

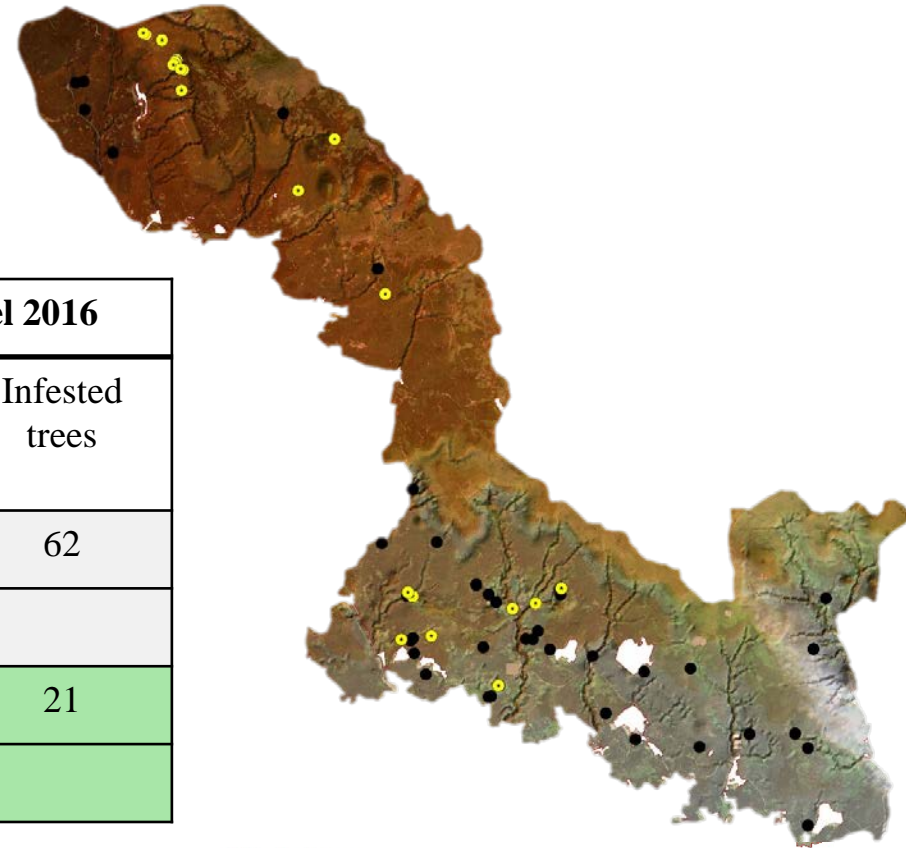
Detection of bark beetle green attack at leaf and canopy level

Haidi Abdullah, Roshanak Darvishzadeh, Andrew K. Skidmore, Marco
Heurich

July -2018
Sumava National Park

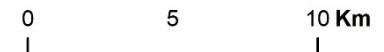
Location of healthy and green attacked sample plots in the Bavarian Forest National Park in July 2016

	Leaf level 2015		Canopy level 2016	
	Healthy trees	Infested trees	Healthy trees	Infested trees
Tree	66	54	93	62
Total	120		155	
Plot	30	21	40	21
Total	51		61	



Plot type

- Infested Plot
- Healthy Plot



Leaf level

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Research paper

European spruce bark beetle (*Ips typographus*, L.) green attack affects foliar reflectance and biochemical properties



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ABSTRACT

The European spruce bark beetle *Ips typographus*, L. (hereafter bark beetle), causes major economic loss to the forest industry in Europe, especially in Norway Spruce (*Picea abies*). To minimise economic loss and preclude a mass outbreak, early detection of bark beetle infestation (so-called “green attack” stage – a period at which trees

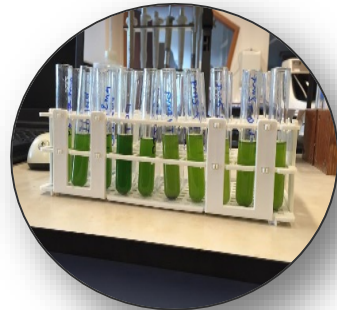
The flowchart of methods used to measure leaf properties



