The Fungibility of Wetlands

"Fungible" means "of such a kind or nàture that one part may be used in place of another equal part in the satisfaction of an obligation." Resources that would score high on a fungibility index include pork hocks, winter feed corn, and lawyers schooled at Yale. Resources that would barely score on the index include dogs, Italian dinners — and wetlands. Even very similar resources can have wildly different values if they are in different locations, a fact lost in the no net loss debate.

By Dennis M. King and Luke W. Herbert

People know that protecting wetlands costs something. They have been willing to support policies to protect wetlands because they have been convinced that the environmental and economic benefits of wetlands exceed the cost of protecting them. What people do not know, yet, is that the criteria wetland managers are using to evaluate the success of wetland policies (such as no net loss) and to barter and even sell wetlands (such as wetland mitigation) ignore the beneficial effects of wetlands on people. Commonly used definitions and measurements of no net loss are so vague that they mask rather than clarify important wetland trends. Worse, they are forming the basis for debiting and crediting in wetland mitigation systems, and for challenges to mitigation trading rules that protect the public interest.

In time, the changing characteristics of wetlands and watershed landscapes that are resulting from all this will become obvious to the people who trusted wetland scientists and policy makers to protect their interests as "stakeholders." This could have far ranging consequences, including the undermining of public support for wetland policies and market-based environmental solutions.

Scientists, lawyers, and policy analysts are usually quite precise about concepts and terms. It is surprising, therefore, that as they consider how to take account of movements toward and away from the generally accepted no net loss goal for wetlands, there has been so very little critical thinking about what it is about wetlands that we don't want to lose. In a political context, of course, being vague about what is meant by no net loss has had some advantages. After all, stakeholders can all be expected to get behind the notion of no net loss as long as they are allowed to interpret what it means for themselves. Until recently, this created an aura of political consensus about wetland policy. However, as the focus of wetland policy has shifted from consensus building to monitoring, comparing, and trading, the strategy of being vague about no net loss is backfiring. In the harsh world of accounting and trading you get what you measure, so it is important to measure what counts. Acres of wetlands are not what counts.

There are four attributes of wetlands that can be measured either directly or using indicators:

Wetland *features* are the site-specific characteristics of a wetland (such as size and hydrology). These establish its capacity to support life and perform biophysical processes.

Wetland *functions* are the biophysical processes that take place within a wetland. These can be characterized apart from any human context (such as cycling carbon and nutrient trapping).

Wetland *services* are the beneficial outcomes that result from ecosystem functions (such as better fishing and hunting, and cleaner water). These require some interaction with, or at least some appreciation by, humans. However, they can be measured in physical terms (such as catch rates and aesthetics).

Wetland *values* are defined in conventional economic terms as the aggregate "willingness to pay" by all individuals for all of the services associated with all of the functions of a wetland. These often are impossible to measure in absolute (dollar) terms, even for specific services, but they can be expressed in relative terms (such as using indicators) for purposes of comparing wetlands. (See my article on developing leading indicators of relative wetland values in the May-June 1997 *National Wetlands Newsletter*.)

These four attributes are related to one another, depend on one another, and sometimes can be used to represent one another. Vegetative cover, for example, is a wetland feature that

