



# Environmental Valuation



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# Environmental Valuation

**Environmental valuation assigns monetary values to environmental impacts, especially non-market impacts. It estimates the value that environmental resources have for people affected by their loss or attracted to them by their characteristics. The aim is to obtain a monetary measure of benefits or costs to individual and social welfare from environmental improvement interventions or consequences of environmental degradation.**



# Why Environmental Valuation Matters

Environmental valuation methods determine the benefits and costs associated with using environmental goods, improving environmental conditions, or remedying environmental damage. These methods must consider the complexity of each area.

The economic benefits of environmental resources extend far beyond obvious uses. For example, national parks provide value beyond tourism—natural amenities and recreation facilities attract and retain people, entrepreneurs, businesses, and retirees to surrounding communities.

## The Challenge

Environmental evaluation is difficult to conduct effectively because it involves factors that are hard to quantify. How do you put a price on clean air, biodiversity, or a pristine forest?

# Need For Environmental Valuation

- Environmental Litigation
- Environmental Dispute Regulation
- Guiding Environmental Regulation
- Evaluating proposed environmental programmes
- Climate Change Policy
- Sustainable Development Planning
- The government used to assess the damage compensation and the need for future changes in environmental policy.

# Key Concepts in Environmental Valuation

## Shadow Prices

Monetary values assigned to abstract or intangible commodities not traded in the marketplace. Shadow pricing is crucial in decision-making where goods lack explicit market prices, helping evaluate costs and benefits of public goods, externalities, or environmental resources.

## Willingness to Accept (WTA)

The minimum amount of money a person is willing to accept to abandon a good or tolerate something negative, such as pollution. It represents the minimum compensation required for an individual to accept something undesirable.

## Willingness to Pay (WTP)

The maximum amount an individual is willing to sacrifice to procure a good or avoid something undesirable. The net difference between WTP and WTA creates the social surplus from trading goods.

# Total Economic Value Framework

Total Economic Value (TEV) recognises that economic value is composed of different parts—some tangible and directly used, some intangible or remote. This framework provides a comprehensive approach to understanding environmental worth.

$$\text{Total Economic Value} = \text{Total Use Value} + \text{Total Non-Use Value}$$

$$\text{Use Value} = \text{Direct Use} + \text{Indirect Use} + \text{Option Value}$$

