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WHAT IS A WETLAND WORTH? CONCEPTS AND ISSUES IN ECONOMIC VALUATION

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ABSTRACT

A wetland has no economic value in and of itself. Nor does it have a unique value, irrespective of context. Economic value is ascribed to a wetland by humans operating at a confluence of individual preferences, property rights, technological opportunities, and available resources. Such values are not generally reflected in market prices, a deficiency that can nonetheless addressed by competent economic analysis, using a variety of empirical techniques. The task is complicated by scientific information shortfalls, by ever-changing technologies and economies, and by evolving societal preferences--but it can be done. Economic valuations have been used in wetland priority rankings and in comparative investment analyses.

What is a Wetland Worth?
Concepts and Issues in Economic Valuation

Steven J. Taff

When you ask an economist a simple question like What is a wetland worth?, you just know that the response will be: "It depends!" That's our stock answer to most every question, it probably seems to you. But it's true. It does depend, on all sorts of factors. Which wetland are you talking about? What does it do? Who owns it? What is the threat? The answers condition the wetland's value, making the estimate, like all economic values, contingent upon context.

Many people balk, I know, to our "putting a dollar value" on an important environmental asset like a wetland or on a flourishing ecosystem or on an individual salamander. (I make the assumption that many of you fall into this camp, since the bulk of you are hydrologists, planners, biologists, legislators--anything but economists.) Humans clearly value these sorts of assets in ways far more intricate and complex than those necessarily supposed in economic valuation studies. But the economic analyses are still worth doing--for at least two reasons. First, if we don't sometimes reduce environmental considerations to money terms, they might not get the attention they deserve. For example, the federal Water Resources Council's "Principles and Guidelines," the bible for among others the Corps of Engineers, requires that proposed project analyses include environmental goods and services

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only "to the extent that they can be monetized." That phrase, as you're all more than aware, really means "do an economic study."

So why not change the rules? While it is a noble pursuit to try to get federal decision rules altered to better reflect the virtues of environmental assets--the dramatic increase of the official federal project discount rate over the past decade is the result of one such pursuit--it is just as valid, I will argue, to try to do a better job of estimating the economic value of environmental services in money terms. Not only is it required, is sometimes very useful to have such values, as we will explore below. That's the second reason for doing legitimate economic analysis.

What constitutes "legitimate" analyses and how we economists go about doing it is the subject of my remarks today. I'll discuss first the source of economic value and the types of value that might be pertinent in a wetlands setting. I'll then sketch some of the ways in which we go about measuring an economic value held by an individual with respect to an environmental asset that doesn't get traded in markets, noting the assumptions necessary for us to aggregate individuals' values into a meaningful overall societal value. I'll close with mention of a few issues that both excite and vex working economists in this area. Throughout, my intent is to apprise you of some of the potentials and pitfalls of economic valuation, so that you as a sometimes buyer of economists' services can be suitably aware of the nature of the product you thereby obtain.

WHY MEASURE ECONOMIC VALUE?

We want to use economic information to help us make decisions about wetlands. The kind of economic valuation study we do depends in part upon exactly why we need this information. That's in part a function of the decisions that face us. A crucial distinction is between private valuations, reflected in the land and other observable markets, and public valuations, often only hinted at by observable transactions. For example, if all we need to know is how much to pay a landowner to acquire complete rights to a given wetland, we might do a land market study, focusing on how much money it would take to convince the owner to sell. Similarly, when assessors want to know what value to place upon a wetland for property tax purposes, they too need only concern themselves with market value.

When public resource managers are trying to figure out on which wetlands to spend scarce program dollars, however, they need estimates not of market values but of social (as interpreted by the agency) benefits. Presumably, those wetlands whose treatment (preservation, restoration, or acquisition) results in the greatest net social benefits will be dealt with first. These calculations can become considerably more complicated than market studies, but they are analytically tractable. Things become more complicated still in investment analyses such as benefit-cost studies where we need to compare "worth" not only across wetlands but across completely different projects.

