Product description – Forest monitoring

Version 2.1, September 2022

Abstract

FESTMETER – Diagnostic technology for the forest

One consequence of climate change can be seen in the increased sensitivity of our forests. Coniferous forests in particular (especially spruce monocultures) are becoming increasingly susceptible to forest pests such as the bark beetle. However, drought stress and fungal infestation are also increasingly causing problems for trees. The earlier a damaged tree is identified and harvested, the less damage is caused to the forest owner. The search for weakened or damaged trees often turns out to be a very difficult and time-consuming undertaking and often the effort is not in proportion to the result. FESTMETER now provides appropriate solutions for this. By means of learning image analysis technology, the health status of forest areas is analyzed (vitality monitoring) and thus the forest owner is actively supported in his often laborious work to maintain a healthy forest stand.

About us

FESTMETER Wöls GmbH was founded in 2016 and offers forest monitoring and vitality analyses with regard to forest damage such as bark beetle infestation in coniferous forests.

The idea to develop a technology for forest condition diagnosis was initially born out of personal need, when Dr. Kurt Wöls, like so many forest owners, was faced with the problem that, due to his job, he had too little time to regularly check his forest areas for weakened or damaged trees. The search for suitable support turned into a research project at the "Center for Applied Technology" in Leoben, where a procedure for vitality analysis focusing on bark beetle infestation was developed.

For several years, this procedure has been offered as a service of FESTMETER Wöls GmbH for forestry operations. We would like to provide foresters and forest owners with a modern instrument to support them in their work to maintain a healthy forest condition. In times of climate change and rapidly changing technologies, the diagnostic procedure has also been further developed and adapted to the requirements of our customers. For example, the type of data collection has been expanded according

to the different area sizes. Likewise, the analysis process has been gradually adapted and automated using the latest technologies. The latest development of FESTMETER is the application of artificial intelligence in the diagnostic process.

Portfolio

Our products are aimed at the early detection of changes in forest conditions for preventive and reactive forestry measures.

For this purpose, aerial images of the forest are collected, including infrared images. The collected images are evaluated with the help of algorithms using trustworthy artificial intelligence according to EU guidelines. The results are available online (see Figure 1).

Figure 1: Data collection, data evaluation, delivery of results

Risk-based AI assisted forest monitoring with high resolution satellite imagery

What is the result of the analysis?

FESTMETER provides the positions (GPS coordinates) of damaged or non-vital trees.

What data is collected?

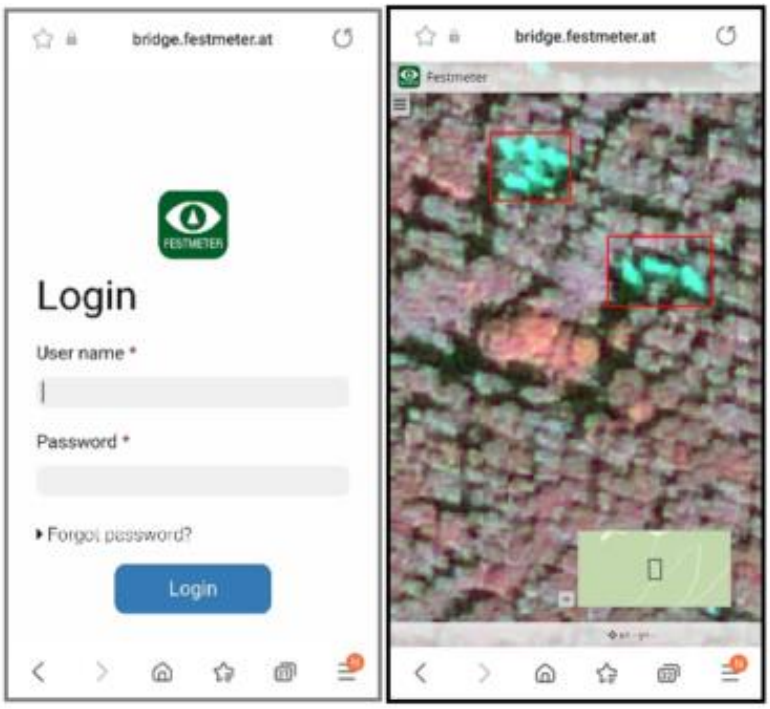
The image data are collected from the air by drones, manned light aircraft or satellites, depending on the requirements.

