Improving Monitoring for Better Integrated Climate and Biodiversity Approaches, Using Environmental and Earth Observations

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02 - 04 Dec 2025, 14th Chinese-German Workshop on Biodiversity and Ecosystem Services
From Environmental and Earth Observation to Policy: Integrated Monitoring for Biodiversity and Climate

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BIOCLIMA: Assessing Land use, Climate and Biodiversity impacts of land-based climate mitigation and biodiversity policies in the EU - Grant Agreement No. 101181408

The BioClima Vision

BioClima envisions **AI-driven Earth observation** as a catalyst for **climate adaptation** and **biodiversity conservation**. Integrating remote sensing, in situ data, and predictive analytics supports **data-informed decisions** and **international collaboration**, advancing scalable, nature-based solutions across Europe and China.

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1.

About BioClima

Quick facts

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EU-China international cooperation project

Funding on the EU side

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- **Programme:** Horizon Europe – Cluster 6: Food, Bioeconomy, Natural Resources, Agriculture and Environment
- **Topic:** HORIZON-CL6-2024-CLIMATE-01-7 - EU-China international cooperation on improving monitoring for better integrated climate and biodiversity approaches
- **Type of Action:** RIA – Research and Innovation Action

Funding on the Chinese side

中华人民共和国科学技术部
Ministry of Science and Technology of the People's Republic of China

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Factsheet

- **Duration:** 48 months
- **Start:** January 2025
- **End:** December 2028
- **Budget:** €5M
- **Grant Agreement No:** 101181408
- **Funding Authority:** European Research Executive Agency (REA)
- **Partnership:** 17 European and 20 Chinese partners
- **Coordinator:** University of West Bohemia in Pilsen, Czech Republic

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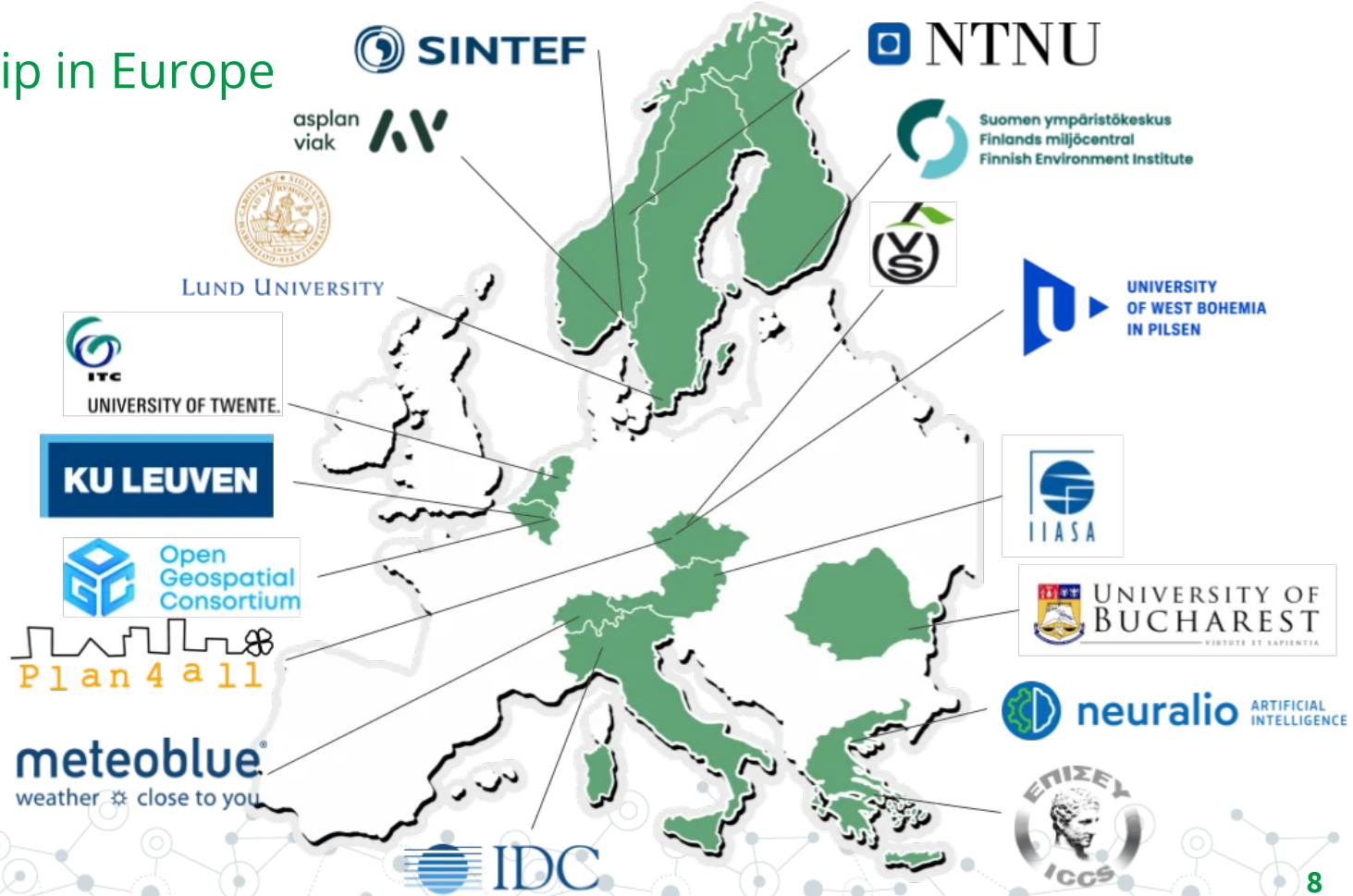
Partnership in Europe