$$\text{Non-Use Value} = \text{Bequest} + \text{Existence Value}$$

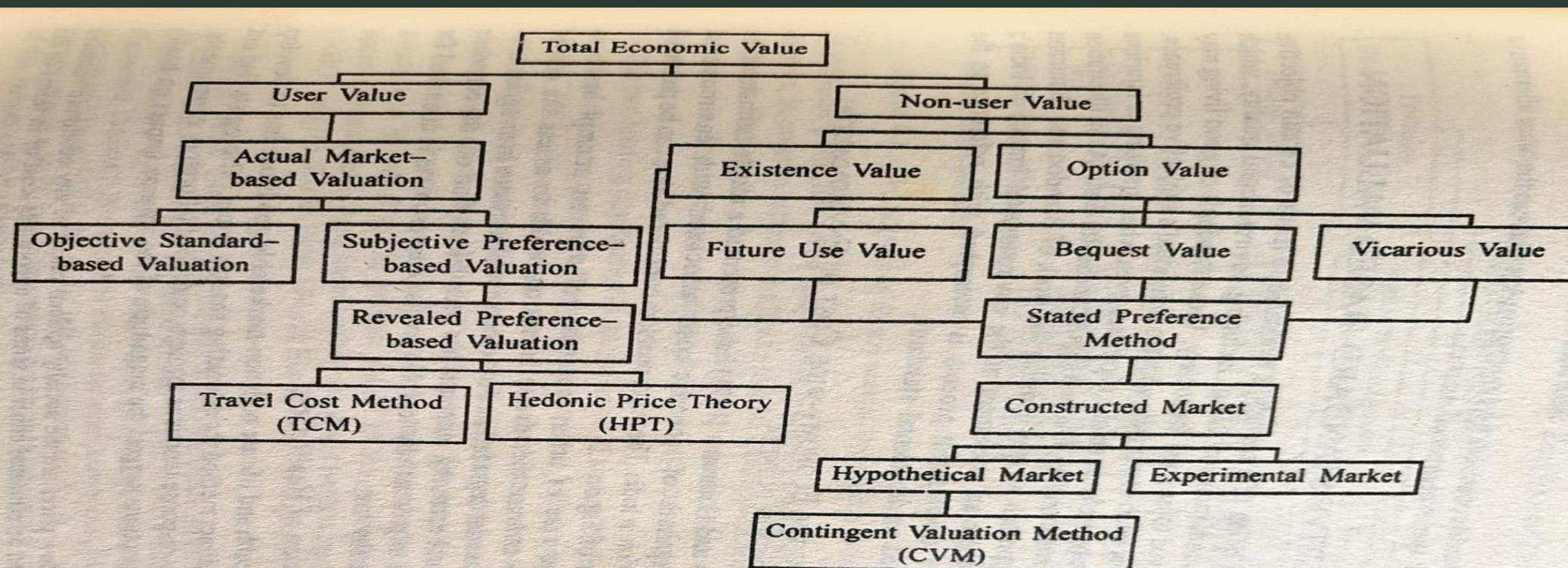


Figure 4.1 Specification of the Total Economic Value of the Environment.

# Understanding Use Values



## Direct Use Values

Benefits from actual consumption or enjoyment of environmental goods. Examples include eating fish, using timber, or enjoying outdoor recreation. These values can often be obtained from existing markets, though externalized costs must be considered.



## Indirect Use Values

Benefits from ecosystem processes that contribute to production of goods and services like soil formation, water purification, and pollination. These are frequently not reflected in market values but can be established by understanding market costs.



## Option Value

Value attributed to preserving the option to utilize ecosystem services in the future. Despite not currently providing benefits, many services retain value for preserving future use options for individuals or others.

# Non-Use Values: Beyond Direct Benefits

**Non-use values refer to increases in individual utility without actually using the good. We may value an ecosystem existing far away even though we rarely visit it. These values capture the intrinsic worth of environmental resources.**

## **Existence Value**

Value attributed to the pure existence of an ecosystem—the value of knowing that a particular species, habitat, or ecosystem does and will continue to exist, regardless of whether we ever experience it directly.

## **Vicarious Value**




Value based on the welfare the ecosystem provides to other people. We value an environmental good because it benefits others, even unknown beneficiaries. If my neighbor's happiness from a clean environment makes me happy, I'm being altruistic.

## **Bequest Value**

A value based on the welfare of the ecosystem may benefit future generations. People feel an obligation to preserve the environment for those who come after us, recognizing that passing resources to the next generation is valuable.

# Valuation Methods Overview

Various methods are used to calculate market values and measure non-market values of environmental goods and services. These methods fall into three main categories based on how they derive value.

	Methodology	Basis of Approach & Description		Main Techniques
1	Market-Based (Production Approach)		Uses standard economic techniques for traded goods.	<ul style="list-style-type: none"><li>• Market Price Method</li><li>• Production Function Analysis</li><li>• Cost-Based Techniques</li></ul>
2	Surrogate Markets (Revealed Preference)		Infers value from behavior in related markets.	<ul style="list-style-type: none"><li>• Travel Cost Method</li><li>• Hedonic Pricing</li></ul>
3	Simulated Markets (Stated Preference)		Constructs hypothetical markets via surveys.	<ul style="list-style-type: none"><li>• Contingent Valuation</li><li>• Choice Modelling</li></ul>

# Hedonic Pricing Method

The hedonic pricing method relies on market transactions for differentiated goods to estimate economic benefits associated with environmental quality. The basic premise is that the price of a marketed good relates to its characteristics or services it provides.

For example, house prices relate to structural characteristics, neighborhood features, and environmental characteristics. If non-environmental factors are controlled, remaining price differences can be attributed to environmental quality differences.

The hedonic price function:

$$P_i = f [S_{1i}, \dots, S_{ki}, N_{1i}, \dots, N_{mi}, Z_{1i}, \dots, Z_{ni}]$$

Where, S represents structural characteristics of the house i i.e. type of construction, house size and number of rooms; N represents neighbourhood characteristics of house i, that is accessibility to work, crime rate, quality of schools etc. It is assumed that only one environment variable affects the property value i.e. air quality (Z).

