India Environmental Valuation Look-up (EVL) Tool

User Guide (Version 1.0)

December 2020

4 City Road
London EC1Y 2AA

+44 (0) 20 7580 5383
eftec@eftec.co.uk
eftec.co.uk

This document has been prepared for UNEP, MoSPI and UNSD by:

Economics for the Environment Consultancy Ltd (eftec)
4 City Road
London
EC1Y 2AA
www.eftec.co.uk

Study team

Adams Koshy
Erika Furbert
Georgie Conlan
Rohit Mistry
Francesco Cherchi

Reviewer

Ece Ozdemiroglu (eftec)

Acknowledgements

The India EVL tool was developed as part of the EU funded "Natural Capital Accounting and Valuation of Ecosystem Services" (NCAVES) project. eftec would like to thank the steering group members, from MoSPI, UNEP and UNSD for their comments.

Data for Development

United Nations

UNEP

Funded by the European Union

Disclaimer

Document evolution

Draft User Guide v1.0	14 December 2020	Ece Ozdemiroglu

This report is based on eftec's Version 1 - May 2019 report template

Summary

What is the tool?

The India Environmental Value Look-up (EVL) Tool (the tool) has been developed for the UN Environment Programme (UNEP), Indian Ministry of Statistics and Programme Implementation (MoSPI) and the United Nations Statistics Division (UNSD). This tool is for use by MoSPI staff and related Indian government departments to navigate a database of 82 valuation studies conducted in India, which have been identified as applicable for value transfer[1]. For full details on the development of the tool, please refer to the Technical Report.

How do I use the tool?

The tool is a Microsoft Excel workbook which 'looks-up' value estimates from a database using the search criteria (referred to as the 'policy context') set by the user. The search criteria includes the state, biogeographic zone, land cover and ecosystem service that you are interested in. Note, the tool database does not include value estimates for all combinations of these search criteria due to gaps in the evidence base and/or no suitable studies identified at the time of the development of the database.

The tool is structured as a series of five tabs (worksheets). As set out in Figure 2, all users (i.e. **the universal user**) should read

(1) **Welcome** tab for an overview of the tool, and
(2) **Look-up** tab for all users to complete the search steps in order to find the most relevant value estimates and provide a high-level summary.

Users who want more information about the value estimates (i.e. **an intermediate user**) should refer to the following tabs:

(3) **Detailed summary** – where relevant, this tab provides more information on value estimates that are reported at a unit value basis (i.e. per something), whether that is per hectare, per household or based on the specific product/service identified, and

(4) **Site-specific summary** – where relevant, this tab provides more information on value estimates that are reported as aggregate values for specific site(s).

[1] Out of a total of 301 economic valuation evidence identified for India. For more information, please refer to the Technical Report.

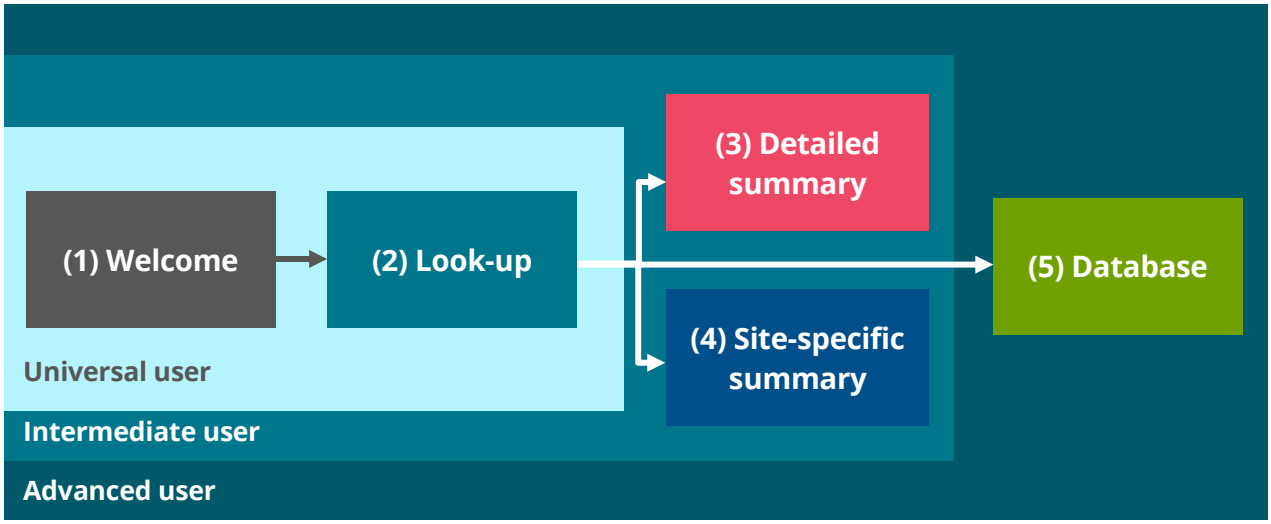


Figure 1: Tool structure for different users

Finally, users who would like to see all of the information that has been collected by the project team on all of the studies in the database (i.e. **an advanced user**) should refer to the **(5) Database** tab.

How do I interpret the value estimates?

The value estimates should be interpreted as:

- A reflection of the evidence in the literature reviewed for the tool specific to the context specified by the user;
- In most cases, they are not a one-to-one mapping to the impacts to be valued in a particular context, given nuances in the source study that cannot be captured by a tool; and
- They may help to determine where to focus further appraisal effort.

As a result, the value estimates are most applicable for:

A. **First-cut, rapid analysis of environmental impacts** (e.g. to scope the requirements of more detailed analysis); or

B. **Valuation of environmental impacts are secondary** in the appraisal/assessment context, relative to socioeconomic and/or health impacts.

How do I find out more?

Further details on how the tool was designed and populated can be found in the Technical Report. **It is strongly recommended that users of the tool consult an economist for guidance on the appropriate use of economic value evidence in an economic appraisal**.

For further guidance, please contact the EnviStats Team, at ssd-mospi@gov.in.

Contents

1. Introduction

The India Environmental Value Look-up (EVL) Tool (the tool) has been developed for the United Nations Environment Programme (UNEP), Indian Ministry of Statistics and Programme Implementation (MoSPI) and the United Nations Statistics Division (UNSD) for use by MoSPI staff and related government departments.

This User Guide accompanies the EVL. It provides supporting information on how to use the tool (Section 2) and how to interpret the results (Section 3).

1.1 Objectives and scope

The purpose of the tool is to provide a snapshot of economic values of ecosystem services/natural capital benefits from relevant, current literature[2]. To inform this, the scope of the tool is limited to studies that:

- Use economic valuation methods consistent with welfare economics theory;
- Reports economic valuation results;
- Uses data from 2000 onwards; and
- Describe the good or benefits and approach in sufficient detail for the estimates to be considered for value transfer.

The intended audience of this tool are MoSPI staff and related Indian government departments involved in economic appraisal and/or natural capital accounting.

For further guidance, please contact the EnviStats Team, at ssd-mospi@gov.in.

1.2 Overview of the tool

The EVL Tool is structured as a series of five tabs (worksheets). As set out in Figure 2, all users (i.e. **the universal user**) should read:

(1) Welcome tap for an overview of the tool, and
(2) Look-up tab for all users to complete the search steps in order to find the most relevant value estimates and provide a high-level summary.

Click on the boxes below to jump to the relevant section of the user guide.

[2] *This follows the approach that has been developed by eftec for the Department for Environment Food and Rural Affairs (eftec, 2015).*

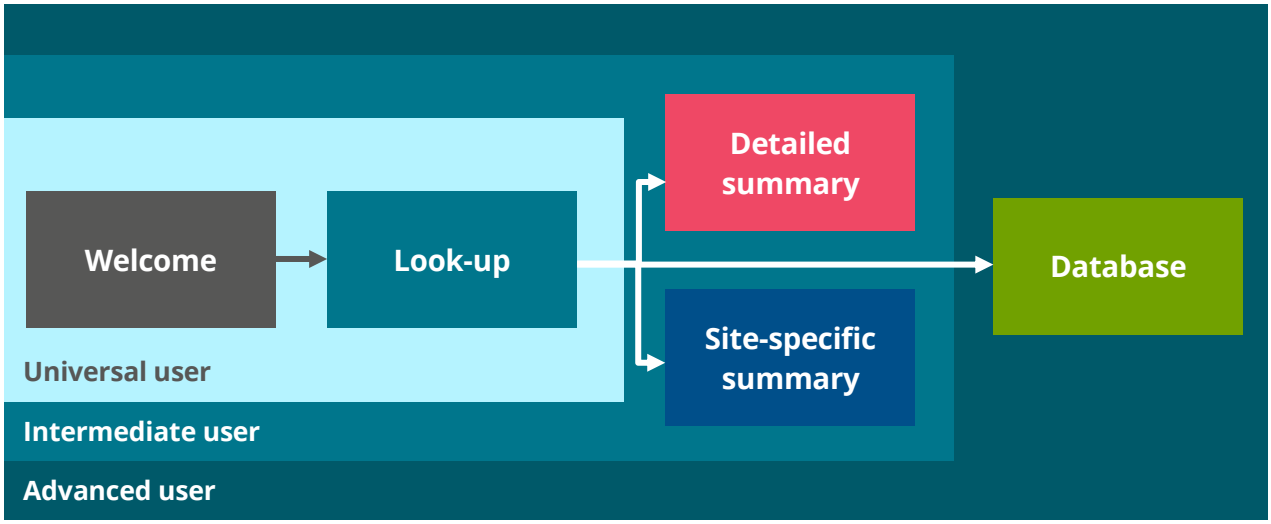


Figure 2: Tool structure

Users who want more information about the value estimates (i.e. **an intermediate user**) can refer to the following tabs:

(3) Detailed summary – where relevant, this tab provides more information on value estimates that are reported as marginal values per relevant unit, i.e. per hectare, per household or per unit of the specific product/service covered; and

(4) Site-specific summary – where relevant, this tab provides more information on value estimates that are reported as an aggregate value for a site.

