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Conference Abstract

Dataspace Integration for Agrobiodiversity Digital Twins with RO-Crate

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Abstract

A severe impact of human-induced climate change is the global decrease in crop yields, threatening the United Nations sustainable development goal (SDG) to end hunger, achieve food security, improve nutrition, and promote sustainable agriculture (SDG 2: "Zero Hunger Goal").

Decision-making on appropriate mitigation strategies requires data integration from heterogeneous data-rich contexts including Earth observation (EO), biodiversity monitoring, gene banks as well as socio-economic data. Accordingly, large-scale initiatives for thematic data spaces, such as the European projects Destination Earth (DestinE) and the Green Deal Data Space, have been launched.

Underutilized crops and crop wild relatives (CWR) can contribute to mitigating the impacts of climate change since their greater genetic diversity allows adaptation of agro-food sources to extreme weather events such as flooding and drought or emerging crop pests.

Within the framework of Biodiversity Digital Twin (BioDT), a prototype digital twin for crop genetic resources modeling is under development. This prototype combines the scanning of genetic resources of CWRs and traditional cultivars for promising pest resistance and abiotic tolerance traits with advanced species distribution modeling and actual climate

scenarios from EO. The aim is to generate habitat suitability maps and identify potential areas where relevant populations are potentially growing (Chala et al. 2024).

The talk gives an overview of data models used to facilitate the required interoperability of both Earth models and environmental data within and across different data spaces such as the DestinE Data Lake (Duatis Juarez et al. 2023). Based on our findings from the use case of agrobiodiversity digital twins, we will discuss approaches for processing machine-actionable digital objects (Fig. 1) containing workflow information (i.e., in the Common Workflow Language format, Crusoe et al. 2022), and for sharing resulting research data in a FAIR (Findable, Accessible, Interoperable, and Reusable) manner by leveraging on so-called webby FAIR Digital Objects involving Research Object Crate (RO-Crate, Soiland-Reyes et al. 2022), FAIR Signposting (Soiland-Reyes et al. 2024) and schema.org and its Bioschemas extension respectively (Castro et al. 2020),

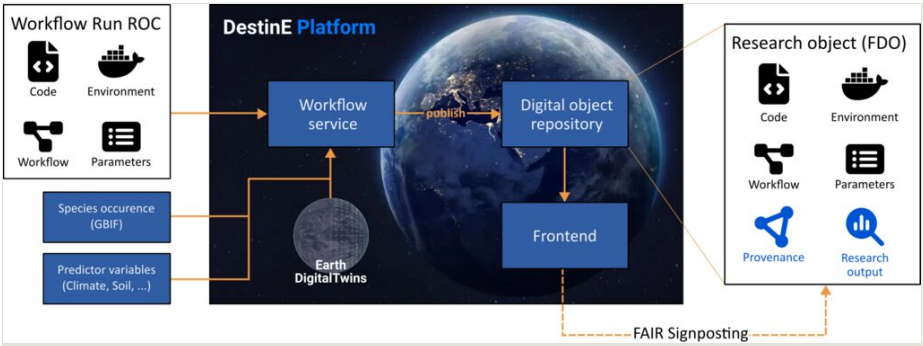

Figure 1.

Overview of architecture and data flow for data space integration of agrobiodiversity digital twins into the DestinE Platform. Workflows are supplied as RO-Crates capturing workflow information and execution parameters. Running workflows will employ, inter alia, Earth observation data from the Copernicus Sentinel missions and on-demand produced data from the Climate Change Adaptation Digital Twin (Wedi et al. 2022). Results are published as webby FAIR Digital Objects enhancing discoverability using FAIR Signposting and Bioschemas.

Keywords

BioDT, FAIR Signposting, FAIR Digital Object, Destination Earth, crop wild relatives, data space, Earth observation, crop modeling, Common Workflow Language, Bioschemas

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Conflicts of interest

The authors have declared that no competing interests exist.

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