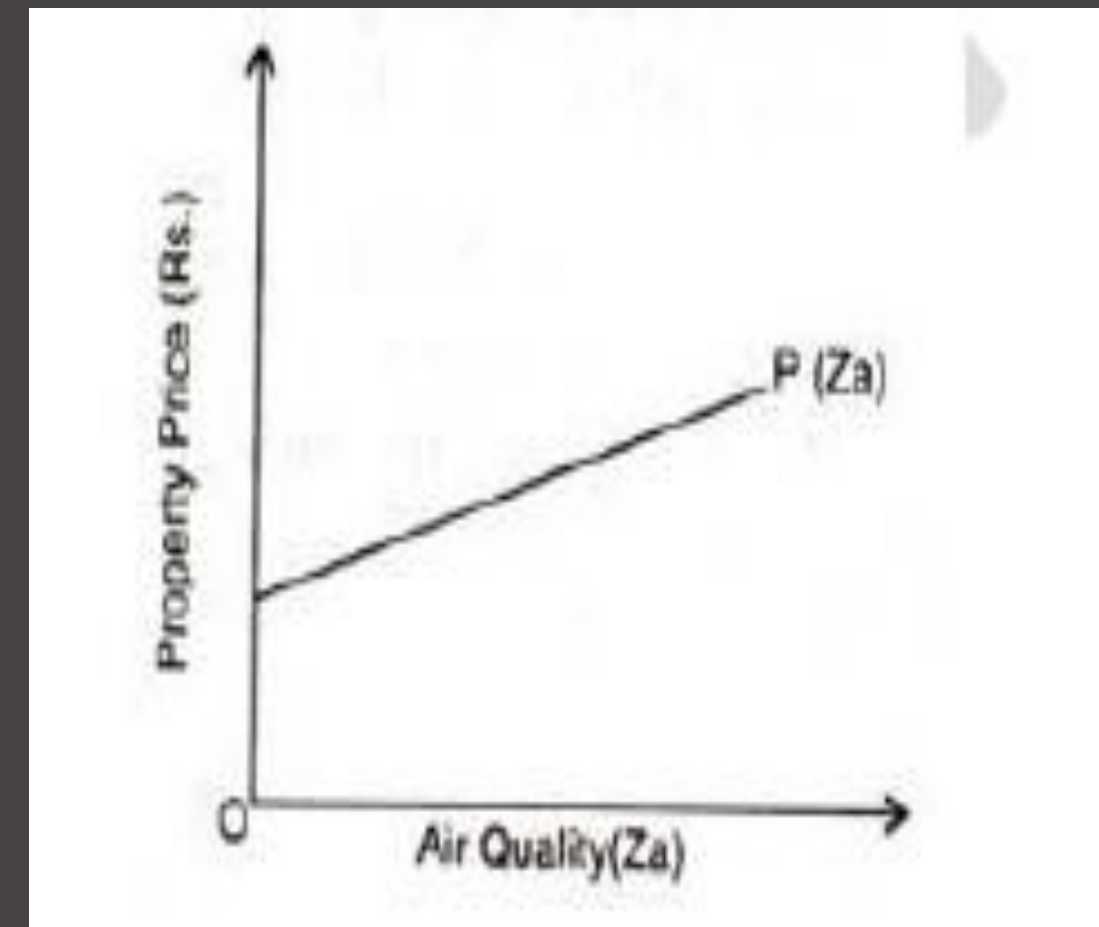
For example, if the linear relation exists, then the equation becomes

$$P_i = [\alpha_0 + \alpha_1 S_{1i} + \dots + \alpha_k S_{ki} + \beta_1 N_{1i} + \dots + \beta_m N_{mi} + \gamma_a Z_a]$$

and  $\gamma_a > 0$ .

There is a positive relation between air quality and property price as shown in the figure below. The figure shows that house prices increase with improved air quality.

It indicates that the implicit marginal purchase price of  $Z_a$  (air quality) varies according to the ambient level ( $Z_a$ ) prior to the marginal change.