What is done with the data?

The collected data of the relevant forest areas are processed, cleaned, supplemented, evaluated, checked, plausibilised and visualised using a series of algorithms.

What does trustworthy AI mean?

FESTMETER works with artificial intelligence (learning algorithms). During development and application, special attention is paid to the guidelines regarding "human primacy and oversight", "technical robustness and security", "privacy protection", "transparency", "non-discrimination", "social and environmental well-being" and "accountability".



How is it delivered?

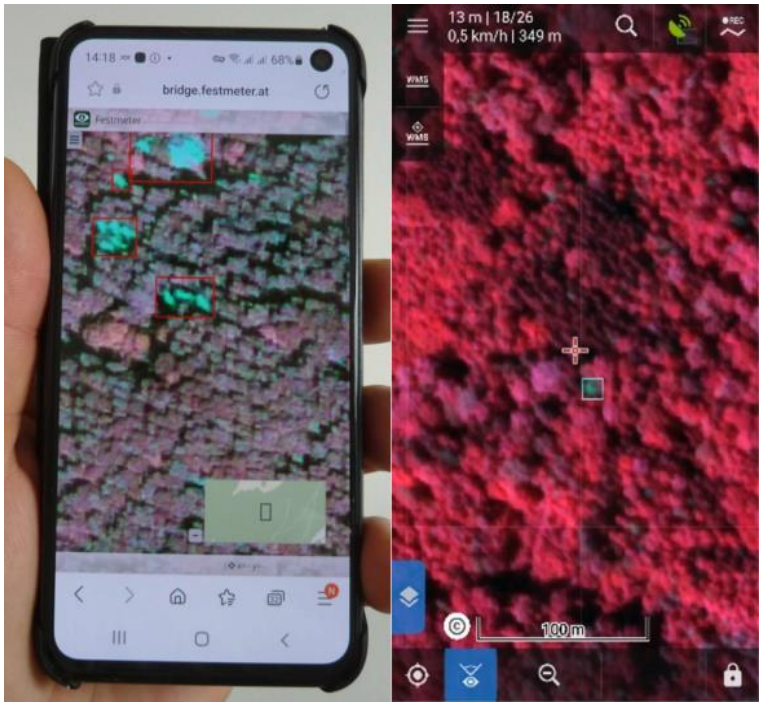
Different formats are available for the delivery of the evaluations:

⇨ Web interface: access to the evaluations on the PC

⇨ Mobile application/App: access to the evaluations on a mobile phone

⇨ Digital GPS coordinates for use on mobile phones or GPS devices

Overview maps and detailed reports in printable format (.pdf)

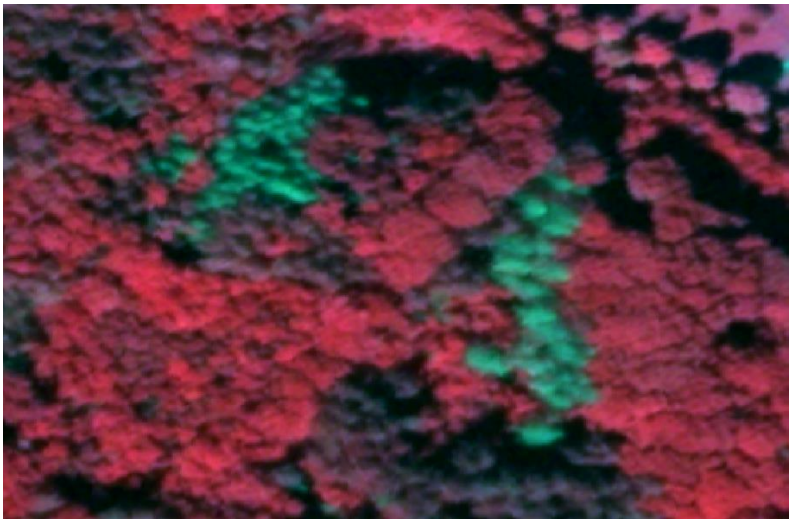


How precise are the results?