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Partnership in Europe

Partnership in China

2.
BioClima Objectives

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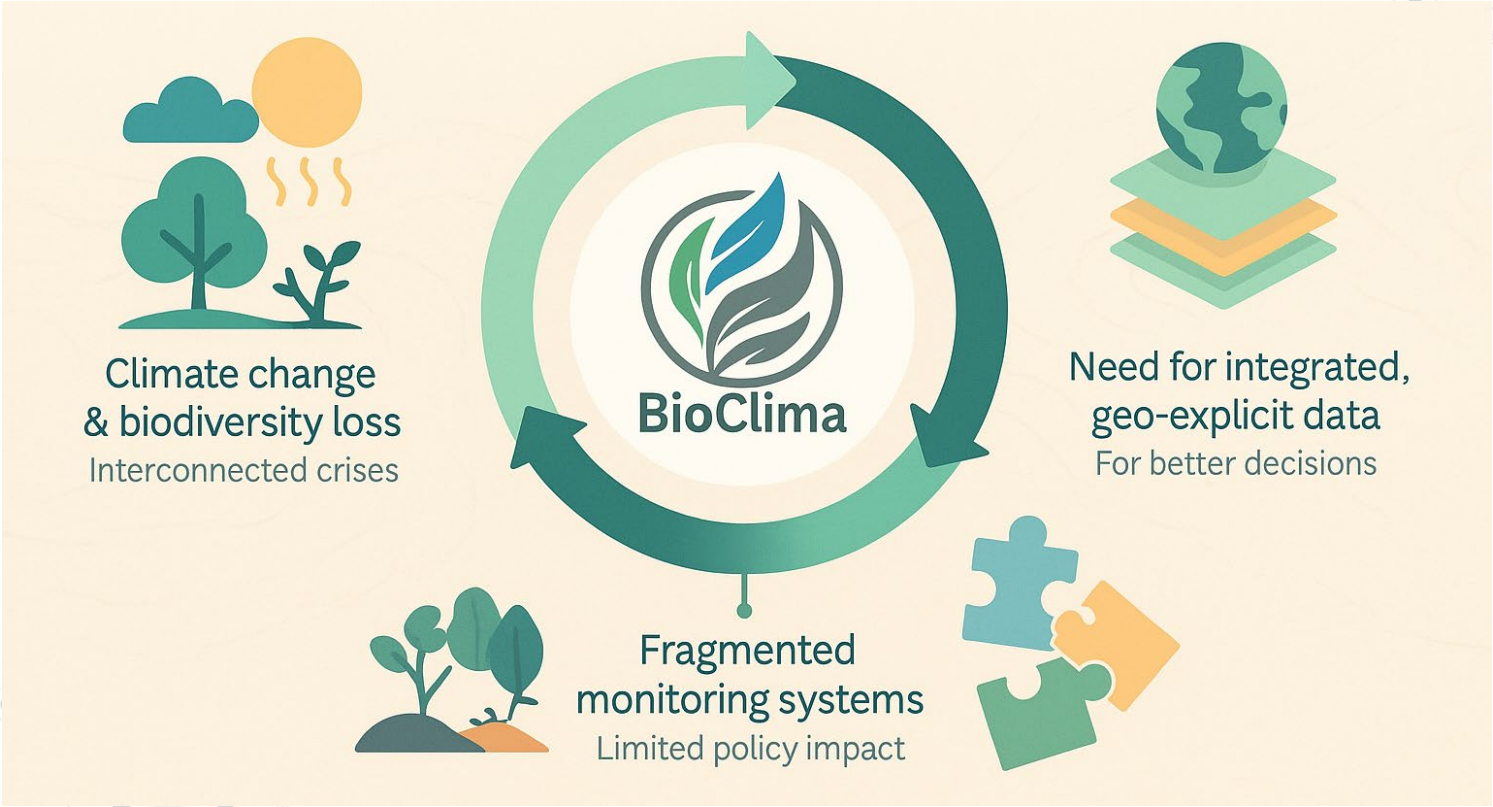
Why BioClima? - Responding to a Global Challenge



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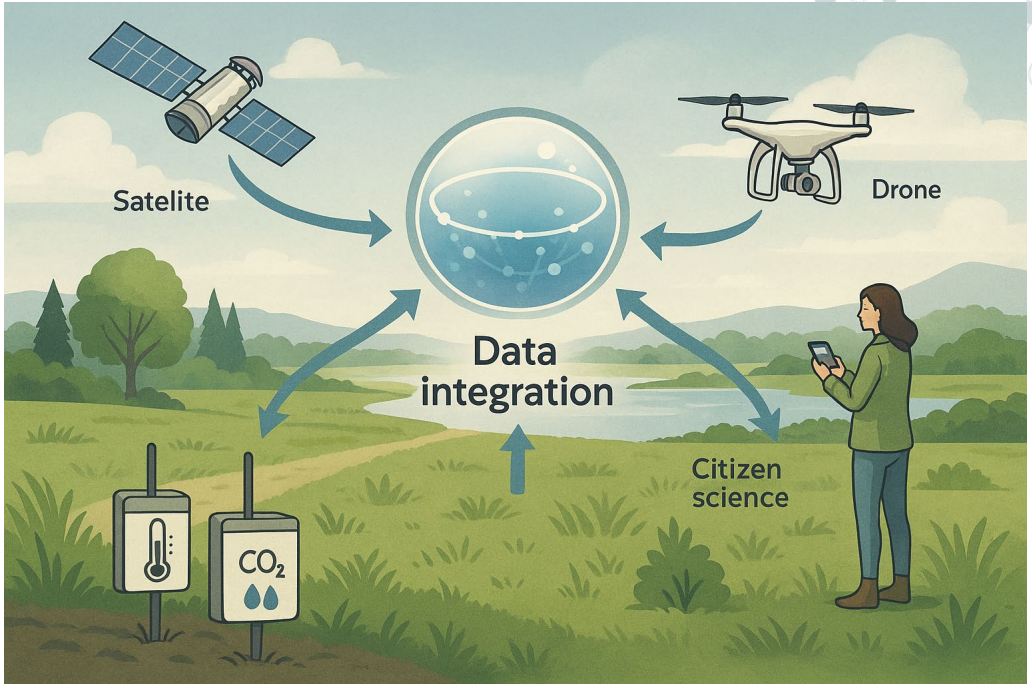
O1 Develop Integrated Observational Systems

To establish advanced integrated monitoring systems for climate and biodiversity that combine Earth observations and environmental datasets to provide comprehensive, geographically-explicit insights into terrestrial ecosystems in the EU and China.



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O2 Advance Data Fusion and Analytical Modelling

To develop sophisticated data models and analytical pipelines that enable seamless fusion of diverse data streams, including climate, land use, and biodiversity datasets, to support predictive modelling, ecological risk assessment, and decision-making. Use of traditional methods as well as innovative AI/ML methods are foreseen.

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O3 Enhance Biodiversity and Climate Change Monitoring via Spatial Patterns

To improve the monitoring of biodiversity and climate change impacts through the development and application of Essential Biodiversity Variables (EBVs) and Essential Climate Variables (ECVs), focusing on vulnerable ecosystems such as forests and grasslands. Assess the impact of climate change on biodiversity and explore the synergies and trade-offs between biodiversity conservation and climate mitigation through detailed comparative case studies in both the EU and China.