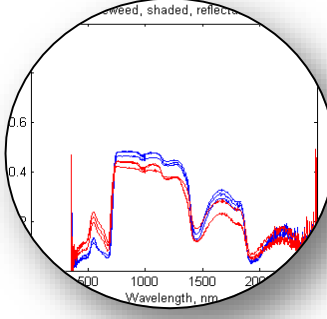
Leaf sample



Destructive method for the chlorophyll content measurement using Acetone (100% V)



Foliar reflectance measurement using an ASD FieldSepc-3 Pro FR spectrometer equipped with and ASD RT3-3ZC integrating sphere

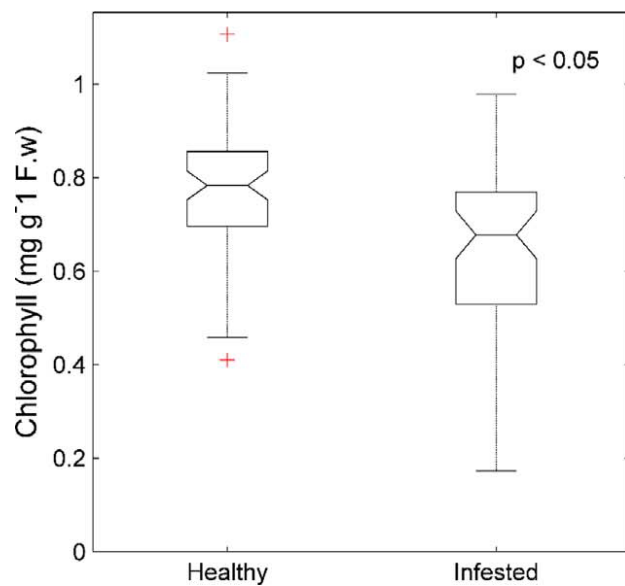


Destructive method for the nitrogen concentration measurement using dried foliar samples