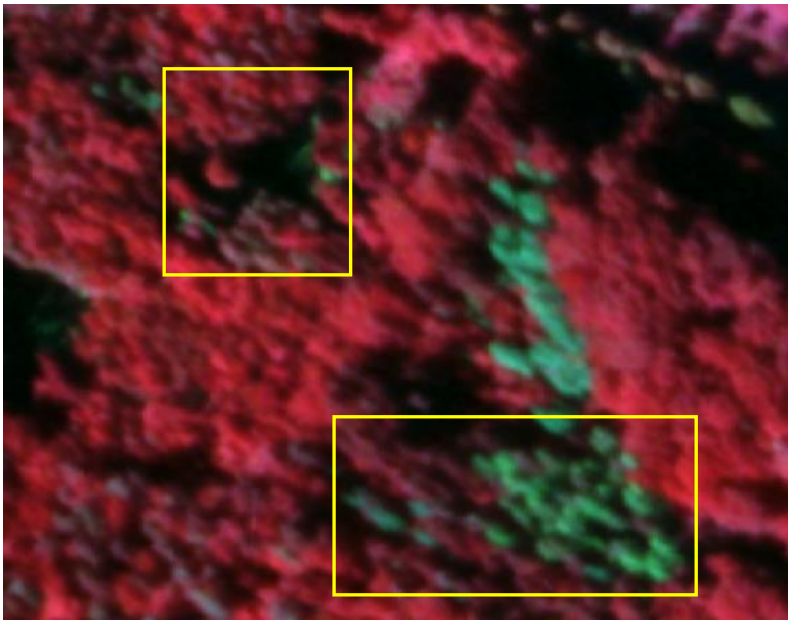
The accuracy is within the range of human estimation. Differences result from the fact that some damage is easier to detect from the ground when standing on the trunk, while some is easier to detect from the air.

When collecting data with drones or aeroplanes, the changes in vitality can be assessed in the individual tree crowns. With high-resolution satellite images, trees and groups of trees can be assessed as shown in the figure.

Examples of the dynamic of damage – beetle nests in a high-resolution satellite image in the near infrared range



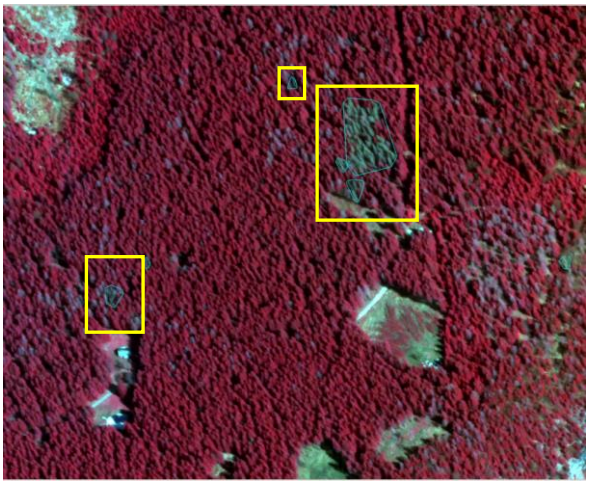
Recording in July



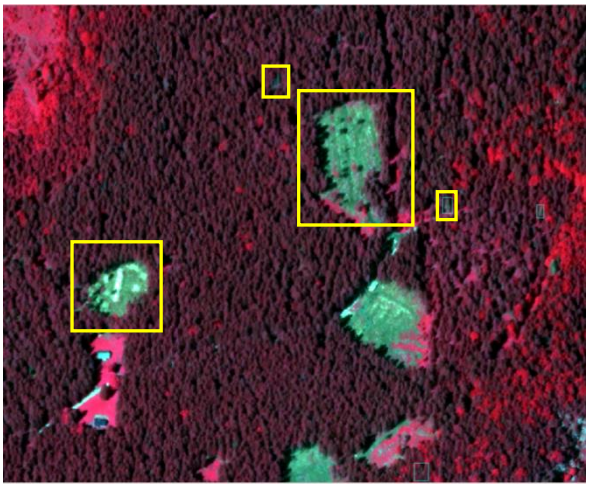
Recording in September

in July 2 beetle nests were detected. In the recording from September you can clearly see the removal of one nest (at the top oft he picture) as well as the spread oft he beetle from the second nest (at the bottom oft he picture).

