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Monitoring of the most industrialized regions in Poland :The climate–radial growth, climate– δ13C and δ18O relationships of Scots pine in the Silesia region

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Scots pine growing in 16 sites in three industrial regions in Poland: Dąbrowa Górnicza, Kedzierzyn- Koźle and Łaziska Górne (Sensuła et al., 2015, 2016; Sensuła and Wilczyński 2017). The sampling sites were located at different distances from industrial factories (between 1 and 20 km). The absolute dated annual tree rings were manually separated as thin slivers and then, pooled and homogenized. The α-cellulose samples were extracted (Sensuła et al., 2011; Sensuła and Pazdur 2013a,b, Sensuła and Wilczyński 2017)in Silesian University of Technology, Poland. The carbon and oxygen stable isotope compositions were measured by IRMS (Isoprime, GV Instruments) at Silesian University of Technology, Poland.
The climate–radial growth relationships were analyzed for the period 1951–2012, whereas the climate–stable isotopic relationships were analyzed for the period 1975–2012. A dendrochronological and mass spectrometric analysis revealed the following: dry and sunny previous September, low winter temperature, and moisture supply in July limit the radial growth of the pines in all the regions. The weather conditions of the current growing season have been the most strongly reflected in the isotopic ratio (positive relationship was noted between δ13C and temperature and sunshine relationships, whereas the negative relationship between δ13C and precipitation and humidity. Whereas, a positive relationship was noted between δ18O and temperature, and negative between δ18O and humidity. Climate signal recorded in stable isotope composition was temporally unstable and only for a few of the climatic parameters we found temporally stable climate signals, however, the variability in the strength and direction of the relationship between variables has been observed. In general, the weather in July and August is important for determining the δ13C and δ18O signals. The instability can reflect the physiological adaptation of the plants to changes in the ecosystem.

References:
Sensuła BM, Pazdur A and Marais MF, 2011. First application of mass spectrometry and gas chromatography in investigation of α-cellulose hydrolysates:the influence of climate changes on glucose molecules in pine tree-rings. Rapid Communications in Mass Spectrometry 25, 4, 489-494.
Sensuła B and Pazdur A, 2013a. Influence of climate change on carbon and oxygen isotope fractionation factors between glucose and α-cellulose of pine wood. Geochronometria 40, 2, 145-152.
Sensuła B and Pazdur A, 2013b. Stable carbon isotopes of glucose received from pine tree-rings as bioindicators of local industrial emission of CO_2 in Niepołomice Forest, 1950–2000. Isotopes Environ. Health Stud. 49, 4, 532-541.
Sensuła B, Opała M, Wilczyński S and Pawełczyk S, 2015. Long-and short-term incremental response of Pinus sylvestris L. from industrial area nearby steelworks in Silesian Upland, Poland. Dendrochronologia 36, 1-12.
Sensuła B, Wilczyński S and Piotrowska N, 2016. Zastosowanie metod dendrochronologicznych oraz spektrometrycznych w monitorowaniu drzewostanów sosnowych na obszarach przemysłowych. Sylvan, 9 : 730-740.
Sensuła B and Wilczyński S, 2017. Climatic signals in tree-ring width and stable isotopes composition of Pinus sylvestris L.growing in the industrialized area nearby Kędzierzyn-Koźle , Geochronometria, DOI 10.1515/geochr-2015-0070

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