9th ICP Forest Scientific Conference

Trees indicator as air pollution and climate change effects in Ulaanbaatar city, Mongolia

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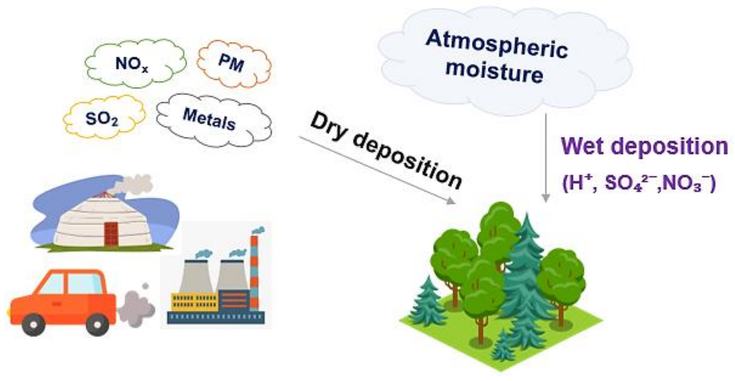
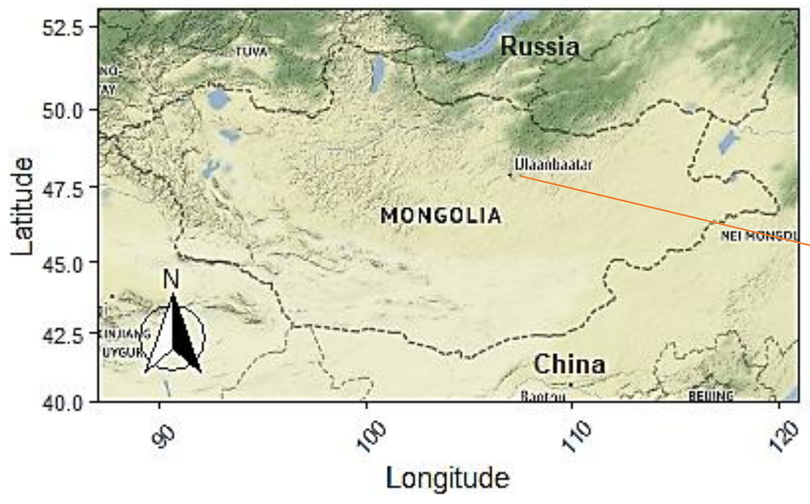
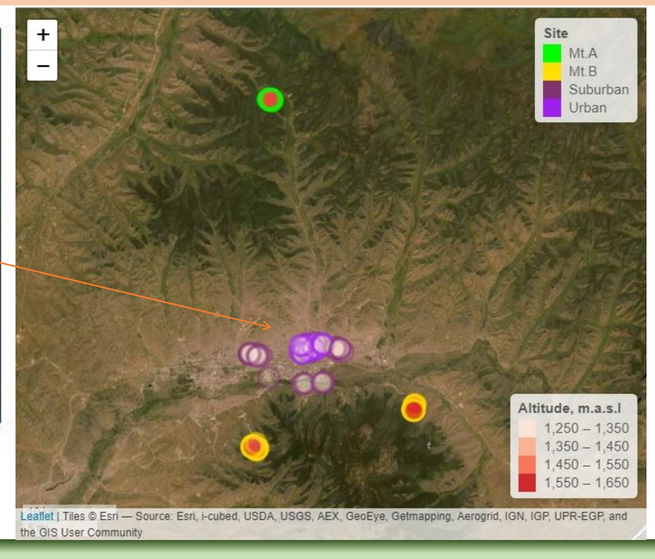
INTRODUCTION



Aim: to assess the effects of air pollution and climate change on urban trees

STUDY AREA





MATERIALS and METHODS

① Tree leaf and needle from 2 mountain and 2 city sites

~ 10 g of fresh samples → drying →  Homogenized by Ball-mill "Retsch mm400" → chemical analysis

① Stable isotope analysis:
$\delta^{13}C$, $\delta^{15}N$, $\delta^{2}H$, and $\delta^{18}O$
conducted by EA- or TC/EA-IRMS