Finally, users who would like to see all of the information that has been collected by the project team on all of the studies in the database (i.e. **an advanced user**) should refer to **(5) Database** tab.

Users

- I am curious about the functionality of the tool → **universal user**
- I would like to see what values are available for my specific context → **universal user**
- I would like to see the range of values that are reported within the value estimates → **intermediate user**
- I would like to find out some high-level information about the values within the value estimates → **intermediate user**
- I would like to see all the values available within the database → **advanced user**
- I would like to see more information about the assumptions, methodology, sampling, user population etc. → **advanced user**

2. Components of the tool

The following sections outline the contents of each tab of the tool.

Welcome	Provides information on the purpose of the tool and the structure. *Click here to return to the tool overview.*

The welcome tab is an introductory page to familiarise new users with the purpose and structure of the tool.

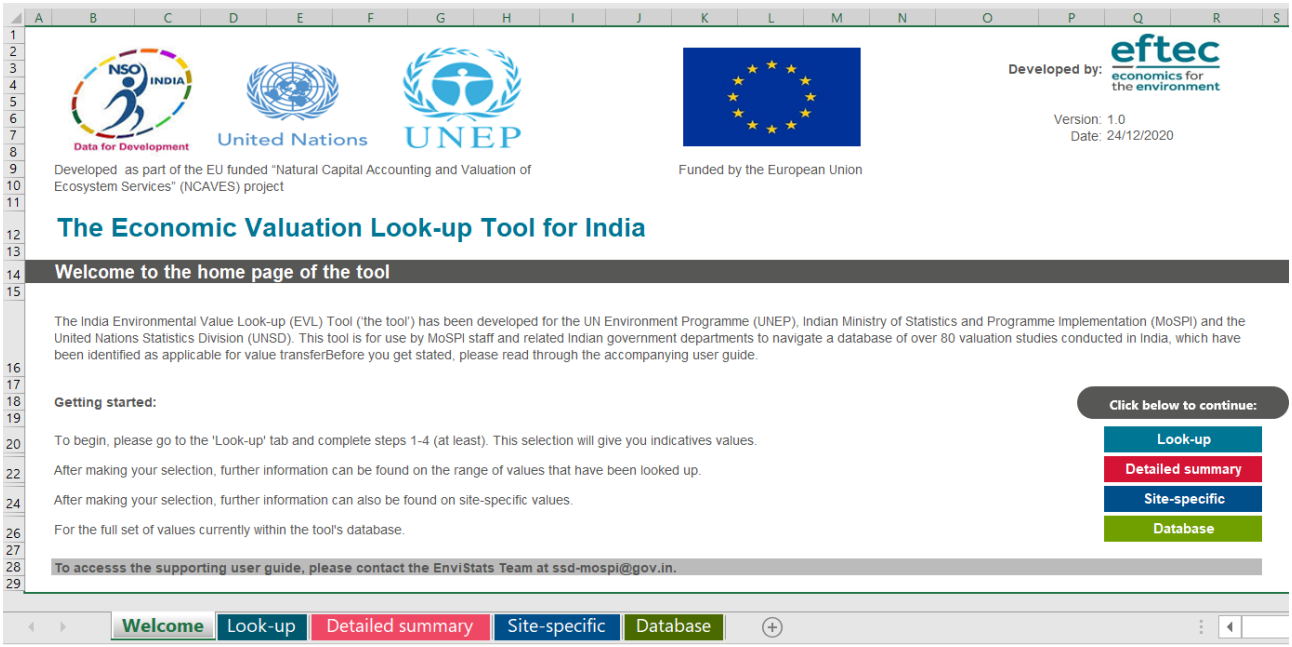


Figure 3: Welcome tab (screenshot)

Use the buttons on the welcome tab to jump to any of the tabs. Similarly, to return to the Welcome tab, please click on the button at the top right of each of the other tabs.

Look-up

Allows users to search the database for relevant value estimates and see a high-level summary of the available evidence.

Click here to return to the Tool overview.

All users are required to use this tab in order to look-up values. The tab is split into two parts: the top part is for the input from the user and the bottom part summarises the outputs of the look-up function.

Inputs – search criteria

It is essential that all users complete the steps in the look-up tab to retrieve value estimates that match your specific context.

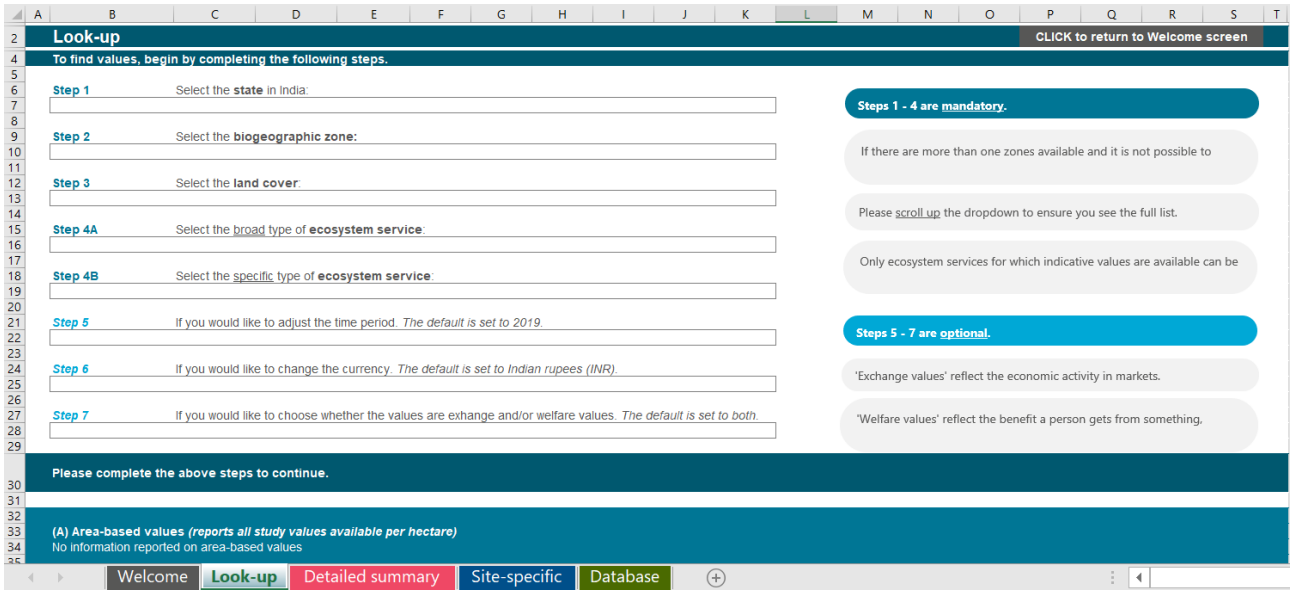


Figure 4: Look-up tab – Input (screenshot)

As set out in Figure 4, there are four mandatory search-steps that all users will have to complete, on the state (Step 1), biogeographic zone (Step 2), land cover (Step 3) and ecosystem service (Step 4A and 4B). A summary of these steps, a description of what you can expect to see on screen and the coverage of the database is reported in Table 1.