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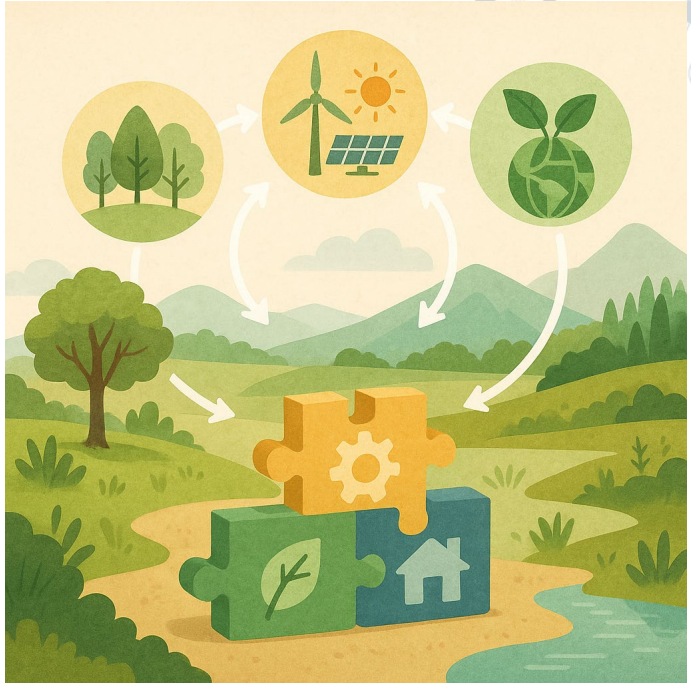
O4 Promote Synergies in Biodiversity Conservation and Climate Mitigation and Adaptation

To identify and implement nature-based and technological solutions that maximise synergies between biodiversity conservation, climate change mitigation, and adaptation efforts, contributing to the resilience and sustainability of terrestrial ecosystems.



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O5 Support Policy and Decision-Making and Upscale from Local to Global

Execute and evaluate **use cases** to demonstrate synergies between climate and biodiversity monitoring, and upscale them to European scale. To provide scientific insights and evidence-based recommendations to support policy-making and the implementation of integrated climate and biodiversity strategies at national and international levels.

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O6 Strengthen International Cooperation, Sustainability, and Capacity Building

Strengthen **EU–China cooperation** through joint knowledge exchange and collaborative environmental research, aligned with GEO, UNFCCC and GBF. Develop a comprehensive strategy for international **communication**, **dissemination**, and **sustainable exploitation of results**, including **education** and **capacity-building** for stakeholders, policymakers, and scientists.

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UNFCCC

GEO

Kunming - Montreal
GLOBAL BIODIVERSITY FRAMEWORK

4.
BioClima Case Studies

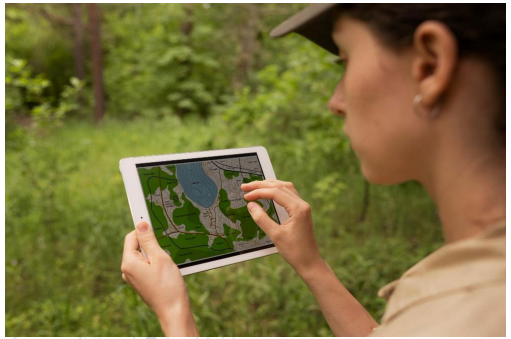
Case Studies

European

BioClima's European sites represent diverse ecosystems - from boreal and Alpine regions to Mediterranean and agricultural landscapes.

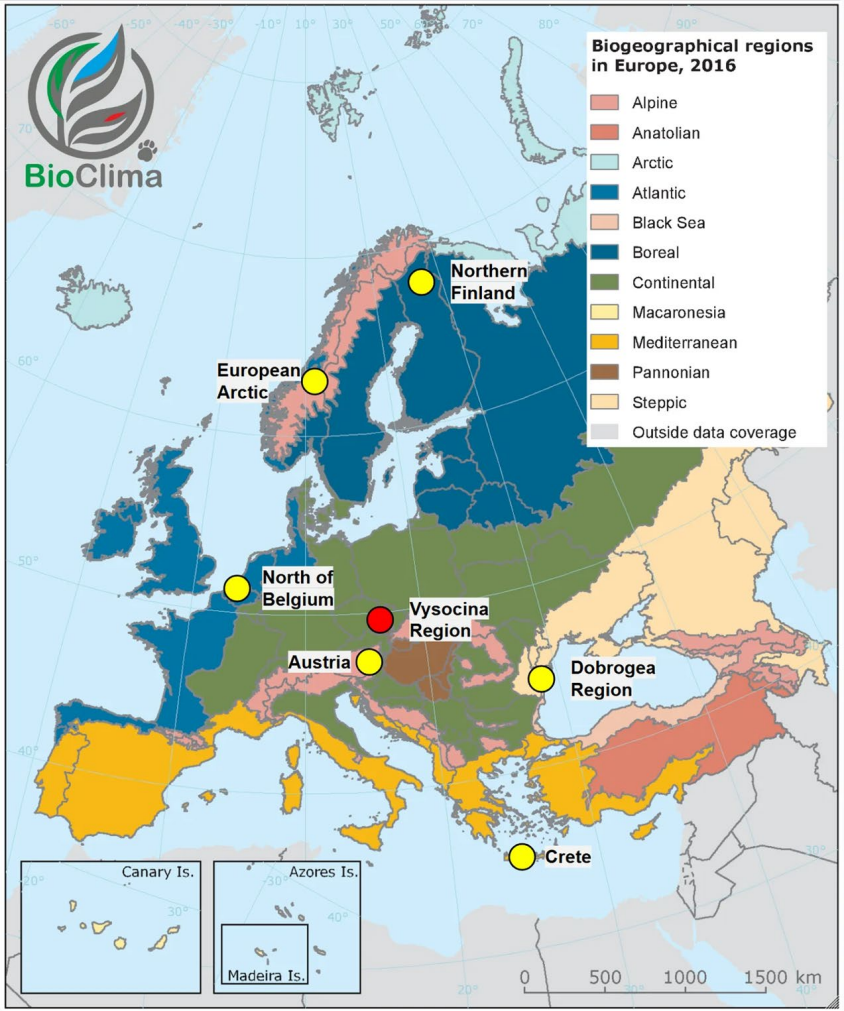
Chinese

China contributes case studies from more than 19 major conservation areas, covering forests, mountains, coastal zones, and tropical regions.

