WETLAND VALUATION ISSUES
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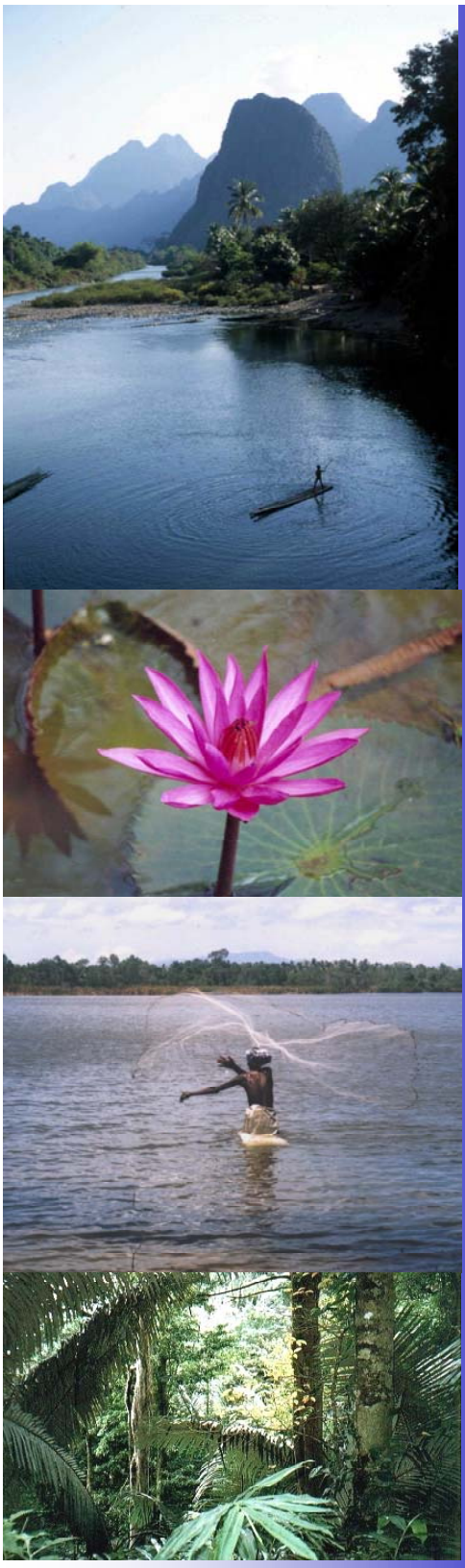
VALUING WETLANDS IN DECISION-MAKING: where are we now?

Wetland under-valuation: defining the problem

Wetland ecosystems yield a wide range of goods and services, many of which have a high economic value. Yet, paradoxically, they have long been perceived by decision-makers as having little value – there are seen to be few economic benefits associated with wetland conservation, and few economic costs attached to their degradation and loss. Given this tendency to under-valuation, it is hardly surprising that wetlands are being rapidly modified, converted, over-exploited and degraded in the interests of other more 'productive' land and resource management options which appear to yield much higher and more immediate profits. Dam construction, irrigation schemes, housing developments and industrial activities have all had devastating impacts on wetland integrity and status, and economic policies have often hastened these processes of wetland degradation and loss. At the same time conservation efforts have traditionally paid little attention to economic values – as a result it has often been hard to justify or sustain wetlands in economic terms, or for them to compete with other, often destructive, investments and land uses.

In fact, the problem is not that wetlands have no economic value, but rather that this value is poorly understood, rarely articulated, and as a result is frequently omitted from decision-making. Although conventional analysis decrees that the 'best' or most efficient allocation of resources is one that maximises economic returns, calculations of the returns to different land, resource and investment options have for the most part failed to deal adequately with wetland values.



