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CLIMTREE project: Assessment of forest decline in French plots

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Laurent Larrieu, Christophe Bouget, Grégory Sajdak, Veronique Cheret, Sylvie Ladet. CLIMTREE project: Assessment of forest decline in French plots. 3. Meeting. Bavaria NP, Aug 2019, Spiegelau, Germany. 12 p. hal-02786552

HAL Id: hal-02786552

<https://hal.inrae.fr/hal-02786552v1>

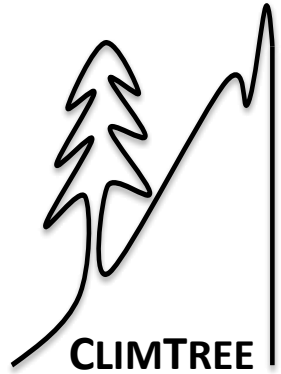
Submitted on 5 Jun 2020

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CLIMTREE

Assessment of forest decline



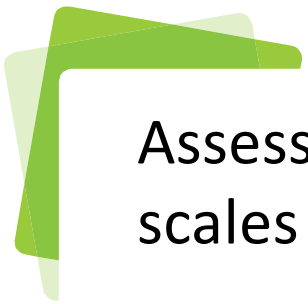
Larrieu L., Bouget C., Sajdak G., Cheret V. & Ladet S.



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SCIENCE & IMPACT



3rd meeting. Bavaria NP 27-28/08/2019

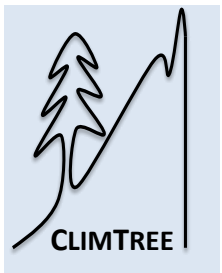


Assessment of forest decline intensity at several spatial scales

Local (i.e. plot) dieback assessment: the ARCHI method (Drenou et al., 2013)

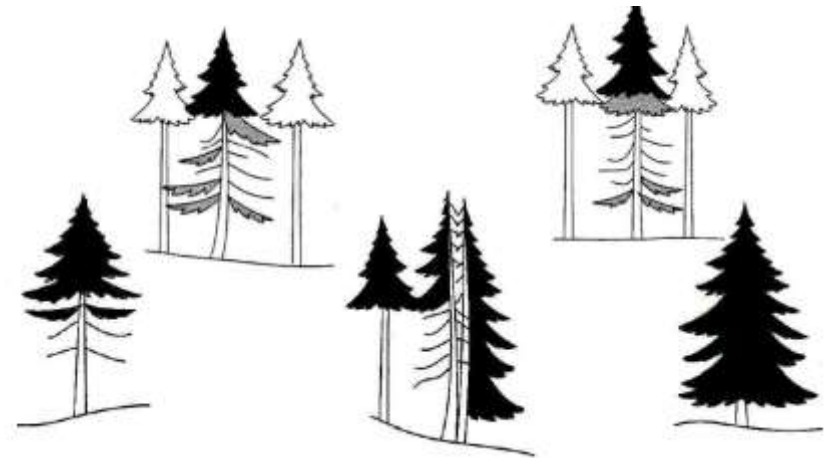
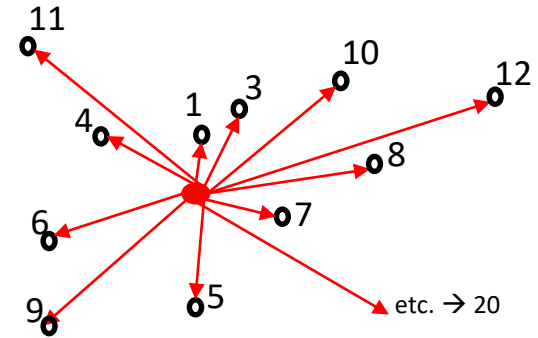
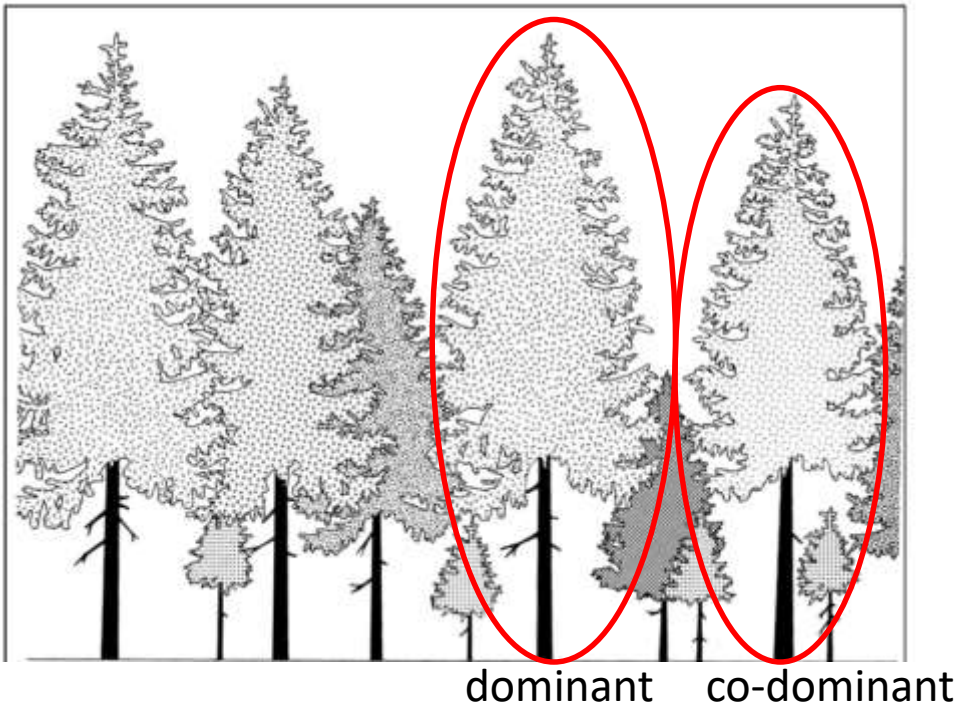
The ARCHI method analyses tree architecture (whole tree, crown, axes and branches) to establish a diagnosis of tree vitality status