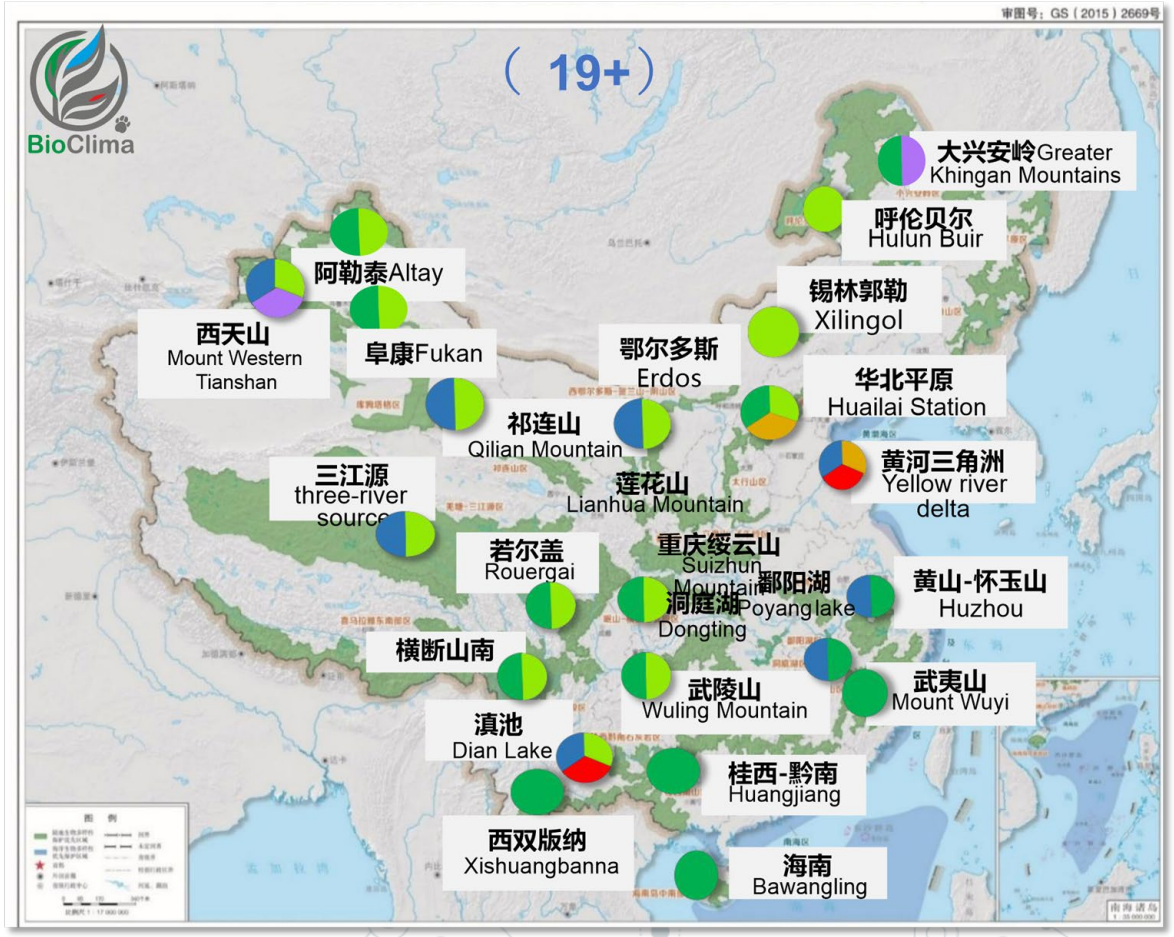


European Case Studies

Location / biogeographical region	Partners	Objective	Scale	Relevant EBVs	Relevant ECVs
Finland: Northern Finland / Boreal / Arctic	SYKE	Natural ecosystems, protected areas	Regional	Ecosystem Structure, Ecosystem Function	Land cover (natural habitats), carbon dioxide fluxes, methane fluxes, data on albedo, snow cover, leaf area index also used. Data on river discharge available.
	Optimise decision-making by integrating modelled carbon balance estimates and EO data on natural habitats, identifying areas with high biodiversity and carbon sequestration potential using the Prebas and Zonation models				
Austria / Alpine	IIASA	Forestry, natural ecosystems, forest fire, climate change	National	Ecosystem Structure, Ecosystem Function	Fire as a major natural disturbance
	Identifying future forest fire hotspots and their impact on ecosystem services using IIASA's FLAM model, considering climate change and management scenarios to upscale modelling to a European scale				
Dobrogea Region, Romania / Steppic	UB	Grassland, natural ecosystems, protected areas	Regional	Ecosystem Structure, Service and Function	Air temperature, wind speed and direction, precipitation, surface radiation budget. Leaf Area Index, albedo, land surface temperature
	Explore the ecological impacts and climate resilience of agroforestry systems using EO and AI-driven time series analysis, focusing on biodiversity-rich yet aridity-exposed areas including the Danube Delta and coastal habitats				
Czech Republic, Vysocina Region / Continental	VSUO, P4A	Forestry, grassland, and land use management, alongside agriculture and natural ecosystems	Local	Genetic composition, ecosystem structure, and ecosystem functions.	Air temperature, wind speed, and greenhouse gases, carbon fluxes, land cover changes, and water cycle elements like soil moisture and river discharge
	Assess the ecological impacts and climate resilience of agroforestry systems, integrating diverse plant species				
European Arctic / Arctic	LU	Understand European Arctic biodiversity and its effects on carbon flux	Regional	Ecosystem structure / ecosystem service and functioning	CO2 flux, land cover, LAI, LST, albedo, snow cover soil moisture, permafrost, insect dynamics
	Analysing the impact of environmental changes on Arctic terrestrial ecosystems, particularly vegetation diversity and its effects on species habitats, carbon dynamics, and greenhouse gas fluxes				
Greece, Crete / Mediterranean	UT	Protected areas, natural ecosystems, management,	Local	Ecosystem structure/ ecosystem functioning	Leaf area index and land surface temperature
	Retrieve EBVs to understand the impact of climate change on forest ecosystems' health and biodiversity dynamics, enhancing monitoring practices				
North of Belgium / Atlantic	KULeuven	Land use management in a region with very intensive agriculture, urban sprawl and changing climate	Regional with link to EU scale	Ecosystem function	Surface atmospheric ECVs and terrestrial ECVs: carbon-land cover, water-soil moisture, energy-LAI, LST
	Explore rural landscapes and ecosystem functioning, focusing on the interplay between land use, climate change, and soil and water management				

