MAPPING INVASIVE *HERACLEUM SOSNOWSKYI MANDEN* WITH SATELLITE REMOTE SENSING FOR EUROPEAN RUSSIA: THE PRELIMINARY RESULTS

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Goals

Hogweed Sosnowskyi (HS) *is* one of the most dangerous invasive species in Russia. Accurate and timely mapping of **HS** is essential for successful control of **HS**. Our aim was to test suitability of freely available radar Sentinel-1,optical Sentinel-2 imagery and Random Forest machine-learning classification methods to map **HS** in temperate Russia (Moscow oblast study area).

Study area and Hogweed *Sosnowskyi*

Moscow oblast is characterized by widespread agricultural land abandonment and the spread of **HS**.

Figure 1. Study area

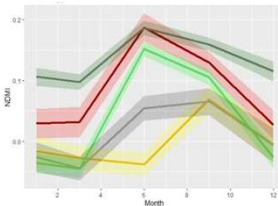**Figure 2. H**ogweed *Sosnowskyi (HS)*

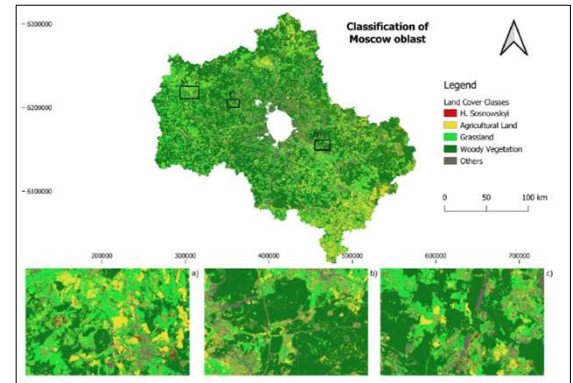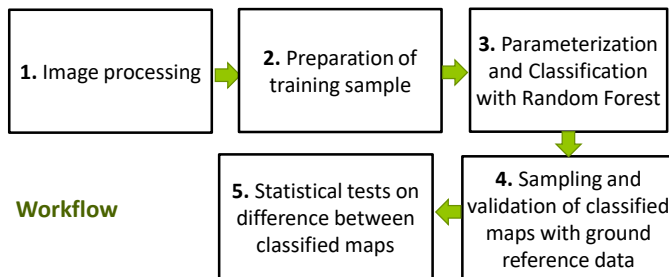**Figure 3. Phenology curves for Normalized Difference Moisture Index for land-cover types, including *HS***

Figure 4. Classified land-cover classes with Sentinel-2, including *HS*

Data and Methods

1. Image processing → **2.** Preparation of training sample → **3.** Parameterization and Classification with Random Forest

5. Statistical tests on difference between classified maps ← **4.** Sampling and validation of classified maps with ground reference data

Workflow

Step 1. Cloud-free monthly composites Sentinel-1, Sentinel-2 A, B for 2019. Cloud computational environment: Google Earth Engine.

Step 2. Expert-based selection of training area, selection minimum mapping unit, distribution across the study area using Sentinel-2, World View imagery
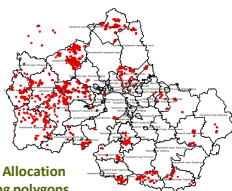

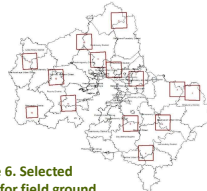**Figure 5. Allocation of training polygons**

Figure 6. Selected areas for field ground reference campaign

Step 3. Evaluation of number of trees, input features, other Random Forest parameters. Classification with Random Forest in Google Earth Engine

Step 4. Two-stage stratified random sampling. Sampling data collection during the field campaigns in 2021. Accuracy assessment

Step 5. Statistical non-parametric McNemar tests to identify difference in accuracies among the classified maps.

Results and Discussion

- Error-adjusted area estimates suggest up to 133,000 Ha were occupied with **HS** in Moscow oblast by 2019 (mapped with Sentinel-2)
- Preliminary **HS** user's accuracy 93%, producer's accuracy 30%
- **HS** was concentrated in northern part of the oblast
- Optical Sentinel-2 monthly composites suited better than Sentinel-1 to map **HS**
- **HS** has unique phenology and specific spectral characteristics that gives preconditions for separability from other land cover classes
- Participatory methods became useful and valid approach for crowdsourcing training and validation data collection
- The proposed workflow is suited for replication of study in other parts of northern Eurasia where **HS** occurs.

References

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4. Мышляков СГ, Артёмова АИ 2017. Картографирование мест произрастания борщевика Сосновского по космическим снимкам Sentinel-2. Пятнадцатая Всероссийская открытая конференция "Современные проблемы дистанционного зондирования Земли из космоса", Москва, Россия