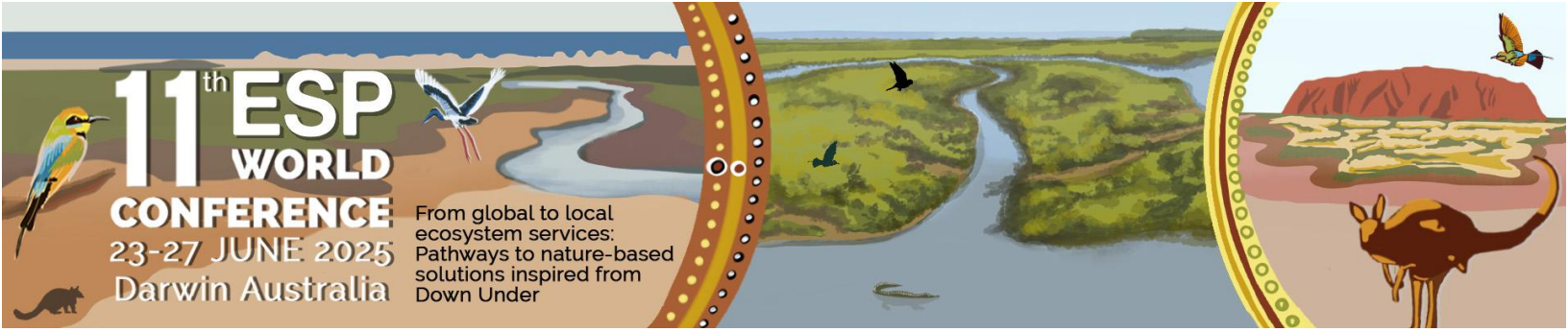


BOOK OF ABSTRACTS

I. SESSION DESCRIPTION

ID: T4

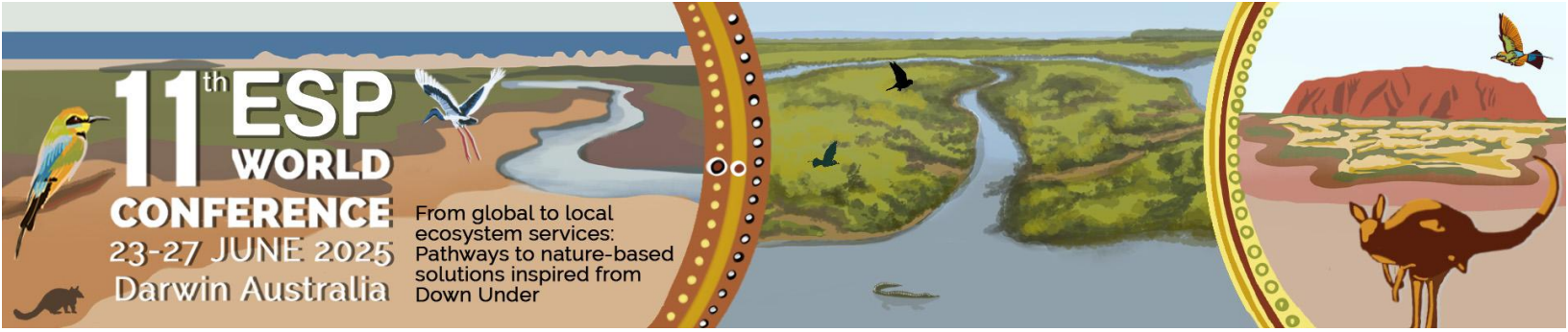
From outer space to local ecosystem service mapping – harnessing state-of-the-art data, methods and tools on various spatio-temporal scales

Hosts:

	Name	Organisation	E-mail
Host:	Benjamin Burkhard	Leibniz University Hannover	burkhard@phygeo.uni-hannover.de
Co-host(s):	Paulo Pereira	Mykolas Romeris University	pereiraub@gmail.com
	Neville Crossman	Flinders University	neville.crossman@flinders.edu.au
	Solen le Clech	Wageningen University	solen.leclech@wur.nl

Abstract:

Much knowledge, data and methodological approaches for more detailed and efficient ecosystem service mapping have been created and are ready-for-use today. High accuracy Earth observation techniques, big data analysis algorithms, monitoring schemes as well as more sophisticated biophysical measurement and socio-cultural survey methods offer the human-environmental system sciences highly applicable new instruments, allowing very accurate studies at various spatio-temporal scales – from global to local and from decades to moments. Modern remote sensing sensors, for instance, do not only allow precise detection of prevailing land cover types, but enable more detailed analyses of environmental indicators like biomass, soil moisture, temperature or human activities that are highly relevant for ecosystem condition, functionality and services supply. In combination with state-of-the-art spatio-temporal approaches like GIS, geostatistics and machine-/deep-learning, large amounts of data can be processed and analysed, allowing the detection of patterns and processes, leading to a better understanding of human-environment interactions. Such information is highly needed for sustainable management of our limited land and natural resources. The session therefore welcomes contributions about above-mentioned data and tools on different spatio-temporal scales, updating the ecosystem services mapping community about their applicability.



Goals and objectives of the session:

To elaborate on newest data and innovative tools available for ES supply and/or demand mapping

Planned output / Deliverables:

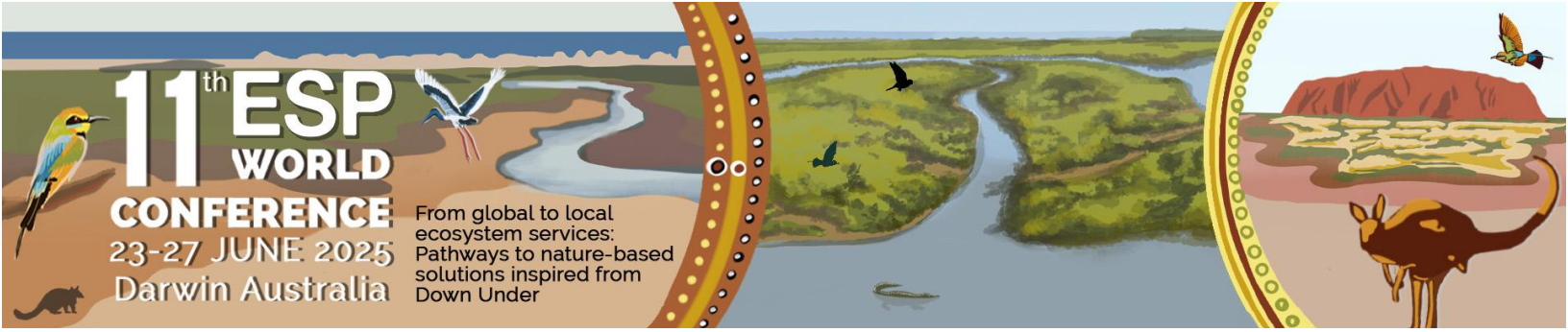
joint publication or topic collection in an open access online journal

