

## BOOK REVIEW

### **Climate change, air pollution and global challenges. Understanding and perspectives from forest research**

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The current public debate on changes in the global biosphere including climate change is much focused on CO<sub>2</sub> in the atmosphere. As far as forests are involved the trees are considered with respect to their role as carbon stores and sinks. With this bias the sociopolitical view is superficial only seeing the tips of the icebergs. The present book is a breakthrough for a deeper and much more balanced understanding by considering complex interactions in detailed multi-component and multi-factor networks.

One chapter (#26) presents a broad review of general implications of changes and challenges of land-use and underlines the primary role of forests. This is the theme of this book as forests globally cover  $4 \times 10^9$  ha, i.e. 27% of the global land surface, with an annual destruction of  $13 \times 10^6$  ha vis à vis an afforestation and reforestation of  $7.8 \times 10^6$  ha, where destruction contributes 12–15% of the annual global C-emissions. Space does not allow an individual appraisal of the 27 chapters authored by 97 contributors. We may have a look at the different parts the book is organized in, mention the pertinent chapters with their numbers (#) and wind up presenting a brief list of the major themes emerging for further considerations.

Part I (# 1) is an Introduction and Part VIII (# 27) presents conclusions. Part II addresses trace gases (# 2), the major ones carbon dioxide (CO<sub>2</sub>) and ozone (O<sub>3</sub>), and in addition methane, carbon monoxide, nitrogen compounds, biogenic volatile organic compounds (BVOCs, # 4). It is demonstrated that it is by far not enough to look at CO<sub>2</sub> alone. This is particularly due to the very strong interactions between CO<sub>2</sub> and O<sub>3</sub> (# 6, # 9, # 10, # 12 to 15). The role of the nitrogen cycle (# 3) is underlined as well as the interaction of O<sub>3</sub> with other gaseous pollutants, because O<sub>3</sub> is a secondary pollutant generated by chemical processing of gases such as CO, CH<sub>4</sub> and VOCs. The role of fires contributing to trace gas pollution is worked out (# 21). Parts III and VI address complexes of forest stands and forest ecosystems. A strong focus is on the pedosphere and soil (# 7) so often overlooked in the general public debate. This is an essential aspect. Globally the carbon pool of soils is 1,500 Gt, about twice the size of that in the air. In the vegetation above soil there is only a bit more than a third of the global C (560 Gt). Soil respiration is 70–80% of the terrestrial respiration and the flux of C in the soils is 25–65% of total primary production. Pedosphere considerations involve mycorrhiza (# 8) and invertebrates in the soil. An important role above ground is played by arthropods (# 11). To work out a balanced risk assessment Part IV presents the delicate network of the interwoven scientific results obtained at various levels including the biochemical and metabolic level (# 13). Forest stands (# 12) and the CO<sub>2</sub>/O<sub>3</sub> interactions (# 9, # 10, # 13 to 15, # 23, # 24) are dominant players here. The close interaction of air pollution and climate change is a topic followed throughout the book, but various global regions are covered in detail in Part V, namely United States of America (# 16), East and South East Asia (# 17), India (# 18), Latin America (# 19) and Southern Africa (# 20), and Northern European forests are considered in a separate chapter earlier (# 5, Part II).

Overall a rich knowledge on a plethora of themes regarding global challenges of forest ecosystems is presented in the book. I think moving beyond that one can extract some major themes whose comprehensive treatment in the book provides new impact for the general public discussion so far seeing only tips of icebergs:

- dramatic challenges of land-use and the role of forests,
- intimate interactions of pollution and climate change,
- the outstanding role of the pedosphere,

- interactions of pollutants such as  $\text{CO}_2/\text{O}_3$ ,  $\text{CO}_2/\text{N}$  cycle,  $\text{O}_3/\text{CO-CH}_4\text{-VOC}$  and the vicious cycles involved, where management of the demands of an exponentially growing human population requires intensification of agriculture and silviculture and this at the same time increases production of pollutants.

Part VII addresses socioeconomic aspects (# 24) and the values of ecological services provided by forests (# 25). We can never override the fact that it is the very nature of nature, in which the species *Homo sapiens* is embedded, that precise predictions are impossible. Scientific theory itself, for example the theory of deterministic chaos, definitely excludes this. This is one side of the coin. Socioeconomic politics dwell on this when they dangerously use the differentiated views of scientists and the uncertainties of results of experimental manipulations and observations of monitoring, as they are also seen in this book, as an excuse for refusing action as we currently witness it with all the halfhearted and insufficient reactions to the tips of the icebergs. The other side of the coin is that the gift of science is enabling us to assess effects of experimental approaches, to monitor developments (# 22), to model consequences and to check the if-this-is-so then that-shall-be-so scenarios by computer simulation. It is irresponsible not to seriously accept the warnings coming up with that. Even though details may remain fuzzy, systems theory teaches that if individual factors largely run out of control stability is lost with an outcome of which ever and we cannot have homeostasis of the world we are living in. In this vein the present book is invaluable and indispensable for all who wish to take part in the discussion on an informed level and especially for those who are in a position where they need to make sociopolitical decisions including the support of more and better research, measures suitable to control if not even reverse pollution, control of land-use and generally actions accepting the dramatic warnings inherent in the scientific observations.

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