A set of ergonomic keys to perform diagnoses in the field

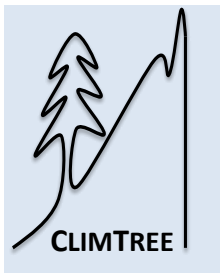


Local (i.e. plot) dieback assessment

Health status of 20 (co)dominant trees the most closer to the plot center



Focus only on conspicuous tree crowns
(in black)



Local (i.e. plot) dieback assessment

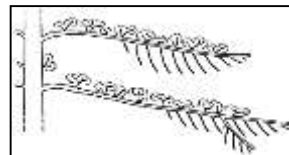
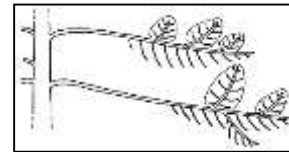
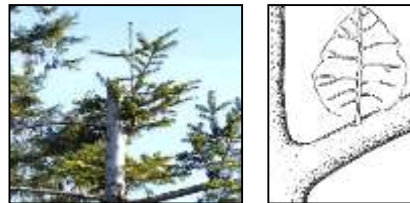
Defoliation
Crown decline
symptoms

+

Crown
restoration
process

=

ARCHI diagnosis
5 tree types

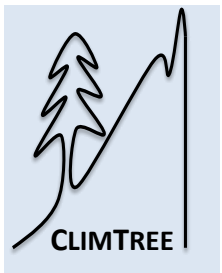


Type and vigor of sprouts

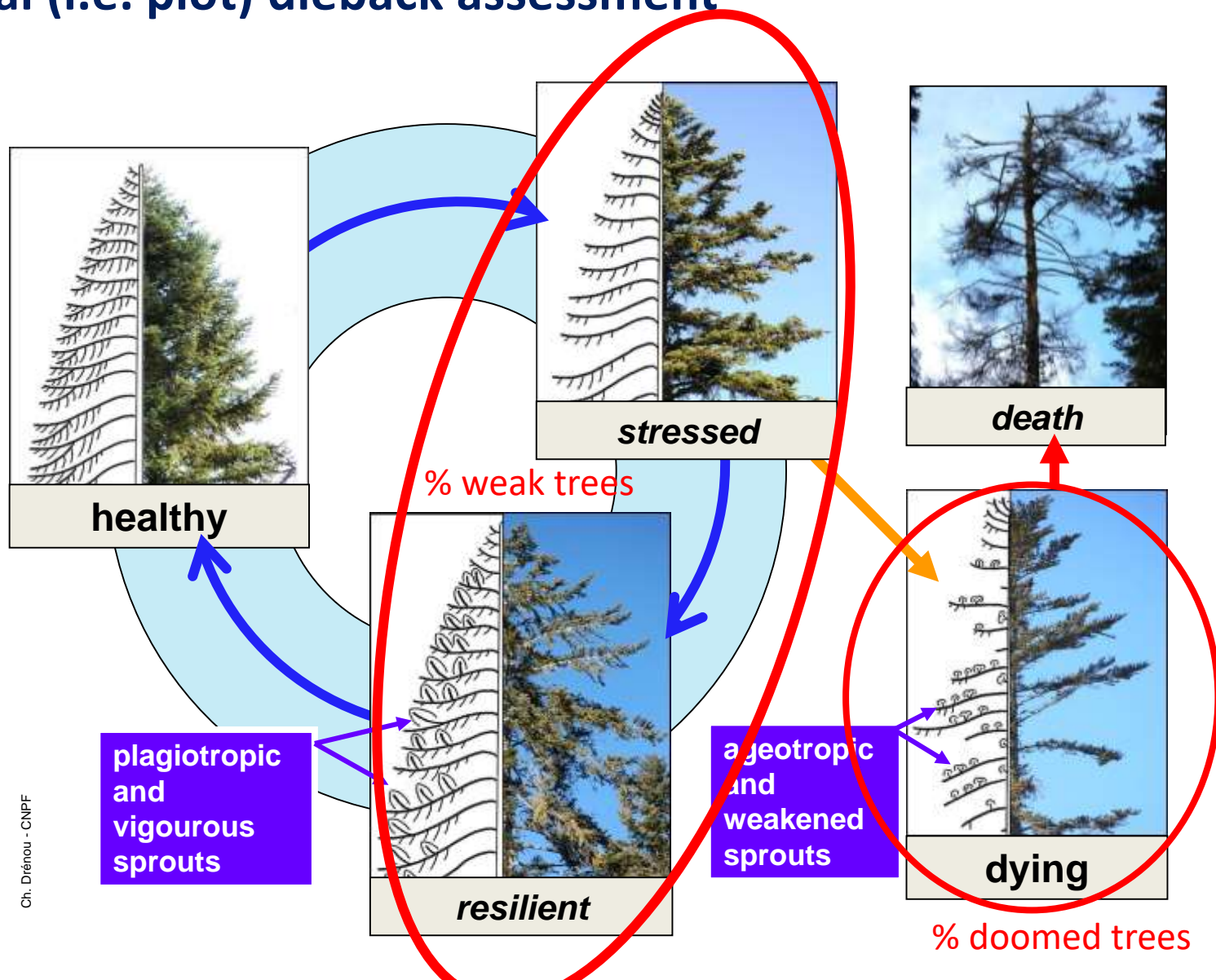
- **healthy**
- **stressed**
- **resilient**
- **dying**
- **crown dieback**

