Red-edge satellite information improves early stress detection in forests

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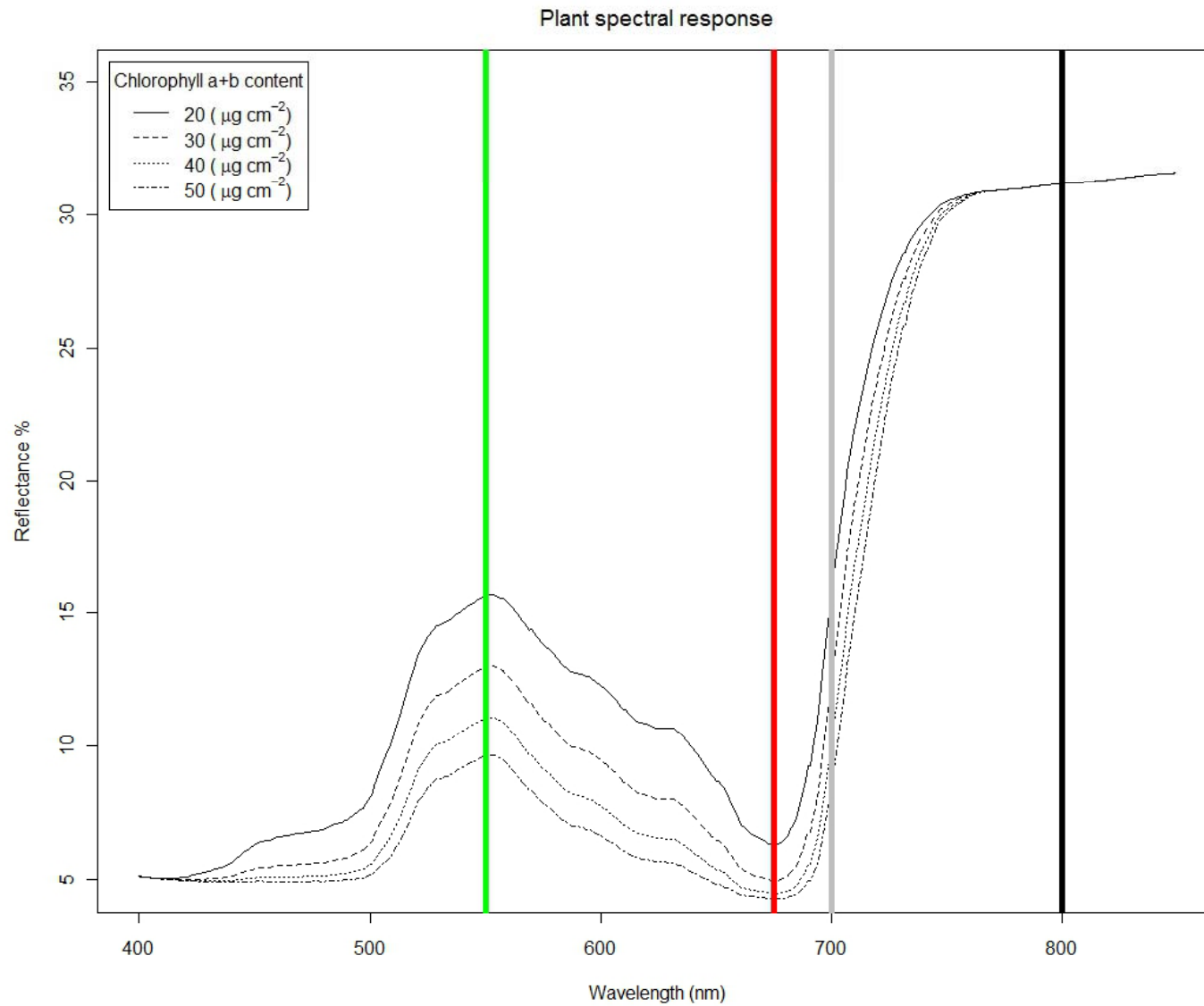
Introduction

Credit: Leo Stoscheck

Introduction (cont.)

