might require a comprehensive assessment.

7.2 Step 2: Define the study area and wetland community

The definition of the study area depends largely on the objectives of the study. An environmental impact study might be concerned with a single wetland, whereas a planning study might be concerned with an entire region.

At a more localized scale, e.g. at the level of a single or small group of wetlands, it might not make sense to draw the geographic boundaries at the catchment or sub-catchment scale. Instead, delineation of the study area boundary requires consideration of the level of influence of the wetland and the geographic pattern of spread of the population around the wetland. Dependence on a wetland will usually decrease with distance from the wetland, and in rural communities where transport is difficult or costly, the limits of utilization might be set by walking distance. In other cases, direct access might be restricted to a single land owner. Since the assessment of vulnerability also takes a community's access to other natural resources into account, this should also be taken into consideration in the definition of the study area. The definition of the geographic limits of the study area and its community are thus case specific, but need to take these logical considerations into account.

There will be an upper limit to the scale at which an assessment of community dependence will be useful. Thus, a very large scale analysis might require a subdivision of the study area into sensible units, preferably along the lines of catchment boundaries. Whatever the geographic boundaries of an analytical unit, the wetlands will be considered together within that unit if there is more than one discrete wetland within the area. For a regional scale analysis, the sensible option would be to use catchment or sub-catchment boundaries, especially where these are marked by landscape features (hills or mountains) sufficiently large enough to add to the cost of wetland use (in terms of travel).

The choice of study area boundaries has some practical limitations that need to be taken into consideration. Census data are readily available at the municipal level and can also be obtained for each of the census enumerator areas within local municipalities. These boundaries do not necessarily coincide with catchment boundaries, however, and some assumptions have to be made where census units overlap catchment boundaries. If catchment boundaries are chosen to define the study area, then the population within that catchment will need to be estimated as closely as possible by manipulation of census data units, and *vice versa*. For example, the proportion of the population living in traditional or informal dwellings needs to be described (rationale provided below).

7.3 Step 3: Describe habitats and provision of services

The wetland(s) in the study area should be described in terms of their type, area and environmental condition (health). This is not an essential step, even for a comprehensive analysis, but it lends more credibility to the results if it is carried out.

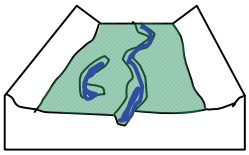
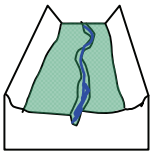
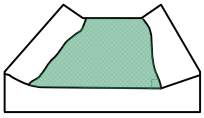
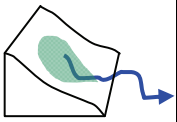
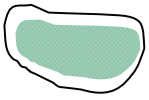
7.3.1 Step 3a: Quantify the area of wetlands of different types

This assessment uses the typology described in Kotze *et al.* (2008; Table 7.2). However, this is just a guide and other typologies could be used where appropriate. The main purpose of the typing step is to guide assumptions made about the extent to which various wetland services will be supplied. This is because different types of wetlands differ in their characteristics and functioning, which determines the nature and extent of wetland benefits and in turn affects assumptions made about the availability of resources.

The total area of wetland(s) of each type (e.g. pans, seepage wetlands) needs to be estimated, and within this, the total area of each major wetland habitat type (e.g. grass, sedge marsh, reed beds, sandbanks, open water) which is relatively homogeneous in terms of the provision of natural resources.

The above should be qualified in terms of wetland environmental condition (health) as far as possible. The health of the wetlands in the study area ideally needs to be taken into consideration in order to inform later steps in the assessment process. This can be done using the WET-Health tool, which can be applied at a desktop level or at a rapid level with the help of a site visit. The methodology is described in detail in Macfarlane *et al.* (2008). Qualitative information on the environmental condition of other natural habitats should also be supplied as far as possible.