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Integrating Wetland Economic Values into River Basin Management

Investment appraisals of dams do not usually consider the economic costs attached to modifying downstream river flows and hydrology, the economic impacts of loss of wetland resources tends not to be factored into calculations of the potential profitability of land reclamation or conversion schemes, cost-benefit analyses of infrastructure projects have rarely incorporated estimates of environmental benefits and costs. Decisions have tended to be made on the basis of only partial information and have thus favoured short-term (and often unsustainable) development imperatives, or led to conservation regimes that generate few financial or economic benefits. In the absence of information about wetland values, substantial misallocation of resources has occurred and gone unrecognised (James 1991), and immense economic costs have often been incurred.

Economic valuation can provide a powerful tool for placing wetlands on the agenda of conservation and development decision-makers. Its basic aim is to determine people's preferences: how much they are willing to pay for wetland goods and services, and how much better or worse off they would consider themselves to be as a result of changes in their supply. By expressing these preferences, valuation aims to make wetland goods and services directly comparable with other sectors of the economy when investments are appraised, activities are planned, policies are formulated, or land and resource use decisions are made. When properly measured, the total economic value of wetland ecological functions, services and resources frequently exceeds the economic gains from activities which are based on ecosystem conversion or degradation (Barbier 1994). Although a better understanding of the economic value of wetlands does not necessarily favour their conservation and sustainable use, it at least permits them to be considered as economically productive systems, alongside other possible uses of land, resources and funds.

Total economic value: a framework for defining wetland economic benefits

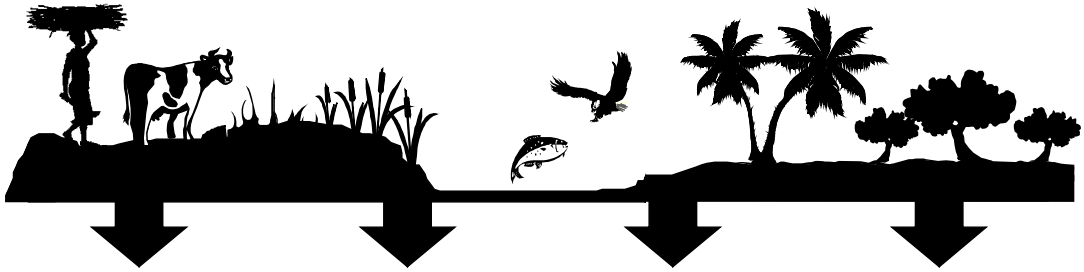
One reason for the persistent under-valuation of wetlands is that, traditionally, concepts of economic value have been based on a very narrow definition of benefits. Economists have seen the value of natural ecosystems only in terms of the raw materials and physical products that they generate for human production and consumption, especially focusing on commercial activities and profits. These direct uses however represent only a small proportion of the total value of wetlands, which generate economic benefits far in excess of just physical or marketed products.

The concept of total economic value has now become one of the most widely used frameworks for identifying and categorising ecosystem benefits (Barbier *et al* 1997). Instead of focusing only on direct commercial values, it also encompasses the subsistence and non-market values, ecological functions and non-use benefits associated with wetlands. As well as presenting a more complete picture of the economic importance of wetlands, it clearly demonstrates the high and wide-ranging economic costs associated with their degradation, which extends beyond the loss of direct use values.

Looking at the total economic value of a wetland essentially involves considering its full range of characteristics as an integrated system – its resource stocks or assets, flows of environmental services, and the attributes of the ecosystem as a whole (Barbier 1994). Broadly defined, the total economic value of wetlands considers includes (Figure 1):

- **Direct values:** wetland raw materials and physical products which are used directly for production, consumption and sale such as those providing energy, shelter, foods, agricultural production, water supply, transport and recreational facilities.
- **Indirect values:** the ecological functions which maintain and protect natural and human systems through services such as maintenance of water quality and flow, flood control and storm protection, nutrient retention and micro-climate stabilisation, and the production and consumption activities they support.
- **Option values:** the premium placed on maintaining a pool of wetlands species and genetic resources for future possible

