Introduction to Ecosystem Service Tools

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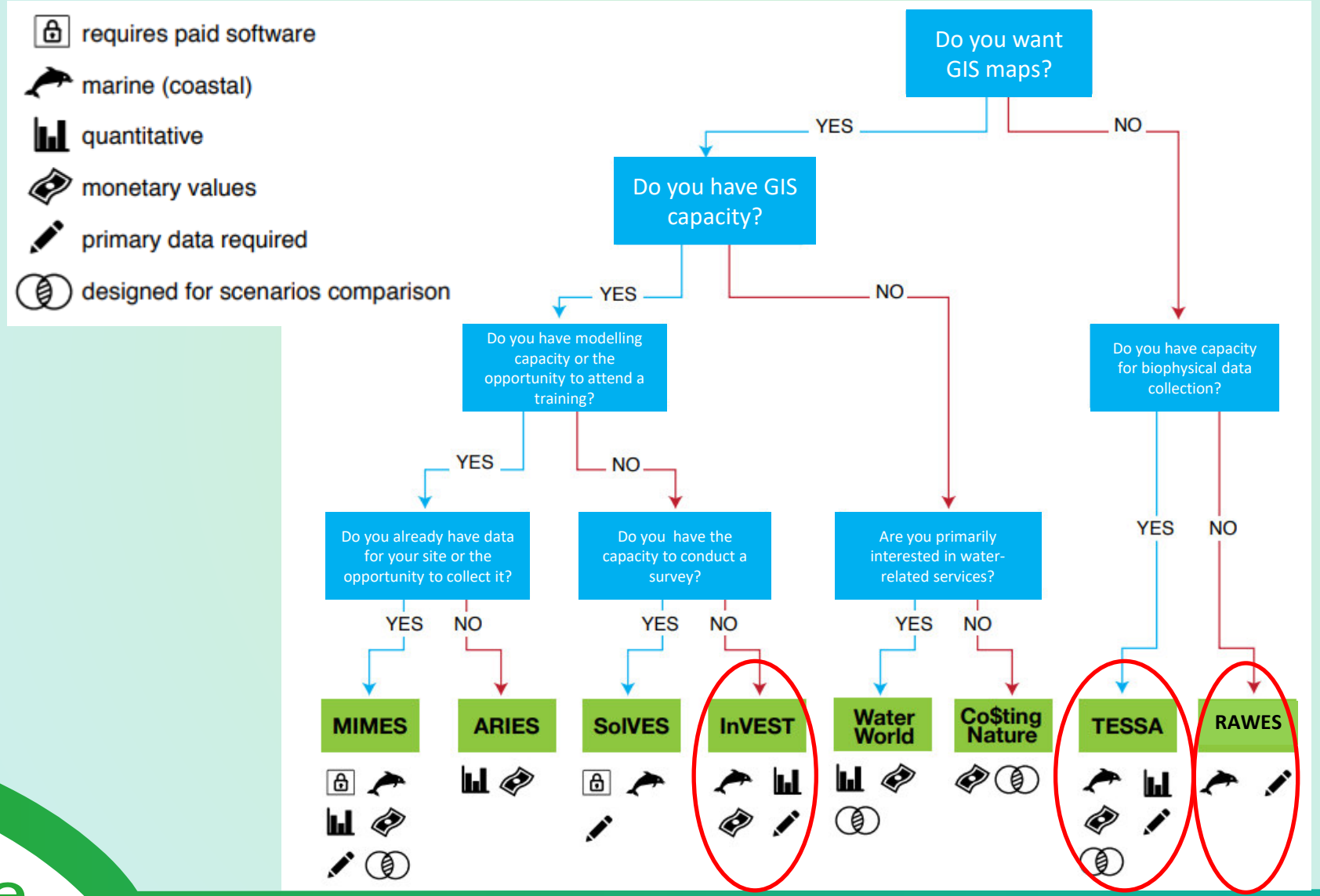
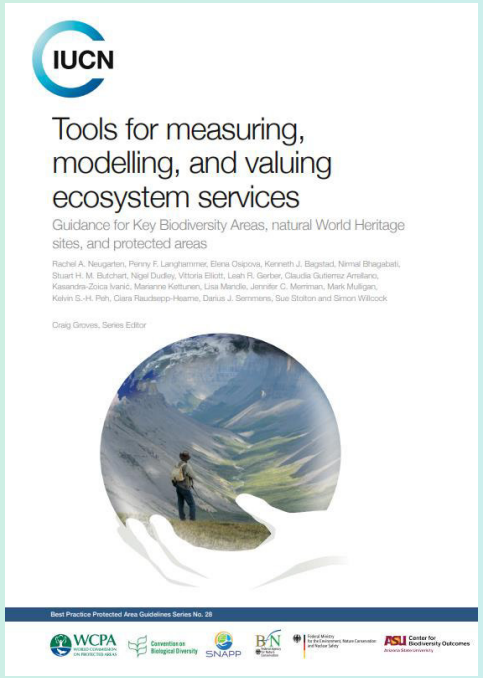
Decision tree for tool selection





Adapted from Neugarten et al., 2018. https://portals.iucn.org/library/node/47778

Rapid Assessment of Wetland Ecosystem Services (RAWES)

13th Meeting of the Conference of the Contracting Parties
to the Ramsar Convention on Wetlands

"Wetlands for a Sustainable Urban Future"
Dubai, United Arab Emirates, 21-29 October 2018

Resolution XIII.17

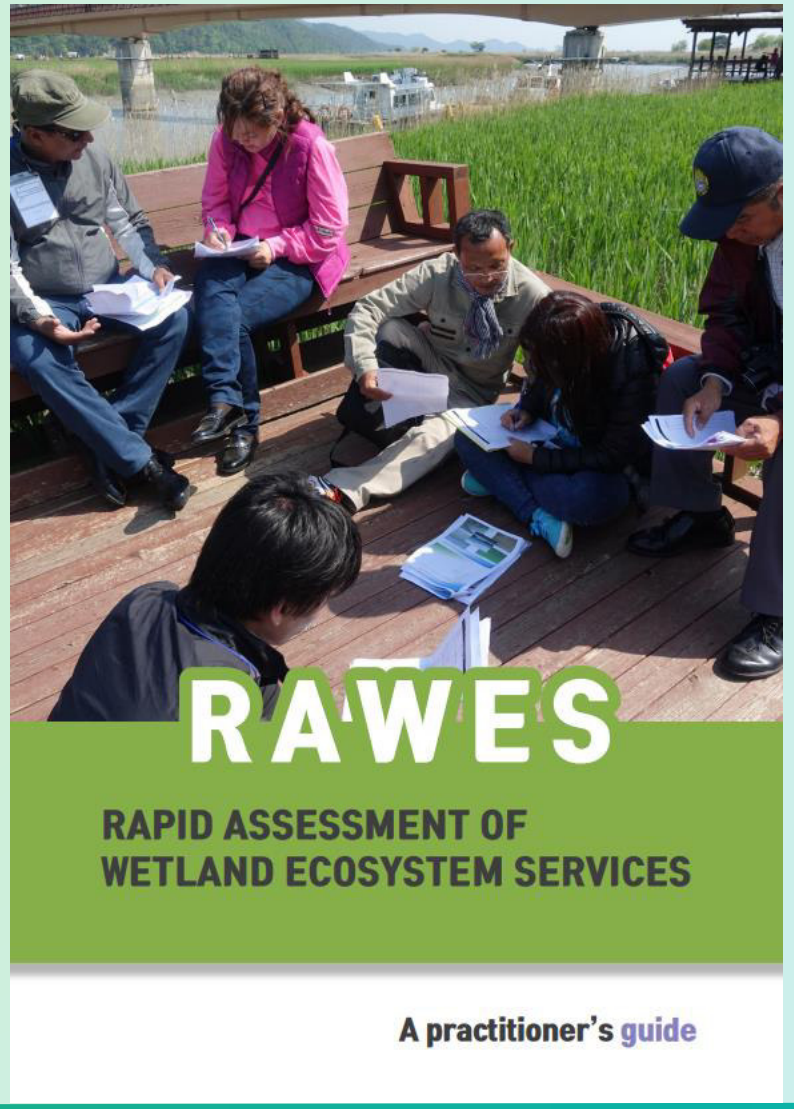
Rapidly assessing wetland ecosystem services

1. RECOGNIZING that, to achieve the Mission of the Ramsar Convention as described in the Strategic Plan 2016-2024, it is essential that vital ecosystem functions and the ecosystem services that wetlands provide to people and nature are fully recognized, maintained, restored and wisely used and that the need to develop approaches for assessing both ecosystem functions and ecosystem services is recognized;

2. RECALLING that Annex A to Resolution IX.1 on *Additional scientific and technical guidance for implementing the Ramsar wise use concept* defines the ecological character of wetlands as "the combination of the ecosystem components, processes and benefits/services that characterize the wetland at a given point in time"; ALSO RECALLING that the *Guidance for valuing the benefits derived from wetland ecosystem services* (Ramsar Technical Report No.3 / Technical Series No.27 of the Convention on Biological Diversity) provides guidance for valuing wetlands and advice on when and why wetland valuation should be undertaken and sets out a framework for the integrated assessment and valuation of wetland services;

3. NOTING that a priority area of focus for the Convention under the Ramsar Strategic Plan 2016-2024 (Resolution XII.2) is to enhance the information about ecosystem functions and the ecosystem services that wetlands provide to people and nature; ALSO RECALLING Target 11 of the Ramsar Strategic Plan 2016-2024, "Wetland functions, services and benefits are widely demonstrated, documented and disseminated", and that the assessment of ecosystem services of Wetlands of International Importance (Ramsar Sites) is a key indicator of progress against this target;

4. FURTHER recognizing that, under Resolution XII. 3[1], on *Enhancing the languages of the Convention and its visibility and stature, and increasing synergies with other multilateral environmental agreements and other international institutions*, Contracting Parties and other stakeholders are encouraged "to increase their efforts to communicate on the values of ecosystem services of wetlands in other sectors' strategies, plans and regulations, and integrate them into a basin approach to land-use plans and other relevant local, national and global decisions";



Rapid Assessment of Wetland Ecosystem Services (RAWES)

- Ramsar-specific
- Systemic
- Rapid
- Qualitative
- Comprehensive

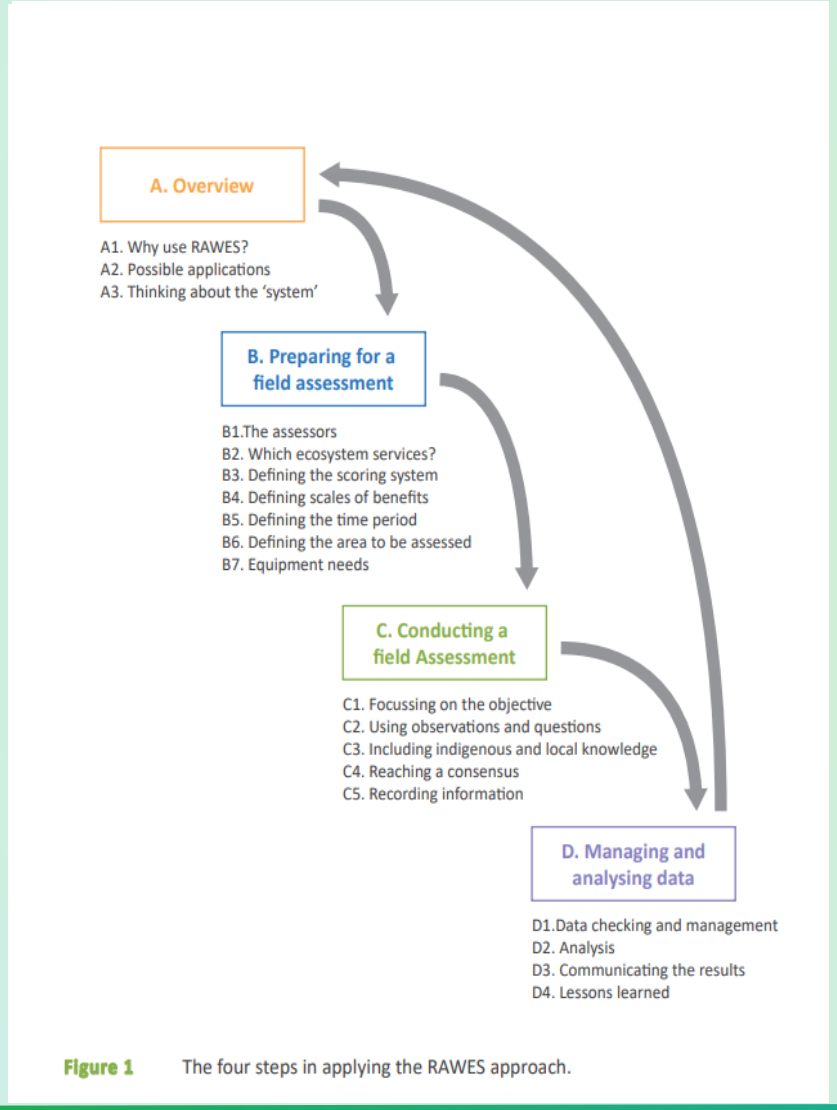
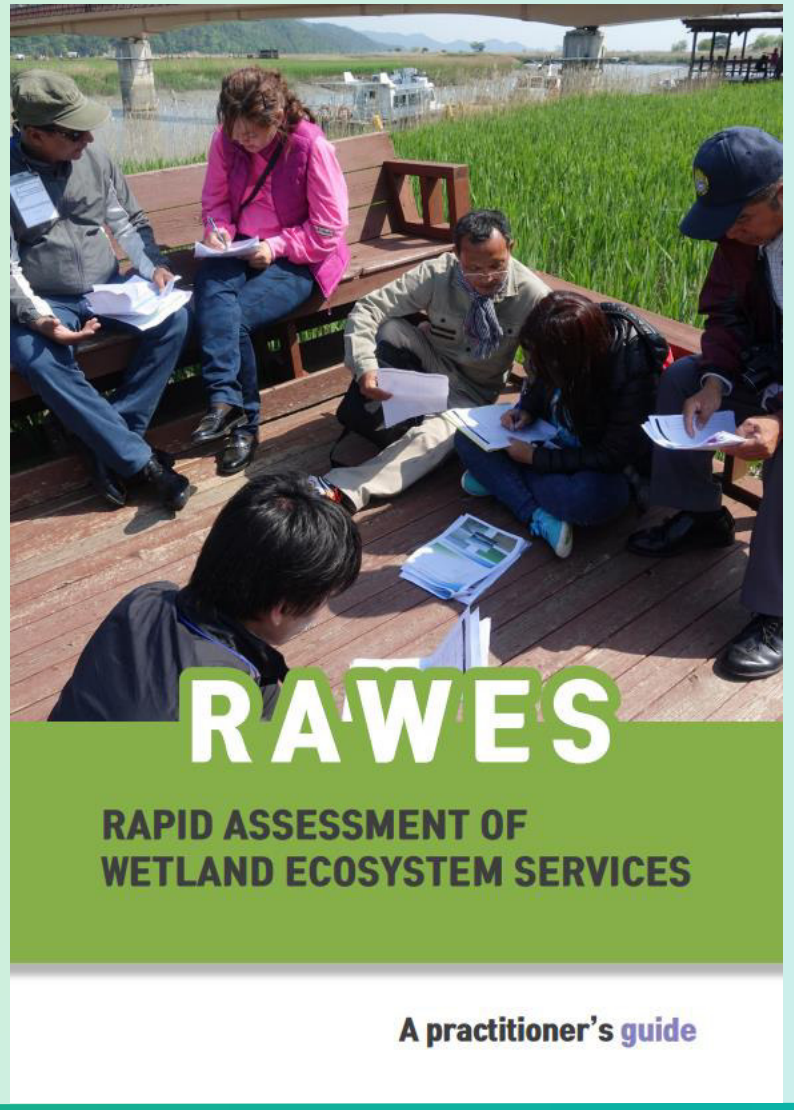


