Indian Institute of Forest Management,
Bhopal

NATIONAL RESOURCE ACCOUNTING AND MONETIZATION OF INTANGIBLE SERVICES OF FOREST

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Role of Macro Economic analysis in FRA, monetization of Intangible Services of Forest

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- Macroeconomics may be defined as that branch of economic analysis which studies the behavior of not one particular unit, but of all the units combined together. Macroeconomics is a study in aggregates. Hence, it is often called Aggregative Economics.

- It is the study of the economic system as a whole. It is the study of the overall conditions of an economy, say, total production, total consumption, total saving and total investment.

- Macroeconomics deals with the great averages and aggregates of the system rather than with particular units in it. It studies the behavior of macro-quantities or macro-variables.

- Since macro-economics splits up the economy into big lumps (or sectors) for purpose of study, it is also called the Method of Lumping.

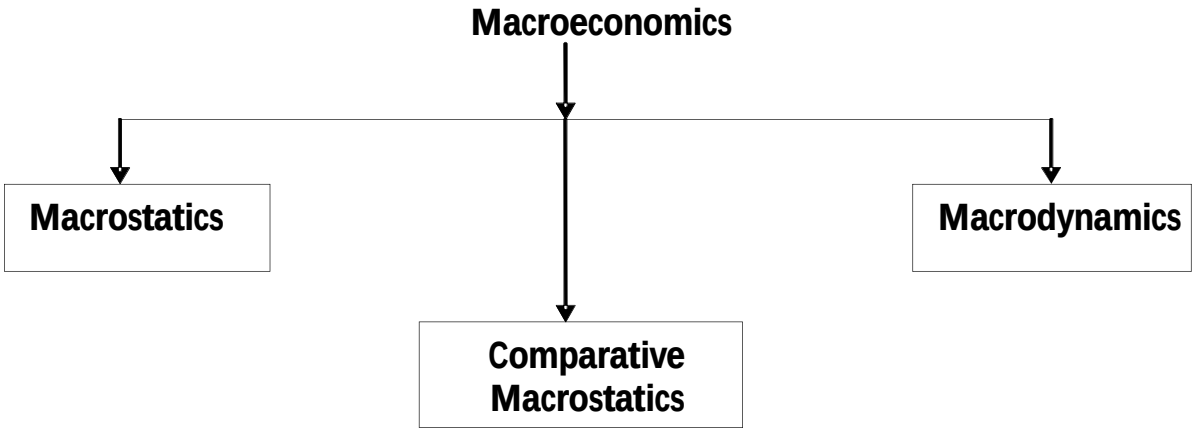
Scope/Field of Macroeconomics

The scope/field covered by macroeconomics may be set forth below:

1. Theory of Income, Output and Employment with its two constituents, namely, the theory of consumption function and the theory of investment function.
2. Theory of Prices with its constituents of theories of inflation, deflation and reflation.
3. Theory of Economic Growth dealing with the long-run growth of income, output and employment as applied to developed and underdeveloped countries.
4. Macro Theory of Distribution dealing with the relative shares of wages and profits in the total national income.

- Theory of Income
- Theory of Output
- Theory of Employment
- Theory of Business Cycle
- Theory of Income
- Theory of Price
- Theory of Economic Growthf

Types of Macroeconomics



1. Macro-statics

It is a method which is used to explain certain aggregative relations in a stationary state. It throws no light on the process by which the national economy reaches final equilibrium.

Macro-statics deals with the final equilibrium of the economy at a particular point of time. It does not study the path by which the economy reaches equilibrium.

It is a technique of analyzing the relations between macro variables in the final position of equilibrium without detailing the process of adjustment implicit in that position of equilibrium.

2. Comparative Macro-statics

As we know, the various macro variables in an economy, such as, total consumption, total investment and total income, etc. keep on changing with the lapse of time. As result, the economy keeps on reaching different levels of equilibria. The method of comparative macro-statics involves a comparative study of different equilibria attained by the economy.

3. Macro-dynamics

- This method has recently been developed by leading economists like Frisch, D. H. Robertson, J. R.Hicks, M. Kalecki, Tinbergen and P. A. Samuelson.

- This is, indeed, a very realistic method of economic analysis, though it is complicated and involves the use of higher mathematics.

Difference between Individual Tree and Forest.

Sl.No.	Individual Tree	Forest
1.	An individual tree germinates, grows and decays.	While a forest goes on for ever with exactly the same internal composition in regard to character of trees that compose it.
2.	An individual tree may not burn so easily.	But forests are very often subject to fires.
3.	An individual tree cannot affect the climate of the vicinity in which it grows.	A forest can.

The aggregate and its individual components are, thus, entirely two different things and the characteristics of one do not necessarily pertain to the other.

Difference between Microeconomics and Macroeconomics

Sl.No.	Basis	Microeconomics	Macroeconomics
1.	Origin	It has been derived from the Greek word 'Micros' which means small.	It is the study of economic actions of individuals and small group of individuals.
2.	Base	The basis of microeconomics is the price mechanism which operates with the help of demand and supply forces.	The basis of macroeconomics is national income output and employment which are determined by aggregate demand and aggregate supply.
3.	Main Objects	To maximize utility.	The main objectives is full employment, economic growths and price stability.
4.	Assumptions	It is based on rational behavior of individuals.	It is based on such variables as the aggregate volume of the output of the economy.
5.	Analysis	It is based on partial equilibrium analysis.	It is based on general equilibrium analysis.
6.	Relation	It is considered as a static analysis.	It includes a changing analysis.

GENERAL MACRO CONCEPTS

Macro-Economic analysis rests upon a large array of concepts, terms and devices.

1. Macro Concepts
2. Variables
3. Functional Relationship and Parameters
4. Accounting and Behaviour Relationship
5. Time series and Cross section Analysis
6. Ex-ante and Ex-post
7. Economic Models
8. Equilibrium

Why Value

- **Compare projects/programmes**
- **Justify and allocate public investment**
- **Encourage public participation**
- **Prioritize projects/programmes**

What is the need?

