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Are We Collecting the Right Economic Data for Local Conservation Needs?

Indicators of Human Uses for Ecosystems

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Empirical Evidence of Conservation Need and Success

As conservation action in developing countries becomes more commonplace, pressure mounts to demonstrate its value to people. The challenge is to show that conservation, or lack thereof, leads to change in economic activity and well-being. One-time surveys can establish the benefits supported by at-risk ecosystems. Cross-sectional studies, that compare economic value at different sites, attempt to deduce the role that ecosystem differences play in the production of economic activity, but these studies do not demonstrate conservation's impact on those values. One way to demonstrate both conservation need and success is to collect time-series data at more than one site on human uses that rely on environmental quality. We call these cross-sectional, time-series data panels.

Panel Indicators: An Approach to Measuring the Effects of Environmental Change and Conservation on Human Uses

A panel of indicators will help to demonstrate conservation success. Conservation often involves slowing a declining trend or reversing a long-term negative change in ecosystem system quality, availability, or stability. In many cases, these declines in ecosystem function are associated with declines in the value of that ecosystem to people. As a result, stopping or reversing these declines through conservation often is expected to result in improvements in human welfare.

Many factors, including conservation, are responsible for the economic value people derive from ecosystems. Even a conservation success can look like failure without an understanding of the role and change of many factors responsible for change in human uses of

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ecosystems. To measure the success of conservation projects requires that we understand the level and rate of change in human uses before the implementation of conservation practices and also the rate of change in nearby places without conservation. Panels of human use indicators, collected using comparable data at many sites, can provide the cross-sectional and temporal comparison needed to demonstrate the effects of conservation action.

Indicators of human use have been developed for a wide variety of conservation resources (e.g., see Bunce et al. 2000). Recently, the National Oceanic and Atmospheric Administration (NOAA) commissioned a guidance document that contains over 80 indicators of human uses for coastal restoration (Salz and Loomis 2005). Despite guidance about collecting human use indicators, we have yet to see any serious guidance about how we should choose among available indicators or how we can link these indicators with data on environmental factors. Below are lessons from our work with economic indicators of ecosystem-dependent human uses in California.

How to Choose Panel Indicators

To be useful for analysis, panel indicators of human use should have the following characteristics:

An obvious link to environmental conditions (relevant)

A need to vary in the short-term (responsive)

An association with an economic value to human use/activity (valuable)

Stakeholder/advisory committee input (credible)

Easily, rigorously, and dependably collected data (feasible)

The primary unit of measure should be human use or consumption—not value and not ecosystem service. The number of non-environmental factors that may influence value is likely to exceed the number of factors needed to explain simple output or consumption. For instance, household income, education, exchange rate, and shadow prices can all affect local prices and values. Estimates of non-market value are difficult to compare on an annual basis, due to large estimation (statistical) errors associated with their estimation.

While ultimately we would like to know how value changes over time (say, the non-market value of a coral reef day), it is much easier to collect and analyze data on quantities demanded (number of coral reef visits). These quantities can be put into a broader economic

context by examining market prices or non-market values taken from the literature. A strict focus on the provision of ecosystem services should be replaced with a focus on ecosystem services demanded, especially when the value to be considered is a use value. Demand, not supply, is the foundation of use value. If an ecosystem service is available, but unused, it does not have value. This is not to say that ecosystem services should not be measured; I would argue, however, that a measure of ecosystem service is not itself indicative of human use or value.

Finally, it is important to try to collect basic, comparable environmental data over the same time period, especially biophysical measures of ecosystem output and function (e.g., species abundance, coral cover, species diversity, etc.). Our focus ought to be on levels of stocks and flows of ecosystem services or environmental conditions with particular attention to major changes in these measures (e.g., floods, forest fires, bleaching events). It is shocks to the system and chronic environmental problems that ought to have the most pronounced effects on human uses.

Table 1 Examples of Human Use Indicator Data: Coral Reefs

Park visitation	Visitors, visits, user fees
Local use	Visitors
Fish landings	Kilograms of catch, fish prices
Hotel nights	Number. of rooms, occupancy, tariffs
Tourist operations	Packages sold

Analyzing Panel Data

Narrative. One can directly examine panel data by looking at trends in the data and visually comparing changes in human uses across similar sites. To use narrative, one follows a three-step process of examination and deduction. First, work with local stakeholders to determine what events may explain large-scale changes in the indicator. Second, plot data to examine trends in economic indicators and identify major changes in economic activities. Third, determine whether large-scale changes in ecosystem conditions (floods, fires, coral bleaching, storms) may have preceded or accompanied the identified changes in economic activity.

Panel data analysis. The real advantage that comes from the collection of panels of data is that is opens a whole world of statistical possibility because we have data on ecosystem condition, non-ecosystem factors, and human use over a variety of conditions and over time

(before and after conservation). To understand how panel data analysis works, look at a developed world case of a wetland restoration near a popular beach in southern California. In 2000, a restoration at Zuma Lagoon was completed in the middle of one of southern California's most popular beaches, Zuma Beach in Santa Monica Bay. To see if this restoration had any impact on visitation, I collected beach attendance data for 27 beaches for the years 1996–2006, plus information on beach closures and posting (days closed/posted and beach mile days closed/posted), rainfall, air temperature, and population growth. These are all factors that could explain changes in beach attendance over time. With 27 beaches for 10 years, I have 270 data points.