Table 1: The search steps you must complete on the look-up tab

Step	Description	Coverage of database
Step 1: Select the state	Select from the dropdown of Indian states and territories.	Data is currently only available for the following states/territories: • Andra Pradesh • Arunachal Pradesh • Assam • Bihar • Goa • Gujarat • Haryana • Himachal Pradesh • Karnataka • Kerala • Madhya Pradesh • Maharashtra • Manipur • Meghalaya • Mizoram • Nagaland • Odisha • Punjab • Rajasthan

Step	Description	Coverage of database
		• Sikkim • Tamil Nadu • Telagana • Tripura • Uttarakhand • Uttar Pradesh • West Bengal • Andaman and Nicobar Islands • Delhi • Jammu and Kashmir
Step 2: Select the biogeographic zone	Select from the dropdown of biogeographic zones in India. Alternatively if there are more than one zone for the state and you are uncertain about which biogeographic zone is relevant, please select 'All available zones'. Depending on your selection in Step 1, this dropdown will automatically update to reflect the relevant biogeographic zone(s) for the selected state. However, if there is no information in the dropdown, this indicates that there are no value estimates available for that zone for that state.	Data is currently available for only nine (out of ten) bio-geographic zones: • Trans Himalaya • The Himalaya • Semi-Arid • The Western Ghats • The Deccan Peninsula • The Gangetic Plains • The Coasts • North-East India • Islands
Step 3: Select the land cover	Depending on your selection in Steps 1 and 2, this dropdown will automatically update to reflect the relevant land cover(s) where values are reported in the database.	Data is currently available for all the land covers: • Built-up • Agriculture

Step	Description	Coverage of database
		• Forest • Grass/grazing • Barren /unculturable /Wasteland • Wetlands/ Water Bodies • Snow
Step 4A: Select the broad type of ecosystem service	Depending on your selection in Steps 1 to 3, this dropdown will automatically update to reflect the relevant broad type(s) of ecosystem services where values are reported in the database.	Data is currently only available for the following ecosystem services: • Crop provisioning services • Grazed biomass provisioning services • Timber provisioning services • Non-timber forest products (NTFP) and other biomass provisioning services (incl those related to hunting and trapping and bio-prospecting activities) • Fish and other aquatic products provisioning services • Water supply • Genetic material services • Land accretion services • Global climate regulation services • Rainfall pattern regulation services (at sub-continental scale) • Local (micro and meso) climate regulation services • Air filtration services • Soil quality regulation services • Soil erosion control services (includes also sediment retention services) • Water purification services (water quality amelioration) - Retention and breakdown of organic pollutants including excess nutrients
Step 4B: Select the specific type of ecosystem service	Depending on your selection in Steps 1 to 4A, this dropdown will automatically update to reflect the relevant specific type(s) of ecosystem services where values are reported in the database.	

Step	Description	Coverage of database
		• Water purification services (water quality amelioration) - Retention and breakdown of inorganic pollutants • Water regulation services - Baseline flow maintenance • Water regulation services - Peak flow mitigation • Flood mitigation services - Seawater (Tidal) surge mitigation (Coastal protection services) • Flood mitigation services - River flood mitigation • Storm mitigation services • Noise attenuation services • Pollination services • Pest control services • Nursery population and habitat maintenance services • Solid waste remediation • Tourism recreation-related services • Local recreation-related services • Amenity services • Education, scientific and research services • Spiritual, symbolic and artistic services • Ecosystem and species appreciation services • Abiotic Services • Not elsewhere classified

For more information on the dropdowns for the state, biogeographic zones, land cover and ecosystem services, please refer to Annex A. Annex A also includes information on all of the additional information for the database.

Please see Figure 5 for a completed example of Steps 1 – 4.

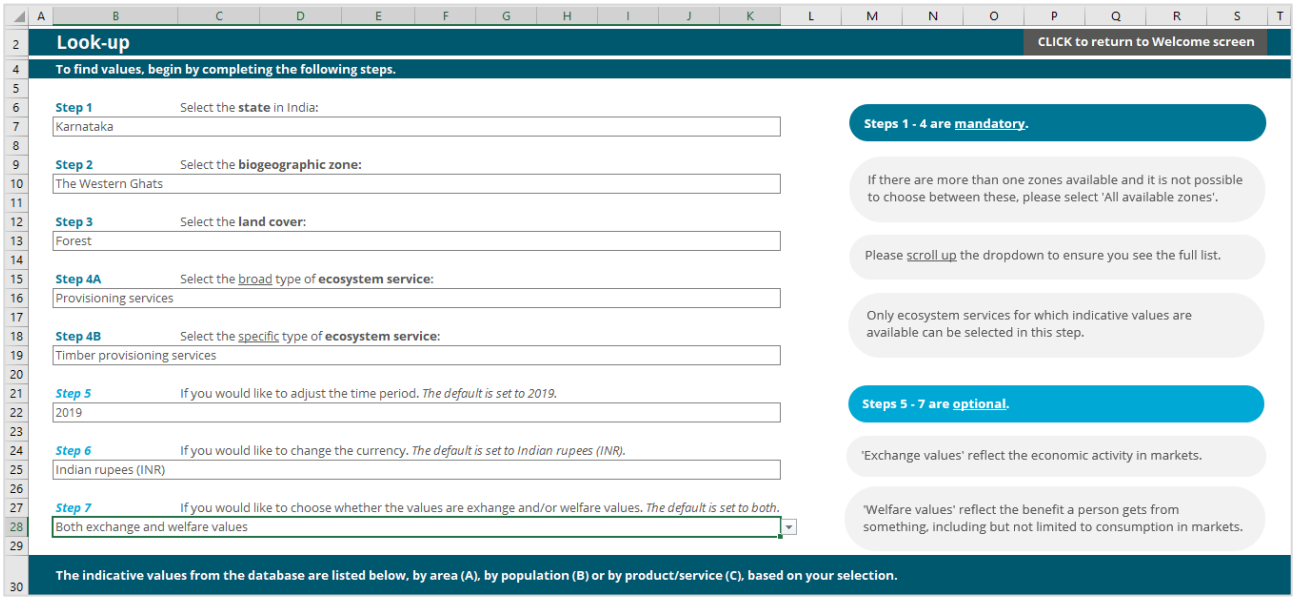


Figure 5: Look-up tab – input completed

Please scroll up the dropdown to ensure that you have seen the full list.

For intermediate and advanced users, the tool provides additional functionality, where you can:

- In **Step 5**, select the time period (i.e. the base year) that you would like the results to be reported for – the default is set to 2019;
- In **Step 6**, select whether results should be reported in Indian rupees (INR) or USA dollars (USD) – the default is set to INR; and
- In **Step 7**, select whether value estimates should be exchange values and/or welfare values (see box below for the difference) – the default is set to both.

Depending on your selection, row 30 will provide details on the type of value estimates available in the database – whether that is for a marginal change or in aggregate (see box below).

Types of values

Different valuation methods use different types of data to estimate individuals' preferences. All methods report the value estimates in monetary terms. The key distinction is between data that reflect the economic activity in markets ('exchange values') and data that reflect the benefit a person gets from something, including but not limited to consumption in markets ('welfare values')[3].

Irrespective of the approach, both types of values can be estimated for a specific 'marginal' change (e.g. an increase in purchases, or in visits to a recreational site), or in 'aggregate' (e.g. the total value of market purchases, or of all visits to a recreational site – which is equivalent to a change from zero - i.e. no market or no asset).

If Steps 1 – 4 are not been completed, row 30 will state "Please complete the above steps to continue".

Results

The second part of the tab reports the results of the 'look-up' of value estimates as either: (I) marginal values per relevant unit; or (II) aggregate values for specific site(s).

(I) marginal values

Depending on your selection, these values will be reported by:

A. Area-based values: reported per hectare;
B. Population-based values: reported per household, or
C. Product/Service-based values: value estimates that are reported per unit of the product or service, e.g. cubic metres of timber, litres of water.

Each section reports the following information: (i) the number of relevant value estimates found in the database; (ii) the value estimates in monetary units; and (iii) the study commentary showing an assessment of the estimates' suitability for value transfer.

