proteus

Ecosystem Services in Focus: Exploring Recent developments in Global Spatial Data

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17TH OCTOBER 2023

TODAY

Presentation: Exploring recent developments in global spatial data representing ecosystem services

- Why are ecosystem services important?
- Recent work on global-scale ecosystem service mapping
- Use of and access to these datasets by businesses

Peer-to-peer discussion

- Q&A with presenters
- Feedback from Partners

WELCOME

Objectives of the Proteus Data Forum sessions

- A venue for direct communication between data users and technical experts
- Increase familiarity with Proteus resources
- Peer-to-peer learning between Proteus Partner companies
- Identifying common challenges & finding solutions

Logistics

- *Frequency* quarterly
- *Scheduling* AM and/or PM sessions
- *Rules* Chatham House discussion, but presentations recorded

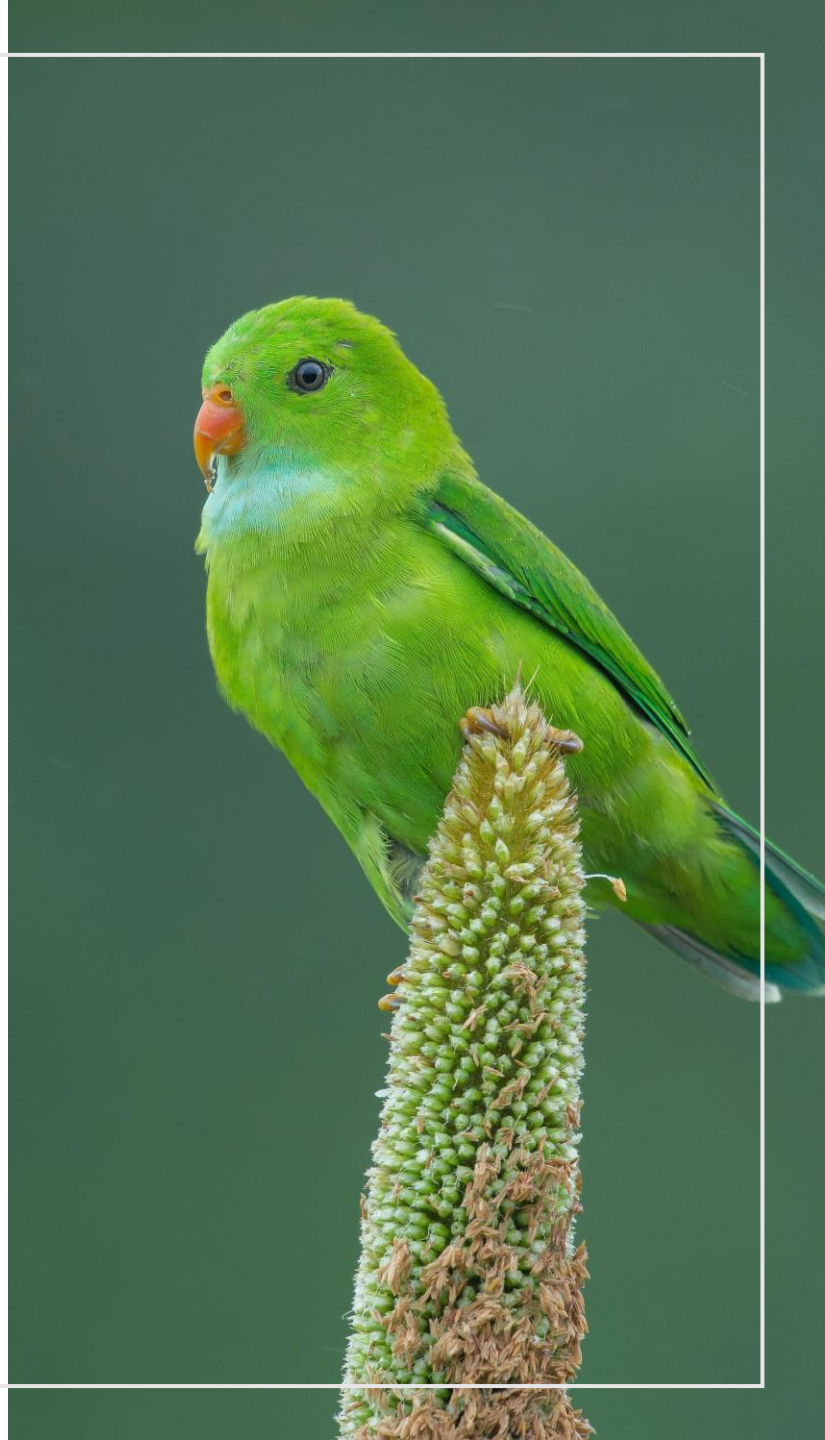
Why are ecosystem services important?

ECOSYSTEM SERVICES (ES)

The contributions of ecosystems to the benefits that are used in economic and other human activity.

(UN 2021)

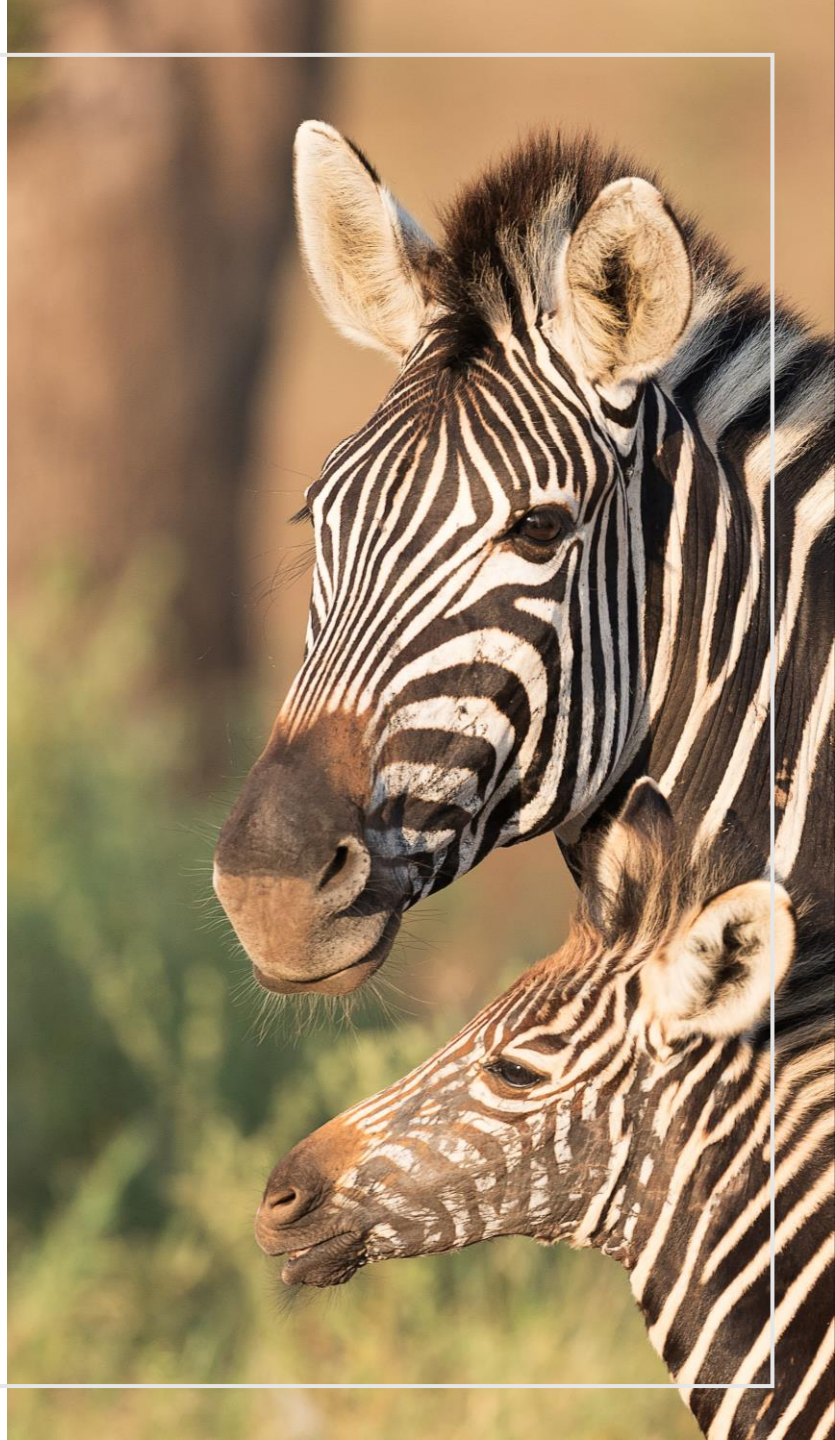
- Regulating - regulation of floods, drought, land degradation, and disease
- Provisioning - food and water
- Cultural - recreational, spiritual, religious and other non-material benefits
- Supporting - soil formation and nutrient cycling



NATURE'S CONTRIBUTIONS TO PEOPLE (NCP)

Nature's contributions to people (NCP) are all the contributions, both positive and negative, of living nature (i.e. diversity of organisms, ecosystems, and their associated ecological and evolutionary processes) to the quality of life for people.