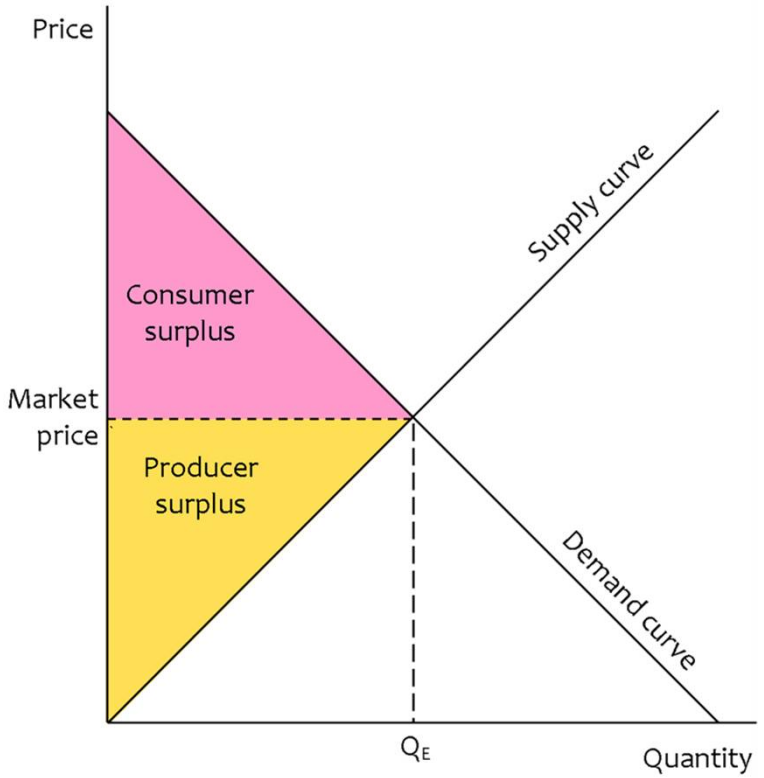
Most benefits do not enter the market

Only a part of benefits recorded

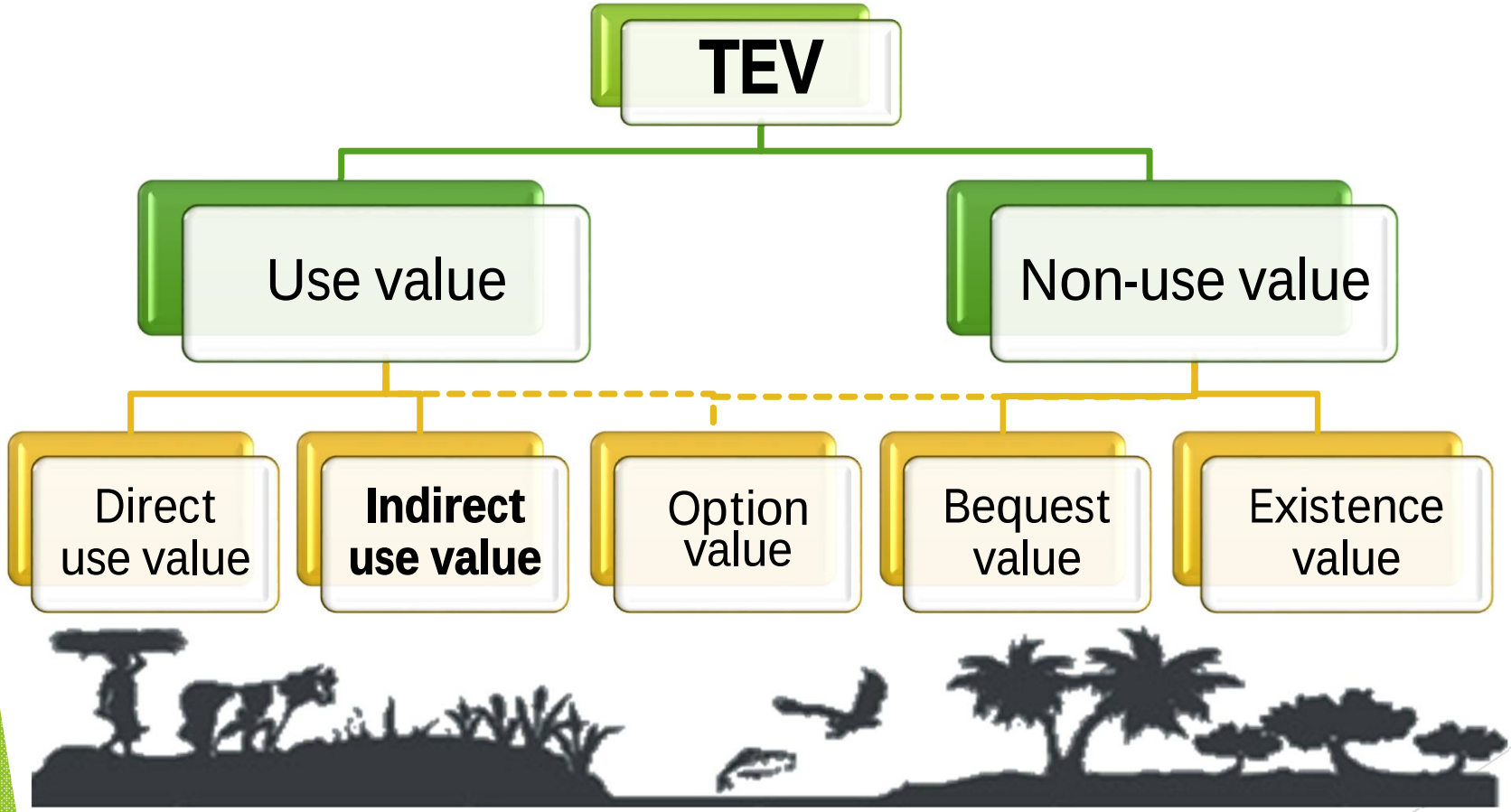
Benefits misattributed

Principles of economic valuation

- A way to define and measure value
- Based on preferences; utility
- Money as measure of economic value
- Willingness to pay and willingness to accept
- Consumer surplus and Producer surplus



Total Economic Value



Monetary valuation methods

Market price method

Productivity method

Hedonic pricing

Travel cost method

Replacement cost

Contingent valuation

Applying value estimates

- Cost-benefit analysis
  1. Specify and describe possible policy actions
  2. Describe and quantify effects leading to costs/benefits
  3. Estimate social costs and benefits
  4. Compare benefits and costs | Discounting

- Other decision frameworks
  - Land suitability | EIA | Cost-effectiveness analysis | Multi-criteria analysis | Risk-benefit analysis | Life-cycle analysis | Decision-analysis

VALUATION IS ESSENTIAL :

- To understand economic benefits of investment in $ / Rs terms.
- How environmental investments are being managed to maximize environmental benefits perdollar spent.
- To prioritize spending for environmental conservation, preservation or restoration.
- Environmental initiatives may result in wide range of economic and environmental benefits across multiple users / stakeholders
- To consider the public values, and encourage public participation and support for environmental initiatives.
- To compare the benefits of different projects or programs

APPLICATION OF THE APPROPRIATE METHOD WILL DEPEND UPON :

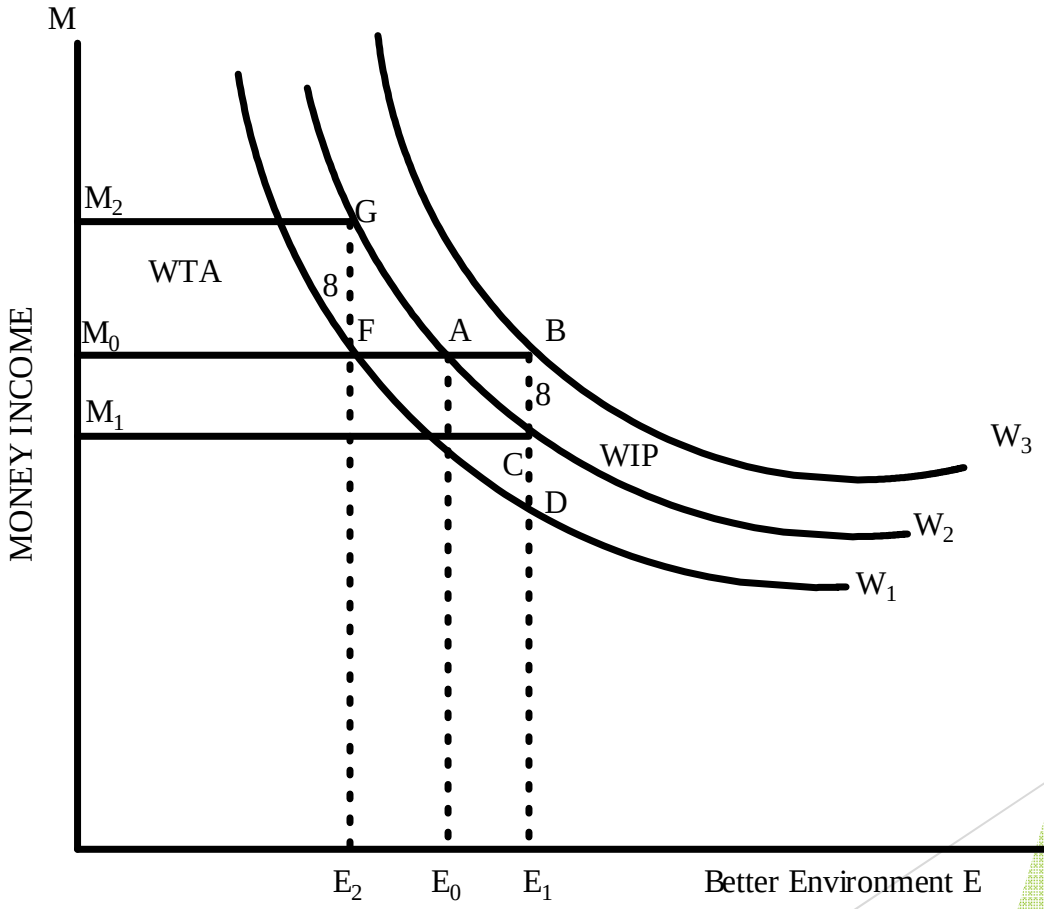
- The type of the resource,
- The nature of degradation and extent of depletion.
- The data available on the extent of degradation or depletion.
- The market price of the product in various economic activities
- The cost involved in the process of regeneration of the resource.
- The rent accruing in similar economic activities.
- The exposure of of population to pollutants.
- The treatment cost of upgrading a resource for different economic activities
- The stakeholders involved
- And many more……

- Three important features of economic values
  1. Irreversibility
  2. Uncertainty
  3. Uniqueness
- Value is influenced by rate of discount
- Compensating variation and Equivalent Variation
  (WTP) (WTA)

Combination of attributes will dictate preferences which are on cautious side of exploitation – Pre cautionary Principle

	Benefits	Losses
WTP(When SHs do not hold Property Rights) : Compensating Variation	To Secure a Benefit	To Avoid Losses
WTA(When SHs hold Property Rights): Equivalent Variation	To Forgo a Benefit	To Tolerate Losses

FIG: ECONOMIC RATIONALE FOR WILLINGNESS TO PAY AND ACCEPT



Taxonomy of Valuation Techniques

I.Cardinal { Monetary Valuation Techniques (market based)}

	Conventional Market (Direct Market)- Objective Methods	Implicit Market (indirect/Hidden market)- Subjective Methods	Constructed Market (Direct)
Based on Actual behaviour	•Effect on production •Effect on health •Defensive or preventive cost	•Travel cost •Wage differences •Property values •Surrogate goods/ proxy market goods	•Artificial market
Based on potential behaviour	•Replacement cost •Shadow project	-	•Contingent valuation
Revealed Preference (payment already made)			Stated Preference (future payments)

II. Ordinal

{Non Monetary Valuation Tech.}

- Contingent ranking
- Multi-criteria analysis (MCA)
- Conjoint Analysis
- Participatory Economic Valuation

II. Benefits Transfer

Table 2.1: Main ecosystem types and their services

	Ecosystem									
Ecosystem service	*Cultivated*	*Dryland*	*Forest*	*Urban*	*Inland water*	*Coastal*	*Marine*	*Polar*	*Mountain*	*Island*
Freshwater			•		•	•		•	•	
Food	•	•	•	•	•	•	•	•	•	•
Timber, fuel, and fiber	•		•			•				
Novel products	•	•	•		•		•			
Biodiversity regulation	•	•	•	•	•	•	•	•	•	•
Nutrient cycling	•	•	•		•	•	•			
Air quality and climate	•	•	•	•	•	•	•	•	•	•
Human health		•	•	•	•	•				
Detoxification		•	•	•	•	•	•			
Natural hazard regulation			•		•	•			•	
Cultural and amenity	•	•	•	•	•	•	•	•	•	•