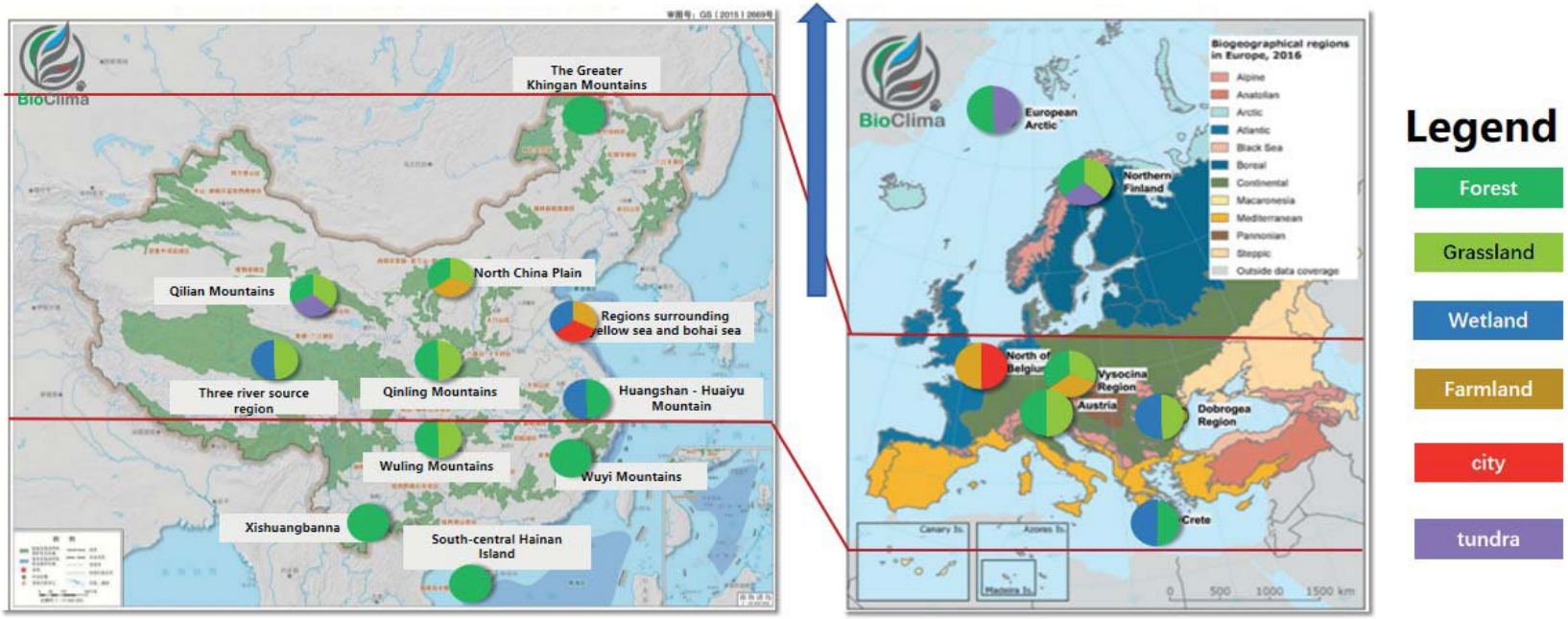


Chinese Case Studies



Case Studies Compared

Control group sharing the same latitude



5.
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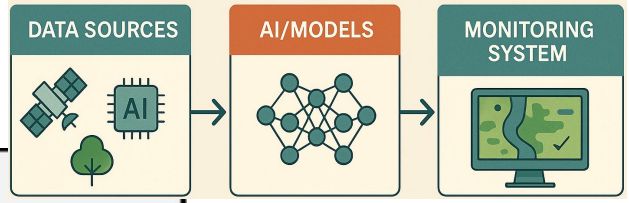
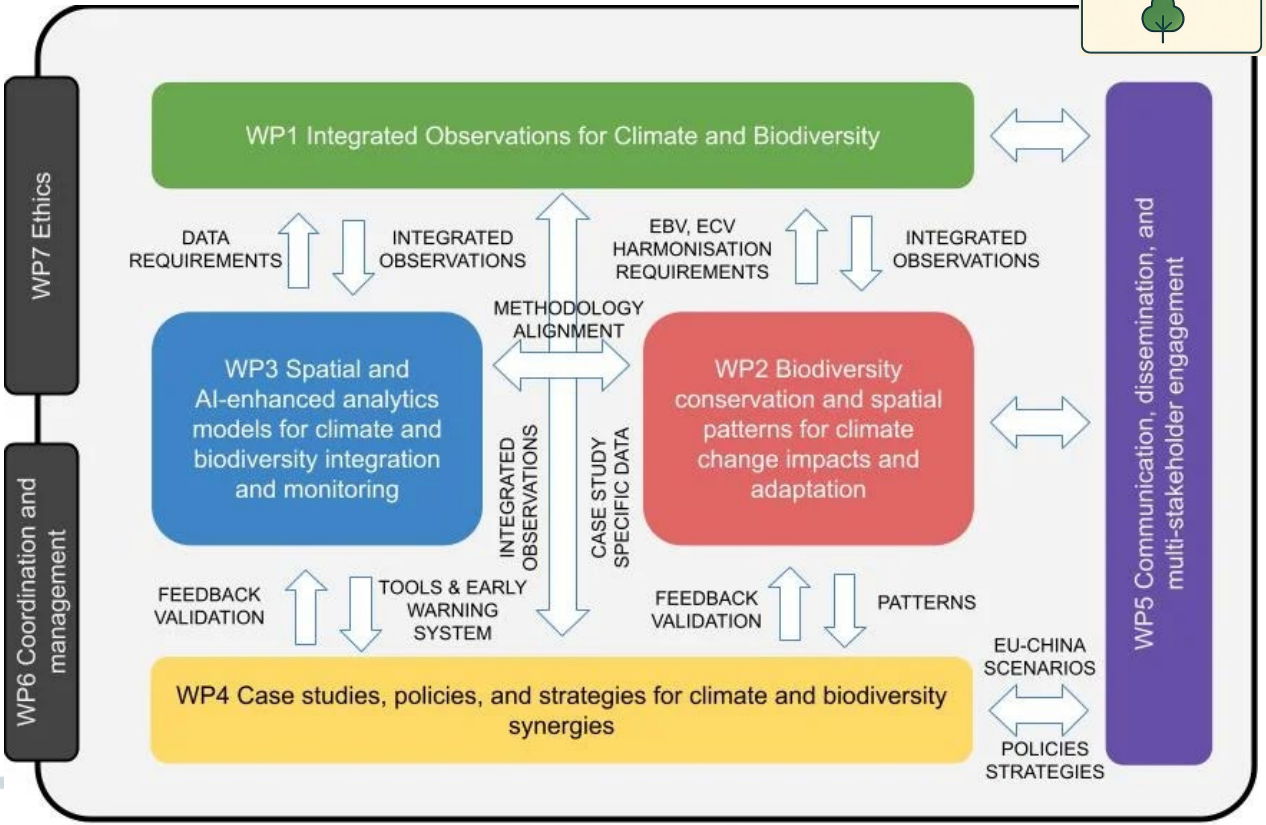
Implementation Plan