Credit: RapidEye

Plant spectral response

Objective

The overall goal of this study was to test if broadband, red-edge information from satellites improves early stress detection in forests
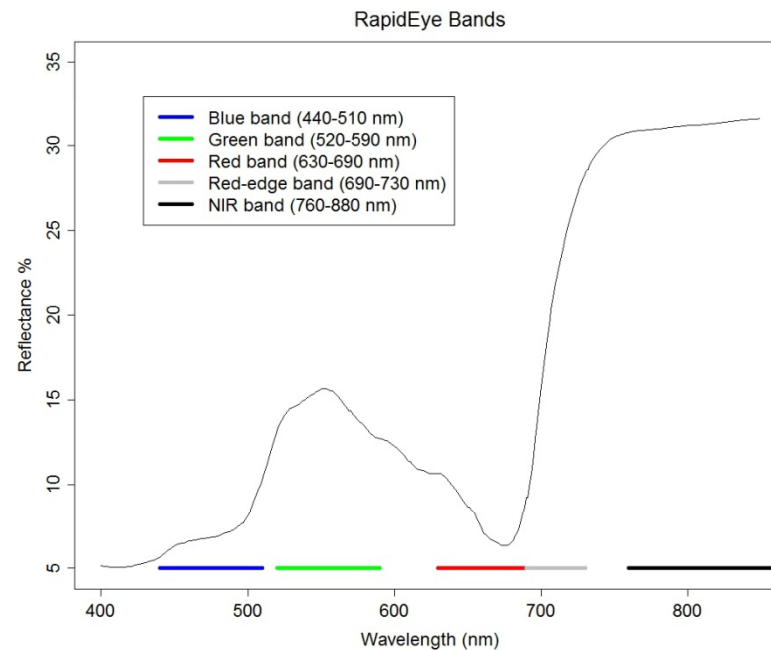
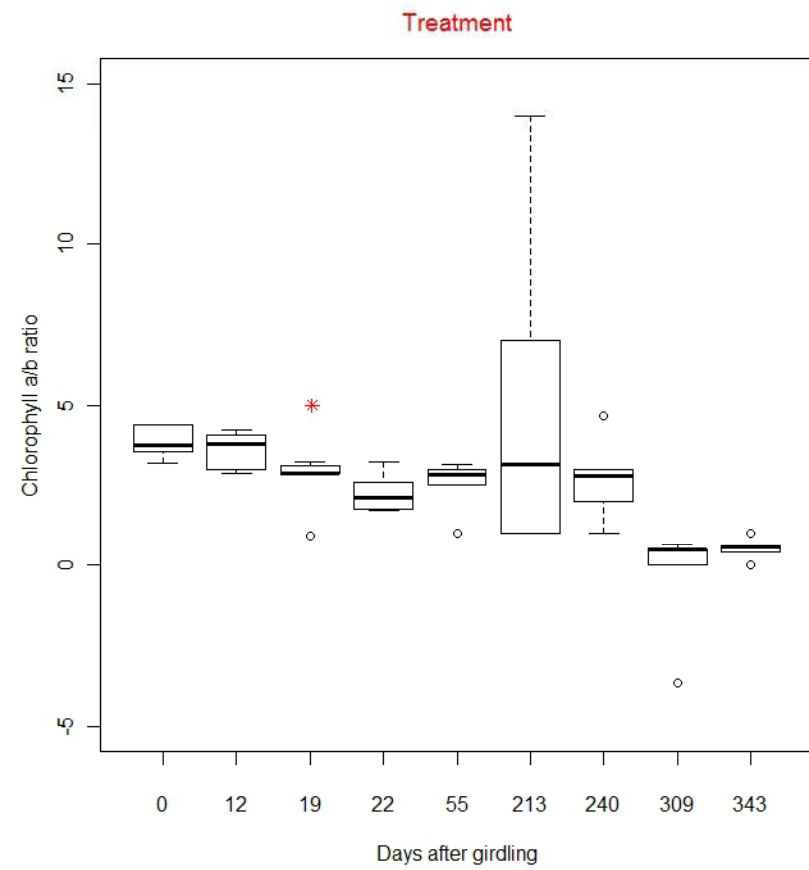# Methods