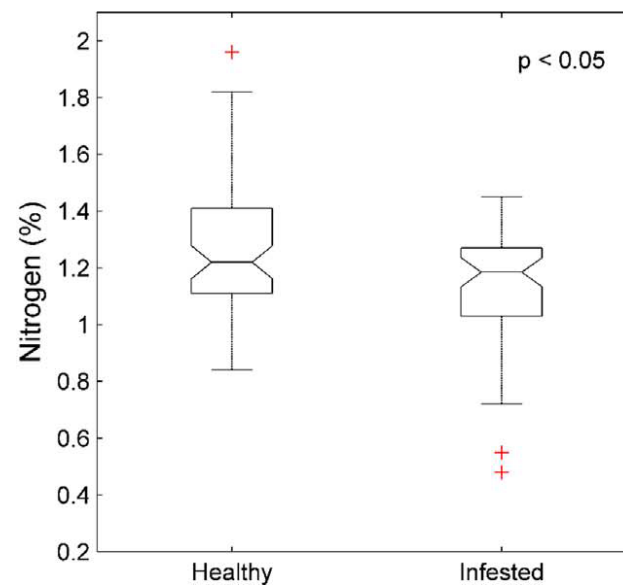




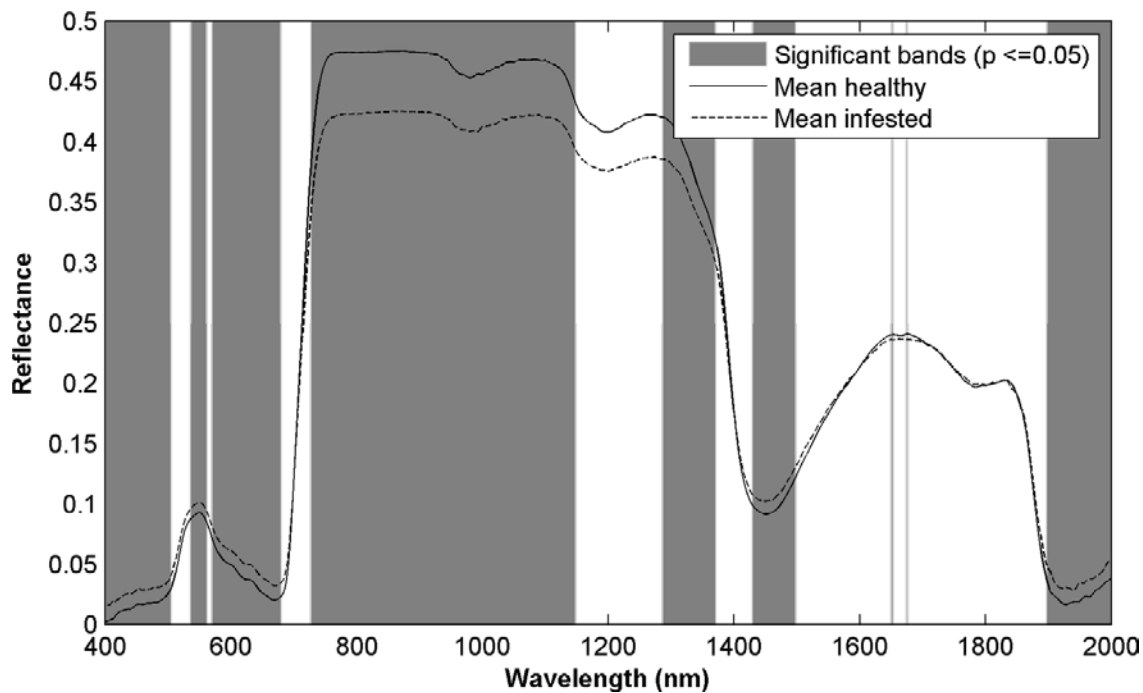
Chlorophyll



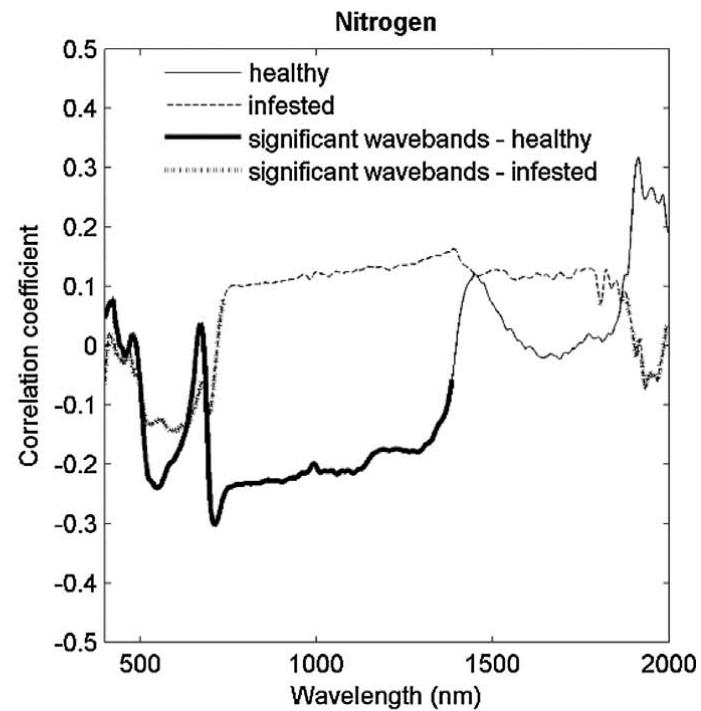
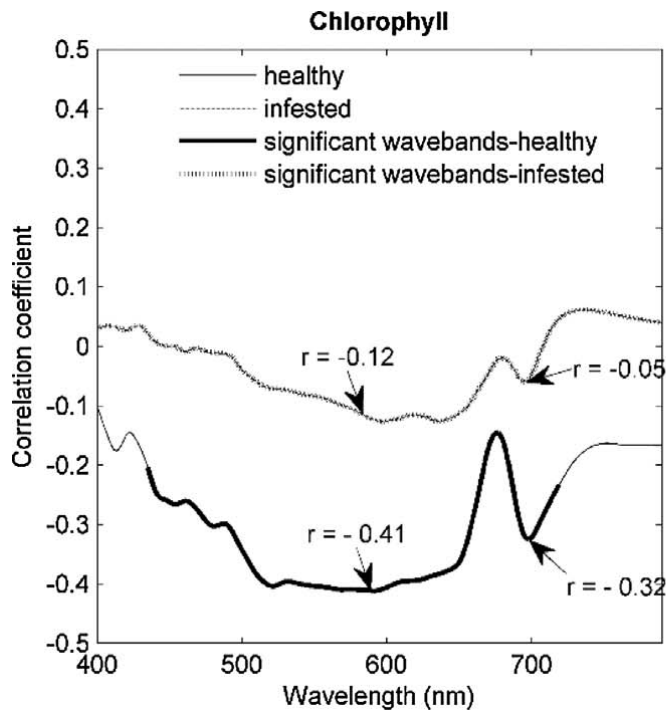
Nitrogen



Distribution of measured chlorophyll and nitrogen concentration for healthy and infested needles.