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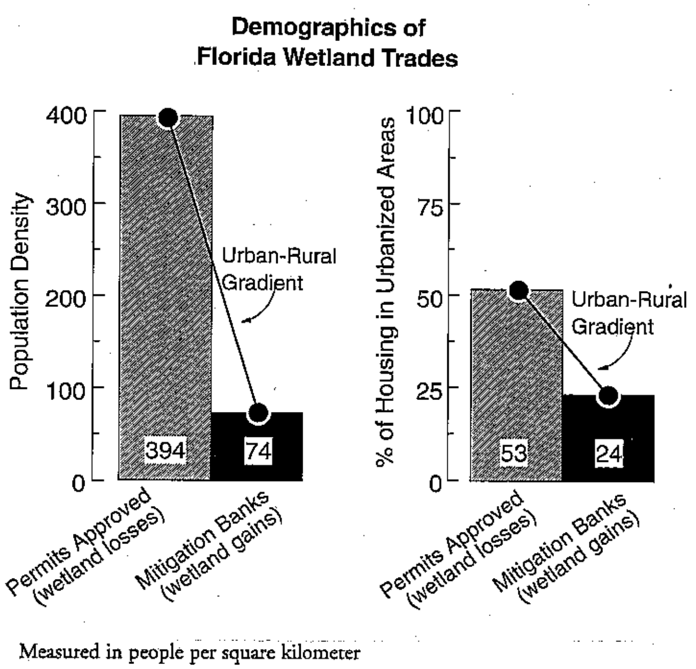
may be a good indicator of a wetland's capacity to trap nutrients, a wetland function. In some but not all landscape contexts that will mean that vegetative cover also is a good indicator of the fish habitat protection the wetland will provide, a service, and the resulting improvements in fisheries, a value.

However, there are important reasons why clear distinctions should be maintained between measures of wetland features, functions, services, and values. The most important one is that the information needed to evaluate each of them and the criteria used to compare wetlands with respect to each of them are different. The features of an ecosystem that might give it a high capacity to provide a particular function (such as suitability as waterfowl habitat) do not guarantee that it will actually provide a high level of *function* (support a high number of waterfowl). Wetlands that provide the highest level of function may not provide the highest level of *service* (birding, hunting, educational, and scientific opportunities). Those that provide the highest levels of service may not be located where they provide the greatest *value* (aggregate "willingness to pay" for additional birding, hunting, and educational opportunities). And lastly, the wetland that generates the greatest overall value may not be located where it will result in a distribution of benefits that is considered *equitable* (opportunities for rich vs. poor).

Box 1



Measured in people per square kilometer

An illustration: Florida mitigation trading

A heated debate is underway in wetland policy circles about whether the United States is achieving the generally accepted no net loss goal. (See the July-August 1997 issue of the *National Wetlands Newsletter.*) That debate is centered on whether wetland acreage created, restored, or enhanced in recent years is equal to or greater than wetland acreage destroyed. However, size is only one of the *features* of wetlands that contribute to functions, services, and values.

We are seeing a market-driven "migration" of wetlands across the urban-rural gradient

With this in mind, we examined if managing wetlands on the basis of acreage or other strictly bio-physical features would result in any adverse change or redistribution in wetland services and values. We did this by analyzing the demographics associated with the changing patterns of wetland distribution that are beginning to emerge in the state of Florida as a result of mitigation banking. Florida is far ahead of the rest of the nation in the number of off-site mitigation banks (31 active or pending banks and dozens more proposed) and is the only state with enough banking activity to allow preliminary testing of landscape and demographic trends.

We began by classifying the 31 mitigation banks and wetland destruction permits (individual and general permits from January 1992 to May 1997) by zip code. We then used the most recent U.S. Bureau of Census data (1990) to compare the demographic characteristics of areas where wetlands in Florida are being gained and lost. We weighted our data by the number of individual permits issued and acres of mitigation to take account of the fact that some zip codes had far greater wetland gains and/or losses than others. We made no attempt to match the wetland losses associated with the approval of any specific permit with the specific mitigation required as part of that permit. The results reflect a central tendency based on a comparison between the mean demographic characteristics associated with permits and acres of mitigation.

We found a great difference in the population densities and patterns of urbanization associated with the areas of wetland loss and wetland gain, as shown in Box 1. The data clearly show that the siting of mitigation banking and permitting is resulting in a transfer of wetlands from highly urbanized, high-population density areas to more rural, low-population density areas. Not surprisingly, wetland permits are being requested in areas where people want to live; mitigation banks are being sited where land is relatively inexpensive, which is where people don't want to live. We are, in effect, seeing a market-driven "migration" of wetlands across the urban-rural landscape gradient. Our next step was to examine if this trend is important.