- +

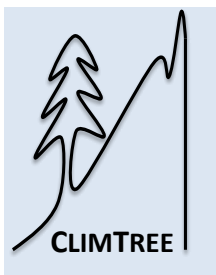
+ Greenness level



Local (i.e. plot) dieback assessment

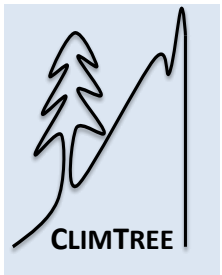
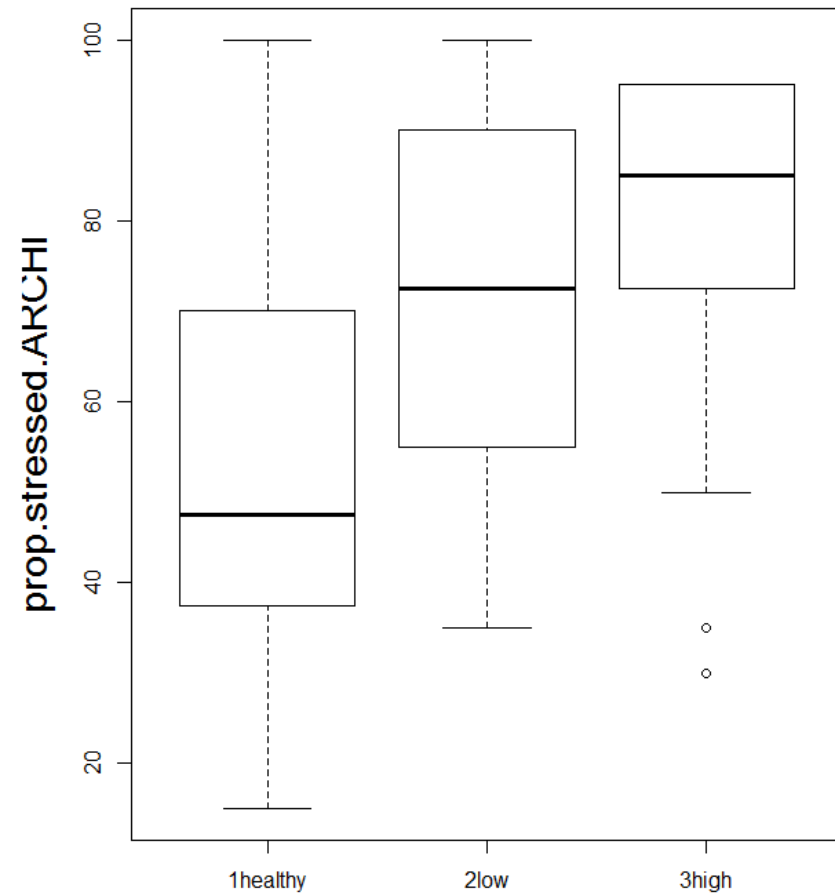
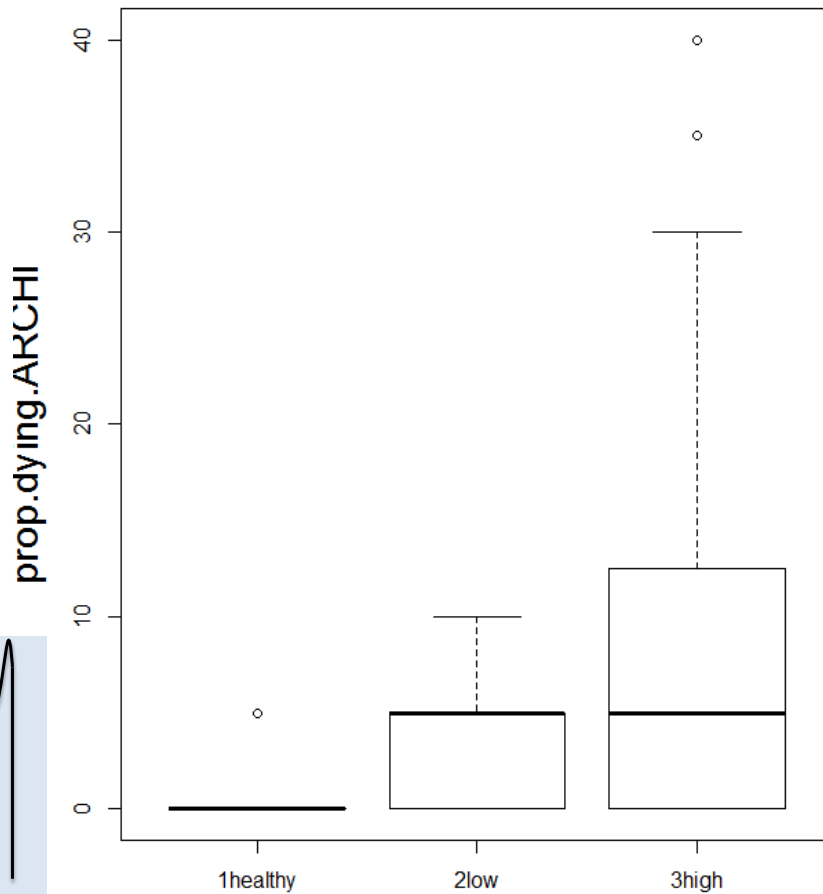


Ch. Drénou - CNPF



Post-hoc assessment of the sampling design (plot scale)