② Elemental analysis:
Cd, Cr, Ni, Zn, P and S etc conducted by ICP-OES

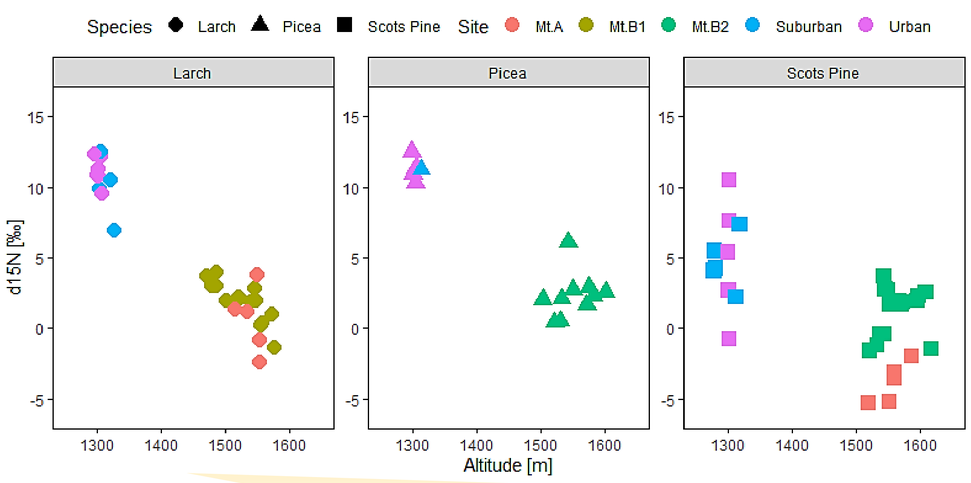
② Tree core

By increment borer with the internal diameter of 5.15 mm → preparation →  Cutting with core-microtome and using a sand-paper → measurements

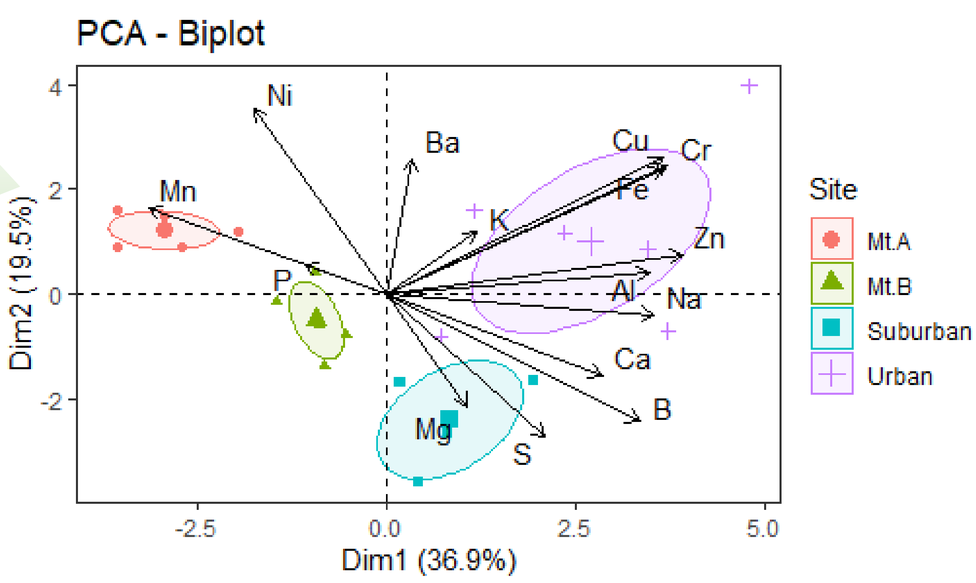
① Scanning with Atrics: High resolution images of scanned tree cores
② WinDendro software: Tree age and Tree ring width (TRW)
③ TSAP-Win software: Crossdating