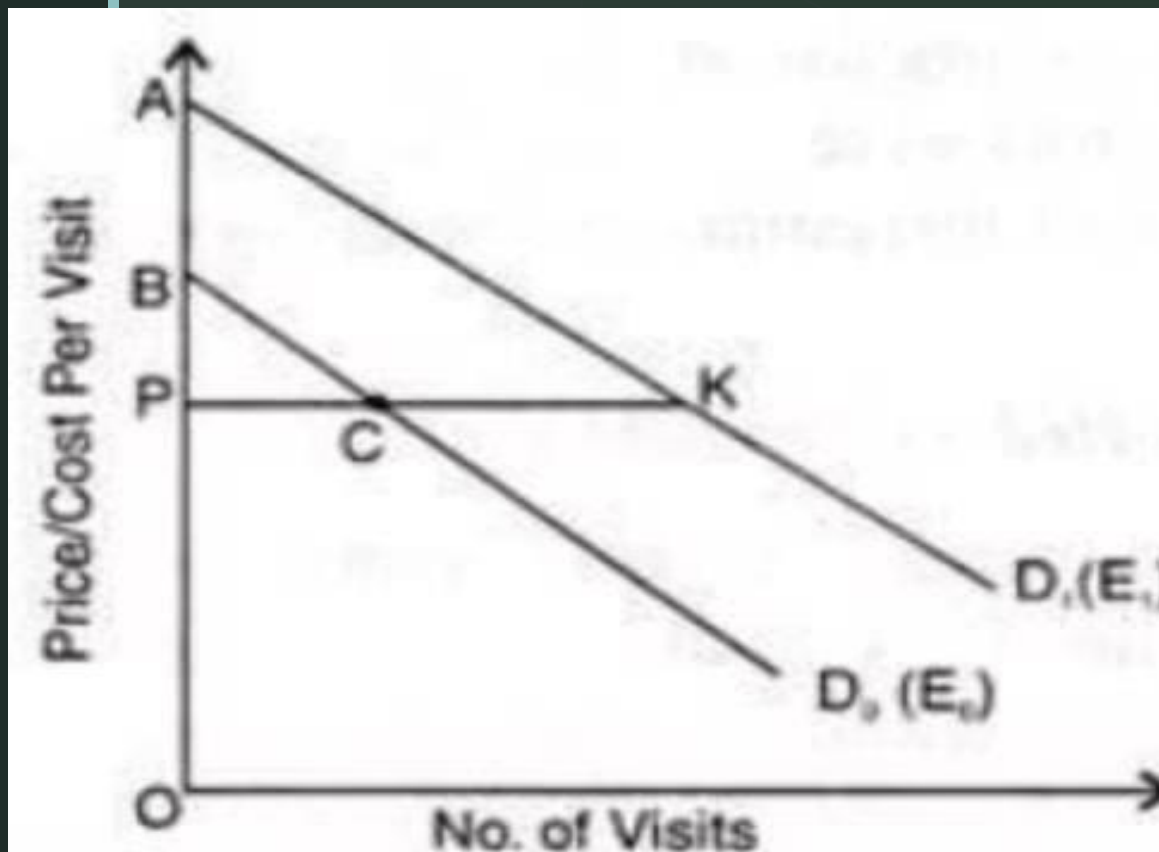
# Travel Cost Method

The travel cost method estimates the value of recreational benefits generated by ecosystems. It assumes that the value of a site or its recreational services is reflected in how much people are willing to pay to get there.

The method uses time and travel cost expenses that people incur to visit a site to represent the value of access. This is analogous to estimating willingness to pay for a marketed good based on quantity demanded at different prices.

When environmental quality improves (from  $E_0$  to  $E_1$ ), the demand curve shifts outward, increasing visits. The net gain in consumer surplus (area  $ABCK$ ) represents the economic value of the environmental improvement.

If there is an improvement in environmental quality of lake, then the demand curve will shift outward as  $AD_1$  and environmental quality level to  $E_1$ . With this effect, the number of visits to  $PK$  increases. The gain in consumers' surplus equals the area  $PAK$ . The net gain in consumers' surplus after an improvement in the lake's environmental quality is shown as:  $PAK - PBC = ABCK$ .