At the plot scale

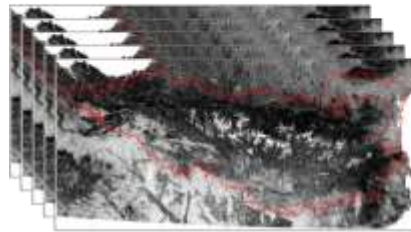


Dieback assessment from stand to landscape scales

The tools

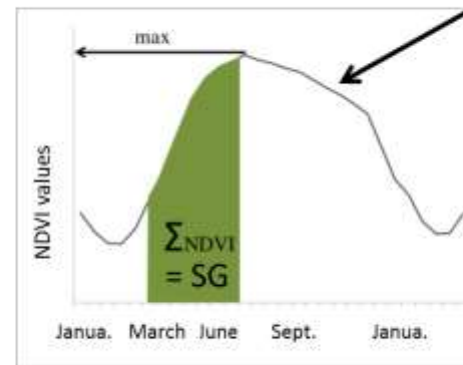
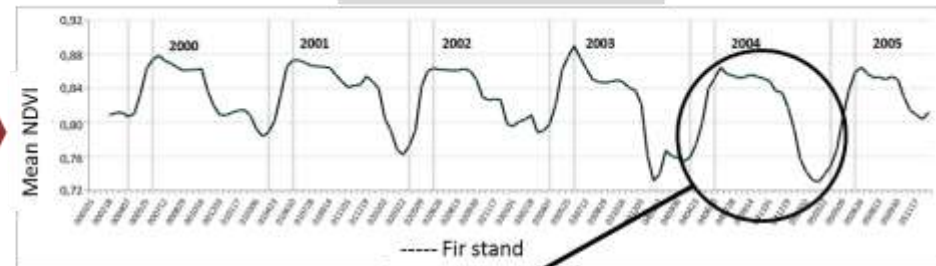
Remote sensing data = MODIS Terra NDVI Time Series (2000- 2017)

