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LETTER TO THE EDITOR

Editorial: "Fifty years Annals of Forest Science"

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Key Message

***Annals of Forest Science* is publishing a series of review papers to celebrate 50 years of activities as a journal in forest and wood science. The reviews emphasize the extent to which forest and wood sciences changed and developed as a large array of disciplines devoted to complex objects with sometimes many conflicting issues.**

Annals of Forest Science was launched during 1964 as *Annales des Sciences Forestières*, a French journal devoted to research in forestry, tree breeding, silviculture, wood quality, and other issues important to forest management. It followed *Annales de l'École Nationale des Eaux et Forêts*, launched 1923 to publish the research work of the Forestry Research Station in Nancy (Aussenac, 2002), and intended to broaden both the audience and author community in the field. The journal was mostly in French up to the 1990s, when it started to publish some papers in English (and in particular several special issues on "Tree Physiology," 1989, and on "Oak genetics and ecology," 1994). At the end of the 1990s, the journal switched massively to the publication of research papers in English and the title changed accordingly to the current *Annals of Forest Science*. This journal, therefore, is among the oldest journals in forest science and benefits a solid experience in the field.

The journal was launched at a moment of significant changes in the organization of forest research in France. During 1964 indeed, INRA (the National Institute for Research in Agronomy) opened a new research department devoted to forests and their products. The department was first active at Nancy as it stemmed from the Ecole Nationale du Génie Rural et des Eaux et Forêts, and was known as National Centre for Forest Research (CNRF), and later on launched research groups at Bordeaux, Orléans, Avignon, Montpellier, and Kourou (French Guyana). Further information may be found on the website devoted to the 50th birthday of this research department (http://www.efpa.inra.fr/Evenements/50-ans).

To celebrate this event and this long-lasting history, *Annals of Forest Science* publishes a series of sponsored review papers written by prominent scientists in the fields of tree biology, forest ecology, and forest products including goods and services. They were asked to provide their personal view on the developments of their research areas and a comprehensive analysis of the challenges ahead in their field.

Indeed, during the last 50 years, our perception of forests and forest sciences has largely changed. One example of such a striking change was the emergence of long-term growth and yield studies revealing the multifactorial causes for the increase of productivity of many forest stands across

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the world. In parallel, forest decline processes occurred locally, or sometimes at broader scales, induced by climatic extremes. Other changes include the increasing awareness among ecologists of the importance of historical (plurisecular) dynamics around forest and land use changes, with far-reaching consequences on the present forest biodiversity. The more recent gradual switch from the concept of "multifactorial management" towards that of "ecosystem services" is another example and launched a new area of research in economics and social sciences. Emergence of new scientific and technical tools led to a complete renewal of the approaches devoted to forest ecosystems and wood. Such tools include among others: modelling; genomics of trees, symbionts, and pathogens; stable isotopes under natural abundance or used in labeling approaches; remote sensing and new imaging tools; large-scale ecological databases; monitoring of CO_2, water use, and greenhouse gas fluxes in forest ecosystems; new tools for xylometry and wood structure analyses; and many other innovations in biology and ecology.

The last decades have seen our industrial world ever more focused on reducing its impacts on the environment as it increased its intensity of resource and energy use. As a global consequence of economic development, climate change and its impact on ecosystems have also turned into central issues for research and policy. Research fostered on these new societal questions has in turn provided new insights into the complexity of forest ecosystems and produced new paradigms. As now recognized, forest-based bio-resources have a significant advantage over non-renewable materials that require a larger amount of fossil fuel energy to manufacture and should play a significant role in the avoidance of carbon emission.

Forest and wood sciences are therefore increasingly important for providing both basic new disciplinary knowledge and trans-disciplinary scientific studies defined by using collaborative bottom-up approaches involving professionals from the modern forestry arena.