Table 7.2: Wetland hydrogeomorphic (HGM) types typically supporting inland wetlands in South Africa (Kotze *et al., 2*008)

Hydro-geomorphic types	Description	Source of water maintaining the wetland[#]	
		Surface	Sub-surface
Floodplain 	Valley bottom areas with a well defined stream channel, gently sloped and characterized by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*
Valley bottom with a channel 	Valley bottom areas with a well defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits, or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*/ ***
Valley bottom without a channel 	Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes.	***	*/ ***
Hillslope seepage linked to a stream channel 	Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well defined stream channel connecting the area directly to a stream channel.	*	***
Isolated hillslope seepage 	Slopes on hillsides, which are characterized by the colluvial movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow, but with no direct surface water connection to a stream channel.	*	***
Depression (includes pans) 	A basin-shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining) and/or intersection of groundwater. It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.	*/ ***	*/ ***

[#]Contribution of the water source is described as: * usually small, ** usually large, or */ *** may be small or important depending on the local circumstances

7.3.2 Step 3b: Describe surrounding habitats

Within the defined study area, the area of major habitat types other than wetlands needs to be described. These would include habitats such as rivers, estuaries, grasslands, forests etc. The level of resolution depends on the amount of information available, and at a course scale may simply be based on a biome map or a simple vegetation map.

7.3.3 Step 3c: Describe the provision of services

The types of services provided by the wetlands in the study area need to be described in as much detail as possible, in terms of:

- provisioning services -
  provision of natural resources;
- regulating services -
  influence on the provision of natural resources in downstream ecosystems;
- cultural services -
  attributes that potentially contribute to tourism business in the area; and
  attributes of potential importance from a cultural, spiritual or recreational perspective.

7.3.3.1 Provisioning services: supply of natural resources

The provision of natural resources needs to be described in as much detail as possible to inform Table 7.3 (which is illustrated with some hypothetical examples). The assumptions made in these estimates should be made explicit and should take the results of the environmental condition ("health") assessment into account. This step is not essential in a comprehensive assessment where relevant data are collected directly from households, but it does lend credibility to the overall process.

7.3.3.2 Regulating services: influence on the provision of water and natural resources in downstream ecosystems

If there is a community that makes use of aquatic resources downstream of the wetland(s) in question, then it might be necessary to consider whether the water quality or the abundance of natural resources used downstream would be affected by the presence of the wetland. This is a particularly difficult aspect to quantify, since little is known of the relationships between water quality parameters and the marginal

productivity of natural resources. At best, this might be treated qualitatively. Much research is required before this metric can be applied to downstream communities with any degree of confidence.

7.3.3.3 Cultural services: potential for contribution to tourism business in the area

The tourism potential of wetlands is likely to be linked to their biodiversity, general habitat characteristics, landscape setting and accessibility. Biodiversity and habitat characteristics such as rarity and beauty will be key factors. The assessment will need to consider the extent to which a wetland is used by tourists, or in the absence of any information on visitor numbers, might have to estimate tourism usage on the basis of its characteristics, using expert opinion and an understanding of tourism in the surrounding area.

Table 7.3: Example table of estimated supply of natural resources by wetlands in the study area relative to supply from all habitats, as well as the availability of substitutes

Natural resources	Provision by wetlands			% of supply of all similar resources in study area from natural habitats	Availability of substitutes (descriptive)
	Area of supply	Estimated yield per ha	Estimated total annual yield in physical units		
Fisheries	20 ha	40 kg/ha	800 kg fish	100%	Local market
Wild foods and medicines	15 ha	5 plants/ha x 0.5 kg	37.5 kg water lilies	25%	Nearest clinic / pharmacy: 250 km
Raw materials (reeds, grasses, etc.)	5 ha reed bed	3 bundles/ha reed bed	15 bundles of reeds	95%	Nearest building materials supplier: 250 km
Grazing capacity	35 ha	5LSU*/ha	2000LSU	40% of overall grazing capacity	N/A
Livestock watering	Descriptive only			5%	
Domestic water	Descriptive only			Varies seasonally from 10-100%	Local well, at a small cost

*LSU = live stock units

7.4 Step 4: Score the benefits derived from the wetlands

7.4.1 Step 4.1: Contribution to household income

The provisioning value of the wetland can be expressed as its contribution to household income in whatever form (e.g. cash income, savings). For the Livelihood Value Index, this contribution is scored, based on the estimated percentage of total household income including non-monetary income from subsistence activities (Table 7.4). Table 7.5 provides a more detailed guideline for the way in which this value needs to be considered.

