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Biomonitoring of atmospheric deposition from petrochemical industry in Thailand by the lichen *Parmotrema tinctorum* (Despr. ex Nyl.) Hale

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This research observed the effects of atmospheric deposition at Map Ta Phut, the largest petrochemical complex in Thailand, on the transplanted lichen *Parmotrema tinctorum* (Despr. ex Nyl.) Hale. The study could provide a precautionary measure for sustainable development. Lichen thalli from a relatively unpolluted area were transplanted to six industrial sites, one rural site and one unpolluted site. Concentrations of NO_3^-, SO_4^{2-}, Cu, Ni, Sb, V and Zn accumulated in the transplanted lichens were used to calculate pollution load indexes (PLIs). It was found that NO_3^- and Sb were the most prominent contaminants accumulated in the lichens at most industrial sites. Their concentrations were 2–4 times higher than those at the unpolluted site. The PLIs from the industrial sites were 1.3–2.2 and from the rural site were 1.1 times higher than the unpolluted sites. A chlorophyll fluorescence parameter Fv/Fm, the indicator of environmental stress, suggested that the areas within the vicinities of 3 km from the main industrial area were affected by air pollution. This study reaffirms the efficiency of this lichen as a bioindicator of air pollution, that need to be considered at an early stage as it could lead consequent impacts on sustainable development.

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Conservation of pyrenocarpous lichens in Finland

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Research among lichen conservation, ecology and distribution has traditionally concentrated on Lecanoromycetes, which includes the majority of the currently known lichens. Pyrenocarpous lichens, i.e. species characterized by perithecioid ascoma and mostly belonging to Eurotiomycetes, have been less studied owing to their small size and poorly known taxonomy. We examined the distribution, ecology and conservation needs of pyrenocarpous lichens on a national scale in Finland by field sampling and using herbarium specimens. DNA barcodes of ITS regions were used in identification of species. The key findings are: 1) Number of species is almost 3-fold than previously known including many undescribed species, 2) The proportion of pyrenocarpous species is much higher among epilithic than among epiphytic species, 3) Many species are extremely rare and have tiny population sizes, 4) Most species occur exclusively on calcareous rocks, aquatic siliceous rocks or on trees growing on shores. We conclude that pyrenocarpous lichens depend on effective habitat conservation; particularly protection of calcareous rocks and forests affected by flooding should be emphasized. Pyrenocarpous lichens have apparently effective dispersal ability and are capable of long-distance dispersal. ITS sequencing is important in species identification and the technique needs to be improved to avoid excessive destructive sampling.

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Impacts of biofuel harvest, retention forestry and prescribed burning on epiphytic lichens in boreal pine-dominated forests

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In the boreal region, intensive forestry has caused endangerment of various forest-dwelling species, including epiphytic lichens. Currently harvest of stumps and logging residues for biofuel intensifies forest use even further. However, certain management methods, such as retention forestry, are also used to counter the negative impacts of forestry. The combined effects of these practices on forest-dwelling lichens are still poorly known. We examined, for the first time, the impacts of retention forestry and prescribed burning as well as the potential influence of biofuel harvest on epiphytic lichens in pine-dominated boreal forests. The data were collected in eastern Finland, from 24 sites treated experimentally with a combination of retention-cutting and prescribed burning. Retained Scots pines, their dead wood legacies and Scots pine stumps all hosted rich lichen assemblages, including Red-Listed species and dead wood specialists. Thus, large-scale stump harvest could be a significant threat to epiphytic lichens, particularly wood-dwelling species. Retention forestry, on the other hand, has a potential to sustain lichen richness in the harvested stands. Prescribed burning decreased lichen richness at stand scale, but as it also created diverse woody habitats, it could enhance the richness on landscape scale – provided that species-rich stands are left outside burning.