This increasing importance is illustrated by a recent bibliometric analysis carried out by INRA on the forestry papers published over a decade between 2002 and 2011. This study established that (i) the number of papers published has doubled over this period, (ii) these papers have been published in 4733 different journals, and (iii) the proportion of these forestry papers is about 1 % of the total scientific production identified in the WOS. Most (around 80 %) of them were published in generalist journals dealing with ecology, plant biology, molecular biology, genetics, evolution, etc. showing that forest ecosystems and wood resources are a matter of highly relevant questions as research objects for these disciplines. This is a clear demonstration of the vitality, the diversity, and the relevance of the research and the production from forest and wood research across the world. The present issue of *Annals of Forest Science* together with the reviews that will be published in future issues reflects this large variety of scales and disciplines mobilized around fundamental questions addressed in these fields.

The first review addresses an old issue, namely that of the phenology of trees, i.e., it basically uses data about bud break in the spring, leaf shedding during fall. The novelty stems from the long-lasting time series and remote sensing techniques used to trace the actual duration of the growth season in deciduous trees. As a main result, the duration of the growth season has considerably increased under temperate latitudes, but we still lack data about the phenology of roots and organs other than leaves to develop a comprehensive model predicting the impact of climate change on the potential productivity of forests (Delpierre et al., 2016). The dynamics of tropical rainforests and their contribution to the global carbon cycle are much better known than a few years ago. Due to high-frequency monitoring with a network of "flux towers," we now know that they are prone to drought and may sometimes suffer severe water deficits that impair growth and carbon storage (Bonal et al. 2015); these forests, which build up large C reservoirs, may temporarily become C sources under extreme climate events. These two reviews provide an original view of the response of forest ecosystems to the ongoing climate changes.

Climate and global changes do not only impact trees but also have consequences for their pathogens and consequently their health; these changes can only be fully understood in an evolutionary ecology perspective, with five key topics: (1) evolutionary diversity of pathogens, (2) adaptation of pathogens to new hosts, (3) breeding for tree resistance, (4) hyperparasitism as a tool for disease management, and (5) the tree microbiota as a factor of resistance to pathogens (Desprez-Loustau et al. 2016). A similar approach based on evolution concepts underpins the current advances in tree genetics; the most important paradigm change in this area is the growing awareness that intra-specific genetic diversity in tree species and local populations is quite large and that this important diversity may be of utmost importance in natural or human-driven adaptation of tree populations and forests to climate change (Scotti et al. 2016). Moreover, some of the understanding of the genetic diversity stemmed from developing large-scale genomics approaches, able to decipher the genome of individuals at an unprecedented rate and provide tools to quantify the degree of diversity within and among species (Plomion et al. 2016). This holds true also for fungi and other pathogens or symbionts and helps draw a phylogenetic perspective about some important fungal functions or some emblematic species of mycorrhizal fungi like the mythic Black Truffle whose life cycle still remains to be fully understood (Le Tacon et al. 2016). Tree genomics has also led to the identification of genes with unknown functions; the use of recombinant protein technologies together with the identification of 3D structures has contributed to the understanding of key biological processes like redox regulation in response to

development processes as well as to environmental constraints in trees (Jacquot et al., 2016). Incidentally in trees as in herbaceous plants, redox reactions control the rates of photosynthesis and hence plant yield. Additionally, the thioredoxin- and glutaredoxin-linked reactions lead to the detoxification of oxygen- and nitrogen-reactive species. They play also essential roles in enzyme protection via glutathionylation and in iron sulfur center assembly into apoproteins. As far as redox regulation is concerned, the physiology of mosses remains poorly understood, but they are an excellent model for development and *Physcomitrella patens* is a system where gene replacement is as easy as in yeast. The use of this moss as a model system may thus help improve our understanding of highly relevant biological processes including biotic and abiotic stress tolerance (Müller et al, 2016).

Another important field for recent developments lies in wood sciences. Wood is the oldest provider of energy and a very useful raw material; it is also increasingly recognized as an essential source for bio-sourced industrial chemicals. Wood structure is rather well known through numerous anatomy studies with a large variety of imaging tools, but the relationship between anatomy and structure vs. mechanical properties remains poorly understood; Perré et al. (2016) present the most recent scientific approaches that allow to model the macroscopic wood properties (thermal conductivity, mass diffusivity, and mechanical behavior) from the knowledge of the wood anatomical structure. Wood processing and machining are important steps in the valorization of this complex product; the review by Thibaut et al. (2016) depicts the main wood machining research carried out in the last decades on the interactions between cutting tools and the wood structure for the different modes occurring in woodcutting. This review covers the contexts of primary conversion (sawmilling, veneer cutting, or green wood chipping) and of secondary processing including the optimization of wood cutting, for improving surface properties necessary for coating. Finally, the review by Pizzi depicts the context of green chemistry for numerous industrial products. It covers the field of elimination of aldehydes from the wood panel adhesives, the green adhesives, and the wood tannin conversion in new bio-based materials such as foams and bio-based plastics (Pizzi 2016).