II. SESSION PROGRAM

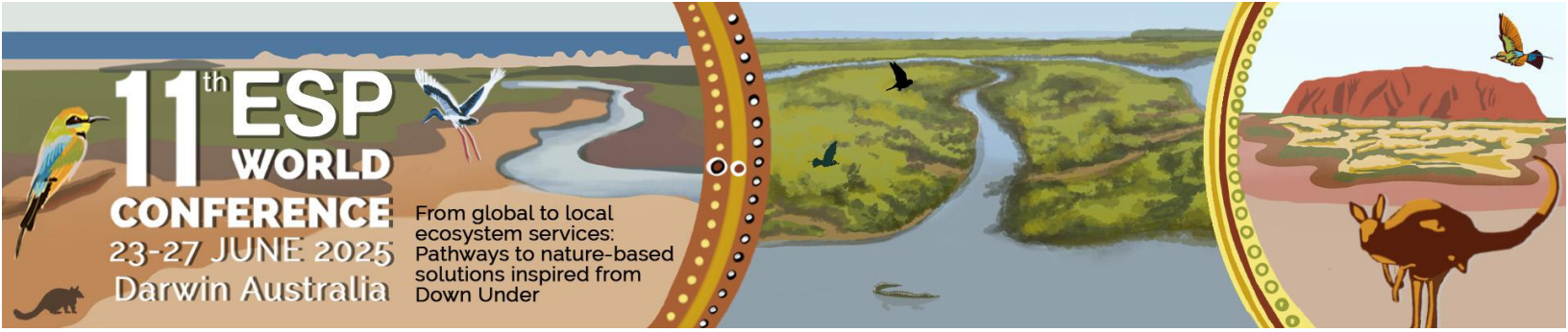
Room: Waterfront 2
Date of session: 24.06.2024
Time of session: 10:30 – 12:30 and 15:30 – 18:00

Timetable speakers:

Time	First name	Surname	Organization	Title of presentation
10:30	Benjamin	Burkhard	Leibniz University Hannover	Session Introduction
10:35	Paulo	Pereira	Mykolas Romeris University	Mapping Ecosystem Services. A resume from several systematic revisions
10:50	Tauany	Rodrigues	Universidade do Estado do Rio de Janeiro	Ecosystem services and biodiversity of the Atlantic Forest: mapping and quantification in contemporary scenario models
11:05	Ramon	Bicudo da Silva	State University of Campinas, Brazil	Secondary natural vegetation cover increases in the Atlantic Forest are important but not offset carbon and habitat losses
11:20	Luana	Meister	Federal University of Paraná, Brazil	Long term analyses reveal losses in regulating ecosystem services in southern Atlantic Forest
11:35	Neville	Crossman	Flinders University, Adelaide, Australia	Using maps of ecosystem service change to help communities adapt to climate change risks in the



Time	First name	Surname	Organization	Title of presentation
				Coorong, Lower Lakes and Murray Mouth, South Australia
11:50	Phub	Dem	Graduate School of Engineering, Nagoya University, Japan	Evaluation of ecosystem service supply and flow from human intervention and intergenerational sustainability perspective.
12:05	Brett	Bryan	Deakin University, Australia	Land Use Trade-Offs Version 2: a next generation, national-scale model of land-use and ecosystem services for Australia
Lunch break Coffee break				
15:30	Stephen	Stewart	CSIRO, Australia	Quantifying the shade, shelter and productivity benefits of agroforestry: global modelling to inform farm-scale assessment
15:45	Kelly	Bryant	Science Division of DETSI Australia	Data without Borders: Harmonising data on the co-benefits of carbon farming with the Co-benefits Tool
16:00	Ethan	Mackereth	University of Adelaide, Australia	Exploring the Impact of Conservation Agriculture on Wind Erosion on South Australia's Eyre Peninsula
16:15	Sylwia	Kulczyk	University of Warsaw	Between numbers and narratives: mapping cultural ecosystem services
16:30	Kiichiro	Hayashi	Nagoya University	Culture ecosystem service assessment focusing on beneficiary movement
16:45	Greg	Barber	Charles Darwin University	A new method of estimating increases in woody vegetation cover for carbon offset projects in Australia's semi-arid zone



Time	First name	Surname	Organization	Title of presentation
17:00	Rahul	Yadav	Forest Research Institute Dehradun, India	Assessing the Role of Land Use on Water Yield in a Himalayan Watershed: A Case Study of the Giri River using the InVEST-AWY Model
17:15	Shankar	Adhikari	Ministry of Forests and Environment, Kathmandu, Nepal	Identification, Prioritization and Mapping of Ecosystem Services in the Panchase Mountain Ecological Region of Western Nepal
17:30				Session wrap-up, next steps TWG4

III. LIST OF ABSTRACTS

The first author is the presenting author unless indicated otherwise.

