LIFE EL-BIOS: The Greek National Earth Observation Data Cube for Supporting Biodiversity Management and Conservation

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ABSTRACT

The recent development of the **Earth Observation Data Cubes (EODC)** framework facilitates EO data management and information extraction, enabling the mapping and monitoring of temporal and spatial patterns on the Earth's surface. This submission presents the LIFE EL- BIOS EODC, specifically developed to **support the biodiversity management and conservation** over Greece. Based on the **Open Data Cube (ODC)** framework, it exploits multi-spectral optical **Copernicus** Sentinel-2 data and provides a series of Satellite Earth Observation (SEO) biodiversity products linked to EBVs, from January 2017 onwards. **Six SEO biodiversity** products are included in the LIFE EL-BIOS EODC:

✓ **Green Fractional Vegetation Cover**
✓ **Annual net primary productivity**
✓ **Leaf Area Index**
✓ **Intra-annual relative range**
✓ **Plant Phenology Index**
✓ **Date of Annual maximum**

❑ **12.400 EO datasets**
❑ **7 TB of data**

LIFE EL-BIOS EODC, to our knowledge, is the **first and only EODC in Greece** right now.
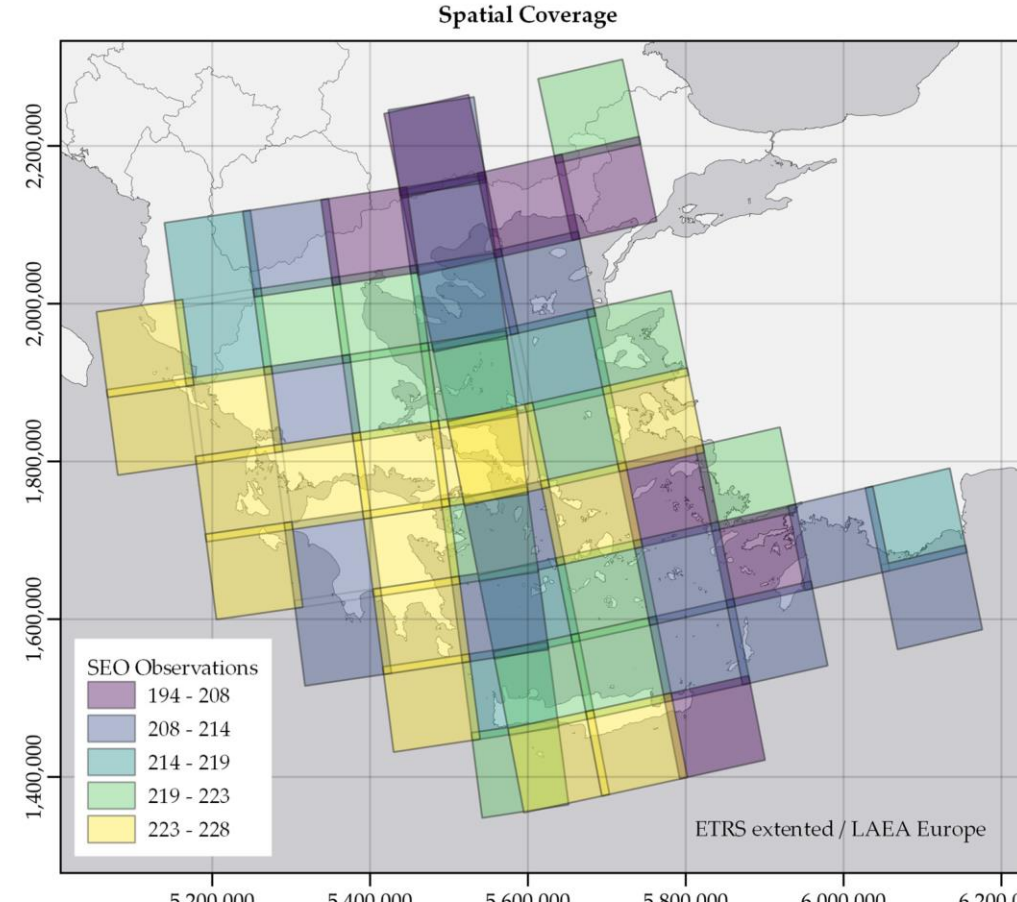
DEVELOPMENT FRAMEWORK