Mean reflectance spectra of healthy and infested leaves at the green attack stage. Gray areas depict the location of wavebands displaying a significant difference between healthy and infested spectra.



Correlation between chlorophyll and nitrogen with the reflectance of individual wavebands. The bold lines represent the wavebands at which the reflectance spectra correlated significantly with the chlorophyll and nitrogen concentrations.

Canopy level

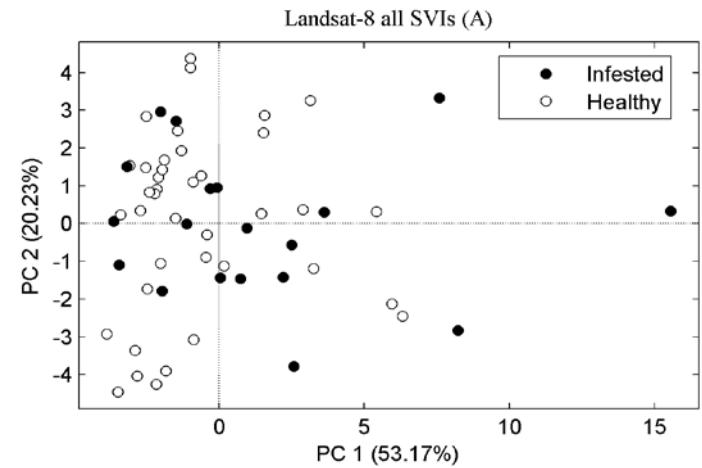
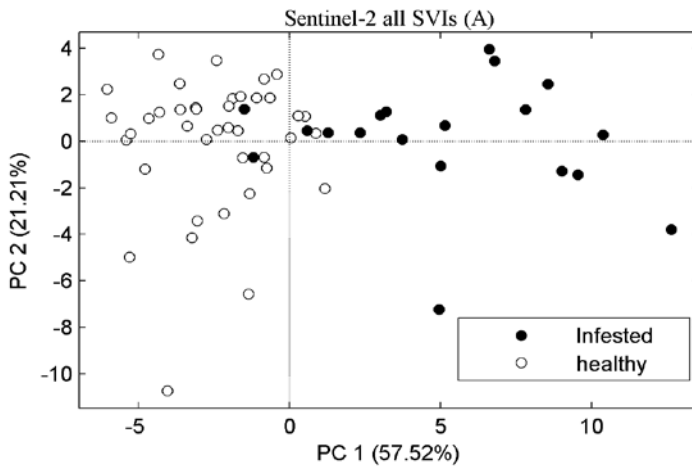
Remote Sensing in Ecology and Conservation

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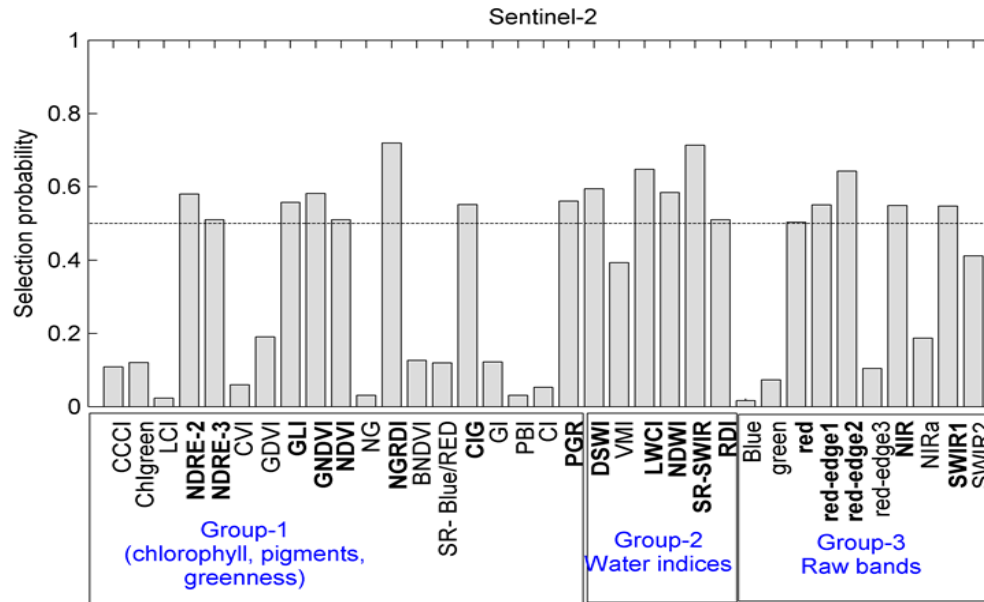
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Sentinel-2 accurately maps green attack stage of European spruce bark beetle (*Ips typographus*, L.) compared to Landsat-8