Figure 1 The four steps in applying the RAWES approach.



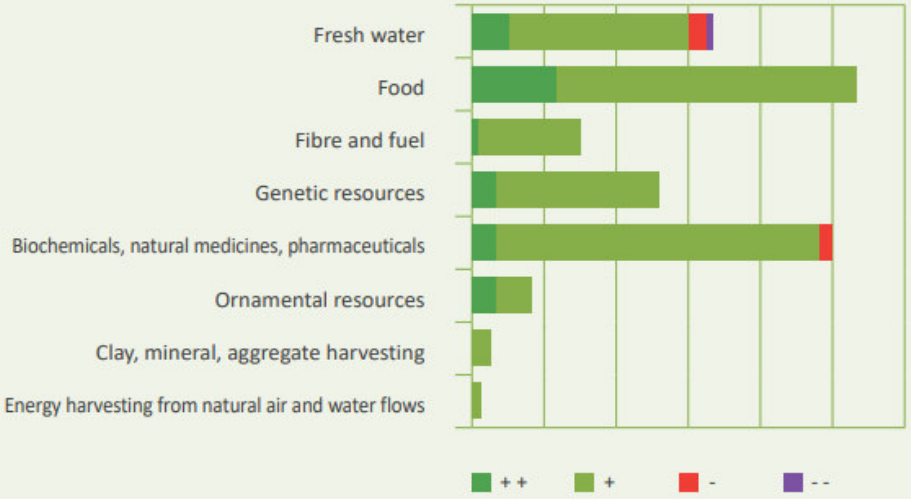
Rapid Assessment of Wetland Ecosystem Services (RAWES)

Box 10 **UNDERSTANDING THE DIFFERENT ECOSYSTEM SERVICES FROM MULTIPLE WETLAND SITES**
WETLANDS OF METROPOLITAN COLOMBO, SRI LANKA

Assessments were conducted on 62 different wetland sites across Metropolitan Colombo. Upon completion of the field assessments, the total number of each of the different scores assigned to each ecosystem service was counted. From the count data it is possible to understand which ecosystem services are the most common and widespread across the city, and therefore the main benefits that are being derived from the wetlands.

The graph below shows the results for the provisioning services. The most frequently occurring and most important provisioning service is the production of food, closely followed by natural medicines. For some wetlands, the provision of fresh water was considered a 'disbenefit' due to high levels of pollution.

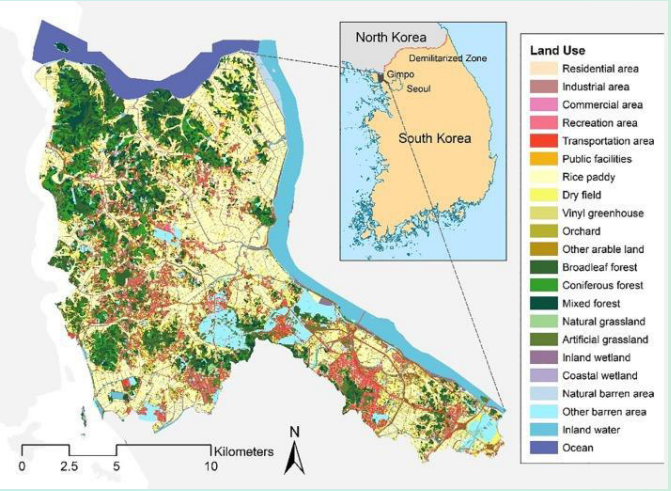
Rice production in the city of Colombo's wetlands

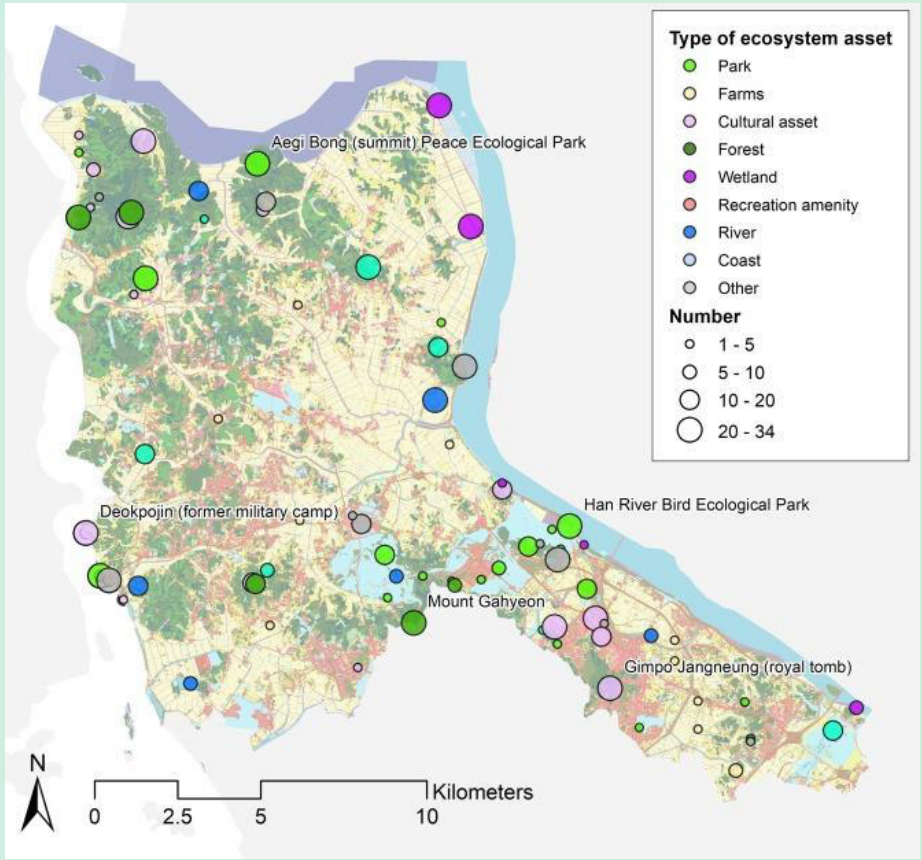


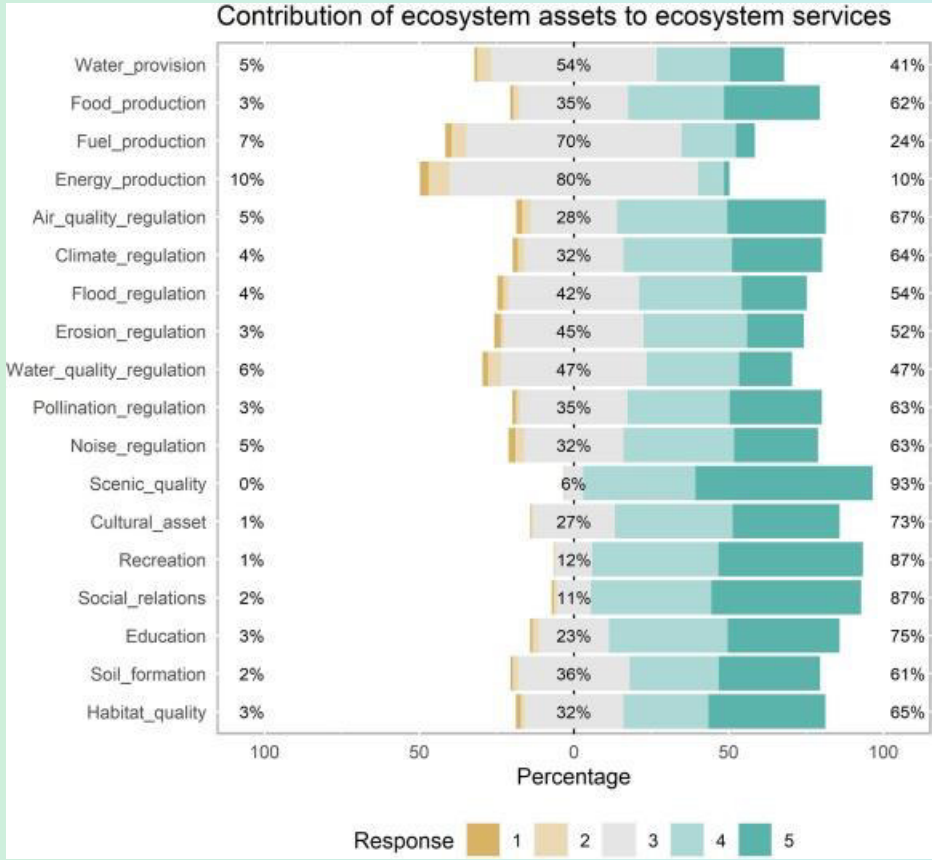
McInnes & Everard, 2017
https://doi.org/10.1016/j.ecoser.2017.03.024

Rapid Assessment of Wetland Ecosystem Services (RAWES)

Kim et al., 2021
https://doi.org/10.1016/j.ecoser.2021.101337







Relevance of RAWES in a Ramsar Convention context

Ramsar Sites Information Service

2,493 Sites covering 256,759,600 ha

© IUCN

KOH KAPIK AND ASSOCIATED ISLETS	Country: Cambodia Designation date: 23-06-1999 Site number: 998 Published since: 11 year(s)	12,000 ha	Download RIS
STUNG SEN	Country: Cambodia Designation date: 02-11-2018 Site number: 2365 Published since: 4 year(s)	9,293 ha	Download RIS
BOENG CHHMAR AND ASSOCIATED RIVER SYSTEM AND FLOODPLAIN	Country: Cambodia Designation date: 23-06-1999 Site number: 997 Published since: 11 year(s)	28,000 ha	Download RIS
MIDDLE STRETCHES OF MEKONG RIVER NORTH OF STOENG TRENG	Country: Cambodia Designation date: 23-06-1999 Site number: 999 Published since: 11 year(s)	14,600 ha	Download RIS
PREK TOAL RAMSAR SITE	Country: Cambodia Designation date: 02-10-2015 Site number: 2245 Published since: 7 year(s)	21,342 ha	Download RIS

- **CEPA Programme**
- **Training of Trainers (Mekong WET)**
- **IBRRI umbrella**

What is TESSA?

Toolkit for Ecosystem Service Site-based Assessment

What is TESSA?

