

*STReESS: Studying Tree Responses to extreme Events: a SynthesiS*

**Cost Action FP1106**

**Short Time Scientific Mission**

**Reference code:** COST-STSM-ECOST-STSM-FP1106-100214-039534

**STSM Applicant:** Dr. Claudia Coccozza (postdoc), Department of Bioscience and Territory, Pesche, Italy

**Host:** Dr. Paolo Cherubini, Swiss Federal Research Institute WSL, Birmensdorf, Switzerland

**Period:** 10 – 21 February, 2014

**Scientific Report**

Project proposal template: The development of dendrochemistry in environmental monitoring

**Introduction**

Annual tree rings record the environment changes, such as pollution events (Leonelli et al. 2012). The dating of tree growth rings combined with the application of the registered information on their structure for environmental and historical studies is referred to dendrochronology (Fritts 1976; Schweingruber 1988; Cherubini et al. 2013). The combination of environmental and historical analyses in tree rings has enhanced the understanding of how variations in atmospheric deposition affect some key processes underpinning tree physiology and adaptation to under changing environmental ecological changes conditions (e.g., Lévy et al. 1996; Watmough and Hutchinson, 1996). Woody plants continuously exposed to pollutants for long periods could be useful indicator for the temporal reconstruction of impact and the evaluation of damage of these pollutants on plant functionality (e.g., Battipaglia et al. 2010, 2013). Tree-rings permit long-term retrospective field observations, enabling investigations of long-lasting effects, such as the impact of chronic pollution on forest trees, “dendrochemistry” (Ferretti et al. 2002).

## References

- Battipaglia G, Marzaioli F, Lubritto C, Altieri S, Strumia S, Cherubini P, Cotrufo MF. 2010. Traffic pollution affects tree – ring width and isotopic composition of *Pinus pinea*. *Science of the Total Environment*, 408: 586-593.
- Battipaglia G, Saurer M, Cherubini P, Calfapietra C, McCarthy HR, Norby RJ, Cotrufo MF. 2013. Elevated CO<sub>2</sub> increases tree-level intrinsic water use efficiency: Insights from carbon and oxygen isotope analyses in tree rings across three forest FACE sites. *New Phytologist* 197: 544-554.
- Cherubini P, Humbel T, Beeckman H, Gärtner H, Mannes D, Pearson C, Schoch W, Tognetti R, Lev-Yadun S. 2012. Olive Tree-Ring Problematic Dating: A Comparative Analysis on Santorini (Greece). *PlosOne* DOI: 10.1371/journal.pone.00547.
- Ferretti M, Innes JL, Jalkanen R, Saurer M, Schäffer J, Spiecker H, von Wilpert K. 2002. Air pollution and environmental chemistry ± what role for tree-ring studies? *Dendrochronologia* 20/1-2: 159-174.
- Fritts HC. 1976. *Tree rings and climate*. Academic Press, London , New York, San Francisco, 567 pp.
- Leonelli G, Battipaglia G, Siegwolf RTW, Saurer M, Morra di Cella U, Cherubini P, Pelfini M. 2012. Climatic isotope signals in tree rings masked by air pollution: A case study conducted along the Mont Blanc Tunnel access road (Western Alps, Italy). *Atmospheric Environment* 61: 169-179.
- Lévy G, Bréchet C, Becker M. 1996. Element analysis of tree rings in pedunculate oak heartwood: an indicator of historical trends in the soil chemistry, related to atmospheric deposition. *Annales des Sciences Forestieres (Paris)* 53: 685-696.
- Schweingruber, F.H. 1988. *Tree rings: basics and applications of dendrochronology*. Kluwer Academic Publishers, Dordrecht, Holland.
- Watmough SA, Hutchinson TC. 1996. Analysis of tree rings using inductively coupled plasma mass spectrometry to record fluctuations in a metal pollution episode. *Environmental Pollution* 93: 93.

## **Purpose of the STSM**

The purpose of STSM was aimed to predispose a project template on the “The development of dendrochemistry in environmental monitoring”, through the direct interaction of the applicant with the host. The main aim of the STSM was to define the gap of knowledge, available instruments and possible collaborations to be conveniently implemented in a successful proposal. Moreover, the opportunity of a project application was assessed for supporting a postdoc position of the Italian applicant at the Swiss host institution.

### **Description of the work carried out during the STSM**

Activities were carried out in the definition of current state of research on annual tree rings record of environmental changes, namely pollution, in particular on the detection of nanoparticles. The lack of knowledge on the detection and storage of nanoparticles in tree rings has been considered as the starting point and proposal basis. The research areas and study motivation were defined in order to understand how variations in atmospheric deposition would affect some key processes underpinning tree physiology and adaptation to changing environmental conditions. Current state and proven skills of the research host on “dendroecology” to define bioindicators in environments subjected to emission of pollutants, combining dendrochronology and dendrochemistry, were the focus of such collaboration.

### **Description of the main results obtained**

A completed proposal was drafted. A detailed research plan was defined, specifying the approach that could be used and the concrete objectives that might be aimed within the project. Studies and experiments were envisaged to reach the set goals. Methods, schedule and milestones by which the research goals might be reached were described. Moreover, the draft proposal has been enriched by the relevance and impact, scientific relevance and broader impact of the provided activities. While, the involvement of structure(s) and staff directly engaged in the achievement of the proposal is still in evaluation phase, other possible collaborations have been identified and contacted.

### **Description about how the results contribute to the Action aims**

Activities of the project proposal are related to the Action FP1106, in the study of effects of extreme events, in particular with temporal changes in effects of environmental conditions on tree growth and species susceptibility to abiotic stress, with a focus on polluted areas. The project is focused on forestry for encouraging a scientific debate on ensuring a sustainable provision of forest products and environmental services. The understanding of state and potential of forest mitigation and adaptation to climate change in a polluted environment, as well as long-term monitoring, needs to be improved. The potential for urban areas to harbor considerable amounts of pollutants needs to be recognized by city planners and urban foresters, so that management practices that

preserve ecosystem and promote services in pollution detection are being promoted. In addition, the collaborative research carried out within the STSM will contribute through the feasible scientific papers to the progress of COST Action FP1106.

### **Contribution to the action aims**

The STSM was based on the aim of the Action FP1106 to link scientific expertise and facilitate data exchange and organization. The STSM fostered collaboration between the beneficiary and Dr Paolo Cherubini, sharing ideas, techniques and infrastructure available in the host institution. During the STSM the collaboration between members of the two institutions was strengthened on the adaptation and response to environmental changes in forest tree species with important ecological value. The activities were focused on the potential of dendro-sciences for the monitoring of environmental pollution, that has increased dramatically and may affect vitality, production and wood quality of European trees, in urban and periurban areas.

This report may be posted on the Action website.

Confirmation by the host institution of the successful execution of the STSM can be found in the attachment.