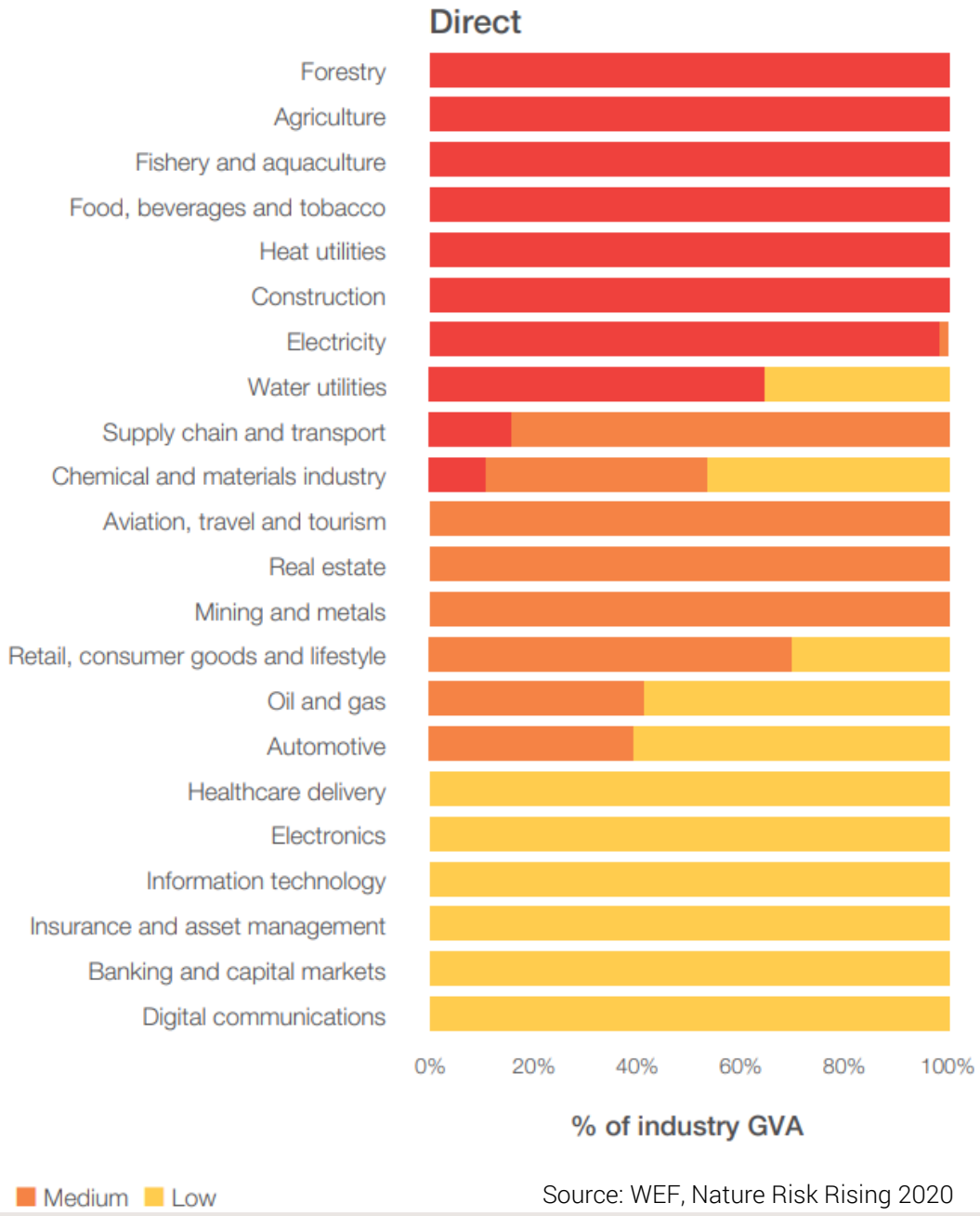
(IPBES 2022)



BUSINESSES DEPEND ON ECOSYSTEM SERVICES

All businesses impact and/or depend on biodiversity, either directly and/or through their supply chains.

Globally, over $44 Trillion of economic value generation is at risk from nature loss (50% of Global GDP).



Source: WEF, Nature Risk Rising 2020

THE WORLD'S ECOSYSTEM SERVICES ARE IN DECLINE

17 of 18 categories assessed have undergone decline

Benefits of nature to people are not easily replaced or replicated when lost

Source: IPBES (2019)

GLOBAL POLICY – THE KUNMING-MONTREAL GLOBAL BIODIVERSITY FRAMEWORK

- 2050 Goal B - "...nature's contributions to people, including ecosystem functions and services, are valued, maintained and enhanced, with those currently in decline being restored…".
- Target 11 - Nature's contributions to people are restored, maintained and enhanced - "…including ecosystem functions and services, such as the regulation of air, water and climate, soil health, pollination and reduction of disease risk, as well as protection from natural hazards and disasters…".


Recent work on global-scale ecosystem service mapping

GLOBAL ECOSYSTEM SERVICES DATA

- Chaplin-Kramer et al., 2022

nature ecology & evolution

Article

https://doi.org/10.1038/s41559-022-01934-5

Mapping the planet's critical natural assets

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Check for updates

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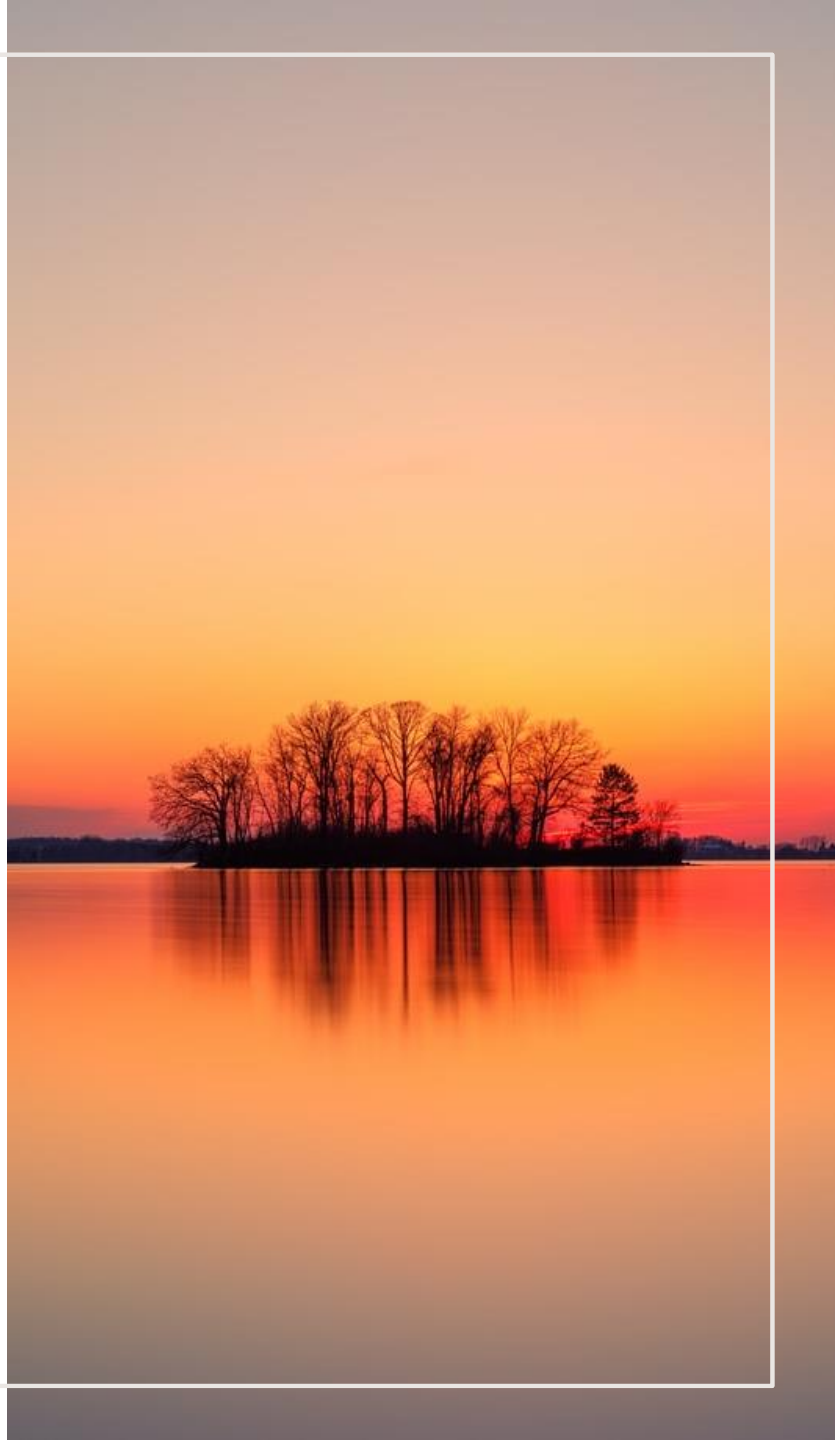
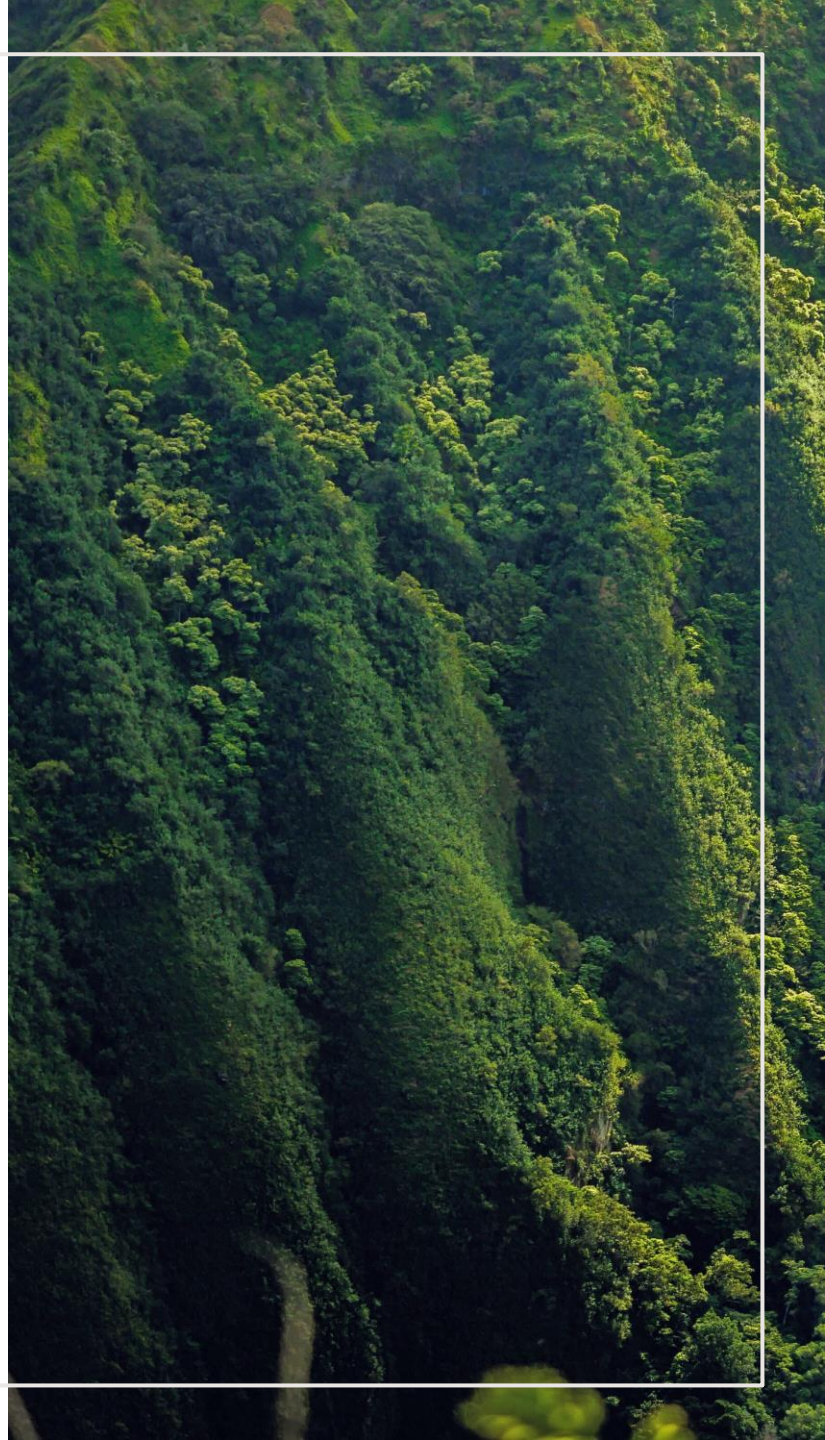


