Understanding Environmental Valuation of Ecology

Ms. Meenakshi Jhanwar
Assistant Professor, Department of Environmental Science, Presidency University, Bangalore, India,
Email Id-meenakshi@presidencyuniversity.in

ABSTRACT:
The term environmental valuation describes a number of methods for putting monetary values on environmental effects, particularly non-market effects. In the past 30 years, there has been a continuous increase in the number of publications on the topic. The term environmental valuation was searched for in articles that had it in the title, abstract, or keywords. The search was carried out using a Web of Science (WoS) electronic database's online literature search engine. According to a search of this database, the phrase environmental valuation first occurred in 1987. Since then, many studies have been published, leading to important advances in both theory and applications.

KEYWORDS:

Environmental Valuation, Environmental Assessment, Non-Market, Search Engine, Term Environment.

I. INTRODUCTION

The term environmental valuation describes a number of methods for putting monetary values on environmental effects, particularly non-market effects. In the past 30 years, there has been a continuous increase in the number of publications on the topic. The term environmental valuation was searched for in articles that had it in the title, abstract, or keywords. The search was carried out using a Web of Science (WoS) electronic database's online literature search engine. According to a search of this database, the phrase environmental valuation first occurred in 1987. Since then, many studies have been published, leading to important advances in both theory and applications. 661 papers were chosen for a study of the literature on environmental valuation from 1987 to 2019 in the current effort. The choice experiment approach is preferred over the contingent valuation method, and this work illustrates this preference. It also demonstrates that only a small number of papers have had a significant influence on the researchers in this field. In the past, non-market valuation has been used to discuss environmental valuation. Its goal is to determine the financial value of the costs or benefits of environmental improvement interventions or the effects of environmental degradation to the welfare of individuals and social groupings.

However, even after assuming the challenges of developing theoretically grounded practical policy tools and avoiding political manipulation, the ultimate goal is not to value a (non-market) environmental good in monetary terms, but rather to equip decision-makers with the necessary tools to take the appropriate political initiatives to efficiently allocate resources, impose taxes, and design compensation schemes. The complexity of the area must be taken into account when using environmental valuation methods to calculate the advantages and disadvantages of using environmental commodities, enhancing their conditions, or repairing environmental harm. The economic advantages of national parks, for instance, go beyond tourists; they frequently help to draw and keep residents, company owners, entrepreneurs, and retirees. The value of other things can, however, be impacted by worsening environmental circumstances, as several researchers have shown via their studies. For instance, it has been suggested that noise and air pollution from traffic have a detrimental impact on real estate prices. According to a survey conducted in Brisbane, 55% of respondents said that noise had a negative impact on the value of their home. By calculating people's willingness to pay to receive environmental benefits, economists have traditionally created instruments to quantify environmental values. The loss experienced by those who benefited from the damaged product and the determination of the proper compensation for losing the benefit are used to calculate the costs associated with environmental deterioration [1], [2]

Total Economic Value (TEV), a general method, integrates all the many values that are categorized in accordance with the service that an environmental good provides. The use values are those that are generated from the resource's actual use, whereas the non-use variables are unrelated to that use. The former includes the ecological value, which is determined by the advantages that environmental goods provide to support life forms and

biodiversity, the option value, which is connected to the good's potential for future use, and the direct use value, which results from the direct use and exploitation of the good. Non-use values are made up of the existence value the worth that people assign to environmental items simply for existing and the bequest value the value that people assign to commodities when they contemplate how their heirs will utilize them in the future. Measurement of the values in TEV is the goal of environmental valuation methodologies.

The following categories can be used to group valuation techniques that are explicitly connected to environmental valuation, despite the fact that some authors have done so. Techniques of expressed preference. These rely on speculative queries and gauge values by posing specific preference-related survey questions to each respondent. The contingent value approaches. Surveys asking respondents how much they would be willing to pay for the use and preservation of an environmental good are used to assess values in a hypothetical market. Estimating individual willingness to pay for changes in the quantity or quality of environmental goods or services is the goal of contingent valuation. Selective experimental design. The respondents are given alternative options using this strategy, where various environmental goods are described by their characteristics. Asserts that the most important advancement in environmental valuation may be a shift from a focus on value to a focus on choice behavior and data that generate information on choices.

