Predictive modeling of bark beetle outbreaks and links to remote sensing

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GOZDARSKI INŠTITUT SLOVENIJE
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Slovenia

Forest area: 1.2 million ha (58%)

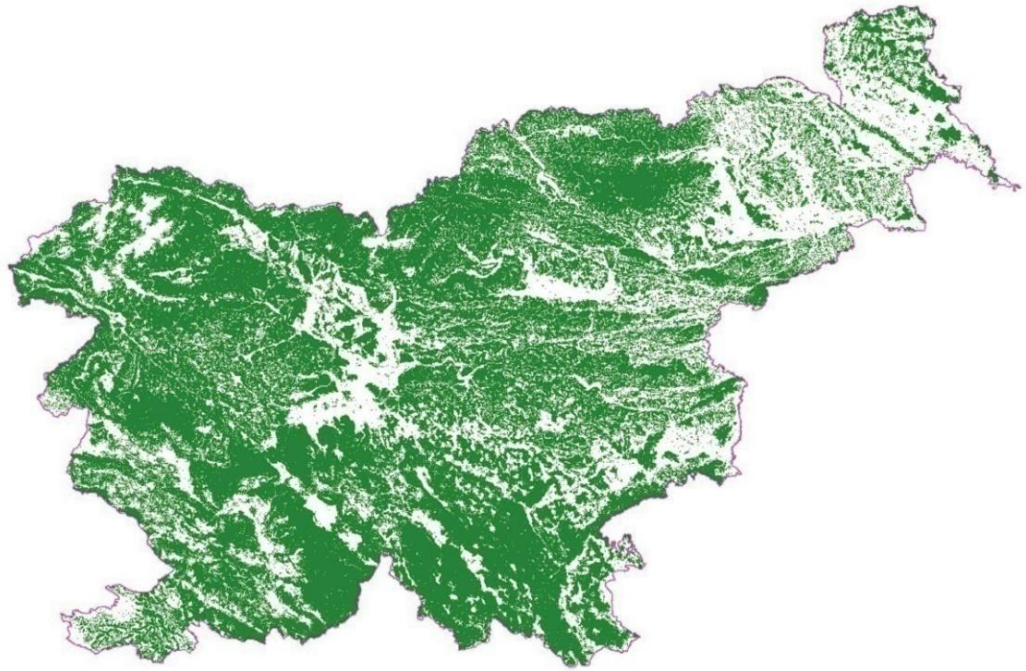
Ownership:

private forests 75%,

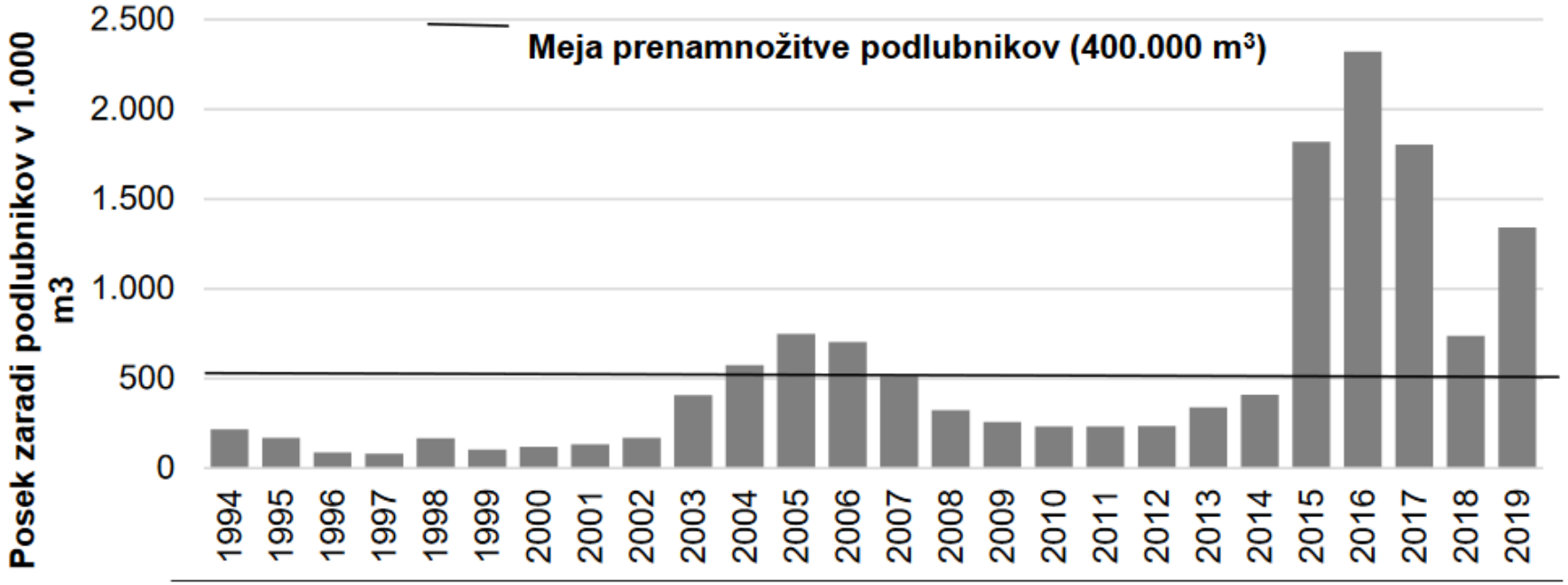
state forests 22% and

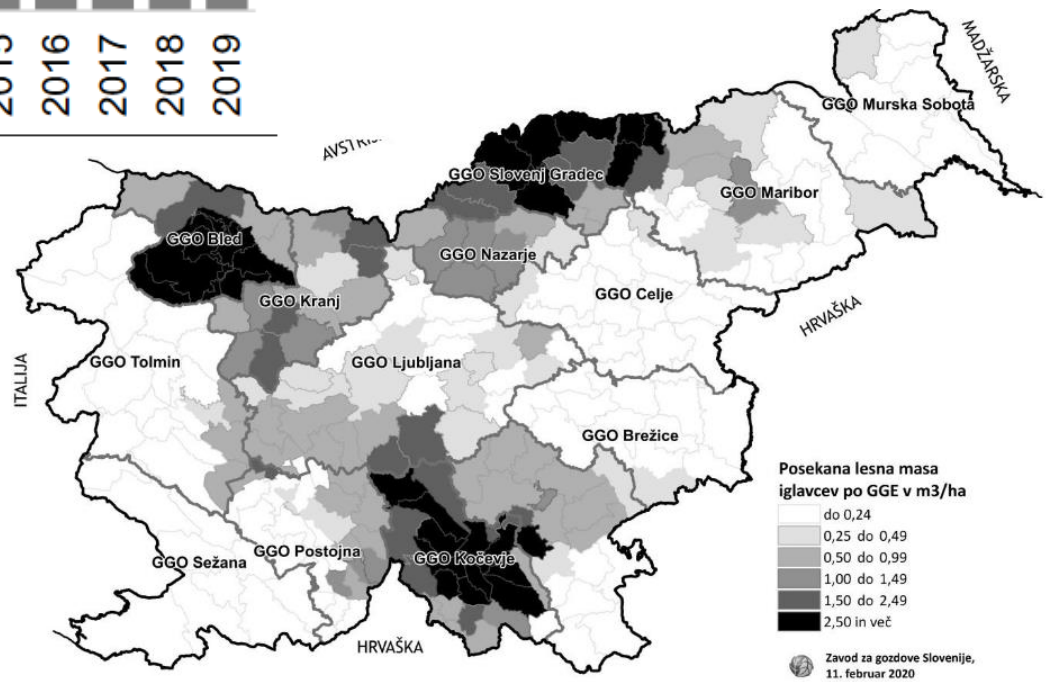
forests of local communities 3%

Number of forest properties: 314,000 (forest owners: 461,000)