AIMS

1. Undertake first global analysis of 14 ES
2. Spatial optimization to locate where critical natural assets are
    - Natural assets are natural and semi-natural ecosystems that provide 90% of current levels of each ES
    - 12 ‘local’ ES optimized at country level
    - 2 ES optimized at global level (carbon storage and atmospheric moisture recycling)
3. Analysis to highlight:
    - Critical natural assets extent and location
    - Number of people benefiting from, and living within these areas
    - Overlap between local and global critical natural assets and between Critical Natural Assets and biodiversity and cultural diversity

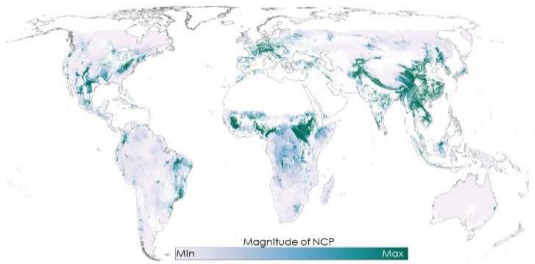


GLOBAL ECOSYSTEM SERVICES LAYERS INCLUDED

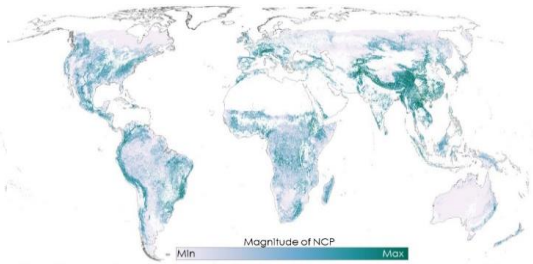
NCP	Source	Units	Original resolution	Realm
Nitrogen retention for water quality regulation	Chaplin-Kramer et al. 2019 (Ref. 10), InVEST (updated)	Kg/ha nitrogen retained * number of people downstream	10 arc-sec (~300 m)	Land
Sediment retention for water quality regulation	Chaplin Kramer et al., InVEST (new for this analysis)	T/ha sediment retained * number of people downstream	10 arc-sec (~300 m)	Land
Crop pollination contribution to nutrition production	Chaplin-Kramer et al. 2019 (Ref. 10), InVEST (updated)	"People fed equivalents"; average pollination-derived energy (KJ), folate, and vitamin A production divided by annual dietary requirements per capita.	10 arc-sec (~300 m)	Land
Fodder production for livestock	Mulligan et al. 2020 (Ref. 51), Co$ting Nature v3 (updated)	Index (0-1) of dry matter productivity utilized by livestock	5 arc-min (~10 km)	Land
Timber production (commercial and domestic)	Mulligan et al. 2020 (Ref. 51), Co$ting Nature v3 (updated)	Index (0-1) of accessible timber harvest for commercial & domestic use (optimized separately)	5 arc-min (~10 km)	Land
Fuel wood production	Mulligan et al. 2020 (Ref. 51), Co$ting Nature v3 (updated)	Index (0-1) of fuel wood accessible to local rural communities	5 arc-min (~10 km)	Land
Flood regulation	Gunnell et al. 2019 (Ref. 32), WaterWorld v2 (updated)	Index (0-1) of green water storage * number of people downstream.	5 arc-min (~10 km)	Land
Access to nature (local recreation and gathering)	Chaplin Kramer et al. (new for this analysis)	Count of people within 10 km of natural and semi-natural habitat	10 arc-sec (~300 m)	Land
Riverine fish catch	McIntyre et al. 2016 (Ref. 16) (updated)	Metric tonnes of fish caught per sq km per year	5 arc-min (~10 km)	Land, freshwater
Marine fish catch	Watson and Tidd 2018 (Ref. 54); (updated)	Metric tonnes of fish caught per sq km per year	30 arc-min (~55 km)	Ocean
Coral reef tourism (nature-based recreation and associated livelihoods)	Spalding et al. 2017 (Ref. 31)	Dollar expenditures (expressed in deciles 1-10)	30 arc-sec (~1 km)	Ocean
Coastal risk reduction	Chaplin-Kramer et al. 2019 (Ref. 10), InVEST (updated)	Unitless risk reduction index * number of people within protective distance	10 arc-sec (~300 m)	Land and ocean

Source: Chaplin-Kramer et al., 2022

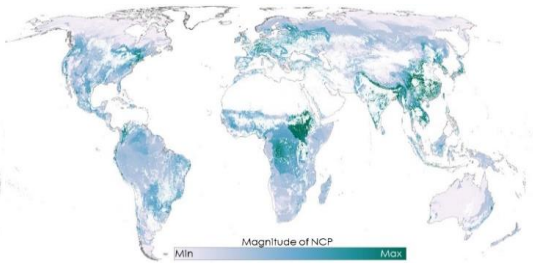
GLOBAL ECOSYSTEM SERVICES LAYERS



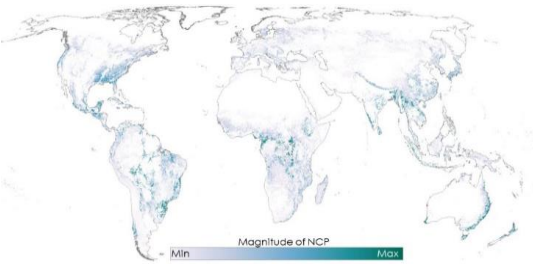
Nitrogen retention for water quality regulation



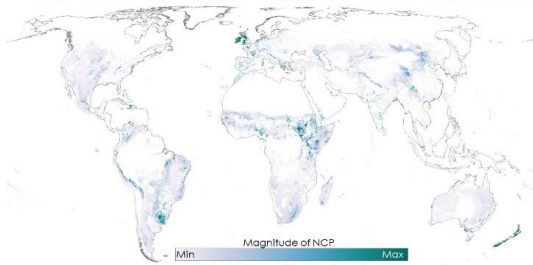
Sediment retention for water quality regulation



