ABSTRACT

The European Green Deal aims at transforming the EU into a modern, resource-efficient and competitive economy, tackling amongst others the aim of zero net emissions of greenhouse gases by 2050 while simultaneously protecting biodiversity and ecosystems in the face of climate change and biodiversity loss. While climate change mitigation targets can support biodiversity conservation, the rapid transition toward climate-neutrality can also counteract these conservation efforts. BIOGAIN addresses the steady decline in biodiversity due to multiple stressors, including land conversion and climate change, and emphasizes the need for spatially explicit planning that prioritizes nature-positive outcomes aligning with the EU Biodiversity Strategy and the Taxonomy. The project focuses on the role of advanced AI-supported data collection and analysis to enhance biodiversity within spatial energy planning and achieve transformation to net-gain instead of no-net-loss strategies.

Emerging data streams aggregating into Essential Biodiversity Variables (EBVs), Essential Climate Variables and knowledge supported by artificial intelligence (AI) reflect complex dynamics on changes in ecosystems that were previously out of reach with traditional sampling methods. We explore the role of Deep Learning Algorithms like CNNs (Birdnet, Megadetector), RNNs and Transformers (Large Language Models and Retrieval-Augmented Generation) to overcome the missing data problem occurring across planning levels and analyze implications on power dynamics, political will, and stakeholder biases in energy planning. The interdisciplinary team analyzes the role of quality and availability of information on biodiversity to create resilience against political will and reshape power dynamics with the overall aim to encourage nature-positive planning.

To this aim BIOGAIN contrasts conventional methods with AI-enhanced approaches, utilizing data from various sources such as passive acoustic monitoring, satellites, UAVs, and environmental DNA. BIOGAIN uses a multi-method approach, involving serious games, Discrete Choice Experiments, Collaborative Decision Analysis and Spatial Optimization to explore how AI-supported biodiversity data can drive societal transformation towards Net-Biodiversity-Gain. The project involves stakeholders across Europe, recognizing the unique trade-offs each country faces between renewable energy goals and biodiversity outcomes. BIOGAIN includes real-world case studies focused on solar, wind, and mixed wind-solar energy development to survey differences in influencing factors and the role of data in planning and decision-making. It focuses on actors at multiple planning levels, particularly in subnational and regional contexts. Through its transdisciplinary approach, BIOGAIN aims to enhance planners' understanding of complex interactions affecting biodiversity, understand the role of advanced data as a lever and its role for creating resilience against power dynamics.