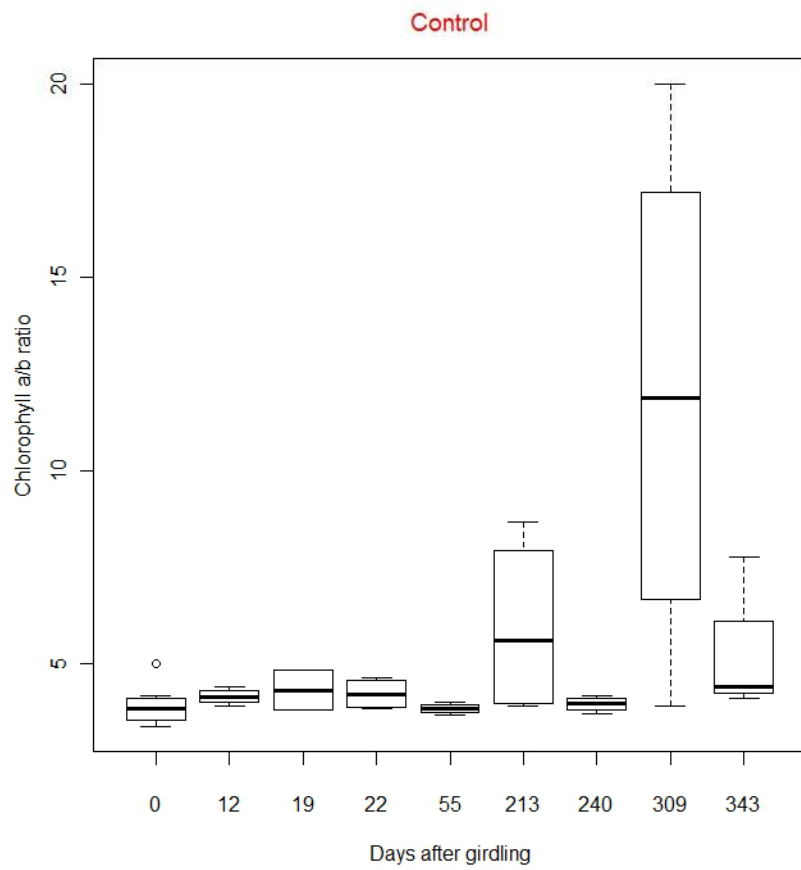Control   Treatment

- Chlorophyll a/b ratio
- 16 satellite images between 7-Sept-09 to 21-Sept-2010

Methods (cont.)

Vegetation Index	Equation	Reference
Normalized Difference Vegetation Index (NDVI)	$NDVI = (R_{band5} - R_{band3})/(R_{band5} + R_{band3})$	Rouse et al. (1974)
Green Normalized Difference Vegetation Index (GNDVI)	$GNDVI = (R_{band5} - R_{band2})/(R_{band5} + R_{band2})$	Gitelson and Merzlyak (1998)
Normalized Difference Red-Edge Index (NDRE)	$NDRE = (R_{band5} - R_{band4})/(R_{band5} + R_{band4})$	Barnes et al. (2000)

RapidEye Bands

Blue band (440-510 nm)
Green band (520-590 nm)
Red band (630-690 nm)
Red-edge band (690-730 nm)
NIR band (760-880 nm)