Revealed approaches for preference. By observing the values of market products connected to the non-market environmental good, such as the cost of a home or a trip to a recreational area, environmental values can be assessed. The technique of travel costs. Values are calculated by taking into account the cost of transport to an environmental good. The approach makes the assumption that the willingness to pay must be at least as great as the incurred travel expenses. Hedonic pricing theory. Prices for traded items are used to calculate values. This strategy is typically applied when environmental conditions have an impact on the pricing of traded items. Both theoretically and practically, the area of environmental valuation has lately grown. This essay emphasizes the important topics covered by experts in the field and attempts to summarize the contributions made by academics based on their influence on the study field.

Methods

We conducted a bibliometric analysis using papers in the Web of Science from 1987 to 2019 to identify the most crucial subjects and evaluate the academic impact of environmental value. Through historical development and the distribution of papers by journals, we evaluated their productivity. The units of analysis were arranged according to the citation and co-citation structure, and the findings provided information about the structure and potential directions of future environmental valuation research. The term environmental valuation appeared in the title, abstract, or keywords of the papers we searched for. The Web of Science electronic databases' online literature search engine was used for the search. On December 17, 2019, the search engine returned 661 items for the years 1987 to 2019 that included articles, book chapters, conference papers, and reviews from 1442 authors.

Environmental Assessment Publication History

After the 1987 release of the first work on environmental valuation that is currently known, the number of publications on the subject has steadily increased over time. Despite the fact that the studies were published in a variety of publications, lists the four most popular as Ecological Economics, Environmental & Resource Economics, Environmental Values, and Journal of Environmental Management, each of which received around 30% of the studies. With 109 papers, or 16.5% of the sample, Ecological Economics stands out as the most prolific source on this topic. Unsurprisingly, environmental and ecological issues receive a lot of attention from the best journals. According to the Journal Citation Reports of the Web of Science, the first six journals are categorized as Environmental Sciences or Environmental Studies. The top 6 journals were placed in the first quartile of their respective categories in 2018 when the impact factor was taken into account, while most of the other journals fell between the first and second quartile [3], [4].

Leading Issues in Environmental Valuation Research

The terms environmental evaluation, willingness to pay, and ecosystem services the most frequently employed by researchers. In 38% of the publications analyzed, the keyword environmental valuation was used. The following keywords provide insightful information about the development of the research issue and the techniques created and used to assess environmental benefits and harm. Willingness to pay is the second most often used keyword and is frequently used in publications pertaining to stated preference methods. Positions 4 choice experiment and 5 contingent valuations of this group of environmental valuation methods are taken by the two aforementioned methodologies. The phrase choice experiments also refer to the choice experiment method, which is listed in position 7. Immediately behind the term environmental valuation is the combined total of both options.

Nature and Humanity

The year 1864 marks the occasion when George Perkins Marsh published his book Man and Nature, or Physical Geography Modified by Human Action, marking the turning point in history when examining how human activity affects the environment became something worth doing. Marsh was in a good position to both observe and assess environmental change throughout his travels as an American diplomat. In this regard, he is remembered for the strong manner in which he drew attention to the disparity between local peoples' and Europeans' views towards the natural environment. While civilization assumes an aggressive attitude, and thenceforth strives to subdue to his control and subject to his uses, all her productivity and all her motive powers, the aboriginal leaves a small footprint on the planet. Preindustrial production methods are typical of inscribed groups, which arrange for the prolonged exploitation of regional natural resources, which is another way to put this distinction into words.

By being connected to the productivity of a constrained range of biophysical flows, which restricts the number of individuals who may utilize the local resources, they are inscribed, or embedded, into local ecosystems. Modern production methods are typical of constructive groups, who create a landscape to suit their economic needs by populating it beyond the capacity of the region's natural resources, importing goods and services from abroad, and destroying the ecosystems in the process. Cooperative groups form around locations where inventions are being used in mass production. Better pay and job possibilities lure workers to move, and they also take advantage of more advanced communications. The most thorough analysis of land management to date occurred in Man and Nature. It was drawn on Marsh's own New England farming experiences as well as his study of the writings of European naturalists, geographers, foresters, and hydrologists. The following provides the clearest explanation of the need for environmental impact assessments and their precautionary principle. We can never know how broad a circle of disturbance we make in the harmonies of nature when we throw the slightest pebble in the ocean of biological life. The equation of animal and vegetable life is too difficult a problem for human intelligence to solve [5], [6].