There remains a significant conceptual difference between valuing "a wetland" and valuing "wetlands". The former might be asked if one were estimating the welfare

effects of a project, say a county ditch repair, that in some way changed a particular wetland. For this, one might use any of several measurement techniques that we will discuss below. (There remains still the problem of valuation of a particular wetland in the context of a system of wetlands. We discuss this elsewhere, as well.) The economic value of "wetlands" with no particular wetland being singled out, might be important in the context of evaluating a policy such as no-net-loss. Here, the question we might be asking is "How much should we spend to do something about the predicted further decline of prairie pothole wetlands?" Much of the traditional wetland valuation technology is useless to answer such a seemingly simple question, but certain new survey research methods permit us to ascribe value to even such a vague environmental asset as "wetlands, not otherwise specified."

WHERE DOES ECONOMIC VALUE COME FROM?

To an economist, there can be no value without human wants, and there can be no costs without foregone opportunities. The economic value of a wetland (as a wetland) is whatever people are willing to pay to keep it from being drained. Actually, it is not even the wetland itself that people value. Rather, people's well-being is the product of the various services that flow from the wetland's basic physical and biological functions. Wetland functions like stormwater retention create economic value only because they provide services like flood damage reduction that people value, that people are willing to pay for. If there was no change in human well-being, there would be no economic value.

Economists use money to measure the intensity of human wants and to compare wants among individuals. We'd prefer to measure "utility," which lies closer to the core of individual preferences, the foundation of economic theory. Unfortunately, 150 years of sometimes sterile but always contentious debate have left us with the conclusion that we just can't do it. Utility is "there," but we can't observe it. As a result, we can't measure it directly. What we can do, however, is observe is how people behave in markets or how they respond to questions. What we see are choices, and from those choices we can infer underlying preferences and thereby measure individual valuations. We then compare and aggregate using a money metric, because such a measure has desirable theoretical properties for these purposes.

So economic value is very much human centered. Wetlands have no intrinsic economic value, in our view, outside this human context. I might note as an aside that most of the noneconomic values claimed for wetlands are, at their core, human centered as well. For example, the idea that some now-obscure salamander might produce in its gall bladder (if salamanders even have gall bladders!) a chemical that might some day be used to cure cancer, so we should treasure a wetland because it houses salamanders--is very much a service that humans desire and economists can measure. Even the notion that wetlands have value simply because they provide habitat for salamanders, regardless of their gall-bladder, can be linked to humans. Why worry about salamander well-being? Because it makes us feel good to know that the salamander flourishes. (This is not the only philosophical justification for "innate"

wetland values. Norton (1986) is an excellent single reference for these issues, even though it nominally deals only with endangered species.)

But we need not claim that all wetland functions can be linked to human preferences in order to do an economic valuation of the resource. It is sufficient merely to posit that some wetland services are desired by humans. All an economic valuation gives you is a money measure of changes in human well-being. In making a decision regarding wetland use, human actors need not (and generally do not) choose on the basis of economic values alone.

If you think of wetlands as a bundle of service flows--just like we teach our students to think of property as a bundle of rights--each of which has its own economic values, you can begin to see how economists approach the question of wetland valuation. Each such service--flood damage reduction, hunting opportunities, scenic amenities, open space--associated with it a separable value, the estimation of which might require a different empirical technique.

The most critical distinction with respect to wetland services is that between use and non-use values. The former are those that require some sort of direct human interaction for them to have a non-zero effect upon human well-being. Examples are hunting, sight-seeing, flood damage reduction, and hay cutting. I get no use value from a wetland if I don't use one of these services. These kinds of values can often be measured by looking at associated spending patterns or by measuring direct payments like access fees.

But there is another class of wetland values that can in some instances taken on substantial magnitude. The so-called non-use values are those increments to my well-being that can be attributed to a wetland even if I never visit it or shoot a duck from it or live downstream. "Just knowing it's there" is enough. These existence values (there are other types of non-use values, as well) can be measured through certain survey techniques. Some people, I must caution you, have difficulty in accepting non-use values as "economic," and they may dismiss policy arguments that rely upon such values to any significant extent. Many economists increasingly recognize, however, the validity of the concept (Kopp, 1991).

