



# REMOTE SENSING FOR EVALUATION OF STATE AND DEVELOPMENT OF SPRUCE STANDS CONDITION IN THE JESENÍKY MOUNTAINS

Orlíková Lucie

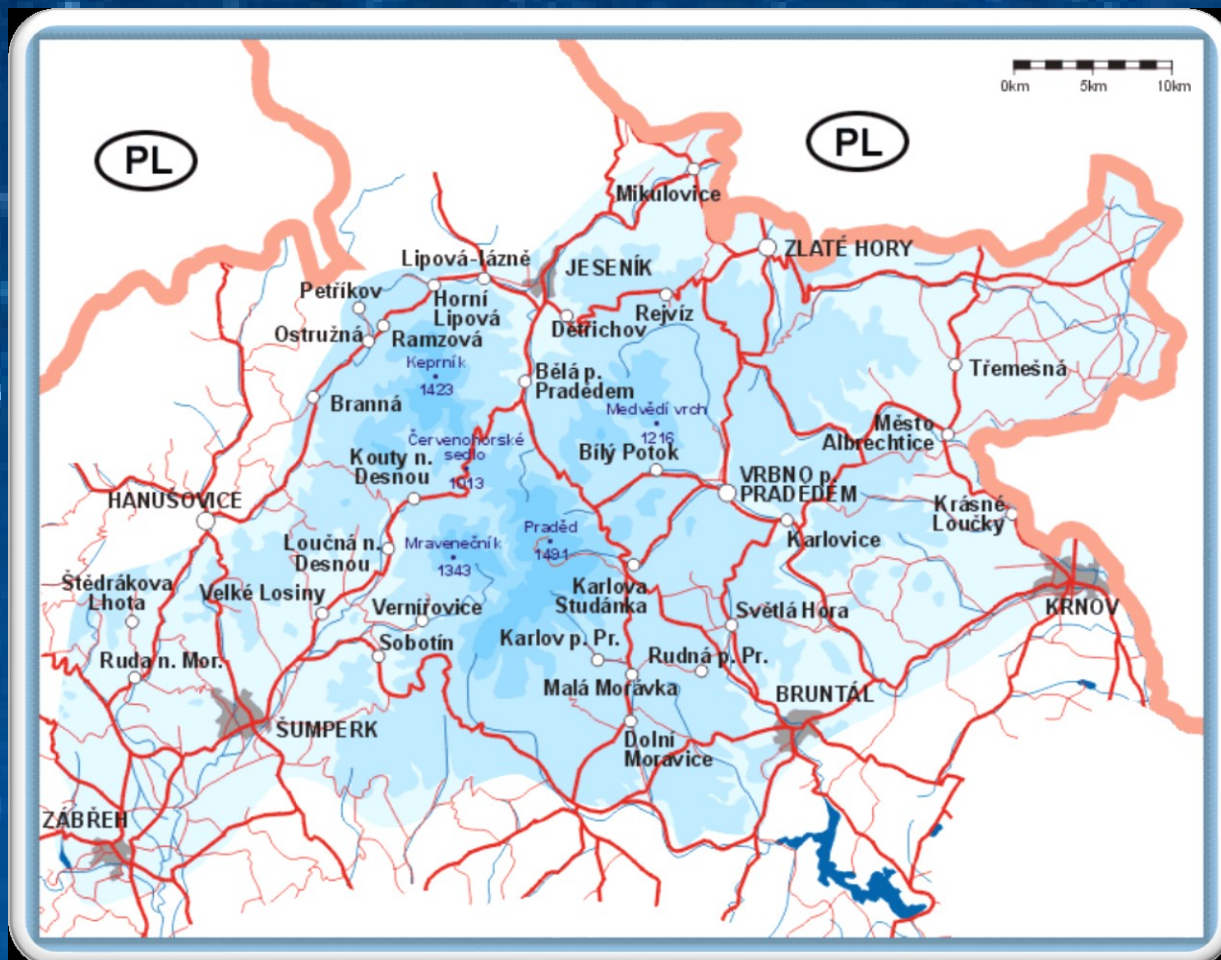
Department of Geoinformatics, VSB – Technical University of Ostrava, Czech Republic

e-mail: lucie.orlikova@vsb.cz

## INTRODUCTION AND OBJECTIVES

Bark beetles are important biotic disturbance agents in the coniferous forests of Europe [1]. The infested tree goes through three stages of attack [2]. These stages are termed green, red and grey attacks. During the green attack stage, the foliage remains green (hence the name green attack), and therefore, it is difficult to detect this stage by the human eye at leaf and canopy levels [3]. Early detection of bark beetles outbreaks at the green attack stage may prove an important step, as management aims to control this species and preclude a mass outbreak. At the green attack stage, the trees hold the next generation of beetles. Management intervention to prevent further outbreaks may, therefore, involve the removal of infested trees before the new brood emerges and migrates.