Innovative Practical toolkit

Low cost methods – Scientifically robust

Ecosystem Services Assessment

Biophysical data and Economic valuation

Accessible to non-experts

Site to Landscape Scale (100 – 100,000 ha)

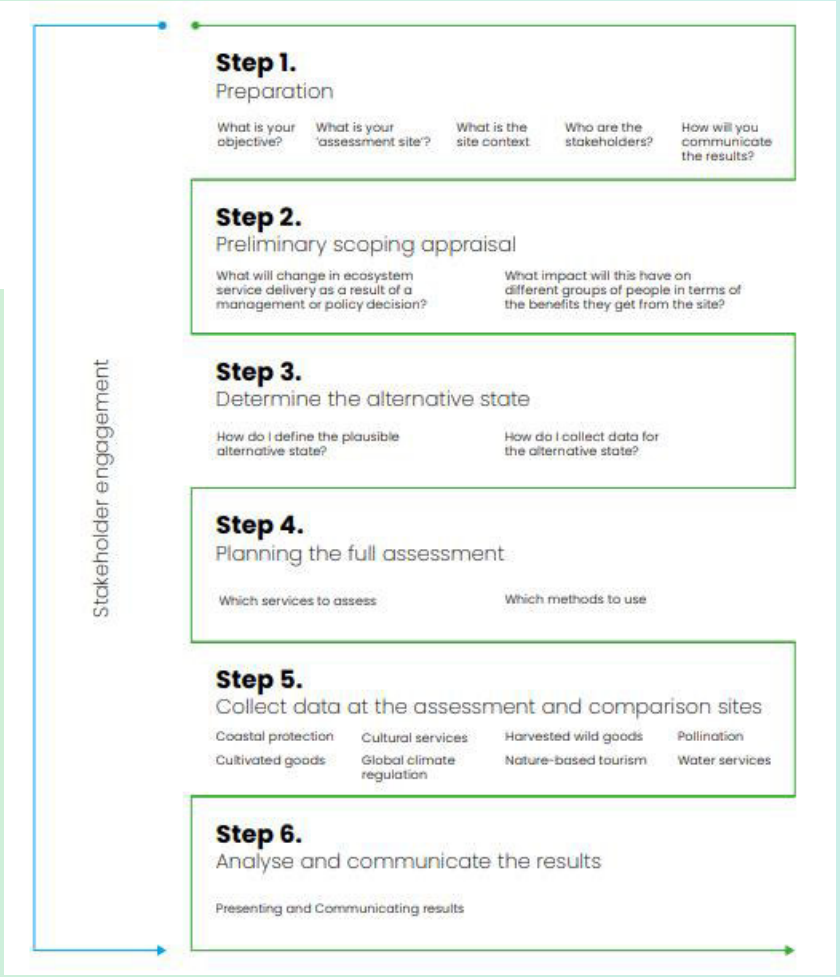
Assessment of change – Comparative valuation

Stakeholders and Beneficiaries

TESSA – A Step by Step Guidance

Allows users to develop an understanding of the benefits people receive from nature, and assess their value in order to generate information for efficient decision-making

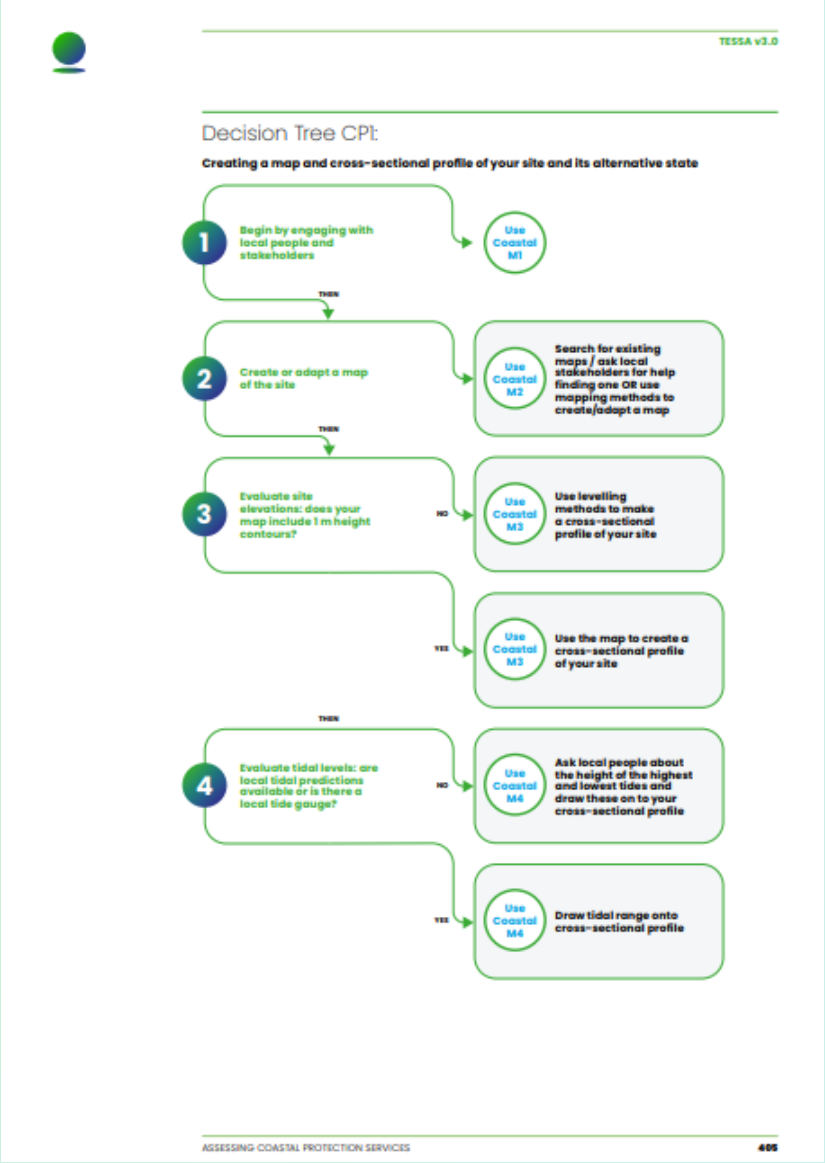
- Set the objectives of the assessment
- Decide on what services to focus
- Methods to measure ecosystem services
- Present and communicate the results



TESSA – A Step by Step Guidance [cont'd]

The toolkit also includes:

- ✓ Decision trees (flow charts)
- ✓ Detailed methods
- ✓ Worked examples
- ✓ Additional Guidance (templates)
- ✓ Section on data synthesis



TESSA – A Step by Step Guidance [cont'd]

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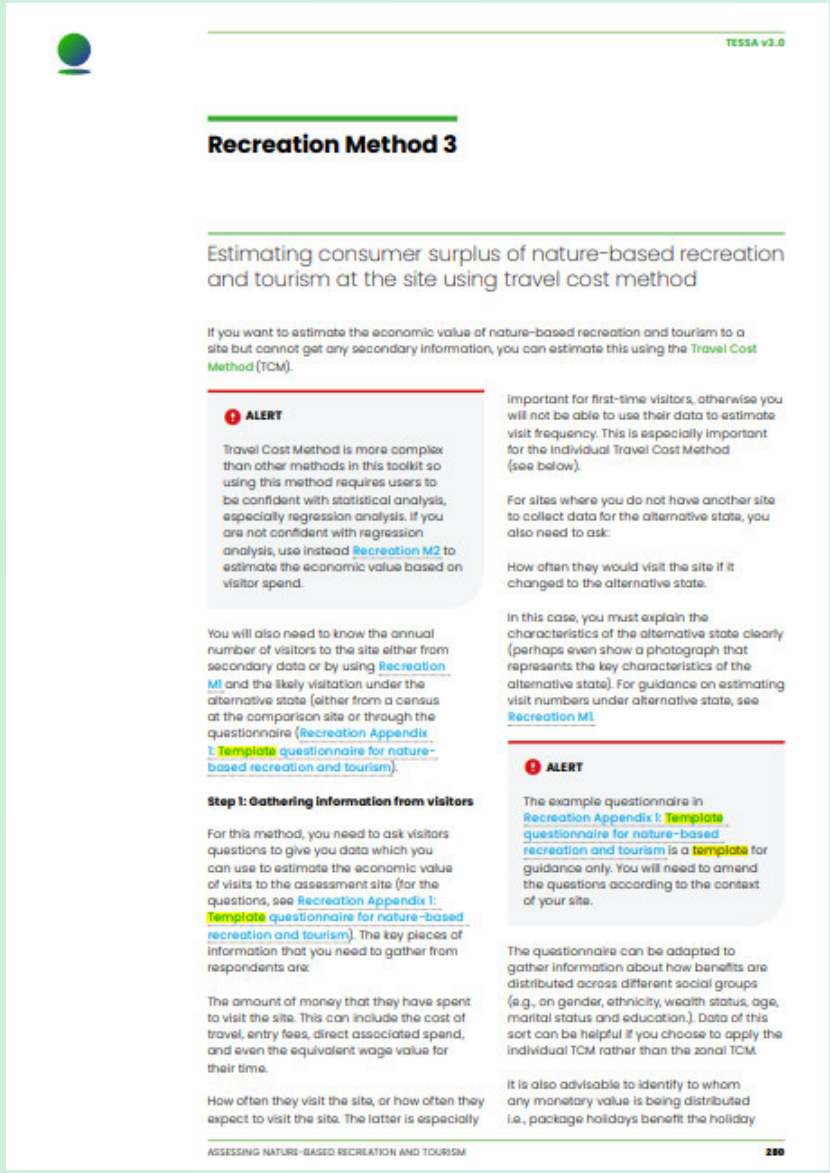

TESSA v3.0

Recreation Method 3

Estimating consumer surplus of nature-based recreation and tourism at the site using travel cost method

If you want to estimate the economic value of nature-based recreation and tourism to a site but cannot get any secondary information, you can estimate this using the Travel Cost Method (TCM).

ALERT

Travel Cost Method is more complex than other methods in this toolkit so using this method requires users to be confident with statistical analysis, especially regression analysis. If you are not confident with regression analysis, use instead Recreation M2 to estimate the economic value based on visitor spend.

You will also need to know the annual number of visitors to the site either from secondary data or by using Recreation M1 and the likely visitation under the alternative state (either from a census at the comparison site or through the questionnaire (Recreation Appendix 1: Template questionnaire for nature-based recreation and tourism).

Step 1: Gathering information from visitors

For this method, you need to ask visitors questions to give you data which you can use to estimate the economic value of visits to the assessment site (for the questions, see Recreation Appendix 1: Template questionnaire for nature-based recreation and tourism). The key pieces of information that you need to gather from respondents are:

The amount of money that they have spent to visit the site. This can include the cost of travel, entry fees, direct associated spend, and even the equivalent wage value for their time.

How often they visit the site, or how often they expect to visit the site. The latter is especially important for first-time visitors, otherwise you will not be able to use their data to estimate visit frequency. This is especially important for the Individual Travel Cost Method (see below).

For sites where you do not have another site to collect data for the alternative state, you also need to ask:

How often they would visit the site if it changed to the alternative state.

In this case, you must explain the characteristics of the alternative state clearly (perhaps even show a photograph that represents the key characteristics of the alternative state). For guidance on estimating visit numbers under alternative state, see Recreation M1.

ALERT

The example questionnaire in Recreation Appendix 1: Template questionnaire for nature-based recreation and tourism is a template for guidance only. You will need to amend the questions according to the context of your site.

The questionnaire can be adapted to gather information about how benefits are distributed across different social groups (e.g., on gender, ethnicity, wealth status, age, marital status and education.). Data of this sort can be helpful if you choose to apply the individual TCM rather than the zonal TCM.

It is also advisable to identify to whom any monetary value is being distributed i.e., package holidays benefit the holiday

TESSA – A Step by Step Guidance [cont'd]

The toolkit also includes:

- ✓ Decision trees (flow charts)
- ✓ Detailed methods
- ✓ Worked examples
- ✓ Additional Guidance (templates)
- ✓ Section on data synthesis

TESSA v3.0

Guidance 2. Stakeholder analysis

This section provides guidance on how to identify stakeholders.

Stakeholder analysis is an essential part of engaging with the most relevant people. The easiest way to do this is to complete a stakeholder analysis matrix, seeking input from people who are familiar with the site. This usually uses two axes to define 'importance' of the stakeholder against the 'influence' of the stakeholder.

In filling this in, consider their characteristics (the kind of organisation/person they are) such as:

- Their main interests in the site
- Their main rights in relation to the site (e.g., access)
- Their impact on the site and its services (current and future potential)
- Their dependence on the site and its services (current and future potential)

Example Stakeholder Analysis Matrix

Adapted from: Department for International Development. (1993). Guidance note on how to do stakeholder analysis of aid projects and programmes. London, UK: Department for International Development.

Influence of Stakeholder	Importance of Stakeholder: Unknown	Little / No importance	Some importance	Significant importance
Significant influence				
Somewhat influential	C		A	
Little/No influence				
Unknown	D		B	

Boxes A, B and C are the key stakeholders of the project. The implications of each box are summarised below:

Box A

These are stakeholders with a high degree of influence on the project, who are also of high importance for its success. This implies that the implementing organisation will need to construct good working relationships with these stakeholders, to ensure an effective coalition of support for the project. Examples might be senior officials and politicians.

Box B

These are stakeholders of high importance to the success of the project, but with low influence. This implies that they will require special initiatives if their interests are to be protected. An example may be traditionally marginalised groups (e.g., indigenous people, youth, women), who might be dependent on a site, but who have little 'voice' in its management.

GUIDANCES 537

TESSA – A Step by Step Guidance [cont'd]

The toolkit also includes:

- ✓ Decision trees (flow charts)
- ✓ Detailed methods
- ✓ Worked examples
- ✓ Additional Guidance (templates)
- ✓ Section on data synthesis

A collaborative contribution

The Toolkit for Ecosystem Service Site-based Assessment has been developed by

tessa

a.r.u.

BirdLife INTERNATIONAL

UNIVERSITY OF CAMBRIDGE

TROPICAL BIOLOGY ASSOCIATION

rspb giving nature a home

UN environment WCMC

University of Southampton

Piloting, feedback, development and improvement of TESSA

Donors

AXA Research Fund

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Cambridge Conservation Initiative

OPERAs

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Cranfield UNIVERSITY

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WWF

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KING'S College LONDON

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natural capital PROJECT

Council of Scientific & Industrial Research

National Trust

US University of Sussex

The Open University

ROYAL BOTANIC GARDEN EDINBURGH

iied

fera

The University Of Sheffield.

Centre for Ecology & Hydrology

UEA University of East Anglia

STAFFORDSHIRE UNIVERSITY

Implementation

Grupo Jaragua, Inc.

Bird Conservation Alliance

NatureFiji MareqetiViti

NatureUganda

blue ventures beyond conservation

WWT

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UNIVERSITY OF CAMBRIDGE

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Association Burundaise pour la protection de la Nature ABN

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AVES Y CONSERVACIÓN BIRDLIFE EN ECUADOR

What is TESSA?