Part of wetlands' value come from their system context, due to physical interrelationships like migratory waterfowl or water in a hydraulic regime, as well as to their relative scarcity. The value of a set of wetlands is something different from a simple aggregation of their individually-determined economic values, because of their heterogeneity and synergy. While the value of a given wetland may diminish with the increase of the size of the entire system, and while the value of the system itself might exhibit diminishing marginal returns, the total value of each can be expected to continue to increase by size or complexity.

WHAT IS IT THAT VALUATION STUDIES MEASURE?

Economic value is, in the sense we're talking here, the monetized increase (or decrease) in human well-being brought about by a wetland service. Economic theory can show that this increase in well-being corresponds to what we call "surplus," the

extra money someone would have been willing to spend for a good, but didn't have to because the actual price was something lower. Surplus is the amount of well-being achieved by the individual over and above the amount of money that changed hands. Technically, when we measure the economic value of a good or a service, we seek to estimate certain areas under its "compensated" demand curves, which take into account the fact that changes in spending affect both individual utility and income. This works, as long as we can observe (or infer) people's consumption choices under different prices. But many wetland services are not associated with a conventional market. What then?

First, consider cases where we observe at least some consumption choices or behavioral changes. Sometimes, we can get at the value of the wetland service by looking at associated goods that do have market prices. For example, the "right to live next to a wetland" is not commonly marketed, but we hypothesize that it has some value to a homeowner, nonetheless. Since this proximity factor can be thought of as an "attribute" of home ownership in certain locations, we can turn to housing market sales data infer the value placed upon nearby wetlands by property buyers. (For a Ramsey County example, see Lupi et al, 1991). The result is, strictly speaking, the value of the right to live next to a wetland, not the value of the wetland itself. Some studies that purport to measure the value of a wetland per se are actually valuations of access rights or other quite human-centered activities.

Another way to get at wetland values indirectly is to use government expenditures to infer the underlying preferences of society. One example: the

Minnesota Legislature mandated a payment of 50% of township average tillable land values for wetland easements acquired under the denied-use provisions of the new wetlands law. (The metropolitan counties have a lower rate.) A different value, but the same idea, was declared for wetland easement acquisition under the RIM Reserve program, where the state paid on average over $800 for each acre of restored wetland easement. We could interpret this to mean that the Legislature, in authorizing and continuing the program, has determined that the benefits to the people of the state exceed to some degree this expenditure level--else why do it?

A third indirect approach could be labeled a replacement cost method. If a wetland service like runoff filtration could be provided equally well by a sewage treatment plant, say, people are presumably indifferent between paying for that treatment plant or paying the same amount to save or create a wetland to provide the same level of filtration. The public value of the wetland, then, with respect to that service, is no higher than the cost of the treatment plant. For, if you can get the filtration from the plant, why would you want to pay more to get the service from a wetland? This reasoning leads to a convenient economic benchmark: the maximum economic value of a wetland service is its full replacement cost. This can be useful because it sometimes is a lot easier to estimate the cost of replacement than it is to estimate the societal benefits provided by a particular wetland or set of wetlands.

The above approaches give us value estimates of wetland services for which markets exist or which are somehow associated with other goods traded in markets. But how do we get values when we can't observe choices, even indirectly?

Essentially, we just ask people. It's not quite that simple, of course. You'll often hear the phrases "willingness to pay" (WTP) and "willingness to accept" (WTA) used by economists doing wetland valuation studies, especially for non-use values. The basic idea is that the value is no more than whatever a person is willing to pay to convert it from cropland or no less than that person is willing to accept as compensation if the wetland is converted to farmland. Not surprisingly, the numbers we come up with are heavily influenced by the existing (perceived) distribution of property rights. If I think you don't have the right to drain your wetland, I'm not going to express as high a WTP to keep it wet as I might otherwise.

This "contingent valuation" technique has come to be the analytic tool of choice among many resource economists and resource management agencies. Its popularity lies in its ability to ascribe monetary values to goods and services that are never marketed (clean air, for example) or don't even exist (a million acres of new wetland, for example). This is the sense in which the valuation is "contingent": people are asked, through highly structured surveys, what they would pay toward the creation of 100 new wetlands, say. Now you might think that this is an extremely dicey approach. What's to keep people from lying, as long as they never will have to pay anything? Two decades of practice have taught economist two things about what we call the possibility of strategic behavior: one is that proper survey research technique can reduce the opportunity for such behavior by respondents, and the other is that people just don't lie very much in these situations.