Source: Millennium Ecosystem Assessment

Table 3.1: Main economic valuation techniques

Methodology	*Approach*	*Applications*	*Data requirements*	*Limitations*
Revealed preference methods				
Production function (also known as 'change in productivity')	Trace impact of change in ecosystem services on produced goods	Any impact that affects produced goods	Change in service; impact on production; net value of produced goods	Data on change in service and consequent impact on production often lacking
Cost of illness, human capital	Trace impact of change in ecosystem services on morbidity and mortality	Any impact that affects health (e.g. air or water pollution)	Change in service; impact on health (dose-response functions); cost of illness or value of life	Dose-response functions linking environmental conditions to health often lacking; under-estimates, as omits preferences for health; value of life cannot be estimated easily
Replacement cost (and variants, such as relocation cost)	Use cost of replacing the lost good or service	Any loss of goods or services	Extent of loss of goods or services, cost of replacing them	Tends to over-estimate actual value; should be used with caution
Travel cost (TCM)	Derive demand curve from data on actual travel costs	Recreation	Survey to collect monetary and time costs of travel to destination, distance traveled	Limited to recreational benefits; hard to use when trips are to multiple destinations
Hedonic pricing	Extract effect of environmental factors on price of goods that include those factors	Air quality, scenic beauty, cultural benefits	Prices and characteristics of goods	Requires vast quantities of data; very sensitive to specification
Stated preference methods				
Contingent valuation (CV)	Ask respondents directly their WTP for a specified service	Any service	Survey that presents scenario and elicits WTP for specified service	Many potential sources of bias in responses; guidelines exist for reliable application
Choice modeling	Ask respondents to choose their preferred option from a set of alternatives with particular attributes	Any service	Survey of respondents	Similar to CV; analysis of the data generated is complex
Other methods				
Benefits transfer	Use results obtained in one context in a different context	Any for which suitable comparison studies are available	Valuation exercises at another, similar site	Can be very inaccurate, as many factors vary even when contexts seem 'similar'; should be used with caution

Source: adapted from Pagiola and others, (forthcoming).

Figure 4.1: Flow of benefits from an ecosystem

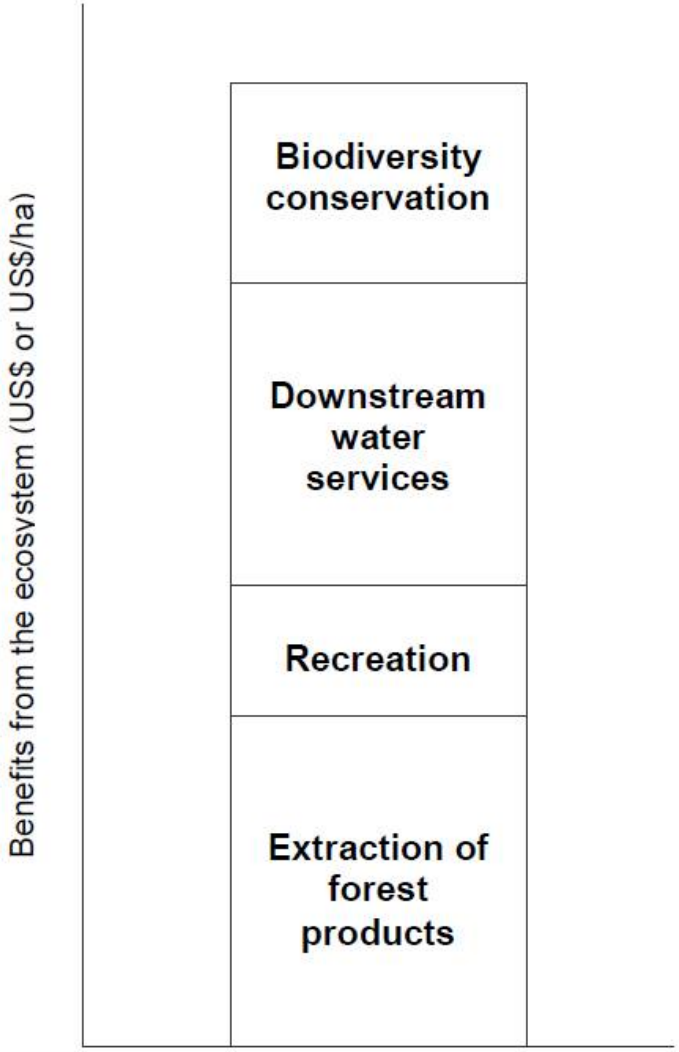


Figure 5.1: Change in ecosystem benefits resulting from a conservation project

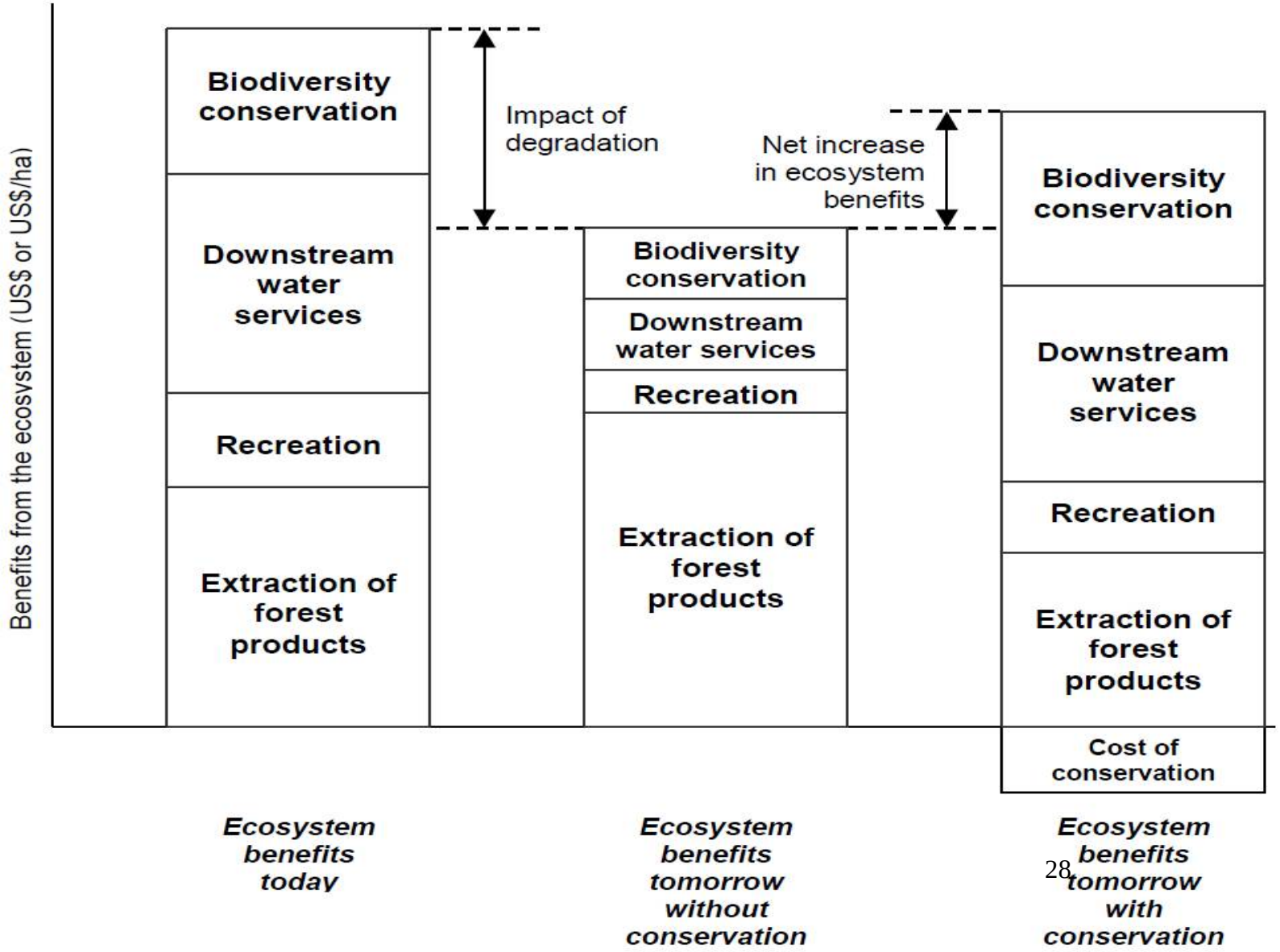


Figure 6.2: Effect of a conservation intervention on the distribution of ecosystem benefits