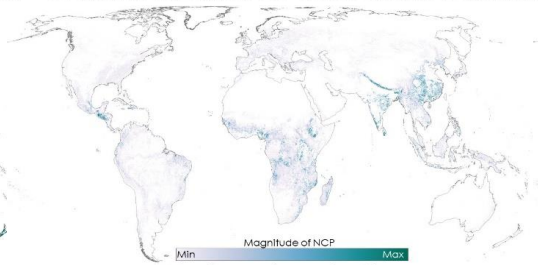
Flood regulation



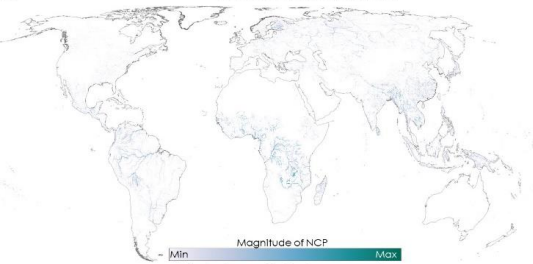
Timber production



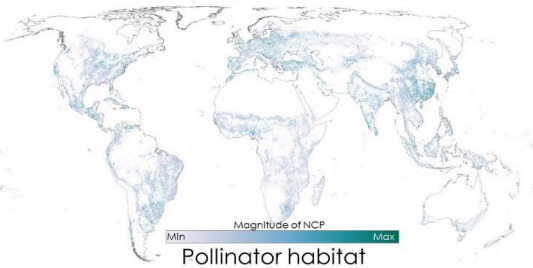
Fodder production for livestock



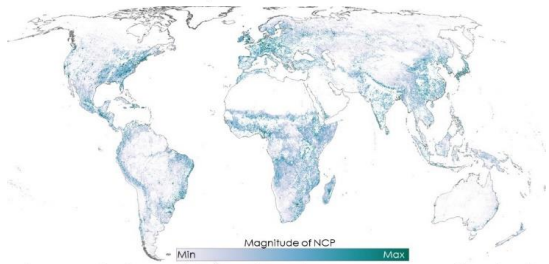
Fuelwood production



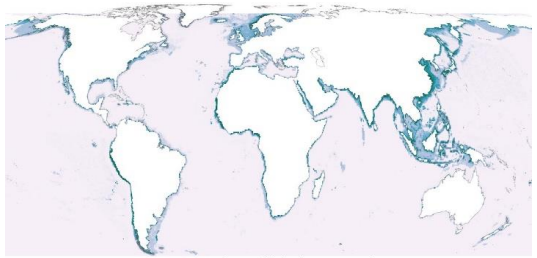
Riverine fish harvest

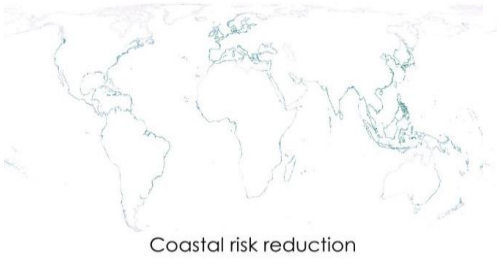


Pollinator habitat
sufficiency for pollination-dependent crops

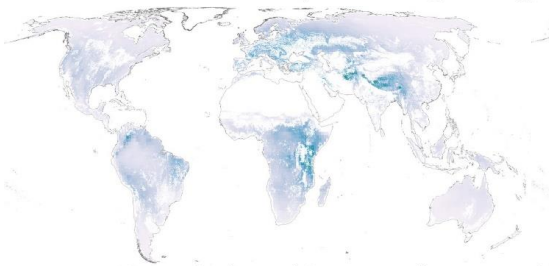


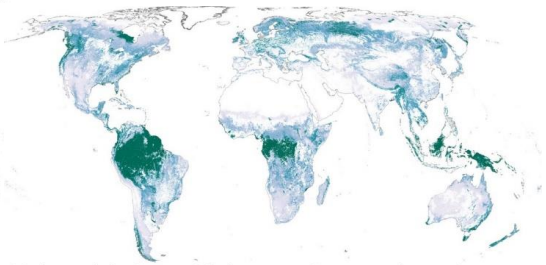
Access to terrestrial nature (recreation, gathering)


Marine fish harvest


Coastal risk reduction


Coral reef tourism


Atmospheric moisture recycling


Vulnerable terrestrial ecosystem carbon storage

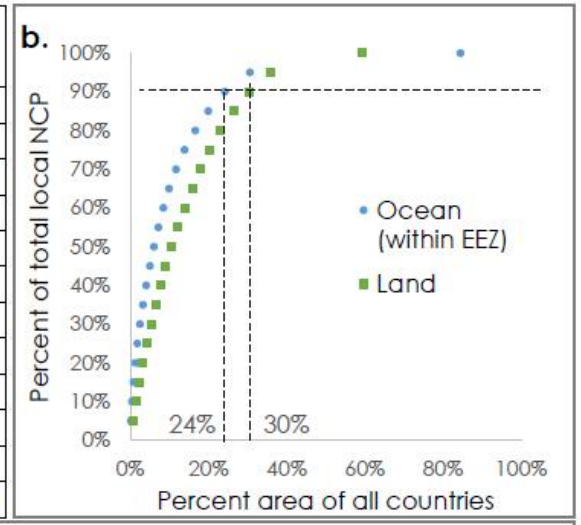
Source: Chaplin-Kramer et al., 2022

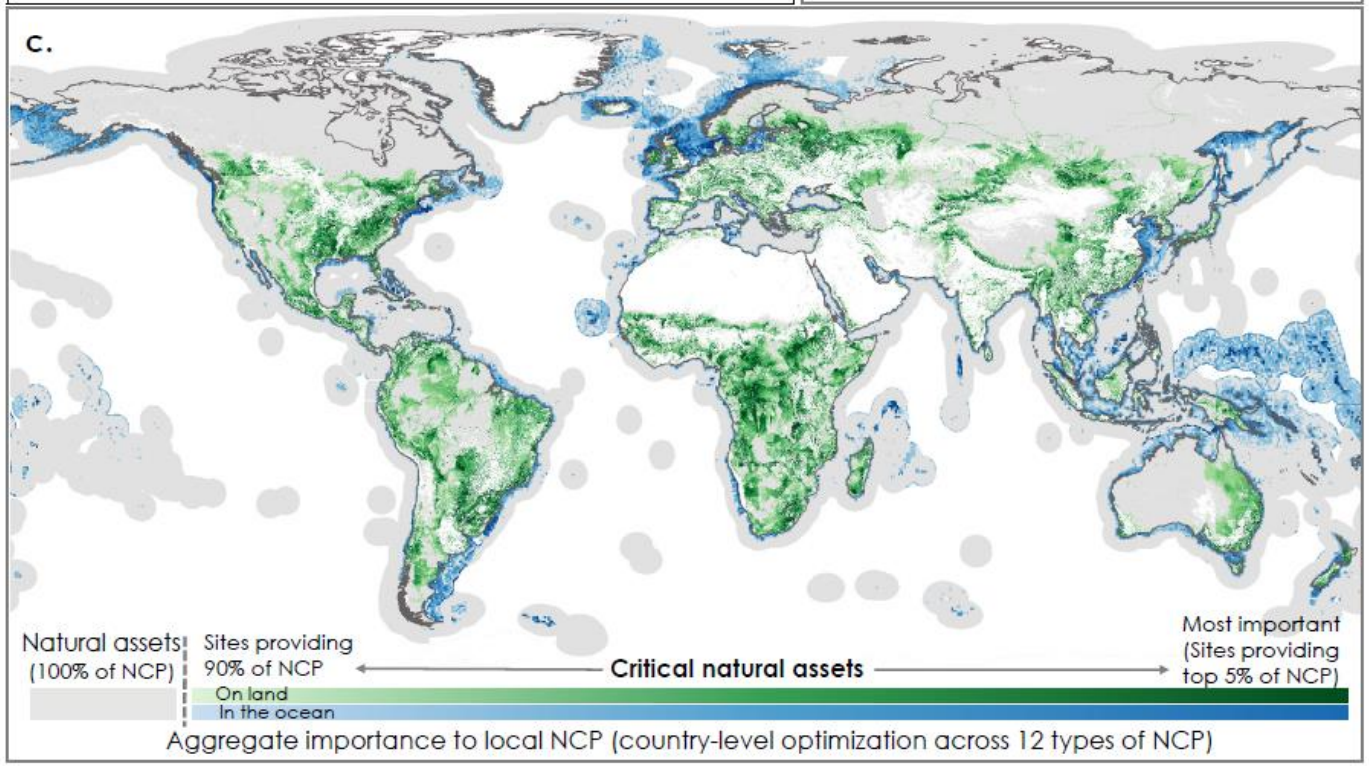
OPTIMIZATION: LOCAL NATURE'S CONTRIBUTIONS TO PEOPLE

- Country level optimization of 12 NCP to provide 90% of current levels of each NCP (30% of land needed)
- 87% of world's population live in areas benefitting from natural assets, 16% live on the assets
- More than 50% of world's population live downstream of CNA's
- Protected areas only represent 15% of CNA's

a.