Table 7.4: Scoring guidelines for assessing wetland contribution to household income, including subsistence income and cost savings

Score	0	1	2	3	4	5
% overall income	0	1-5%	6-10%	11-15%	16-20%	>20%

Table 7.5: Types of value that need to be considered in the estimation of the wetland contribution to household income (using Table 7.4 as a guideline for scoring)

Source of income	Total	Wetland contribution
Net value of natural resources and products sold, consumed or bartered		
Net value of agricultural products sold, consumed or bartered		
Net value of livestock products sold, consumed or bartered		
Net value of livestock benefits – manure, draught and banking		
Net income from business / trade		
Income from employment		
Other income		
TOTAL		

For a comprehensive assessment, the information required for this step is collected in household surveys and is analyzed quantitatively (e.g. see Lannas and Turpie, 2010, and the valuation protocol developed as Volume IV of this series – Turpie and Kleynhans, 2010). At the intermediate level, estimates may be gathered using rapid appraisal methods such as those used in Turpie *et al.* (1999), in which focus groups provide an indication of the above. The method can be carried out semi-quantitatively through multiple focus-group meetings. For a rapid assessment, a score may be assigned based on expert opinion.

A rapid assessment can only provide a very rough indication of the potential of the wetlands to be important to local communities, and has to be based on a set of assumptions about the nature of wetland use in relation to readily available parameters, such as household income. The demand for wetland resources is likely to be negatively correlated with household income, in that poorer households will probably be more reliant on wetlands. Wetland use would be expected to be positively related to the proportion of households living in traditional dwellings and/or informal structures, because of the raw material requirements of these structures. It would also be expected to be positively correlated with distance to markets, because of the lack of availability of substitute building materials, fuel and other goods. Income is often negatively correlated with the proportion of traditional and informal dwellings, and also with distance to markets (Gordon and Turpie *in prep*., Figure 7.1). Since they are correlated, it can be expected that one of these factors can provide a reasonable estimate of the potential levels of natural resource use. Household income and type of dwelling are both readily available statistics for any census area. Although household income is intuitively an obvious parameter to use, there are potential pitfalls in using average income data. Two communities with a different distribution of wealth might have the same average household income but with a different number of people below the poverty line. Thus for the purposes of this index, the proportion of the population living in traditional or informal dwellings can be taken to be indicative of the level of demand in a rapid assessment (Table 7.6).