Results and discussion
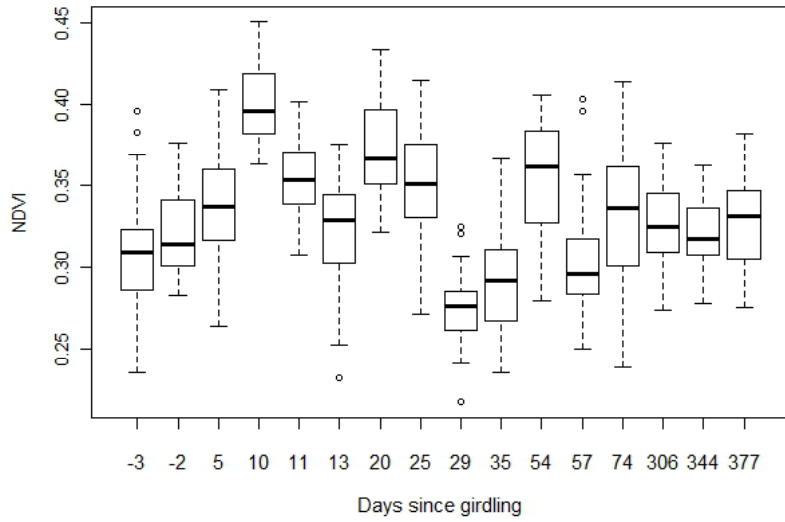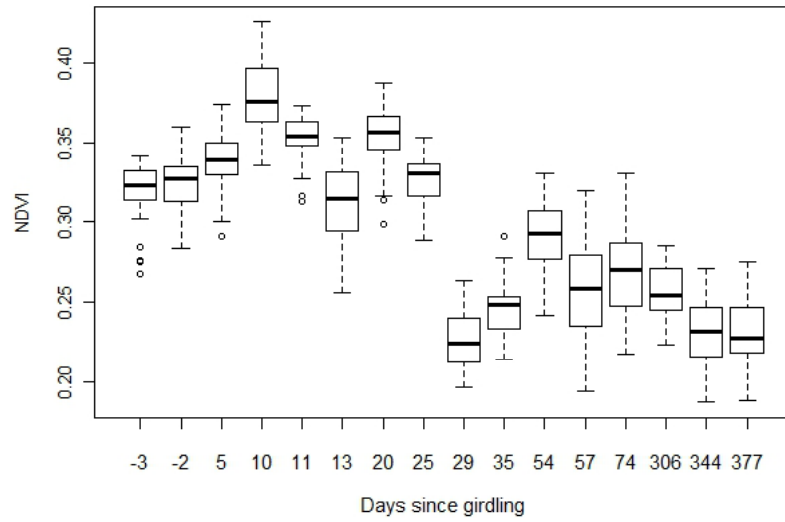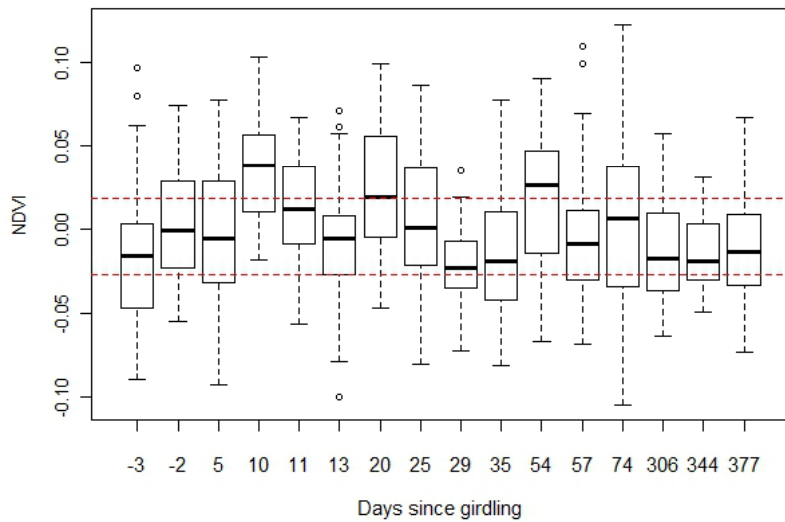
Results and discussion (cont.)