- Moderate Resolution Imagery Spectroradiometer (MODIS)
- free data
- spatial resolution 250m (pixel=6.5 ha)
- Every 8 or 16-days



Analysis of trends in MODIS NDVI time series

Pluriannual NDVI cycle

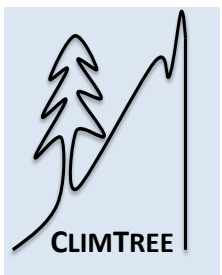


Spring Greenness (SG)

Vegetation index
NDVI
(Normalized Difference
Vegetation Index)
 $NDVI = (PIR - R) / (PIR + R)$

SG= phenological indicator linked to **spring vegetation activity**

= sum of NDVI calculated over a fixed period of MODIS images from the onset of SG (end of April) to the maximum NDVI (in end of June) before the dry season (Reed 2006) 7

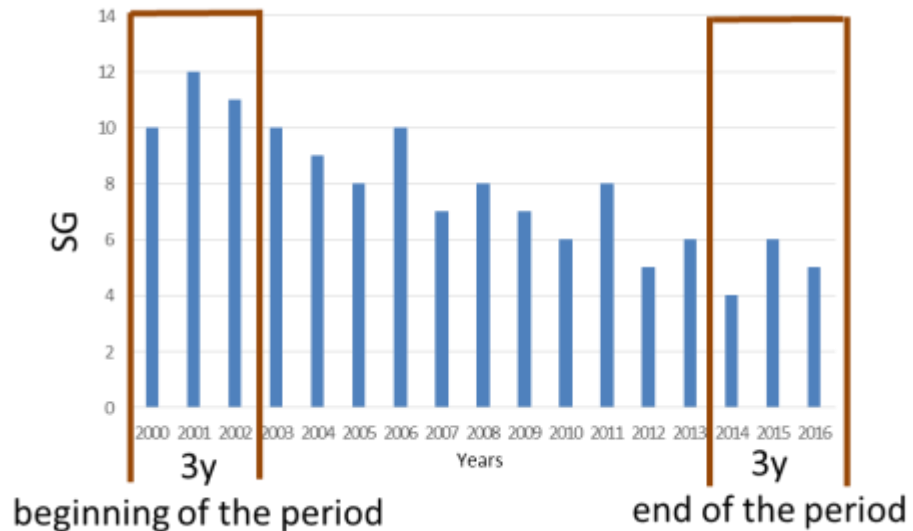


Dieback assessment from stand to landscape scales

The tools

Detection and monitoring of gradual or sudden changes in forest health
(Lambert et al., 2013)

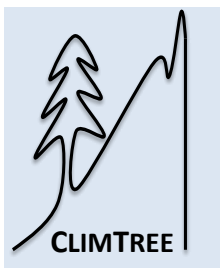
Measurement of variations of photosynthesis activity within the period 2000 – 2016 = **index of vitality trend**



for 1 pixel = 6ha

Index of vitality trend

$$D_{nor_SG} = \frac{\begin{matrix} 2014 \\ \text{max } SG \\ 2016 \end{matrix} - \begin{matrix} 2000 \\ \text{max } SG \\ 2002 \end{matrix}}{\begin{matrix} 2000 \\ \text{max } SG \\ 2002 \end{matrix}}$$