[3] *Under some conditions exchange values are a good measure of welfare, but this is often not the case for environmental goods and services, nor in relation to public goods for which there are no exchange values because no market exists. For example, outdoor recreation or benefits to human health from better air quality can often be free to access, but nevertheless have high welfare.*

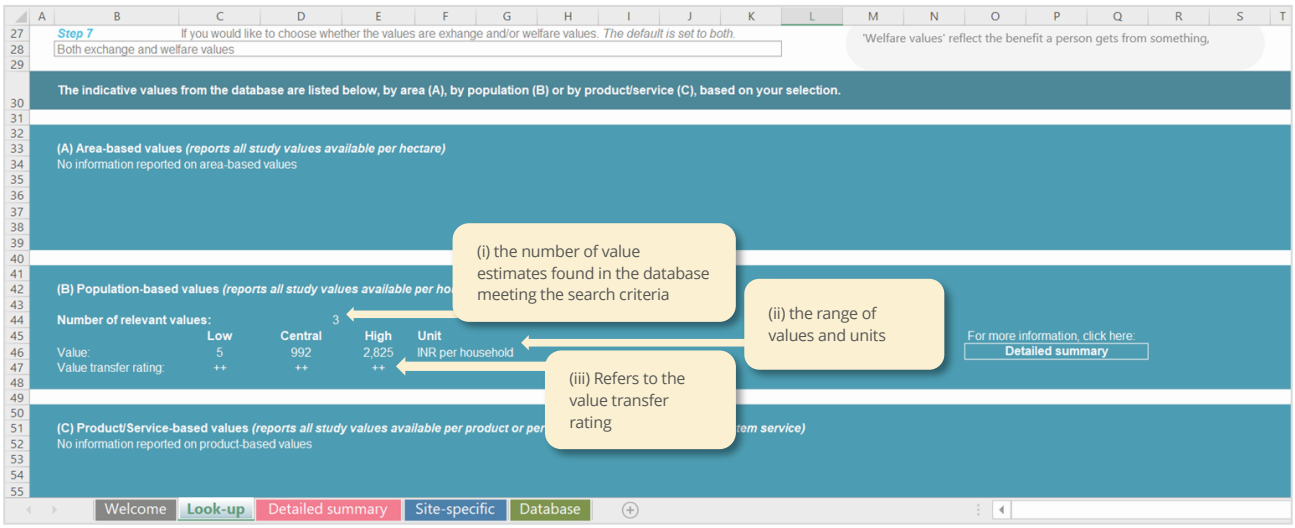


Figure 6: Look-up tab – Output for marginal values (screenshot)

For more information on the values under each type, click the 'Detailed summary' button to go to the tab *Detailed summary*.

Although the units for values reported in (A) and (B) values are standardised, for (C) (Product/Service-based values) units vary depending on the type of product and service selected. As a result, if there is no consistent list of units applied, the range of values will not be reported in the Look-up tab and the full list of values will be shown only in the Detailed summary tab.

(II) Aggregated site-specific values

Depending on your search criteria, the database may include estimates of all values attributed to all benefits provided by a site. These aggregated (i.e. total) values are unique to a location within the state and biogeographic zone selected. In these instances, information will appear in the blue box on screen (Figure 7). A maximum of the first four site-specific values will be reported. Any further sites will be reported in the Site-specific tab. Note, this may include more than one reference to the same site, if there are more than one value for the same site.

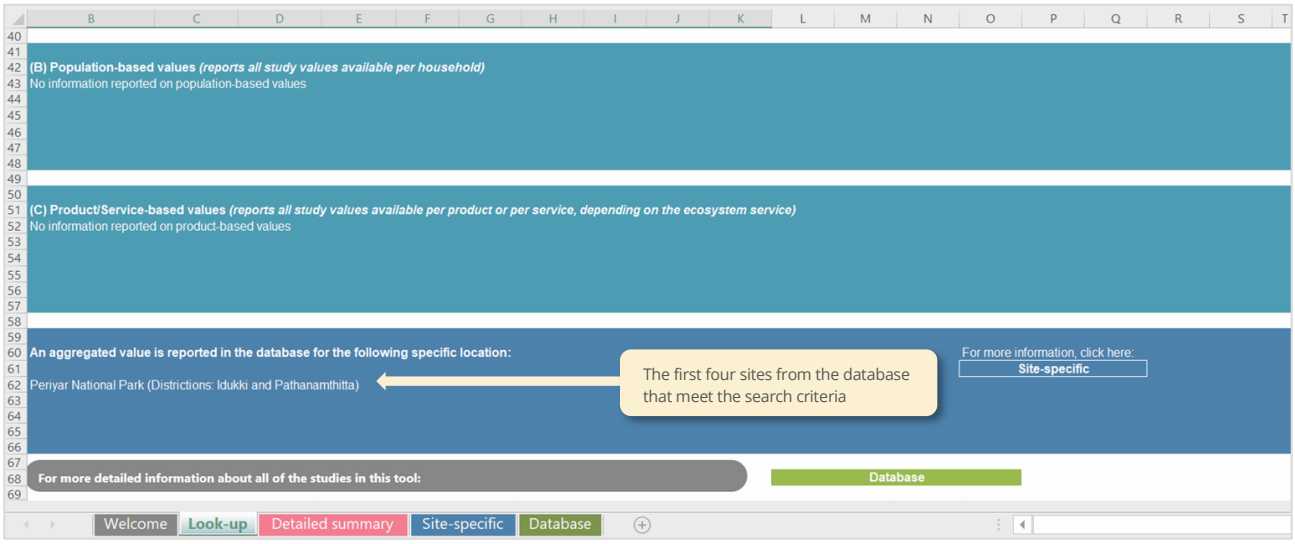


Figure 7: Look-up tab – Output for aggregated site-specific values (screenshot)

For information on the values, click the button to go to the tab *Site-specific*.

Detailed summary

Based on the value estimates, (where relevant) see more information about the range of values reported.

Click here to return to the tool overview.

As with the look-up tab, the detailed summary tab is organised based on the type of value estimate: (A) area-based values; (B) population-based values; and (C) product/service-based values. All three sections are organised in the same format, where information is presented in:

- A graphical representation of the range of values; and
- A tabular reporting of the values and key datapoints alongside this (see below for more information).

Depending on the value estimates selected, the information reported in the tab will automatically update. The figures below showcase two potential ways that information may be reported. In Figure 8, only two value estimates (from a single paper) are relevant for (A) area-based values, both of which only have central values.

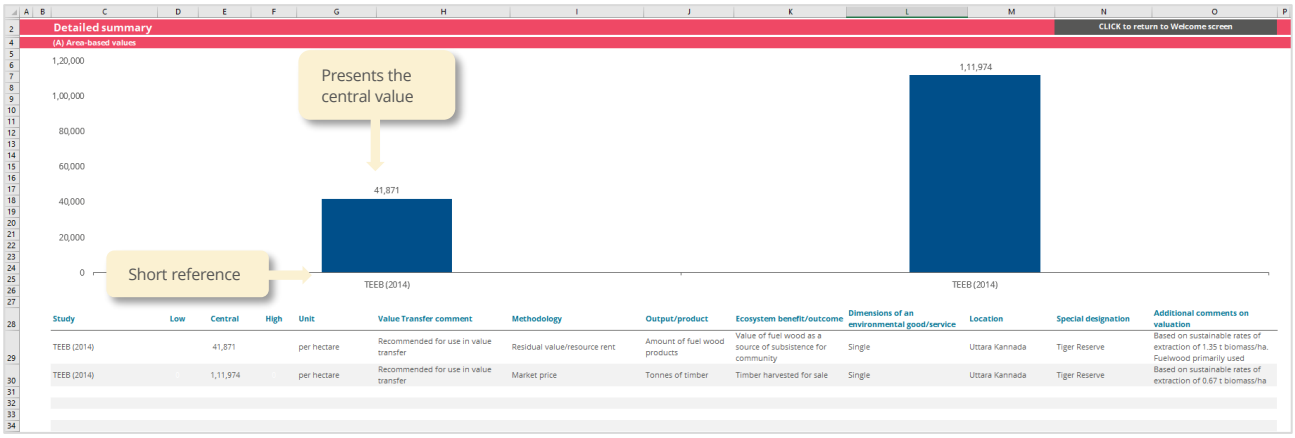


Figure 8: Detailed summary tab – single central values (screenshot)

In Figure 9, nine values are relevant (also from a single paper) for (B) population-based values, all of which include a range.

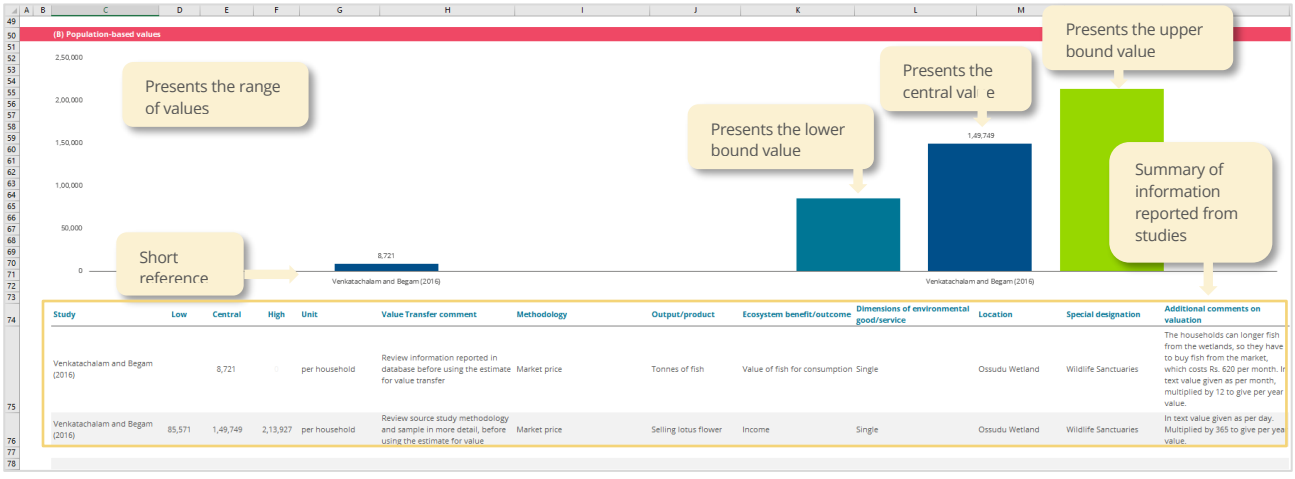


Figure 9: Detailed summary tab – range of values (screenshot)

Table 2 summaries the key information reported. For more information about each attribute please refer

to Annex A.

