



Tree species and recovery time drives soil restoration after mining: A chronosequence study

Lingling Shi (1,2), Jianchu Xu (1), and Ostermann Anne (1)

(1) Key Laboratory of Plant Diversity and Biogeography of East Asia, Kunming Institute of Botany, Chinese Academy of Sciences, (2) Department of Agricultural Soil Science, University of Göttingen

Open-pit mining activities for metals and minerals have impacted vast areas of the Earth's surface and left behind highly disturbed and degraded landscapes. However, our understanding of tree species and recovery time on the restoration of biotic and abiotic soil properties remain incomplete. Topsoil (0–15 cm) was collected from plantations of four tree species: alder, acacia, pine, and cypress. A chronosequence of restoration was selected to assess the effect of recovery time: vegetation-free post mining land (unrestored control), 5–10 years (young plantation), and 20–25 years (old plantation). The soil physicochemical characteristics and phospholipid fatty acids were analyzed. After 20 years of restoration, the soil organic carbon (SOC) concentration increased, on average, from 1.4% to 4.7% for alder, cypress, and acacia. However, SOC was similar under pine plantations in unrestored control and at the late stage of restoration. The restoration of soil total nitrogen was faster than the SOC pools for all tree species investigated. Compared with the unrestored control, the total microbial biomass increased by 74% after 20–25 years of restoration. A similar increase was observed for bacterial biomass. The studied sites partly exhibited residues of trace elements that exceeded Chinese environmental quality standards (Cd, As, Cu, and Cr). However, only Cu affected the soil community; arbuscular mycorrhizal biomass decreased with an increase in Cu concentration. In conclusion, the recovery time, rather than the tree species, was the main determinant in the alteration of key soil physicochemical parameters in the restoration of phosphate-mining degraded landscapes, at least during the first 20–25 years.