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Short communication

TESSA: A toolkit for rapid assessment of ecosystem services at sites of biodiversity conservation importance

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ABSTRACT

Sites that are important for biodiversity conservation can also provide significant benefits (i.e. ecosystem services) to people. Decision-makers need to know how change to a site, whether development or restoration, would affect the delivery of services and the distribution of any benefits among stakeholders. However, there are relatively few empirical studies that present this information. One reason is the lack of appropriate methods and tools for ecosystem service assessment that do not require substantial resources or specialist technical knowledge, or rely heavily upon existing data. Here we address this gap by describing the Toolkit for Ecosystem Service Site-based Assessment (TESSA). It guides local non-specialists through a selection of relatively accessible methods for identifying which ecosystem services may be important at a site, and for evaluating the magnitude of benefits that people obtain from them currently, compared with those expected under alternative land-uses. The toolkit recommends use of existing data where appropriate and places emphasis on enabling users to collect new field data at relatively low cost and effort. By using TESSA, the users could also gain valuable information about the alternative land-uses; and data collected in the field could be incorporated into regular monitoring programmes.

1. Introduction

There has been growing international recognition that the contribution that nature makes to human well-being is often not adequately valued or integrated in decision-making, and that ecosystem services are being eroded as a result (MEA (Millennium Ecosystem Assessment), 2005), with considerable cost to society (Kumar, 2010). Increasingly, governments are being asked to initiate a range of policy processes aimed at integrating the environment and development, including environmental mainstreaming (UNDP-UNEP (United Nations Development Programme – United Nations Environment Programme), 2009), achieving the proposed Sustainable Development Goals (UNCSD (United Nations Conference on Sustainable Development) Secretariat, 2012) and delivering a Green Economy (ten Brink et al., 2010). In addition, countries have committed to assessing their contribution to the Convention on Biological Diversity's Strategic Plan 2011–2020 by tracking progress against the 20 Aichi Biodiversity Targets

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nature sustainability

Check for updates

The economic consequences of conserving or restoring sites for nature

Richard B. Bradbury[1,2]✉, Stuart H. M. Butchart[2,3], Brendan Fisher[4], Francine M. R. Hughes[5], Lisa Ingwall-King[6], Michael A. MacDonald[7], Jennifer C. Merriman[8], Kelvin S.-H. Peh[2,9], Anne-Sophie Pellier[3], David H. L. Thomas[10], Rosie Trevelyan[11] and Andrew Balmford[2]

Nature provides many benefits for people, yet there are few data on how changes at individual sites impact the net value of ecosystem service provision. A 2002 review found only five analyses comparing the net economic benefits of conserving nature versus pursuing an alternative, more intensive human use. Here we revisit this crucial comparison, synthesizing recent data from 62 sites worldwide. In 24 cases with economic estimates of services, conservation or restoration benefits (for example, greenhouse gas regulation, flood protection) tend to outweigh those private benefits (for example, profits from agriculture or logging) driving change to the alternative state. Net benefits rise rapidly with increasing social cost of carbon. Qualitative data from all 62 sites suggest that monetization of additional services would further increase the difference. Although conservation and restoration did not universally provide greater net value than the alternative state, across a large, geographically and contextually diverse sample, our findings indicate that at current levels of habitat conversion, conserving and restoring sites typically benefits human prosperity.

Recent decades have seen increasing recognition of the economic and human well-being consequences of degradation of nature[1–3]. However, the degradation continues, perhaps in part because inadequate steps are taken to ensure that planning and management decisions are informed by estimates of their net consequences for benefits (ecosystem services) to different stakeholders[4]. Although criticisms of valuation are well rehearsed, from the ethical to the analytical[5,6], cost–benefit and cost-effectiveness analyses are demanded in many regulatory contexts and provide a useful, if partial, lens on the impacts of decisions on human prosperity. An early review[7] found only five site-level studies worldwide comparing the aggregate economic value of flows of ecosystem services delivered by the site when relatively intact with its potential economic value when converted to more human-dominated forms of use. Although tiny, this sample suggested retention of (or sustainably managing) areas of natural habitat typically delivered net economic benefits to people. While striking, this result was almost certainly conservative, given that assessments of service flows at one point in time tend to fail to consider whether those flows can be maintained sustainably into the future[8]. Despite growing understanding of the economic consequences of conserving or restoring nature[9–11] and development of new tools for ecosystem service assessment[12], remarkably few additional studies[3,13,14] have investigated this key question of the net economic value of conserving (or restoring) individual sites.

A new data synthesis on the net benefits of conservation

We addressed this lack of evidence by synthesizing data from a relatively large sample of published and unpublished studies that used the framework of the Toolkit for Ecosystem Service Site-Based Assessment (TESSA; http://tessa.tools)[15] to develop the earlier review[7], evaluating the net consequences of plausible changes in habitat state on the benefits provided by particular sites. TESSA provides relatively simple methods, within a consistent framework, for evaluating the difference in ecosystem service flows, in biophysical and (where possible) economic terms, provided by a site under contrasting states. The resulting analyses do not claim to be full economic valuations but do aspire to cover as many of the main services provided by a site as possible, in either state, and always include the services driving state change. The toolkit emphasizes broad stakeholder participation—including those benefiting most from the change in state—to identify the main ecosystem services and plausible alternative land uses and to facilitate local data collection. Our literature review yielded information on 15 sites (13 in International Scientific Indexing (ISI) journal papers) that met our criteria (Methods) for analysis. Unpublished studies provided information from 47 additional sites (Supplementary Data). The combined set of 62 sites spanned six continents (Supplementary Table 1), contrasting (1) a nature conservation state with a more human-modified state (for example, protected area versus conversion to agriculture; 44 sites) or (2) an ecological restoration state with the pre-restoration (human-modified) state (for example, restoration to intertidal habitat versus coastal area claimed for agriculture; 18 sites). Henceforth, we refer to nature conservation and ecological restoration states as 'nature-focused' and the contrasting states as 'alternative'. These studies provided data on multiple services, including the most important private and toll (club) benefits

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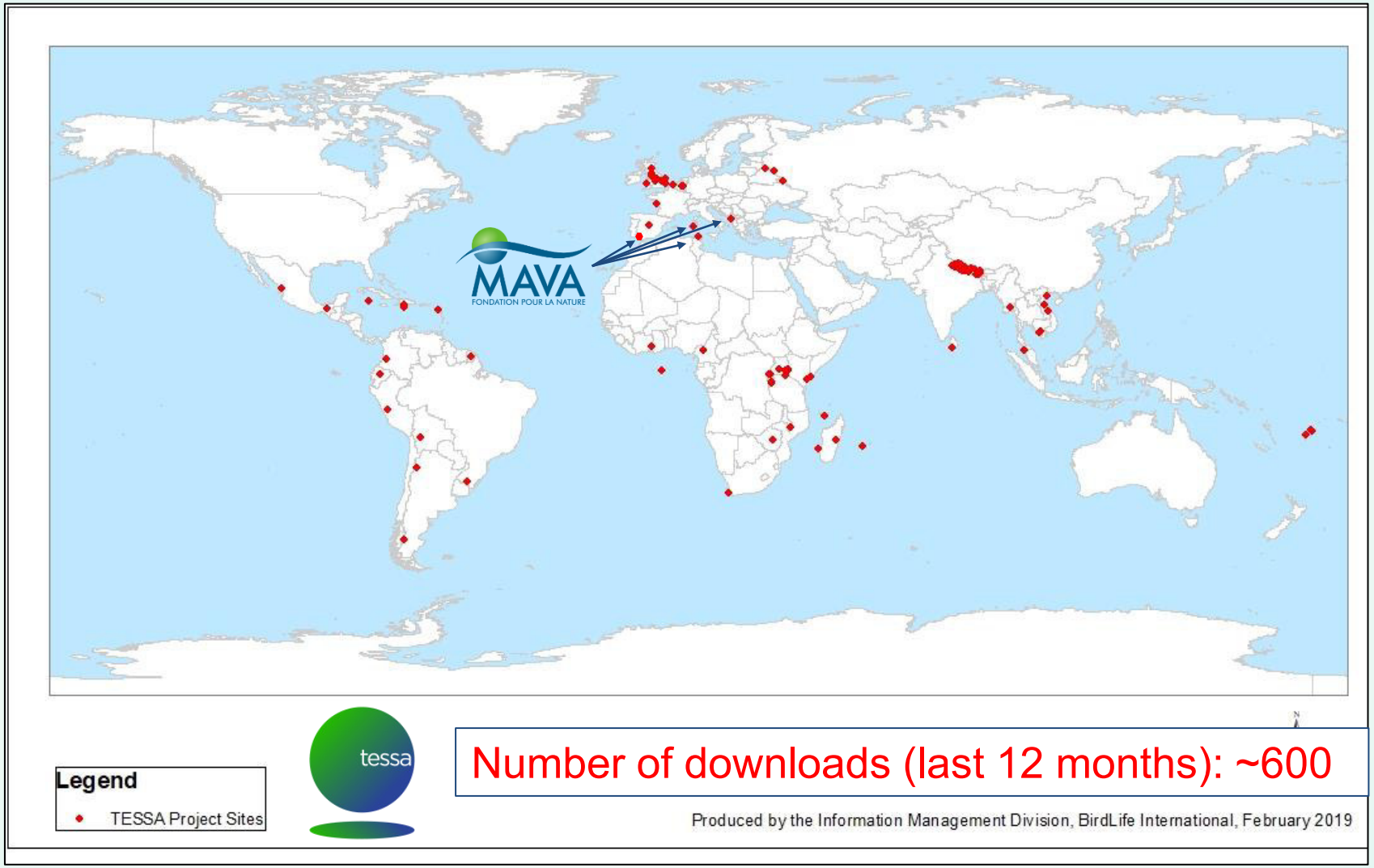
Partnership for nature and people

TESSA applications worldwide



[Hatch group page : TESSA Publications and Case Studies]

TESSA users




- Int'l NGOs / NGOs / GOs
- **Conservation practitioners (first target)**
- **Forestry, fisheries, water managers, land use planners, development organizations, researchers, etc.**
- Expanding to **corporate users**

TESSA compared with other tools?

- Guidance for using secondary data and collecting new data
- Combines qualitative and quantitative methods
- Quick, one off assessment
- No mapping required
- No complex 'black box' models
- Engages stakeholders
- Less technical approach

[Hatch group page : How TESSA is different from other tools]

How to use TESSA?

Key Concepts in TESSA

- Assessing the impacts of change – The Alternative State
- Comparative valuation of multiple ecosystem services
- Importance of beneficiaries and trade-offs
- Step-by-step framework

Assessing the impact of change

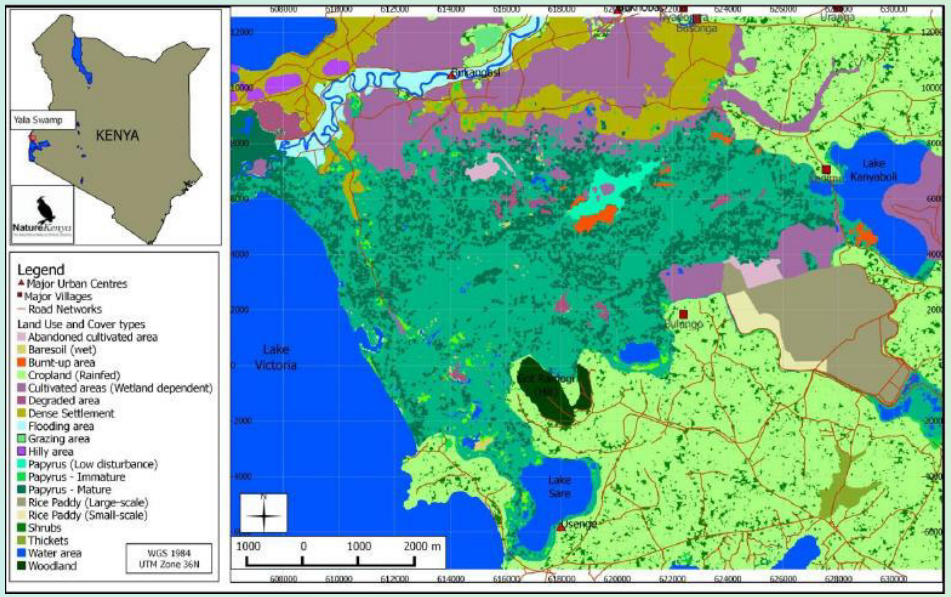
CHANGE

Site assessment
(current state)
100% Native forest

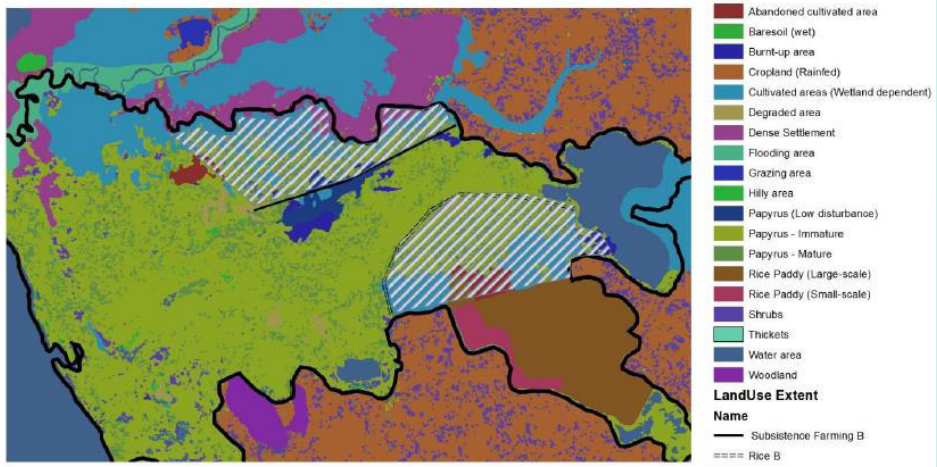
Alternative state
95% Subsistence agriculture
5% Secondary Forest