Table 2: Summary of information reported in 'Detailed summary' tab

Attribute	Description
Study	Short reference of study
Values	Range of value estimates reported (where available)
Unit	The units associated with the value
Study comment	A short commentary on each study, based on the information provided in the studies – see Annex B for more information
Methodology	The methodology used to estimate the value
Output/product	The output of the ecosystem service (e.g. crops)
Ecosystem benefit/outcome	The outcome to humans from the ecosystem service (e.g. income from crops)
Dimensions of an environmental good/service	Whether the value refers to a single dimension (i.e. only the service that you have selected) or multiple dimensions
Location	A short description of the location within the state selection
Special designation	A short description/classification of the special designation (where applicable)

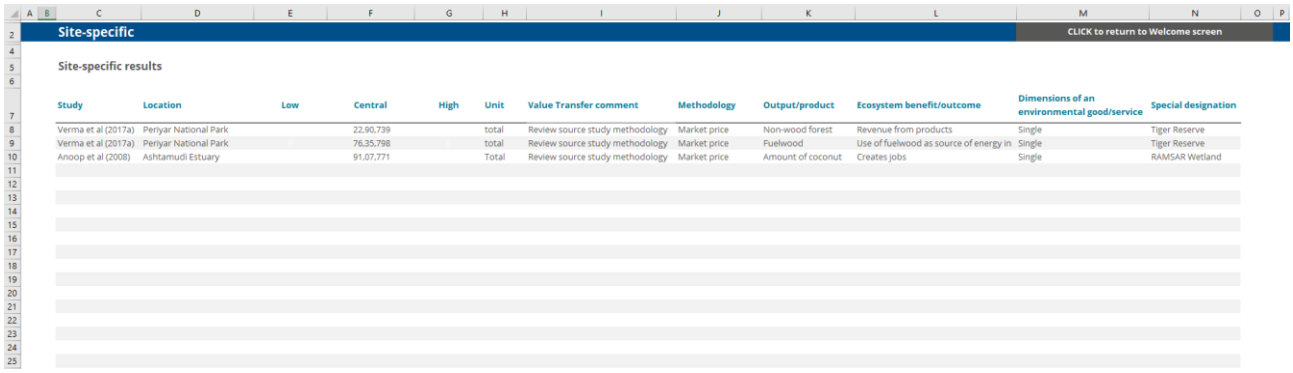
If the value estimate from a study covers multiple ecosystem services, using such an estimate to value one ecosystem service would lead to an overestimate of that service.

Site-specific summary

Based on the value estimates, (where relevant) see more information about the site-specific values reported.

Click here to return to the Tool overview.

Some studies report the aggregate value estimates for all the benefits provided by a site or in terms of all beneficiaries. Where more information is reported on the benefits and beneficiaries in the original study, this is reported in the tool. However, it is not possible to apportion these aggregate values to the units of household or area (e.g. per hectare). As with the detailed summary tab, key information is summarised in Table 2 (above).



Site-specific

CLICK to return to Welcome screen

Site-specific results

Study	Location	Low	Central	High	Unit	Value Transfer comment	Methodology	Output/product	Ecosystem benefit/outcome	Dimensions of an environmental good/service	Special designation
Verma et al (2017a)	Periyar National Park		22,90,739		total	Review source study methodology	Market price	Non-wood forest	Revenue from products	Single	Tiger Reserve
Verma et al (2017a)	Periyar National Park		76,35,798		total	Review source study methodology	Market price	Fuelwood	Use of fuelwood as source of energy in	Single	Tiger Reserve
Anoop et al (2008)	Ashtamudi Estuary		91,07,771		Total	Review source study methodology	Market price	Amount of coconut	Creates jobs	Single	RAMSAR Wetland

Figure 10: Site-specific tab (screenshot)

Database

Reports the full set of results collated for the 82 studies.

Click here to return to the tool overview.

This tab provides the summary of all information that has been collated for the 82 studies. Each row in the database refers to a unique value. The database reports information on all of the following broad categories:

I. Reference information – summary of the study's reference;
II. Land cover – (one or more) land cover/land use category the value refers to;
III. The good – information on the policy context and details on the good/service valued;
IV. The change – information on the change in the good/service valued;
V. Value evidence – details on the value(s) reported, including units, year of the assessment etc.;
VI. Method(s) – summary of the methodology, the validity/robustness of the results and the sample;
VII. Location – overview of the location the study was assessed for;
VIII. User/non-user population – information on the users and/or non-users assessed by the study;
IX. Substitutes – information on any substitutes that are considered as part of the assessment; and
X. Market constructs – summary of the market construct for the good/service valued.

For more detailed information on these categories, please refer to Annex A.

For more information on the database, please refer to the technical report.

3. Interpretation of results

The primary purpose of the tool is to provide easy access to a selection of value estimates from India to inform economic appraisal, policy briefings and/or ecosystem accounting. The applicability of these estimates to a particular context will depend on:

- The level of accuracy in evidence required for the decision to be made in each context;
- The expected significance of the environmental impact; and
- The proportionality of effort in appraisal, including the time and resources available for gathering and analysing the assessment of impacts, compared to the significance of environmental impacts or the value of the project or policy appraised.

Value estimates are not suitable for use in situations where significant environmental impacts are expected[4]. In principle, the value estimates are most applicable for:

A. **First-cut, rapid analysis of environmental impacts** (e.g. to scope the requirements of more detailed analysis); or

B. **Valuation of environmental impacts are secondary** in the appraisal/assessment context, relative to socioeconomic and/or health impacts.

Key points for interpreting and understanding the use of value estimates are:

- **Value estimates should be interpreted as broad generalisations of the values that have been observed for different environmental goods and impacts**. This monetary evidence may be informative in appraisal weighing environmental impacts alongside other economic and social impacts of a policy or project.
- **In most cases value estimates will not provide a one-to-one mapping to the impacts (costs and benefits) to be valued in a particular appraisal**. The source study valuations relate to various levels of provision of environmental goods and different types and scales of impact. There is a 'margin of error' when using value estimates. This is due to the uncertainty resulting from using the source valuations in a broad and generalised way.

  The tool has limited scope for adjusting value estimates to account for context specific factors in an appraisal such as the current level of environmental quality / provision of the environmental good; the scope of the change in its provision; the location and timing of this change; etc. More detailed assessments that build on a first-cut analysis provided by the tool should aim to provide an explicit account of these factors. Further guidance is provided in Defra's value transfer guidelines (eftec, 2009).
- **Value estimates may help determine where to focus further appraisal effort**. This can include highlighting the need for more detailed value transfer or primary valuation evidence where: (i) the scale of environmental impacts influences cost-benefit analysis results that inform policy or project options (including mitigation options); and/or (ii) where the trade-offs between different impacts (environmental or otherwise) is uncertain.

[4] A more detailed assessment of impacts will be required with more robust approach to valuation, such as formal value transfer or primary economic valuation.

References

eftec (2010). Valuing Environmental Impacts: Practical Guidelines for the Use of Value Transfer in Policy and Project Appraisal. Report for the Department for Environment, Food and Rural Affairs. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/182376/vt-guidelines.pdf

eftec (2020). India Environmental Valuation Look-up (EVL) Tool – Technical Report. Final report.

IUCN (2020). The IUCN Global Ecosystem Typology v1. 01: Descriptive profiles for Biomes and Ecosystem Functional Group.

Rodgers, W.A. and Panwar, S.H. (1988) Biogeographical classification of India. New Forest, Dehra Dun, India

UNSD (2020a). Chapter 6: Ecosystem services concepts for accounting. In: System of Environmental-Economic Accounting 2012 - Experimental Ecosystem Accounting Revision. July.

UNSD (2020b). Chapter 9: Accounting for ecosystem services in monetary terms. In: System of Environmental-Economic Accounting 2012 - Experimental Ecosystem Accounting Revision. Chapter Draft prepared for global consultation. May 2020.

Annex A: Database components

The database tab presents a summary of all the information that has been collected from the 82 studies. An outline of the aspects of the database is set out in **Table 3**, with additional details on the contents of each category. In addition, details are included in the tables (**Table 4 – 9**) and figures (**Figure 11 – 12**) below.

