



Developing Research Projects in a Virtual Research Environment

Training Module

Prepare Project: Readiness Level 0

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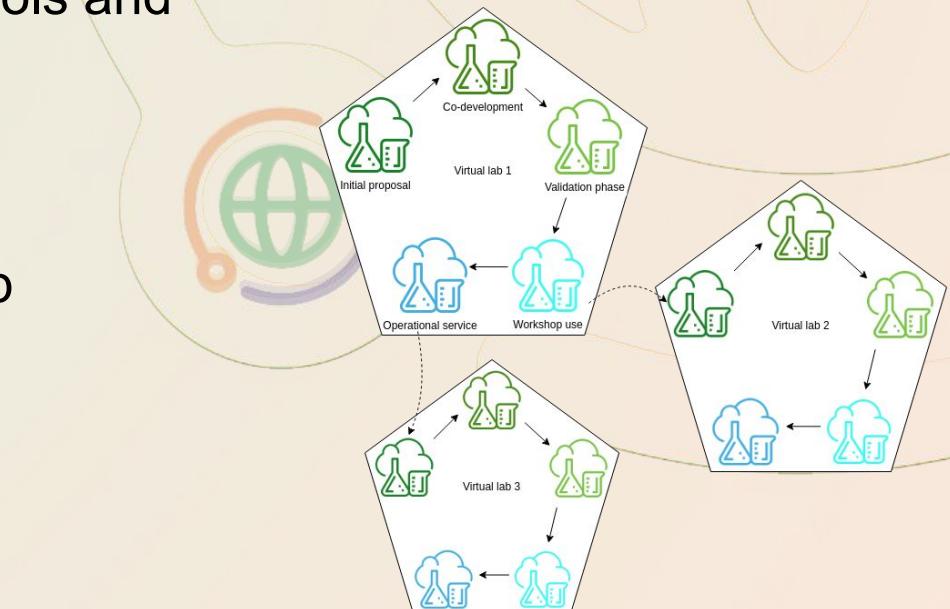
IR0000032 – ITINERIS, Italian Integrated Environmental Research Infrastructures System

(D.D. n. 130/2022 - CUP B53C22002150006) Funded by EU - Next Generation EU PNRR-Mission 4 "Education and Research" - Component 2: "From research to business" - Investment 3.1: "Fund for the realisation of an integrated system of research and innovation infrastructures"



Readiness level framework

- A NaaVRE virtual lab provides a collection of research tools and assets customized for a specific research need:
 - Assets created in the virtual lab
 - Documents that support the usability of the virtual lab

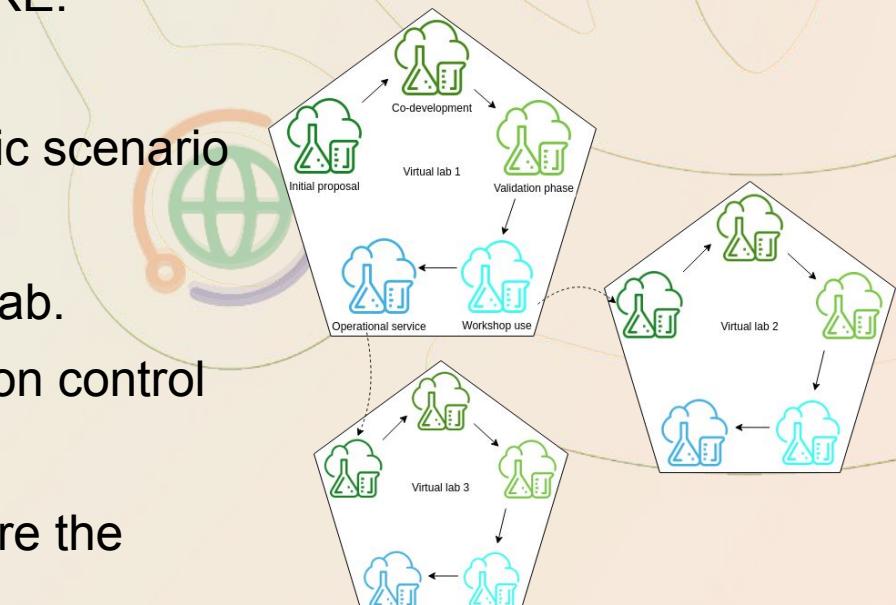


Readiness level framework: Assets & Documents

- **Assets:**
 - **The codebase:** Any code written for the virtual lab. The codebase interacts with external resources such as software libraries and external data
 - **Internal data:** Produced in the virtual lab by data processing, data analysis, and simulations
 - **Workflows and workflow components** (created by containerizing cells from the notebooks in the codebase)
- **Documents:**
 - Metadata
 - Documentation, including a tutorial