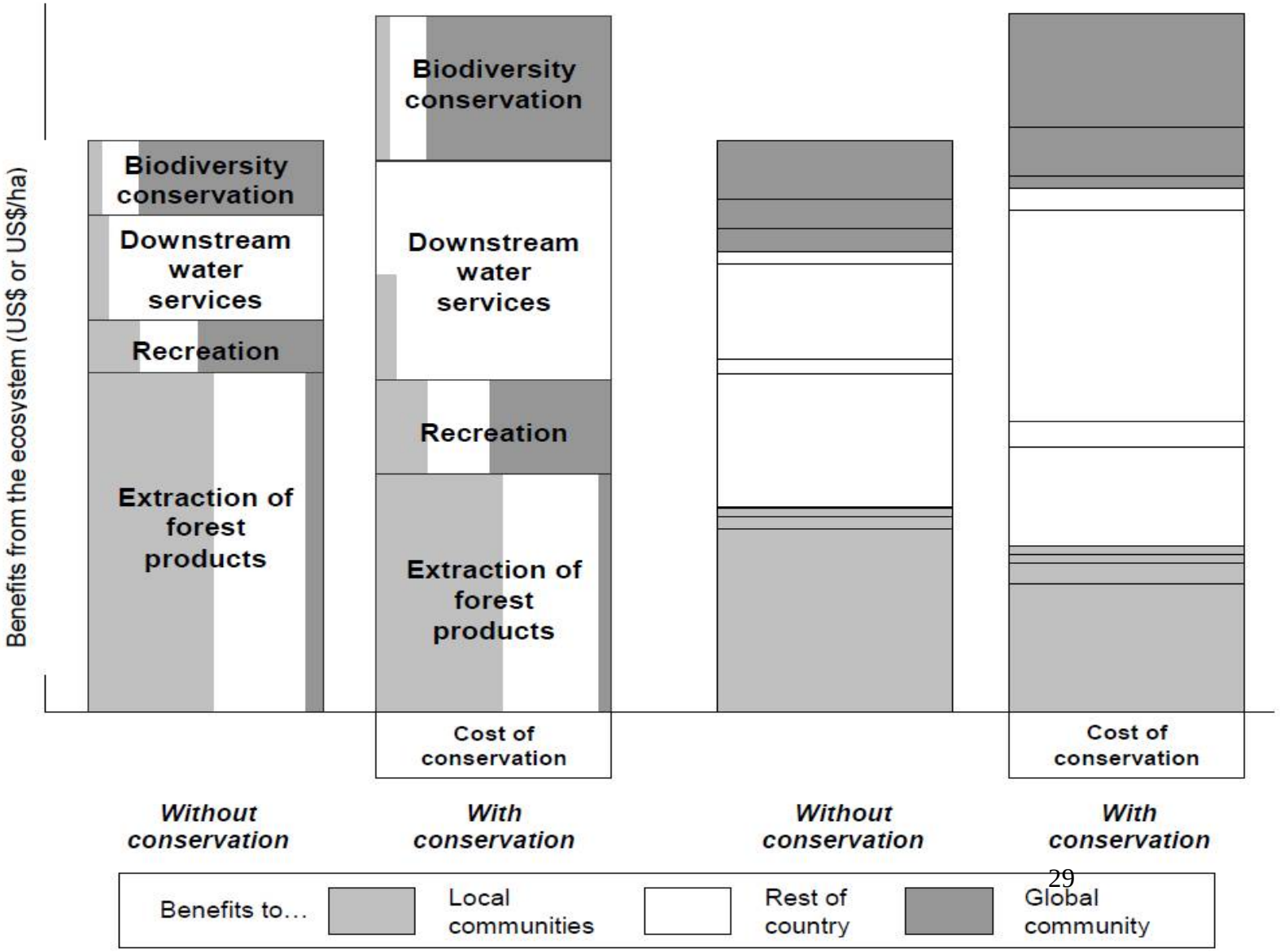


Figure 7.1: Identifying potential financing sources for conservation

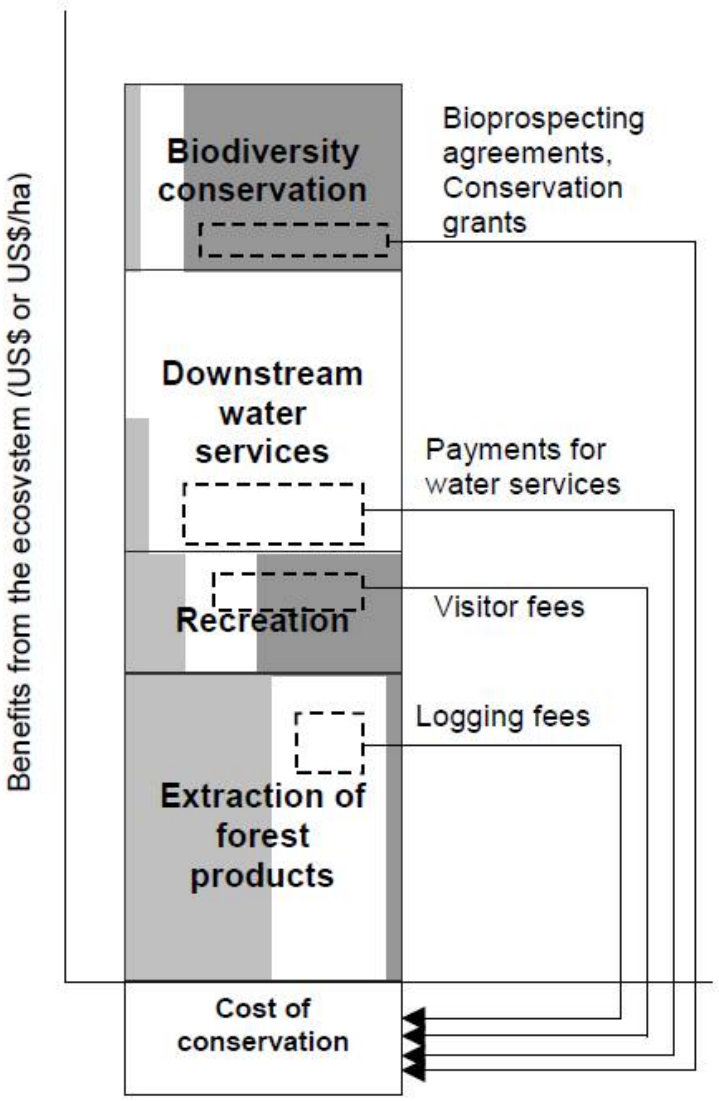


Figure 7.2: Identifying potential financing sources for a conservation intervention

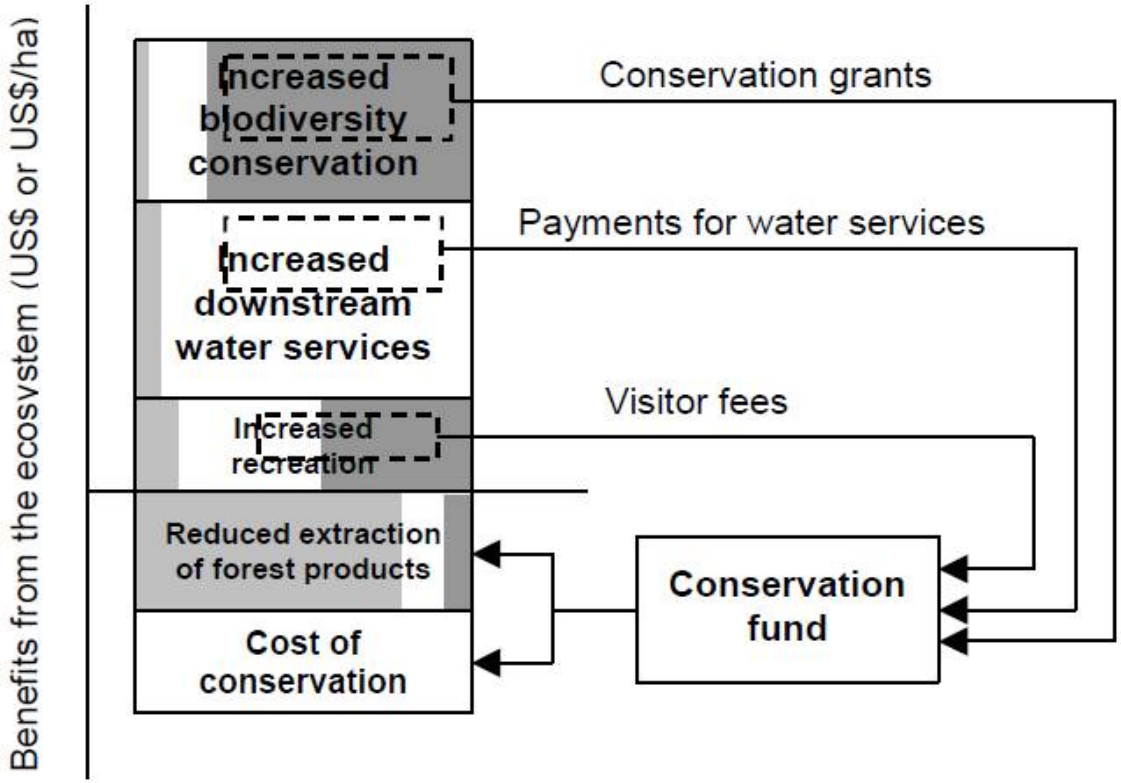


Table 8.1: Approaches to valuation

Approach	*Why do we do it?*	*How do we do it?*
Determining the total value of the current flow of benefits from an ecosystem	To understand the contribution that ecosystems make to society	Identify all mutually-compatible services provided; measure the quantity of each service provided; multiply by the value of each service
Determining the net benefits of an intervention that alters ecosystem conditions	To assess whether the intervention is economically worthwhile	Measure how the quantity of each service would *change* as a result of the intervention, as compared to their quantity without the intervention; multiply by the marginal value of each service
Examining how the costs and benefits of an ecosystem (or an intervention) are distributed	To identify winners and losers, for equity and practical reasons	Identify relevant stakeholder groups; determine which specific services they use and the value of those services to that group (or changes in values resulting from an intervention)
Identifying potential financing sources for conservation	To help make conservation financially sustainable	Identify groups that receive large benefit flows, from which funds could be extracted using various mechanisms

A. Objective Valuation Methods

1. MARKET PRICES APPROACH

For environmental products that have a market price, their monetary value may be estimated as follows :

[TV = P.Q.]

