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Detection of forest stress from European spruce bark beetle attack in Northern Italy through a stress classification algorithm based on NDVI temporal changes

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The European spruce bark beetle (*Ips typographus*) is one of the most detrimental insects of the European spruce forests. An effective mitigation measure consists in the removal of infected trees before the beetles leave the bark, which generally happens before the end of June. To minimize economic loss and prevent tree destruction, fast and early detection of European spruce bark beetle is therefore crucial for the future of spruce forests.

In order to detect the forest stressed regions, possibly associated to the beetle infestation, we investigated the forest vigour changes in time. One of the most damaged regions is Northern Italy in which the beetle diffusion has highly increased after the Storm Adrian of late 2018.

In this work we used Sentinel-2 images of a study area in the mountain territory of Val di Fiemme (Trento, Italy) from early 2017 to late 2021. A preliminary field investigation was necessary to localize healthy (green) and stressed (red) trees. NDVI index trends from Sentinel-2 showed an evident vigour discrepancy from green and red regions.

We therefore conceive a classification algorithm based on the slope of fitting lines of NDVI over time. Model accuracy is around 86%. The result is a classified map useful to distinguish stressed and healthy forest areas.

By using the proposed method and Google Earth Engine computational capabilities, we highlight the potential of a simple and effective model to predict and detect forest stressed areas, potentially associated with the diffusion of the European spruce bark beetle.