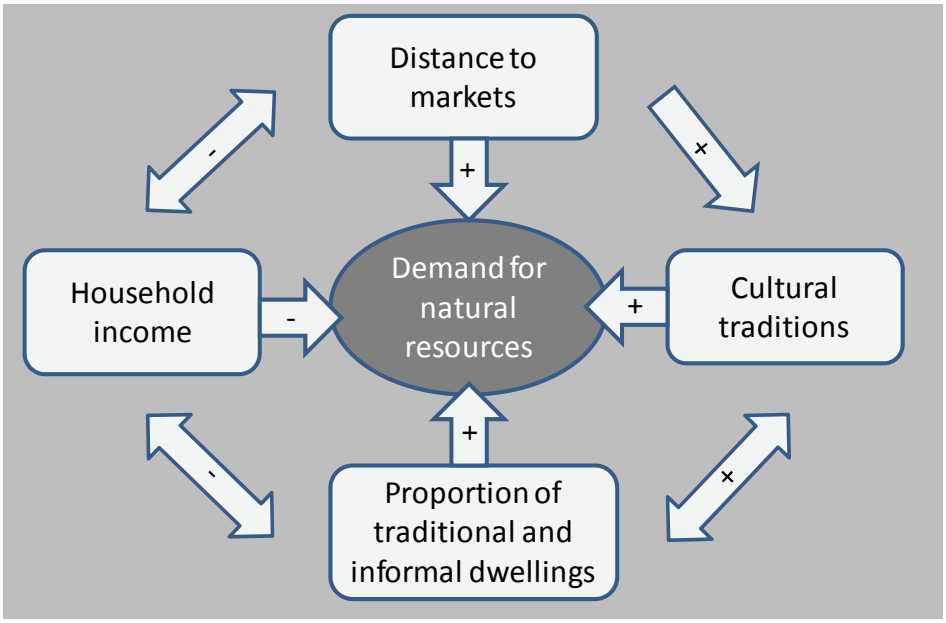


Figure 7.1: Schematic diagram of the major relationships affecting household demand for natural resources. + and – signs indicate expected positive or inverse correlations.

In addition to census data, aerial photographs will add significant value to desktop assessments, and can be used to modify scores in a subjective manner. For example, one would expect to see households clustering around wetlands that are useful for cultivation but not necessarily around wetlands that are useful for grazing, since households are generally likely to be closer to their fields than their grazing areas. Households situated closer to wetlands would also be more likely to be obtaining benefits from them than those situated further away.

Table 7.6: Scoring guidelines for the rapid assessment of contribution to household income

Score	0	1	2	3	4	5 (high)
a. Demand: % of households in traditional or informal dwellings	0	<5	5-15	15-25	25-50	>50
b. Supply relative to demand: are resources plentiful or scarce in relation to the amount demanded by households?	N/A	*D>>S	D>S	D=S	S>D	S>>D
Contribution to income = minimum (a, b)						

*D = demand, S = supply

7.4.2 Step 4.2: Contribution to domestic water supply

For a comprehensive or intermediate assessment, this information can be gleaned from key informants or focus groups. For a rapid assessment, demand can be assessed on the basis of availability of piped water, and the proportion of the demand met by the wetlands under study should be considered in the light of the wetland characteristics and alternative sources of water (Table 7.7). Information on access to reticulated water can be obtained from census data. This can be used to assess the probable level of demand for in-stream water. The availability of water from natural sources (rivers, groundwater, and wetlands) should be assessed in relation to this demand, and the degree to which wetlands contribute to this water supply needs to be assessed, taking seasonal fluctuations into account.

Table 7.7: Scoring guidelines for the assessment of domestic water benefits

Score	0	1	2	3	4	5 (high)
Comprehensive or intermediate						
Stated degree of reliance on wetland(s) for domestic water use	None	Very little use	Regular use but alternatives are available	Most use, but alternatives are available	Highly reliant, and alternatives are costly / problematic	Critical (no alternatives)
Rapid (desktop)						
a. Proportion of households without access to reticulated water	0	<5	5-15	15-25	25-50	>50
b. Water supply capacity of wetland in relation to other sources (e.g. rivers, boreholes) and overall demand	N/A	D >> S	D > S	D = S	S > D	S >> D
Benefits obtained in terms of domestic water use = minimum (a, b)						

*D = demand, S = supply

7.4.3 Step 4.3: Importance of wetland resources for income smoothing/food security

The degree to which natural resources provide an income smoothing or food security function is associated with a risk spreading strategy and is particularly difficult to assess. The natural resource may provide a tide-over function on an annual basis, such as just before crops are harvested, or may be a lifesaver during years in which crops fail due to poor rainfall. This can be described by stakeholders during field surveys in a comprehensive or intermediate assessment. For a rapid assessment, the capacity of the wetland to provide this service (by providing resources during seasons or years when crop or other production is low) as well as the need for the service in terms of the risk that households face of suffering agricultural losses due to environmental variability will have to be assessed based on expert opinion. For instance, households reliant on seasonal dryland cropping in an area of highly variable inter-annual rainfall would be at high risk. Because there are numerous variables affecting the importance of wetlands for income smoothing or food security, the index is not prescriptive in terms of assigning intermediate scores.