Interlinks between work packages

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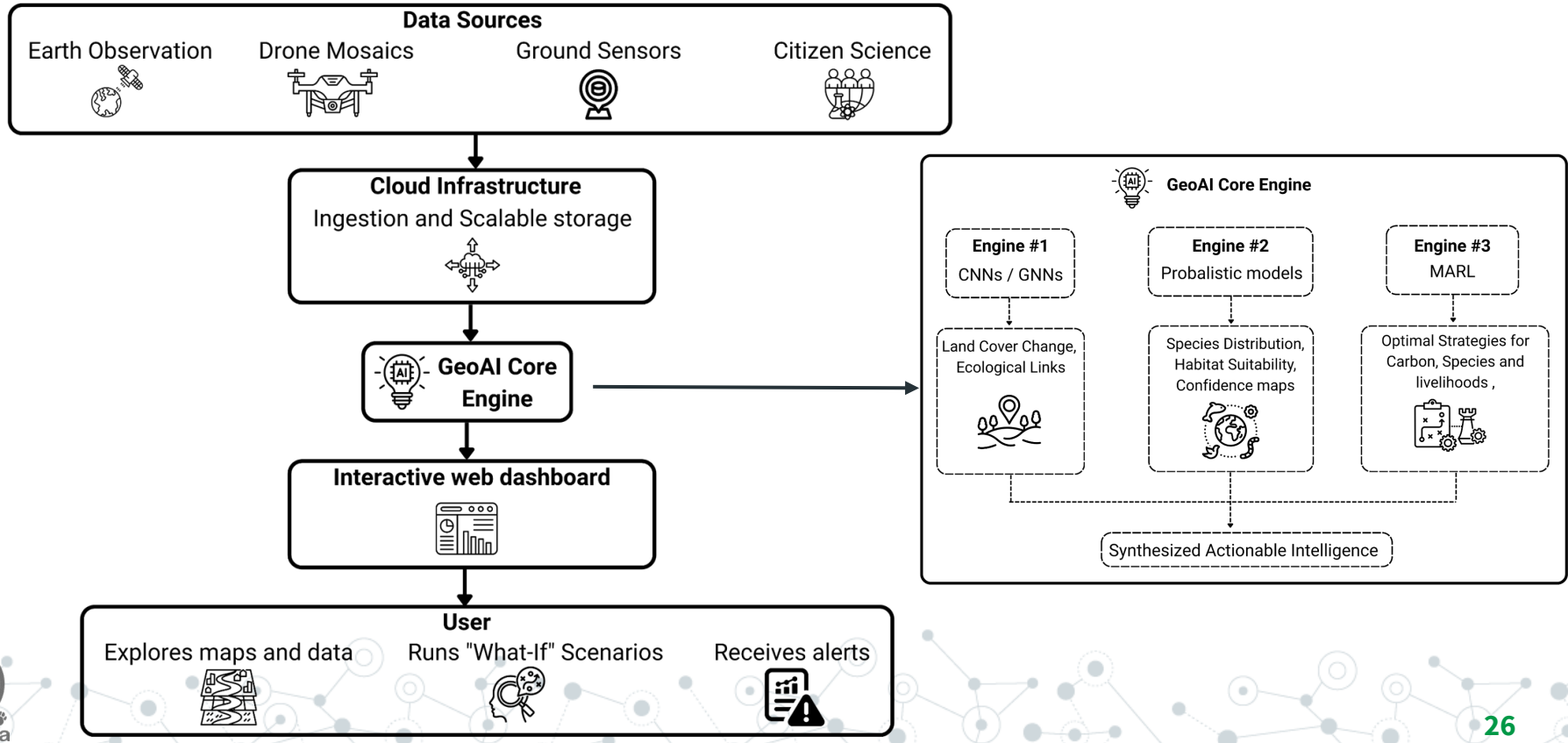
BioClima Technical Flowchart



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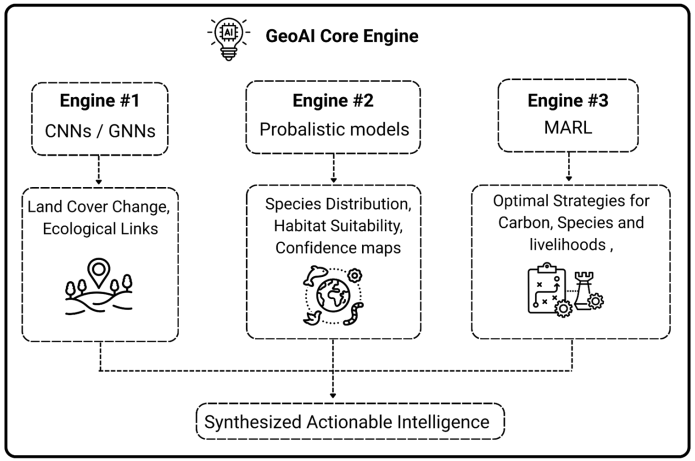
GeoAI Core Engines



Probabilistic Species Distribution Models

What it does: Fuses climate, land use and habitat data to predict where different species can thrive now and in the future. Crucially, it provides confidence maps to show the certainty of its predictions.

Why it matters: Allows for proactive conservation, protecting the habitats of tomorrow

Land Cover & Ecological Connectivity

What it does: Uses Convolutional and Graph Neural Networks to detect land-cover changes at a 10-meter resolution and identify crucial ecological corridors between habitats.

Why it matters: Helps us understand habitat fragmentation and prioritize conservation efforts.

Multi-Agent Reinforcement Learning (MARL)

What it does: This is our most innovative feature. It treats each landscape unit as an "agent" that learns through simulation. These agents test different actions—conserve, restore, or develop—to find strategies that maximize combined rewards for carbon storage, species richness, and local livelihoods.

Why it matters: It moves beyond simple prediction to help us find optimal, win-win solutions for both people and nature.

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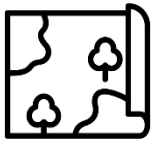
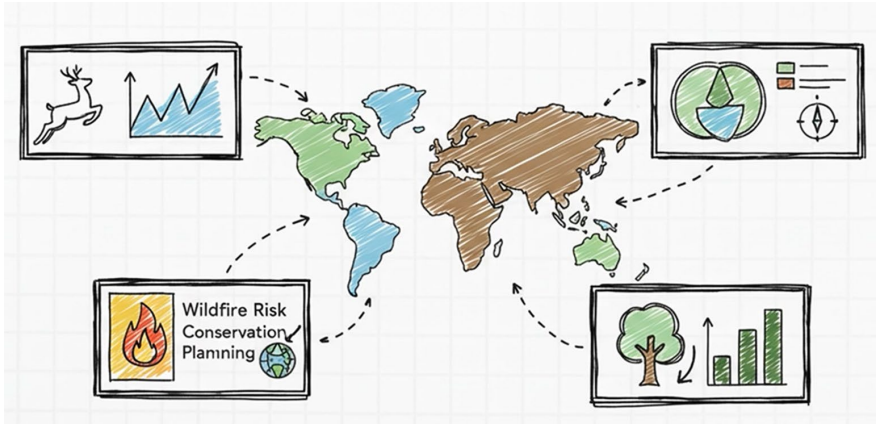
The BioClima Dashboard Functional Capabilities

Wildlife Population Monitoring



Habitat and Land Cover Mapping

Habitat Suitability Modelling



Forest Ecosystem Projection

Wildfire Risk Modelling

Spatial Conservation Planning

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Czech Case Study

Transition from traditional static monitoring to a dynamic, AI-driven analytical framework.