Are the resulting values therefore the "correct" ones? That depends upon what we mean by correct. All values and prices, marketed or nonmarketed, are contingent upon property rights, technologies, and individual preferences. Too, the price of something is not necessarily its value. People might be willing to pay more than they did, and sellers might have taken less. So it's difficult to establish a benchmark value against which to compare the results of a valuation study. Experimental evidence suggests, however, that the values obtained from well-constructed valuation studies are quite consistent over time and across individuals. (The best single source in the contingent valuation literature is Mitchell and Carson, 1989.)

It is sometimes argued (especially by those who <u>really</u> like wetlands) that economic valuation studies are flawed because people don't really know just how important wetlands are to their well-being. If only they did know, it is claimed, their valuations, measured perhaps through a contingent valuation study, would be higher, and hence governments and property owners would choose to save more wetlands. To be sure, all economic analysis is subject to problems of ill-formed and uninformed preferences. But the come-back is also hard to refute. What else have we to go on? Individual choices at a given point in time are assumed to reflect that person's best guess at that time as to what's best for him or her. All of welfare economics, indeed all of conventional economics, is based upon this notion. If we don't trust individuals to know their own preferences, who is it that we should trust?

WHOSE VALUES SHOULD BE COUNTED?

Whenever we do valuation studies--or economic studies of any sort--we have to carefully draw some circles (at least figuratively) around the group of people whose preferences are to be aggregated. ("Accounting stance" is the formal term.) Depending on where we draw the circle--around the wetland's locality, county, state, nation, whatever--we might obtain quite different economic values for a given wetland. Two major factors come into play here. The larger the circle, the larger is the number of people who might reveal a positive preference for a wetland preservation project, say. But at the same time, the larger the circle, the more likely it is that certain economic transactions, especially travel expenditures, get counted as mere "transfers," rather than as economic value. Transfers do not count when we measure welfare changes. Very often, the "correct" accounting stance depends upon who asked the original question or upon who is to pay for the study itself.

The total value of a wetland is the aggregate of the values for all the services held by all the individuals within the circle of analysis. For this aggregation to be theoretically correct, we have to make several severe restrictions about the nature of individual preferences.

Every time we compare your costs and my benefits in a single-scale money framework like the benefit-cost ratio, we must either assert that everyone counts equally (the usual decision, sometimes called Utilitarianism) or propose some interpersonal weighting scheme. The only way to theoretically justify the unweighted adding up of individual valuations to arrive at a total societal wetland value is to

assume that everybody's preferences (or at least everybody within a separately estimated subgroup) are the same whatever their income. We also assert that everyone's well-being ought to be changed equally, that there is to be no redistribution of wealth. The former restriction, which we call homothetic preferences and allows us to speak of a "representative" user, is risky enough, because we're pretty sure that people don't actually behave in the way inferred by such a restriction. The second is more value-laden, in that it says that an additional dollar increases the well-being of everyone the same. For the most underpaid graduate student and for the loftiest football coach, each additional dollar has the same affect on individual welfare.

Therefore, when you accept your consultant's wetland value estimates, you usually implicitly accept the assumption that every individual's preferences count equally and that societal welfare can be represented by the simple sum of individuals' welfare. We do this all the time, especially in benefit-cost studies. We have to, to get anywhere--but sometimes we neglect to tell you about it.

Even if you don't accept that these assumptions are valid or even fair, you still might accept the resulting measures of value if you can be convinced that the assumptions do not grossly violate the spirit and intent of your original need for the analysis. For certain decisions, the assumption of identical users does not do grievous harm to the search for the "correct" value of a wetland.

A separate aggregation issue is how values--however derived--are denominated. This is especially true when valuation is being used for policy purposes. For example, if one is considering a policy of regulating wetland drainage through a permit system,

one might want to know the valuation of that system from the perspective of users. In this case, a total valuation is probably more appropriate than would be a dollar per acre measure, since the overall figure gives a better sense of the benefits of the policy itself. A dollar per user figure might be appropriate when one is scaling a proposed tax or user fee. A dollar per duck (or some other measure of service unit) figure might be warranted if one is considering, say, the merits of a scheme that would pen-raise and release birds as mitigation for wetland habitat drainage.