Table 7.8: Scoring guidelines for the assessment of income smoothing benefit. Intermediate scores are interpolated

Score	0	1	2	3	4	5 (high)
Comprehensive or intermediate						
Stated importance	None in this respect	Occasionally provides some value during bad times				Critical for maintaining wellbeing during certain periods or in certain years
Rapid						
a. Seasonal availability of agricultural resources vs. wetland resources	Coincide in time					Opposite in time
b. Degree of dependence on agriculture	None	Very low contribution to aggregate household income				Nearly all households rely on farming as their principle activity
c. Degree of production variability in the local agricultural system	N/A	Relatively little, winter and summer crops				Only plant in one season, dryland cropping and inter-annual rainfall variability is high
Overall score = average (a,b,c)						

7.4.4 Step 4.4: Safety-net value

For a comprehensive or rapid assessment, some sense of the safety-net function can be obtained from interaction with local communities, based on who uses the wetland(s). For example, if it is mainly outsiders or newcomers, or families that have suffered a shock of some kind, then this is indicative of a safety-net role. Land tenure is a key factor in this assessment. For a rapid assessment, these social data are usually not readily available, and land tenure, coupled with the degree to which the developmental setting provides opportunities for newcomers, would be the key indicators (Table 7.9).

Table 7.9: Scoring guidelines for assessment of safety-net value for rapid to comprehensive levels of assessment. Intermediate scores are interpolated

Score	0	1	2	3	4	5 (high)
a. Property rights	State no utilization	Private land-owner (single or few)		Limited use		Open access
b. Developmental setting	N/A	Stable or closed community				Open / growing community that attracts desperate people (e.g. peri-urban areas)
Potential safety-net value (average (a,b)) or general interpretation as follows:	**Negligible safety-net value**	**Safety-net benefits felt by very few members of a stable community that suffer shocks such as death**				**Critical for survival of >20% of households that have suffered shocks such as death or retrenchment or are trying to escape extreme rural poverty**

7.4.5 Step 4.5: Computation of the wetland benefit score

Computation of the wetland benefit score is shown in Table 7.10. The overall benefit score for the wetland is taken as the maximum of the four components, rather than a weighted average. This recognizes the fact that it is enough for any one of these benefits to be derived from the wetland(s). For example, if the wetland is of little value for the first three, but provides an important safety-net function, then the average might reflect only a moderate score overall, leading to quite a different management conclusion.

Table 7.10: Computation of the wetland benefit score out of 5

Benefits from wetland	Example score
Direct and indirect contributions to household income (cash, wages, subsistence and other cash savings; score from Table 7.6)	2
Contribution to domestic water supply (score from Table 7.7)	1
Importance in income smoothing / food security (risk spreading; score from Table 7.8)	4
Importance or potential importance as a safety-net (score from Table 7.9)	2
Wetland benefit score out of 5 (maximum of the four scores)	**4**

7.5 Step 5: Assessment of community vulnerability

The preceding steps served to ascertain the services supplied by the wetlands and the degree to which these benefit the community. This step assesses the vulnerability of the community by evaluating its assets. The following guidelines are provided for the assessment of the levels of the five types of capital that collectively affect a community's vulnerability to poverty (see Figure 6.1, discussion in Section 4 and descriptions in 4.3.3).

7.5.1 Physical capital

Physical capital can be assessed on the basis of existing information, for all levels of assessment, by using GIS data and/or maps and census data (Table 7.11).

Table 7.11: Scoring guidelines for the assessment of physical capital. Intermediate scores are interpolated with reasons

Score	0	1	2	3	4	5
a. Health and sanitation infrastructure	Absence of clinics, sanitation systems					Enough clinics to serve community, most households have flush toilets
b. Transport infrastructure and access to markets	More than 2 days travel to formal shops and markets					A variety of formal shops and markets within the community
c. Farming infrastructure	None					Sophisticated irrigation systems
Physical capital score (guided by average (a,b,c))	**Non-existent**	**Very poor**	**Poor**	**Fair**	**Good**	**Very good**

7.5.2 Financial capital

Financial capital can be assessed using census data, for all levels of assessment (Table 7.12).

