# A REVIEW ON ENVIRONMENTAL INDICATORS AND MANAGEMENT

## UN STUDIU ASUPRA INDICATORILOR DE MEDIU ŞI MANAGEMENT

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***Abstract:*** *Ecological indicators can facilitate an adaptive management approach, but only if acceptable levels for those indicators have been defined so that the data collected can be interpreted. Because acceptable levels are an expression of the desired state of the ecosystem, the process of establishing acceptable levels should incorporate not just ecological understanding but also societal values.*

***Rezumat:*** *Indicatorii ecologici pot facilita o apropiere managerială adaptativă, dar numai dacă nivelurile acestor indicatori au fost astfel definite încât datele colectate să poată fi interpretate. Deoarece niveluri acceptabile sunt o expresie a stării dorite într-un ecosistem, procesul stabilirii nivelurilor acceptabile trebuie să incorporeze nu doar acorduri ecologice, ci şi valori sociale.*

***Key words*****:** *ecologic, indicator, environment*
***Cuvinte cheie***: *ecologice, indicatori, mediu*

Ecological indicators programs are being developed to assist with managing many types of system around the world, including parks, trans-boundary water bodies, and many categories of natural habitats. The appeal of indicators is their representative nature and their flexibility; they have been used to monitor trends in key resources over time, provide early warning of environmental degradation, diagnose the cause of an existing problem, and track the implementation of management actions. How well an ecological system is described by a suite of indicators depends on the quantity and diversity of the indicators and the quality of the data used to develop and evaluate those indicators. The selection of indicators should be based on clear criteria, with specific purposes in mind and careful consideration of the trade-offs between desirable indicator characteristics. Thoughtfully selected indicators can provide valuable information about both the condition of the ecological system and the effectiveness of the management actions being implemented.

However, the usefulness of a set of indicators for decision-makers also depends on defining acceptable levels for each indicator so that the monitoring data that is collected can be interpreted. Acceptable levels should be explicit statements of the desirable range of measured values for each indicator. They should reflect management goals, scientific understanding, and social values. Without information about acceptable levels, an indicator cannot be used to make management decisions. Only by systematically separating acceptable measured values of indicators from unacceptable values can managers identify those ecosystem components that require management[1].

Unfortunately, the failure to define acceptable levels is a common shortcoming of many indicator initiatives. In part, this occurs because the long-term goals and objectives of many management programs are not clearly specified. Although a number of studies have pointed out the need for comparing indicator values to established benchmarks, few programs

[1] *Anderson, D., Environmental Economics, Pensive Press 2007*

have actually achieved this goal. The overwhelming majority of indicators programs simply present trends in indicator values over time.

From a purely ecological perspective, acceptable levels should be based on a scientific assessment of the range of values that collectively represent a stable and healthy ecosystem. Ecological thresholds, levels of ecosystem components that are irreversible or can trigger major changes in other ecosystem components, should also be considered. However, because ecosystems can exist in many different stable states, this does not predetermine a particular ecological condition.

Acceptable levels must also be defined from a social perspective; that is, they must reflect the environmental conditions that are socially desirable or acceptable. Ecosystem managers can and do target socially desirable ecosystem conditions in order to meet societal goals. Ideally, social considerations are merged with scientific understanding to establish an acceptable level. Water quality standards are a common example of acceptable levels that are based on a scientific understanding of the problem, merged with judgments about acceptable risks to ecological and human health.

However, the social judgments imbedded in these acceptable levels are sometimes ''hidden'' from the public by scientific experts and water quality managers and might or might not reflect the values of the stakeholders using the water body. Public support for ecosystem management would be enhanced if these judgments are made more visible and explicit and managers defined their benchmarks in terms that laypeople can understand and support.

Some indicator programs have tried to incorporate social perspectives into selection of acceptable levels. In the realm of park and wilderness management, indicators have been used to evaluate a range of resource and social conditions such as trampling of soils and trailside vegetation, crowding, and conflicting uses. The acceptable levels or standards of quality, established for these indicators represent thresholds in impacts caused by visitor use and are most commonly generated using visitor surveys. These acceptable levels focus on user perspectives and the social values they represent.

Some programs have likewise defined management end points that serve as acceptable levels for a number of the indicators that they use. These acceptable levels have been defined based on both ecological consideration and social perspectives. They express ecological conditions in measures that laypeople understand. The acceptable level has been set based on the public's expectation that water clarity will return to previous levels.

The goal of this research was to explore an approach for defining acceptable levels of ecological system indicators that explicitly considers social perspectives and values. To bring together ecological characteristics and social values, we used a set of indicators that translated environmental conditions into measures people understand. Our approach is based on normative theory, which provides a theoretical and empirical foundation for developing acceptable levels from the social perspective[2].