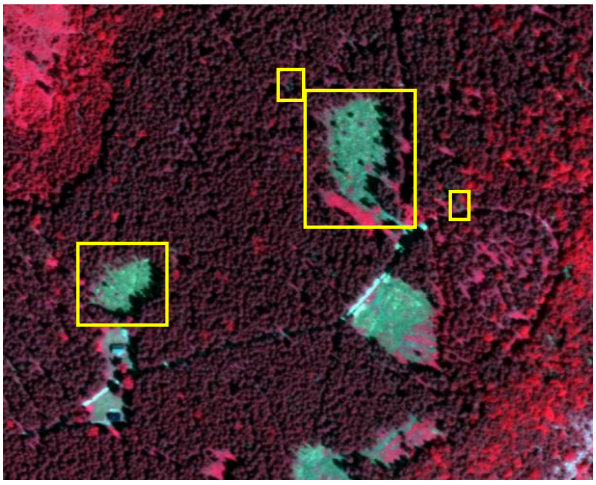
Example of a time series with high-resolution satellite images – development of beetle nests / reprocessing / further spreading



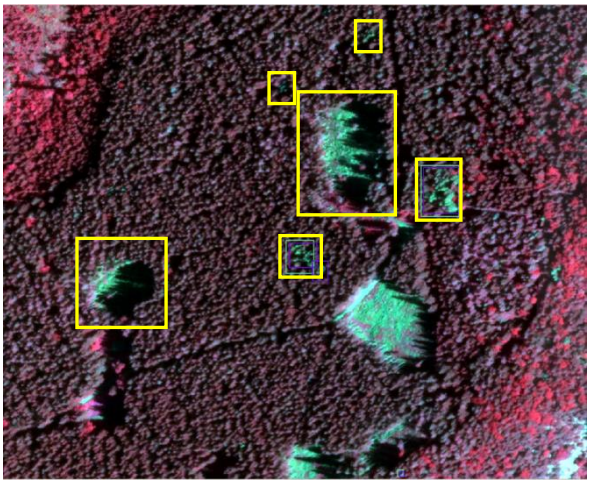
Recording in May



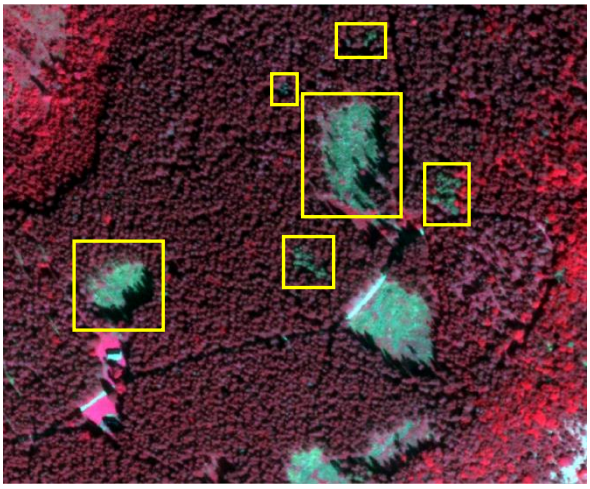
Recording in June



Recording in July



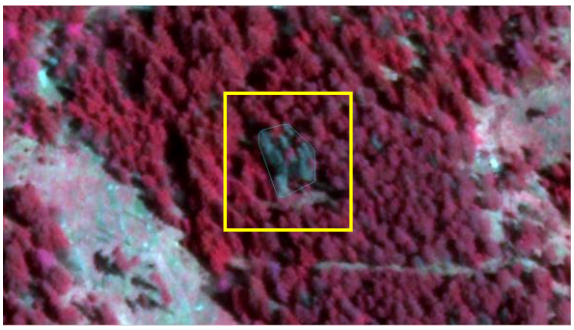
Recording in August



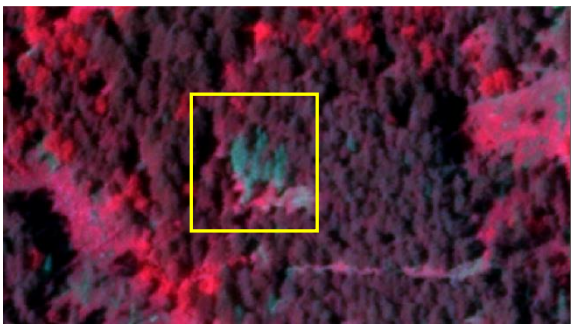
This series of pictures shows an example of the possible development of detected beetle nests: At the beginning of the season in May, two beetle nests were detected. In June, the infested trees have already been removed. Over the course of the season, the further gradual spread of the beetle is clearly visible.

On the left: Recording in September

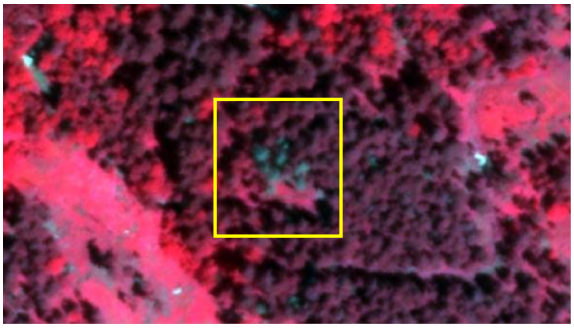
2. Example of a time series with high-resolution satellite images – statics of beetle nests