Bark beetles in Slovenia





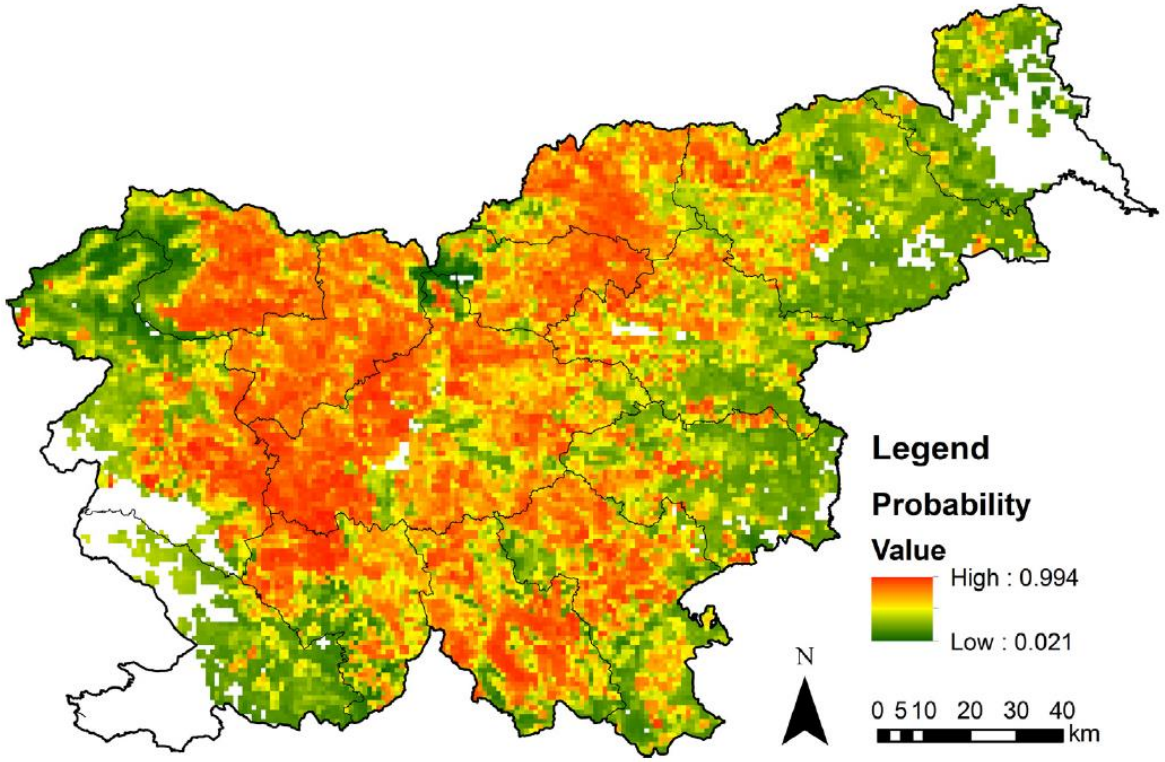
Aim

- Present the implementation of predictive modeling in Slovenia
- Links of the models with remote sensing

Methods for short term prediction

- Logistic regression
- Spatial autocorrelation
- Grid size 1km x 1km
- Different variables: weather, topology, soil properties, sanitary felling previous year

Bark beetle outbreak predictions: European spruce bark beetle



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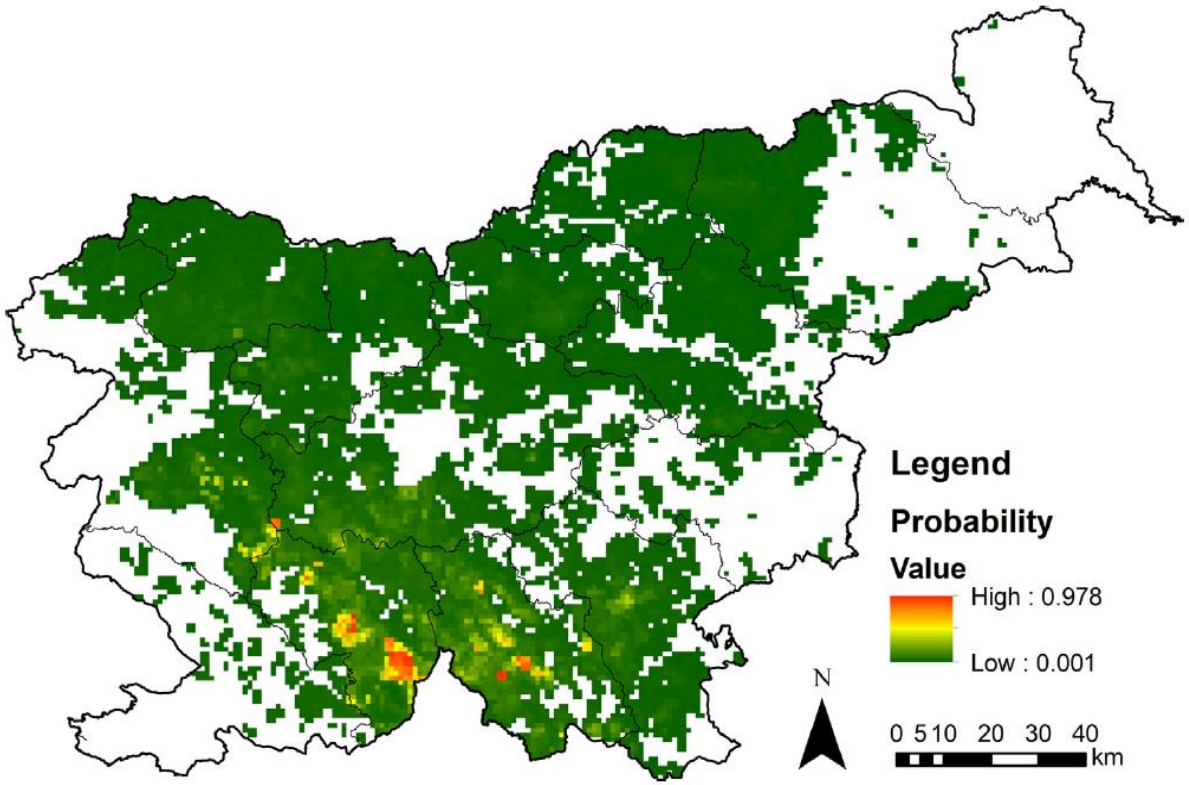
Variables