Readiness level 0

- **Feasibility:** Check if the research activity can be done in NaaVRE.
- **Team:** Team of virtual lab developers to build the virtual lab
- **Plan:** Write a development plan for the virtual lab. What scientific scenario will be investigated and what is needed to enable that?
- **Codebase:** The virtual lab coordinator will create a new virtual lab.
- **Version control:** Store the codebase on a repository with version control (e.g. git).
- **Documentation:** Pick a nice name for your virtual lab. Make sure the name won't be mixed up with other virtual labs.

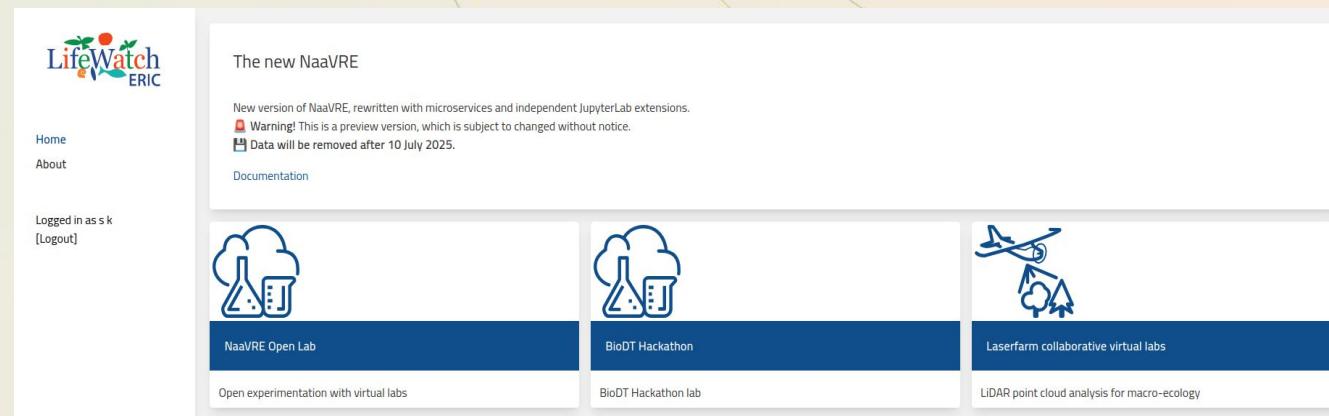


Starting point

- Get started at :