And more is to come in next issues. We do hope this series of review papers provides an insight into the large-scale changes underwent by forest and wood sciences over the last decades, and of the wealth of open questions we still need to solve given the importance played by forests in the biosphere, and for a sustainable development of green bio-economy.

References

Aussenac G (2002) From the "Annales de l'École Nationale des Eaux et Forêts" to the "Annals of Forest Science", eighty years of forestry science publications in France. Ann For Sci 59:789–793

Bonal D, Burban B, Stahl C, Wagner F, Hérault B (2015) The response of tropical rainforests to drought—lessons from recent research and future prospects. Ann For Sci: 1-18. doi:10.1007/s13595-015-0522-5

Delpierre N, Vitasse Y, Chuine I, Guillemot J, Bazot S, Rutishauser T, Rathgeber CK. (2016) Temperate and boreal forest tree phenology: from organ-scale processes to terrestrial ecosystem models. Ann For Sci: 1-21. doi:10.1007/s13595-015-0477-6

Desprez-Loustau M-L, Aguayo J, Dutech C, Hayden K, Husson C, Jakushkin B, Marçais B, Piou D, Robin C, Vacher C (2016) An evolutionary ecology perspective to address forest pathology challenges of today and tomorrow. Ann For Sci: 1-23. doi:10.1007/s13595-015-0487-4

Jacquot J-P, Couturier J, Didierjean C, Gelhaye E, Morel-Rouhier M, Hecker A, Plomion C, Gütle D, Rouhier N (2016) Structural and functional characterization of tree proteins involved in redox regulation: a new frontier in forest science. Ann For Sci: 1-16. doi:10.1007/s13595-014-0442-9

Le Tacon F, Rubini A, Murat C, Riccioni C, Robin C, Belfiori B, Zeller B, De la Varga H, Akroume E, Deveau A, Martin F, Paolocci F (2016) Certainties and uncertainties about the life cycle of the Périgord black truffle (*Tuber melanosporum* Vittad.). Ann For Sci: 1-13. doi:10.1007/s13595-015-0461-1

Müller S, Gütle D, Jacquot J-P, Reski R (2016) Can mosses serve as model organisms for forest research? Ann For Sci: 1-12. doi:10.1007/s13595-015-0468-7

Pizzi A (2016) Wood products and green chemistry. Ann For Sci: 1-19. doi:10.1007/s13595-014-0448-3

Perré P, Almeida G, Ayouz M, Frank X (2016) New modelling approaches to predict wood properties from its cellular structure: image-based representation and meshless methods. Ann For Sci pp 1–16. doi:10.1007/s13595-015-0519-0

Plomion C, Bastien C, Bogeat-Triboulot M-B, Bouffier L, Déjardin A, Duplessis S, Fady B, Heuertz M, Le Gac A-L, Le Provost G, Legué V, Lelu-Walter M-A, Leplé J-C, Maury S, Morel A, Oddou-Muratorio S, Pilate G, Sanchez L, Scotti I, Scotti-Saintagne C, Segura V, Trontin J-F, Vacher C (2016) Forest tree genomics: 10 achievements from the past 10 years and future prospects. Ann For Sci: 1-27. doi:10.1007/s13595-015-0488-3

Scotti I, González-Martínez S, Budde K, Lalagüe H (2016) Fifty years of genetic studies: what to make of the large amounts of variation found within populations? Ann For Sci: 1-7. doi:10.1007/s13595-015-0471-z

Thibaut B, Denaud L, Collet R, Marchal R, Beauchêne J, Mothe F, Méausoone P-J, Martin P, Larricq P, Eyma F (2016) Wood machining with a focus on French research in the last 50 years. Ann For Sci: 1-22. doi:10.1007/s13595-015-0460-2