Figure 1: Total Economic Value of Wetlands



DIRECT VALUES	INDIRECT VALUES	OPTION VALUES	NON-USE VALUES
Production and consumption goods such as: Water, Fish, Firewood, Building poles, Thatch, Wild foods Medicines, Crops, Pasture, Transport, Recreation, **… *etc* ...**	**Ecosystem functions and services such as:** Water quality and flow, Water storage and recharge; Nutrient cycling; Flood attenuation, Micro-climate, **… *etc* ...**	**Premium placed on possible future uses or applications, such as:** Agricultural, Industrial, Leisure, Pharmaceutical, Water use, **… *etc* ...**	**Intrinsic significance of resources and ecosystems in terms of:** Cultural value, Aesthetic value, Heritage value, Bequest value, **… *etc* ...**

From Emerton 1999

uses, some of which may not be known now, such as leisure, commercial, industrial, agricultural and pharmaceutical applications and water-based developments.

- **Existence values:** the intrinsic value of wetlands ecosystems and their component parts, regardless of their current or future use possibilities, such as cultural, aesthetic, heritage and bequest significance.

Methods for valuing wetland benefits

The simplest, most straightforward and commonly used method for valuing any economic good or service is to look at its market price – how much it costs to buy, or what it is worth to sell. In many cases market prices can provide an accurate indicator of the value of wetland goods, when they are freely bought or sold. Yet, as is often the case with environmental resources, market prices do not necessarily reflect the real economic value of wetlands. Many wetland goods and services are never traded, are under-valued by market prices, are subject to prices which are highly distorted, or have characteristics of public goods which mean that they cannot be accurately allocated or priced by the free market. Especially, market prices may be inappropriate for valuing wetland services and functions (which tend to be under-priced, or not priced at all), and subsistence-level use of natural resources (which are consumed within the household, or are not traded through formal markets). Yet these categories of benefits typically contribute a large proportion of the total economic value of wetlands, and failing to consider them runs the risk of seriously under-valuing wetlands.

For these reasons, it is frequently necessary to find alternative or additional techniques for valuing wetland goods and services, if their total economic value is to be more comprehensively expressed. Parallel to the advances made in the definition and conceptualisation of total economic value, techniques for quantifying environmental values and expressing them in monetary terms have also moved forward over the last decade (Gren and Söderqvist 1994). Today a wide range of methods which move beyond the use of direct market prices are available, and used, for valuing wetland benefits. These include approaches which elicit people's preferences directly (such as through contingent valuation

methods) as well as those which use indirect methods to impute people's preferences through their purchase of related goods and services (for example through production functions, dose-response relationships, travel costs, replacement costs, or mitigative or avertive expenditures). These methods, and their application to wetland ecosystems, are summarised in Box 1 below and are described in detail elsewhere (see for example Barbier 1994, Barbier *et al* 1997, Emerton 1999, Gren and Söderqvist 1994, James 1991).

Box 1: Commonly-used valuation tools

- **Replacement costs:** Even where wetland goods and services have no market themselves, they often have alternatives or substitutes that can be bought and sold. These replacement costs can be used as a proxy for wetland resource and ecosystem values, although usually represent only partial estimates, or under-estimates.

  In order to value non-marketed use of papyrus products by local households in Bushenyi District, Uganda, the price of substitute products was used. Annual household consumption of papyrus products was expressed in terms of equivalent market substitutes, including clay tiles instead of thatch, rubber floor coverings instead of mats, plastic bowls instead of baskets, and purchased firewood instead of papyrus fuel (Nsingwire 1995). Replacement costs were also used to value the benefit of Korea's coastal wetlands in treating wastewaters and pollutants. Here, the costs of building and operating a waste treatment facility were used as a proxy for the replacement cost of wetland services (Lee 1998).

- **Effects on production:** Other economic processes often rely on wetland resources as inputs, or on the essential life support provided by wetland services. Where they have a market, it is possible to look at the contribution of wetland goods and services to the output or income of these wider production and consumption opportunities in order to assess their value.