Table 7.12: Scoring guidelines for the assessment of financial capital

Score	0	1	2	3	4	5
% of households with income over R38 000 (2001 census) or equivalent, or updated definition of poverty line	0-19%	20-39%	40-59%	60-79%	80-94%	95-100%

7.5.3 Social capital

Social capital is assessed on the basis of the existence of social groups, reciprocity among households, degree of social contact and civic involvement (Table 7.13). For a comprehensive or intermediate assessment where there is opportunity to interview stakeholders, it would be reasonable to rate this element of the index, using expert understanding of the study community, relative to communities elsewhere. Indicators such as the above are not available, for example, in census data. Thus, for a desktop assessment, it would be necessary to rely on expert opinion.

Table 7.13: Scoring guidelines for the assessment of social capital. Intermediate scores have to be interpolated.

Score	0	1	2	3	4	5
a. Groups (e.g. natural resource committees, water user associations)	None	There are few groups or they are inactive				Active user groups or associations for most activities
b. Social support (in the form of unpaid help or reciprocity) among households	None	Immediate family only	Among extended family	Family and close friends	Family, friends & neighbours	Strong among whole community
c. Social networks in terms of degree of contact with relatives, friends and rest of community	N/A	Very little interaction				High degree of interaction
d. Civic participation		Most people apathetic about civic action and voting				Most people get involved in civic action and voting
Social capital score = average of (a to d)						

7.5.4 Human capital

Human capital refers mainly to the education or skill status of members of the community, which provides opportunities for empowerment and employment. The best indicator of this will be the matriculation rate from the census data, irrespective of whether the assessment is carried out at a comprehensive, intermediate or rapid level (Table 7.14).

Table 7.14: Scoring guidelines for the assessment of human capital

Indicators	0	1	2	3	4	5
% population with matric education	0	<5	5-10	10-15	15-20	>20

7.5.5 Natural capital

The assessment of natural capital available to a community should consider the abundance of arable land, grazing and harvestable natural resources (from wetland and other natural habitats) relative to the demands of the community. It is assumed that these three categories of resources are substitutable to a large extent, and thus the overall score is the maximum of the three sub-scores.

In the case of a comprehensive or intermediate assessment, this information can be obtained from discussions with the communities involved. A rapid assessment would require consideration of GIS data on vegetation and soils, as well as land use, coupled with the density of households and their expected demands (Table 7.15).

Table 7.15: Scoring guidelines for the assessment of natural capital. Intermediate scores have to be interpolated

Score	0	1	2	3	4	5
a. Arable land	None	Meets less than 10% of community needs	Meets less than half of community needs		Just enough to meet community needs	More than enough to meet community needs
b. Grazing	No grazing available	Lack of grazing severely restricts the number livestock			Just enough to meet community needs	Not a limiting factor in terms of livestock numbers
c. Harvestable natural resources	N/A	Natural resources extremely scarce relative to household demand			Just enough to meet community needs	Abundant terrestrial and aquatic natural resources relative to household demand
Natural capital score = maximum (a,b,c)						

7.5.6 Overall assessment of vulnerability

The computation of the vulnerability score is summarized in Table 7.16. The vulnerability score is based on an assessment of the community's overall access to the five types of capital. The overall score is calculated as the average score and this is then subtracted from 5 to obtain the Vulnerability score. A high overall score (on a scale of 0 to 5) indicates a high level of vulnerability.

Table 7.16: Computation of the vulnerability score

Vulnerability to poverty	Example Score
Physical capital (infrastructure and markets)	3
Financial capital (household income)	1
Social capital (networks / cohesion)	5
Human capital (education)	1
Natural capital (resources and other ecosystem services)	4
Vulnerability score (5 – average score)	**2.2**

7.6 Step 6: Assessment of dependence

The Wetland Dependence Score is calculated as the Wetland Benefit Score (Table 7.10) multiplied by the Vulnerability Score, and is expressed as a value out of 5 (Table 7.17). A high score out of 5 signifies a relatively high level of dependence of the community on its wetlands.