GEMS and Monitoring

Marsh encouraged farmers to err on the side of caution when it came to wildlife rather than take the chance of killing an essential component of their agricultural system. A little over a century later, in 1970, the US National Environmental Policy Act mandated the creation of Environmental Impact Assessments in order to assess any negative consequences of brand-new plans that would alter drainage and landform. The Global Monitoring System (GEMS), which was approved by the United Nations Conference on the Human Environment in Stockholm, came next two years after that. Then came a wave of conventions and conferences that elevated the discussion of environmental assessment to the top of both international and domestic economic growth agendas. As a result, programmes for surveillance, monitoring, and impact assessment at the levels of the biosphere, ecosystem, landscape, and population have been able to use ecological principles. Among the initial benchmarks are:

1. The International Whaling Commission is founded by the International Convention for the Regulation of Whaling of 1946.
2. International Union for the Protection of Nature (IUPN) founded in 1948; UN Charter.
3. The Winner Green Foundation, Princeton, New Jersey, USA, hosted the Winner Green Conference on Man's Role in Changing the Face of the Earth in 1955.
4. Man's Role in Changing the Face of the Earth was released in 1956 (Thomas Ed. 1955).
5. 1957 The International Union for Conservation of Nature and Natural Resources (IUCN) replaces the IUPN.
6. Law of the Sea, 1958. Conventions are approved during the inaugural UN Conference on the Law of the Sea.
7. 1958 survey on UK rivers' quality
8. Antarctic Treaty of 1959; United Nations Economic and Social Council adopts resolution to publish list of national parks and similar reserves worldwide.
9. World Wildlife Fund (now known as the Wide Fund for Nature) was founded in 1961.
10. The UK government was established in 1961 as a result of the National Survey of Air Pollution.
11. Silent Spring was published in 1962 by Carson.
12. The International Biological Programme (IBP) was started in 1964 by the International Council of Scientific Unions (issue).
13. IUCN Red Data Books were originally published in 1966.
14. 'Biosphere' Conference of UNESCO in 1968.

15. Friends of the Earth (FOE) was founded in 1969.
16. Environmental Impact Assessments must be prepared in accordance with the National Environmental Policy Act (NEPA) of 1970.
17. Launch of the UNESCO Man and the Biosphere (MAB) Programme in 1971. Formed was Greenpeace International.
18. The Global Monitoring System (GEMS) concept was approved by the Stockholm Conference in 1972, and the United Nations Environment Programme (UNEP) was established. The magazine Ecologist funded the book Blueprint for Survival. Published: Limits to Growth (Meadows et al., 1972).
19. The United States' National Aeronautics and Space Administration (NASA) launched Landsat 1 in 1972.
20. Regional Seas Programme of UNEP launched in 1974.
21. The Kenya Rangeland Ecological Monitoring Unit (KREMU) was founded as a consequence of cooperation between Kenya and the Canadian International Development Agency, in accordance with the 1975 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).
22. 1976 The International Council of Scientific Unions (issue) receives reports from the Scientific Committee on Problems of the Environment (SCOPE) on the worldwide trends in the biosphere that most urgently demand international and interdisciplinary scientific endeavor.
23. Desertification Conference of the UN in 1977.
24. The 'greenhouse effect' is acknowledged at the 1979 World Climate Conference, which the World Meteorological Organization organized.
25. 1980 saw the announcement of the IUCN's World Conservation Strategy and the founding of the World Conservation Monitoring Centre.
26. Arid Lands Information Network published BAOBAB Journal on Arid and Semi-Arid Areas in 1988 [7], [8].
27. 1997 Case Studies and Readings from the Human Impact Reader Andrew Goodie Oxford:

Environmental Impact Evaluation

Before making important decisions or committing to something, the process of identifying, foreseeing, assessing, and mitigating the biophysical, social, and other pertinent implications of development ideas. An assessment's goal is to cover biodiversity at all pertinent scales and provide enough survey time to account for seasonal features. It is crucial that it is connected to the issue of securing sustainable livelihoods for local people based on biodiversity resources. It should concentrate on processes and services which are necessary to be maintained and safeguarded in this context. Every environmental assessment begins with the premise that biodiversity must be protected if it is to endure and carry-on offering benefits, values, and services to both present and future generations. In order to sustain yields and harvests over time, it is important to identify, protect, and promote sustainable use of biodiversity. Examining the effects of development on the advantages of biodiversity resulting from the provision of necessary ecological services and life support systems, such as Water production, water purification, waste breakdown, flood control, storm and coastal protection, soil formation and conservation, sedimentation processes, nutrient cycling, carbon storage, and climatic regulation are all important aspects of water management. The price of replacing these services is taken into consideration during the appraisal process. Important biodiversity is found in places that:

1. Support endemic, uncommon, and disappearing environments, species, and genetic variants.
2. Support the genotypes and species that are necessary for the survival of other species.
3. Serve as a buffer, connect a habitat or ecological corridor, or significantly contribute to the preservation of environmental quality.
4. Are essential for migration or have significant seasonal applications.
5. Support ecosystems, species populations, and habitats that are weak, in danger across their ranges, and slow to recover.
6. Support exceptionally vast or uninterrupted stretches of untouched nature.
7. Act as climate change refugee for biodiversity, promoting persistence and the continuation of evolutionary processes.
8. Support biodiversity, particularly in settings where it takes a long time for a particular area to establish characteristic biodiversity.
9. Currently have little biodiversity, but with the right interventions, they have the potential to create high biodiversity.