1. Mapping Ecosystem Services. A resume from several systematic revisions.

First authors(s): Paulo Pereira

Other author(s): Katarzyna Bogdziewicz, Egle Baltranaite, Marija Meisutovic-Akhtarieva, Luis Valenca Pinto, Miguel Inacio

First author affiliation: Environmental Management Center, Mykolas Romeris University, Vilnius, Lithuania

Contact: pereiraub@gmail.com

Keywords: Mapping, Ecosystem Services, Systematic Reviews, Validation

Mapping Ecosystem Services (ES) has grown in the last years due to the establishment of different strategies at the global ((Millennium Ecosystem Assessment (MEA)) and regional level (European Union Biodiversity Strategy, 2030). However, this evolution was not equal around the globe. In this work, we aim to review several published systematic reviews focused on mapping ES in

forecasting future land use impacts on ES, lakes, protected areas, urban and peri-urban areas and tourism impacts on coastal ES globally. According to all the reviews, most works were conducted in Europe and Asia. In forecasting future land use impacts on ES and Urban and peri-urban areas, regulating ES studies were the most mapped, while, in lakes protected areas and Tourism impacts on coastal ES, cultural were preferred. The supply dimension was the most mapped, and most works did not apply an established classification; MEA was preferred only in the Lakes ES systematic review. Biomass was the regulating ES most mapped in all systematic reviews, and Physical and experiential interactions with the natural environment were the most studied cultural ES. In Lakes ES systematic revision, the transformation of biochemical or physical inputs to ecosystems was the most mapped regulating ES. In contrast, in the others, the regulation of physical, chemical, and biological conditions was the most studied. Qualitative methods were preferred in all the systematic reviews (except for Lake ES). Finally, the validation step was overlooked in all the systematic reviews. A mall percentage of the works validated their outcomes. Overall, more than 400 studies were assessed with detail, allowing us to identify the areas where mapping ES needs to be developed and the sections and divisions that are urgently needed. These works can be the basis for further mapping and development of ES mapping studies.

2. Ecosystem services and biodiversity of the Atlantic Forest: mapping and quantification in contemporary scenario models

First authors(s): Tauany Rodrigues

Other author(s): Márcia C. M. Marques, Aliny P. F. Pires, Fernando Resende

First author affiliation: Universidade do Estado do Rio de Janeiro

Contact: tauanyrodrigues27@gmail.com

Keywords: water security, food security, pollination, biodiversity

Biodiversity and ecological processes in ecosystems contribute directly or indirectly to human well-being. Ecosystem services, or the benefits nature provides to people, include processes that

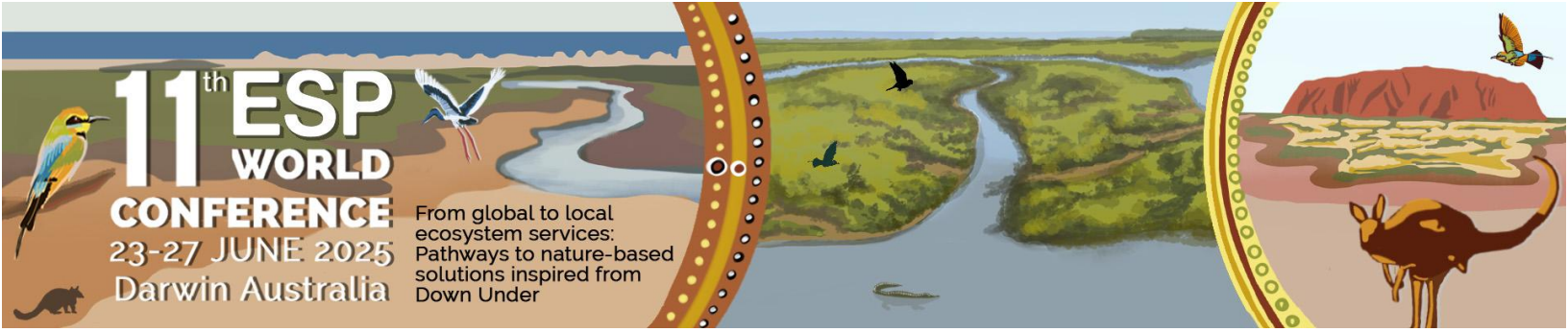
ensure food, water, climate regulation, and social security, affecting various sectors of society. However, studies on biodiversity still need to explore how inventory data interact with ecosystem service provision patterns and how these relationships align with conservation strategies. The Atlantic Forest is a critical biome in Brazil, housing over 70% of the country's population while being one of the world's biodiversity hotspots. This biome exemplifies the complex relationship between people and nature, making it a key area for developing strategies that integrate biodiversity conservation and human well-being. We assessed the potential for promoting co-benefits in conservation planning by mapping and quantifying strategic ecosystem services and aligning them with biodiversity databases. Using the InVEST tool, we evaluated carbon stock, crop pollination, nutrient delivery ratio, and seasonal water yield. We integrated these assessments with biodiversity data on mammals, amphibians, reptiles, birds, plants, and odonates from the IUCN and BIEN databases. Our findings reveal multiple relationships between biodiversity and ecosystem services, which vary by taxonomic group and service identity. Plant richness was positively associated with aboveground carbon and runoff, while animal richness exhibited an opposite pattern, showing negative correlations with aboveground carbon and runoff. These mismatches suggest that different taxonomic groups respond distinctively to ecosystem functions. Plants contribute directly to carbon storage and water retention, whereas animal richness may be linked to disturbed environments. Our results highlight the need to consider multiple biodiversity components in conservation planning. A comprehensive approach incorporating both plant and animal diversity is essential for maximizing ecosystem service benefits and ensuring effective conservation strategies.

3. Secondary natural vegetation cover increases in the Atlantic Forest are important but not offset carbon and habitat losses

First authors(s): Ramon Bicudo da Silva

Other author(s): No

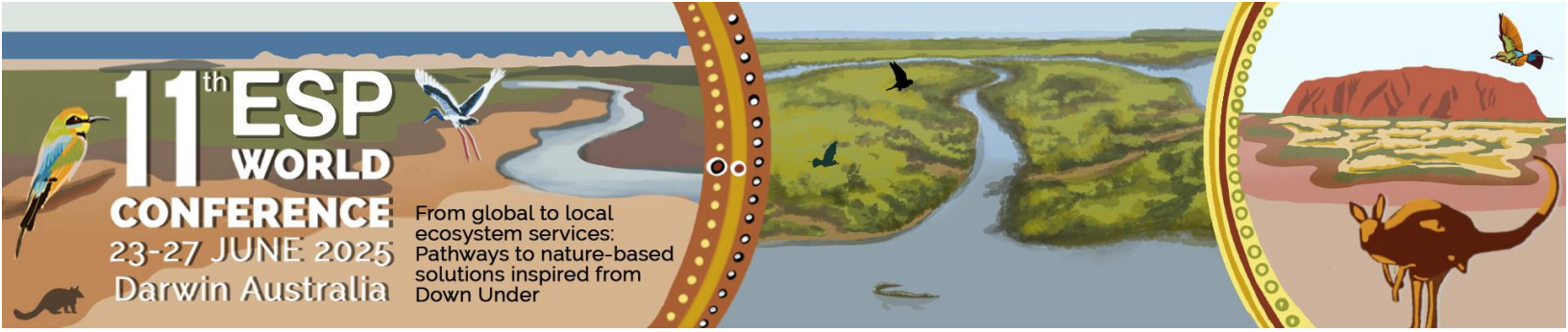
First author affiliation: State University of Campinas



