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Detection of *Azolla filiculoides* in River Systems using Sentinel 2 Imagery and Random Forest Classification in the Google Earth Engine

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Sharing is encouraged

Relevance

Invasive Aquatic Plants

- Threat to biodiversity and Water quality [1,2]
- EU Regulations
  - Prevention, mitigation and monitoring required [3]
- High management costs [4]

Species Distribution Data

- Improve predictive modelling (occurrence, spread, boom-bust dynamics) → mitigation and adaptation

Target species: Azolla filiculoides

- Small floating fern, unique pink/red coloration, forms hick mats → oxygen depletion [5]
- Invasive in EU countries: France [6], Poland [7], Spain [8], …
- Min. winter temperature limits growth → climate change amplifies spread [8]
- Not (yet) listed as Invasive alien species of EU concern → Lack of aquatic monitoring [9], focus on Water Hyacinth (No.1 invasive) [10-13]

Close-up of a leaf

A. filiculoides (pink-tinged) with *Lemna minor*

Single *Azolla filiculoides* plant showing the roots

Image: Wikimedia

Fig: Mass occurrence of *A. filiculoides* on Tagus, May 2020. Management: Rafting Blockade. Source: Mateusz Draga Image: Francisco Castañares

Conclusions and Outlook

- Rapid, globally scalable framework with high accuracy for automatic water and vegetation mapping
- Refine Band selection for training: Include aquatic vegetation indices, water indices
- Apply trained classifier to new unseen region
- Peer-review method through manuscript submission

→ Investigate Spread Pattern on national scale / EU scale for last decade

Method

- Pixelwise Classification with Random Forest (RF)
- Automated Workflow: Google Earth Engine
- Water Detection:
  - Individual Classifiers for every scene = accuracy
- *A. filiculoides* detection:
  - One classifier = robustness

Validation

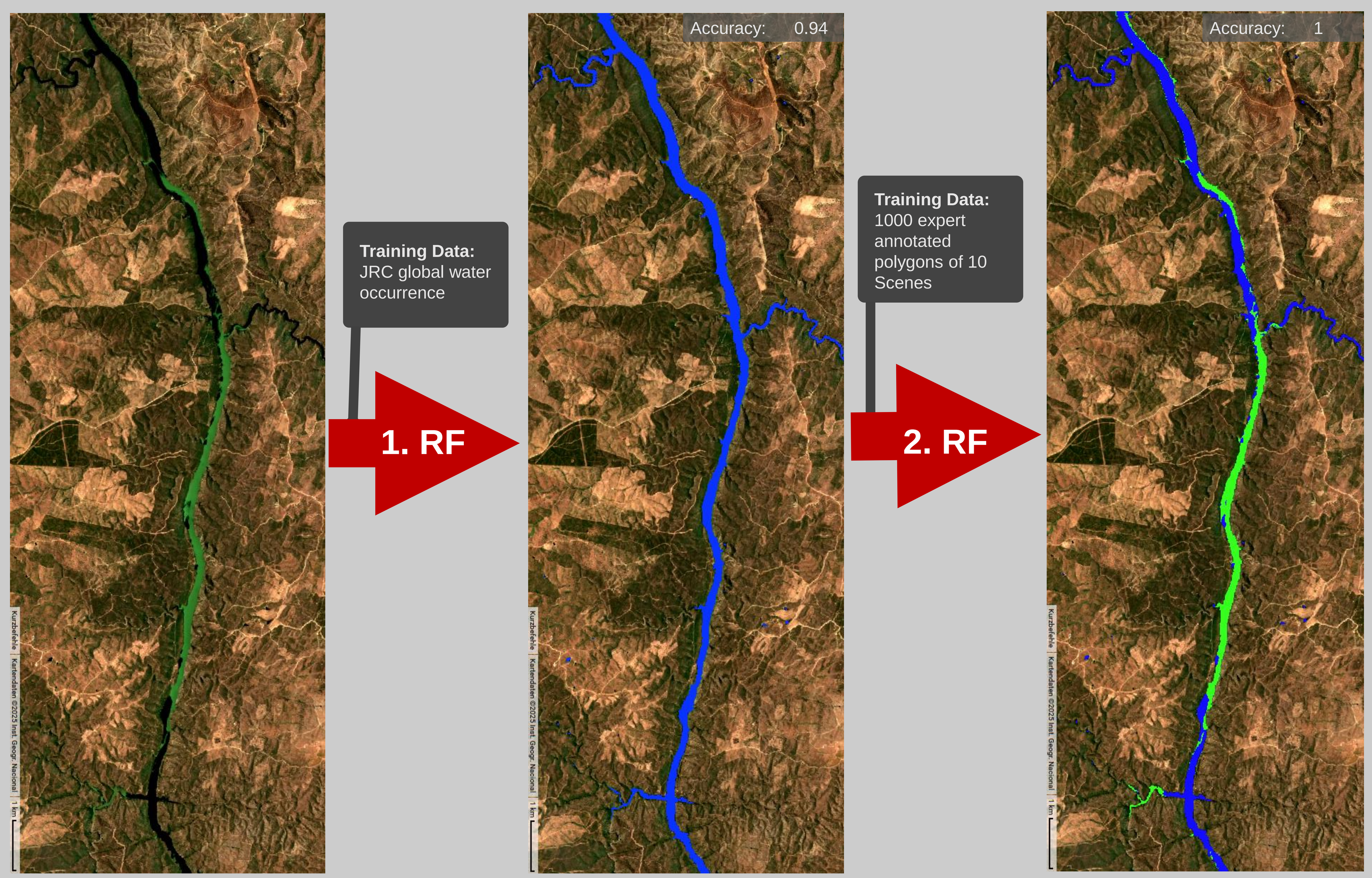
Train/Test Area:

- Over 100 km of Tagus River Spain
- 8 years with ~ 850 Scenes

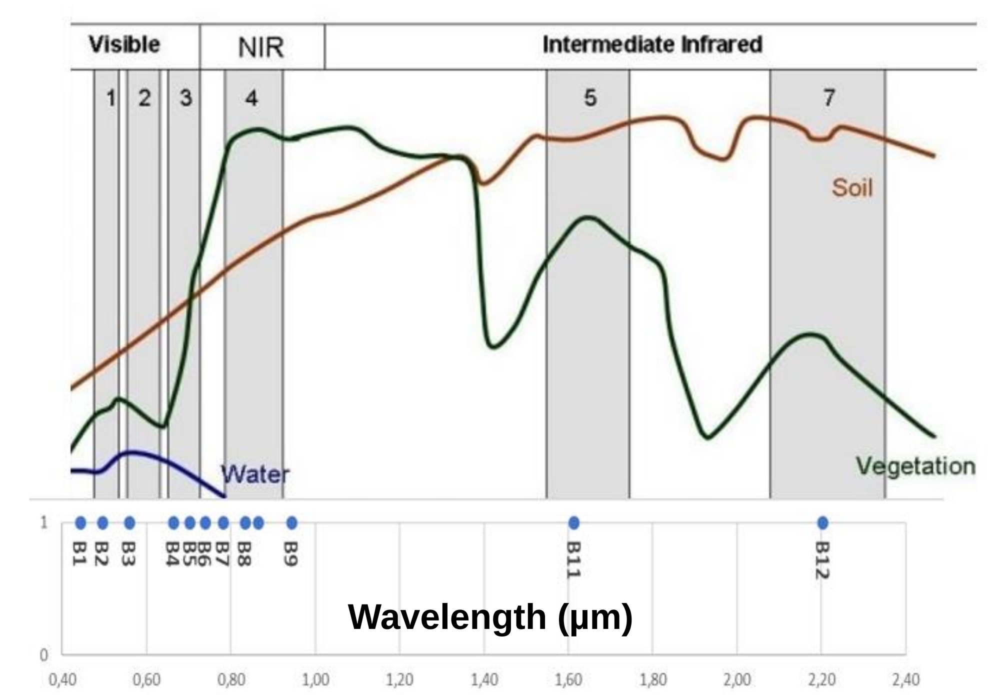
Test-Split validation: water

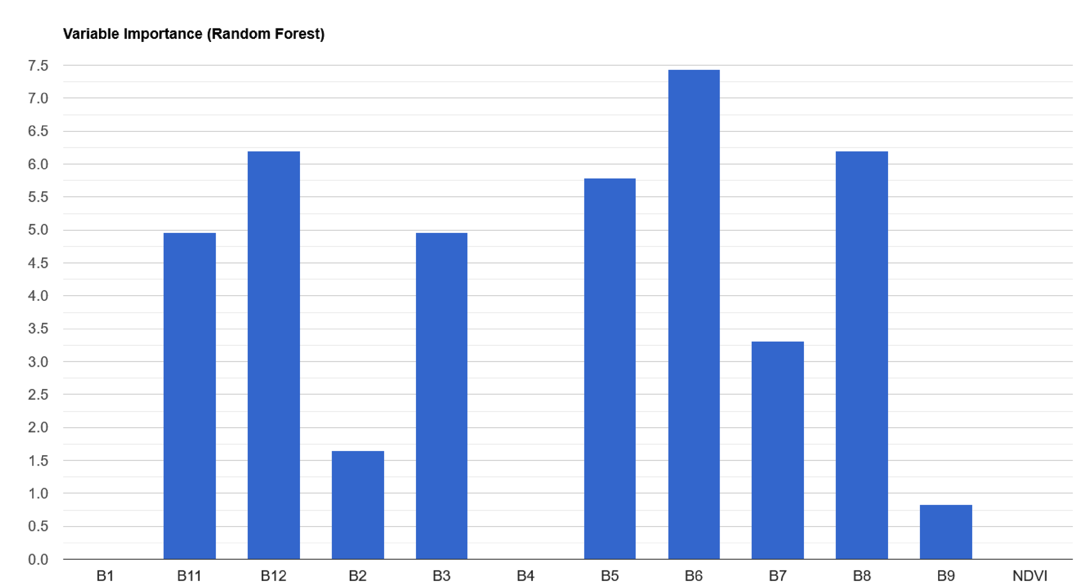
- Mean metrics of 30 classified scenes:
  - Overall/Test accuracy: 0.94
  - Kappa: 0.89
  - MCC:
    - Ours: **0.89**
    - Singh et al., 2020: [10] **0.69**

Sentinel 2 Scene | **Water Body classification** | ***A. filiculoides* classification**



Explainability





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