LIFE EL-BIOS EODC leverages **ODC** to manage EO data cubes, storing metadata in **PostgreSQL**. Sentinel-2 L2A data is accessed via **STAC API**, while ODC-OWS enables spatiotemporal queries, **visualization** and **downloads** via the LIFE EL-BIOS web GIS UI.
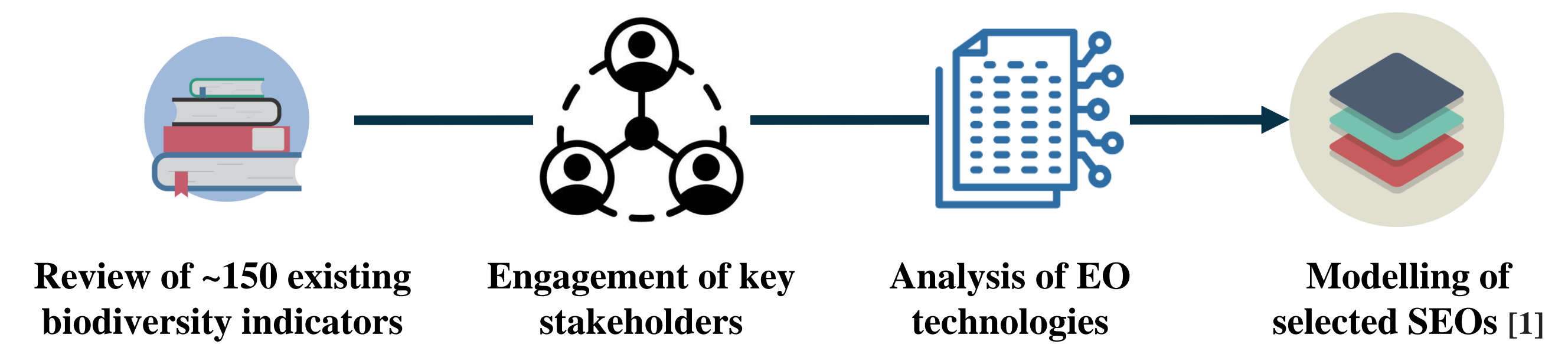