Normative Principles

Because people and biodiversity depend on ecosystems that are healthy and functional, the Convention on Biological Diversity promotes an ecosystem approach to impact assessment that is unrestricted by artificial borders. In order to deal with the dynamic character of ecosystems, uncertainty, and the frequently unpredictable nature of ecosystem functions, behaviour, and reactions, the ecosystem method is participative and necessitates a long-term perspective based on a biodiversity-based research area and adaptive management. Concerns about biodiversity are not just found in protected areas. Even the most urbanized cities still contain remnants of natural systems, and these elements frequently contribute significantly to the quality of life there. The advantages from the commercial use of biodiversity are properly distributed, and traditional rights and uses of it are recognized in IA. Future generations' demands should be taken into account with those of the present.

It is important to look for alternatives that do not trade on biodiversity's capital in order to satisfy immediate demands, as this could endanger the ability of future generations to satisfy their own needs. The precautionary principle is used whenever significant biodiversity may be in danger and there is inadequate information to either estimate risks or put effective mitigation measures in place. The precautionary principle calls for delaying development approval until the best possible knowledge can be gathered through engagement with local stakeholders and experts and/or until fresh biodiversity data can be gathered and aggregated. In order to guarantee that all relevant parties have been consulted and that significant biodiversity values are taken into account, an environmental assessment entails extensive consultation. Only via negotiations with the many societal groups or individuals who have an interest in biodiversity can biodiversity be valued. Whenever possible, use conventional knowledge and indigenous wisdom. To prevent the improper exploitation of knowledge of biodiversity, carefully collaborate with indigenous populations.

Operational Guidelines

Screening Biodiversity inclusive screening standards are used to assess the potential impact on significant biodiversity resources. Potential effects on regions supporting protected species and protected areas should be among the triggers for biodiversity screening in impact assessments. Effects on other, unprotected but crucial for biodiversity regions. Activities that provide a specific threat to biodiversity based on their nature, scope, location, timing, duration, and reversibility. Territories owned by indigenous people, extractive reserves, wetlands, fish breeding grounds, soils prone to erosion, characteristic habitat that is mostly unaltered, flood storage regions, groundwater recharge sites, etc. Encourage the creation of a biodiversity screening map that highlights key ecosystem functions and biodiversity assets. To determine conservation priorities and targets, link this effort, if at all possible, with the creation of a National Biodiversity Strategy and Action Plan (NBSAP) and biodiversity planning at sub-national levels e.g., regions, local governments, towns.

Scoping

Scoping results in IA Terms of Reference, which outline the topics to be researched and the procedures to be followed. Use scoping as a chance to examine ideas to avoid or reduce detrimental effects on biodiversity and to bring up biodiversity concerns. Making a scoping report for consultation is good practice. Taking into account the information already available as well as any early surveys or talks, this should address the following issues:

1. The kind of project, Programme, strategy, or policy, potential alternatives, and a list of initiatives that may have an impact on biodiversity.
2. A study of biodiversity's opportunities and limits including no net biodiversity loss and biodiversity restoration options.
3. Expected biophysical changes in the environment in the soil, water, air, vegetation, and fauna brought on by projected activities or by any socioeconomic changes.
4. Identification of effects on ecological connectivity and potential cumulative effects, as well as spatial and temporal scales of influence.
5. In the absence of the proposal, information that is currently available on baseline conditions and any predicted trends in biodiversity.
6. Potential effects of the plan on biodiversity in terms of composition, structure, and function.
7. Services and values provided by biodiversity that were determined after engagement with stakeholders, as well as changes that are anticipated.
8. Possible mitigation strategies, taking into account any applicable legal obligations, to prevent, reduce, or make up for major biodiversity harm or loss
9. Information needed to enable decision-making and a list of significant information gaps
10. Proposed IA schedule and methodology

11. Create sector-specific in-country guidance that transforms this general scoping procedure into tools, including rules and model Terms of Reference, for actual application [9], [10].