Contact: rbicudo@unicamp.br

Keywords: Landscape ecology, remote sensing, map algebra, ecosystem service, conservation policies

This study analyzed trends in (a) primary natural vegetation cover (NVC) loss, (b) secondary NVC dynamics (persistent and ephemeral regeneration), and (c) their impacts on carbon stocks and habitat provisioning in the Brazilian Atlantic Forest biome, a global biodiversity hotspot, over 37 years. Using the MapBiomas v.9 land-use/cover dataset derived from Landsat imagery, combined with spatial ecosystem service distribution, the analysis was grounded in a landscape ecology framework, emphasizing both composition and configuration, to advance multidimensional perspectives in landscape sustainability science. The biome's NVC decreased by 4.2 Mha, driven by a gross loss of 12.8 Mha of primary NVC (~1.4 Gt of carbon lost). On the other hand, persistent (gross gain) secondary NVC gained 8.6 Mha (~0.170 Gt of carbon, with potential for ~0.987 Gt in 80-years), contributing 23.5% of the biome's NVC composition by 2021. However, ephemeral regeneration accounted for 3.8 Mha (equivalent of 44% of persistent secondary NVC gains), negatively impacting habitat provisioning and carbon sequestration. Deforestation significantly affected priority areas for biodiversity conservation, with a net NVC loss of 1.2 Mha. Secondary NVC played a crucial role in mitigating deforestation impacts, improving landscape connectivity and patch size, and enhancing habitat provisioning. However, persistent secondary NVC replacement rates in high-priority areas lagged behind biome-level trends, especially in regions of extremely high biological importance. In addition, I argue that ephemeral regeneration represents a missed opportunity to achieve higher conservation levels across the biome. Conservation mechanisms should prioritize addressing this issue to shift the net loss trajectory toward more persistent and sustainable regeneration over time. This study underscores the essential role of secondary NVC in buffering deforestation impacts and highlights the need for targeted conservation efforts in priority areas to sustain biodiversity, carbon storage, and ecosystem services in the Atlantic Forest biome.



4. Long term analyses reveal losses in regulating ecosystem services in southern Atlantic Forest

First authors(s): Luana Meister

Other author(s): Marcia C. M. Marques

First author affiliation: Ecology and Conservation Graduate Program, Plant Ecology Laboratory, Federal University of Paraná

Contact: luanameister.22@gmail.com

Keywords: biophysical, Brazil, mapping, trade-offs

Understanding ecosystem services (ES) is crucial for policies aimed at ensuring biodiversity conservation, natural resources, and livelihoods for humanity. The Atlantic Forest plays a vital role in providing services to 70% of the Brazilian population, with significant tension between agricultural production and natural resource conservation in the southern region of the biome. In this research, we have measured, mapped, and analyzed the synergies and trade-offs among ecosystem services. Our research has focused on the distinct features of the Atlantic Forest biome, which offers a wide range of ecosystem services such as providing habitats for multiple species, regulating the climate, supplying water, and offering cultural opportunities. We defined eight indicators of four categories of ESs and analyzed them in 399 municipalities in Paraná State, Brazil, over two different temporal scales. The categories of services were represented by indicators of, regulating services (carbon storage, soil conservation, and water yield), supporting services (biodiversity), provisioning services (cassava, orange, and soybean production), and cultural services (cultural opportunities). The findings revealed significant shifts in the provision of ecosystem services and an increase in trade-offs over decades. Temporal analysis showed a dramatic reduction in regulatory services contrasting with a substantial rise in provisioning services, notably soybean production, one of Brazil's main export commodities. Municipalities exhibited variations in ES production, and four distinct groups were identified based on the similarity of indicator values among municipalities. These regional disparities, influenced by land use and conservation practices, resulted in the formation of landscape clusters (bundles): Non-

fragmented Forest Landscape, Fragmented Forest Landscape, Homogeneous Agricultural Landscape, and Mixed Agricultural Landscape. The research emphasizes the need to identify synergies and trade-offs among different types of ecosystem services and calls for integrated management strategies to reduce regional disparities and promote the multifunctionality of ecosystems.

5. Using maps of ecosystem service change to help communities adapt to climate change risks in the Coorong, Lower Lakes and Murray Mouth, South Australia

First authors(s): Neville Crossman

Other author(s): Grazia Zulian, Felix Kühn, Benjamin Burkhard

First author affiliation: Flinders University

Contact: neville.crossman@gmail.com

Keywords: Climate change adaptation; ecosystem service maps; local communities; RAMSAR wetlands

The Coorong, Lower Lakes and Murray Mouth region in South Australia is on the RAMSAR list, making it an area of international significance. Yet like many RAMSAR wetlands, climate change poses a major threat to the ecological, social and economic systems in the region. Increased frequency and intensity of floods and droughts predicted under climate change threaten the Coorong's ecosystem services, which underpin community livelihoods. Examples include recreation and tourism activities, provision of fresh water for consumption and agriculture, cultural and spiritual values, and biodiversity and healthy ecosystems. More intense and frequent droughts and floods will compromise the local ecosystems' ability to continue supplying these services. But the extent of the impact, and how communities can adapt or respond, remain unknown.

This study models and then maps the change in ecosystem service supply under two plausible climate change scenarios in the Coorong. The resultant maps will be used to inform local communities in the region about the risks posed by climate change. Community members, which included local farmers, small business operators, environmentalists and government workers, will be brought together in a series of local workshops to understand the climate change risks as presented in the maps, and then develop adaptation strategies to reduce risks.

6. Evaluation of ecosystem service supply and flow from human intervention and intergenerational sustainability perspective.

First authors(s): Phub Dem

Other author(s): Kiichrio Hayashi

First author affiliation: Graduate School of Engineering, Nagoya University, Japan

Contact: pdem.cnr@rub.edu.bt

Keywords: Ecosystem services, sustainability, RTF, Provisioning Ecosystem services, agriculture.