Total Value = Unit market price * Quantity

Eg. Price of various species vary by markets, by length, girth, age

Where :

Market prices are corrected for any known market and policy failures (e.g. externalities, taxes and subsidies)

Harvesting and transport costs are deducted form the gross value in order to derive the net value of a product. Account is taken of seasonal changes in market prices

Quantity harvested is based on maximum sustainable yield (MSY)

Market price analysis will tend to underestimate value since it does not account for consumer surplus

2. OPPORTUNITY COST OR SUBSTITUTION OR PRODUCTION FUNCTION APPROACH

VALUE OF MANURE IN TERMS OF EQUIVALENT CHEMICAL FERTILIZER

Consider the situation of Sukhomajri, the famous watershed experiment carried in the early 80s in lower Shivaliks hills in Haryana state. Under an integrated watershed programme, the villagers of Sukhomajri (and later on many other villages) took to stall feeding the cattle, thereby reducing the pressure on forest slopes. This activity alone enabled them to collect dung at their door step, usable as manure for their crop cultivation. Stall feeding has reversed the process of forest degradation. What is the value of stall feeding then ? It is evaluated in terms of the amount of chemical fertilizer saved in maintaining the crop agriculture. That is the value of the substitute for manure. The computation follows as **:**

⇨**The equivalence of manure per cattle per year is 30 kg of nitrogenous and 4 kg of phosphate fertilizer.**

⇨**As compared to the pre-watershed (and stall feeding) situation, the amount of dung collected has doubled (as per the survey in the villages).**

⇨**This is equivalent to 17 kg. of fertilizer per year (15 kg of nitrogeneous + 2 kg of phosphorus fertilizer), per animal per year.**

⇨**Going by the market price of fertilizer, the value of this fertilizer saved is Rs. 37.40 (per kg.) or Rs. 636 per animal per year.**

Summary based on : Chopra et. Al. 1990

3. DEPRICIATION OR NET PRICE APPROACH

This method determines the value of a resource at the beginning of a period as the volume of the proven reserve times the difference between the average market value per unit of the resource and the per unit cost of extraction, development and exploration (including a normal rate of return on invested produced capital). In the case of non-renewable (mineral) resources, this stock comprises only the proven reserves, that are exploitable under present economic conditions and therefore have a positive net price (Bartelmus et.al., 2001).

The net price method is based on the Hotelling rent assumption I.e. in a perfectly competitive market the net price of a natural resource rises at the rate of interest of alternative investment, offsetting the discount rate.

In practice, the cost of depletion is calculated by multiplying the depleted quantities of natural resources with the average net price at the beginning and end of the accounting period (UN, 2001)

4. DEPRICIATION OR NET PRICE APPROACH…….continued

The value of the resource at time T using the Net Price method would be given by :

$$V_t = (p_t - c_t)\, Q = N_t \cdot \sum_{t=0}^{T} Q_t$$

Where p_t - Price of the resource in period t

c_t - Unit cost of extraction, development and exploration (including a normal rate of return on invested produced capital)

$N_t = p_t - c_t$ = unit value of the resource has less the costs of extraction, development, and exploration

Q_t = Quantity exploited during period t.

Similarly the change in the value of the resource between time periods To and T1 would be given by :

$$-V = V_1 - V_o = (Q - Q_o)\, N_o - Q.N_o = -Q_o.N_o$$

5. USER COST ALLOWANCE APPROACH

El Serafy suggests that total resource rent cannot be deducted from GDP, acknowledging the fact that a resource-rich country has a real income advantage in comparison with a resource-poor country. A portion of the rent should be counted as value added, the reward for human effort.

The idea is to convert a time-bound stream of (net) revenues from the sales of an exhaustible natural resource into a permanent income stream by investing a part of the revenue, that is, the 'user cost' allowance over the lifetime of the resource. Only the remaining amount of revenues should be considered 'true income' (El Serafy as cited in Bartelmus et al., 2001).

Explicitely, R is the annual net revenue from the sales of the resource, assumed constant over its lifetime (of n years) 'true income' X can be calculated such that R-X represents the 'capital' element whose accumulated investment at an interest rate r duing the n years would create a permanent stream of income of X per annum. In other words,

$$R_0 + \frac{R_1}{1+r} + \frac{R_2}{(1+r)^2} + \ldots\ldots\ldots \frac{R_r}{(1+r)^T} = X_0 + \frac{X_1}{1+r} + \frac{X_2}{(1+r)^2} + \ldots\ldots\ldots + \frac{X_T}{(1+r)^T} + \ldots\ldots\ldots \infty$$

With R assumed to be constant (=R), this would give the true income X, as

$$X = R \left[1 - \frac{1}{(1+r)^{T+1}} \right]$$

and the user cost element as

$$R - X = R \left[\frac{1}{(1+r)^{T+1}} \right]$$

6. The Replacement Method or the Maintenance Cost Method:

According to this method the value of natural resource is determined by the restoration cost of produced and non-produced natural assets. This methods defines cost of a natural resource as the cost that would be incurred to maintain the original level of the resource at the beginning. For example, the replacement cost of ground water resources would be equal to the cost of recharge of this water to its original level. This approach has been widely used in the literature mainly for renewable natural resources. For instance, restoration cost of a forest compartment whenever, some replacement or alterations are to be done in forest areas is a common example in mining areas.

7. The Change in Productivity Method:

This method estimates the environmental cost is terms of loss of production arising from depletion of water resources is likely to reduce productivity in crop cultivation by (a) reducing the area under cultivation, (b) changing cropping pattern or © reduction in the yields. Or, degradation of land is likely to reduce yield per hectare in the similar way. Other applications can be on measuring the costs of soil erosion based on crop loss or water pollution based on fish stock damage. The technique is most appropriate when the environmental change directly causes an increase or decrease in the output of a good (or service), which is marketed.

B. Maintenance costing of natural asset:

Subjective Valuation Method

Subjective Valuation Methods measure possible environmental value as expressed or revealed in real of hypothetical markets. These methods can be broadly divided into Surrogate Market Valuation and Contingent Valuation.

Surrogate Market Valuation approaches use information relating to market goods to infer the value of an associated non-market good. The different valuation techniques used here are:

I. Hedonic Pricing

II. Travel Cost

A. PROPERTY PRICING / HEDONIC PRICING

(a) Identify how much of a property differential is due to a particular environmental quality difference between properties.

(b) Infer how much people are WTP for Increase in environmental quality

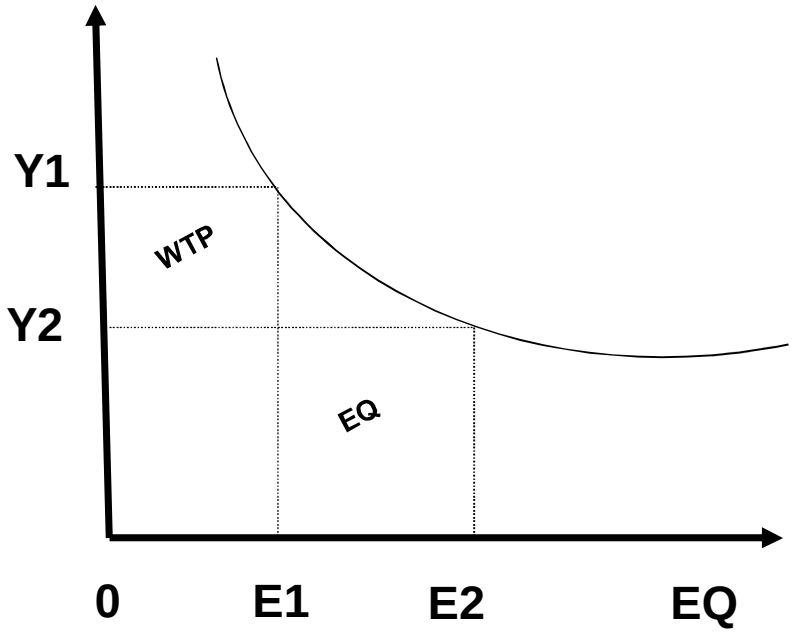


Fig: WTP for improvement in Air Quality

HEDONIC PRICING…….contd..

Various steps involved in this method are :

P=P (S.N,A,E) where

P=Property price, S = Structural characteristic of property/housing, N= neighborhood characteristics (e.g. Safety, market, relative, friends houses, employment, transport, recreational),A= Accessibility Variables (School, workplace, city centre) E= Environmental factor.

- **From information on the price function calculate the marginal WTP for the environmental factor or slope of the WTP curve that gives us the additional marginal WTP for an increase or decrease in environmental attribute E.**

HEDONIC PRICING

Various steps involved in this method are :

- **Identify a well functioning market in the first place.**
- **Compare market values for identical properties (in terms of rooms, size etc.) and see whether the presence or absence of the favorable environmental attribute is reflected in any price difference.**
- **Observations on many properties with and without the identified attribute to be valued. Need to have detailed descriptions of properties in order to rule out the effect of structural differences as opposed to the environmental attribute sought.**
- **Establish a statistical relationship – define the hedonic price function to show how price changes with the environmental attribute holding other things constant;**

Major factors people normally used in buying property in the city of Bhopal (Source : Economic valuation of BWL, Verma, 2001)

Table : Ranking Of Various Factors Considered while Buying Property

S.No.	Factor	Scores
1.	Drinking water	0.99
2.	Safety	0.94
3.	School Quality of Construction Hospital	0.88 0.87 0.87
6	Age of House	0.85
7.	Park Market Air Pollution	0.80 0.79 0.79
10.	Work Place	0.79
11.	Density Noise Pollution	0.70 0.70
13	Lake	0.67
14	Household Help	0.56
15	Road	0.31

High priorities are given to availability of drinking water, safety, existence of school for children, and nature of property. The reason for low preference for location near or in front of lake (0.67) is due to the fact that (I) the lake is no more clean and

(ii) Not many new properties are under construction as such due to lack of availability of vacant land. But the property prices of existing houses fetch high premium when they are resold.