Survey

Consider biodiversity at all pertinent levels, and give yourself ample survey time to account for seasonal features. Put your attention on the procedures and offerings that present a vital chance to examine alternatives and bring up the issue of biodiversity issues. The CIAI advises using the following inquiries as the basis for the evaluation:

1. How much will the suggestion have a major impact at the gene level on?
2. What is the genetic diversity of species, especially those that are rare, in decline, or that have been designated as priorities in NBSAPs and/or subnational biodiversity plans?
3. Possibilities for interactions between species populations, for instance, by increasing habitat fragmentation and isolation?
4. Extinction risk?
5. Existence of populations with a local adaptation?
6. What extent, at the species level, will the proposal:
7. Alter the habitats' species richness or composition in the study area?
8. Alter the communities' species composition?
9. Cause the extinction of some local species?
10. Species that have been deemed priorities in NBSAPs or regional biodiversity programmes, respectively.
11. Increases the danger of alien species invasion?
12. How much of the following at the ecosystem level will the proposal?
13. Alter the quantity, caliber, or geographical configuration of the habitat?
14. Impede initiatives to improve the quality or availability of habitat?
15. Damage the ecosystem's natural processes and functions, especially those that local residents depend on?

Finally

Is there an alternative habitat that can support the populations of the related species if habitats are destroyed or altered?

Exist Opportunities to Link or Combine Habitats?

Utilize an ecosystem-based strategy and involve pertinent parties, such as neighborhood communities. Think about all the variables that affect biodiversity. Indirect drivers of change, which are more difficult to quantify, include demographic, economic, sociopolitical, cultural, and technological processes or interventions, as well as direct drivers of change associated with a proposal such as land conversion and vegetation removal leading to loss of habitat a key driver of biodiversity loss, emissions, disturbance, introduction of alien and genetically modified species, etc. Analyze the effects of the options in light of the starting point. Compare to biodiversity thresholds and objectives. For information and goals, consult NBSAPs, subnational biodiversity plans, and other conservation reports.

Consider cumulative threats and consequences that may come from planned plans, programmes, or policies as well as recurrent impacts of projects of the same or different sort over time and geography. Cultural, social, economic, and biophysical variables all affect biodiversity. Thus, cooperation among the IA team's various expertise is crucial, as is the incorporation of research results that have an impact on biodiversity. Enlighten us on the cause-and-effect relationships. Quantify the changes to biodiversity's quantity and quality, if you can. Describe the likely effects of any biodiversity losses connected with the proposal, including the price of replacing any lost biodiversity services. Find out how these connect to any statutory requirements or pertinent biodiversity priorities and objectives. List the legal problems that provide the constraints for making decisions.

Mitigation

Avoidance or prevention, mitigation including site restoration and rehabilitation, and compensation are some of the different ways that remedial action can be taken. Apply the positive planning approach, which prioritizes avoidance and uses compensation as a last resort. Avoid compensating in an excuse manner. Seek out chances to improve biodiversity. Recognize that compensation may not always be an option and that there may be situations where it is necessary to reject development proposals due to irreparable biodiversity loss.

Review to Inform Decisions

Where there are considerable consequences on biodiversity, a specialist with the necessary skills should analyses environmental reports with relation to biodiversity. The participation of impacted groups and civil society should be taken into consideration depending on the degree of confidentiality of public decision-making.

Making Choices

To find solutions that are both economically viable and socially and environmentally sustainable, avoid putting conservation goals against development goals and strike a balance between conservation and sustainable use. Apply the precautionary principle when there is insufficient information on significant biodiversity issues, and the no net loss principle when there are irreversible losses connected to the proposal.

Management, Vigilance, Assessment, and Auditing

It is critical to understand that there is no way to forecast how perturbations in biodiversity will respond, especially over very long timescales. To ensure that mitigation is effectively implemented, unexpected negative effects are detected and addressed, and any negative trends are detected, management systems and programmes, including clear management targets (or Limits of Acceptable Change (LC)), should be put in place. A periodical audit of impacts on biodiversity is provided for. Where disruption or accident conditions potentially endanger biodiversity, emergency response procedures and/or contingency plans should be implemented.

II. CONCLUSION

Researchers working in the current stage of environmental valuation must deal with novel problems and developing patterns. Similar to other research fields, environmental valuation methodologies can be advanced by incorporating machine learning techniques into the valuation process. This is done by building massive databases using the increasing capacity to collect enormous amounts of data. This evolution should not, however, be limited to novel uses of tried-and-true valuation techniques. To address new valuation process components, researchers must create novel strategies. We anticipate that academics will focus the most on proposing new methods for environmental valuation on climate change, one of the key concerns of the twenty-first century.

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