In response to diminishing ecosystem benefits, research on independent analyses of ecosystem service (ES) supply potential has flourished across time and space. However, the high prevalence of geographical heterogeneity in provisioning ES (P-ES) supply and demand sites has led to substantial human intervention and intra- and inter-regional routing (ES flow), posing threats to their long-term viability. Previous studies have mostly conducted independent analyses of P-ES supply, flow, and/or demand, overlooking their interdependence and broader implications due to lack of conceptual framework capable of effectively allocating supply and demand, demonstrating sustainability repercussions across spatiotemporal scales, and identifying emergent trade-offs. To address this need, alongside conventional ES assessment approaches, the Resource Time Footprint (RTF) is introduced as a new indicator to evaluate the human intervention part of ES supply and flow from an intergenerational perspective. RTF measures the

temporal length of occupation of four resources—materials, land, labor, and pollutants—by comparing their utilization against individual allocation. It incorporates sustainability aspects such as intergenerational equity and carrying capacity while using a threshold of 100 years. The efficacy of this integration is evaluated through a case study covering conventional ES potential assessment for 2010 and 2020, as well as RTF analysis of consumable rice in Bhutan. The ES supply potential analysis observed a 3.5% increase across 17 ESs. The RTF analysis showed that resource utilization remained within the allocated capacity in both cases. However, potential strain on specific resources—such as land and water use (24.63 and 18.69 years) highlight the need for interventions to ensure sustained benefits. The introduced indicator is validated through results obtained from conventional emergy synthesis. Overall, introduced indicator proved replicable across P-ESs, effectively quantifying pressures and guiding management strategies to maintain nature's regenerative capacity while meeting human needs.

7. Land Use Trade-Offs Version 2: a next generation, national-scale model of land-use and ecosystem services for Australia.

First authors(s): Brett Bryan

Other author(s): Nick Williams, Carla Archibald, Fjalar de Haan, Jinzhu Wang, Nick van Schoten, Xinhao pan, Jo Sanson

First author affiliation: Deakin University

Contact: b.bryan@deakin.edu.au

Keywords: Land use modelling; climate change; environmental limits; agri-food demand

The Land-Use Trade-Offs model Version 2 (LUTO 2) represents a generational leap in sophistication and functionality from its predecessor's groundbreaking contributions to national scale land-use change modelling in Australia. LUTO 2 is an integrated land systems model that represents the entire Australian land mass at a cell resolution of 0.01 degrees (~1.1 km) and

projects change on an annual basis from 2010 to 2100. LUTO 2 finds future land-use and management arrangements which meet agri-food demand at lowest cost, within environmental limits for water use, greenhouse gas emissions, and biodiversity. It can simultaneously account for the complex interplay between environmental outcomes (both trade-offs and co-benefits) whilst providing an understanding of how Australia can meet domestic and international demand for agricultural production framed by global climate, population, and consumption scenarios. Supply-side sustainability solutions in LUTO 2 include new land uses such as environmental plantings, riparian plantings, agroforestry, carbon plantings, farm forestry, and BECCS; and land management types such as agricultural technologies, ecological grazing, methane inhibitors, and early dry season savanna burning. Demand-side solutions bring together multiple domestic and international diet pathways, import trends, and waste and feed efficiency settings which enable 1000+ fully user-specified demand scenarios. Here we illustrate the use of LUTO 2 to identify robust pathways for Australia to meet future agri-food demand, net zero emissions, and the Kunming-Montreal 30x30 target by 2050. Results show how the land sector can meet future food and export demand as well as ambitious GHG and biodiversity targets, within catchment-based water-use limits but significant changes to land use and management are required at substantial cost. The model's open-source nature promotes transparency, innovation, and collaboration within the scientific community, making it a valuable tool for informing real-world decision-making and policy.

8. Quantifying the shade, shelter and productivity benefits of agroforestry: global modelling to inform farm-scale assessment

First authors(s): Stephen Stewart

Other author(s): Thomas Baker, Jacqui England, Anthony O'Grady, Shaun Brooks, Daniel Mendham

First author affiliation: CSIRO

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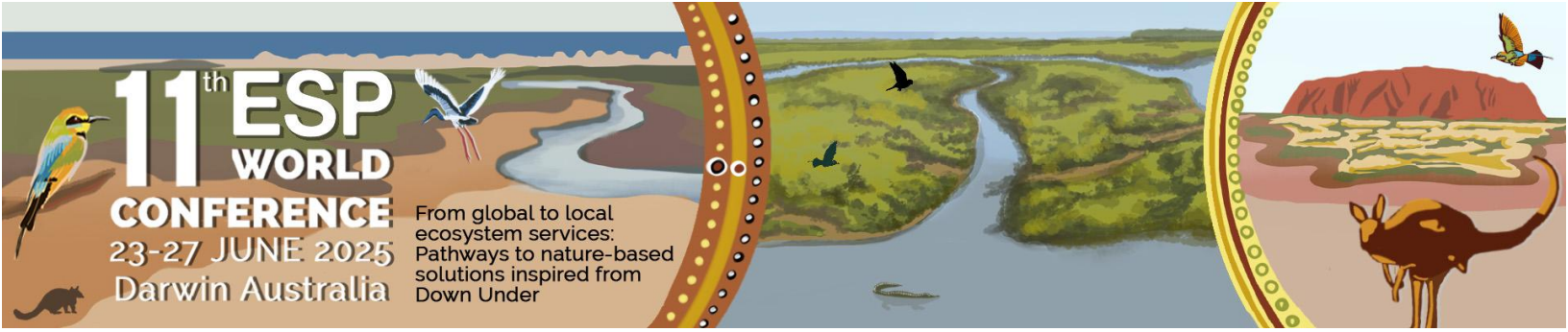


Keywords: agroforestry, productivity, shelter, farm-forestry, co-benefits

Agroforestry is a 'nature-based solution' that provides a wide range of potential ecosystem services, many of which are currently not considered by existing modelling tools and frameworks. We describe the design and implementation of fine-scale (approx. 5 m) geospatial models that quantify the impact of silvopasture, paddock trees and linear agroforestry on agricultural productivity. These models explicitly incorporate the composition, configuration and structure of farm assets, allowing for interactions between distinct land cover and land use types, and enable assessment of service flows across property boundaries (i.e., imports and exports). Case studies at 10 farm enterprises in southeast Australia show marginal expected impacts upon net crop and pasture productivity (<1%) when integrating trees into the landscape; however, there were large increases in shade availability (up to 61%) and shelter from extreme weather (up to 165%) that can mitigate the risk of livestock mortality and crop failure due to extreme weather events. While there was considerable uncertainty in the modelled values, these findings were typically consistent with previous agroforestry research in Australia (e.g., APSIM, National Windbreaks Program). These spatially-explicit models can be incorporated into existing ecosystem services modelling or natural capital accounting workflows, and have the potential to be applied at broader spatial scales or incorporated into decision support tools.