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Czech Case Study - Three Interlinked Use Cases

Long-term LULC and Climate Interactions (1985–Present)

To quantify Land Use/Land Cover (LULC) changes across the entire pilot region over the last 40 years and analyze their statistical dependencies with regional climate variability using AI algorithms.

Bark Beetle Disturbance Dynamics (2016–Present)

To characterize the regime shift caused by the 2016 bark beetle calamity, analyzing deforestation and subsequent reforestation trajectories in relation to climatic anomalies.

Local Biodiversity, Microclimate, and Water Retention

A detailed local study in Matějov to assess how small water retention measures (ponds, revitalized wetlands) influence microclimate and biotic interactions, specifically the "Pest-Bird" nexus.

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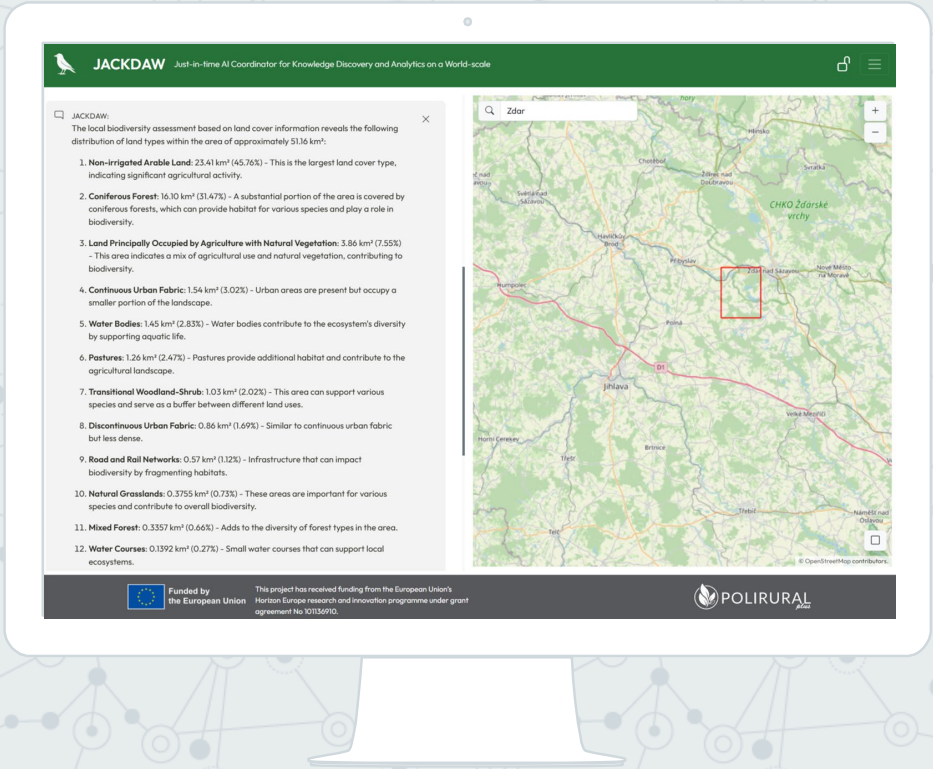
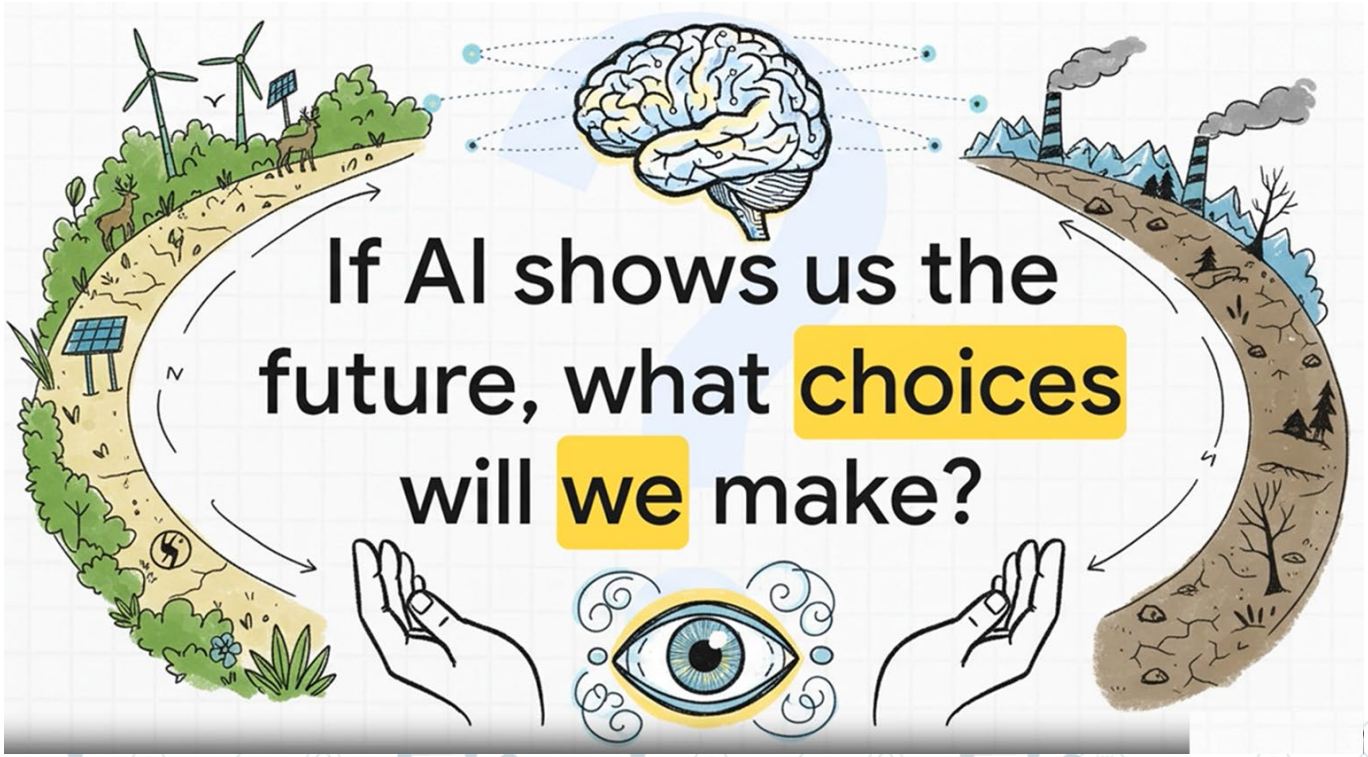


JackDaw

GeoAI chat agent combining natural language and spatial data.