RESULT and DISCUSSION

❶ $\delta^{15}N$ isotope analysis in tree needle

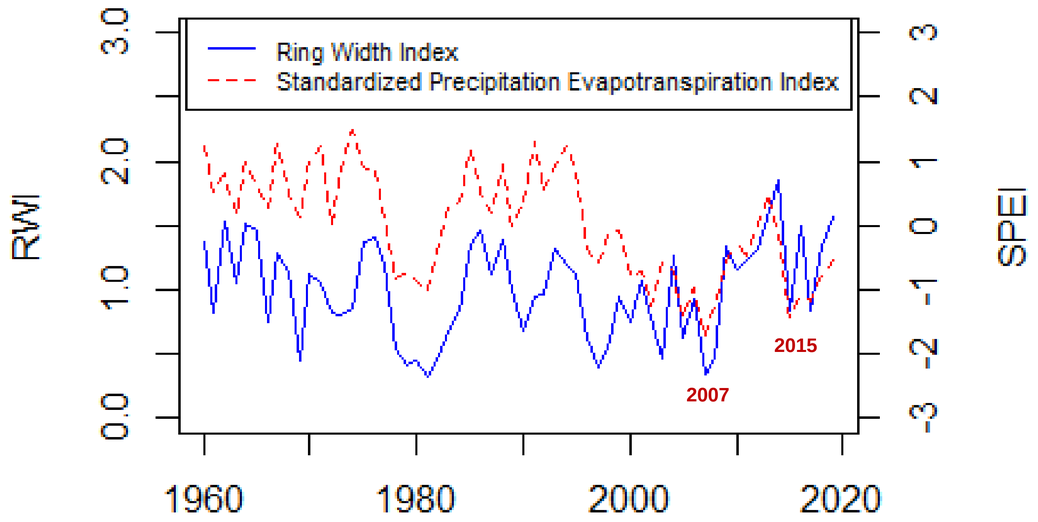


PCA of chemical elements of needles:
higher values of all elements (except Mn) at urban and suburban more than two mountain sites.



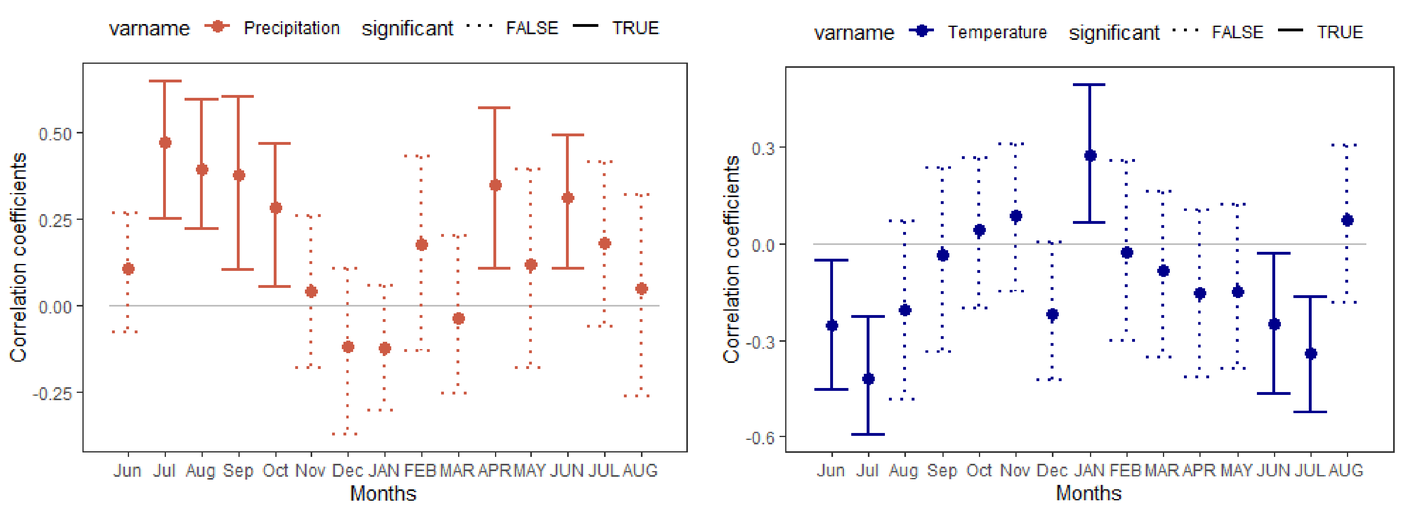
$\delta^{15}N$ values in conifers were higher at the **two urban sites (0 to 15‰)** compared to the **two mountain sites (-5‰ to 5‰)** indicating that urban trees are threatened by air pollution.

❸ Tree-ring chronology of *L. Sibirica* at site Mt.B



As result of RWI and SPEI comparisons between 1960 and 2020 shows the increasing trend in the frequency and severity of drought since the late 1990s.

❹ Tree growth and climate relationships (*L. Sibirica* at site Mt.B)



Tree ring width shows significant correlation with precipitation during growing season.

Cooler temperatures during early summer in previous and current year are significantly correlated with tree growth. And it was strongly influenced by the amount of precipitation during vegetation periods in previous and current years.

CONCLUSION

The study showed that tree needles in urban and suburban areas can accumulate on their surface various elements including B, Cu, Cr, Fe, S and Zn. It is concluded that nitrogen stable isotope and chemical composition of tree needle can serve as a good indicator of atmospheric pollution. Since the late 1990s, the changes in MAT and MAP lead to intensified droughts nearby Ulaanbaatar city.

ACKNOWLEDGEMENT

The research has been initiated through collaboration of ICP Forests and EANET and funded by the Swiss Government Excellence Scholarships.