Results and discussion (cont.)
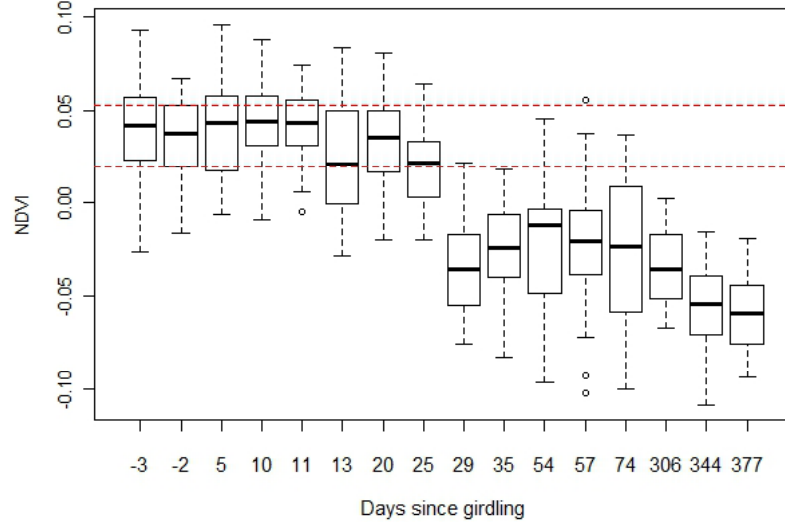
Red index