Table 7.17: Composition of the Wetland Dependence Metric (scores out of 5)

Parameter	Example Score
Wetland benefit score (Table 7.10)	4
Vulnerability score (Table 7.16)	2.2
Wetland Dependence Score (benefit score x vulnerability score)	**1.8**

7.7 Step 7: Calculate the Wetland Livelihood Value Index

7.7.1 Estimation of the score

The Wetland Dependence Score (Table 7.17) is integrated with scaling data to determine the Wetland Livelihood Value of the wetland(s) in the study area. In a monetary valuation exercise, the value of the wetland would be expressed as the total value for the wetland

(Rands per year), or as value per unit area (Rands per ha per year), or the net present value over a period of time (Rands or Rands per ha). Because aspects of the socio-economic value of a wetland cannot easily be estimated in monetary terms, the Wetland Livelihood Value Index is expressed as a score that can be used for comparative purposes. Like monetary values, it can be expressed as an aggregate score or as a value per unit area.

A qualitative unit has to be defined for the Wetland Livelihood Value Index in order to distinguish it from a monetary value, and in order to avoid the use of broad categories that might not provide sufficient resolution in cases where many wetlands are to be compared. Using the fact that a community scoring 5 in terms of the Wetland Dependence Score is highly dependent on a wetland for its survival, the unit for the Wetland Livelihood Value Index is defined in terms of **Dependent Household Equivalents (DHE).** The concept and name of this measure is specifically chosen to convey the sense of livelihood importance of a wetland. However, it must be noted that this is merely a qualitative, relative measure with which to compare the value of different wetlands to local livelihoods. Thus, the index can be calculated as either:

Wetland Livelihood Value (in DHE) = Wetland Dependence Score x hh

or

Wetland Livelihood Value (in DHE/ha) = (Wetland Dependence Score x hh)/A,

where DHE = Dependent Household Equivalents, hh is the number of households in the defined community and A is the area of the wetland(s) in hectares. Note that the number of households must be the same as those considered in estimation of the Wetland Dependence Score. Hypothetical examples are given in Table 7.18.

Table 7.18: Hypothetical example calculations of Wetland Livelihood Value Index

Area of wetlands (ha)	Households	Wetland Dependence Score	Wetland Livelihood Value Index	
			DHE	DHE/ha
10 ha	2	5	10	1
10 ha	30	5	150	15
100 ha	2	5	10	0.1
100 ha	30	2.5	75	0.75

7.8 Step 8: Assessment of sustainability

As a final step, the WET-SustainableUse tool (Kotze, 2010) should be applied in order to qualify the result of this study with a statement about the level of sustainability. This will have an important bearing on the interpretation of the results obtained. For example, if the livelihood value of the wetland is high, but it is being used unsustainably, then it will be extremely important to devise a strategy to safeguard the benefits supplied by the wetlands.

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9. GLOSSARY

Cultural services: The less tangible services provided by ecosystems such as recreation, aesthetic enjoyment and spiritual fulfilment.

Dependent Household Equivalents (DHE): A measure to convey the sense of livelihood importance of a wetland in relation to the number of households in the user-community.

Human Development Index (HDI): A composite measure of poverty that includes measures of life expectancy, income, education, access to clean drinking water and representation in decision-making processes.

Livelihood: The capabilities, assets and activities required to make or gain a living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base.

Livelihood assets: The human capital, financial, natural, social and physical assets central to determining people's livelihoods.

Poverty: The state of having little or no money and few or no material possessions, and is influenced by geographical location, age, gender, class, ethnicity, community structure and social agents and politics.

Provisioning services: The provision by ecosystems of natural resources such as food, water, timber and fibre.

Regulating services: The services performed by ecosystems that regulate the environment, such as the regulation of climate, floods, disease, waste and water quality.

Resource rent or economic rent: The return a factor of production receives in excess of the minimum required to bring forth the service of the factor, or the surplus available in a 'production unit' after accounting for the costs of production, including a reasonable return to capital. Resource rent is the economic rent generated from use of a natural resource.

Vulnerability: For a household or community is its susceptibility to stressors or changes, and is determined by the combined strength of its physical, social, financial, human and natural capital assets.

Wetland value: The value associated with the direct use, indirect use, option and existence values of a particular wetland.