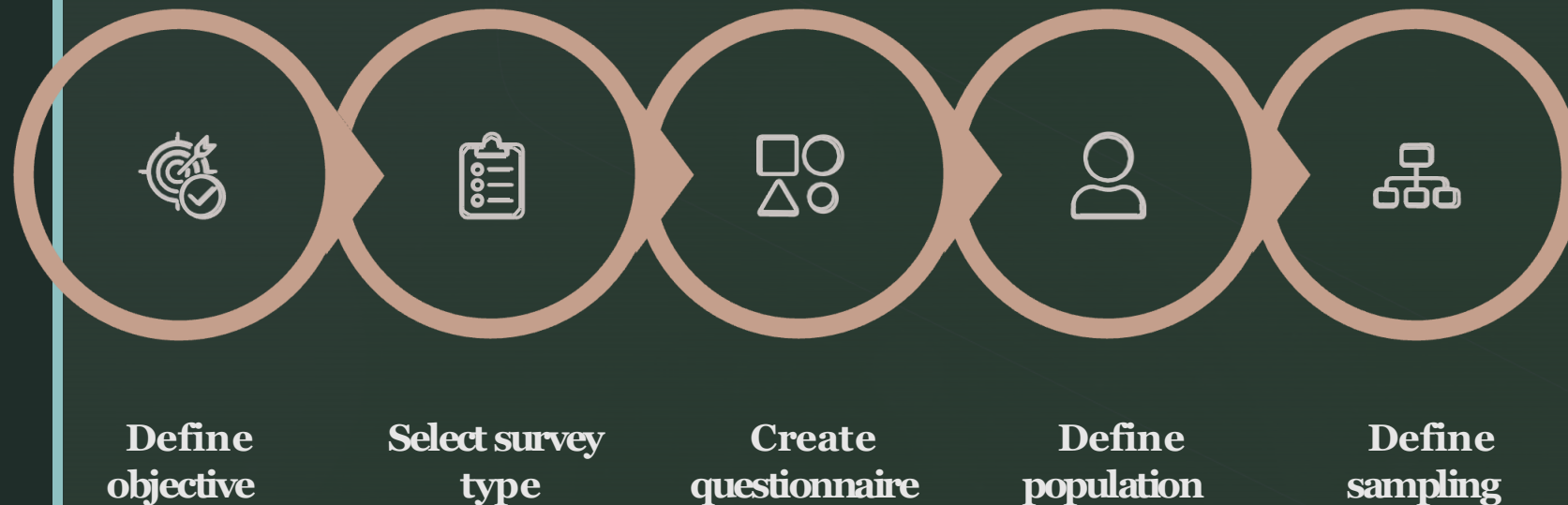


# Contingent Valuation Method

## Questionnaire-Based Preferences

Discovers individual preferences for environmental changes by asking people about their willingness to pay or accept compensation. The only method that can assess non-use values like biodiversity existence values, whilst also estimating use values such as recreational benefits.

Can evaluate changes before they occur, making it valuable for ex-ante policy assessment.



# Surrogate Market Approaches



## Property-Value Method

Analyses real estate prices to estimate willingness to pay for environmental quality. Decomposes property prices into components like air quality, noise levels, and location.



## Travel-Cost Method

Uses travel expenditure data to estimate the value people place on visiting recreational areas and natural sites.



## Choice Experiment Method

Decomposes environmental goods into attributes, asking individuals to state preferences for simultaneous changes in multiple features.

# Cost-Based Valuation Techniques

## 1 Opportunity Cost

Values environmental protection by what is foregone to achieve it. Basis for compensation payments when government restricts land use rights.

## 2 Relocation Cost

Estimates monetary value of environmental damages based on potential costs of relocating facilities affected by environmental quality changes.

## 3 Replacement Cost

Measures expenditures required to replace or restore productive assets damaged by development, compared against prevention costs.

# Impact-Based Valuation Methods

## Dose-Response Method

Establishes links between pollution levels and physical responses, such as crop yield reduction or material decay. Values changes using market prices or shadow prices.

Example: Air pollution effects on plant growth valued through lost agricultural output.

## Human Capital Approach

Values environmental attributes through effects on labour quantity and quality. Focuses on health impacts and resultant costs from illness, accidents, and medical treatment.

Estimates the value of expected future earnings lost due to adverse environmental conditions affecting human health.

## Productivity Method

It applies when environmental goods/services are among the inputs used to produce a marketed good. An appropriately specified production function may indicate the contribution of these inputs to the output, and from this information, one may deduce the benefit due to these inputs. The value of the environmental resource is inferred from changes in production levels, revenues, or input costs due to environmental improvement or degradation. Commonly applied in agriculture, fisheries, forestry, and industry. Best suited where environmental inputs are a key factor of production

# Contingent Choice Method

- It is a very versatile method, which can be applied to the valuation of almost all environmental goods and services, irrespective of being marketed or non-marketed
- It can be used to calculate the use value, the non-use value and the option value.
- Provides richer information by valuing multiple attributes
- simultaneously rather than a single scenario.
- Data collected through structured questionnaires presenting hypothetical choice sets.
- Example: Respondents choose between forest conservation plans differing in biodiversity level, recreational access and annual tax cost

# The Market Price Method

This method estimates consumer surplus and producer surplus using market price and quantity data for the environmental goods/services traded in the market.

Best suited for traded natural resources.

Market prices are determined by the forces of demand and supply.

Straightforward and easy to apply where market data is available.

Cannot value non-market goods like clean air, scenic beauty, or biodiversity not traded commercially.

Example: Valuing a forest by the market price of timber it produces per year