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Methodological Bases for Predicting Siberian Moth Outbreaks in Dark-Coniferous Forests of Central Siberia

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INTRODUCTION & AIM

The Siberian moth (*Dendrolimus sibiricus Tschetverikov, Lepidoptera: Lasiocampidae*) is a significant threat to the taiga forest ecosystem in Siberia. Evergreen trees are unable to tolerate severe defoliation, which ultimately leads to their death.

The current insect pest monitoring system fails to provide the necessary tools for the timely implementation of measures aimed at eliminating the outbreak at its earliest stage.

The objective of the present study was to refine the forest pathology monitoring system by developing a spatial model to predict the primary areas of the Siberian moth outbreak in dark-coniferous stands of Central Siberia.

METHOD

The methodological approach to the spatial modelling of Siberian moth outbreak areas is based on an understanding of the ecology of the pest, the characteristics of site conditions and landform, and remote sensing data. The algorithm was developed through a retrospective analysis of previous outbreaks.

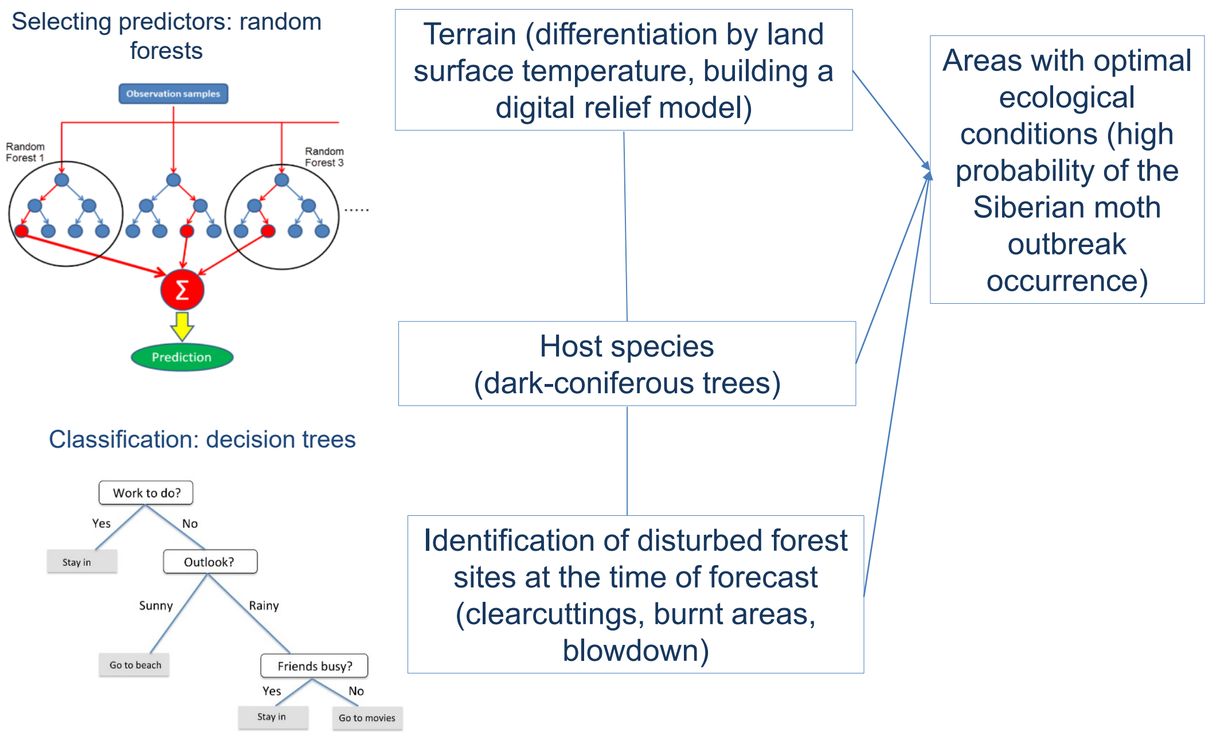
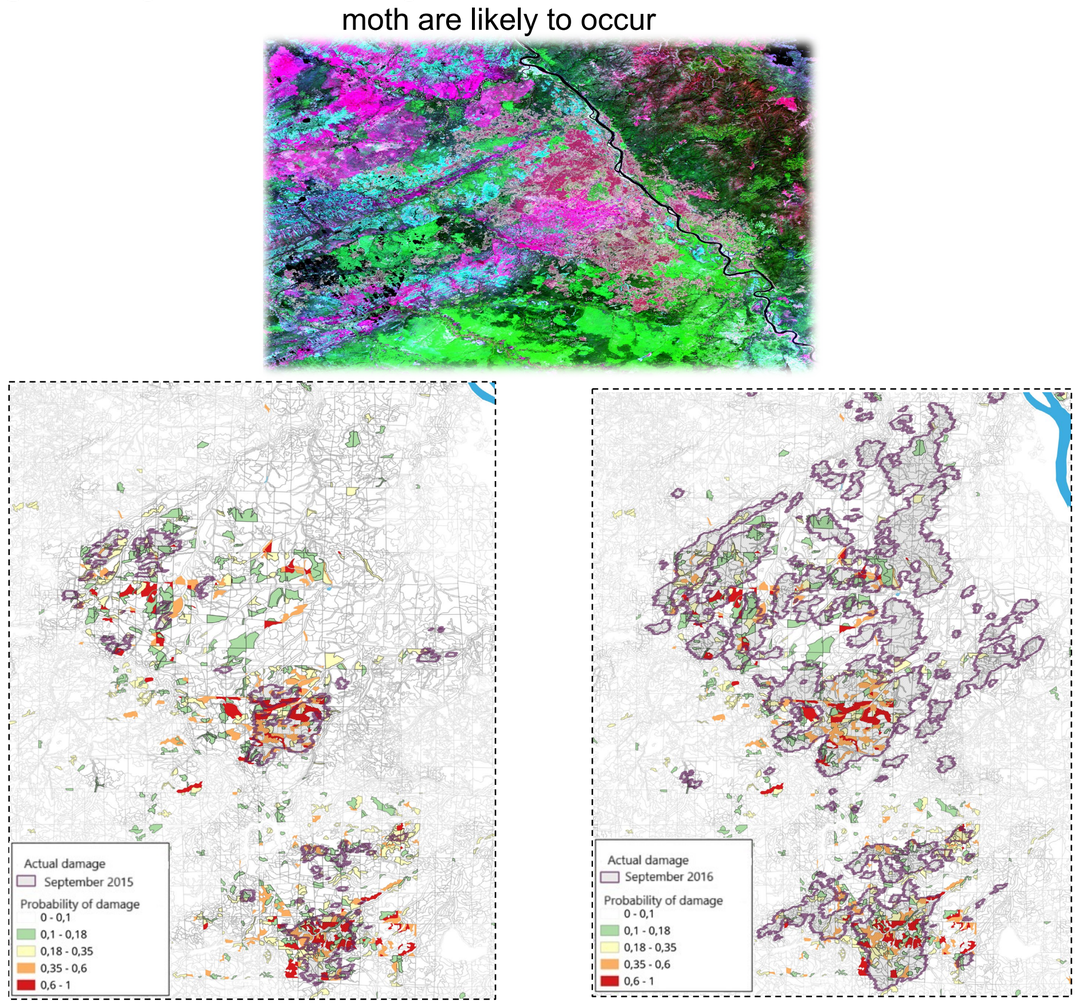