Alternative State [example]

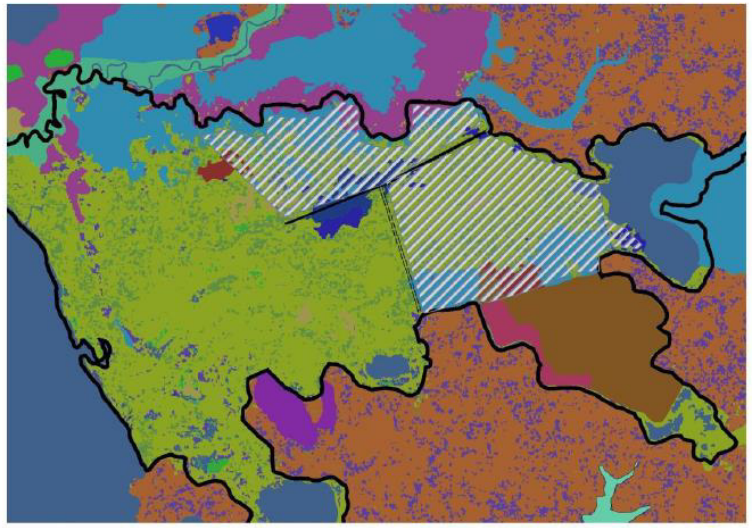
Current State : Yala Swamp, Kenya



a) Balanced Scenario

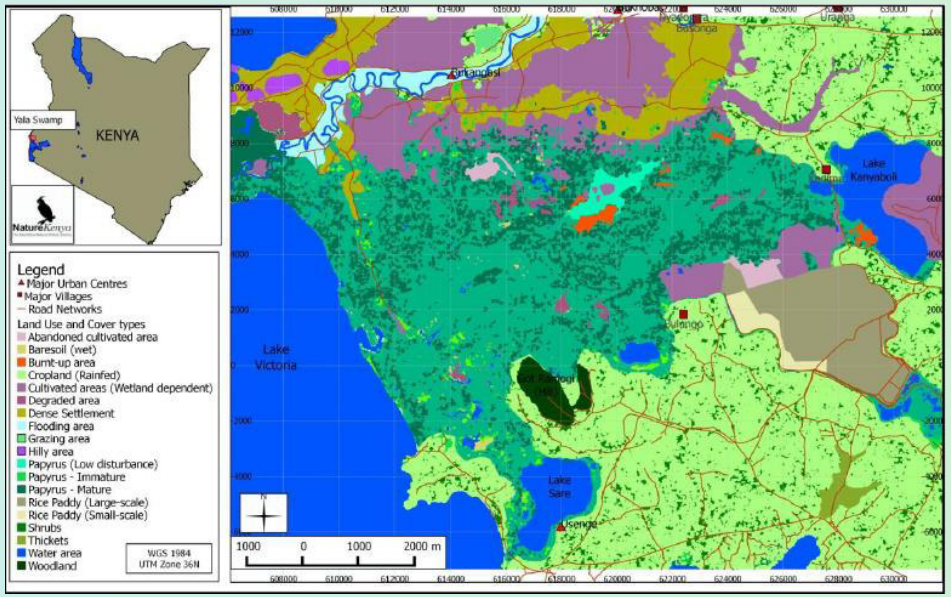


b) Continued Development Scenario

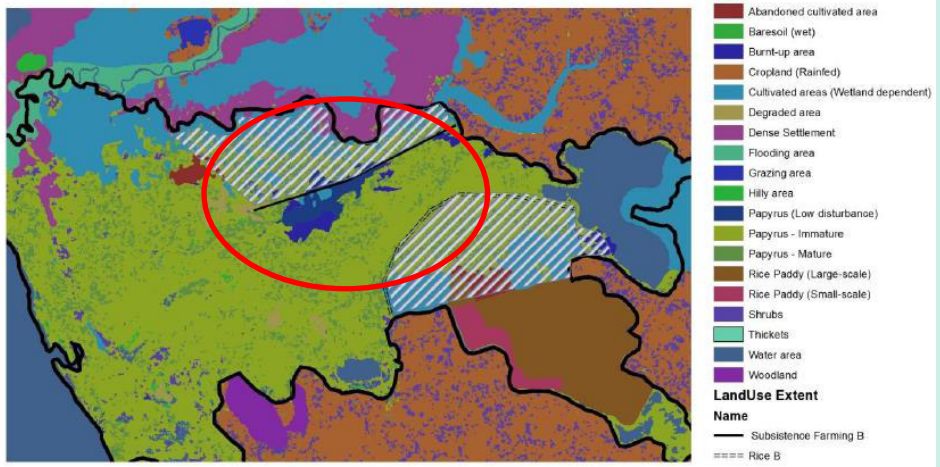


Alternative State [example]

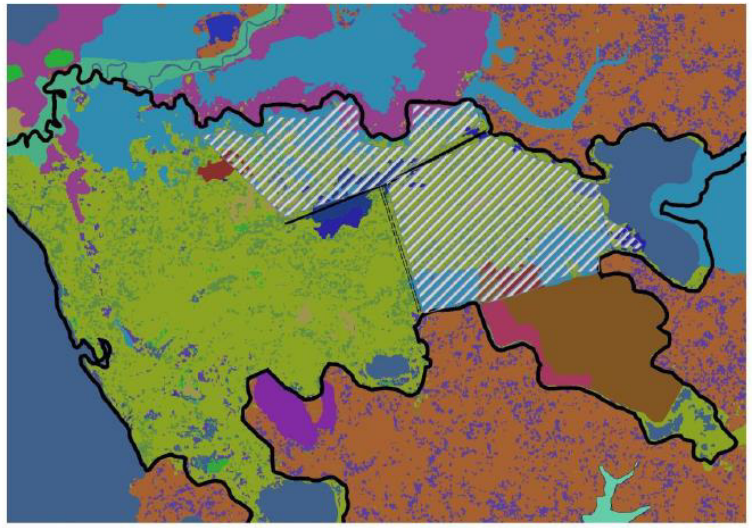
Current State : Yala Swamp, Kenya



a) Balanced Scenario

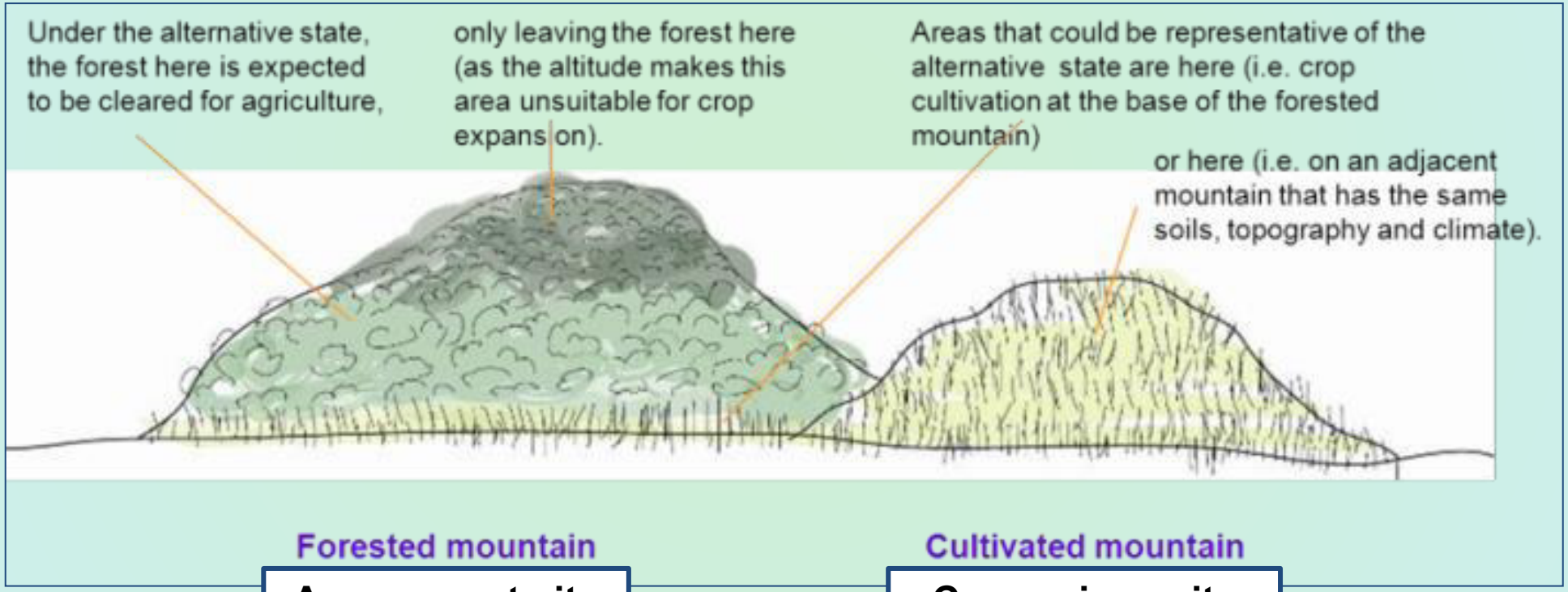


b) Continued Development Scenario



How to measure ES in the Alternative State conditions?

- As much as possible, measurements should be taken from a real place to represent the alternative condition of your **assessment site** = the **comparison site(s)**

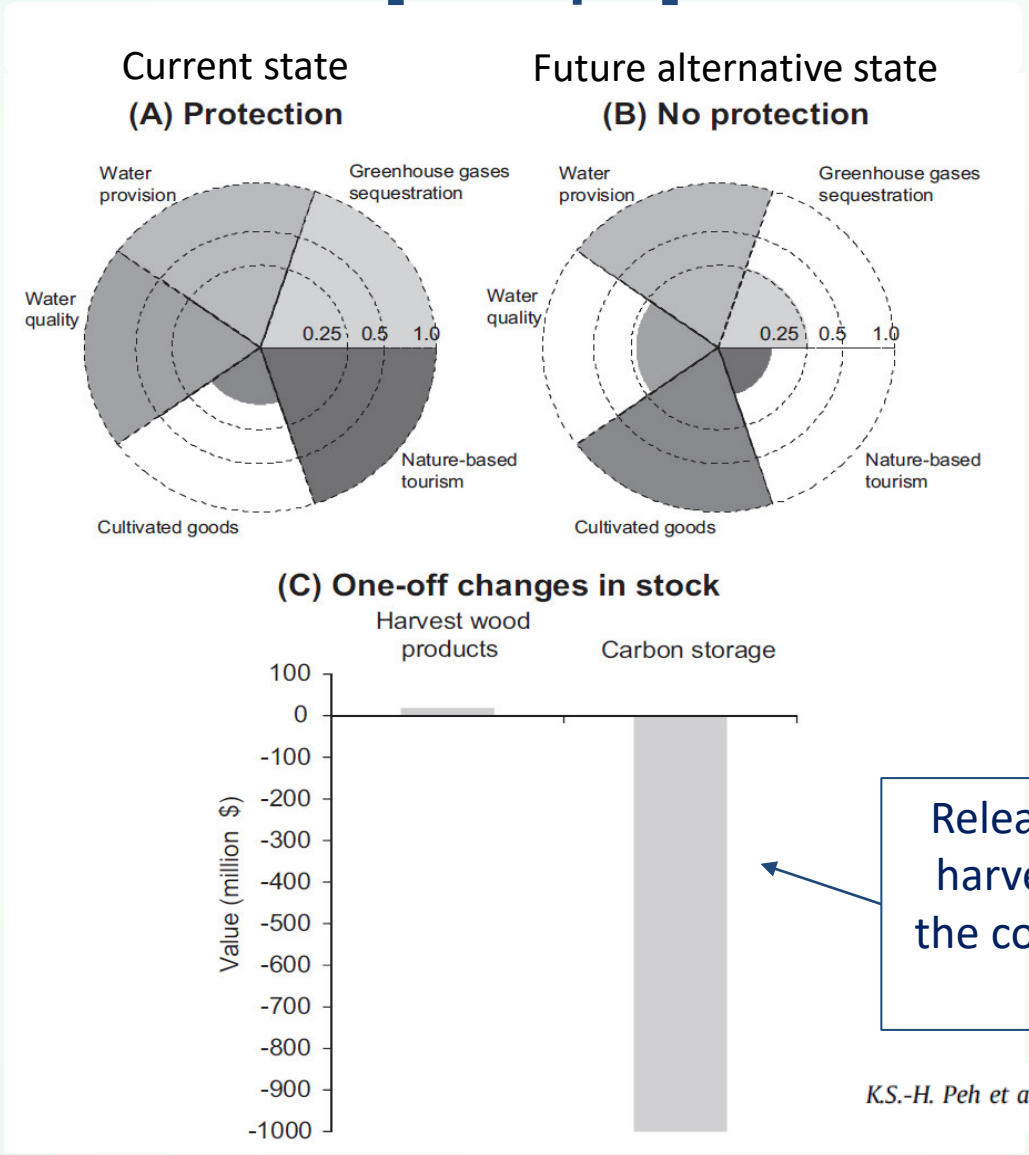


Why comparative valuation of multiple ES?

- ✓ Simple assessment of the gross values of a particular service is less useful - Relative values give decision-makers an idea of the net consequences of decisions
- ✓ Understand the impacts of management or land-use change on ES delivery
- ✓ Influence decision-making and promote efficient planning
- ✓ Preserve ES & their associated benefits people rely on
- ✓ Inform on human well-being & biodiversity conservation objectives

Comparative valuation [example]

Shivapuri National Park, Nepal



Net monetary benefit was estimated at $11million/year

Release of carbon and use of harvested wild goods during the conversion from Protected to NON-protected

K.S.-H. Peh et al. / Ecosystem Services 22 (2016) 359–369

Beneficiaries

An ecosystem service only exists if someone derives benefits from it.