For sake of simplicity, we assumed that the functions of the wetland areas that are gained and lost as a result of a mitigation trade are identical. (Consider this a best-case scenario since, typically, losses imply a total loss of functions while gains often involve only improvements in existing functions). This allowed us to focus on how differences in population density near the wetland affect the services and values provided by a given level of function. Box 2 lists the 13 most often cited wetland functions and some typical services associated with them and notes how population density is likely to affect: 1) the level of services associated with a given level of function, and 2) the values associated with those services. Of the functions listed, 10 generate services and/or values that increase, all other things equal, with the average population density of the nearby area.

Since wetland functions take place outside of any human context, they will be provided regardless of whether people live nearby. However, without being in the vicinity of people, those functions might not result in any services. Similarly, it may be necessary for those services to occur within the vicinity of people in order to result in any significant value. For example, a wetland site may provide excellent wildlife viewing, regardless of whether many people live nearby or have access to the site. However, the site's proximity or access to humans strongly influences the recreational, educational, and aesthetic values it will provide.

Even wetland functions that generate "passive" services and values, such as the amelioration of adverse environmental consequences of human activity, require proximity to people. The amount of excess stormwater generated by impervious surfaces such as parking lots, roads, and rooftops, for example, is far greater in areas that are highly urbanized with higher population densities. In rural areas, the capacity of a wetland to attenuate peak periods of stormwater runoff and prevent damage to adjacent natural resources and real estate may not be utilized, therefore the function may provide no service or services that have limited value. The proximity of a wetland to people also affects the payoff from its capacity to filter sediments, nutrients, and contaminants; and along the coast, its ability to reduce ocean wave and surge damage.

Certainly, trading wetlands from highly populated areas to relatively unpopulated areas reduces the risks that certain functions may eventually be lost due to adverse effects of nearby human activity (biodiversity support being one good example). However, our research shows that it will also reduce the services and/or values that many functions can be expected to provide.

Box 1 and Box 2 illustrate that wetlands in Florida are being traded across the urban-rural gradient and that this is resulting in losses of the services and values that wetlands provide. An additional factor that deserves attention is scarcity. Wetlands are scarce and becoming scarcer in urban areas. This means that the services they provide there generate greater values on a per capita basis than identical wetland services provided in relatively rural areas where wetlands are less scarce.

Box 3 reflects how the value of an identical acre of wetland decreases as it is transferred down the urban-rural gradient. This is due to two reasons:

1.) Lower population densities, by definition, imply more land per capita and a higher likelihood of substitute wetlands and wetland services being available. This is reflected by Line 1 in Box 3, which shows that the marginal value of an extra acre of wetland on a per capital basis decreases as the population density decreases.

2.) Lower population densities, by definition, imply that fewer

Box 2

Wetland Functions	Typical Related Services	Will Greater *SERVICE* Result from Greater Nearby Population Density?	Will Greater *VALUE* Result from Greater Nearby Population Density?
Fish Habitat	Recreational/ Commercial Fishing	○	●
Waterfowl Habitat	Hunting, Birdwatching	○	●
Fur-bearer Habitat	Hunting, Wildlife Viewing	○	●
Vegetation	Extractive Industries	○	●
Pollution Assimilation	Water Quality, Habitat Protection	●	●
Storm-water/Runoff Attenuation	Flood Prevention, Habitat Protection	●	●
Floodwater Storage	Property Damage Avoidance	●	●
Sediment/Nutrient Trapping	Water Quality, Habitat Protection	?	?
Storm Surge/Wave Protection	Property/Shoreline Damage Avoidance	●	●
Groundwater Recharge/Discharge	Drinking Water Quality	○	●
Natural Area/Open Space	Recreation, Education, Aesthetic Enrichment	●	●
Climate Control	General	○	○
Biodiversity Support	General	○	○

● = yes ○ = no ? = site dependent

people live in the vicinity of the wetland and benefit from the many wetland services that require access, adjacency, and proximity. This is reflected by Line 2 in Box 3, which shows that as the population density decreases in the vicinity of the wetland, the number of people who benefit from the wetland declines.

