BioSpace25 - Biodiversity insight from Space
10 - 14 February 2025 | ESA-ESRIN | Frascati - Italy

Habitats Suitability , Connectivity and Species Distribution

Session objectives

This session show-cased different approaches to:

1. Map species distributions at the global scale
2. Assess species populations
3. Map and assess habitat suitability and its change at local scales
4. New applications of earth observation data to detect wildlife and understand their movements

Main messages

SPECIES DISTRIBUTIONS

- scalability – computationally intensive workflow, multi-step workflow may pose challenges
- biases in data: uneven sampling of distribution
- minimum data standards in the input point data need definition
- data poor species/regions – many remote and tropical regions remain data poor -> could be informed by data rich regions?
- spatial performance: user interface where the expert can highlight areas where the user can annotate the map
- Including phylogeny improves model performance
- relevant information predicting species abundance from presence-only data

Main messages

NOVEL METHODS

- Genetic diversity based on species populations and geographical extent
- Direct detection of wildlife from EO data is becoming more advanced
- Satellite data, e.g. SWARM data can be used to understand animal navigation

RECOMMENDATIONS FOR ESA

- Increased spatial and temporal resolution
- In situ data quantity and quality is fundamental

CHATGPT summary

The session presents various research efforts aimed at improving biodiversity monitoring through advanced species distribution modeling (SDM) and remote sensing technologies.

Advancing 1km² SD EBVs – Researchers from Yale discuss progress in developing high-resolution global SDMs using remote sensing data to support conservation planning. They highlight challenges such as data gaps and computational limitations.

From Presence-Only to Abundance Models – A team from France demonstrates how transfer learning can improve abundance predictions in SDMs, particularly for rare species, using Mediterranean fish as a case study.

Predicting Marine Species Distributions – Researchers in France apply deep learning models to open-ocean environments, leveraging satellite data to predict marine species distributions with high accuracy.

Integrating Phylogenetic Data for SDMs – A study at Yale proposes a new framework that incorporates evolutionary relationships to improve distribution models for data-deficient species, using South American hummingbirds as a test case.

Monitoring Genetic Diversity via Earth Observation – A Swiss-led initiative, "Genes from Space," introduces a tool that uses satellite data to infer genetic diversity, serving as an early warning system for biodiversity loss.

Ecological Niche Models and Time-Series Remote Sensing – A Portuguese research group applies time-series remote sensing data to monitor biodiversity trends in a national park over two decades.

Walruses from Space – A UK-based team compares walrus population counts obtained from satellite imagery with drone-based surveys, finding that satellite counts are reliable but tend to underestimate numbers.

Albatrosses from Space – A citizen science project engages volunteers to count wandering albatross populations in satellite imagery, demonstrating the feasibility of crowdsourced monitoring.

MagGeo Tool for Animal Navigation Studies – A UK-based initiative links geomagnetic field data with wildlife GPS tracking to explore how migrating animals use Earth's magnetic field.

Overall, these studies showcase innovative methodologies for biodiversity monitoring, leveraging machine learning, remote sensing, and citizen science to address data limitations and enhance conservation planning.