



# **Climate Change, Air Pollution and Global Challenges: Chapter 15. Metabolomics and Transcriptomics Increase Our Understanding About Defence Responses and ... (Developments in Environmental Science)**

*Elina Oksanen, Sarita Keski-Saari, Sari Kontunen-Soppela, Markku Keinänen*

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In this chapter, we present information about metabolomic, transcriptomic and ecophysiological responses of birch (*Betula pendula*, *Betula papyrifera*) and aspen (*Populus tremula*, *Populus tremula*×*Populus tremuloides*, *Populus nigra*) species to increasing ozone, CO<sub>2</sub> and/or climate warming collected from several long-term field experiments and complementary laboratory studies. Metabolomic and genetic analyses have indicated several changes in metabolites (phenolic and volatile organic compounds in particular), defence reactions and target pathways for ozone and CO<sub>2</sub> action, and a strong impact of climate warming on metabolism of these tree species. We have been searching for metabolic and genetic indicators for ozone tolerance/sensitivity of birch and aspen and connections between gene expression, metabolite and physiological response. In the end, we discuss the limitations, challenges and current needs for methodological developments particularly in metabolomic techniques leading to more efficient tools in climate change research.

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