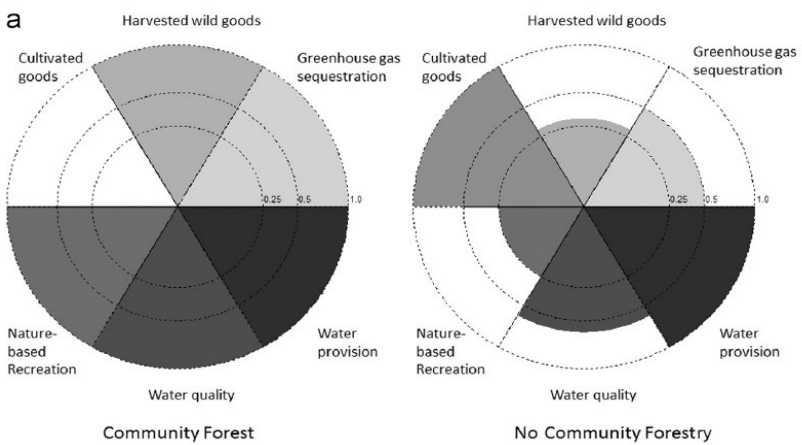
Social, political, economic and ecological factors play a role in the **distribution of benefits**, and the **impacts of change.** These may not be equitable.

It is essential to **understand who the beneficiaries are** so that the full consequences of changes in ES can be assessed.




Beneficiaries – Understanding ES trade-offs

Impacts of change in service provision on beneficiaries at different scales



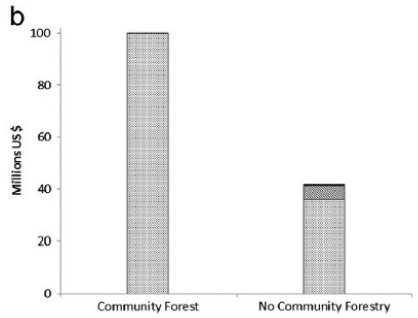


Fig. 3. Ecosystem services change. Ecosystem service values for the current (CF) and alternative state (no CF) of Phulchoki Mountain Forest IBA for: (a) annual flows (US $ yr^{-1}) for greenhouse gas sequestration, water provision, water quality, nature-based recreation, cultivated goods and harvested wild goods; and (b) one-off stock changes (US $) for carbon storage (dotted), timber (hatched) and fuelwood (black).

J.C. Birch et al. / Ecosystem Services 8 (2014) 118–127

Legend

+: increases

- : decreases

= : no change

TESSA v3.0

http://tessa.tools

6 Steps of TESSA

Qualitative assessment
Create/gather LULC of the site
Identify Key Stakeholders

Workshops/Meetings – Scoping appraisal

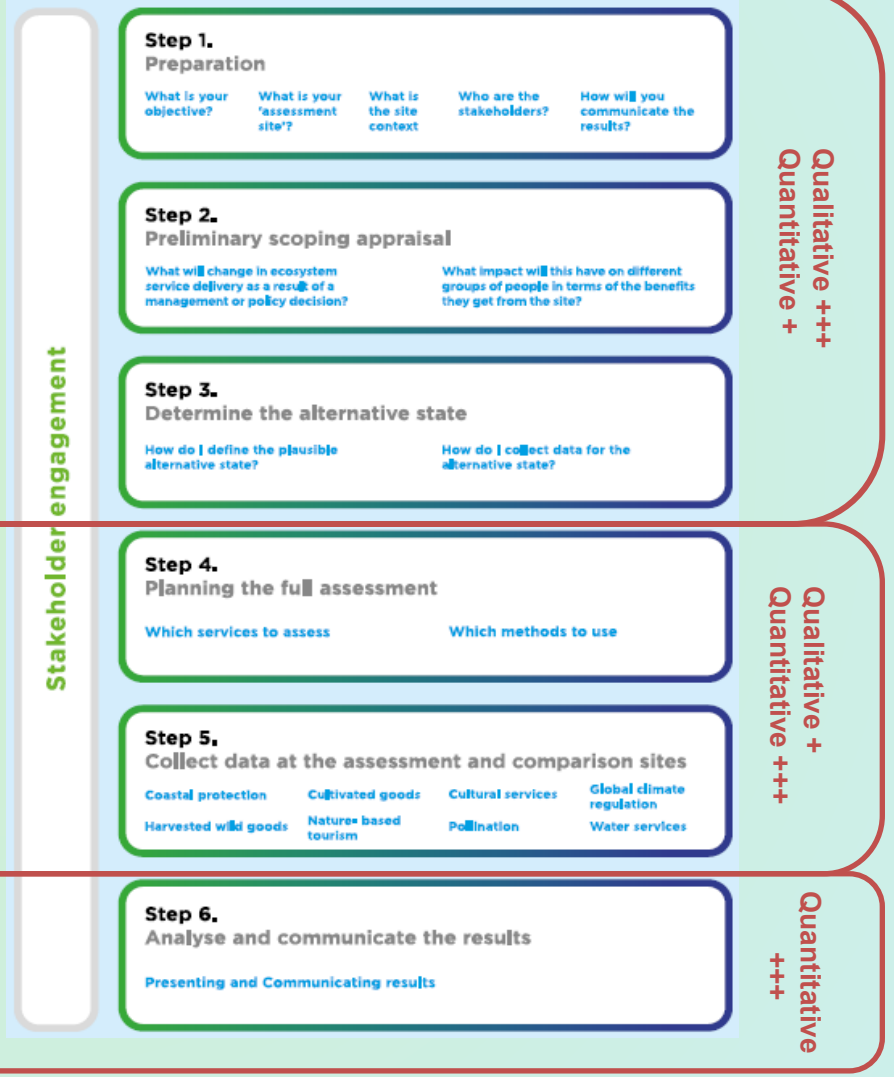
Identify the foreseeable change of the site

Select methods for the ES assessment
Field collection / Secondary data

Analysis of biophysical and economic values
Communication of results

Step-by-step framework

Figure 4. TESSA Step by Step Framework



Importance of stakeholder engagement

- TESSA encourages stakeholder engagement throughout the process from Step 1 through 6
- Guidance on how to identify and engage the appropriate people.
- Engagement throughout the process built strong relationships invaluable for the project(s), improves information flow, and fosters ownership.

Practical methods available

simple & rapid

optional

	Global climate	Water services	Harvested wild goods	Cultivated goods
Biophysical / quantitative methods	Forest transects	Hydrological modelling	Expert interviews	Expert interviews
	Soil sampling	Individual household surveys	Focus group discussions	Focus group discussions
	Dry mass	Water monitoring (quality/quantity)	Individual household surveys	Individual household surveys
Economic Valuation methods	Market values	Avoided damage cost	Market values	Market values
	Social cost	Mitigation cost	Substitute price	Substitute price
	Benefits transfer	*Benefits transfer*	*Benefits transfer*	*Benefits transfer*

Practical methods available

simple & rapid

optional

	Nature-based recreation	Pollination	Coastal protection	Cultural
Biophysical / quantitative methods	Expert interviews	Dependency ratios	Mapping / visual inspection / GPS	Questionnaires / surveys
	Published data	Desk-based methods	Literature / databases / numerical models	Interpretative drawings
	Visitor surveys / census	Visitation rates	Sediment traps / marker horizons	Photo voice / Storytelling
Economic Valuation methods	Visitor spend	Exclusion experiments	Damage reduction	
	Travel cost			
	Benefits transfer			

Principles of TESSA [summary]

- Help non-experts with limited capacity to measure several ES relatively rapidly

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Principles of TESSA [summary]

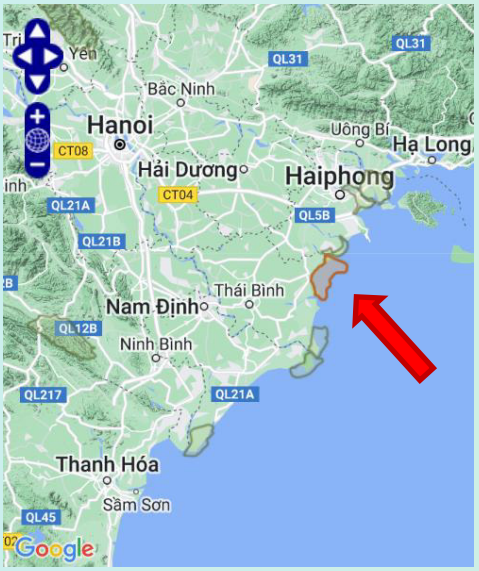
- Help non-experts with limited capacity to measure several ES relatively rapidly
- Estimate difference between current state and plausible alternative state(s)
- Involve stakeholders and beneficiaries
- Provide scientifically robust data to influence management, policy- or decision-making (and for monitoring).

TESSA is a flexible framework

- ✓As simple as possible without losing science
- ✓Use to level of own capacity and knowledge
- ✓Designed to be adapted to suit context
- ✓Welcome “add-ons” and other complementary methods
- ✓ Encourage feedback and further improvements through new projects

The experiences of Myanmar and Vietnam with TESSA

The experience of Thai Thuy in Vietnam



The area of the IBA (Important Bird and Biodiversity Area) was selected as the site for this measurement. Background information and previous research was collected for scoping and identifying the beneficiaries.

All data collected during the survey were analyzed with the existing data and literature. For the climate regulation and disaster prevention, desk top analyses were conducted.

Preliminary work & Rapid appraisal

- Define site, based on biological importance and perceived threats
- Explore policy context
- Identify the stakeholders
- Identify habitat, services and beneficiaries

Methods selection

- Select relevant services to assess
- Select appropriate methods for each service

Data acquisition

- Collect/collate data for site

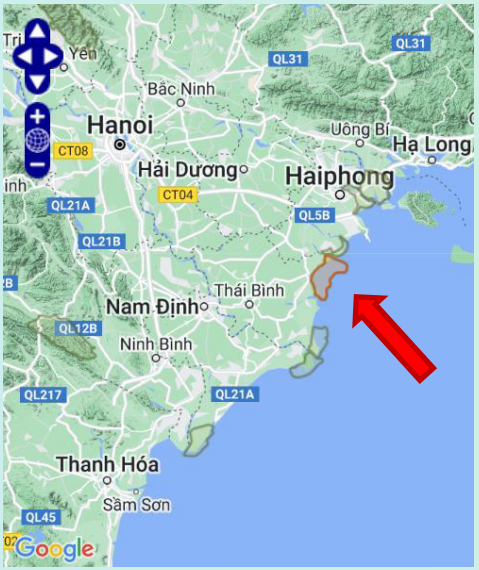
Analysis and communication

- Analyse data
- Communicate messages

In this survey, four ecosystem services were identified and methods for each service were selected
- Harvested wild goods
- Cultivated goods
- Disaster risk reduction
- Global climate regulation

Data was collected from existing data and simple interviews. In order to identify missing services and collect information, a stakeholder meeting was conducted with the representatives of the area.

The experience of Thai Thuy in Vietnam



Exchange rate: 22,300VND/USD

Benefit

Harvested Wild Goods $2.2 million/year

Fish harvested in Thai Thuy district $1.37 million/year [1]
Shellfish collected in the mudflat $0.87 million/year

Cultivated Goods $ 11.7 million/year

Fish and Shrimp harvested from semi natural aquaculture $0.58 million/year ($2,524/ha/year) [2]
Fish harvested from intensive aquaculture $8.93 million/year ($7,558/ha/year) [2]
Clam harvested from clam culture in mudflat $ 1.93 m/year
Salt production in the salt farm $0.22 million/year [3]

Disaster Risk Reduction $ 1.1 million/year

Protective benefits of mangrove forest $1.05 million/year [4]

Climate Regulation $60.3 million

The benefit of global climate regulation from the carbon stored in the wetland is $ 60.26 million. This is an one-off stored value, i.e. not an annual value. [5]

Net Benefit : $ 15.0 million / year
Plus $ 60.3 million of carbon storage function

Water Purification

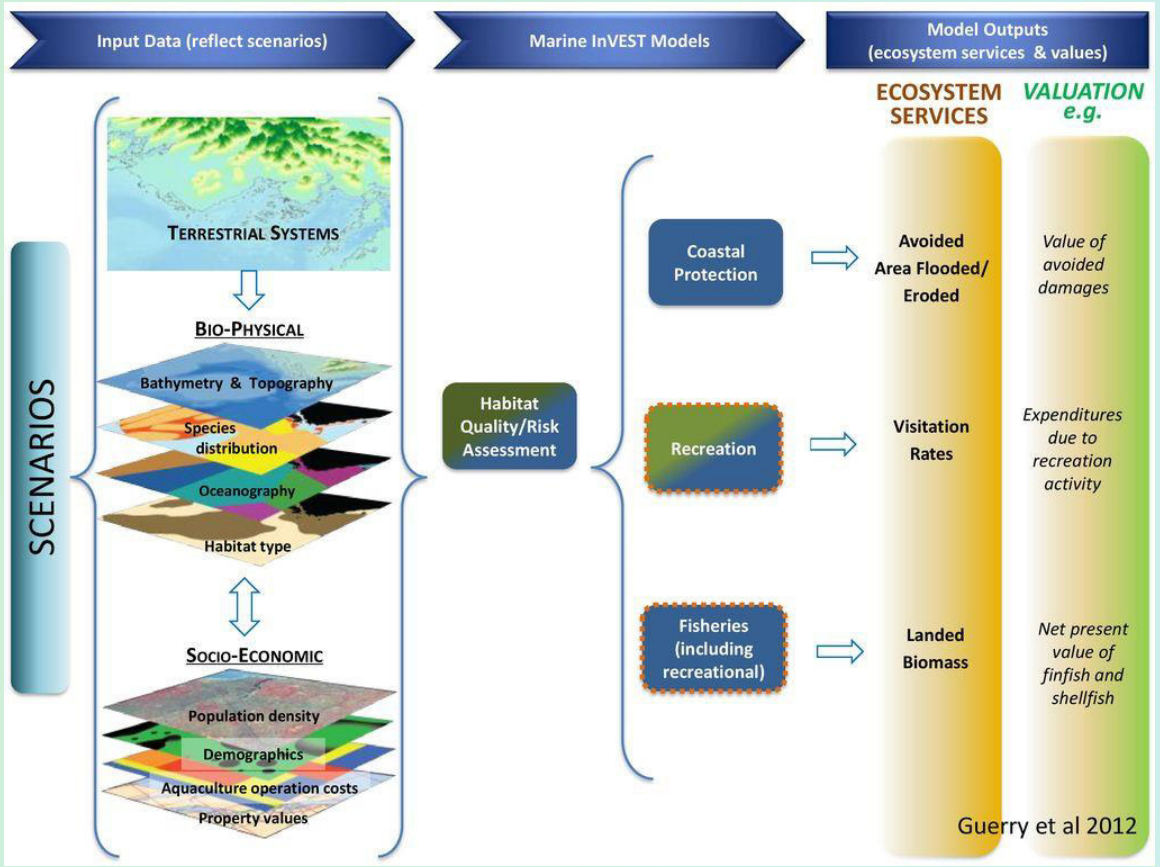
The mudflat conducts water purification through the activities of living organisms such as clams, microalgae and bacteria in the mud. Mangroves also have a waste treatment function and these functions are vital to maintain seawater quality.