9. Data without Borders: Harmonising data on the co-benefits of carbon farming with the Co-benefits Tool

First authors(s): Kelly Bryant

Other author(s): Science Division of DETSI (The Department of the Environment, Tourism, Science and Innovation) Australia

First author affiliation: The Queensland Department of the Environment, Tourism, Science and Innovation

Contact: kelly.bryant@des.qld.gov.au

Keywords: Carbon farming, co-benefits, Land Restoration Fund, Condition, Connectivity.

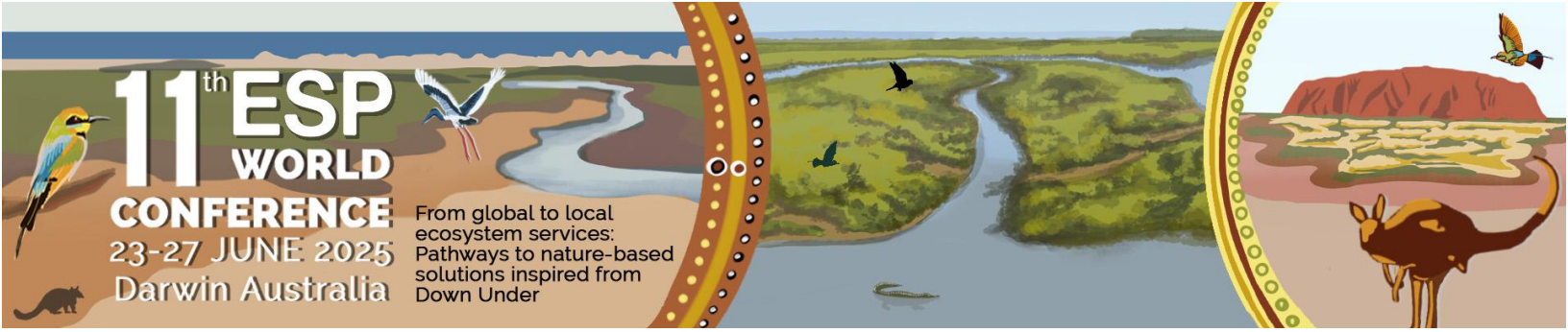
The Co-benefits Tool (CBT) is a decision-support tool which helps predict and prioritise the benefits of carbon farming projects and nature-based activities across Queensland, Australia. The CBT calculates a proposed project's likely environmental benefits using public datasets within an environmental accounting framework.

The Queensland Government's Land Restoration Fund (LRF) invests in projects that reduce carbon emissions or increase carbon sequestration (under the Australian Carbon Credit Unit Scheme) and values the co-benefits also generated. Co-benefits are additional positive environmental, socio-economic, and First Nations outcomes from carbon farming. The CBT aids the LRF to assess projects for possible investment by comparing them in terms of their potential environmental benefits and carbon reduction, regardless of size, location, or carbon method.

The CBT standardises co-benefit assessments using a data-driven and repeatable two-step process. Firstly, it evaluates potential BioCondition benefits (condition for biodiversity), including site-based benefits and the benefits to landscape connectivity. Secondly, it combines these with environmental priorities to compute benefit indices for different asset classes. An index is used because, while it can evaluate something, it has no specific units of measure and combines different factors, indicators and datasets into a single value or score. The aim is to understand and compare overall condition change from a project when the input data can be large and complex. The underlying statewide datasets are at various scales, for example, land use mapping, regional ecosystem mapping, the Statewide Landcover and Trees Study, and potential habitat mapping for flora and fauna.

This ability to harmonise large, diverse data ensures that investment decisions are made with the best available information. The CBT results are considered by decision-makers alongside other factors such as value for money and impact on state interests.

The full CBT methodology details the science and strategy behind the tool, also exploring further potential applications and refinements.



10. Exploring the Impact of Conservation Agriculture on Wind Erosion on South Australia's Eyre Peninsula

First authors(s): Ethan Mackereth

Other author(s): Bertram Ostendorf, Tim Herman, Amelie Jeanneau

First author affiliation: The University of Adelaide

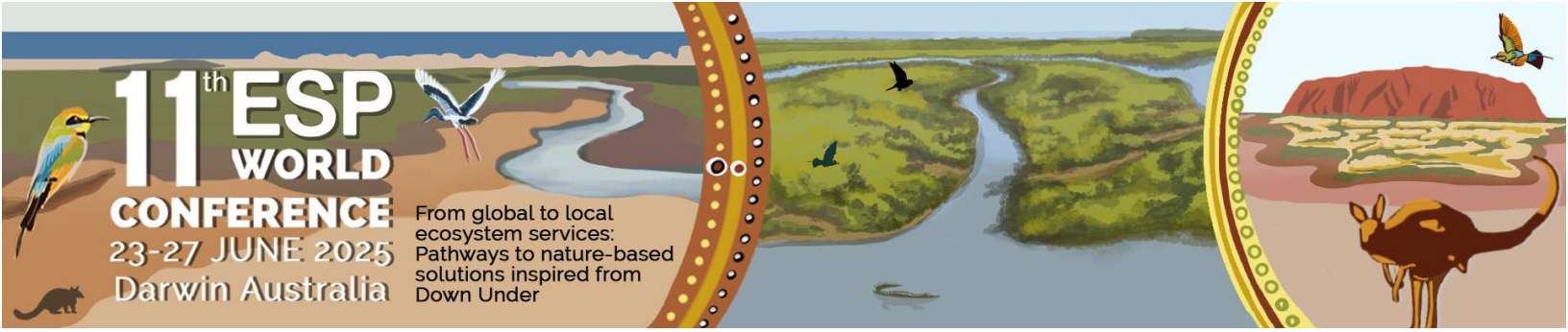
Contact: ethan.mackereth@adelaide.edu.au

Keywords: Wind Erosion, Spatio-Temporal Modelling, Big Data, Conservation Agriculture, Ecosystem Services

Soil loss by wind erosion is a major cost to agriculture, human health, and infrastructure. Agricultural practices substantially impact protective soil cover and the susceptibility of land to wind erosion. Land management policy in the past has strongly focused on reducing repeated cultivation of soil, but there is paucity of quantitative information on the effectiveness of past policy and thus limited evidence for future policy development related to wind erosion.