Figure 1. Algorithm for modeling the areas in which outbreaks of the Siberian moth are likely to occur



Date of observation: September 2015 — Date of observation: September 2016

Figure 2. Retrospective analysis of damage to dark-coniferous stands based on remote sensing data in the initial phase of the outbreak occurrence (Yeniseyskoe forest management unit , Krasnoyarsk Krai, 2015–2018 outbreak)

RESULTS & DISCUSSION

A spatial model for forecasting the initial outbreak areas of the Siberian moth has been constructed for Central Siberia (Krasnoyarsk Krai). The model is based on GIS and employs binary classification (high/low risk of damage) with the objective of enhancing forest pathology monitoring.

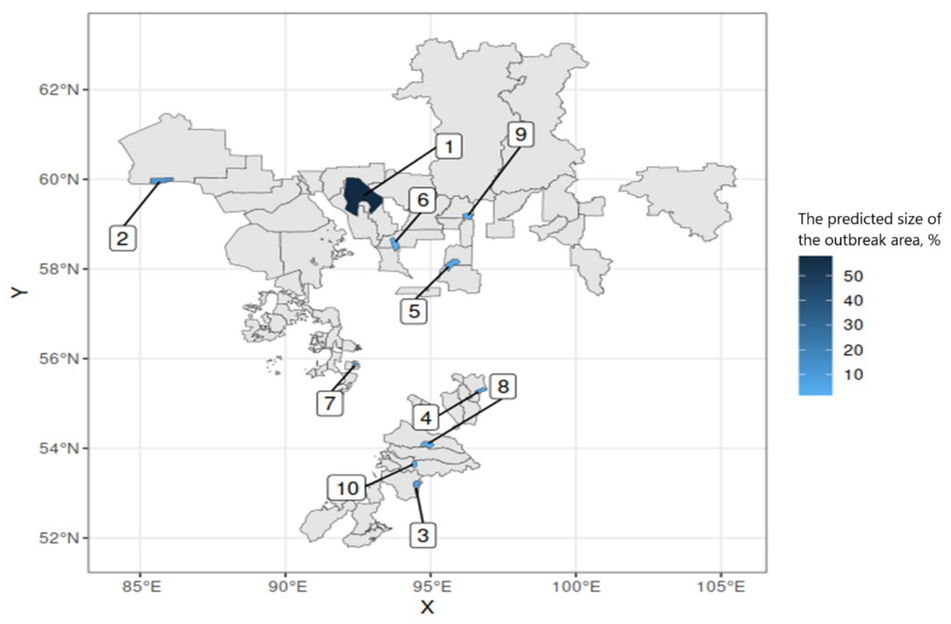


Figure 3. The areas within Krasnoyarsk Krai where the Siberian moth outbreaks are most likely to occur

The model permits the establishment of a network of closely monitored locations, wherein preventive measures may be implemented and activities organized in a timely manner to identify and localize pest outbreaks at the regional level and in smaller areas, such as forest management units.

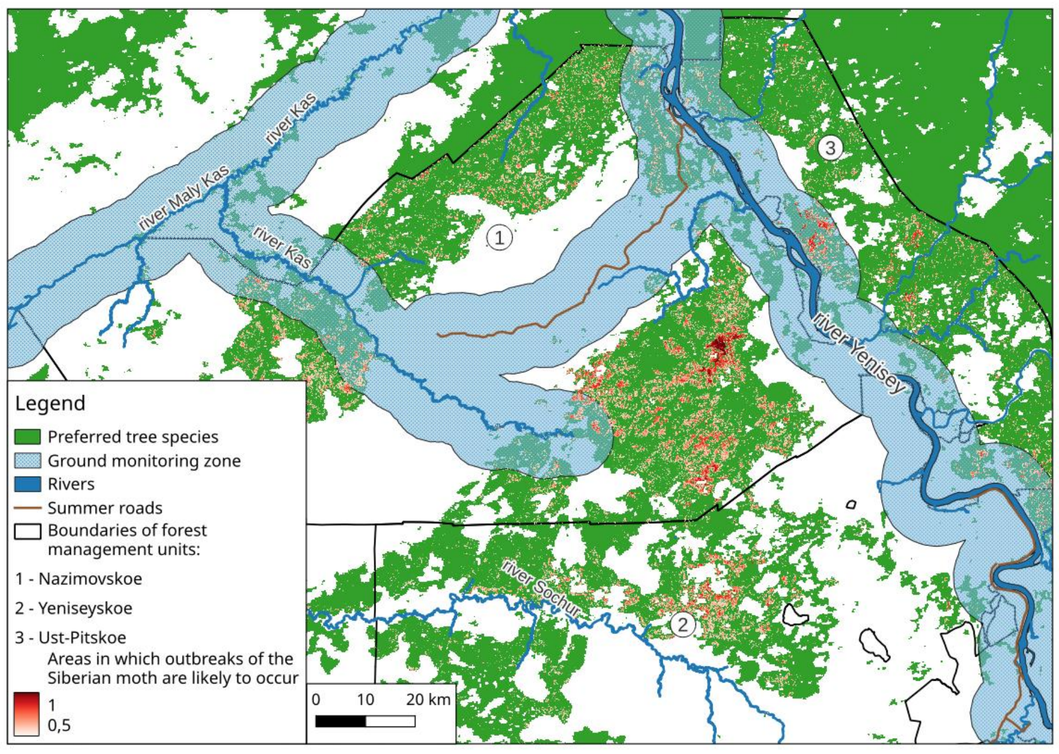


Figure 4. Forecast map of primary outbreak areas of the Siberian moth within the Yeniseyskoe forest management unit of Krasnoyarsk Krai

CONCLUSION

The research yielded a model of spatial distribution that may be used for forecasting the primary outbreak areas of the Siberian moth. The forecast model is estimated to have an overall accuracy of 75%. The degree of accuracy of this indicator is contingent upon the specific set of predictors and the extent of the territory under consideration. Verification of the developed model is currently underway.

The research was carried out within the framework of the project "Methodological bases for assessment of forest pathology risks in southern Central Siberia" (№ FEFE-2024-0016) under the state order of the Ministry of Science and Higher Education of the Russia for implementation by the Scientific Laboratory of Forest Health.