List of Local Nature's Contributions to People (NCP) modeled
Nitrogen retention for water quality regulation
Sediment retention for water quality regulation
Pollinator habitat sufficiency for pollination-dependent crops
Fodder for livestock
Timber production
Fuelwood production
Flood regulation
Riverine fish harvest
Access to terrestrial nature (for local recreation and gathering)
Coastal risk reduction (terrestrial and marine)
Marine fish harvest
Marine recreation (coral-reef tourism and associated livelihoods)

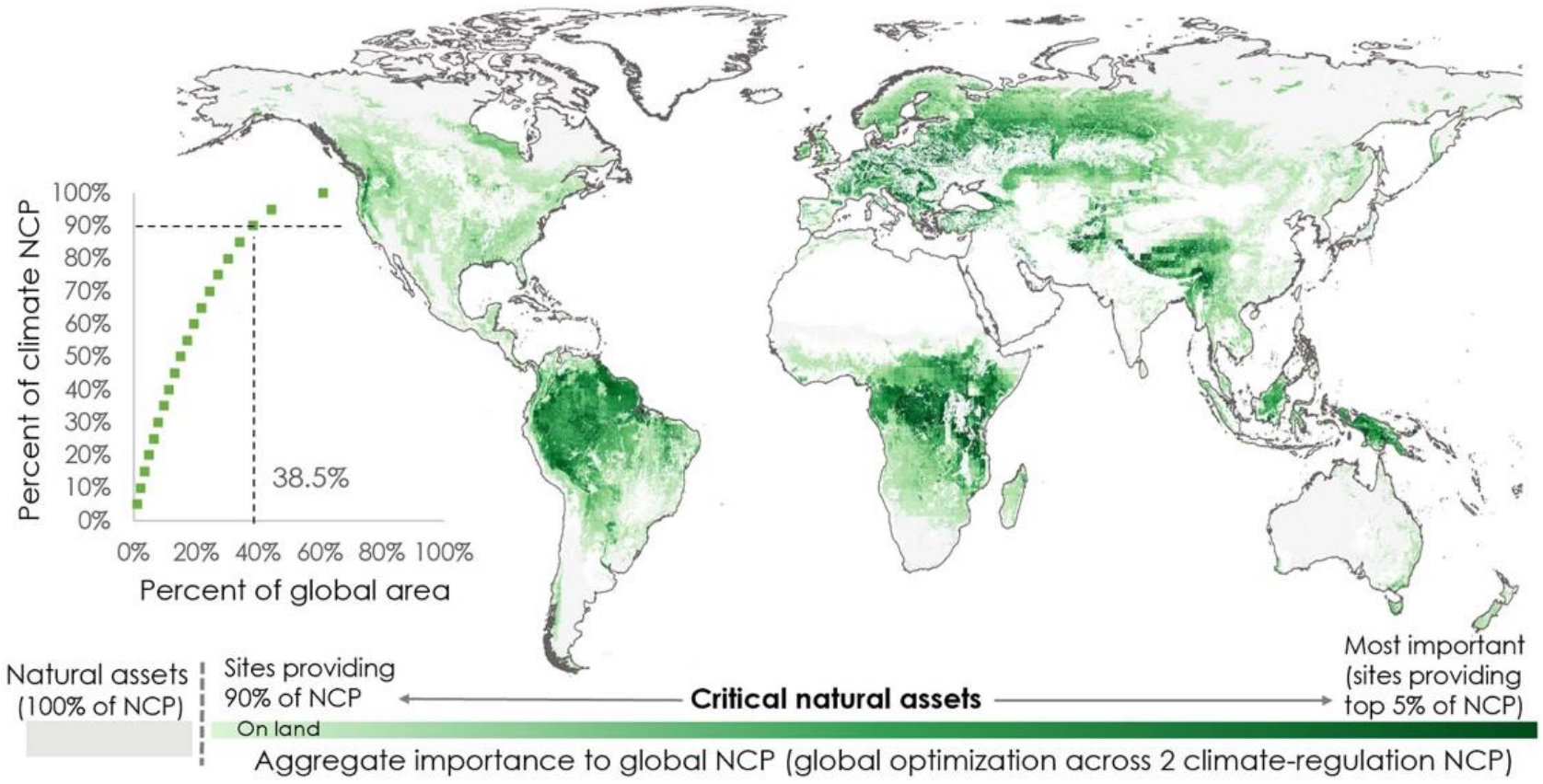




Source: Chaplin-Kramer et al., 2022

OPTIMIZATION: GLOBAL NATURE'S CONTRIBUTIONS TO PEOPLE

- Global optimization of carbon and moisture recycling
- 39% of land area required
- Combined with local NCP, 44% of global land area would be needed



As in Fig. 1, the NCP accumulation curve reflects the total area required to maintain target levels of both global NCP (optimized globally, not within each country), with dotted lines denoting the area of critical natural assets (90% of global climate NCP in 39% of land area). The map shows critical natural assets for global climate NCP, with darker shades connoting greater contribution to aggregate NCP.

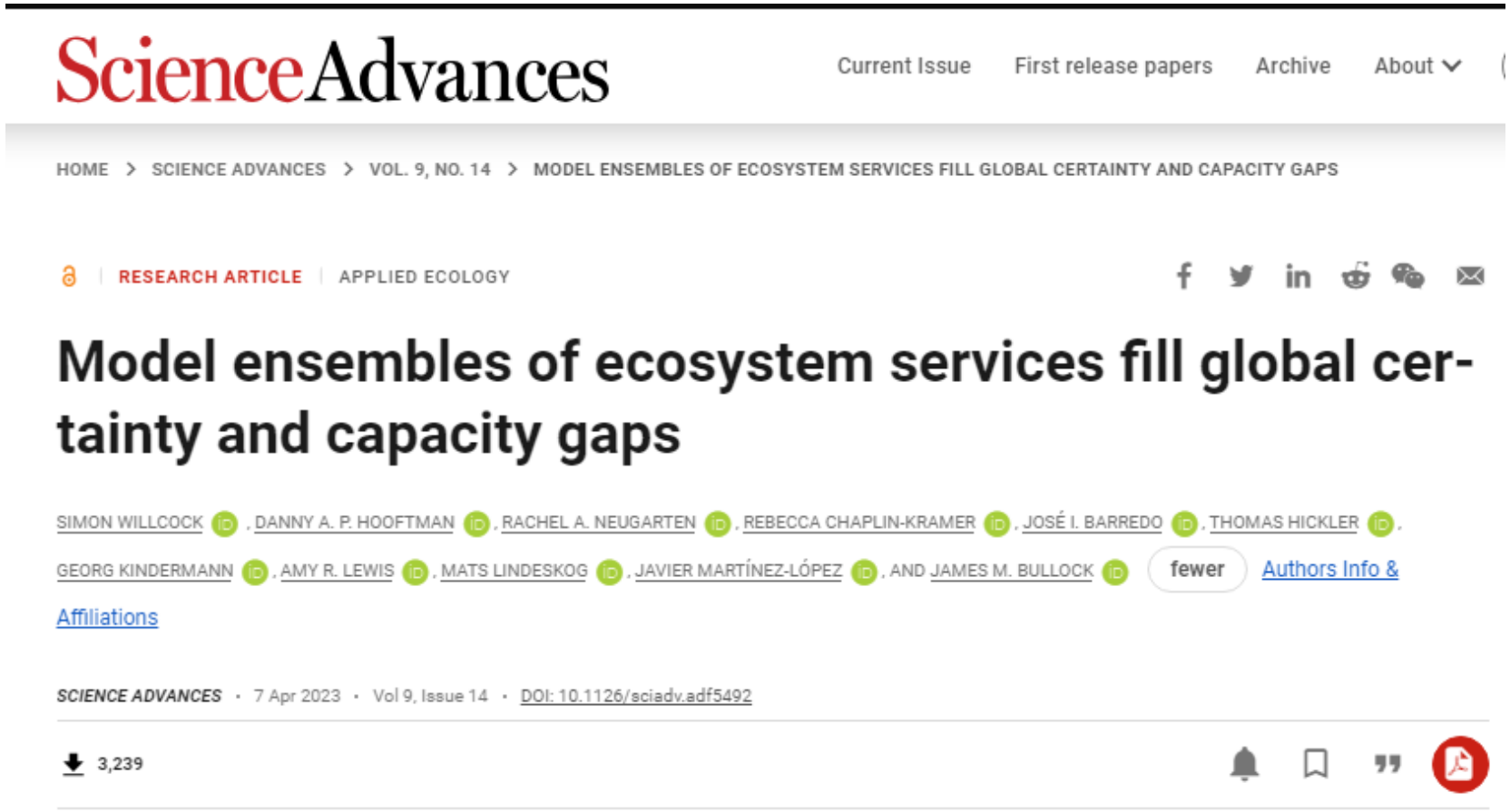
Source: Chaplin-Kramer et al., 2022.

