Conservation value method

Excerpt from the draft SAB Committee report, *Valuing the Protection of Ecological Systems and Services*: *The committee discussed two types of biophysical rankings. The first is a ranking method based on conservation value. The conservation value method develops a spatially-differentiated index of conservation value across a landscape based on an assessment of rarity, persistence, threat, and other landscape attributes, reflecting the contribution of these attributes to sustained ecosystem diversity and integrity. These values can be used to prioritize land for acquisition, conservation, or other purposes, given relevant biophysical goals. Based on geographic information system (GIS) technology, the method can combine information about a variety of ecosystem characteristics and services across a given landscape and overlay ecological information with other spatial data. Conservation values have been used in various contexts by federal agencies (e.g., the U.S. Forest Service, Fish and Wildlife Service, National Park Service, and Bureau of Land Management), non-governmental organizations (e.g., The Nature Conservancy and Nature Serve), and by regional and local planning agencies.*

Further reading

Brown, N., L. Master, D. Faber-Langendoen, P. Comer, K. Maybury, M. Robles, J. Nichols, and T.B. Wigley. 2004. Managing elements of biodiversity in sustainable forestry programs: Status and utility of NatureServe's information resources to forest managers. National Council for Air and Stream Improvement Technical Bulletin Number 0885.

Grossman, D.H., and P.J. Comer. 2004. Setting priorities for biodiversity conservation in Puerto Rico. NatureServe Technical Report.

Riordan, R. and K. Barker. 2003. Cultivating biodiversity in Napa. Geospatial Solutions November 2003.

Stoms, D.M., P.J. Comer, P.J. Crist and D.H. Grossman. 2005. Choosing surrogates for biodiversity conservation in complex planning environments. Journal of Conservation Planning 1.

Overview. In many contexts, decision makers need to know the conservation values for specific biophysical characteristics across different geographies, and the distribution of these values across the landscape. Examples requiring the use of these values include the need to know what sites are important for the conservation of biological diversity, and numerous decisions regarding the protection of wetlands and mitigation of wetland impacts. Every landscape can be characterized by a suite of ecological properties that form the basis for environmental, social, and economic values. The Conservation Value Method is a scientific process to map these values across the landscape for use in decision making. Conservation value can be defined as a measure of the contribution of a landscape unit to the conservation of species diversity, as defined or estimated by relevant experts.

This method also allows the incorporation of social preferences through the development of preferred conservation goals for different biophysical and ecological properties. More than one set of goals can be developed to represent the interests and objectives of different stakeholders. The conservation values are used as the basis for the evaluation of alternative actions in contributing to the social goals that are being addressed. If the social goal is biodiversity conservation, for example, the evaluation of any action is a measure of the contribution of this action to sustained ecosystem diversity and integrity.

This method assigns a value to each individual land area within a given region based on its contribution to a conservation-based goal. This application of scientific information and methodology results in the mapping and valuation of biological and ecological features in a regional context. This provides spatial value attributes for the representative biological and ecological characteristics and features of that area. These can include both biotic factors (e.g., distribution and abundance of plant and animal species) and abiotic factors (e.g., soils, hydrology, climate) that are spatially distributed across the landscape. Some of these features in turn provide information about the ecosystem services provided by the land. This method can be completed with current Geographic Information System-based technologies.

Because each land area has multiple ecological dimensions, the values associated with the contributions of these different dimensions are often weighted and aggregated, with the weights determined by the relevant stakeholders in a given decision context. Different stakeholders will apply different weights, depending on the objective of their analysis (e.g., biodiversity vs. wetlands protection). In addition, spatial information about ecological characteristics can be overlain with other spatial data of interest to these stakeholders.

This process of weighting and mapping the resources that represent what people want to preserve is sometimes referred to as “green printing.” For example, groups such as Trust for Public Lands use this phrase when working with Watershed Stakeholder groups to get them focused on steps to implement conservation. It allows for an effective approach with multiple stakeholders to prioritize parcels in the landscape for acquisition and conservation.

Brief description of the method The Conservation Value Method, as detailed by Grossman and Comer (1994), was developed as a general approach to create biodiversity-based conservation values. It represents a structured set of steps for constructing those values, and is built to incorporate the input of stakeholders at multiple points in the process. These values are generated from system attributes for uniqueness, irreplaceability, level of imperilment, and ecological services.