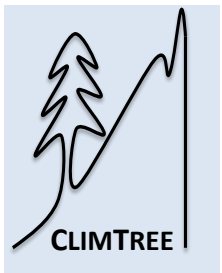
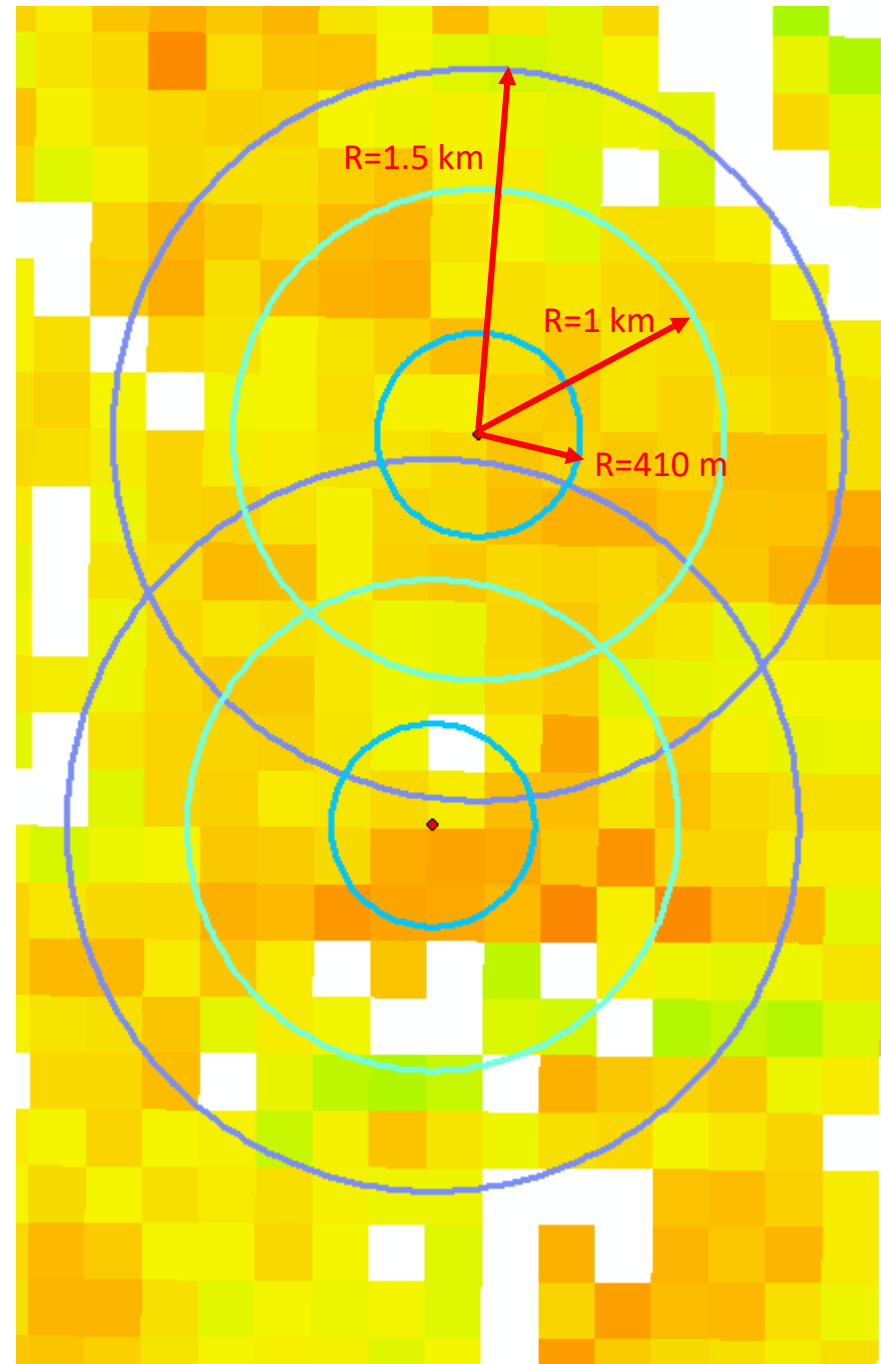
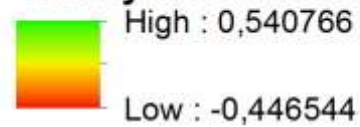