AIMS

1. Provide access to global ES data (capacity gap)
    - Provide globally consistent ES datasets for five ES of high global and local relevance
2. Provide estimate of uncertainty in ES models (certainty gap)
    - Combines multiple models for consensus-based global ES maps at high resolution
    - Ensembles tested for accuracy against independent validation data

GLOBAL ECOSYSTEM SERVICE DATA

- Willcock et al., 2023



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RESEARCH ARTICLE | APPLIED ECOLOGY

Model ensembles of ecosystem services fill global certainty and capacity gaps

SIMON WILLCOCK, DANNY A. P. HOOFTMAN, RACHEL A. NEUGARTEN, REBECCA CHAPLIN-KRAMER, JOSÉ I. BARREDO, THOMAS HICKLER, GEORG KINDERMANN, AMY R. LEWIS, MATS LINDESKOG, JAVIER MARTÍNEZ-LÓPEZ, AND JAMES M. BULLOCK fewer Authors Info & Affiliations

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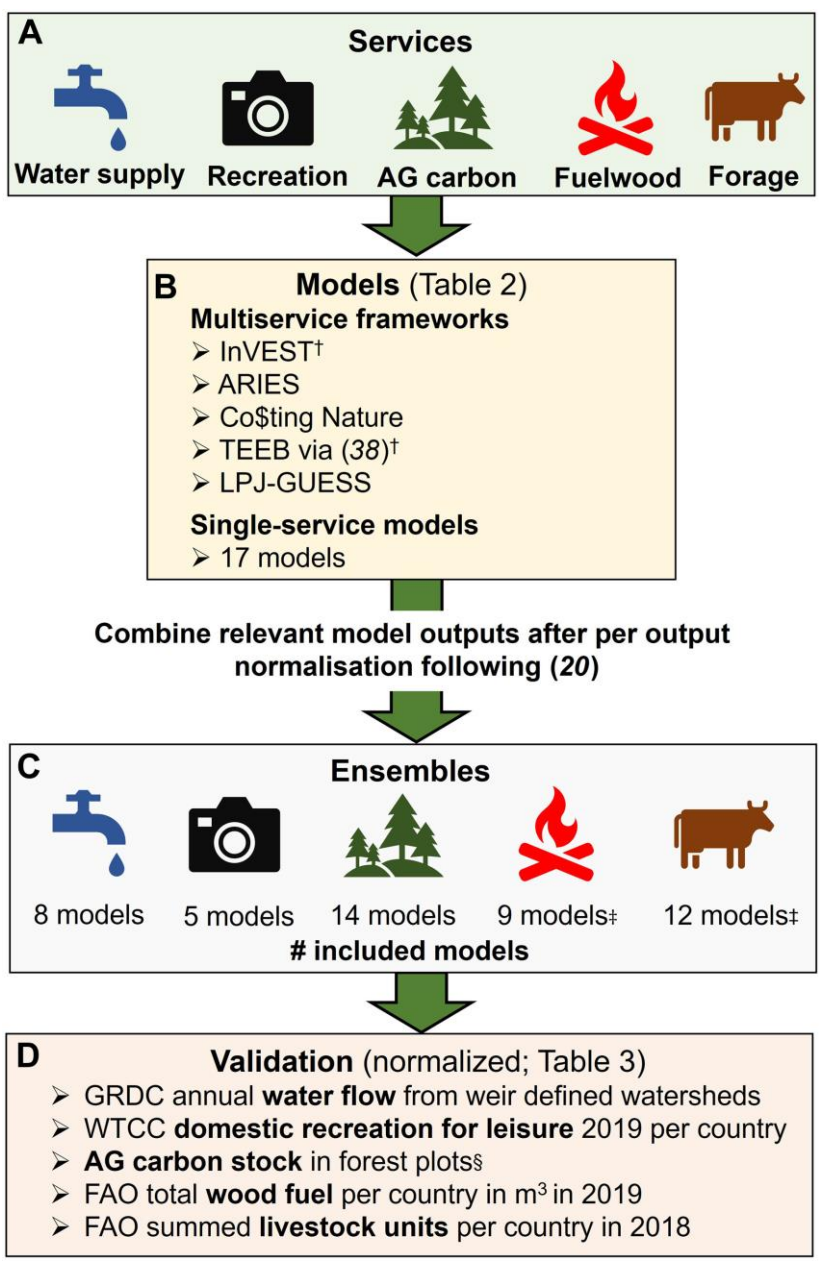
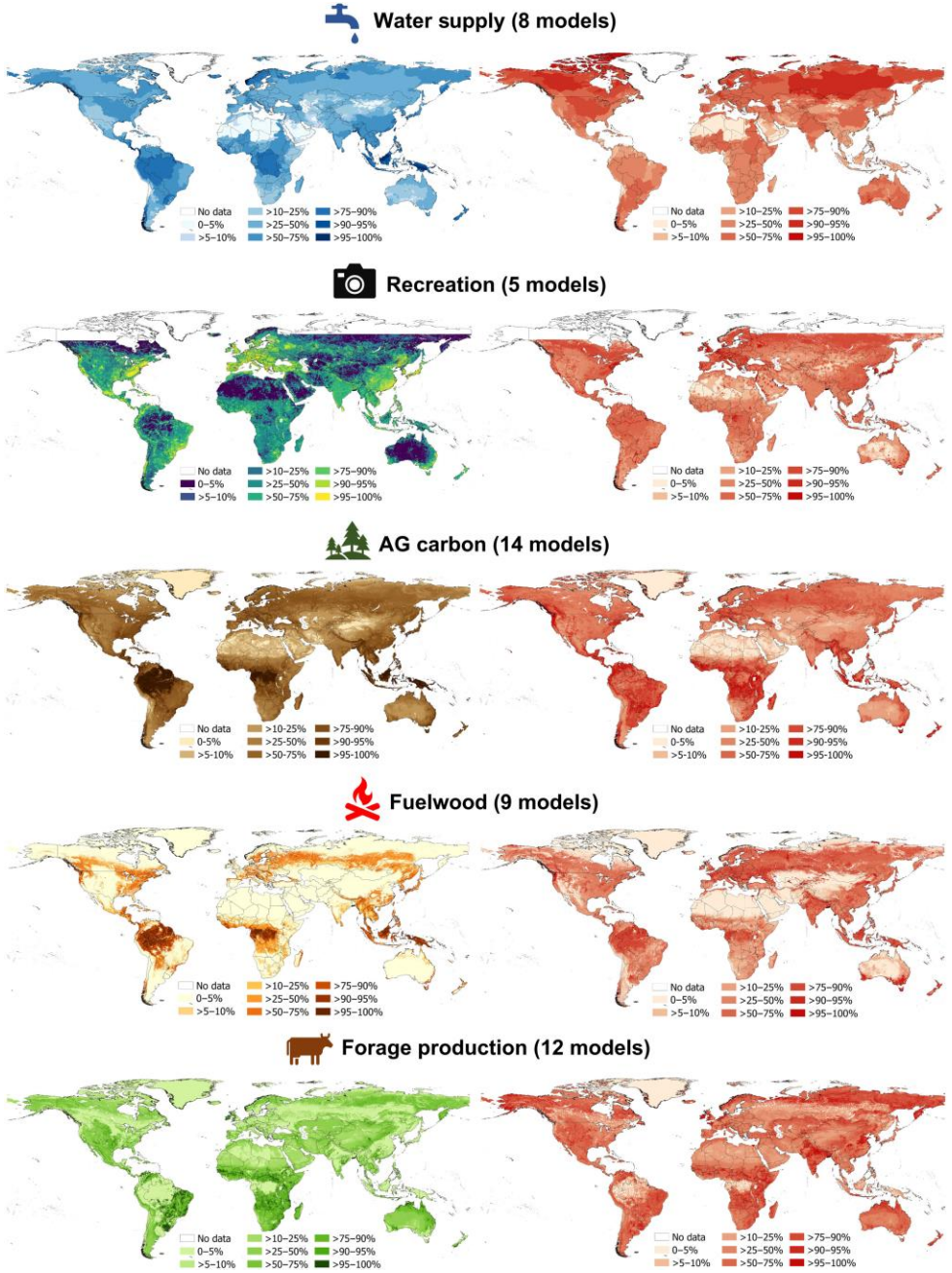
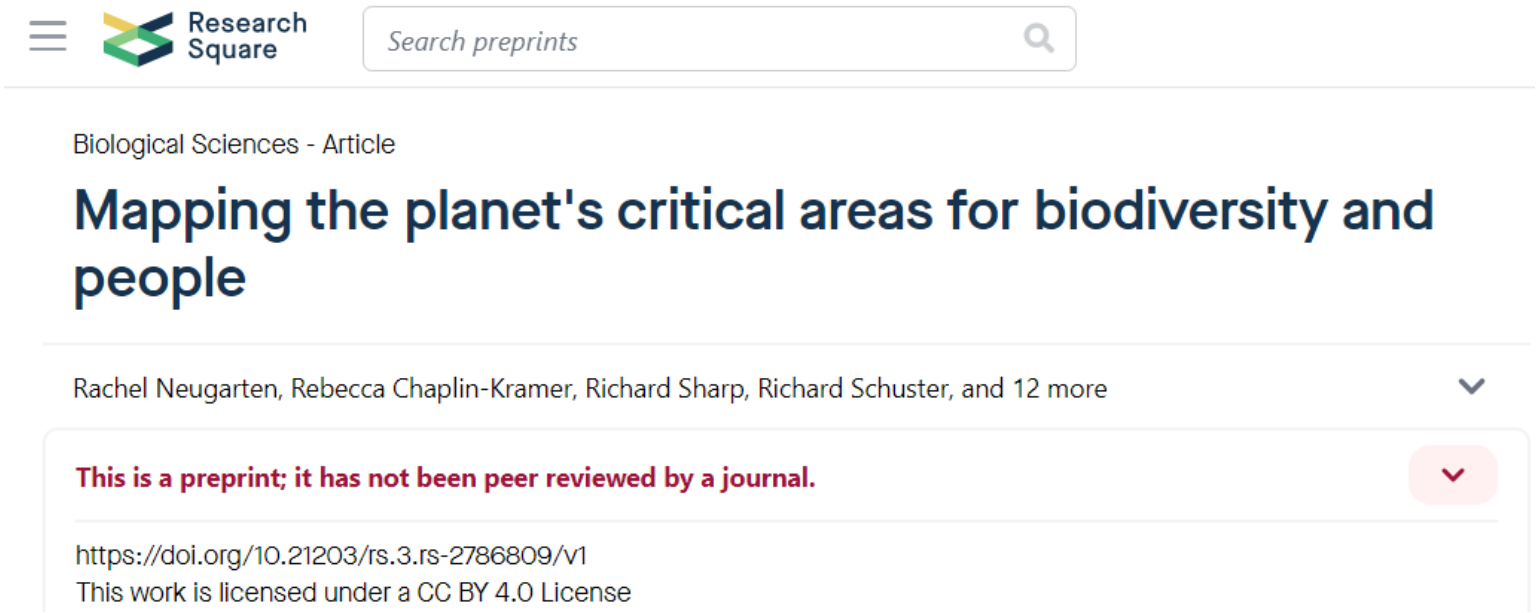