- Amount of spruce
- Slope
- Phosphorus
- Soil depth
- Soil cation exchange capacity
- Soil base saturation percentage
- SPI
- Temperature
- Sanitary felling because of spruce bark beetles in the previous year
- Sanitary felling because of abiotic factors in the previous year

Bark beetle outbreak predictions: Fir bark beetles



De Groot & Ogris 2019

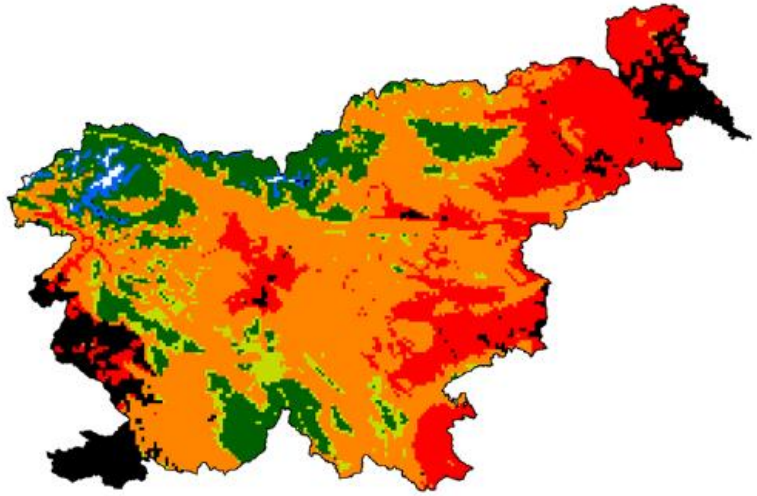
Variables

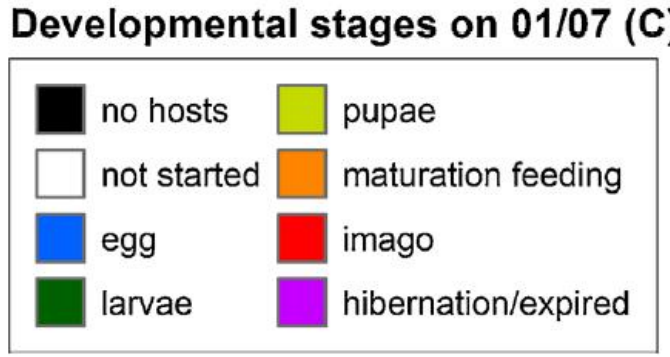
- Amount of fir
- Slope
- Altitude
- Phosphorus
- Soil depth
- Soil cation exchange capacity
- Soil base saturationpercentage
- SPI
- Temperature
- Sanitary felling because of fir bark beetles in the previous year
- Sanitary felling because of abiotic factors in the previous year