The property prices seem to be affected by the major factors such as :

*** Neighborhood:- ranked on a scale of 1 to 5, with 1 = best neighborhood and 5= the worst;**

*** Market:-, ranked on a scale of 1 to 5, where rank 1 = very close to a good market and rank, 5= far away from a good market;**

*** Access:-, with rank 1 = when the area is close to the centre of the city, rank 5= far away from the heart of the city;**

*** Lake - Rank as 1= close to the lake; rank 2 = far away from the lake;**

*** Environment:- Rank 1= presence of sanitary conditions, cleanliness, parks and ample open spaces, otherwise lower ranks;**

*** Housing Density:- Very dense area sand similar extremely isolated areas were equally given low ranks while optimally populated areas were ranked at 1.**

An estimated regression equation linking the property price with these factors is obtained as:

Property value as Rs./sq.ft = -607.596 + 282.739* NEIGHBOURHOOD-

112.570* MARKET + 101.902* ACCESS + 185.896*Lake+ 111.047* ENVIRONMENT - 67.203 * HOUSINGH DENSITY .

(r squared + 0.781; All the t-statistics are significant for the estimated regression).

From the estimated equation, it is found that with all other factors set at their average, the presence of the lake alone seem to make a difference of Rs. 186 per square ft in the price of the property, which is quite significant.

• A partial correlation test was done between price in Rs/sq. ft and presence of lake and the value came out to be 0.495 adjusting for all parameters.

B. TRAVEL COST (TC) HOTELLING (1931), LAWSON (1939)

- **Measures Benefits associated with recreational resource – Parks, rivers, beaches.**
- **Measures the amount of money that people expend to use the resource (their TC).**
- **Get the value of 'attribute' i.e. recreational resource by exp. In another market.**

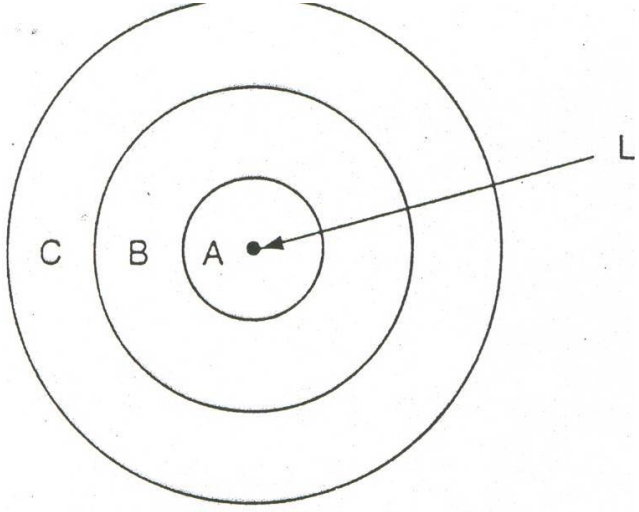


Fig 10.10 The location of a visitor attractio

Location of site

TRAVEL COST (TC) HOTELLING (1931), LAWSON (1939)……contd

V = f (tc, x)

V= No. of visits to the park (Visitation rate)

TC = TC to reach the park

X = Vector of other socio economic variables

•Zonal TCM (ZTCM)

Visitation rate = (No. of visits to the park / year from the zone) / (total population of the zone).

•Individual TCM (ITCM)

Calculation of consumer surplus

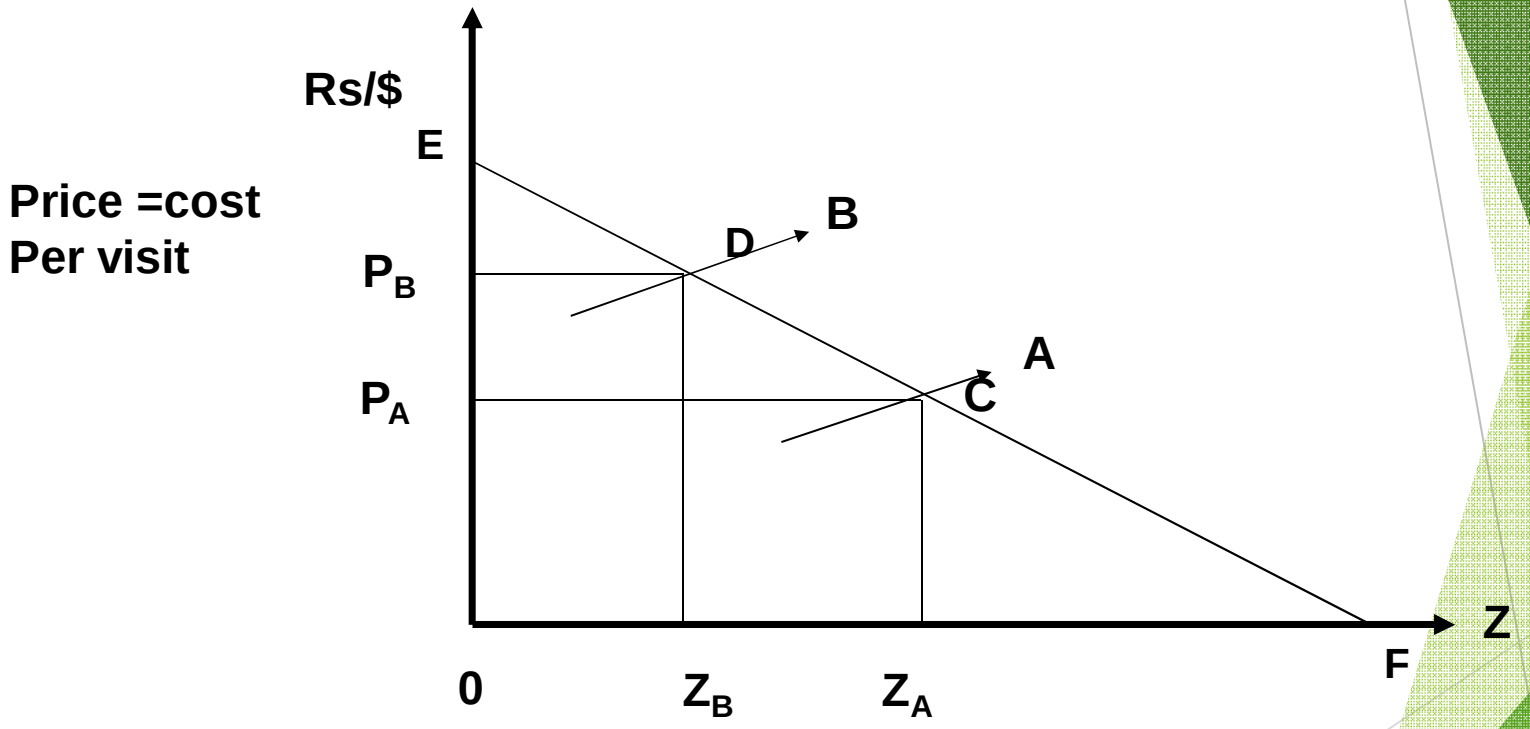
CS = [Total willingness to pay] – [Actual Expenses]

= [TWTP – AE]

or [Average WTP] – [Average Expenses]

TRAVEL COST (TC) HOTELLING (1931), LAWSON (1939)……contd

Workout CS for visitor to Zone A and Zone B etc.



Visit Frequency (visitor days per person per year)

VARIOUS STEPS IN A TCM STUDY

- **Divide the visitors into different distance or population zones as locals, domestic, foreigners and so on and treat them additively separable.**
- **If necessary (depending upon the site), mark out geographical zones as wildlife area, water bodies, flora area and so on.**
- **Obtain visitation rate for each distance or population zone, by sampled questionnaire method.**
- **Estimate TC on the basis of :**

  (a) Entry fees (EF)

  (b) Time spent in the area (T)

  (c) Various travel costs (TC)

  (d) Boarding and lodging costs (BL)

VARIOUS STEPS IN A TCM STUDY……..contd…

(e) Socio-economic status of visitor

- ➥ **Social status, education (ED)**
- ➥ **Income (INC)**
- ➥ **Age (A)**
- ➥ **Interest in and perception about envit (PE)**

[Cost should include - Direct expenses incurred by visitor getting to and fro from the site + opportunity cost of time spent travelling (tax, income foregone) at the site + Entry fees + other incidental expenses]

► **Demand Curve**

$$V_i = a + b\,TC_i + c\,INC_i + dED_i + ePE_i + fSTC_i + \ldots\ldots\ldots\ldots$$

Where V= No. of visits to the site, TC = Total Travel cost per visit, INC = Individual income, ED = respondents educational level, PE= Perception about envit, STC = travel cost to substitute sites, i= respondent as visitor or geographical zone or both, a,b,c,d,e = coefficients to be estimated