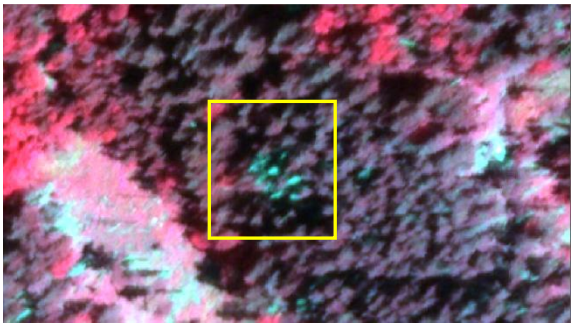
Recording in May



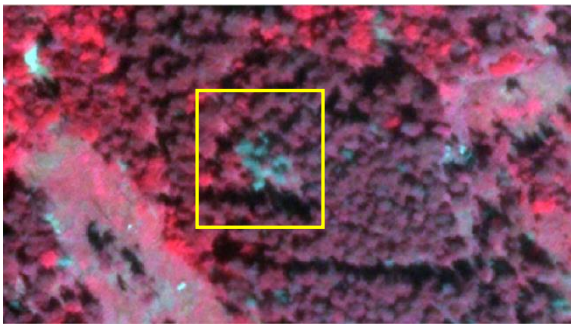
Recording in June



Recording in July



Recording in August

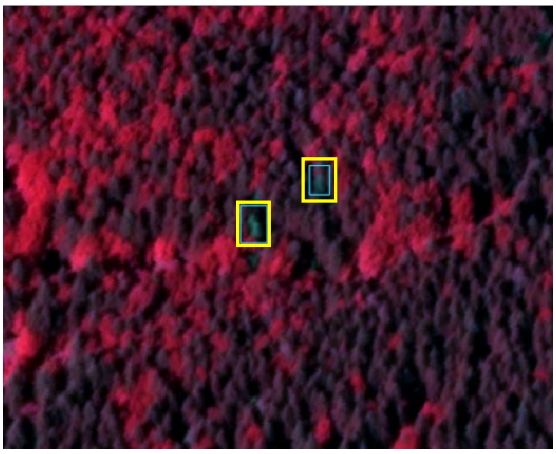


Recording in September

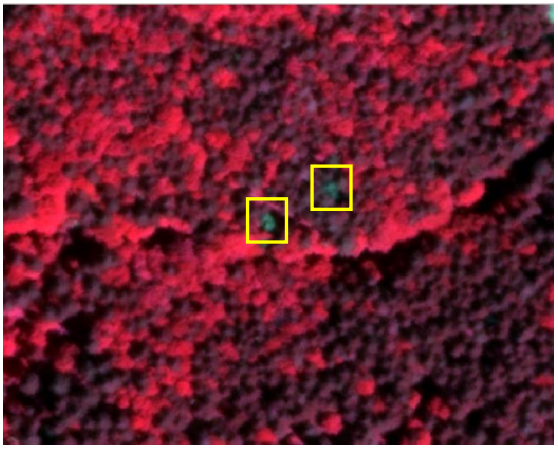
This series of images shows another possible monitoring result: the beetle nest detected in May remains unchanged over the further recordings.

3. Example of a time series with high-resolution satellite images – drastic development of beetle nests

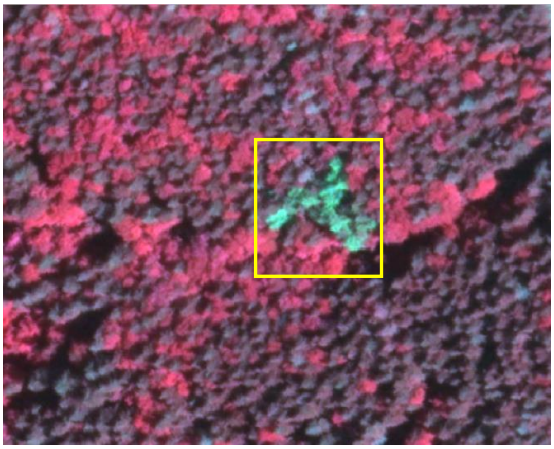
Recording in May



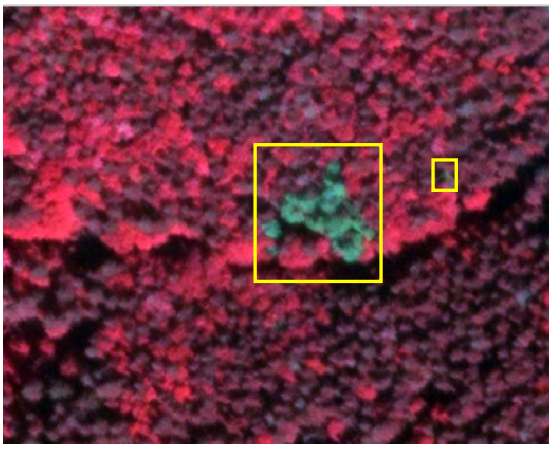
Recording in June



Recording in July



Recording in August



Recording in September

This series of pictures illustrates the drastic development of beetle nests: In May, one damaged tree was detected. In June, a second one has already been added, and in July the situation hardly changes. In August, the massive spread in the form of a large beetle nest becomes visible. In September, a tree to the right of the nest appears suspicious and should be observed for possible further spread..

Table 1: Product portfolio, product data sheet

			
Data collection/ aerial photography	Risk-based forest monitoring with satellites	Forest monitoring with aircraft	Forest monitoring with drone
Forest monitoring objective	changes in trees on large areas	changes in the tree canopy	sensitive changes in the tree canopy
Evaluation accuracy	dead tree/group of trees	discoloured tree crown	slightly discoloured tree crown
Frequency of data collection	monthly	by arrangement (8-week)	by arrangement (monthly)
Area output [ha]/day	>> 1.000 ha/day	15.000 ha/day	up to 300 ha/ day
Product use	as of 1.000 ha	as of 500 ha	as of 5ha
Delivery time	5 working days after data collection; for larger areas, staggered in consultation	after consultation	5 working days after data collection
Access to geoserver	yes	yes	yes
Online access	yes	yes	yes
App	possible	possible	possible
Connection to existing GIS system	possible	possible	possible
Lead time	3 days and weather dependent	10 days and weather dependent	10 days and weather dependent
Alerting	possible	possible	possible

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