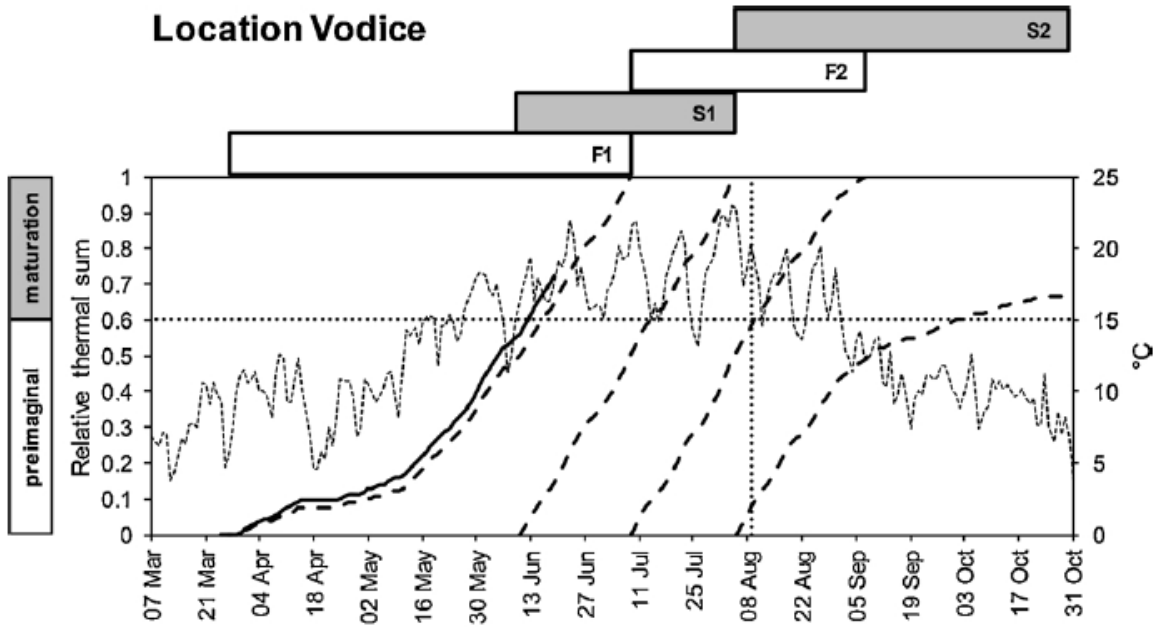
Methods RITY and CHAPY

- Phenological models for spruce bark beetles
  - RITY for *Ips typographus*
  - CHAPY for *Pityogenes chalcographus*
- RITY based on the PHENIPS model
- Both models uses for input INCA weather model data (only temperature)
  - INCA = Integrated Nowcasting through Comprehensive Analysis
  - Analysis part of the system combines surface station data **with remote sensing data** in such a way that the observations at the station locations are reproduced, whereas the **remote sensing data provide the spatial structure for the interpolation**
- RITY and CHAPY used for management of spruce bark beetles:
  - Managment of monitoring (traps)
  - WebApp for deadline of sanitary felling of spruce attacked by spruce bark beetles