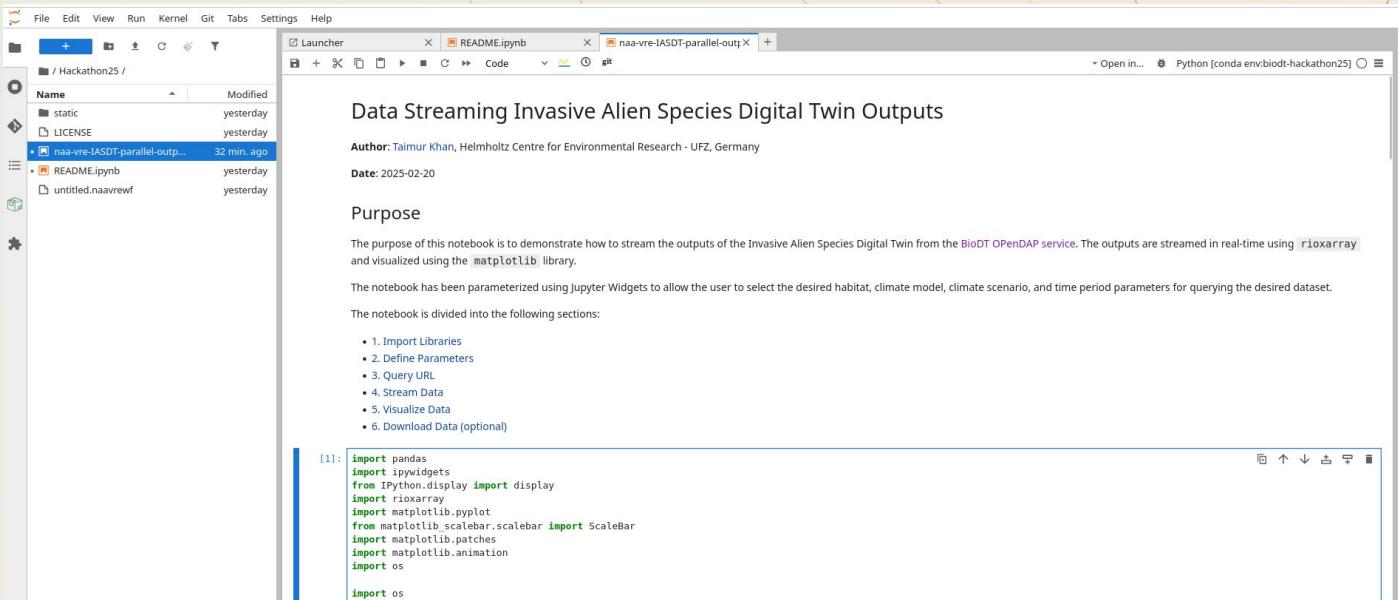
<https://new.demo.naavre.net/vreapp>

- The notebook in the BioDT lab is to demonstrate how to query, download and visualize the outputs of the Invasive Alien Species from an OPeNDAP service
- Parameters:
 - desired habitat
 - climate model
 - climate scenario
 - time period parameters



The Hackathon25 Repository

- Invasive Alien Species Notebook: [naa-vre-IASDT-parallel-outputs.ipynb](#)
- Instructions on how to interact with MinIO cloud store [README.ipynb](#)



The screenshot shows a Jupyter Notebook interface with the following details:

- File Explorer:** Shows the directory structure of the 'Hackathon25' repository, including 'static', 'LICENSE', 'naa-vre-IASDT-parallel-outputs.ipynb' (selected), 'README.ipynb', and 'untitled.naavrwf'.
- Launcher:** Displays the 'naa-vre-IASDT-parallel-outputs.ipynb' notebook in the foreground.
- Content:**
 - Title:** Data Streaming Invasive Alien Species Digital Twin Outputs
 - Author:** Taimur Khan, Helmholtz Centre for Environmental Research - UFZ, Germany
 - Date:** 2025-02-20
 - Purpose:** The purpose of this notebook is to demonstrate how to stream the outputs of the Invasive Alien Species Digital Twin from the BioDT OPeNDAP service. The outputs are streamed in real-time using `rioxarray` and visualized using the `matplotlib` library.
 - Sections:** The notebook is divided into the following sections: 1. Import Libraries, 2. Define Parameters, 3. Query URL, 4. Stream Data, 5. Visualize Data, 6. Download Data (optional).
 - Code:** The code cell [1] contains the following Python imports:

```
import pandas
import ipywidgets
from IPython.display import display
import rioxarray
import matplotlib.pyplot
from matplotlib_scalebar.scalebar import ScaleBar
import matplotlib.patches
import matplotlib.animation
import os
```



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Invasive Alien Species Parameters

- **param_habitat_name:**
 - forests
 - open_forests
 - scrub
 - natural_grasslands
 - human_maintained_grasslands
 - wetland
 - ruderal_habitats
 - agricultural_habitats
- **param_climate_model:**
 - Current
 - GFDL-ESM4
 - IPSL-CM6A-LR
 - MPI-ESM1-2-HR
 - MRI-ESM2-0
 - UKESM1-0-LL
 - Ensemble
- **param_species_class:**
 - Liliopsida
 - Magnoliopsida
 - Pinopsida

```
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import rioxarray
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Invasive Alien Species Outputs

- * **merged_output**: The Mean Speases distribution
- **animated**: The Mean Speases distribution animated over the years

