TOPWOOD NEWSLETTER

May, 2018 - N° 3

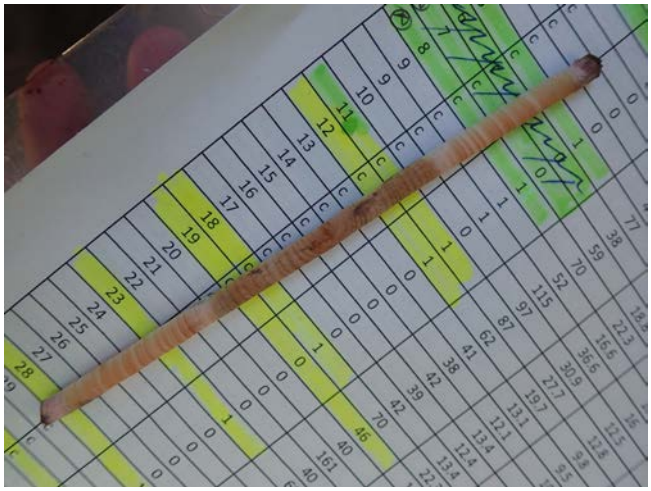
EDITO

The third Topwood newsletter is dedicated to the NIRS calibration of wood quality traits and of complex drought-resistance traits like vulnerability to cavitation. NIRS is one of the promising tools studied by the Topwood participants. NIRS could improve the efficiency and the profitability of the forest-wood chain, by permitting early assessment of wood quality. Early identification of raw timber properties will allow accurate allocation of the wood resource to the wood industry and to the different types of final products. The unprecedented speed of the climate change imposes to take action and to facilitate forest adaptation to the new conditions. NIRS will make it possible to measure critical adaptive traits like resistance to drought. It will be possible to identify and choose trees with a better adaptive value. The selected trees will participate to the breeding programs or to the natural regeneration and produce more adapted generations.

NIRS calibration for microdensity, vulnerability to cavitation and ultrasonic resonance: State of the art regarding the activities in the frame of the TOPWOOD project

The task “NIRS calibration” is an important TOPWOOD activity of the working package “High throughput phenotyping of wood quality”, because NIRS would offer the possibility for extremely fast and low cost tree screening for wood quality and plant physiological traits that are important for tree survival.

Two principal scientific actions are covered by the action. Firstly, we evaluate wood basic properties related to the quality of the products by means of different non-destructive methods such as NIRS, microdensity and ultrasonic resonance. Secondly, we also aim at characterizing **functional traits** of **adaptive relevance** (vulnerability to cavitation, hydraulic conductivity and fitness) by using the same non-destructive techniques.



Nirs field measurement

SUMMARY

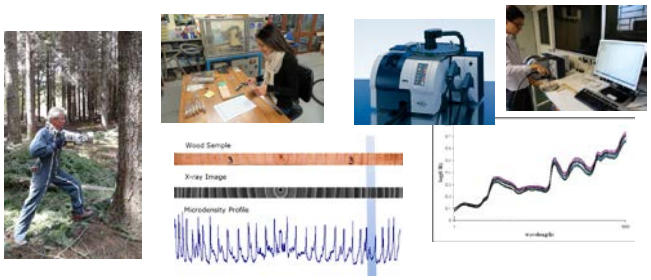
Quality of the woody product

Regarding NIRS calibration for wood quality, reference values were obtained by measurements in standing trees, logs and boards. In addition, increment cores were collected. Species investigated in Argentina were *Pinus ponderosa*, *Pseudotsuga menziesii*, *Araucaria angustifolia*, *Pinus taeda* and hybrid pines; in Spain, *Eucalyptus globulus*, *Pinus pinaster* and *Pinus radiata*. The plant material covered a broad range of different silvicultural managements, index quality and age and provenances.

Ultrasonic Reference data were obtained by Esther Merlo on standing trees with portable ultrasonic devices. Thereafter trees were harvested and measurements were repeated on logs and boards. Two concentric circles were painted in the logs to know the position of each board within the tree, in particular if they came from the inner or from the peripheral zone. Boards were then sent to the laboratory in order to obtain the reference values for modulus of elasticity and rupture. From the same trees, core samples were taken and microdensity profiles were assessed and NIR spectra are going to be collected.

First results for *P. ponderosa* grown in Argentina indicated that stem density of the plantation had a rather weak or no effect on the technological values of ponderosa pine. Wood quality was more influenced by the lack of pruning, since the effect of knots was more relevant. Mechanical strength and density were low compared to other pine species cultivated in Argentina.