Table 3: Aspects of the database

Category	Details
I. Reference information	• Study ID • Author(s) • Publication year • Year of data used/study conducted • Publication reference
II. Land cover	• Land cover/Land use, which follows Level I of India's LULC classes - see Table 4

III. The good	• Description of the policy good context.
	• Natural capital asset, which follows the IUCN Global Ecosystem Typology – see Table 5
	• Ecosystem service, which follows current UNSD guidance, with additions identified during the research – see Table 6
	• Outputs or ecosystem benefits of the service
	• Outcomes, which lists the outcomes to users/non-users of the ecosystem service.
	• The physical characteristics of the good
	  ○ Including whether it is a commodity or service, and the dimensions of the environmental good/service
	  ○ Including any special designations (e.g. a tiger reserve) based on the ENVIS Centre on Wildlife and Protected Areas – see Table 7
	• Component(s) of total economic value estimated – see Figure 11
	• Whether the good is market or non-market.

IV. The change	• The description of change
	• The nature of the change:
	  ○ Whether a quantity change (e.g. an increase in carbon emissions), quality change (e.g. an improvement in water quality) or both.
	  ○ Improvement / deterioration
	  ○ Whether an acute (e.g. an accident), chronic (ongoing) change or not relevant
	  ○ Whether a marginal or non-marginal change
	• The quantity of change, including the unit(s)

V. Value evidence	• Monetary value (central and ranges) and the original currency and year • Unit(s) • Type of unit • Currency • Year of assessment

Category	Details
	• Whether the value is annual or one-off • Whether the value is an exchange or welfare value • Whether the value is an aggregate estimate, unique to a location (Y/N answer)

VI. Method(s)	• Methodology used in the study, largely based on UN SEEA Chapter 9 – see Table 8
	• The validity / robustness of the results
	  ○ Whether the function has been defined (Y/N answer)
	  ○ Whether information is reported and sampling and tests of validity (Y/N answer)
	• The sample
	  ○ The size of the sample and its units
	  ○ Whether a description of the sample has been provided (Y/N answer)
	  ○ Whether information is reported on the sampling method (Y/N answer)

VII. Location	• Biogeographical region, following India's 10 biogeographic zones – see Table 9 and Figure 12 • States, with all states and provinces in India • Specific location, if provided

VIII. User/Non-user population	• Report separately for users and non-users:
	  ○ Whether describe the population (Y/N answer)
	  ○ The type of user
	  ○ The size of the population
	  ○ Whether the population is Indian and/or tourist
	  ○ The frequency of use
	  ○ Socioeconomic characteristics, especially income

IX. Substitutes	• Description of the substitutes for the good
X. Market constructs	• State the market construct

Table 4: Land Use/land cover

Sl.	Level I	Level II
I.	Built-up	Urban
		Rural
		Mining
II.	Agriculture	Crop land
		Plantation
		Fallow
		Current Shifting cultivation
III.	Forest	Evergreen / Semi-evergreen
		Deciduous
		Forest Plantation
		Scrub Forest
		Swamp / Mangroves
IV.	Grass/ Grazing	Grass/ Grazing
V.	Barren / unculturable /Wasteland	Salt Affected Land
		Gullied / Ravinous Land
		Scrub land
		Sandy area
		Barren rocky
		Rann
VI.	Wetlands / Water Bodies	Inland Wetland
		Coastal Wetland
		River / Stream / canals
		Water bodies
VII.	Snow	Snow

Source: MoSPI LULC

Table 5: Natural capital asset reference list

Natural Capital Asset	Description
Tropical-subtropical forests biome	The Tropical-subtropical forests biome includes moderate to highly productive ecosystems with closed tree canopies occurring primarily at lower latitudes north and south of the equator.
Temperate-boreal forests and woodlands biome	Temperate-boreal forests and woodlands biome include moderate to highly productive tree-dominated systems with a wide range of physiognomic and structural expressions distributed from warm-temperate to boreal latitudes.
Shrublands and shrubby woodlands biome	The Shrublands and shrub-dominated woodlands biome includes oligotrophic systems occurring on acidic, sandy soils that are often shallow or skeletal.
Savannas and grasslands biome	Ecological functions within the Savannas and grasslands biome are closely linked to a continuous ground layer of grasses that contribute moderate to very high levels of primary productivity driven by strongly seasonal water surplus and deficit cycles.
Deserts and semi-deserts biome	The Deserts and semi-deserts biome includes low to very low biomass ecosystems occurring in arid or semiarid climates, principally associated with the subtropical high-pressure belts and major continental rain shadows.
Polar-alpine (cryogenic) biome	The Polar-alpine biome encompasses the extensive Arctic and Antarctic regions as well as high mountainous areas across all continental land masses. Primary productivity is low or very low, strictly seasonal and limited by conditions of extreme cold associated with low insolation and/or high elevation, further exacerbated by desiccating conditions and high-velocity winds. L
Intensive land use biome	Intensive land-use systems include major anthropogenic enterprises of cropping, pastoralism, plantation farming, and urbanisation. Maintenance of these systems is contingent on continuing human interventions, including alterations to the physical structure of vegetation and substrates (e.g. clearing, earthworks, and drainage), the supplementation of resources (e.g. with irrigation and fertilisers), and the introduction and control of biota.
Anthropogenic subterranean voids biome	The Anthropogenic subterranean voids biome includes a single functional group of ecosystems that owe their genesis to excavation by humans. They include underground mines, transport tunnels, tombs, defence and energy installations, and other infrastructure.
Palustrine wetlands biome	At the interface of terrestrial and freshwater realms, the Palustrine wetlands biome includes vegetated floodplains, groundwater seeps, and mires with permanent or intermittent surface water.
Rivers and streams biome	The Rivers and streams biome includes lotic ecosystems throughout the world, flowing from elevated uplands to deltas, estuaries, and lakes. They are defined primarily by their linear structure, size, and flow regimes.
Lakes biome	The Lakes biome includes lentic ecosystems defined by their still waters. They vary in area, depth, water regime, and connectivity to other aquatic systems across a global distribution. Gradients in water regimes, temperature, lake size, and salinity exert critical influences on the function, productivity, diversity, and trophic structure of lake ecosystems.
Artificial wetlands biome	The Artificial wetlands biome includes built structures that hold or transfer water for human use, treatment, or disposal, including large storage reservoirs, farm dams, recreational and ornamental wetlands, rice paddies, freshwater aquafarms, wastewater storages and treatment ponds, and canals and drains.
Transitional waters biome	The Transitional waters biome includes coastal inlets that are influenced by inputs of both fresh and marine water from terrestrial catchments and ocean tides, waves, and currents. They include deep-water coastal inlets or fjords restricted to high latitudes as well as estuaries, bays, and lagoons, which are scattered around coastlines throughout the world.

Natural Capital Asset	Description
Marine shelf biome	The Marine shelf biome is distributed globally between the shoreline and deep sea-floor biomes and is dominated by benthic productivity. It includes ecosystems with biogenic substrates (such as seagrass meadows, kelp forests, oyster beds, and coral reefs) and minerogenic substrates including rocky reefs, sandy bottoms, and muddy bottoms.
Anthropogenic marine biome	Humans have constructed, deposited, or dumped artificial structures in the oceans that either confine managed marine organisms or attract marine biota that would not otherwise occupy such locations.
Shorelines biome	The Shoreline systems biome comprises naturally formed, intertidal abiogenic habitats situated at the interface between land and sea.
Supralittoral coastal biome	The Supralittoral coastal biome marks the landward extent of the transition from marine to terrestrial biomes. It is elevated above the direct influence of waves and tides (see the Shoreline biome) and beyond the direct influence of freshwater seepage or rivers (see brackish tidal biota).
Brackish tidal biome	The Brackish tidal systems biome is associated with prograding depositional shorelines at the interface of terrestrial, freshwater, and marine realms. The relative influences of marine, freshwater, and terrestrial processes vary from strongly fluvial deltas to marine-dominated intertidal forests and terrestrial-dominated coastal saltmarsh.

Source: IUCN (2020).