We reviewed past land-management practices and developed two scenarios of land management in the Eyre Peninsula, South Australia to simulate surface conditions prior to the widespread adoption of conservation tillage. We then use a state-of-the art wind erosion model in order to compare historical sediment flux estimates with the hypothetical scenarios.

Results of this study show that current conservation agriculture practices may have reduced soil loss with estimates of wind erosion increasing between 84% and 168% in the two scenarios. This demonstrates the role that agricultural practices play in regulating ecosystem services. Also demonstrated is the need for big data with detailed spatial resolution and high temporal resolution in weather drivers to realistically reflect the extremely skewed distribution of soil loss.



11. Between numbers and narratives: mapping cultural ecosystem services

First authors(s): Sylwia Kulczyk

Other author(s): Marta Derek, Edyta Woźniak, Tomasz Grzyb

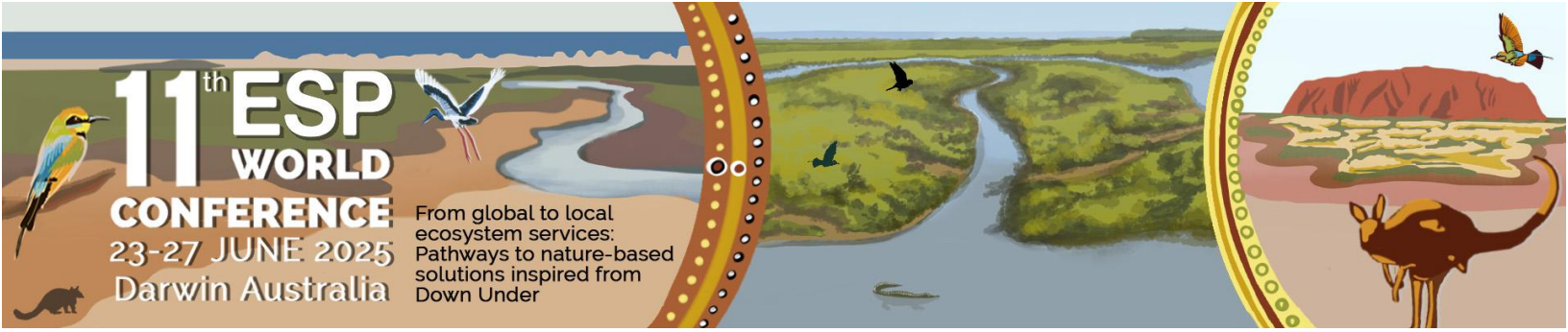
First author affiliation: University of Warsaw

Contact: skulczyk@uw.edu.pl

Keywords: cultural ecosystem services, mapping, fieldwork, satellite monitoring

Mapping cultural ecosystem services is a challenging task. They are not only dependent on scale, space, and landscape context, but are also highly diversified due to individual or group perceptions of nature, aesthetic values, and spiritual significance. This implies that different sources of data and analysis tools should be combined to obtain a meaningful image of the spatial distribution of cultural ecosystem services.

In this presentation, we share our experience in addressing the challenge of mapping CES, drawing on more than ten years of work in Poland. The studies include both rural and urban landscape and span from site scale of the individual city park to the lakeland region. While mapping the potential, use, and demand of cultural ecosystem services, we combined quantitative and qualitative data of various origins – from satellite monitoring to narrative walks. The results of the studies show that quantitative analysis of large data sets allows recognition of individual service and its spatial differentiation even in detailed site scale. However, recognising how cultural services are co-produced and related to each other, and how this picture changes spatially, requires data acquired through qualitative research. Moreover, the qualitative approach opens the door for the inclusion of services that are primarily constructed culturally (e.g., spiritual experiences), the mapping of which is particularly challenging.



12. Culture ecosystem service assessment focusing on beneficiary movement

First authors(s): Kiichiro Hayashi

Other author(s): Sun Zixin, Yuya Shimoyama, Yiyao Wang, Ferdinando Villa, Stefano Balbi

First author affiliation: Nagoya University

Contact: maruhaya98--@nagoya-u.jp

Keywords: Cultural ecosystem service, GIS, Location data, ARIES

Culture ecosystem service (CES) is one of ecosystem services(ESs) provided from the nature defined by Millennium ecosystem assessment in 2005. For some CESs, such as, autumn leaves in aesthetic value, beneficiaries can enjoy the CES from off-site (sometime on-site). For other CESs, such as, recreation, beneficiaries need to move by themselves from a demand area to the CES provided place to enjoy its CES concerned. These characteristics are different from other types of ESs, like, provisioning and regulating services. It is difficult to catch the value of CESs because of its subjective nature. Environmental economic valuation approaches, questionnaire-based surveys, etc. are frequently used to catch these values.

In this study, authors conducted researches to evaluate CESs by using a combination of field visits, mapping studies and location data analysis. The study focused on urban forest parks in Nagoya, Japan. First, authors visited several times for urban forest parks and checked CESs provided including seasonal differences.

Second, based on these filed visits, mapping and statistical studies were conducted to categorize the parks. Third CES value assessment were conducted by using location data obtained from KDDI which was collected from smartphone users of “au brand ” in Japan. The data is 125m-grid mapping data with hourly gender and age range information. Then two approaches were conducted. One is focused on urban forest park boundary. Other focused on a 125m-grid mapping analysis. As a result, the CESs were appropriately assessed and the parks were categorized into several types. And these approaches especially for the third approach can be

applicable to wide area with relatively low cost. Finally, one part of the assessment methodology will try to be incorporated into ARIES k.Modeler.

13. A new method of estimating increases in woody vegetation cover for carbon offset projects in Australia's semi-arid zone.

First authors(s): Greg Barber

Other author(s): No

First author affiliation: Charles Darwin University

Contact: gregbarber1966@yahoo.com.au

Keywords: Carbon offsets, integrity, nature-based solutions, natural climate solutions.