The question is, when we control for the above factors and we also have site specific constants (such as recognizing that each beach starts with a different baseline of attendance), did attendance at Zuma Beach change differently than at its 26 neighbors following the completion of the restoration. To discover this, I used panel analysis that is both cross-sectional (compares across beaches) and time series (compares change over time). For the restoration event, I used a variable that indicates if a beach has a completed restoration in place. In this case, only Zuma Beach had such a restoration. Results showed that when controlling for other factors, the Zuma Beach restoration event increased visitation by between 225,979 visits/year and 1,630,476 visits/year (at the 95 percent confidence level) with a mean value of 928,000 visits/year.

The non-monetary results alone make a case for the restoration project. If we want to put this figure in an economic context, we can turn to the literature, which indicates that the average beach goer in southern California spends around US$ 25 per visit (Pendleton and Kildow 2005). This means restoration encourages almost $25 million more in expenditures near Zuma Beach. We also know that the non-market value of a beach day is $15 per visit. So, Zuma Beach's restoration generates almost $15 million more in economic well-being for visitors. These numbers are over-estimates because some beach goers came to Zuma from other beaches—but the result is unmistakable. While beach attendance in Santa Monica Bay declined over the period, attendance at Zuma Beach remained high following the restoration event.

Collecting Panels of Indicator Data in the Tropics

Keep indicators simple. With time-series and panel data, it is more important to collect simple and reliable information over time and from many sites than it is to collect complicated, nuanced data. It is easier to count (and explain) fish than it is to estimate the average proportion

of income derived from fishing; it is easier to interpret changes in scuba trips to different reefs within a region than to interpret consumer surplus estimates of trips to the same sites.

Keep it to a few indicators. Laundry lists of indicators are difficult to implement and unlikely to be collected at many sites for many years. For each major ecosystem type, we need 3–4 basic human use indicators that meet the criteria described above.

Provide constant feedback, support, and analytical help. Indicators are only as valuable as the rigor of their collection and the soundness of their analysis. Fortunately, the Internet provides a means for communicating ideas, sharing methods, and asking questions of experts that may be many thousands of miles from the place where data are collected.

Start with sites within one region. The beauty of panel analysis is that accounting for the causes of change is often easier than trying to model or explain absolute differences in sites. To reduce the number of explanatory factors needed in an analysis, data should be collected in clusters of sites that are culturally, geographically, and climatically similar.

Other Benefits of Collecting Panel Data

The collection of panel data raises public awareness of the link between environment change and human uses. We all know the power that indicators have on the public perception of well-being and the demand for policy action (consider the Dow Jones Industrial Average, the employment rate, or gross domestic product). Collecting human-use indicator data should focus public awareness on human activities that depend on ecosystem health.

Basic indicator data can be collected and simple trend analysis performed without the need of advanced graduate training. Data on fish catch, scuba trips, and bird-watching visitors can be collected easily by local people. (More sophisticated analysis can and should be performed at a regional or national level.) Involved local people get a better understanding of the scientific process and become more literate participants in conservation planning and implementation. Often there is a fear that indicator data should not be collected because a lack of expertise will result in erroneous interpretation. In fact, stakeholders routinely make such interpretations in the total absence of data.

A panel of indicators can help to demonstrate the on-site effects of environmental degradation in clear, easily understood terms. In public arenas, where anecdotes often have as much sway as science, panels of indicators can be used to test and verify competing “stories” about the environmental origins of changing human uses. In Morro Bay, we use an interactive

website to let people test their own preconceptions about the causes of decline in the local fishery (see **http://www.slosea.org/initiatives/economic.php**).

Conclusion

It is widely agreed that we need a systematic way of measuring conservation success. To measure both the human need for conservation and the impacts of conservation on human well-being, we need systematic collection of basic data on human uses of ecosystems—over many years and many places, a type of information we call panel data. Only then can we begin to understand and demonstrate the economic outcomes of conservation action.

In practice, there are challenges to collecting panel data. There exist different and sometimes unique measures of human use for nearly every major type of ecosystem or even ecosystem service. A one-size-fits-all approach will not help us move forward in the collection of these important data. Neither will long lists of candidate indicators. Instead, conservation professionals, scientists, and stakeholders need to work together to develop short-lists of human use indicators that reflect the most important uses of different types of ecosystem services—forests, coral reefs, mangroves, savannas. These indicators need not be comprehensive, they simply need to be economically important and closely tied to ecosystem condition. These indicators need to be accompanied by the basic data on ecosystem conditions and services, many of which already are collected as a routine part of environmental monitoring. Other measures of ecosystem services have been recommended, but not measured (see Boyd 2007). With these basic indicators of human use, we can finally begin to answer “why do we need conservation here?” and “how has conservation helped our local or regional economy and the people who depend on the ecosystems conserved?”

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