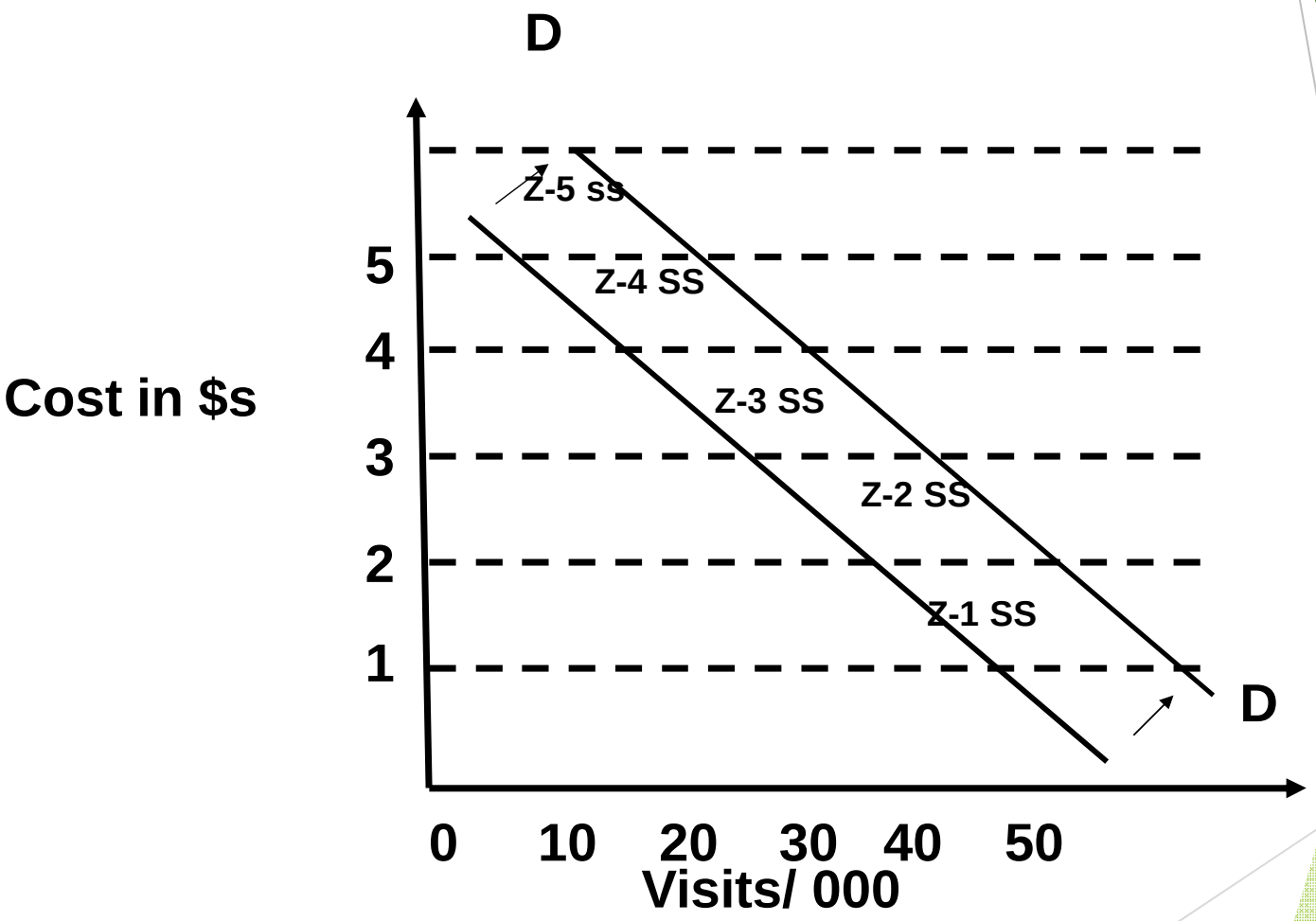
ZTCM and ITCM

ZTCM	ITCM
(i) Unit of analysis is zone	(i) Zoning concept is absent
(ii) Visitation rate is calculated for each zone (dependent variable)	(ii) Dependent variable is no. of visits by respondents to a site during a year.
(iii) VR = No. of units to a site per year / total population of the zone	(iii) No. of observation no. of respondents.
(iv) ZTCM is used when visitors are local, regional, foreign tourists.	(iv) Sample size is smaller
(v) Effect of population on visitation is accounted for no. of visits by each resident	(v) Visitors are locals
(vi) Sample size is large	(vi) Values zoos, amusement parks, (urban recreational centres.
(vii) Values national park, monuments, beaches.	

FOREST CAMPGROUND STUDY (ZTCM)

ZONE	COST ($)	NO. OF VISITORS	TOTAL POPULATION	VR	VISITS PER 1000 POPULATION
1	2	250	5,000	.05	50
2	3	400	10,000	.04	40
3	4	4,500	1,50,000	.03	30
4	5	1,600	80,000	.02	20
5	6	3,000	3,00,000	.01	10

DEMAND CURVE FOR TOTAL RECREATION



Demand curve for total recreation

Khecheopalri Lake (Wishing lake), Gyalshing district, West Sikkim

Khecheopalri lake is considered as one of the sacred lakes of this state both by the Buddhist and the Hindus. No water sport or other activities besides prayers are allowed around it.

Case : Valuing eco-tourism in a sacred lake of the Sikkim Himalaya, India.

- **Sacred lakes of the Himalayan region attract visitors and pilgrims from all over the world for their aesthetic, cultural and spiritual importance. The Sikkim Himalaya has more than 150 lakes at different altitudes and most are considered sacred.**
- **The recreational biodiversity and sacredness values of Khecheopalri, a lake situated in the west district of Sikkim state, India has been worked out to reflect the ecotourism value of the lake.**
- **Visitor numbers began to increase in Sikkim in 1990 as a result of a relaxation of regulations that opened a number of new areas to both domestic and foreign tourists.**
- **Until 1980, the state hosted only 15,454 visitors, but this had increased five fold by 1990, and reached 1,43,410 in 1998.**

- **The number of visitors to Khecheopalri lake has grown rapidly from 16068 in 1997 to 18713 in 1998. In 1998, 7800 visitors arrived at the lake form Sikkim as pligrims.**
- **About 78% of the pilgrims visited the lake for religious purposes and 16% cited the rich biodiversity of the area as their purpose in visiting.**
- **Approximately 56% of foreign visitors, 43% domestic visitors, 35% of local community members and 28% of pilgrims showed some interest in conservation and maintenance of watersheds.**

The salient features of the study are:

- **A sample survey of 360 visitors, consisting of 50 members of the local community, 140 pilgrims, 95 domestic and 75 foreign visitors was carried out.**
- **Only 180 respondents (20 community members, followed by 34 domestic, 51 foreign visitors and 75 pilgrims) showed their willingness to pay (WTP) for conservation and protection of the lake, while others refused to participate.**

III. CONTINGENT VALUATION

Theatre Approach/Constructed / simulated market based/ Direct Approach/ based on potential behavior

CONTINGENT – As the information sought from survey respondents conditional/contingent upon some hypothetical market context by describing amenity, actual or likely provision of amenity, people will respond contingent upon scenario described to them.

- **It elicits bids / valuation**

  (Open ended questions, payment cards, bidding games, Dichotomous choice – take it or leave it).

- **Question on attitudes, expectations, need and opinion – related to amenity.**

- **WTP and WTA.**

- **CV surveys are administered through personal interviews (IS), over telephone or by mail (questionnaire).**

- **Widely applicable to value / estimate benefits**
  - **of water quality improvement.**
  - **of reduced air pollution**
  - **of existence value of wilderness**
  - **of tourism project**
  - **of improved sewage**
  - **of improved water supply**
  - **to value reserves / heritage sites**
  - **to value improved landscape or aesthetic benefits**

Various steps involved in a CVM are:

1. Preparing the individuals or households in terms of their framework of mind about a hypothetical market situation to conserve, preserve or promote natural resources, for which they have to pay or spend. They should be fully convinced that there are no markets on such non-consumptive activities, but they are benefiting from such preservation.

2. There are two basic alternative approaches to CVM. First, a dichotomous question method, second open -ended question method. In the first instance, either a range or a binary choice is given to the respondents to state their preference. In the later case, they are asked to state their preference out of an open-ended range, say any thing more than Rs.5 Invariably, the open-ended question methods underestimate the WTP.

3. Give them an option of choosing from (a) a random set of values reflecting willingness to pay, or (b) an ordered set of values (preferably in a range or band).

4. After interacting with them further on the need for conservation and preservation of biodiversity, asking if they would revise their earlier preferred number or value (on WTA).

5. Also ascertain if they are willing to pay in labour time, in kind etc.

6. Collecting various socio-economic attributes about the individuals being interviewed,

7. Formulating a model (using a regression technique) of linking the WTA with the social-economic attributes of the individuals.

8.Simulating the model to arrive at a stable value for WTA (alternatively for the average individual).

II. Ordinal /Non Monetary Valuation Techniques

1. Contingent Ranking

√ Ranking & scores are obtained for range of products

√ Numeraire or anchor item with known value is used to obtain WTP of respondents for various products

√ Value of benefits are expressed in terms of the value of 'Numeraire'

Case: Contingent Ranking of Agro-forestry benefits in Zimbavwe

3. Conjoint Analysis (contingent choice Frameworks)

√ Basically a versatile marketing research technique that provides valuable information for new product development & fore casting, market segmentation & pricing decisions

√ Examines various trade-offs to determine the combination of attributes that will be most satisfying to the consumer.