Annual time series undergo outlier masking, gap filling, and Savitzky-Golay smoothing through automated **EO pipelines** via **containerized** workflows. SEO products are reduced to monthly, quarterly, or annual composites, supporting **national-scale analysis.**
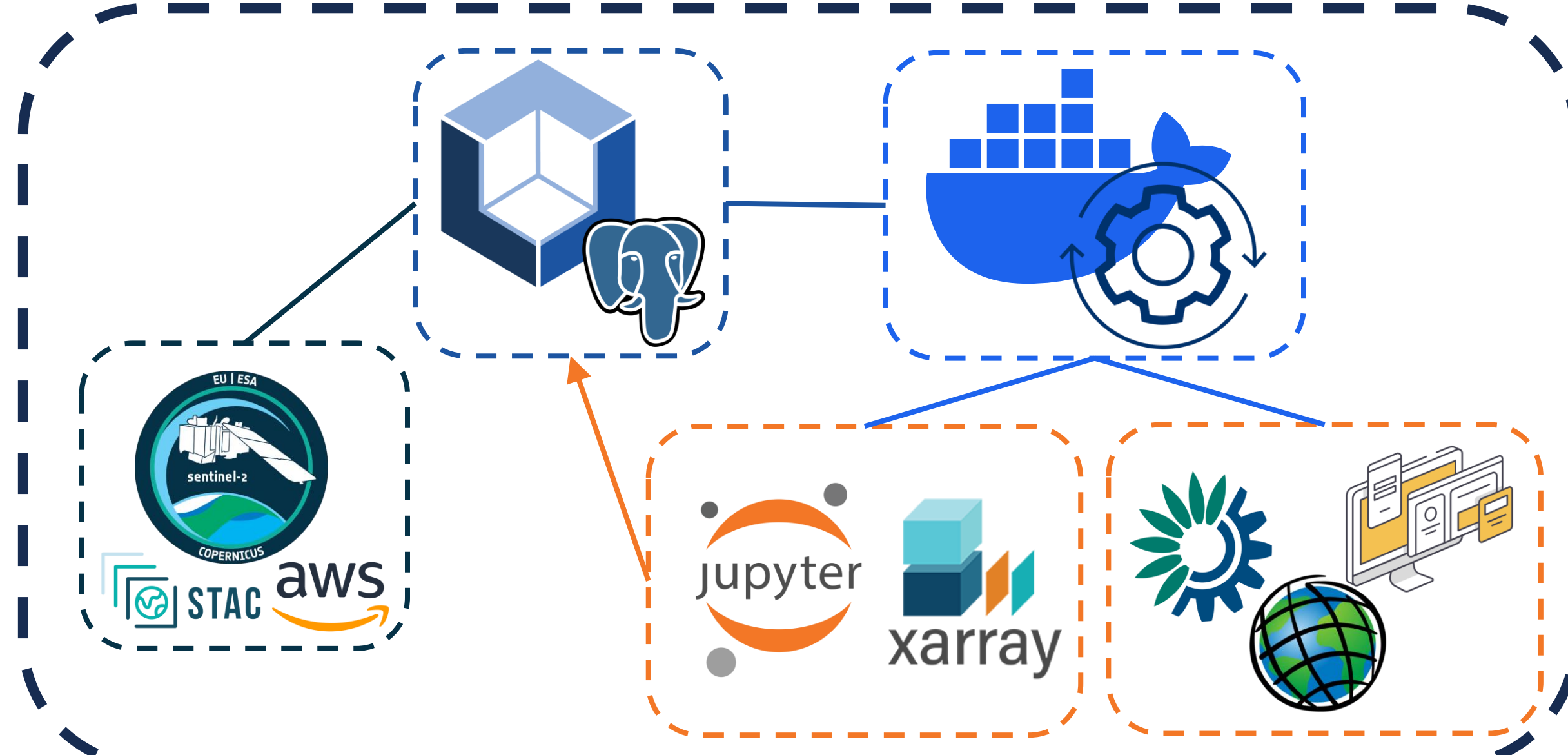
The LIFE EL-BIOS Greek National Earth Observation Data Cube