IS A MONEY MEASURE REALLY NECESSARY?

The use of money as a common metric is traditional, but not required in project analysis. Any measure that permits project ranking and interpersonal comparison and aggregation would be suitable. For example, Costanza et al. (1989) use energy flux (BTUs) from each wetland function for this purpose. Although they then go on to monetize their results, this is not a necessary step.

Another metric used in functional ranking schemes is the habitat evaluation procedure (HEP) modified by the Minnesota Department of Transportation for their wetland mitigation program. A HEP value is assigned to each wetland, without reference to demand for the services from that wetland. (In this sense, it is not a human-centered scheme as is economic valuation, although one might make a case that human values permeate the system's choices of which habitats are "better" than others.) As with money, if you accept that a higher HEP value is better than a lower value, the metric is suitable for ranking wetland projects. If in addition you can argue

that the HEP scores are cardinal (i.e., that the differences between scores have meaning), you can aggregate scores across wetlands to come up with a grand program score. (The proposed Minnesota Wetland Evaluation Methodology has similar merits, and it considers many more wetland functions than does HEP.)

The drawback of any of these non-money evaluation schemes is that they do not permit comparisons across programs. How many HEP points, for example, should be traded off against possible investment in additional prison capacity? With money, you can do it--with appropriate assumptions on individual preference structure, of course.

Money values, for all their faults, are extremely useful when it comes to public investment analysis. Nevertheless, the difficulties in assigning economic values to wetlands has led some observers to call for a completely different approach to wetland decision making. An example is a recent nationwide aquatic ecosystems restoration study that argues for what they call an opportunity cost analysis (in contrast to a benefit-cost analysis), which "accepts a human-based determination of value but looks to collective action to define values" (National Research Council, 1992, p. 359). The basic idea is to determine the costs (all costs, not just engineering costs) of the project but not try to value the benefits. The decisionmakers are then to decide, "Is it worth it?" While this approach to valuation can avoid confronting the problem of putting a money value on wetlands, it cannot avoid the equally challenging problem of measuring in some way the intangible opportunity costs of a restoration project.

Is economic valuation all that practical? One of the arguments made in favor of using a single-dimension metric like HEP in valuing wetlands is that, even though it looks solely at habitat functions, the resulting rankings may not be that far off from those resulting from more extensive and more costly full-function studies like the proposed WEM. Information is not free. It costs money to get more data to make better decisions, and sometimes the resulting decisions are not that much better.

Is there a similar method in the case of economic valuation? Not right now, at least not one that is commonly agreed upon. We do know that there is sometimes a tradeoff between "physical" information and economic information. For example, Kozloff et al. (1992) found cost savings in spending scarce information dollars on learning more about the landowner's sale price than in learning more about how the property contributed to off-site pollution damage.

WHAT ABOUT NO-NET-LOSS?

When no-net-loss becomes the official policy of the federal or state governments, there is a presumption that the present number of wetlands or the present level of wetland services has somehow been determined to be at least not too large, else further diminution would be allowed. The policy does not imply, however, that the present number of wetlands is optimal, because room is commonly left for a hypothetical increase in the service level. The practical effect of the policy, however, is to keep the current level essentially unchanged, because expansion is so costly and relatively few budget resources are dedicated to restoration or creation of new wetlands.

Once a declaration of no-net-loss has been made, the presumption is that no further loss in wetland extent will be tolerated, whatever the social benefits of drainage or other alteration. Like endangered species, wetlands as a class could then be considered to have been declared of infinite value. Since many wetland services could be replicated through wetland restoration or creation, however, it is imprecise to speak of no further loss of wetlands. Rather, the no-net-loss declaration is over the size of the wetland service flow. Specific wetlands might be drained, but their services (or functions) must be replaced, either through mitigation or full replacement.

A COUPLE OF ISSUES . . .