√ Basis- In a real purchase situation, the consumers do not make choices based on a single attribute like comfort, instead they examine a range of ... or attributes and then make judgements or trade - off to determine their final purcahse ehoice.

Eg. Flight with extra-wide/ regular seats; costing $ 700 / $ 400 $ duration 5/3 hours.

Choice	Seat Comfort	Price	Duration
1.	Extra-wide	$700	5 Hours
2.	Extra-wide	$700	3 Hours
3.	Extra-wide	$400	5 Hours
4.	Extra-wide	$400	3 Hours
5.	Regular	$700	5 Hours
6.	Regular	$700	3 Hours
7.	Regular	$400	5 Hours
8.	Regular	$400	3 Hours

Choice 4: Most preferred

√ **Choice 5 : Least preferred**

√ **Preference for other choices is determined by what is important to that individual**

Hypothetical Utilities for an individual consumers

Duration	Utility
3 Hours	42
5 Hours	22

Comfort	Utility
Extra-wide seats	15
Regular seats	12

Cost	Utility
$400	61
$700	5

Other attributes: time of flight, day, meals, stop-over etc.

CA extended to NRM

Eg. Rank five different types of groundwater protection programs (Method of protections, cost of programme, length of payment, who would benefit)

I. Method of Protection (4 Alternatives)

*** Creation of town wide groundwater protections district (drilling new wells in areas where water is uncontaminated & placing development restriction land near well fields or recharge areas)**

*** Construction of water treatment facility.**

*** Installation of private pollution control device**

*** Purchase bottled water**

II. Cost of the Programme

Range from $ 0-$325/H.H./year

III. Length of Payment

(I) Payment each year for next 5 years

(ii) payment each year for next 10 years.

Iv. Who would Benefit

*** Participating HHs only on public water/ All HHs / Present generation only / Future generation also**

→ Statistical techniques are then applied to interpret the results.

→ Pictures are also used in rural surveys.

4. Multi Criteria Analysis (MCA): Composite Decision Making Criterion

→ What happens when markets do not exist (no market price) but people are aware of use values & there are many non-use values

→ Values are expressed ordinarily & not cardinally

→ Method is based on qualitative preferences :

higher the dependence/stake/interest → Higher preference → Higher will be the value/score assigned by people → also expresses people's perception for resource conservation/degradation.

→ **Quantitative & Qualitative variables are ranked, weighted to give utility scores composite criterion**

→**Relative values are obtained by scores/ ranks**

→ **Scores are standardized & weighted (Effects table : Alternatives & Effects) .**

→ **Appraisal scores**

→ **Scores can be converted into an absolute use value provided market value of one of the product exist (that product is used as Numeraire)**

$MU_i / MU_t = S_i / S_t = P_i / P_t$

$P_i = \frac{S_i \times P_t}{S_t}$

→ 't' test can be performed to test

NHo : No difference in value scores given to fuel, fodder, timber, grazing & NTFPs by villagers/ HHs located in different watersheds.

→ Relative value scores can be used to analyse socio-economic characteristics - land ownership, social status, perceptions based on gender etc.

→ DEFINITE PACKAGE to estimate the scores

Case: 1. Yamuna Basin in India

2. Pagbilao Mangroves in Phillipines

AIWAR WATERSHED (Source: Kadekodi 2000)

No. of H.Hs. 95

Average Productivity of Timber = 0.069 m^3 / Hectare / Year

Average Price of timber = Rs. 12,360/ m3

Forest Products	Rank	Score	Relative Value of Forest Resources (Rs/ Hectare)
Food	5	0.23	676.39
Fodder	2	0.92	2705.56
Fuel	1	1.00	2940.82
Timber	4	0.29	852.84
Grazing	3	0.51	1499.82
NTFP	4	0.09	264.67
Hunting	5	0.00	0.00
Asthetic	5	0.00	0.00

Note: Relative values of Products show WTP of people.

Case: of people who rely on forest as safety nets or for supplemental income

5. PARTICIPATORY ECONOMIC ANALYSIS

- social mapping and wealth ranking to differentiate stakeholder sub-groups.
- seasonal calendars and time lines to understand how the use and importance of wild resources varies over time, including analysis of price trend with key local informants to assess changes in resource scarcity;
- maps, model and transects to differentiate the resource and help understand the main historical changes in resource status;
- the use of role-plays to elicit the range of benefits
- matrix scoring and ranking techniques to elicit the relative values of direct and indirect use values (financial and non-financial);
- product flow diagrams and tenure maps to clarify resource control and access.

III. BENEFITS TRANSFER APPROACH

The basic idea is to 'borrow' an estimate of WTP in context i site and apply it to j site, but after making adjustments for the different feature of the two contexts. For example, if incomes vary between the two situations, we might have

$$WTP_j = WTP_i (Y_j / Y_i)^e$$

Where Y is income per capita, WTP is willingness to pay, and 'e' is the income elasticity of demand, i is usually called the *Study* site and j is the new /subject/ *target* or *policy* site.

Valuation Techniques and Application

COST-PRICE-INCOME- VALUE BASED APPROACHES

WTP & WTA across costs and benefits

	Benefits	Losses
WTP	To secure benefits	To minimize losses
WTA	To forgo benefits	To tolerate losses

Market price method

Type	**Revealed willingness to pay**
Element of TEV captured	Direct use and indirect use
Approach	Exchange value that regulating services have in trade.
Ecosystem services valued	Those that contribute to marketed products
Data requirements	•Demand of goods •Production costs and market price
Benefits	•Market data available and robust •Actual preferences •Standard economic techniques
Limitations	•Only for those which are marketed •Distorted market prices •Not suitable for measuring large-scale changes

Market price method - Application

- Bhitarkanika Mangrove Ecosystem (Badola & Hussain 2004)
  - Nutrient retention (US$ 3 mn/year)
  - Land formation (US$ 1 mn/year)
- Economic valuation of freshwater ecosystem services in US from 1971-1997 (Wilson & Carpenter 1999)
  - Fisheries
- The total economic value of Amazonian deforestation, 1978–1993 (Torras 2000)
  - Sustainable timber, NTFP

Factor income method

Type	**Revealed willingness to pay**
Element of TEV captured	Indirect use
Approach	Trace impacts of changes in regulating services on produced goods
Ecosystem services valued	Services that serve as inputs to market products
Data requirements	•Changes in ecosystem services •Impact of these changes on production
Benefits	•Relatively inexpensive •Standard economic techniques
Limitations	•Data intensive •Not all services serve as inputs to marketed goods •prone to double counting •Lack of biophysical understanding

Factor income method - Application

- Water-flow regulation in Yangtze river (Guo et al. 2000)
  - Process-based simulation model
  - Water retention and discharge -> Hydroelectric dam
  - Increase in electricity production = 40 GWH/year

- Vulnerability of world agriculture with pollinator decline (Gallai et al. 2009)
  - Production dependence ratio on pollinators
  - TEV of pollination worldwide = US$ 225 bn/yr
  - Consumer surplus = US$ 300-450 bn/yr

Hedonic pricing method

Type	**Revealed willingness to pay**
Element of TEV captured	Direct and indirect use
Approach	Extract effects of environmental factors on price of goods that include those factors
Ecosystem services valued	Air quality; Visual amenity; Landscape
Data requirements	•Prices of goods •Environmental and non-environmental characteristics of goods
Benefits	•Based on actual market transaction •Data availability
Limitations	•Data intensive; statistical expertise •Only captures WTP for perceived benefits •Heavily dependent on model design •Primarily related to property prices

Hedonic pricing method - Application

- Economic valuation of Bhoj wetland, India for sustainable use (Verma et al. 2001)
  - Regression analysis of property rates
  - Factors: location characteristics, market proximity, accessibility to other necessities, environmental factors and vicinity to the lake
- The amenity value of the urban forest (Tyrvainen 1997)
  - 1006 apartment sales data from North Carelia, Finland
  - Apartment characteristics, location and environmental quality variables

Travel cost method

Type	**Revealed willingness to pay**
Element of TEV captured	Direct and indirect use
Approach	Derive demand from data on actual travel costs
Ecosystem services valued	Recreational activities
Data requirements	•Monetary travel costs •Opportunity cost of time
Benefits	•Observed behavior •Relatively inexpensive •Results to easy to interpret and explain
Limitations	•Limited to recreational benefits •Trips to multiple destinations •Data intensive •Prone to biases and subjectivity

Travel cost method - Application

- Hell Canyon on Snake river
  - Hydroelectric dam proposal
  - Benefits (US$ 80000/yr) – Costs (US$ 900000/yr)
  - Congress voted to prohibit further development

- Travel cost method in Yuele Mountain Park, China (Tang 2009)
  - Assessment of recreation value
  - US$ 1 for local and US$ 1000 for non-local individuals
  - Calculation of optimum entrance fee

Damage /Defensive Cost : Replacement Replenishment / Rehabilitation /Relocation Cost based methods

Type	**Imputed willingness to pay**
Element of TEV captured	Direct and indirect use
Approach	Use cost of replacing the lost goods/services
Ecosystem services valued	Depends on relevant markets
Data requirements	•Extent of loss of goods/services •Cost of replacing them
Benefits	•Market data available and robust •Less data intensive •Estimates cost of producing the benefits
Limitations	•Fails to consider social preferences •Can overestimate the actual value •Mismatch between avoided damage or replacements and original benefit

Thanks for your patience listening