Phenological model RITY







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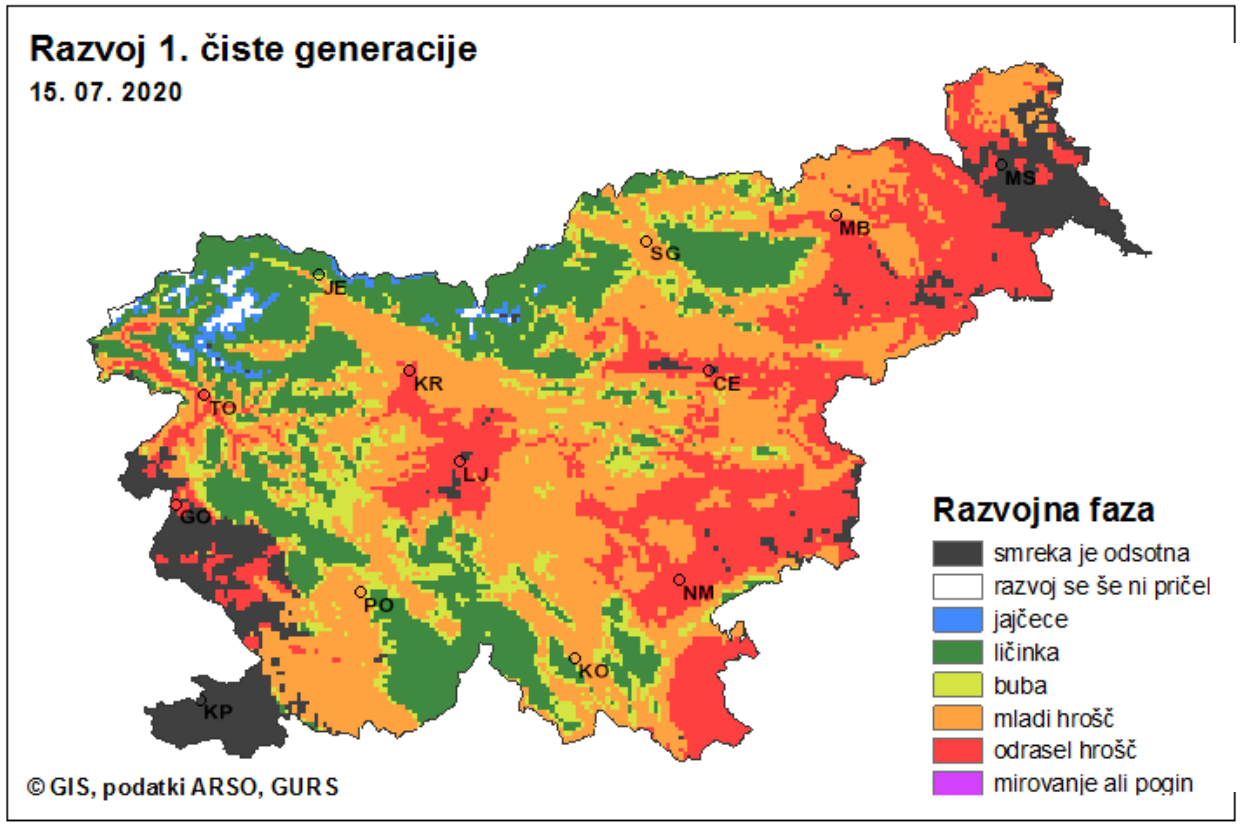
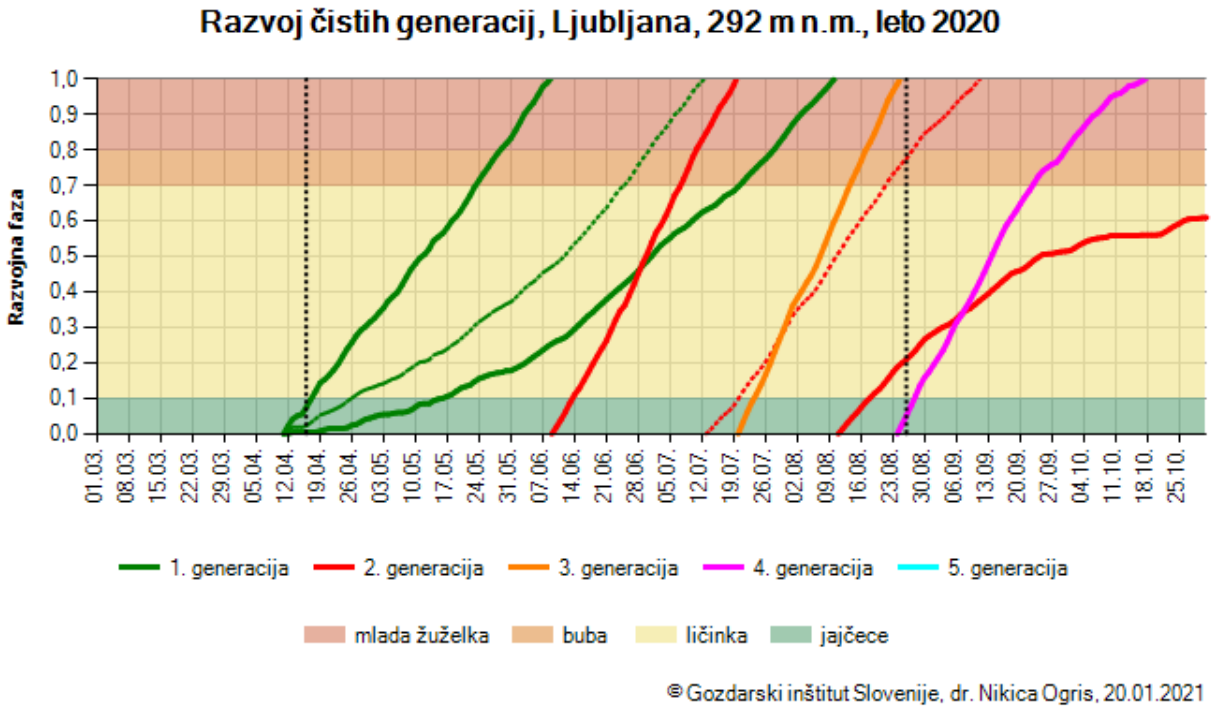
Phenological model CHAPY





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Links to remote sensing

- Use of remote sensing data for phenological prediction
- Focus the location of remote sensing
- Start of remote sensing