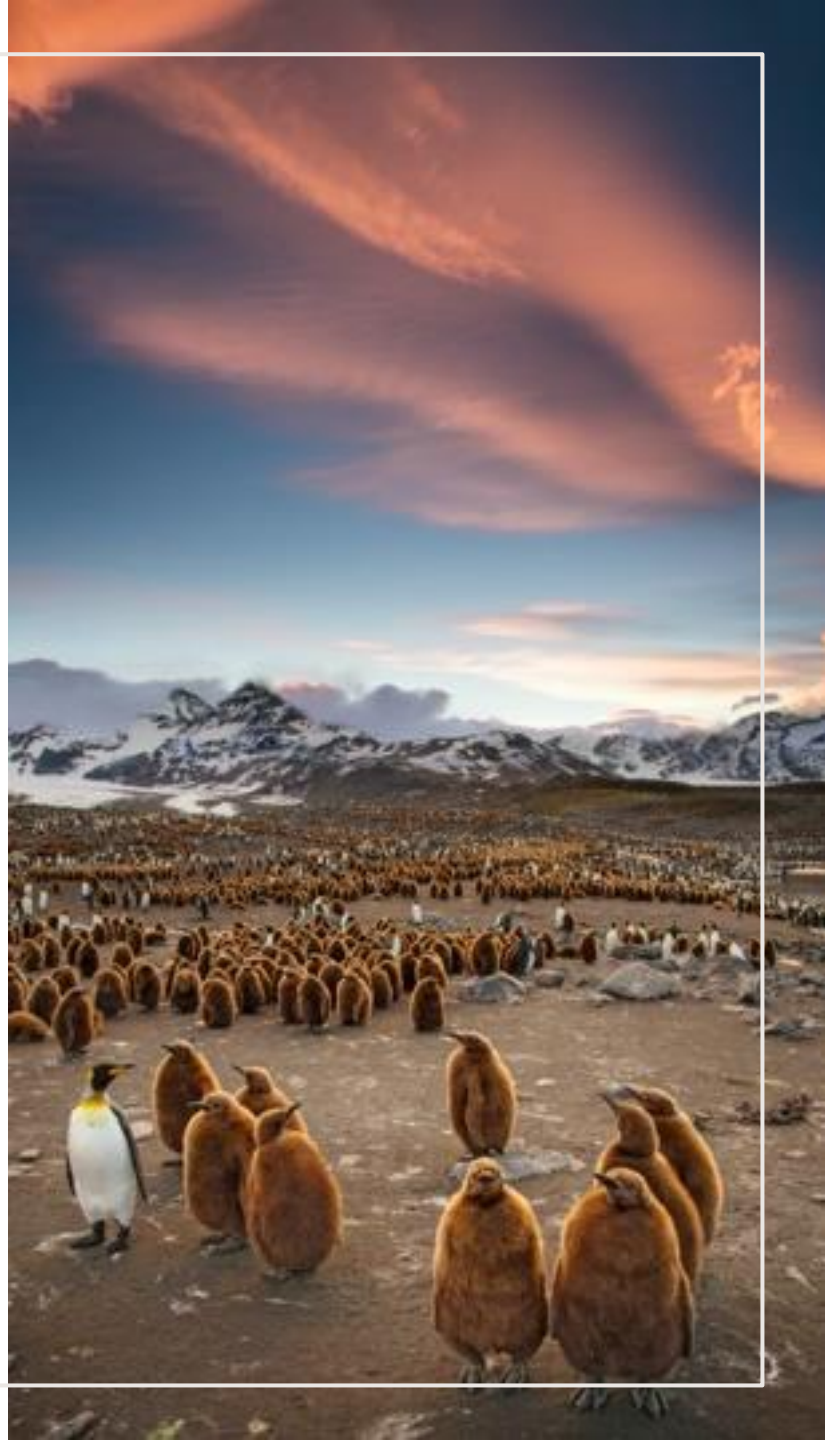
Source : Willcock et al., 2023



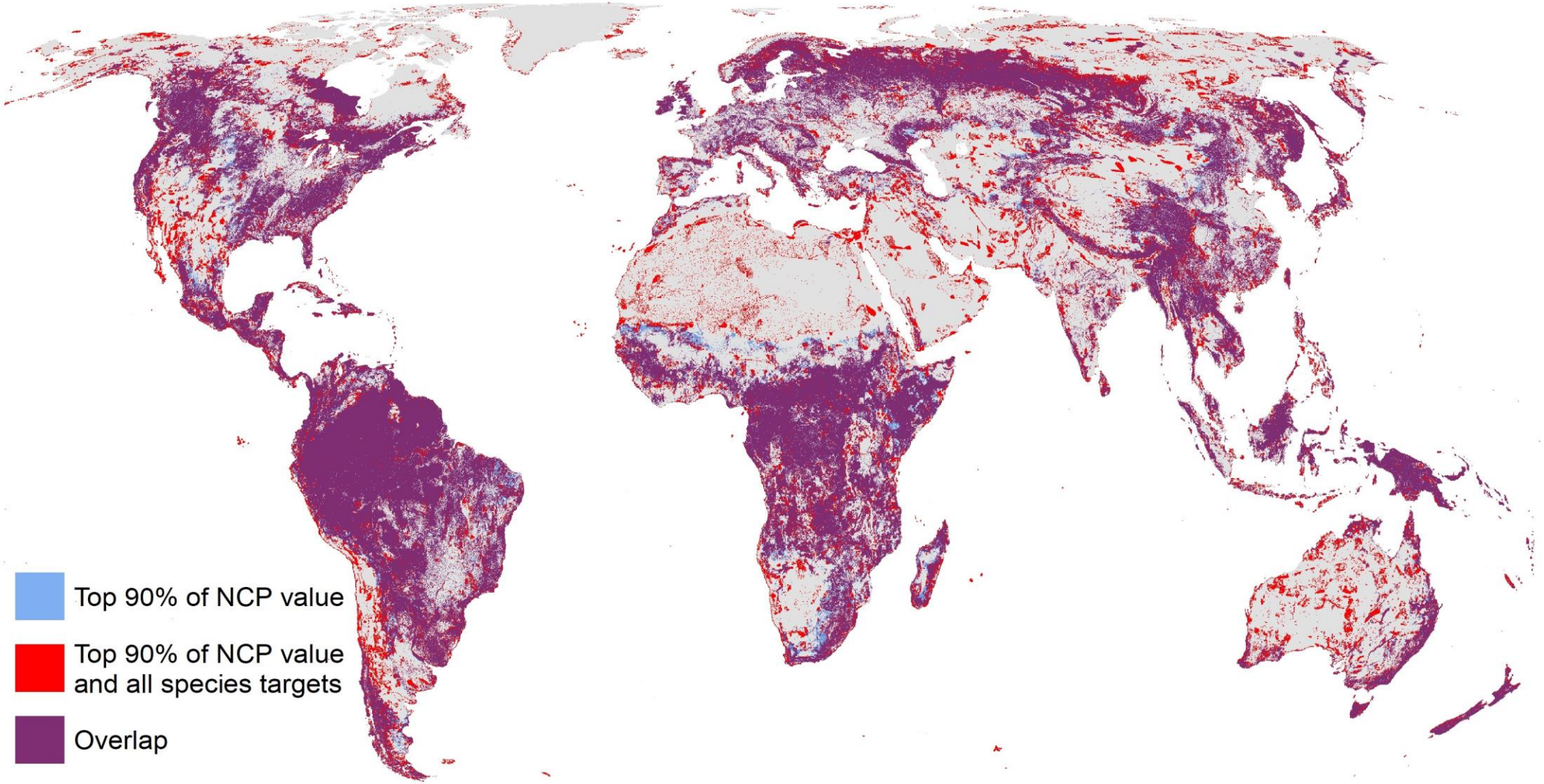
ONGOING WORK

- Include biodiversity and development potential in optimization. Neugarten et al., 2023 (in review)