A Normative Approach to Defining Acceptable Levels of Ecosystem Indicators Norms is a theoretical construct that have a long tradition and are widely used in sociology. As the term suggests, norms represent what is considered ''normal'' or generally accepted within a cultural context. In a more technical sense, norms are cultural rules that guide behavior. Those behaviors are a function of a sense of obligation to abide by the norm and the related belief that sanctions (rewards and/or punishments) are possible depending on whether or not the norms are followed. It is this sense of obligation and its associated sanctions that make norms different from and potentially more powerful than attitudes. Attitudes are positive or negative evaluations of behavior, whereas norms define what behavior should be. Sanctions associated

[2] *Kolk A., Economics of Environmental, Management, Pearson Press, 1999*

with norms can range from informal and internally imposed (e.g., feeling guilty) to formal and externally imposed (e.g., being publicly ostracized).

When norms apply to behaviors that are important to society and for which there is wide agreement, they can ultimately be codified into public policy or even law (e.g., vehicles must be driven on the right side of the road).

Much of the sociological work on norms has been driven by development of the return potential model. This model is built using responses given to survey questions that evaluate the acceptability of a range of behaviors. The response data are graphed so that behaviors are displayed on a horizontal axis and evaluations of those impacts are displayed on a vertical axis. The resulting line connecting the evaluation scores is called a ‘‘norm curve.’’

Norms can be measured for both individuals (personal norms) and groups (social norms). As the terms suggest, personal norms are measures of the standards or evaluations of individuals, whereas social norms represent shared standards or evaluations of a group.

Social norms are measured by aggregating and plotting the evaluation data for a group. The resulting line is called a ‘‘social norm curve.’’ Normative data can be especially useful in helping to formulate acceptable levels for environmental conditions.

Applications of normative theory and methods to the environmental context involve an extension of normative theory and methods as originally conceived. Many of these applications address the acceptability of environmental and social conditions, not behavior. Unlike behavior, resource and social conditions might not be subject to sanctions or entail an explicit notion of obligation on the part of individuals. However, environmental impacts are a direct consequence of human behavior, and the decision to allow such impacts to accumulate to socially unacceptable levels represents institutional behavior of management agencies. These agencies have an obligation to manage the environment to meet the needs of society and, ultimately, can be subject to sanctions (public disapproval, legal challenge) if they fail to live up to this obligation. This extension of normative theory allows application of norms to environmental issues[3].

In the environmental arena, normative theory and methods have been applied most in the field of park and outdoor recreation management. These applications have addressed both ecological and social conditions in parks, including soil erosion and destruction of vegetation along trails and at campsites and crowding and conflicting uses.

Using Social Norms for Indicators in an Adaptive Management Approach Adaptive management is based on the premise that if appropriate information is gathered as management actions are implemented, managers can learn as they go. Changes in measured indicator levels can provide that information, including not just information about ecosystem condition and the effectiveness of the management actions but also information about the validity of the hypotheses upon which the management actions were based. By specifying acceptable levels for indicators, managers articulate their desired outcomes and thereby provide means for evaluating the effectiveness of their management priorities and approaches. By organizing indicators in an adaptive management approach, managers can increase their understanding of the ecosystem regardless of the outcomes of management. Improved understanding also reduces uncertainty, thereby enhancing the likelihood that future management strategies will be successful.

## CONCLUSIONS

We believe that ecological indicators have enormous potential for improving management decision-making, but only if they are chosen with awareness of societal values.

[3] *Tietenberg T.,Environmental and Natural Resource Economics, Pearson Press, 2005*

Once appropriate indicators are selected, they must be made interpretable by establishing acceptable levels that balance social preferences with ecological integrity. The social judgments that are implicit in formulating ecological benchmarks are often ‘‘hidden’’ from the public by scientific experts and managers. The normative approach offers one way to help make these judgments more visible and explicit. Likewise, the importance of integrating social values and enhancing public support for ecosystem management is discussed at length in the literature.

However, there is little consensus about how to accomplish this. The techniques presented here have considerable potential for quantitatively assessing social preferences for valued ecosystem characteristics, regardless of the ecological system. We encourage applications of these methods in other systems and suggest that if indicator programs are to reach their full potential, greater focus must be brought to bear on specifying acceptable levels that can be used as management targets. If information about social preferences can be combined with related information about ecological condition and function, then a truly integrated and holistic approach for interpretation and use of indicators information within an adaptive ecosystem management framework is possible.

**LITERATURE**


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