Green index
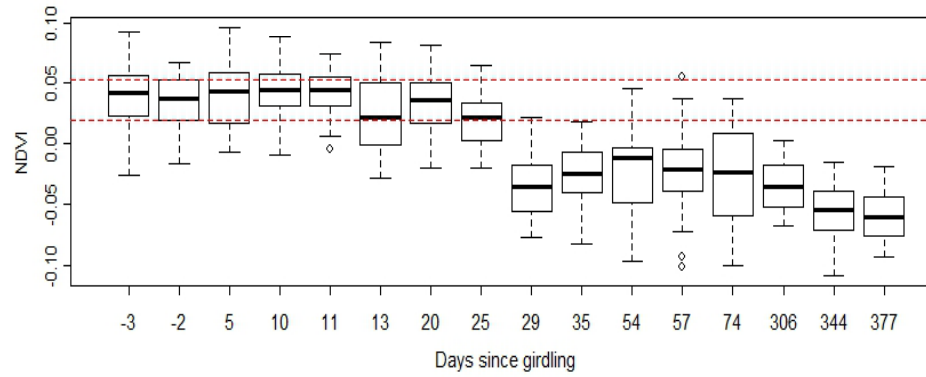
Red-edge index

75th percentile

25th percentile
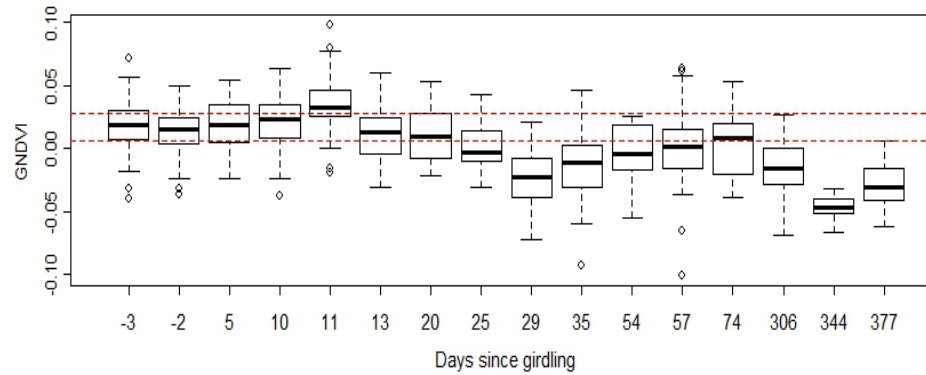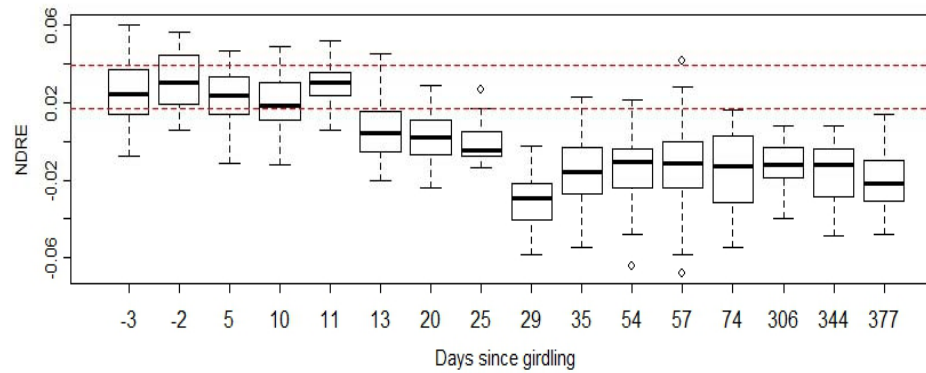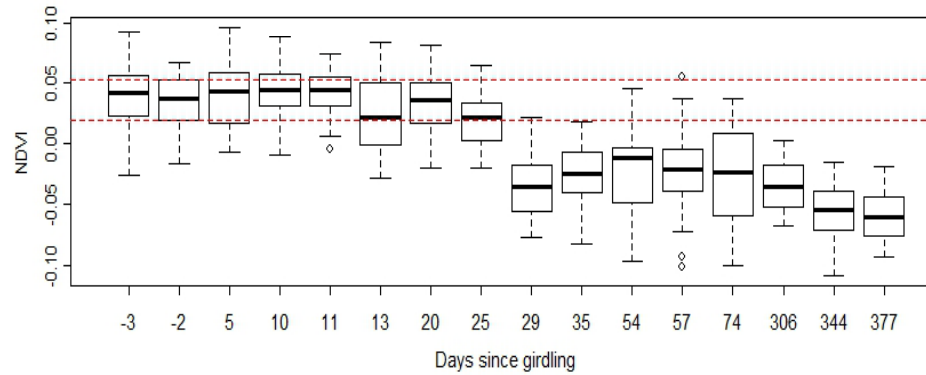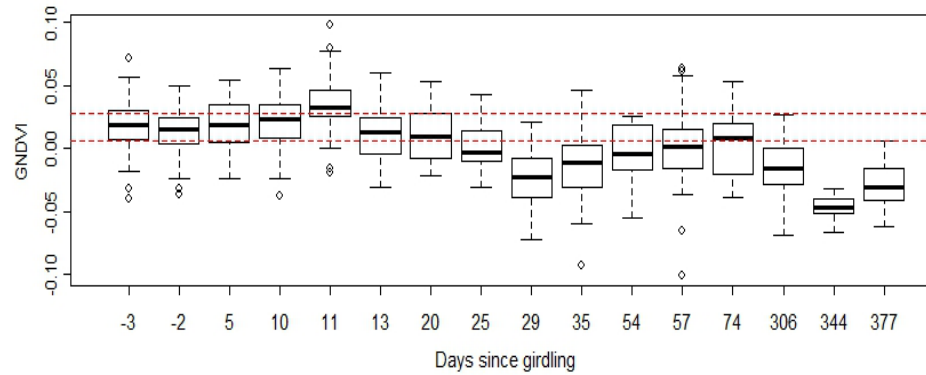
Results and discussion (cont.)
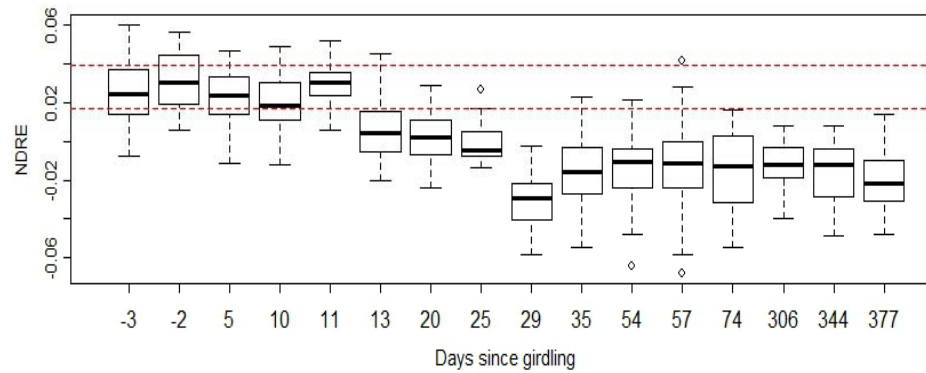
Red index