The method begins with an identification of the species, ecosystems, and associated ecological services – and an assessment of their status and condition across the landscape of concern. The evaluation is based on characteristics such as rarity, representation, threat, landscape integrity, and other relevant factors. There are several national databases that can provide much of the baseline information. The network of state Heritage Programs develop and maintain status and distribution information about thousands of plants and animals, along with different vegetation and ecosystem types. The Integrated Taxonomic Information System (ITIS) maintains a standardized list of species names for use by scientists and federal agencies. The U.S. Fish and Wildlife Service maintains information about endangered species and wetlands, the U.S. Geological Survey manages databases characterizing ecosystem characteristics and integrity, and the Department of Transportation manages information on the density and location of roads and infrastructure across the country. The standardized integration of these datasets within the Conservation Value methodology provides a robust foundation for decision making.

The places where a given element of conservation interest is found (termed an "occurrence") is assigned a quality and viability score based on attributes of size, condition, and landscape integrity. The trends and condition for each conservation element are presented in a summary status attribute, a conservation rank (reference NatureServe, IUCN). The global assessment and the quality information about individual occurrences are then used to develop a spatial "ecological value layer," which portrays a spatial distribution of the conservation value along with metadata regarding the quality and confidence of each occurrence. This layer can reflect the specific conservation goals of the stakeholders, as they can alter the relative importance of different conservation elements based on their management or conservation objectives. To the extent that stakeholders are interested in multiple ecological features (e.g., multiple species), the information for each ecological value layer is aggregated to create an overall "conservation value summary." This summary value layer provides a spatially aggregated representation of the biodiversity and conservation values that represent the values of the conservation or management stakeholders. The final (aggregate) conservation values are used to support decision making, e.g., to prioritize preservation-based land acquisitions, mitigate wetland loss, direct point and non-point source permits, etc. These spatial conservation values can also be integrated with socio-economic and other spatial data to integrate those data into the decision-making process.

The Conservation Value Method was developed primarily to identify priority areas and activities that would sustain or improve the condition of biodiversity and ecosystem health. This GIS based methodology can support different types of decisions by adding different data and values to the model. For example, one could quantify Bureau of Land Management land for its value as recreational use, natural resource extraction (timber, mineral, oil and gas), and water quality (denitrification, water purification) and quantity (flood control, snow pack).

This method is often used to evaluate the impact of a proposed action on current conditions. This requires the development of future scenario maps that can reflect a new policy, a development action, modeled population growth, a natural disaster, or any number of different change scenarios. The intersection of the change scenario with the conservation value model allows for clear reporting on the changes to either the composite conservation value or the individual conservation values. This is often used to choose between change scenarios (e.g., road placement, point source licenses), and to protect against potential threat (toxic transport, oil line placement).

The Conservation Value Method can contribute to EPA decision making in a number of ways. First, in contexts where the Agency's goals are defined in terms of conservation objectives or requirements, such as under the Endangered Species Act, the method could provide a means of making decisions about where to focus available conservation funds. In addition to contributing to decision making focused on specific conservation goals, the outputs from the conservation method could play a key role in EPA decision making (and the C-VPESS valuation framework) in the following ways: a) it could be used as a prediction of ecological impacts that would then be used as an input in an economic valuation study; b) it could be combined with other non-monetary value information (for example, from social-psychological surveys) to characterize preference-based values when monetization is not possible or desirable; and c) it could be used as a means of quantifying biophysical impacts when they cannot be quantified (as required by the OMB Circular A-4).

Status as a method The Conservation Value Method approach represents a sequence of iterative steps that have been developed by the scientific community over the past thirty years. The components that have been aggregated into this emerging methodology include ecological classification and mapping standards, conservation ranking standards, conservation planning methodology, and occurrence mapping standards. There is widespread use of various components of these methods across U.S. federal agencies, though the utility use of the comprehensive integrated methodology has only recently become accessible and manageable for the non-specialist. The ranking methodologies for conservation elements (plant, animals, and ecosystems) has been documented in the scientific literature over many years and is in common use by numerous federal agencies (e.g., U.S. Department of Agriculture, U.S. Forest Service, U.S. Fish and Wildlife Service, National Park Service, and Bureau of Land Management). The viability and quality ranking criteria for the occurrences of conservation elements has been the topic of widespread analysis by International Union for Conservation of Nature, The Nature Conservancy, NatureServe and others. The conservation planning methods have emerged from Australian natural resource agencies (e.g., Commonwealth Scientific and Industrial Research Organization) and are well published in the conservation science literature (see Possingham, H.; I. Ball; and S. Andelman. 2000; Leslie, H.; M. Ruckelshaus; I. R. Ball; S. Andelman; and H. Possingham. 2003). EPA has used different components of this methodology to identify and prioritize rare and threatened species that need protection (e.g., working with the pesticide industry to protect biological diversity) and to characterize different wetland ecosystems to prioritize protection activities.