  The benefit of the Hadejia-Nguru wetlands for groundwater recharge was valued a production function approach. Wetland value was assessed by modelling the demand for water for household consumption and dry season irrigated agricultural production, and relating welfare changes to changes in ground water levels (Acharya 1998). The economic value of mangroves in Pagbilao, Philippines, was assessed by looking at their contribution to fisheries production. Sustainable harvests were calculated, and the impacts of mangrove nutrient production on productivity were isolated in order to determine the role of mangrove management in fisheries production (Janssen and Padilla1996).

- **Damage costs avoided:** The reduction or loss of wetland goods and services frequently incurs costs in terms of damage to, or reduction of, other economic activities. These damage costs avoided can be taken to represent the economic losses foregone by conserving wetlands.

  Wetlands around the Tana River and Delta, Kenya, provide important flood attenuation services for nearby infrastructure and surrounding human settlements. These services were partially valued by modelling the impact of wetland loss on the frequency and severity of flooding, and assessing the costs of damage avoided to roads, buildings and other infrastructure (Emerton 1994).

- **Mitigative or avertive expenditures:** It is almost always necessary to take action to mitigate or avert the negative effects of the loss of wetland goods and services, so as to avoid economic damage. These mitigative or avertive costs can be used as indicators of the value of conserving wetlands in terms of expenditures avoided.

  Coastal marshes and mangroves play an important role in shoreline stabilisation, erosion control, flood and storm protection on Mahé Island in the Seychelles. The value associated with these functions was calculated by applying a preventive expenditure approach. In the absence of wetlands services it would be necessary to construct groynes and flood barriers to offset or mitigate coastal erosion and damage to infrastructure, the cost of which was used as a proxy for the value of coastal marsh and mangrove services (Emerton 1997).

- **Hedonic pricing:** Hedonic methods look at the differentials in property prices and wages between locations, and isolate the proportion of this difference that can be ascribed to the existence or quality of wetland goods and services.

  The amenity and landscape benefits of Bhoj wetland in the city of Bhopal, India were valued using hedonic pricing methods. This compared house prices in different parts of the city, and isolated the premium on property prices for houses that were in close proximity to the Upper and Lower Lakes (Verma 2001).

- **Travel costs:** wetlands typically hold a high value as a recreational resource or destination. Although in many cases no charge is made to view or enjoy natural ecosystems and species, people still spend time and money to reach wetlands. This spending — such as on transport, food, equipment, accommodation, time, etc. — can be calculated, and a demand function constructed relating visitation rates to expenditures made. These travel costs reflect the value that people place on leisure, recreational or tourism aspects of wetlands.

  The travel cost method was applied to value the recreational value of wildlife viewing in Lake Nakuru National Park, Kenya. This was done by administering a questionnaire to visitors which collected data on origin, distance travelled, income and expenses. Demand curves were constructed using regression analysis to describe the relationship between travel costs and number of visits, and individual and aggregate willingness to pay for wetland recreational services were estimated (Navrud and Mungatana 1994).

- **Contingent valuation:** Even where wetland goods and services have no market price, and no close replacements or substitutes, they frequently have a high value to people. Contingent valuation techniques infer the value that people place on wetland goods and services by asking them their willingness to pay for them (or willingness to accept compensation for their loss) under the hypothetical scenario that they would be available for purchase.

  Contingent valuation methods were used to assess the value of a maintaining the Chao Phraya River in Thailand as a clean and well-functioning environment. A survey was carried out to gauge Bangkok residents' willingness to pay for a clean environment through eliciting bids for various measures to improve river water quality and minimise pollution loads entering the river (Tapvong and Kruavan 1999).

