The TANABBO (Tatra Mountains Bark beetle infestation prediction model, Kissiyar et al. 2005, Jakuš et al. 2005, Ďuriačiová at al. 2020) decision support system combines freely available satellite imagery with stand characteristics to predict the occurrence of beetle-induced tree mortality in subsequent years. TANABBO is also a GIS-based system for the evaluation of forest stand predisposition to bark beetle attacks (Jakuš et al. 2017). The system is based on the known causal links between bark beetle outbreaks and environmental parameters. A module on the prognosis of a bark beetle stand infestation is also a part of the system. The system captures vegetation change over time using a time-series of Landsat images, NDVI (The normalized difference vegetation index), a digital terrain model at the resolution of Landsat pixel size, and available stand characteristics (stand age, volume, average diameter, and average height) at the stand resolution from forest management databases (Jakuš et al. 2003). A system of partial models is used, where each partial model produces an output which is later used as an input for the main model. The main output from the forecasting part of TANABBO is a subsequent-year prediction of bark-beetle-caused tree mortality. This forecast is important for the planning of forest protection measures in the subsequent year. The one-year forecast of bark-beetle-caused tree mortality is based on the combination of the two processes related to the spread of tree mortality over the landscape: the initiation of bark beetle spots and the spots spreading (, Jakuš et al. 2003, Robertson et al. 2007). Spot initiation means the creation of new bark beetle infestations in areas without previous attacks, which is difficult to predict and relates to long-distance beetle dispersal occurring even during beetle epidemics (Jakuš et al. 2005). Spot spreading represents the expansion of an existing bark beetle spot into a neighbouring forest stand (Jakuš et al. 2005). Spot spreading becomes dominant over the course of the beetle outbreak, and in later phases, the majority of new infestations are adjacent to previous years' infestations (Kautz et al. 2011, Potterf et al. 2019).

**References**


Jakuš R, Grodzki W, Ježik M, Jachym M (2003). Definition of spatial patterns of bark beetle Ips typographus (L.) outbreak spreading in Tatra Mountains (Central Europe), using GIS. In: Proceedings of the conference "GTR NE-311 Survey and Management of Forest Insects" (Mc Manus M, Liebhold A eds). Kraków (Poland), 1-5 September 2002. Ecology USDA Forest Service, Newtown Square, PA, pp. 25-32.

Ďuriačiová et al. (2020)A Bark beetle infestation predictive model based on satellite data in the frame of decision support system TANABBO, iForest (in print)

Jakuš R, Ježík M, Blaženec M (2005). Prognosis of bark beetle attacks in TANABBO model. In: GIS and databases in the forest protection in Central Europe (Grodzki W eds). Centre of Exellence PROFEST at the Forest Reseach Institute, Warsaw, Poland, pp. 35-43.

Jakuš R, Blaženec M, Koreň M, Barka I, Lukášová K, Lubojacký J, Holuša J (2017). TANABBO II model pro hodnocení rizika napadení lesních porostů lýkožroutem smrkovým *Ips typographus* (L.) [Coleoptera: Curculionidae]. Lesnický průvodce 1/2017. Výzkumný ústav lesního hospodářství a myslivosti, v. v. i., Jíloviště, Czech Republic, pp. 71. [in Czech]

Kautz M, Dworschak K, Gruppe A, Schopf R (2011). Quantifying spatio-temporal dispersion of bark beetle infestations in epidemic and non-epidemic conditions. Forest Ecology and Management 262: 598-608. doi - https://doi.org/10.1016/j.foreco.2011.04.023

Kissiyar O, Blaženec M, Jakuš R, Willekens A, Ježík M, Baláž P, Valckenborg JV, Celer S, Fleischer P (2005). TANABBO model: a remote sensing based early warning system for forest decline and bark beetle outbreaks in Tatra Mts. - overview. In: GIS and databases in the forest protection in Central Europe (Grodzki W eds). Centre of Exellence PROFEST at the Forest Research Institute, Warsaw, Poland, pp. 15-34.

Potterf M, Nikolov Ch, Kočická E, Ferenčík J, Mezei P, Jakuš R (2019). Landscape-level spread of beetle infestations from windthrown- and beetle-killed trees in the non-intervention zone of the Tatra National Park, Slovakia (Central Europe). Forest Ecology and Management 432: 489-500 doi - https://doi.org/10.1016/j.foreco.2018.09.050

Robertson C, Nelson T, Boots B (2007). Mountain Pine Beetle Dispersal: The Spatial – Temporal Interaction of Infestations. Forest Science 53: 395-405.