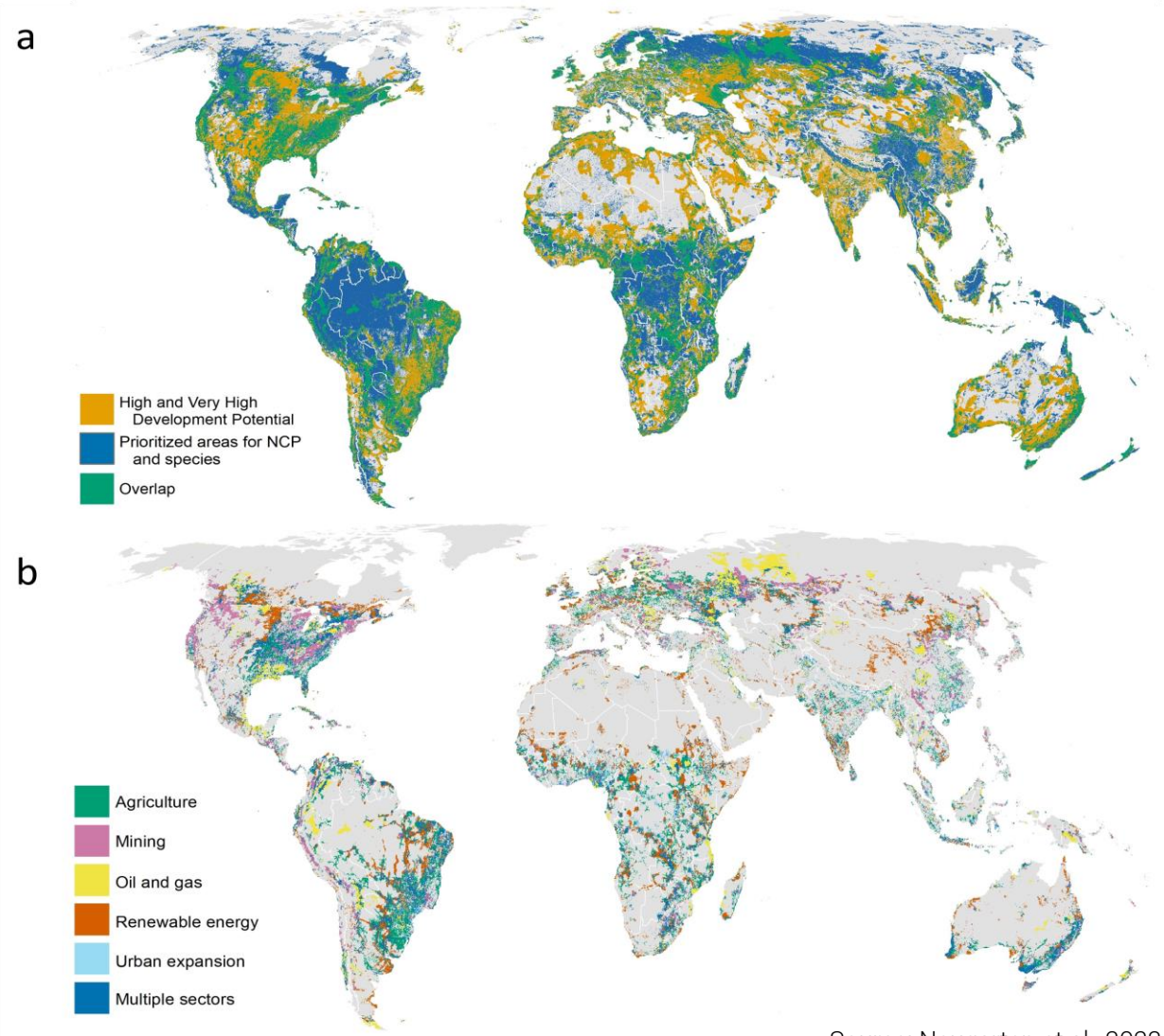
OVERLAP BETWEEN PRIORITY FOR NCP AND SPECIES



Source: Neugarten et al., 2023

OVERLAP BETWEEN NCP, BIODIVERSITY AND DEVELOPMENT POTENTIAL

- More than 37% of global land area high in NCP and biodiversity also has high development potential
- For example, the renewable energy sector (solar, pv, wind, hydropower) overlaps with 10% of priority areas for NCP and biodiversity



Source: Neugarten et al., 2023


Use of and access to these datasets by businesses

HOW CAN THESE DATA BE USED BY BUSINESSES

Examples of potential uses include:

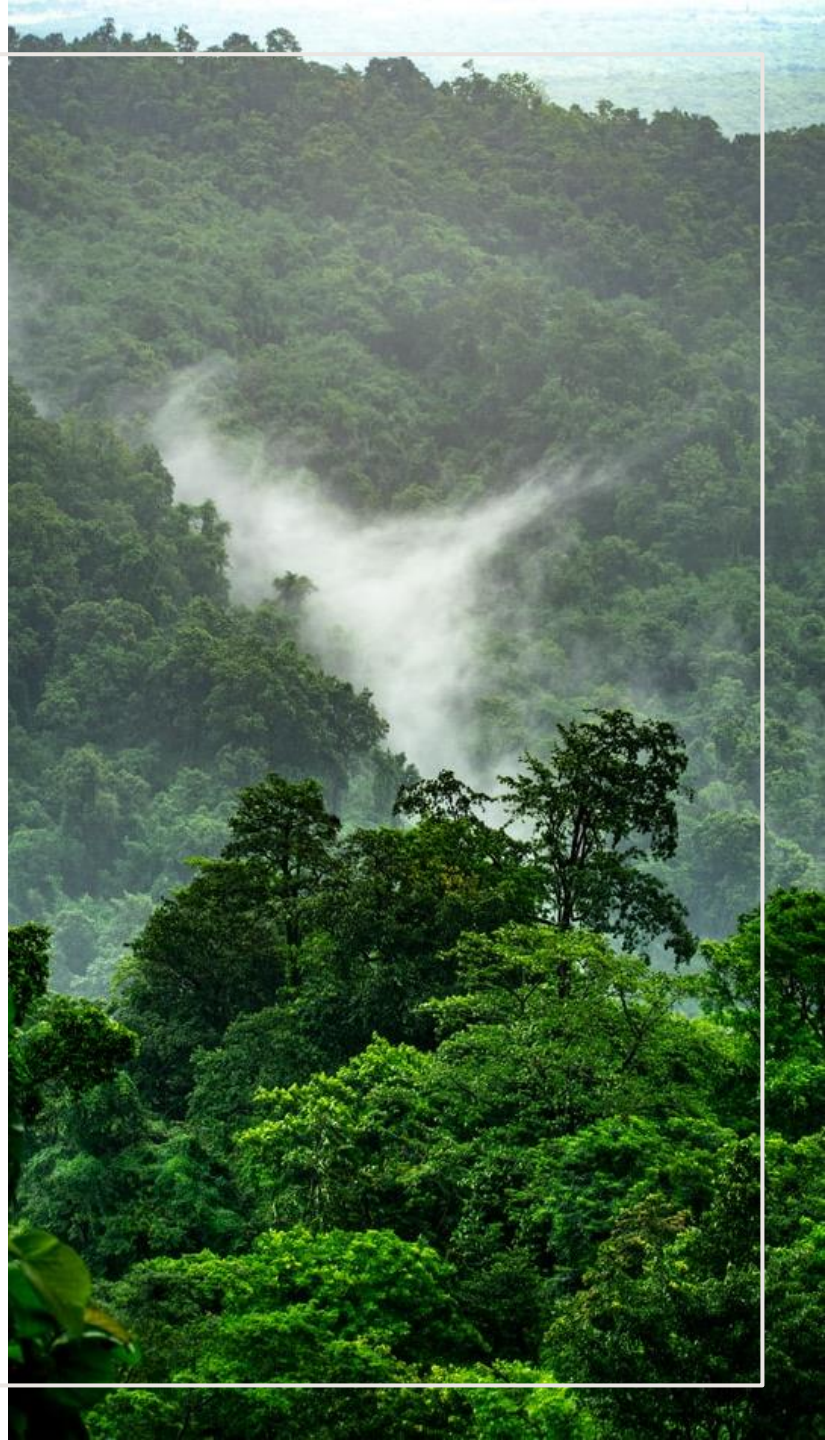
- Screening for locations likely to be important for ecosystem service delivery
- Assessing the scale and scope of dependencies on ecosystem services in different locations
- Beginning to understand potential consequences of impacts on nature for local communities
- Strengthening consideration of interactions between people and nature in desk-based impact and prioritisation analysis

Area	Criteria	Recommended metrics and reference datasets
Ecosystem service delivery importance	• Areas important for delivery of ecosystem service benefits, including to Indigenous Peoples and Local Communities. These include areas in which healthy ecosystems and biodiversity support local livelihoods, areas in which biodiversity and ecosystem services are important for the realisation of human rights, areas that have been traditionally owned, occupied or otherwise used and/or acquired by Indigenous Peoples and Local Communities, and areas of biocultural importance to Indigenous Peoples and Local Communities.	• Indigenous Peoples' and community-conserved territories and areas (ICCAs) • Global Land Governance Index LANDex Indicators • The Indigenous Navigator • LandMark (also available in the Global Forest Watch map) • ENCORE (that contains hotspots of natural capital depletion spatial layers) • InVEST (quantifies, maps and values ecosystem services) • TESSA • Ocean Wealth (maps ocean ecosystem services) • Critical Natural Asset layers

Source: The TNFD LEAP Approach - Criteria for sensitive location identification and reference datasets (L4)

DATA AVAILABILITY

1. Chaplin-Kramer et al., 2022
    - Critical Natural Assets
    - Vulnerable Carbon layer
2. Wilcock et al., 2023
    - Dataset
3. Neugarten et al., 2023
    - Mapping the planet's critical areas for biodiversity and people (not peer-reviewed)
    - Development potential



Thank you

UN environment programme

WCMC