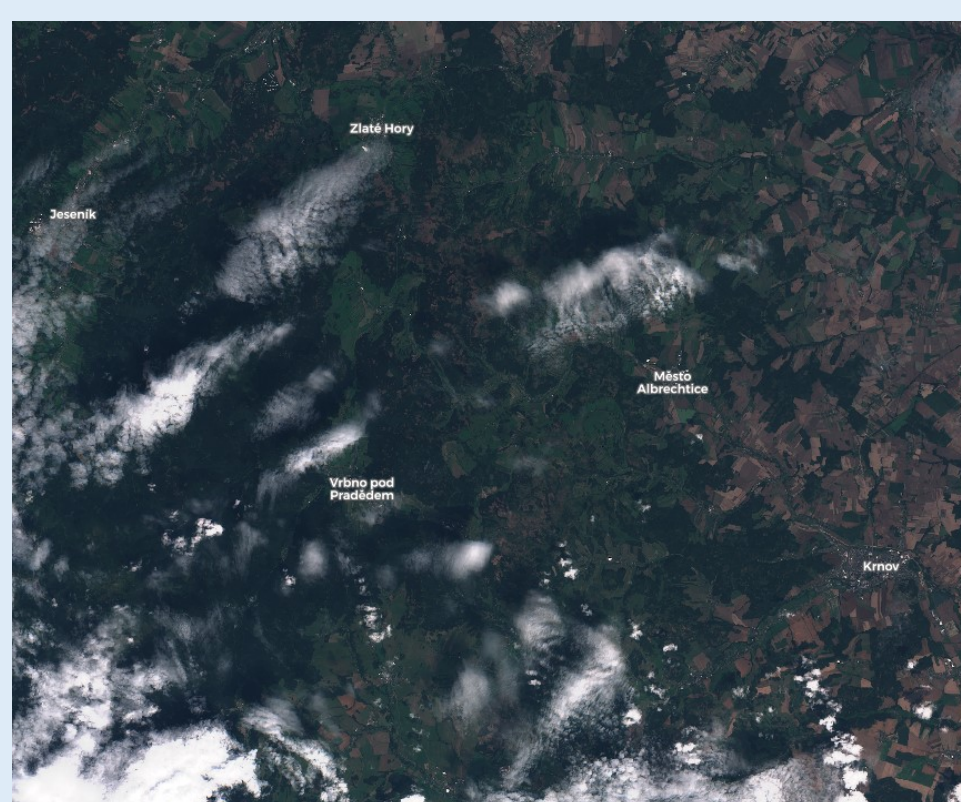
This study focuses on the use of Sentinel-2 images to evaluate condition of spruce stands in the Jeseníky Mountains. For these purposes were selected vegetation indices available in the literature. First satellite images were preprocessed and subsequently calculated vegetation indices. From the generally known were used Normalized Difference Vegetation Index, Leaf area index and Simple Ratio. Then were calculated Green Vegetation Index and Red Green Index based on the monitoring of needles color changes. To evaluate moisture conditions were used indices Foliar Moisture Index and wide-band Normalized Differential Infrared Index. The goal was a comparison of the results of these indices and assessment of their applicability. The selected study area is the Jeseníky Mountains (Fig. 1). The data was acquired in the March – July period of 2018.