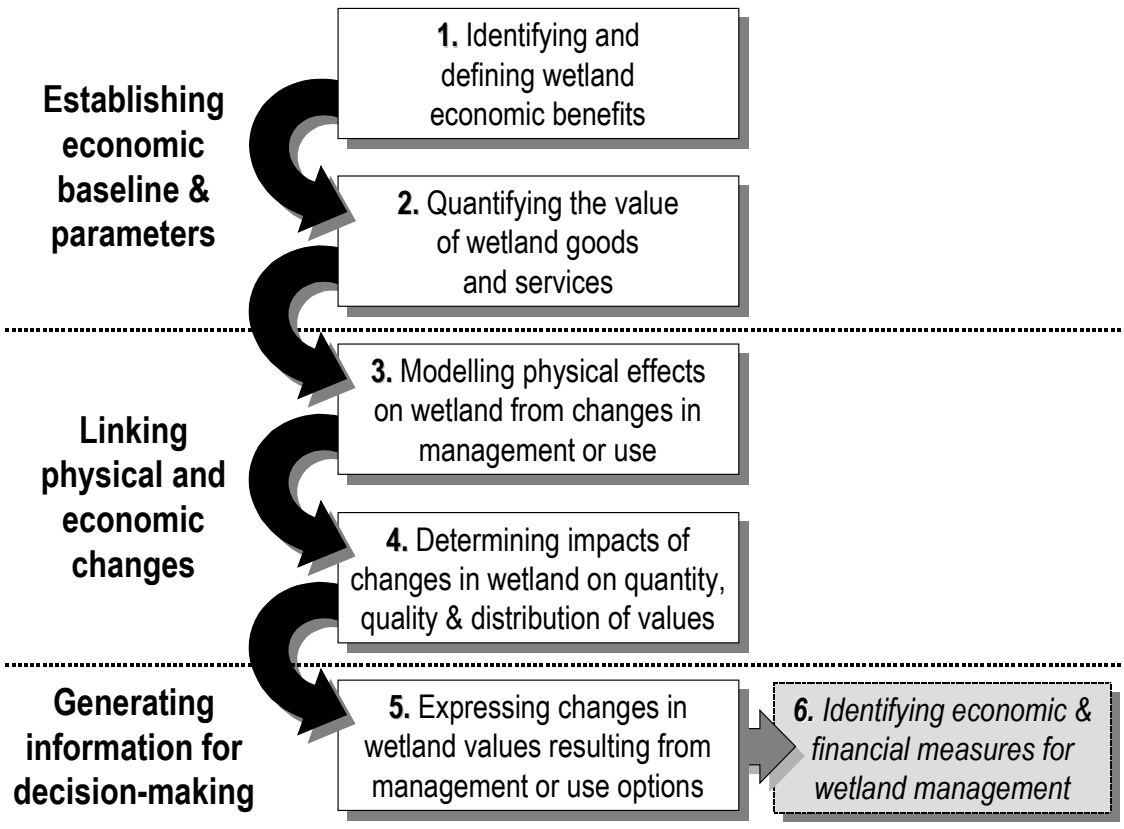
Expressing wetland values for decision-making

Calculating the economic value of wetlands is not an end in itself. Rather, it is a means of providing information which can be used to make better and more informed choices about how resources are managed, used and allocated. Economic arguments and indicators exert a powerful influence over these choices, and decision-makers need to be able balance the relative gains from different activities and investments, including those that are concerned with conservation as well as those that lead to wetland modification, degradation or conversion. Valuation enables wetlands to be factored into economic decisions.

Decision-makers are primarily concerned with choosing between different uses of land, funds and other resources – for example whether to manage a wetland under strict protection or to allow for some form of sustainable use, whether or not to build a dam, irrigation scheme or housing estate, which infrastructure design option to invest in, or whether to zone a wetland for conservation or to convert it to settlement or agriculture. In order to integrate wetlands values into these decision-making processes, it is necessary to trace the economic implications of changes in the stock of wetland resources, flows of wetland services, or attributes of wetland systems that result from following a particular course of action, and factor them into measures of its economic desirability.