Dieback assessment from stand to landscape scales

Legend

- ClimTree plots
- 54 ha buffer zone
- 315 ha buffer zone
- 700 ha buffer zone

Vitality trend index

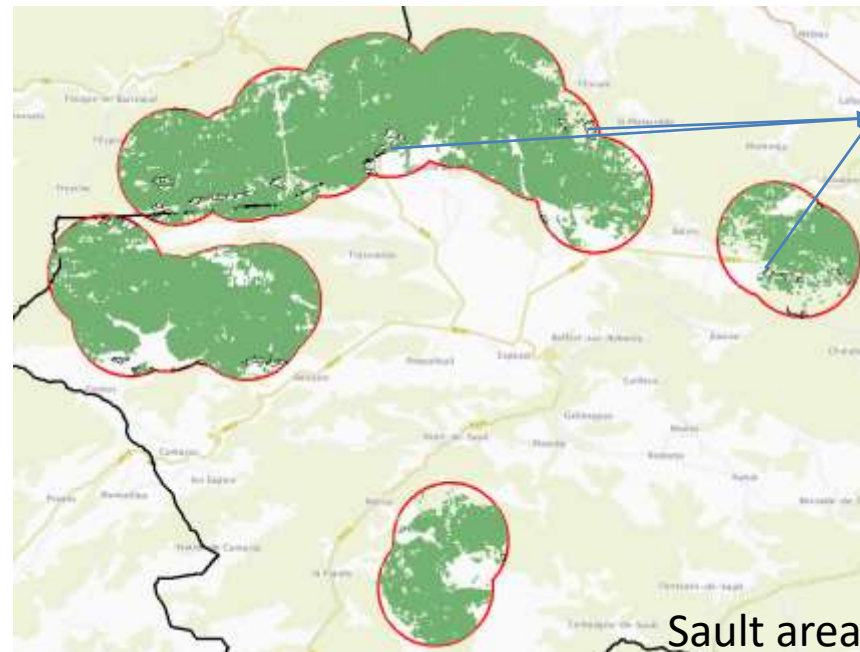


Dieback assessment from stand to landscape scales

Calculation procedure


1. Evaluation of fir proportion in the buffer

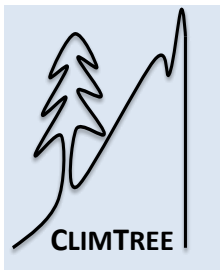
- Selection of **conifer** polygons: OSO 2017 map (www.theia-land.fr/ raster 10 m, 17 classes)
- Selection of **fir** stands: BD forest 2014-2018 (IGN, 32 classes)



Pinus stands deleted

 *Abies alba*

 700ha-buffer

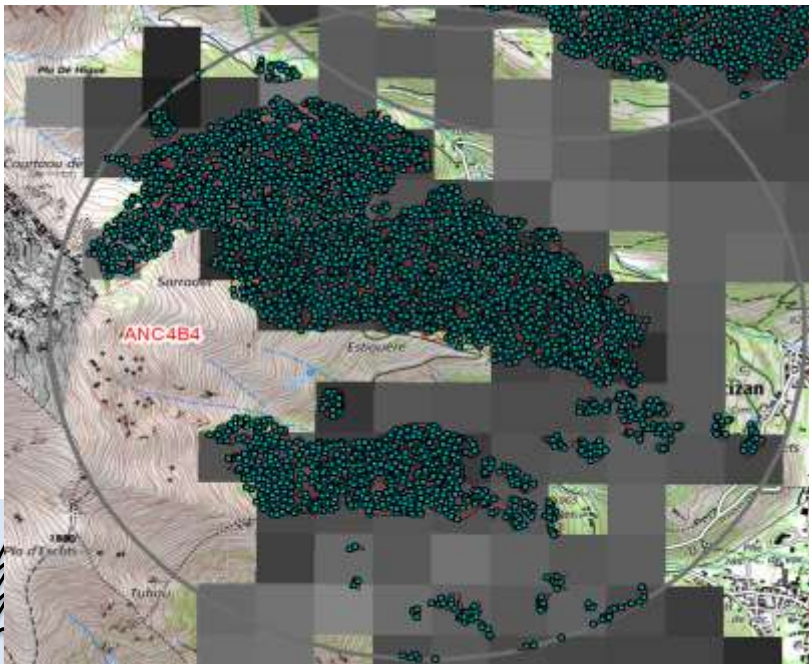


Dieback assessment from stand to landscape scales

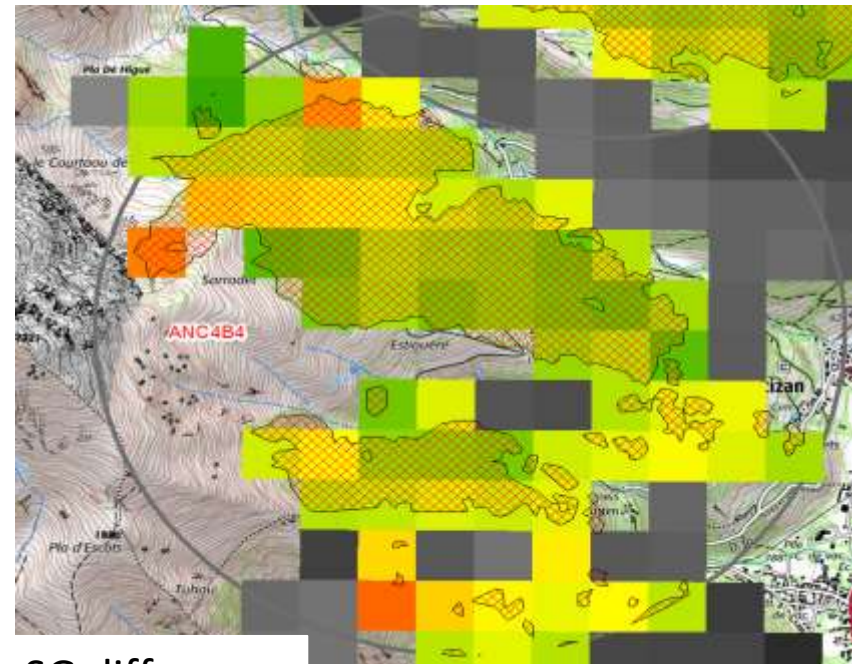
Calculation procedure

2. Evaluation of fir proportion in the buffer

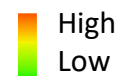
Pixel selection using the
“random spot mask” method