Table 6: Reference list of ecosystem services

Ecosystem service		Description
Provisioning services		
Biomass provisioning services	Crop provisioning services	Biomass provisioning services are the ecosystem contributions to the growth of plant, animal and other biomass (e.g. fungi) that are subsequently harvested by economic units for various uses. These uses include the production of food, fibre, energy, medicines and cosmetics. These services may be provided in cultivated and natural production contexts and will reflect final ecosystem services.
	Grazed biomass provisioning services	
	Timber provisioning services	
	Non-timber forest products (NTFP) and other biomass provisioning services (incl those related to hunting and trapping and bio-prospecting activities)	
	Fish and other aquatic products provisioning services	
Water supply		Water supply services reflect the combined ecosystem contributions of water purification and water regulation to the supply of water to economic units for various uses including domestic consumption, irrigation and hydropower. It is a final ecosystem service.
Genetic material services		Genetic material services are the ecosystem contributions from all biota (including seed, spore or gamete production) that are used by economic units (i) to maintain or establish a new population, (ii) to develop new varieties or (iii) in gene synthesis. It is a final ecosystem service.
Regulating and maintenance services		
Global climate regulation services		Global climate regulation services are the ecosystem contributions to the regulation of the concentrations of gases in the atmosphere that impact on global climate, primarily through the retention of carbon in ecosystems. It is a final ecosystem service collectively consumed by governments on behalf of society.
Rainfall pattern regulation services (at sub-continental scale)		Rainfall pattern regulation services are the ecosystem contributions of vegetation at the sub-continental scale, in particular forests, in maintaining rainfall patterns through evapotranspiration. It is a final ecosystem service.
Local (micro and meso) climate regulation services		Local climate regulation services are the ecosystem contributions to the regulation of ambient atmospheric conditions (including micro and mesoscale climates through the presence of plants that improves the living conditions for people and supports economic production. Examples include the evaporative cooling provided by urban trees and the contribution of trees in providing shade for livestock. It is a final ecosystem service.

Ecosystem service		Description
Air filtration services		Air filtration services are the ecosystem contributions to the filtering of air borne pollutants through the fixing and storage of pollutants by ecosystem components, particularly plants, that mitigates the harmful effects of the pollutants. It is a final ecosystem service.
Soil quality regulation services		Soil quality regulation services are the ecosystem contributions to the decomposition of biological materials that maintains the fertility and characteristics of soil for human use. It is an intermediate service.
Soil erosion control services (includes also sediment retention services)		Soil erosion control services are the ecosystem contributions, particularly the stabilising effects of plants, that reduce the loss of soil (and sediment) and mitigate or prevent potential damage to human use of the environment or human health and safety. It is generally an intermediate service (contributing to biomass provisioning services) but it can also be a final ecosystem service (preventing damaging effects to houses and buildings from mass movement of soil).
Water purification services (water quality amelioration)	Retention and breakdown of organic pollutants including excess nutrients	Water purification services are the ecosystem contributions to the restoration and maintenance of the chemical condition of surface water and groundwater bodies through the dilution, breakdown and storage of pollutants by ecosystem components that mitigates the harmful effects of the pollutants on human use or health. It can be a final or intermediate ecosystem service.
	Retention and breakdown of inorganic pollutants	
Water regulation services	Baseline flow maintenance	Water regulation services are the ecosystem contributions to the regulation of river and groundwater flows. They are derived from the ability of ecosystems to absorb and store water, and gradually release water during dry seasons or periods. Services concerning baseline flows may be final or intermediate, while those concerning extreme events are generally final ecosystem services.
	Peak flow mitigation	
Flood mitigation services	Seawater (Tidal) surge mitigation (Coastal protection services)	Seawater surge mitigation services are the ecosystem contributions of linear elements in the landscape, for instance dunes or mangrove ecosystems along the shore, in protecting the shore and thus mitigating the impacts of tidal surges or storms on local communities. This is a final ecosystem service.
	River flood mitigation	River flood mitigation services are the ecosystem contributions of riparian forests and other riparian ecosystems in protecting the banks of rivers from floods by providing structure and a physical barrier to high water levels and thus mitigating the impacts of floods on local communities. This service complements the peak flow mitigation service in which ecosystems regulate water levels. River flood mitigation is a final ecosystem service.
Storm mitigation services		Storm mitigation services are the ecosystem contributions of vegetation, especially linear elements in the landscape, in mitigating the impacts of wind, sand and other storms (other than water related events) on local communities. This is a final ecosystem service.
Noise attenuation services		Noise attenuation services are the ecosystem contributions to the reduction in the impact of noise on people that mitigates its harmful or stressful effects. It is a final ecosystem service.

Ecosystem service		Description
Pollination services		Pollination services (or gamete dispersal in marine contexts) are the ecosystem contributions by wild pollinators to the fertilization of crops that maintains or increases the abundance and/or diversity of other species that economic units use or enjoy. It is generally an intermediate service, especially in the context of biomass provisioning services.
Pest control services		Pest control services are the ecosystem contributions to the reduction in biological interactions of the incidence of species that prevent or reduce the output of biomass from ecosystems. It is generally an intermediate service, commonly in the context of biomass provisioning services.
Nursery population and habitat maintenance services		Nursery population and habitat maintenance services (including gene pool protection) are the ecosystem contributions to the presence of ecological conditions (usually habitats) necessary for sustaining populations of species that economic units use or enjoy. It is generally an intermediate service, for example in the context of biomass provisioning services (fish provisioning services) and in the context of ecosystem and species appreciation services.
Solid waste remediation		Solid waste remediation services are the ecosystem contributions to the transformation of an organic or inorganic substance that mitigates its harmful effects. It can be a final or intermediate ecosystem service.
Land accretion services*		Soil provisioning service where sediment and soil are trapped by vegetation, in particular in mangroves.
Cultural services		
Recreation-related services	Tourism recreation-related services	Recreation-related services are the ecosystem contributions, in particular through the biophysical characteristics and qualities of ecosystems, that enable people to use and enjoy the environment through physical and experiential interactions with the environment. They are final ecosystem services. A distinction is made between local and tourism related services to reflect the type of visitor engaging with ecosystems.
	Local recreation-related services	
Amenity services		Amenity services are the ecosystem contributions to local living conditions, in particular through the biophysical characteristics and qualities of ecosystems, that provide benefits including recreational opportunities, visual aesthetics and lower levels of air and noise pollution. They are final ecosystem services.
Education, scientific and research services		Education, scientific and research services are the ecosystem contributions, in particular through the biophysical characteristics and qualities of ecosystems, that enable people to use and enjoy the environment through intellectual and representative interactions with the environment. They are final ecosystem services.
Spiritual, symbolic and artistic services		Spiritual, symbolic and artistic services are the ecosystem contributions, in particular through the biophysical characteristics and qualities of ecosystems, that are recognised by people for their cultural, historical, sacred or religious significance. They are final ecosystem services.
Ecosystem and species appreciation services		Ecosystem and species appreciation services are the ecosystem contributions, in particular through the biophysical characteristics and qualities of ecosystems, that people seek to preserve because of their non-utilitarian qualities. They are final ecosystem services.

Ecosystem service	Description
Other services	
Abiotic services	Flows from the environment to people that are not considered as ecosystem services, for example the flow of mineral resources that are extracted by economic units. They are distinguished from ecosystem services by considering the relative importance of current ecological processes in their supply.
Not elsewhere classified (nec)*	Services that are not elsewhere classified, for example jute retting.

- *Primary source: UNSD (2020a). For additional services identified through research (*), description developed by project team.*

Table 7: Special designation of site/ area

Broad Type	Specific
Sites of Conservation Importance	Tiger Reserve
	Elephant Reserve
	Biosphere Reserve
	RAMSAR Wetland Sites
	Natural World Heritage Site
	Cultural World Heritage Sites
	Mixed World Heritage Sites
	Important Coastal and Marine Biodiversity Areas (ICMBAs)
	Important Bird Areas (IBAs) in India
	Potential Important Bird Areas
	Key Biodiversity Areas
	Biodiversity Heritage Sites
Protected Areas of India	Marine Protected Areas
	National Parks
	Wildlife Sanctuaries
	Conservation Reserves
	Community Reserves
Other	Multiple
	Not Relevant

Source: ENVIS Centre on Wildlife and Protected Areas. See: http://wiienvis.nic.in/Database/ConservationAreas_844.aspx

