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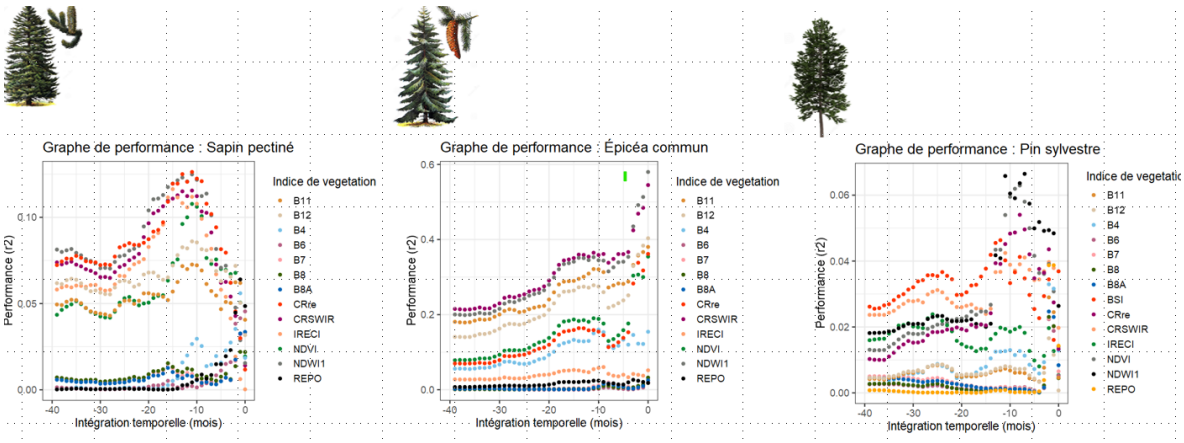

Spatial monitoring and environmental determinism of the French temperate conifers dieback

Principle investigator: Christian PIEDALLU, UMR Silva

Collaborations : Département Santé des Forêts, INRAE (Tetis), IGN (LIF), ONF, CRPF

Thematic action concerned: : *WP2*

Context —
This funding complements those obtained to pay a doctoral student from November 2022 for three years. This research is carried out in a context of adaptation of forests to climate change, following the observed decline of many tree species in recent years.

Objectives —
The planned work aims to map over large geographical areas the decline of the main temperate conifers (fir Norwegian spruce and Scots pine) and their evolution over time since 2018, and to identify the conditions that could lead to their decline in order to map their vulnerability.

Approaches —
This work is based on the analysis of sentinel-2 satellite images which are compared to inventory data on the 5 French mountain ranges. The specific work steps are:
- calibration of the Fordead time series processing chain developed by UMR Tetis in order to optimize the detection of mortality of each of the three species using satellite images, and evaluation of the method
- quantification of dying surfaces and their evolution over time using the results obtained in the previous step
- modelling of dying areas in order to identify explanatory factors for their triggering in relation to climatic extreme events.

Key results —

- Processing of more than 4,200 sentinel2 tiles since 2016 and calculation of 10 vegetation indices over France
- - Evaluation from 39,000 trees whose health status is known, of the most relevant spectral bands and vegetation indices to explain the dieback of each species, as well as of the optimal temporal integration for their detection
- Evaluation and comparison of performances according to the dieback intensity and the mixing rate, identification of the most relevant method for each species
- - Start of an M2 internship on the mapping of extreme events

Main conclusions including key points of discussion —

- Highlighting different responses (indices, temporal integration) depending on the species, with better performance for spruce than fir or Scots pine,
- Highlighting detection thresholds depending on the state of health and temporal integration, by species

Perspectives —

- Quantification of dying surfaces using methods that have been identified during the last steps (before this summer)
- Mapping of extreme events indices (before this summer)
- Linking dying to climatic extreme events using modeling techniques

Valorization —

(Scientific: publications, book chapter, presentation at conferences...); economic: Soleau envelope, patent, license...; distribution: press release, interview...)

- Publication currently being written for submission to “Remote sensing of environment”
- Presentation of results at the IUFRO conference in Stockholm in June 2024
- Communication of results to the study partners

Leveraging effect of the project—

- Possible improvement of the ForDead processing chain by its designers following the results obtained, results used by the DSF (health monitoring department of the ministry)