Eco-tourism

Eco-tourism such as bird watching and walking in the mudflat has not been developed at Thai Thuy but there is potential to attract tourists. Well managed eco-tourism can provide benefits not only for tourists, but also for local people as an income source.

Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST)

- Modular
- Based on complex equations
- Maps in, maps out
- Stand-alone app
  but GIS software still needed



natural capital PROJECT

https://naturalcapitalproject.stanford.edu/software/invest

Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST)

InVEST models

Carbon | Read more »

Coastal Blue Carbon | Read more »

Coastal Vulnerability | Read more »

Crop Pollination | Read more »

Crop Production | Read more »

Habitat Quality | Read more »

Habitat Risk Assessment | Read more »

Offshore Wind Energy | Read more »

Recreation | Read more »

Reservoir Hydropower Production (Water Yield) | Read more »

Scenic Quality | Read more »

Seasonal Water Yield | Read more »

Sediment Retention | Read more »

Urban Cooling | Read more »

Urban Flood Risk Mitigation | Read more »

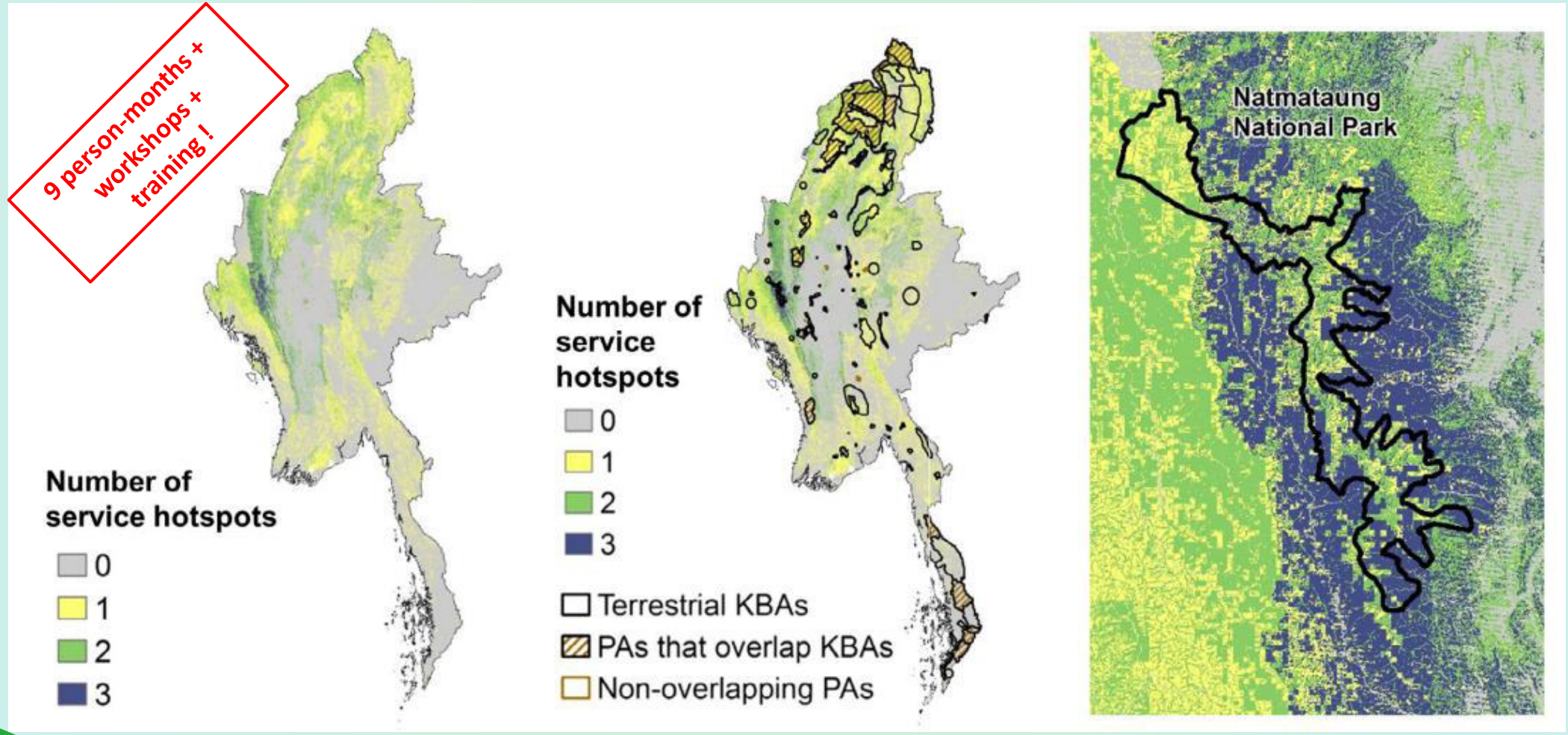
Urban Stormwater Retention | Read more »

Water Purification | Read more »

Wave Energy | Read more »

https://naturalcapitalproject.stanford.edu/software/invest

InVEST application: Overlap of ES hotspots and KBAs/PAs



Mandle et al., 2017 in Neugarten et al., 2018.
https://portals.iucn.org/library/node/47778

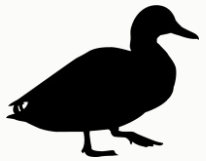
Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST)

InVEST models

Carbon | Read more »

Coastal Blue Carbon | Read more »

Coastal Vulnerability | Read more »



Crop Pollination | Read more »

Crop Production | Read more »

Habitat Quality | Read more »

Habitat Risk Assessment | Read more »

Offshore Wind Energy | Read more »

Recreation | Read more »

Reservoir Hydropower Production (Water Yield) | Read more »

Scenic Quality | Read more »

Seasonal Water Yield | Read more »

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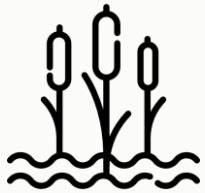
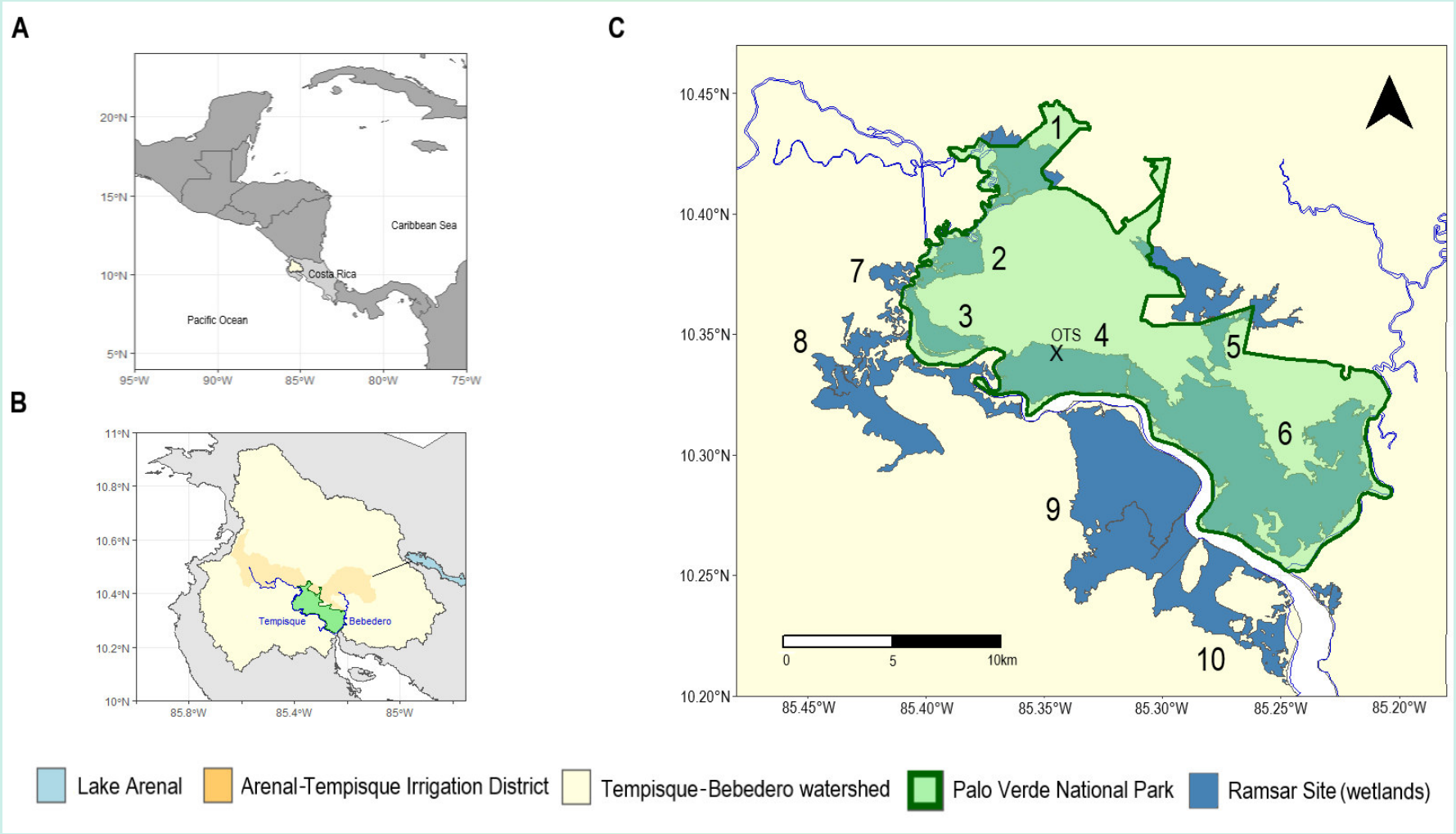
Water Purification | Read more »



Wave Energy | Read more »

https://naturalcapitalproject.stanford.edu/software/invest

InVEST application: Overlap of ES hotspots and hydrological units

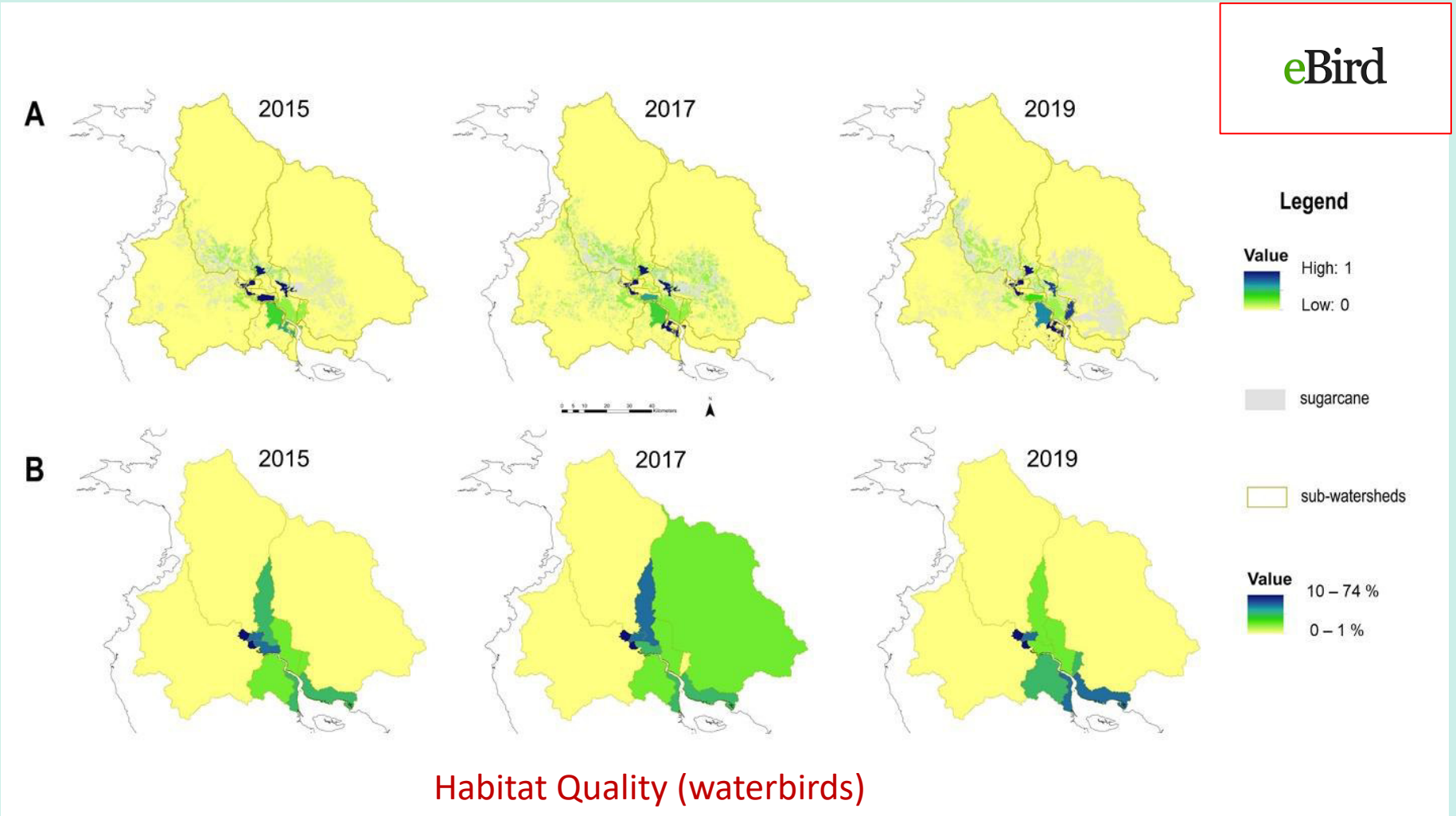


Barchiesi et al., 2022: Wetland hydropattern and vegetation greenness predict avian populations in Palo Verde, Costa Rica