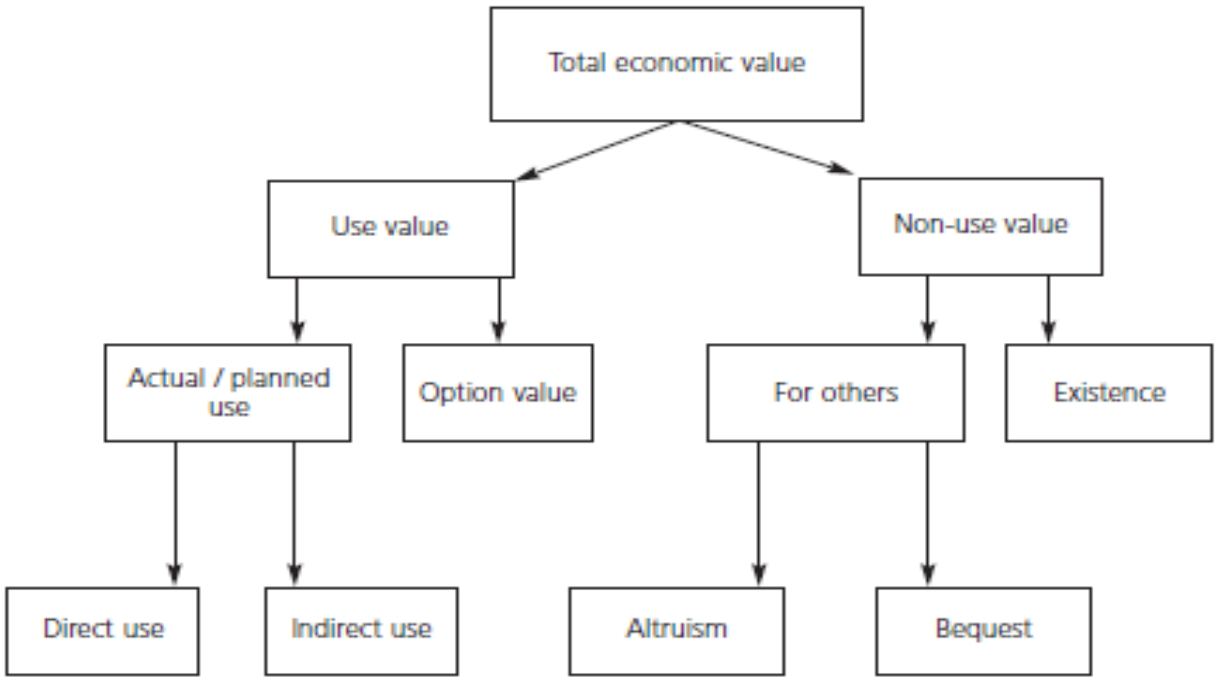


Figure 11: Total economic value

Table 8: Economic valuation methodology

Method	Description
Market price	Observed transaction prices for the ecosystem service
Residual value/ resource rent	Deducting cost of inputs from gross value of the final products
Productivity change	Change in the market value of a product consequence upon a change in the supply of the ecosystem service
Replacement cost	Cost of replacing the ecosystem service
Defensive/ avertive expenditure	Expenditures incurred in preventing adverse environmental impacts
Expenditure on complements (e.g. to recreation)	Expenditures on complements to benefit from an ecosystem service (e.g. the cost to reach a recreation area)
Hedonic pricing method	Econometric analysis of property data to derive demand curve for environmental characteristics
Travel cost method (single-site, multi-site, zonal, individual)	Econometrics analysis of visitor expenditure data to derive demand curve for recreation
Stated preference: contingent valuation	Statistical analysis of answers on WTP for a hypothetical environmental change
Stated preference: choice experiment	Statistical analysis of answers on WTP for hypothetical environmental changes (multiple alternatives)
Meta-analysis	Statistical analysis of multiple independent studies
Opportunity cost of alternative use	Forgone benefits of not using the same ecosystem asset for alternative uses

Source: Developed based on UNSD (2020b).

Table 9: Biogeographic zones of India

Bio-geographic Zones of India	Bio-Geographic Provinces of India
Trans Himalaya	1A: Himalaya- Ladakh Mountains 1B: Himalaya-Tibetan Plateau 1C: Trans-Himalaya Sikkim
The Himalaya	2A: Himalaya- North West Himalaya 2B: Himalaya- West Himalaya 2C: Himalaya- Central Himalaya 2D: Himalaya- East Himalaya
The Indian Desert	3A: Desert-Thar 3B: Desert-Katchchh
Semi-Arid	4A: Semi - Arid- Punjab Plains 4B: Semi - Arid- Gujrat Rajputana
The Western Ghats	5A: Western Ghats-Malabar Plains 5B: Western Ghats- Western Ghats Mountains
The Deccan Peninsula	6A: Deccan Peninsular-Central Highlands 6B: Deccan Peninsular- Chotta Nagpur 6C: Deccan Peninsular- Eastern Highland 6D: Deccan Peninsular- Central Plateau 6E: Deccan Peninsular- Deccan South
The Gangetic Plains	7A: Gangetic Plain- Upper Gangetic Plains 7B: Gangetic Plain- Lower Gangetic Plains
The Coasts	8A: Coasts-West Coast 8B: Coasts- East Coast 8C: Coasts-Lakshadweep
North-East India	9A: North-East- East- Brahmaputra Valley 9B: North-East-North East Hills
Islands	10A: Islands-Andaman 10B: Islands-Nicobar

Source: Rodgers and Panwar (1988).

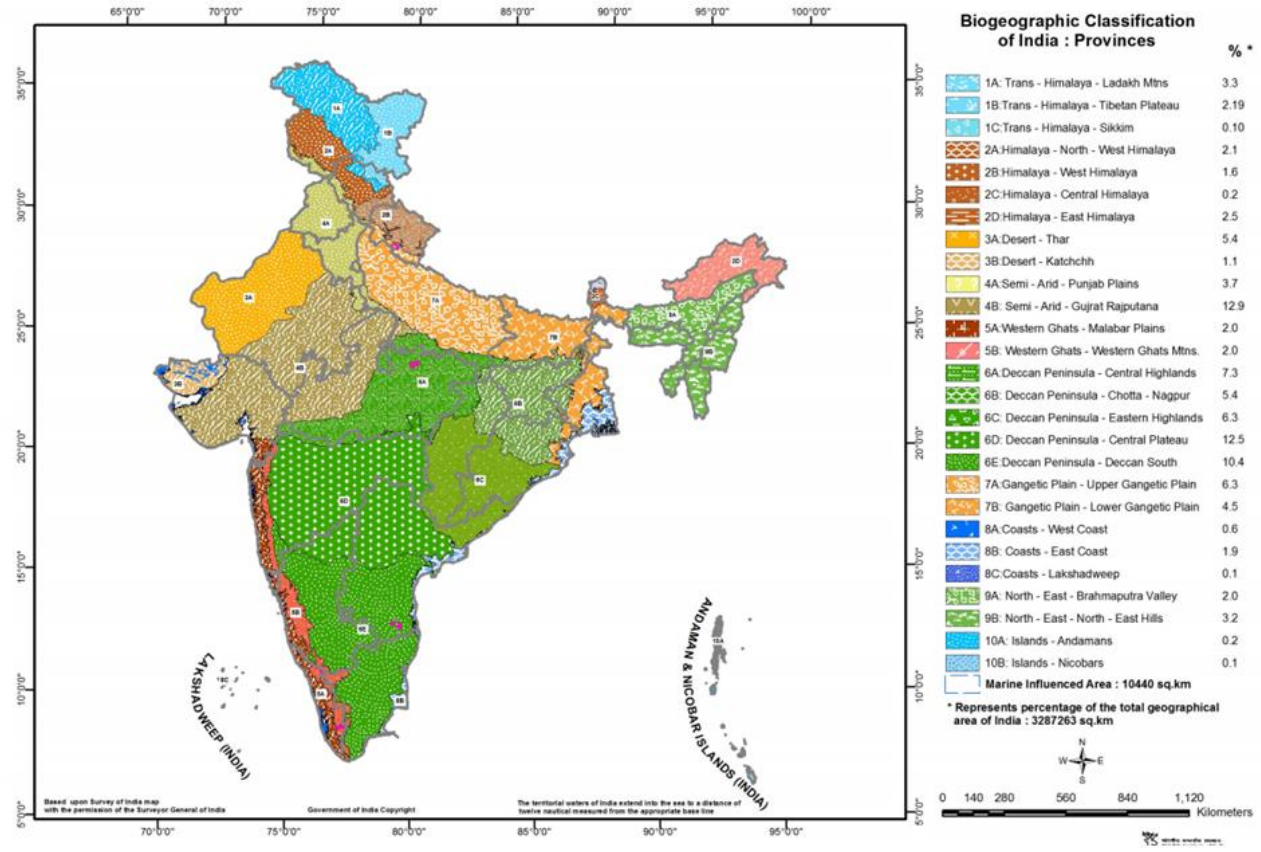


Figure 12: Biogeographic zones

Source: MoSPI (pers. comms. 2020)

Annex B: Study quality assessment

The quality of the value estimate is assessed based on the information provided in the study to determine the suitability of the estimate for value transfer – following the UK's Value Transfer Guidance (eftec, 2010).

1. Does the study report the policy context, the good and the change of in sufficient detail and quality?
2. Does the study define the affected population appropriately and, where relevant, sampled sufficiently?
3. Are the study results valid and robust based on the reporting of the study?

Each value estimate in each study is assessed on each question on a rating of 1 to 3, where 3 is the highest rating.

The aggregated score is then used to identify a study rating (see Look-up tab) and the study commentary (see Detailed summary and Site-specific summary).

Score	Value Transfer rating	Value transfer comment
8 – 9	+++	Recommended for use in value transfer on the basis of the information contained in the database
6 – 7	++	Review information reported in database before using the estimate for value transfer
3 – 5	+	Review source study methodology and sample in more detail, before using the estimate for value transfer

eftec
economics for the environment

4 City Road, London EC1Y 2AA
+44 (0) 20 7580 5383
eftec@eftec.co.uk
eftec.co.uk
@eftecUK

User Guide | December 2020