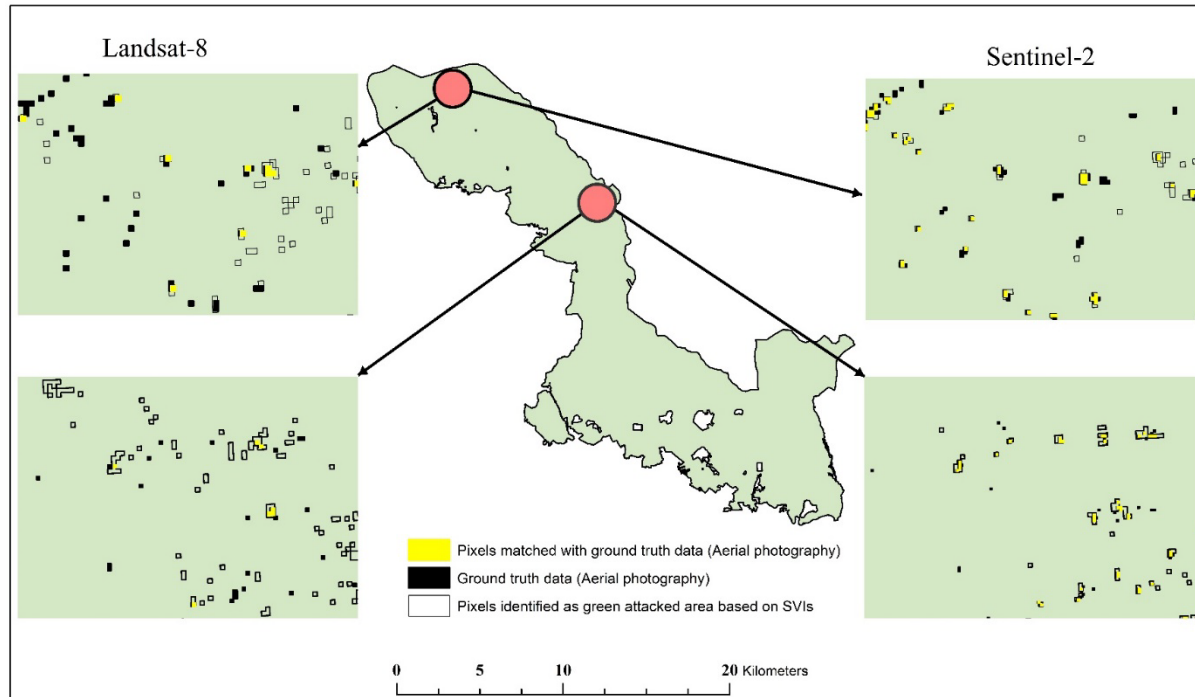
Cluster plots based on the first two PCs



Selection probability value of SVIs obtained from PLS-DA Random frog algorithm



$$\text{Green attacked pixels} = \begin{cases} 1, & \text{if } 0.45 \leq NDRE \leq 0.80 \\ 0, & \text{otherwise} \end{cases}$$



Identified pixels as green attack from (SVIs)	Reference pixels (Aerial photography)	Pixels correctly matched	Mismatched Pixels	Error
Landsat-8 (612 pixels)	417 (30 m)	221 (36 %)	391	64%
Sentinel -2 (539)	687 (20 m)	362 (67 %)	177	33%



THANK YOU

Any questions