InVEST application: Overlap of ES hotspots and hydrological units

Palo Verde, Costa Rica © S. Barchiesi

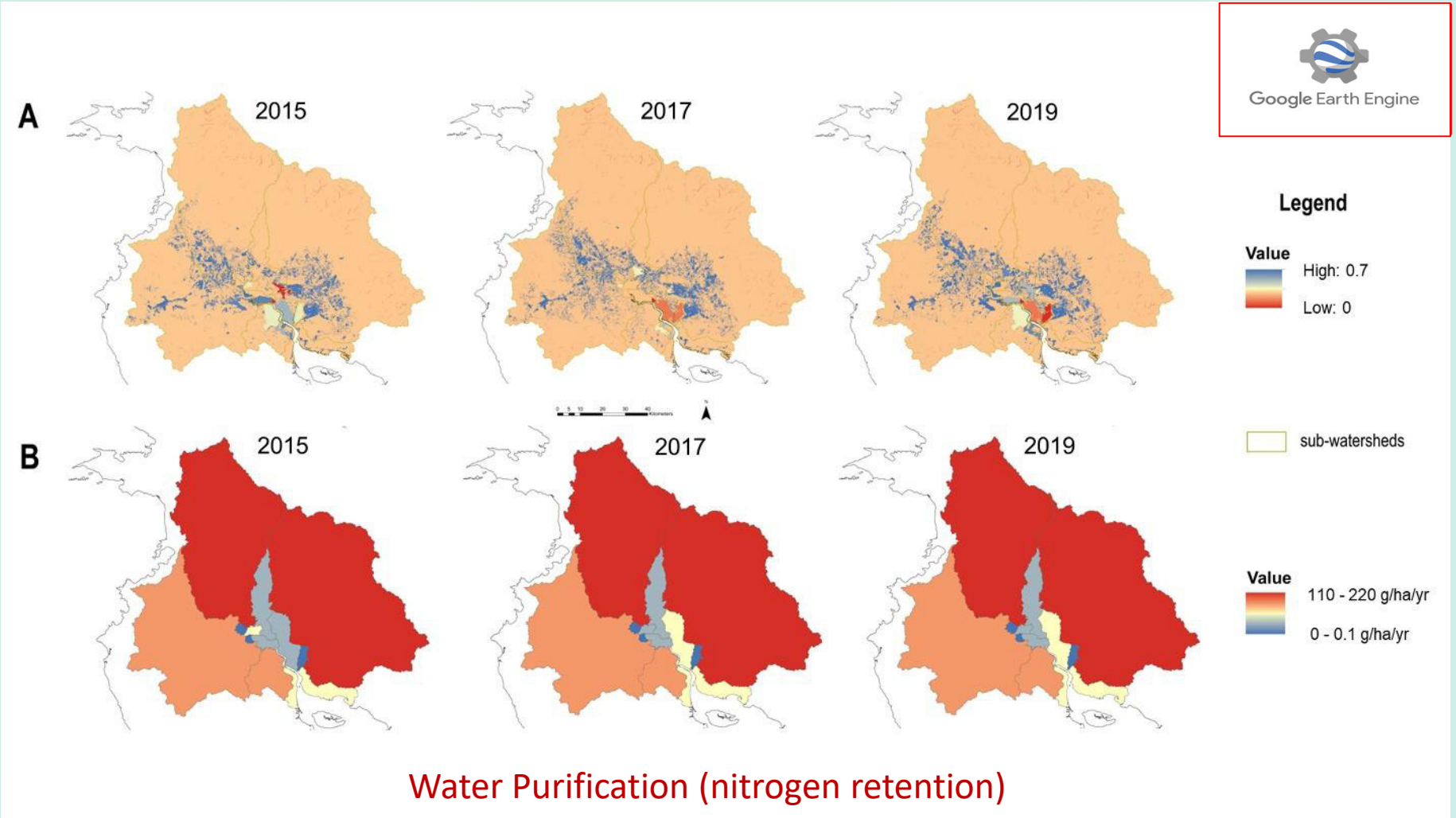
InVEST application: Overlap of ES hotspots and hydrological units



Habitat Quality (waterbirds)

Barchiesi et al., 2022: Wetland hydropattern and vegetation greenness predict avian populations in Palo Verde, Costa Rica

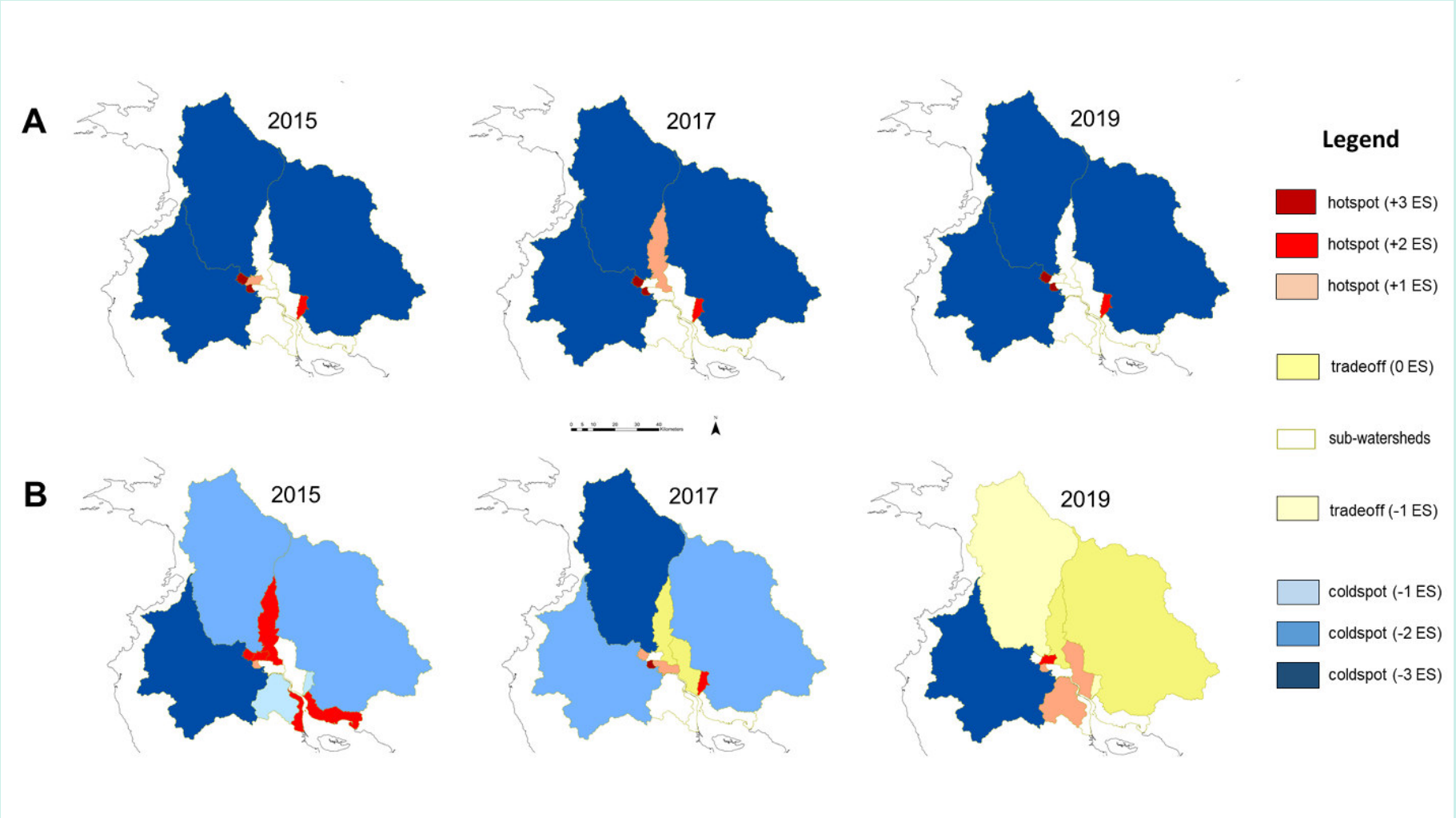
InVEST application: Overlap of ES hotspots and hydrological units



Water Purification (nitrogen retention)

Barchiesi et al., (forthcoming)

InVEST application: Overlap of ES hotspots and hydrological units



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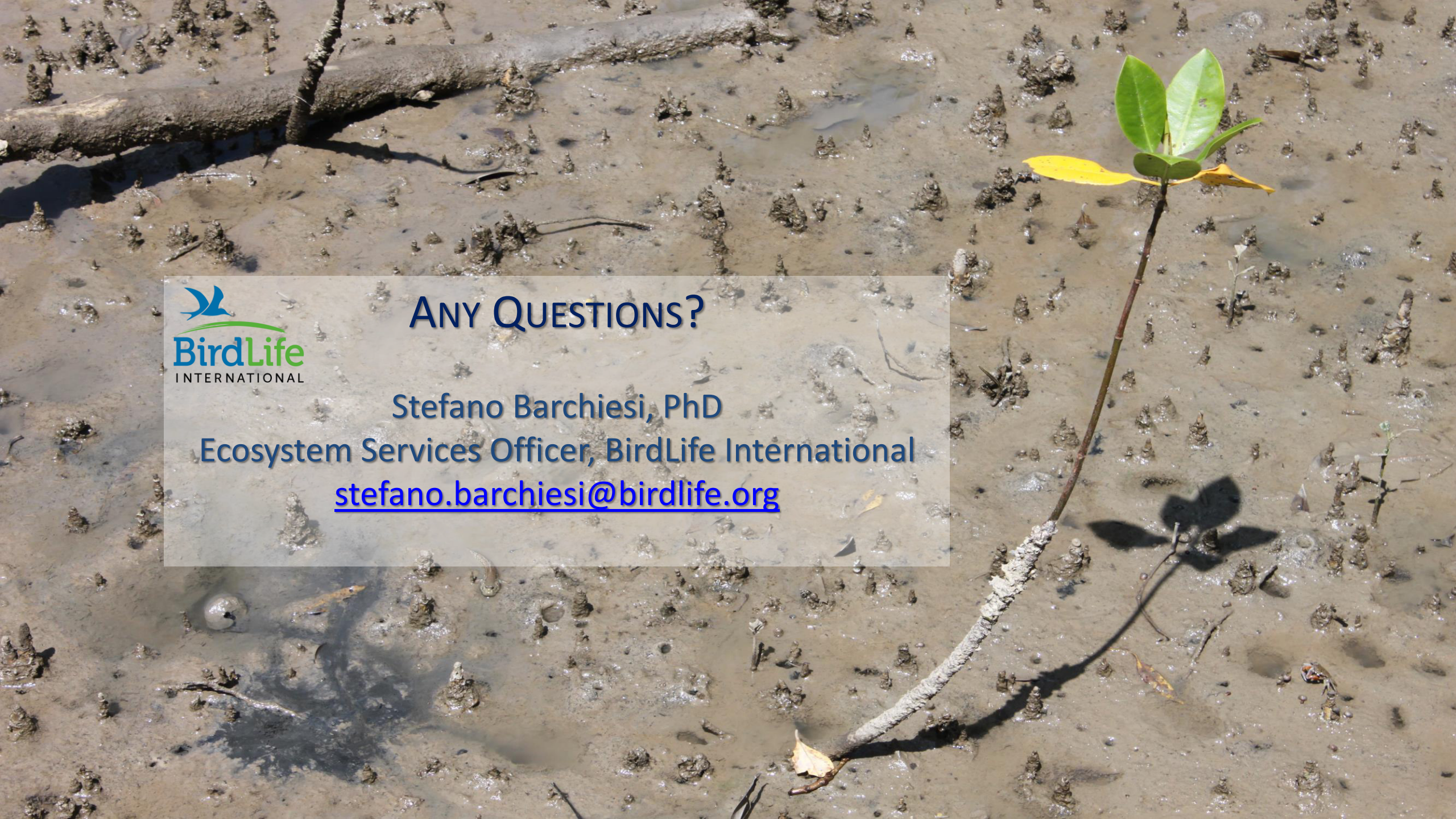

Any Questions?

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stefano.barchiesi@birdlife.org