

Air pollution monitoring and tree and forest decline in East Asia: A review

ABSTRACT

Air pollution and atmospheric deposition have adverse effects on tree and forest health. We reviewed studies on tree and forest decline in Northeast and Southeast Asia, Siberia, and the Russian Far East (hereafter referred to as East Asia). This included studies published in domestic journals and languages. We identified information about the locations, causes, periods, and tree species exhibiting decline. Past air pollution was also reviewed. Most East Asian countries show declining trends in SO₂ concentration in recent years, although Mongolia and Russia show increasing trends. Ozone (O₃) concentrations are stable or gradually increasing in the East Asia region, with high maxima. Wet nitrogen (N) deposition was high in China and tropical countries, but low in Russia. The decline of trees and forests primarily occurred in the mid-latitudes of Japan, Korea, China, and Russia. Long-term large N deposition resulted in the N saturation phenomenon in Japan and China, but no clear forest health response was observed. Thereafter, forest decline symptoms, suspected to be caused by O₃, were observed in Japan and China. In East Russia, tree decline occurred around industrial centers in Siberia. Haze events have been increasing in tropical and boreal forests, and particulate matter inhibits photosynthesis. In recent years, chronically high O₃ concentrations, in conjunction with climate change, are likely have adverse effects on tree physiology. The effects of air pollution and related factors on tree decline are summarized. Recently, the effects of air pollution on tree decline have not been apparent under the changing climate, however, monitoring air pollution is indispensable for identifying the cause of tree decline. Further economic growth is projected in Southeast Asia and therefore, the monitoring network should be expanded to tropical and boreal forest zones. Countermeasures such as restoring urban trees and rural forests are important for ensuring future ecosystem services.

Keyword: Acid rain;. Forest health; Forest monitoring; Nitrogen depositions; Ozone; Sulfur dioxides