SEO product	Alias	EBV Proxy	Temporal Resolution
Green Fractional Vegetation Cover	FVC	Live cover fraction	Quarter
Annual net primary productivity	NDVI-I	Physiology	Year
Leaf Area Index	LAI	Physiology	Month
Intra-annual relative range	IARR	Primary productivity	Year
Plant Phenology Index	PPI	Phenology	Quarter
Date of Annual maximum NDVI	DAM	Phenology	Year

Review of ~150 existing biodiversity indicators → Engagement of key stakeholders → Analysis of EO technologies → Modelling of selected SEOs [1]

LIFE EL-BIOS is a hub for Greek biodiversity data, integrating sources like EEA, EIONET, scientific societies, and government bodies. It covers MAES, LULC, ecosystems, species, and conservation, with visualization and download options.

The UI offers the ability to compare areas between two times. Through **ODC-OWS** SEO products can be loaded and visualized to visually assess changes. Areas that underwent abrupt or gradual changes can be identified through browsing between SEO products and compare through a slider window. This way we can view drought or fire related events. For example in **Santorini** island, 2023 suggests gradual decline in NDVI values. A second example, the impact of the 2023 megafire is visible between quarterly composites.
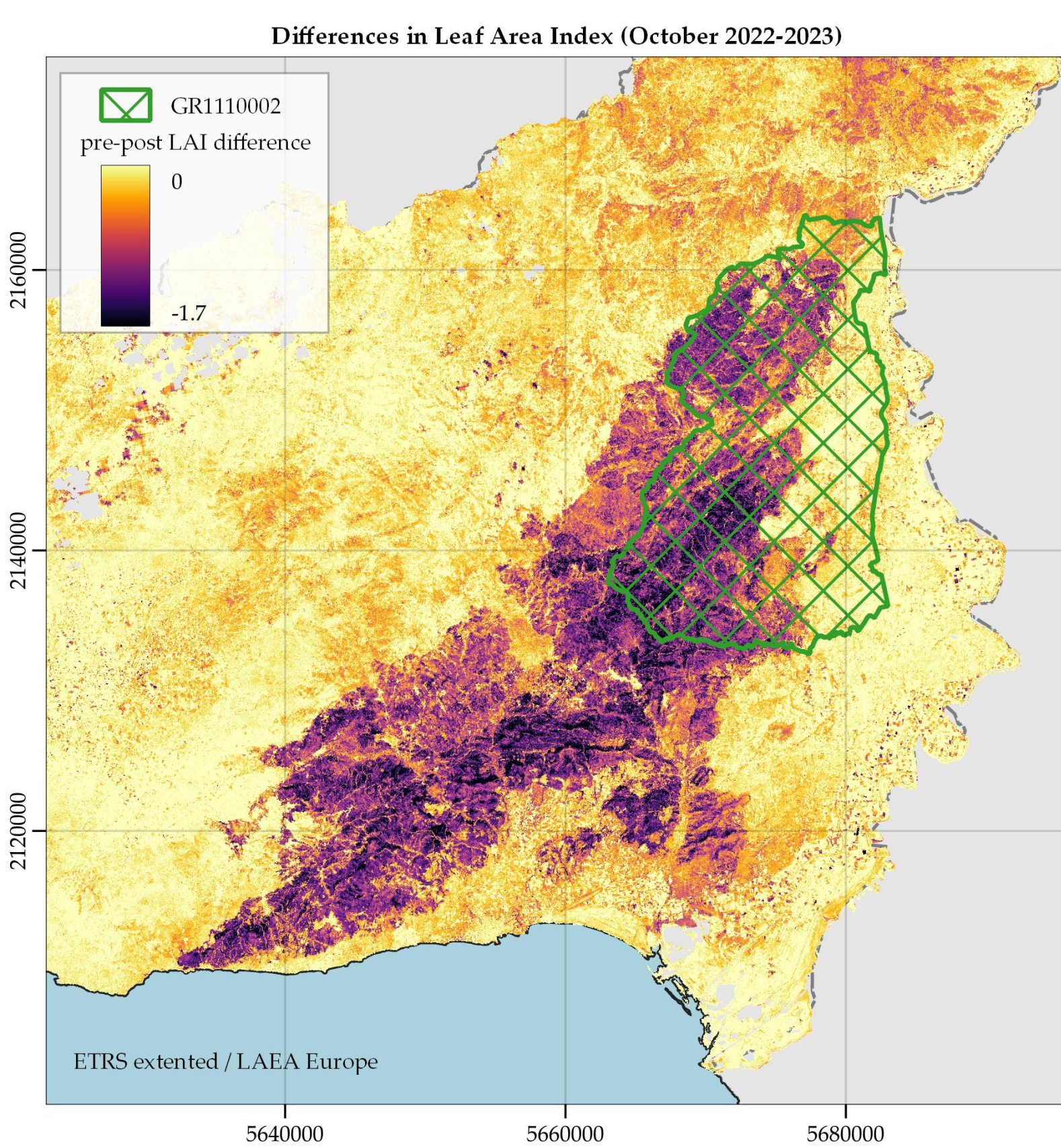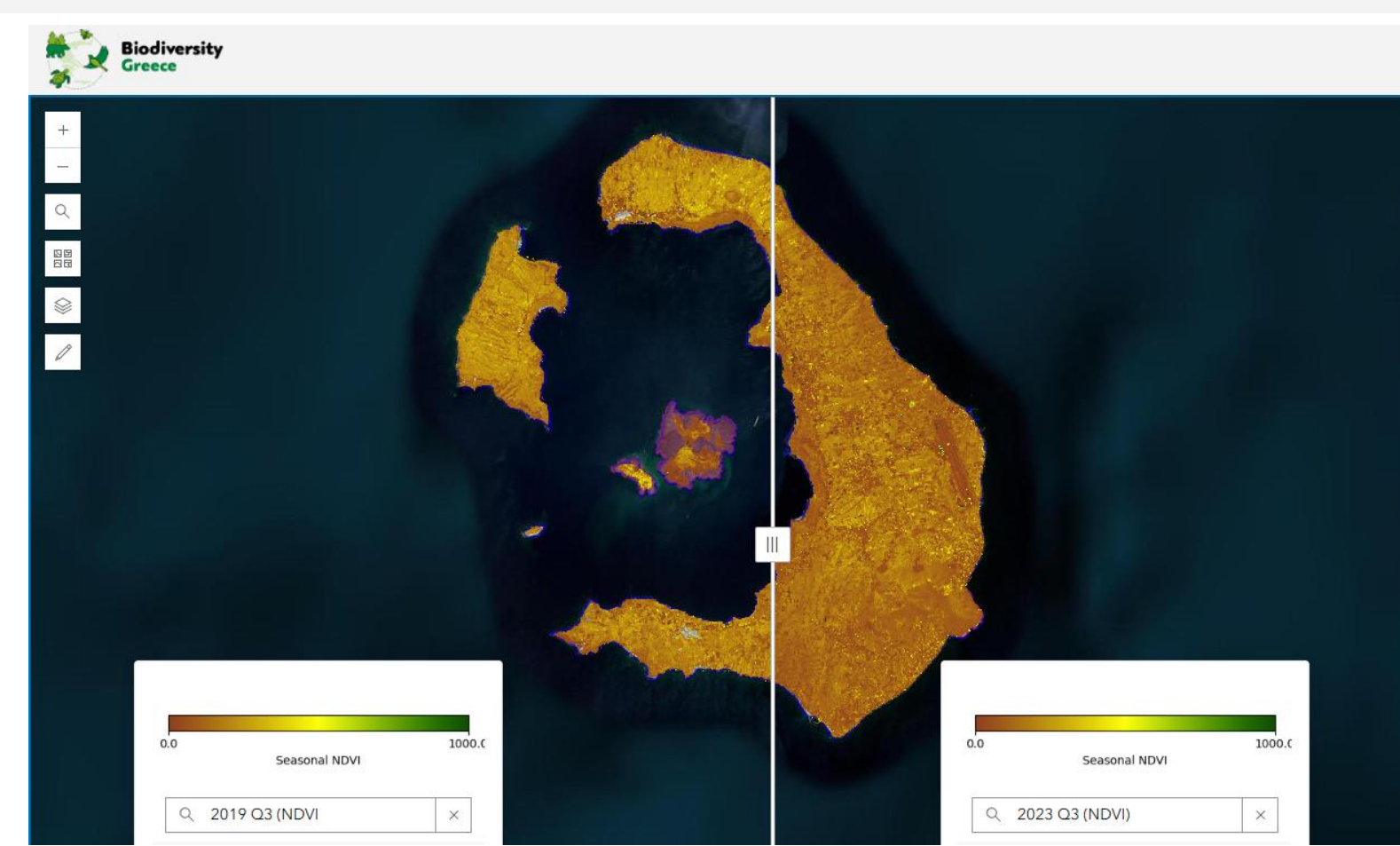
Through Jupyter Notebooks, is feasible to connect to the LIFE EL-BIOS EODC and extract aggregated statistics. For instance, boxplots for a Natura 2000 park show the **primary productivity** of each year, with a significant drop in 2023 highlighting the fire in the **Dadia** forest, the largest wildfire in Europe in the recent years [2].