This methodology is increasingly being used by the larger planning community for different purposes at multiple scales. The examples listed below will illustrate the breadth of these applications. The Land Trust of Napa County has used the methodology to identify priority conservation acquisitions for the next ten years. The U.S. Forest Service is testing its use for the development and monitoring of National Forest plans. The Conservation Trust of Puerto Rico has applied these methods to clarify conservation and development priorities and options across the island. The state of Mata Grosso in Brazil is using this approach to integrate a conservation reserve program into private landholdings.

Decision contexts where this method could be used by EPA include:

- Enumeration of biodiversity protection implications that result from policy changes (i.e., change of protection status for isolated wetlands)
- Identification of critical riparian habitat
- Prioritization of remediation action on superfund sites
- Due diligence reviews and Environmental Impact Statements as a prerequisite for permitting
- Identification of reference conditions for establishment of baseline quality metrics for wetland and aquatic habitats
- Assessment of the status of target species and ecosystems
- Analysis of mitigation equivalencies and priorities
- Baseline information for ecosystem integrity and environmental impact monitoring

<u>Strengths/Limitations</u>

<u>Conceptual Strengths/Limitations</u> The Conservation Value Method will create a quantitative spatial representation of ecological and biological values within a regional context. The spatial range of these analyses can vary from local to regional scales. This data provides a baseline for a broad range of natural resource assessment and management decisions, and can be integrated with spatial monetary valuations to inform cost-effective land management and regulatory decisions. The specific decisions will determine that types of data and analyses that are required to address the question.

<u>The Method's Strengths</u>

- The method is adaptable to address different questions.

- The method can be run repeatedly to represent temporal change or different landscape scenarios.
- Results are commonly aggregated to derive a single benefits number, but all of the native data is constantly maintained in the system and can be presented separately.
- The output is both understandable and communicable to the interested audience and other stakeholders. Provides the opportunity for visualization of outcomes that many other methods lack.
- The results are repeatable, and the process and algorithms are very transparent.

The method's weaknesses Issues with the lack of data, the currency and confidence in available data, along with access to 'sensitive' data represent potential obstacles for the application of this method. There are many ways to create surrogate datasets that will allow users to adapt to different types of barriers. Some training and tools are also required to use this method.

Practical Strengths/Limitations

The assumption is that there is sufficient coverage of standardized biodiversity data required to implement these methods. The standards for each step of the method have been developed, and the data that is required will be dependent upon the specific application questions. Where sufficient data does not yet exist, additional resources will need to develop this information in order to complete the methodology. In some cases, surrogate information and models are required to incorporate the spatial representation of poorly inventoried conservation targets across the landscape.

This method requires local scientific data, knowledgeable scientific interpretation and conservation planning expertise. The magnitude of the need is contingent upon the application and the current state of data and knowledge. There are many sources available from which to obtain this knowledge.

Treatment of Uncertainty There are confidence measures built into the methodology that can be integrated into the decision-making analysis or displayed independently for consideration. The most significant sources of uncertainty in the use of this method include:

- The variability in the quantity and quality of the data
- The limitations of scientific understanding of distribution and quality criteria for some ecological factors
- The level of stakeholder understanding of the linkages between ecological components and the services they value

Research needs There is both a need and an opportunity to actively explore integration of stakeholder elicitation approaches (e.g., social scientific surveys) with ecological condition mapping. Additional R&D to show how GIS-based systems could be designed to integrate monetized and other quantitative valuation approaches on a common spatial and temporal GIS background could yield significant benefits.

Key References

Brown, N., L. Master, D. Faber-Langendoen, P. Comer, K. Maybury, M. Robles, J. Nichols, and T. B. Wigley. 2004. Managing Elements of Biodiversity in Sustainable Forestry Programs: Status and Utility of NatureServe’s Information Resources to Forest Managers. National Council for Air and Stream Improvement Technical Bulletin Number 0885.

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