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# Early and late seasonal carbon sequestration and allocation in larch trees growing on permafrost in Central Siberia

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Despite large geographic extent of deciduous conifer species Larix gmelinii, its seasonal photosynthetic activity and translocation of photoassimilated carbon within a tree remain poorly studied. To get better insight into productivity of larch trees growing on permafrost soils in Siberian larch biome we aimed to analyze dynamics of foliage parameters (i.e. leaf area, biomass, %N, %P etc.), seasonal dynamics of photosynthetic activity and apply whole tree labeling by $13CO_2$, which is powerful and effective tool for tracing newly developed assimilates translocation to tissues and organs of a tree (Kagawa et al., 2006; Keel et al., 2012).
Experimental plot has been established in mature 105 year-old larch stand located within the continuous permafrost area near Tura settlement (Central Siberia, 64o17'13" N, 100o11'55" E, 148 m a.s.l.). Trees selected for experiments represented mean tree of the stand. Measurements of seasonal photosynthetic activity and foliar biomass sampling were arranged from early growing season (June 8, 2013) until yellowing and senescence of needles on September 17, 2013. Labeling by 13C in whole tree chamber was conducted by three pulses ($[CO_2]max \leq$ 2,500 ppmv, $13CO_2$ (30% v/v)) at the early (June) and late (August) phase of growing season for different trees in 3 replicates each time.
Both early season and late season labeling experiments demonstrated high rate of $13CO_2$ assimilation and respective enrichment of needle tissues by 13C: $\delta$13C increased from -28.7 up to +670‰ just after labeling. However, there was distinct post-labeling dynamics of needle $\delta$13C among two seasonal experiments. At the early season 13C depletion in labeled needles was slower, and $\delta$13C approached after 40 days ca. +110 ‰ and remained constant till senescence. In the late season (August) needles were losing labeled C with much faster rate and approached only +1.5 ‰ upon senescence (28 days exposition). These findings suggest that in early season ca. 20% of assimilated C was used for needle structures development. In opposite, in late season the 13C label having fewer fixation in needle was translocated to other tissues/organs (i.e. label appearing in twigs, phloem and accumulating in fine roots). Different 13C translocation rate in early and late season shows the importance of needle phenology as well as differences in dominant physiological processes among seasons. The research is supported by RFBR grant 13-04-00659a.