Carbon offsets derived from sequestration in ecosystems are often controversial and their benefits contested. If they do not represent 'real' carbon abatement, they damage global efforts to stabilise the climate, by allowing industrial emissions to be higher than they would otherwise be, within a given emissions reduction goal. Australia has one of the world's largest emissions offset schemes, but the integrity of these credits has often been contested.

One of the largest-scale methodologies in the scheme is Human Induced Regeneration of a Permanent Even-aged Native Forest, where increased tree cover is thought to result from the removal of livestock or the cessation of periodic tree clearing on predominantly natural ecosystems in Australia's semi-arid zone. Close to 160 million tonnes of CO2-e credits were issued before the method was suspended.

We developed a completely new method of testing the integrity of these credits, by modelling whether increases in tree cover are real, permanent, additional and avoid leakage. We analysed a selection of these projects by combining linear regression time-series statistical methods, with

remotely-sensed environmental variables to 182 active carbon offset projects in western New South Wales.

We found that 75 of the projects did show statistically significant increases in tree cover after controlling for the effects of variable rainfall. We then applied the regression model to one project's land area, at the satellite pixel scale, to better understand which localised ecological factors may be impacting on model coefficients and their statistical significance.

For policy makers and regulators, this method provides assurance that only 'real' carbon abatement is credited. Project operators could use these insights to design projects. Credit purchasers manage the financial and integrity risks of a portfolio of abatement.

Further analysis of these ecological coefficients, spatially varying across different vegetation types, could be used to demonstrate biodiversity co-benefits.

14. Assessing the Role of Land Use on Water Yield in a Himalayan Watershed: A Case Study of the Giri River using the InVEST-AWY Model

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The Indian Himalayas play a pivotal role in regulating water supply and yield, attributing to its dense forest cover and types. It influences downstream water quality, supporting biodiversity and the ecosystem of a region. However, climate change and anthropogenic activities have compromised the ecological integrity and threatened water quality and yield. Water yield is an

essential Ecosystem Service (ES) that reflects the amount of water resources available in the region. Understanding the spatial distribution and temporal variations of water yield is crucial in changing land use and climate for sustainable water resource management. The assessment of the water yield ES is extensively unmapped in the fragile river basins of the Himalayas. The Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) Annual Water Yield (AWY) model is a prominent approach based on the water balance method, considering factors such as precipitation, evapotranspiration, vegetation cover, etc., to estimate the total annual water yield at a spatial scale. The study aimed to quantify water yield ES and assess the role of land use using the InVEST-AWY of the Giri River watershed (2651.5 km^2) in the Himalayan region. The results provided pixel-level information on the status of water yield under different land uses and climate scenarios. The results were validated using the available ground data and statistical approaches. The study highlighted that the changing land uses and climate conditions have a significant role in governing water availability. It identified the sub-watersheds of high importance in terms of vulnerability towards dynamic water yield. It will help decision-makers to make informed decisions and formulate advanced conservation strategies. The results suggested that such remote sensing-based models could be a novel approach to understanding and mapping ES efficiently in the challenging terrain of the Himalayas, where quantifying ES is critical.

15. Identification, Prioritization and Mapping of Ecosystem Services in the Panchase Mountain Ecological Region of Western Nepal

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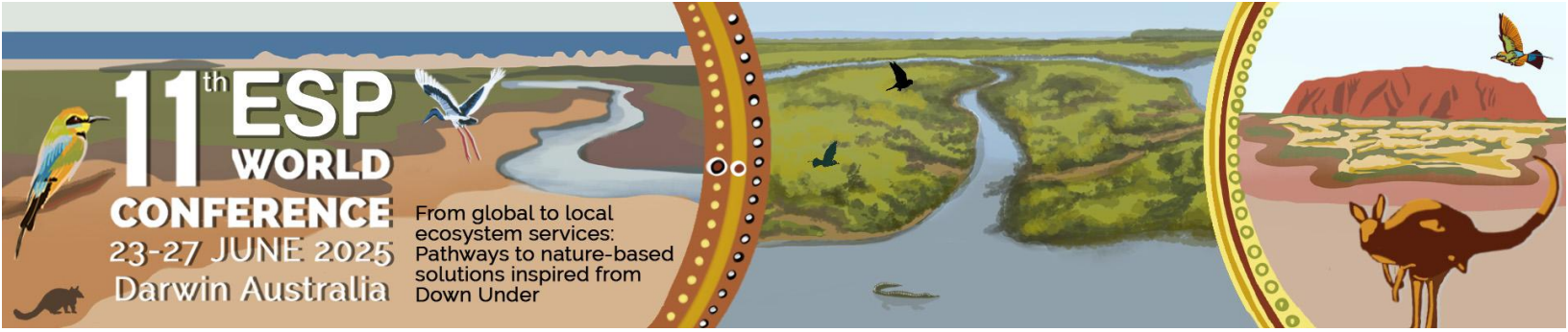
Keywords: Ecosystem services; livelihoods; mapping; prioritization; Nepal



Ecosystem services (ES) are critical to human well-being, especially in developing countries. Improved understanding of the status of ES is required to help people improve their quality of life. The status of ES is largely unknown in many regions of Nepal. This study was carried out in one of Nepal's biodiversity hotspots, the Panchase Mountain Ecological region (PMER), to identify, prioritize and map the major ES in the region. Primary data for the study were collected through key informant interviews, focus group discussions, a transect walk, and field observations. Similarly, secondary data were obtained from published and unpublished reports and satellite images of the study area. The data were analyzed both qualitatively and quantitatively. Thirty-seven ES were identified from the study landscape. Among them, nine were provisioning services, thirteen regulating services, nine cultural services, and six supporting services. Interestingly, the prioritization of ES among stakeholders differed on the basis of their background, particular features of their landscape, professional engagement, and individual interests. For instance, forest users prioritized provisioning services for their daily needs whereas forest managers prioritized regulating and cultural services for overall ecosystem management and aesthetic values. Mapping of the ES from the landscape for 1995 and 2015 identified that forest area and associated ES have likely increased, especially in the upland regions, while agricultural land and their associated ES have decreased. The study can be used as a reference by planners and policy makers in managing ES in the PMER to increase synergies and reduce trade-off among various services.