25-29 days

Green index

25-29 days

Red-edge index

11-13 days

Conclusion

Red-edge employing index detected stress after 11-13 days – up to 18 days earlier than traditional indices.

Red-edge information could be of great importance for improving forest health monitoring from satellites and should be considered when monitoring forest health in a changing climate

Acknowledgements

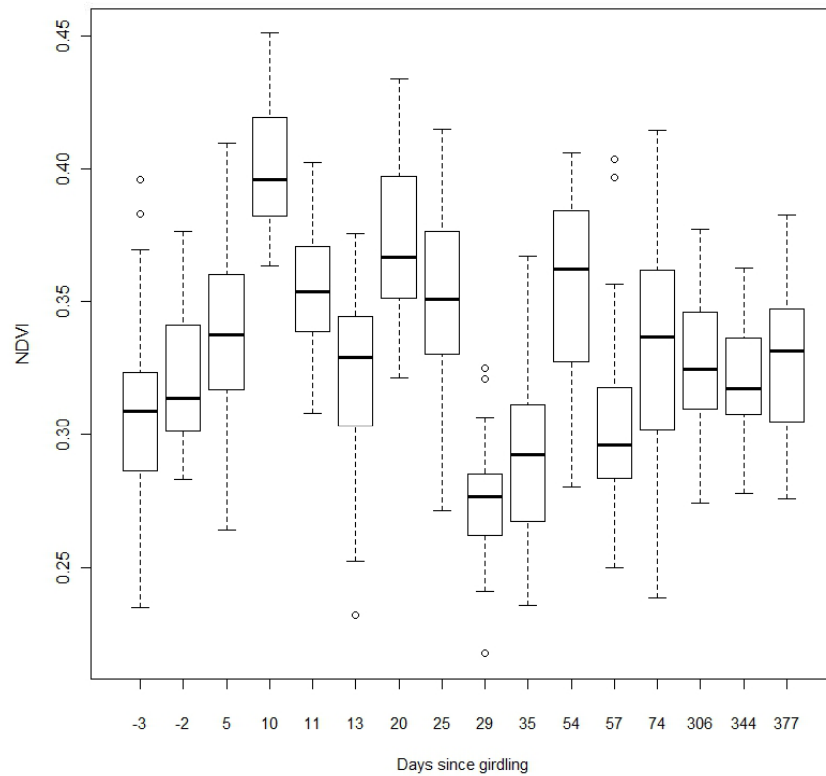Contact: Jan Eitel (jeitel@vandals.uidaho.edu)
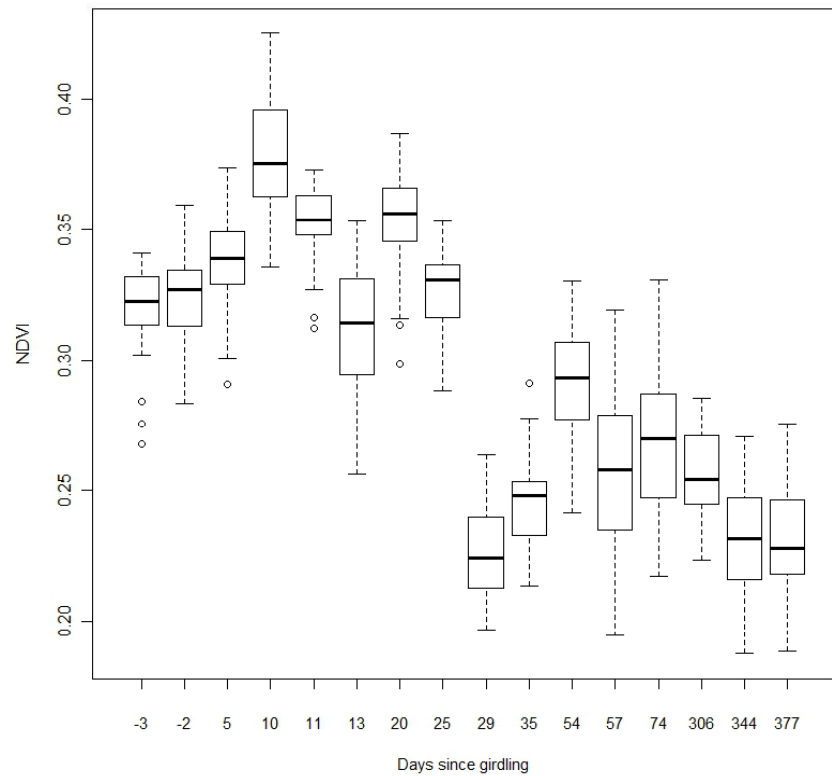
Thank you