Standing trees are evaluated with portable ultrasound equipment and subsequently cut and processed. The timber boards and beams are again characterized with ultrasound and then sent to the laboratory to obtain the reference values

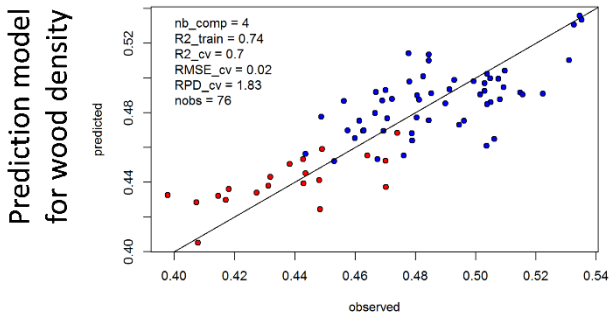


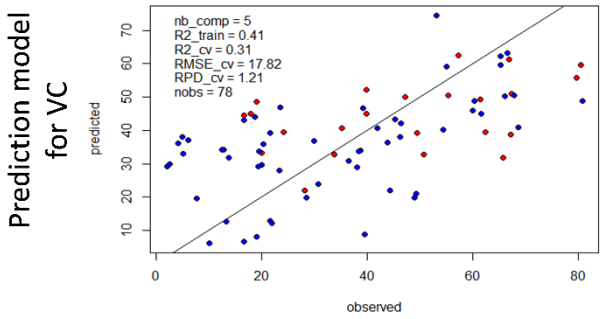
Functional traits of adaptive relevance

Anne Sophie Sergent and her colleagues from INTA Bariloche have been working together with project partners from INRA Orléans on the NIRs prediction of vulnerability to cavitation in Cypress (*Austrocedrus chilensis*). The cypress populations covered a longitudinal and latitudinal gradient. Trees came from a common garden experiment in Bariloche and from a genetic test at Trevelin. Five trees of each population were investigated. The hydraulic vulnerability curves (VCs, the references values for the NIRS calibration) of the Argentinean sample set were measured in Bariloche together with **Jose Almeida**. Basic wood density was assessed in Orléans (**Frédéric Millier**).

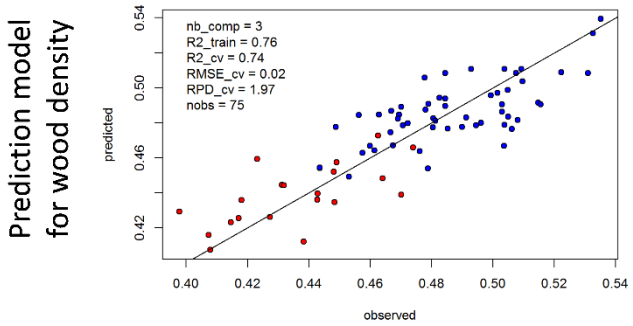
The preliminary NIRS calibration for the VCs was quite promising. In addition, INRA Orléans and INTA Bariloche followed a given protocol in order to obtain the NIRS spectra, and arrived at very similar results.

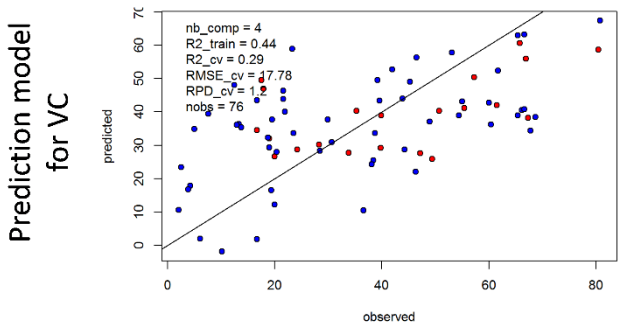
Bariloche





Orleans





Another project part investigates the potential of NIRs for discriminant analysis of survival prospects of trees after drought. In total, 4096 NIRS spectra of 169 samples from Ponderosa pine, 109 in Douglas-fir and 111 in cypress were collected during the mobility of **Inés Bertoldi** at INTA Bariloche. All trees have already been phenotyped by microdensity profiles. Cypress, for instance was processed during the mobility of **Anne Sophie Sergent** in summer 2016 at INRA Val de Loire. At the moment the data are being analyzed at INTA Bariloche.

Nirs Training session Bariloche 2018

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