SG data



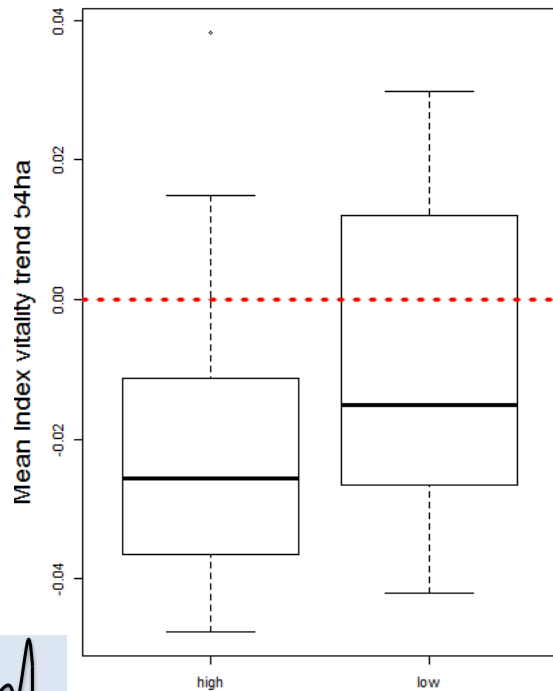
SG difference



Post-hoc assessment of the sampling design (stand → landscape scales)

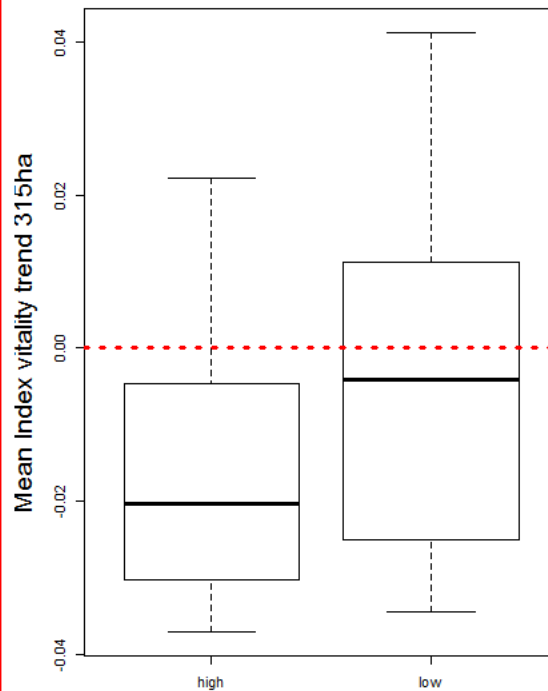
Stand scale

54 ha

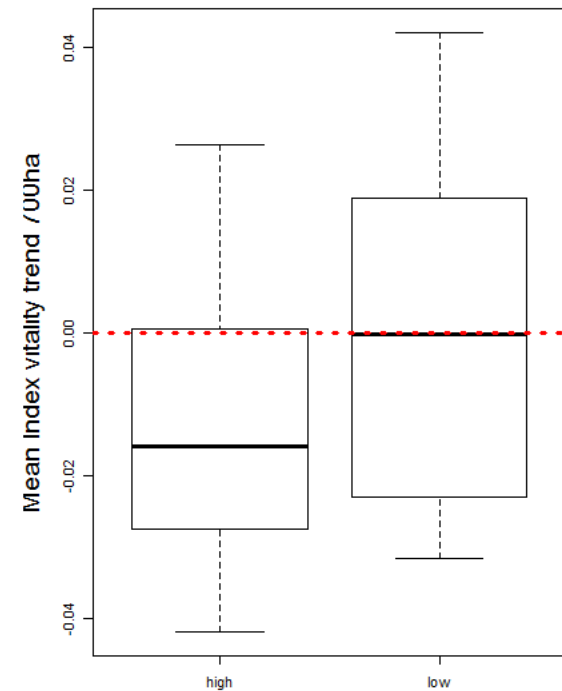


Landscape scale

315 ha



700 ha



Dieback level