Various studies have demonstrated the utility of applying a simple bio-economic model in order to generate information for wetland decision-making (Colavito 2002, Creemers and van den Bergh 1998, Bennett and Whitten 2002). This type of model presents a useful tool for relating wetland values to decision-making, and involves a number of iterative steps (Figure 2) – establishing an economic baseline from which to measure wetland changes, linking physical changes in wetland status and integrity to changes in these economic values, and expressing the results as indicators or measures that can be integrated into broader economic appraisal or analysis

Figure 2: Expressing wetland values for decision-making



processes. In some cases such models are taken one step further, and information about wetland costs and benefits are also used to identify financial and economic measures for wetland management.

The scope, scale and outputs of such models vary. The most comprehensive, and accurate, picture can be gained from adopting an approach which encompasses the total economic value of the wetland ecosystem as a whole (Creemers and van den Bergh 1998) and incorporates the dynamics of economic and environmental processes within a temporally and spatially explicit framework (Bockstael 1996). Data constraints however often force a partial valuation model, and decision-making is often concerned only with specific resources, areas, groups, localities or effects. Various options also exist as to how the results of these models are expressed. Most commonly valuation information is used to feed into economic or investment appraisal processes, and is expressed through traditional cost-benefit analysis indicators such as net present value or internal rate of return. In many cases additional indicators are used to highlight the economic impacts of changes in wetland status on specific groups or areas, such as actual or potential contribution of wetland goods and services to livelihoods, income, government revenues or wider development processes.

Wetland valuation: where are we now?

This brief has described how wetland under-valuation has led to land and resource use decisions being made on the basis of incomplete or inaccurate information, often resulting in decisions which are neither economically nor ecologically optimal. It also outlines the advances made over recent years in finding ways of defining, measuring and expressing environmental values. Wetland valuation no longer requires lengthy, cumbersome, and costly data collection and analysis, but has become relatively simple, low-cost and easy-to-implement. Rather than resulting in complex and often purely academic findings, valuation techniques are also increasingly being used to generate practical management and policy information.

These new adaptations of economic concepts, methods and models have enabled wetland values to be much more easily and accurately expressed, and have yielded important information and insights. Although wetland ecosystems remain poorly represented in environmental valuation studies, and still there has been considerably more work carried out in temperate, rather than tropical, wetlands (Barbier 1994, Gren and Söderqvist 1994), this situation is beginning to change. A growing body of information is becoming available on the economic value of tropical wetland ecosystems. This addresses many different countries, wetland types and categories of benefits, and develops and applies a wide variety of valuation methodologies. In many cases these studies represent the first attempt to quantify the economic importance of wetlands in a country, for a particular ecosystem type, or in relation to a specific set of benefits or beneficiaries.

An important objective of wetland valuation is to provide an improved basis for designing land and resource use policies and management systems (Barendregt *et al* 1998). Despite the steps forward that have been made in calculating and expressing the value of wetland goods and services, a major challenge remains – to ensure that the results of these studies, and the figures they generate, are actually fed into decision-making processes and used to influence conservation and development agendas. Wetland valuation does not have to be a costly, complex or purely theoretical exercise. It has a wide range of practical applications to real-world policy and management issues, can easily be integrated into development and conservation decision-making processes, and is able to be carried out in situations where information, time, funds and human resources are extremely limited. Economic valuation provides a powerful, but currently under-utilised, tool for decision-making. Although valuation cannot by itself overcome the omission of wetland concerns from decision-making, it can make strong arguments and present convincing data to decision-makers which underline their economic importance.

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This project aims to develop, apply and demonstrate environmental economics techniques and measures for wetland, water resources and river basin management which will contribute to a more equitable, efficient and sustainable distribution of their economic benefits at the global level and in Africa, Asia and Latin America, especially for poorer and more vulnerable groups.

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