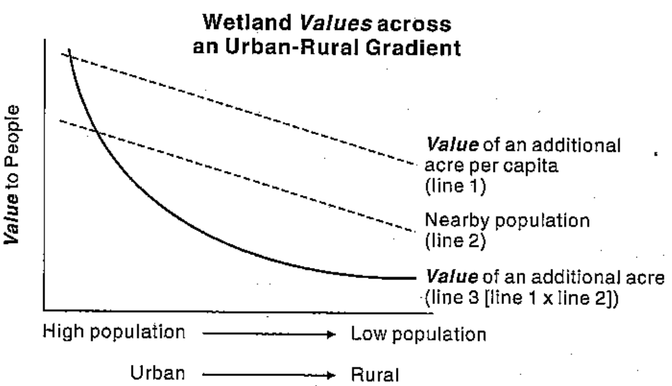
Line 3 in Box 3 represents the overall value of an additional acre of wetland traded across the urban-rural gradient. It is the product of Line 1 and Line 2 (per capita value per acre of wetland multiplied by the average population density). Since both factors decline along the urban-rural gradient, the overall value of an acre of wetland gained or lost declines significantly along the gradient.

The important impact of this one factor, the urban-rural gradient, demonstrates how comparing wetlands on the basis of their size or bio-physical features alone ignores reductions in wetland services and values even where the goal of no net loss of function is achieved.

The urban-rural gradient explored in this paper is only one of the factors that should be given more attention when evaluating trends and managing trades in wetland resources. Other human and natural factors that may also have a significant effect on the relative functions, services, and values of wetlands include:

- Wetland transfer from areas of high to low biodiversity;
- Wetland transfer from coastal to inland locations;
- Replacement of lost natural wetlands (destruction) by restored or enhanced wetlands (partial gains) or wetland preservation (possible future loss avoided);
- Delays between losses and gains and the resulting differences in services and values during the interim; and
- Mitigation success rates, especially what proportion of proposed mitigation is actually undertaken and what portion of what is undertaken is succeeding.

Box 3



Value: based on each acre having identical features, functions, and services; differences in value are based on the number of people near the wetland (access, adjacency, proximity to the wetland) and the availability of substitutes for services provided by an additional wetland acre

The human landscape

Our research shows that the location of wetlands in the human landscape context is enormously important in assessing the fungibility of wetlands and in determining whether obligations to protect the public interest in wetlands are being met. The Florida case illustrates that where criteria are not used for comparing wetland services and values, economic incentives exist to site mitigation banks in relatively rural areas where high wetland functions can be provided at the lowest out-of-pocket costs. While this may provide an efficient and politically expedient short-term solution to wetland conflicts, it does result in long-term trends that have the potential to reduce the services and values of wetlands.

Comparing wetlands on the basis of their size or bio-physical features alone ignores reductions in wetland services and values even where the goal of no net loss of function is achieved

It is the accounting criteria used to assess wetland trends and mitigation trades that establishes the "obligation" that public officials and other mitigation providers have to replace wetlands. Measuring the success of wetland policy and the terms of wetland trading purely on the basis of changes in wetland acreage or wetland functions masks important changes in wetland services and values.

It may never be possible to compare wetlands on the basis of their absolute "dollar" value. However, the fungibility of wetlands still can be defined in terms that reflect what is important about wetlands. The five questions that should be addressed to determine if wetlands are fungible, and if mitigation obligations have been met, are pretty basic: what, when, where, how, and for whom. Accounting management or trading standards that gloss over these questions cannot hope to establish obligations to protect what is important about wetlands. ■

See also: Bohlen, C.C. and King, D.M. 199? "Location and Wetland Values: Some Pitfalls of Offsite Mitigation in the Chesapeake Watershed." In Nelson, S. and P. Hill (Eds.) Toward a Sustainable Coastal Watershed: The Chesapeake Experiment. *CRC Publication No. 149. Chesapeake Research Consortium, Edgewater, Maryland.*

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