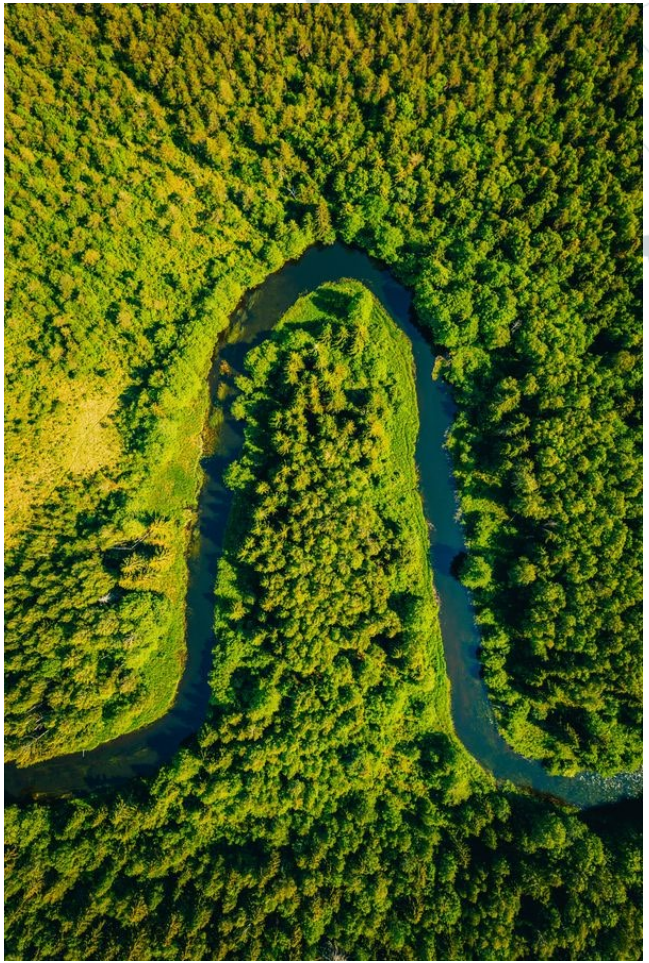
5.
BioClima Impact

Data- and Evidence-Based Choices



Policy Alignment

- Supports **EU Green Deal** & **Biodiversity Strategy**
- Linked to **EU-China Flagship on Climate and Biodiversity**
- Builds on **GEO BON**, **EuropaBON**, **Sino-BON**, **GEOSS**, **Copernicus**



GEO BON

EUROPABON

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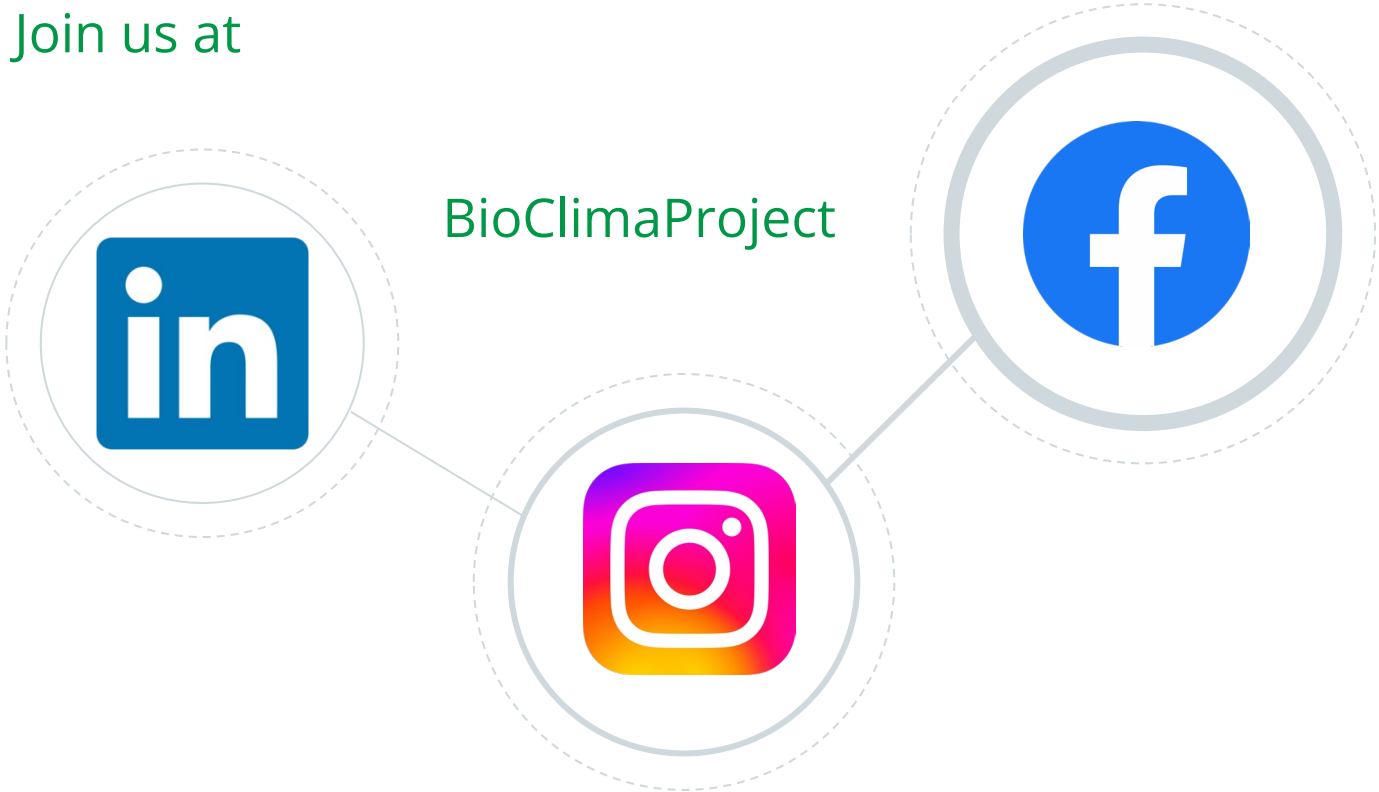
BioClima Doesn't Start from Scratch

Join us at

BioClimaProject



Thank you!

Any questions?

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