Differences in Leaf Area Index (October 2022-2023)

GR1110002 Dasos Dadias - Soufli
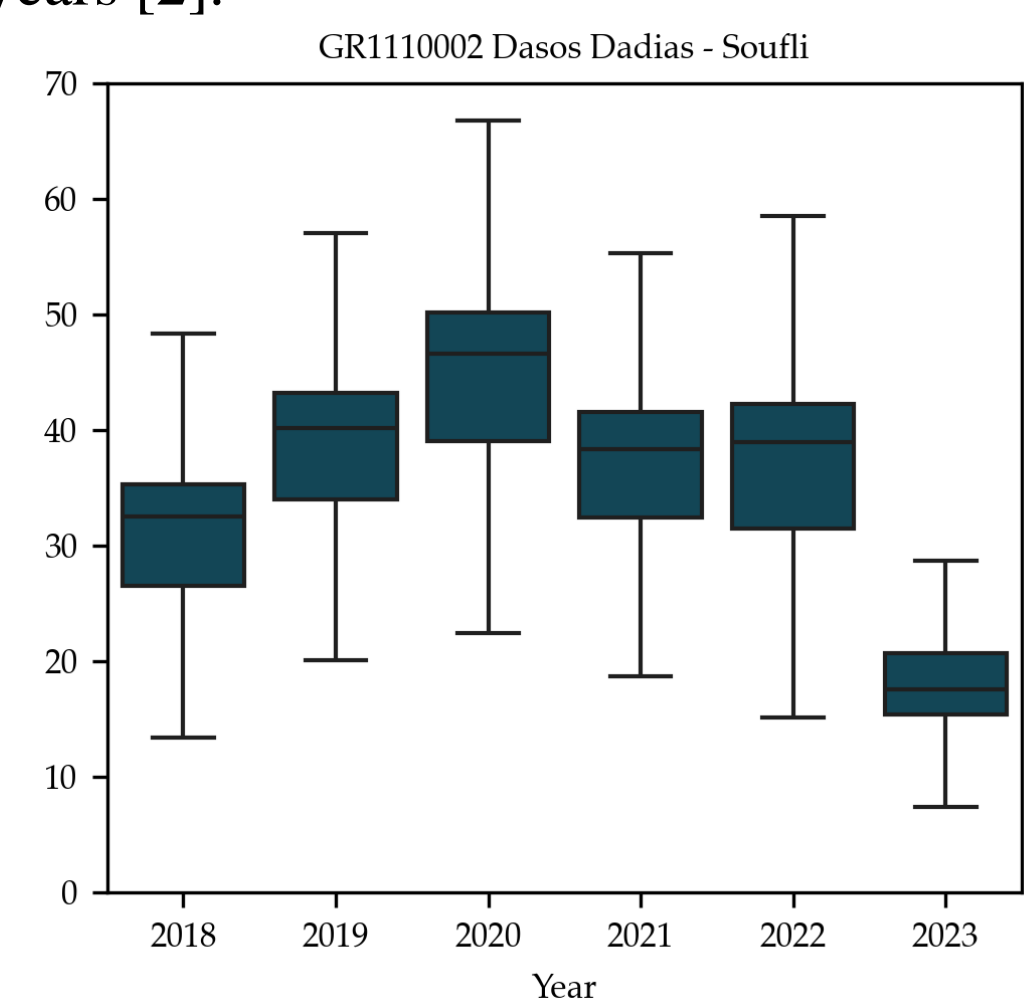
CONCLUSIONS

The LIFE EL-BIOS Earth Observation Data Cube (EODC) provides Greece's first EO-derived biodiversity inventory, offering **analysis-ready datasets** at a 10 m resolution from 2017 onwards. By structuring data in time series stacks, EL-BIOS enables efficient **biodiversity monitoring, scientific analysis, and policy support** at local, national, and EU levels. Future scalability can be enhanced through sandbox environments and semantic search, and change detection applications. Ultimately, EL-BIOS EODC streamlines Big EO data utilization, empowering researchers to focus on biodiversity conservation, land change detection, and environmental assessments. As the first EODC in Greece, it sets a foundation for future advancements in **EO-driven biodiversity monitoring and decision-making**.

REFERENCES

1. Mallinis, G., Fitoka, E., Chrysafis, I., Fotakidis, V., Chatziiordanou, L., & Chatzicharalabous, E. (2024, September). EO-based indicators for biodiversity monitoring at national scale in Greece: framework development for the Hellenic biodiversity information system (EL-BIOS). In *Tenth International Conference on Remote Sensing and Geoinformation of the Environment (RSCy2024)* (Vol. 13212, pp. 500-513). SPIE.
2. Fotakidis, V., Roustanis, T., Panayiotou, K., Chrysafis, I., Fitoka, E., & Mallinis, G. (2024). The EL-BIOS Earth Observation Data Cube for Supporting Biodiversity Monitoring in Greece. *Remote Sensing, 16*(20), 3771.

ACKNOWLEGDEMENTS