Contact Information:

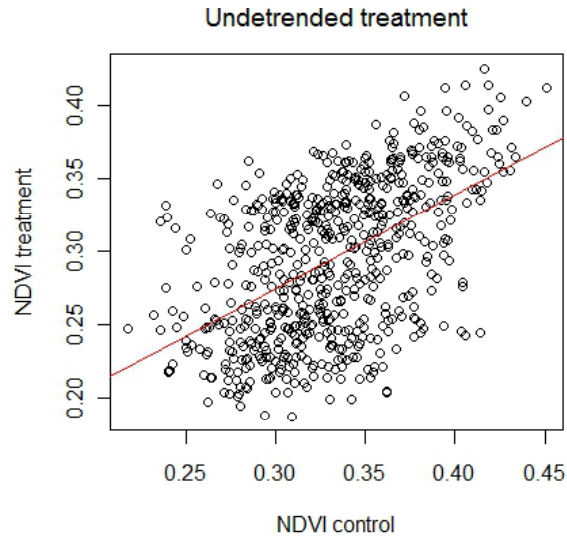Jan Eitel (jeitel@vandals.uidaho.edu)
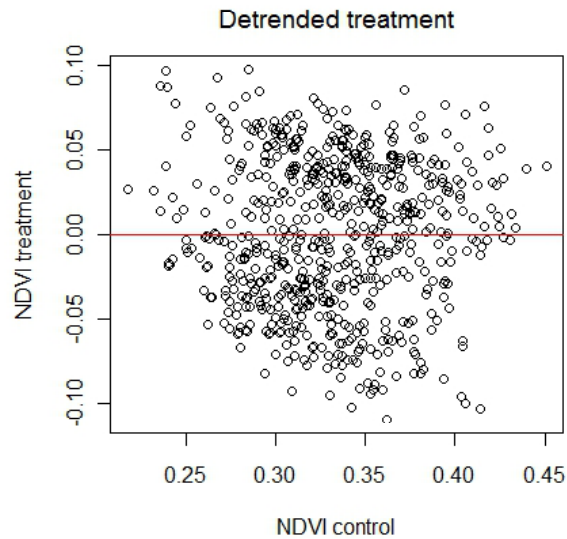
Results and discussion (cont.)

Detrending

$$y = \alpha + \beta x + \varepsilon \qquad [1]$$

$$yd = y - (\alpha + \beta x) \qquad [2]$$