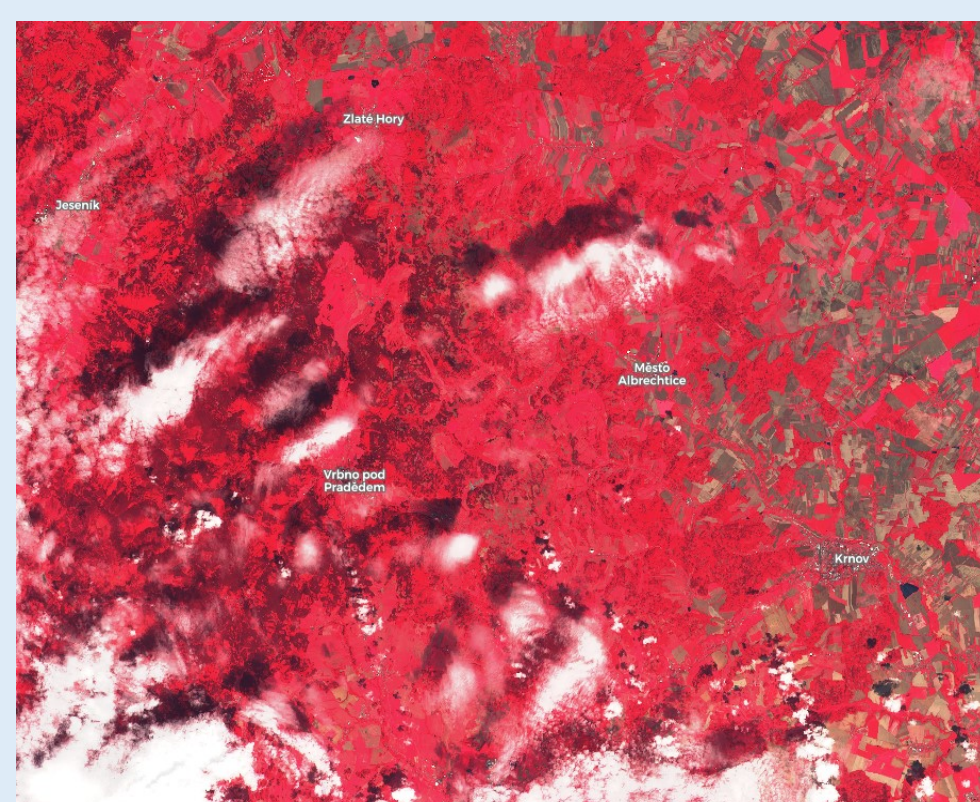
## METHODS AND EARLY RESULTS

In the current study several vegetation indices and spectral derivatives were calculated based on Sentinel-2 data and tested according to their suitability to differentiate between spruce classes based on their vegetation stress level.

An example of several vegetation indices is below (20.7.2018). The indices were computed for whole period.



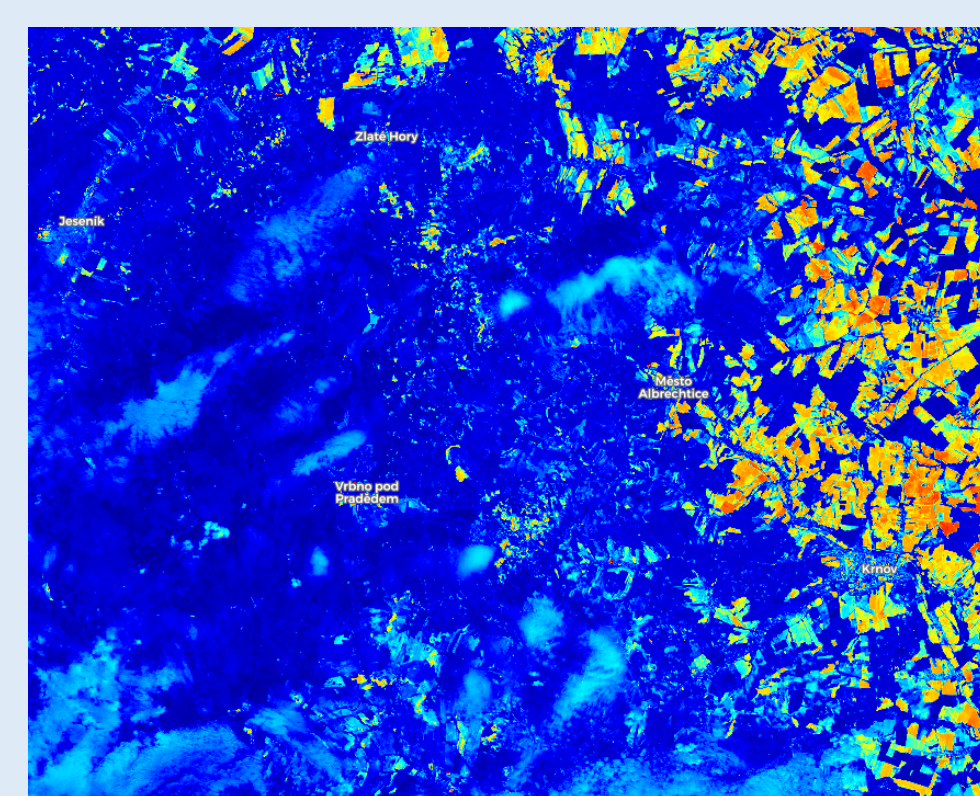
a) True color



b) False color



c) NDVI based on combination of bands (B8-B4)/(B8+B4)



d) Moisture index based on combination of bands (B8A-B11)/(B8A+B11)

## CONCLUSION

The bark beetle is a very dangerous and destructive insect infesting mature spruce forests. The growing number of data sources (sensors and web-based data portals) and data formats (one-to-n-dimensional) requires the rapid development of a new generation of analytical methods so that the data for monitoring forest conditions can be exploited efficiently.

Although researches study are in the first stage, current results are promising. For the future work is planned to use older data for comparing forest damage.

Work emphasis on distribution of each phase of forest development affected by bark beetle. According to selected legend, involving multiple stages of damaged but also recovering forest, the images will be classified by Neural Network, Support Vector Machine and Object classification methods. Application of these methods on selected images required a suitable choice of parameters and rules to achieve optimal results.

Another outcome of this work will be to evaluate the influence of the processed images WorldView-2 and Sentinel 2 on the final classification performance.

## REFERENCES

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