Not all is perfect in the wetland valuation business. (It wouldn't be as interesting if it were.) While economists tend to agree about what it is we're trying to do--measure the aggregate money value of a change in peoples' well-being caused by a change in an environmental asset--we haven't reduced it to a cook book. I'll mention only two areas of recent theoretical and empirical concern. First is that of a striking difference between willingness to pay and willingness to accept measures for the same environmental service, even though our received theory suggests the two ought to be quite similar. The second is the lack of adequate "production functions" calibrated for specific wetland types.

When economists first started getting really serious about linking welfare theory and benefit valuation, they correctly noted that the demand curves we see in the world, so-called Marshallian demand, are not the theoretically correct curves to use in

measuring the change in social welfare. Compensated demand functions (discussed above) were shown to be more accurate. The problem is, there are two theoretically correct surplus measures (compensating variation and equivalent variation), both obtainable (with some computation) from observations of consumer choice and market prices. Which one to use?

Early on, Willig (1976) showed that for many of the situations economists were interested in analyzing (the welfare effects of a price change, as in a proposed tax), it didn't really matter. The two "correct" (and unobservable) measures of welfare change weren't that far off from ordinary (and observable) Marshallian consumers surplus. Consequently, consumers surplus could be measured and used "without apology." This was great, because most analysts were doing this anyway, both because it was easier and because the data were so messy that they tended to (they still do) swamp any theoretical niceties.

The comfort this provided analysts was considerable, because it seemed to allow us to use either WTP or WTA questions to value a good (especially a non-use good) at the margin. It didn't seem to matter much whether we asked how much the respondent was willing to pay for more of the wetland service or willing to accept in compensation for some reduction in the same service. (Technically, the tight bracketing of EV and CV around consumer surplus was for the same change, either an increase or a decrease, in the level of service. Because of loose language in the literature, however, many writers equate WTP with CV for an increase and WTA with EV for a decrease from current levels. This causes no end of confusion with students,

because actually there are compensating WTA measures and equivalent WTP measures as well.)

This was fine, but in an increasing number of empirical studies of environmental services like air pollution in the Grand Canyon, the estimated willingness to accept measures greatly exceeded the willingness to pay measures for the same good. This was embarrassing, since our theories said it shouldn't happen. To the credit of the profession, instead of theorists telling analysts that applied research techniques were obviously wrong, they instead started to change the theory, often incorporating elements of the literature from social psychology. One thread of the emerging theory (Hoehn, 1991) suggests that the kind of service under consideration matters more than we once thought. If the service is one that people think is easily replaceable by some other good or by the creation of a new wetland, say, then the two measures of welfare will be fairly close together. Either will do for a valuation. But if the asset is deemed essentially irreplaceable, with no substitutes, then the two measures might be quite divergent.

Which is the correct one, in that case? Both. What does this mean for wetland valuation? Since the bulk of wetland services are likely, in my judgement, to be viewed as substitutable, the measures of value coming from economic studies of any one wetland are likely to be reasonably close, whichever type of question, WTP or WTA, is asked.

The second problem is one that economists can only decry, but not do anything about. To do adequate wetland valuation studies, we simply must have more

information about the services that result from wetland functions. Economic valuation, relying as it does on scientific knowledge of wetland functions, is difficult when that science is meager:

> Economics, as an empirical discipline, lives near the top of the information food chain. While it is capable of generating elegant (if perhaps not universally acceptable) frameworks for setting priorities, empirical implementation requires enormous amounts of information about the physical and biological consequences of decisions, much of it currently unavailable. (Randall, 1986, p.104)

Let me give you an example. We recently did some work on the cost effectiveness of the State's RIM Reserve wetland restoration program (Lee, 1990). Our approach was to measure against the known costs of easement acquisition and engineering, the sequential benefits of various wetland services that were expected to arise. The idea was that if we found one or a few services that provided measurable public benefits that exceed the known costs, then we need proceed no further: the program would be shown to be a good public investment. (It might not be the "best" investment, but that's another story.) In particular, we looked at the increase in welfare attributed to increased waterfowl hunting opportunities from the restoration program. Through our empirical work, we were reasonably satisfied with our estimates of increased (monetized) welfare per new (dead) bird. This is equivalent to our knowing a portion of the demand function for waterfowl.

