

Invasive alien species Digital Twin (IAS-DT)

Ahmed El-Gabbas; Taimur Khan; Marina Golivets; Ingolf Kühn Helmholtz Centre for Environmental Research – UFZ

Data sources and RIs

Invasive Alien Species Digital Twin (IAS-DT)

Introduction

Invasive alien species (IAS) negatively affect biodiversity, ecosystem functioning, and human well-being. The impacts of IAS will likely exacerbate in the future due to new species introductions and the synergy with other drivers of global change. We aim to use statistical models to estimate where and under which conditions new invasions of plant might occur and what might be the overall extent of those invasions. We are particularly interested in

- understanding how the number of IAS changes across Europe;
- which plant IAS may pose the biggest threat to biodiversity and ecosystem service provisioning in the future;
- what habitats are most susceptible to plant invasions and may require increased attention from managers.

Technical description

IAS-DT



Overview of IAS-DT components

1) Dynamic Data-Driven Application Systems (DDDAS) based workflows listen for changes in data sources (1.a. feedback loops), pull and process required data (1.b. data processing), merge and reconcile new and old data (1.c. data assimilation), version datasets and add metadata (1.d. state + FAIR metadata management), and transfer

- Model (LUMI HPC): We will model multiple IAS simultaneously in a joint species distribution modeling framework, a technique that accounts for species co-occurrence patterns and better projects the overall assemblage composition
- Scale: Europe (10×10 km equal-area grid)
- Data workflow: DDDAS system architecture; OPeNDAP server, the state of the natural systems (and of the digital twin) is kept, updated, and versioned

Dependent variable

>1400 plant IAS (FloraVeg.EU)

- Global Biodiversity Information Facility (GBIF, >10 million observations)
- European Alien Species Information Network (EASIN, >117,000 additional grid cells)
- Integrated European Long-Term Ecosystem, critical zone and socio-ecological Research (eLTER, ~120 sites in Europe)

Potential predictors

Habitat (EUNIS) / land cover (Copernicus)

- updated datasets (data + log files) to a data server (1.e. data servicing).
- 2) OPeNDAP Cloud Server services the datasets from the previous component and provides an interface to all IAS-DT data (input, output, metadata, and log files). The server also serves as an interface for third-party applications to access information contained in the IAS-DT.
- 3) IAS Joint Species Distribution Model is the modelling block of IAS-DT that uses input data to estimate gridded IAS numbers per habitat type.

4) IAS-DT dashboard dashboard presents aggregated results of IAS-DT in a simplified and intuitive manner to BioDT users and stakeholders and serves as a communication tool.





GBIF

eLTER

 (γ)

European Commission

- CHELSA climatologies current (1981–2020) and various future climate change scenarios (CMIP6)
- Soil class
- Spatial sampling bias
- Propagule pressure and disturbance level road & railway density



opernicus