The problem was, we were unable to find a suitable estimate of the waterfowl <u>supply</u> function: how many new birds could we expect from each acre of new wetland? Wildlife biologists have found this a difficult number to get, perhaps because it is not the sort of number that is relevant for their own intellectual and management

endeavors. But it is crucial for economic analysis of this type. (Our study wasn't the only one. Bergstrom, 1991, et al. report a similar problem in their work on Louisiana coastal wetland valuation).

By the way, the best estimate on waterfowl production we could obtain, coupled with our empirical estimates of increased welfare, led to an estimate of total wetland restoration program benefits (waterfowl production functions only) that was considerably lower (like 90%) than program costs. Economic justification of the RIM wetland reserve (and, by implication, other wetland restoration efforts) must lie in other, as yet unmeasured, wetland service values.

CONCLUSIONS

You've probably figured out by now that I'm not going to be able to tell you what a wetland is worth. What I can say is this: A wetland is worth whatever we say it is. This phrase may sound a little glib, but it contains a great deal of my message today. Wetlands have no economic value in and of themselves. Value lies in humans, so it is <u>we</u> who determine valuations. And since the majority of the services that wetlands provide are not marketed (and so don't have an observed price) and since many of these are not even associated with goods and services that are marketed (and so don't have an implicit price), we often have to measure value by finding out what people <u>say</u> about wetlands, by using carefully constructed surveys.

Economic valuations have come to take on large presence in wetland decision making. This may be for good or ill, depending upon your own preference structure.

Whichever, it seems reasonable to require that if we do economic valuations, we do them correctly and explicitly. Most agency people are well-versed in the intricacies of biology or hydrology or the law, but they sometimes ask for more background on the economic research they frequently find themselves supervising or even doing themselves. Good economic valuation studies are time-consuming and expensive, just as are good biological or hydrographic studies. Even the emergence of some short-cut or cookbook valuation techniques would not relieve professional wetland managers of the desirability of understanding more about economic theory and empirical techniques. I hope my presentation today helped a little along these lines.

REFERENCES

Bergstrom, J. and R. Brazee. 1991. "Benefit Estimation." in Heimlich, R.E. ed. A National Policy of "No Net Loss" of Wetlands: What Do Agricultural Economists Have to Contribute? USDA ERS, AGES 9149.

Costanza, R., S.C. Farber, and J. Maxwell. 1989. "Valuation and Management of Wetland Ecosystems." Ecol. Econ. 1(4): 335-62.

Hoehn, J.P. 1991. "Valuing the Multidimensional Impacts of Environmental Policy: Theory and Methods." Am. J. Agr. Econ. 73(3): 289-99.

Kopp, R.J. 1991. "The Proper Role of Existence Value in Decision Making." Resources for the Future, Discussion Paper QE91-17. August.

Kozloff, K., S.J. Taff, and Y. Wang. 1992. "Micro-Targeting the Acquisition of Cropping Rights to Reduce Nonpoint Source Water Pollution." Water Resources Research. 28(3): 623-28, March.

Lee, S.T. 1990. "The Waterfowl Hunting Value of Restored Wetlands in Minnesota." Unpublished Masters Paper, Department of Agricultural and Applied Economics, University of Minnesota.

Lupi, F., T. Graham-Tomasi, and S.J. Taff. 1991. "A Hedonic Approach to Urban Wetland Valuation." University of Minnesota Department of Agricultural and Applied Economics Staff Paper P91-8. February.

Mitchell, R. C. and R.T. Carson. 1989. Using Surveys to Value Public Goods: The Contingent Valuation Method. Washington DC: Resources for the Future.

National Research Council. 1992. Restoration of Aquatic Ecosystems: Science, Technology, and Public Policy. Washington DC: National Academy Press.

Norton, B.G. ed. 1986. The Preservation of Species: The Value of Biological Diversity. Princeton, NJ: Princeton University Press.

Randall, A. 1986. "Human Preferences, Economics, and Preservation," in B.G. Norton, ed. The Preservation of Species: The Value of Biological Diversity. Princeton, NJ: Princeton University Press.

Willey, R.D. 1976. "Consumer's Surplus Without Apology." Amer. Econ. Rev. 66(4): 589-597.