Figure S1. Temporal variations of raw data in (a) the foliar $\delta^{13}$C and (b) C/N of nine trees in the typical forest during 1999–2019. The four trees LL23, LL24, LLR2, and LLR3 were continuously sampled from 1999 to 2011, and the tree R04 was sampled during 2008–2010, 2014, 2015, and 2017. The four trees S1, S2, S3, and S4 were sampled from 2013. The number of trees sampled for the foliar $\delta^{13}$C (a) every year was: $n = 0$ in 2012; $n = 4$ in 1999–2007, 2011, and 2015; $n = 5$ in 2008–2010 and 2016; $n = 6$ in 2013, 2018, and 2019; $n = 7$ in 2017; $n = 8$ in 2014. The number of trees sampled for the foliar C/N (b) every year was: $n = 0$ in 2012 and 2015; $n = 4$ in 1999–2007, 2011, 2013, 2014, and 2016–2017; $n = 5$ in 2008–2010; $n = 6$ in 2018 and 2019. From each tree, four branches were taken, and leaves were mixed well before the analyses. All data obtained in each year were averaged to build a successive temporal variation in the foliar $\delta^{13}$C and C/N (Fig. 3d and 3f).
Figure S2. Temporal variations in raw data of (a) the foliar $\delta^{15}$N of the same trees as in Fig. S2, and (b) the method of calculation to obtain successive temporal variation in the foliar $\delta^{15}$N. The $\delta^{15}$N value differs from tree to tree because of differences in the nitrogen sources of the tree. To obtain continuous temporal variation, first, the average values from LL23, LL24, LLR2, and LLR3 during 1999–2011 ($\delta^{15}$N$_{aver,1}$) and S1–S4 during 2013–2019 ($\delta^{15}$N$_{aver,2}$) were calculated, and, second, the differences between the averages and LLR3 ($\Delta_1$ and $\Delta_2$, respectively) were obtained. Then, the continuous average value was calculated by adding $\Delta_1$ and $\Delta_2$ to $\delta^{15}$N$_{aver,2}$ (Fig. 3c).
Figure S3. Daily variation in soil moisture water equivalent (SWE, mm), including ice from the surface of the mineral soil layer to 60 cm during May to September from 1998 to 2019. Cumulative SWE from a depth of 60 cm to 30 cm, 30 to 15 cm, and 15 to 0 cm are shown in the figure. Black dotted, dashed, and solid lines show continuous daily data, and open circle, triangle, and square shown in 2001 and 2004 represent one-day data (manually observed data). The filled circle, triangle, and square with an arrow in the left side of each figure represent SWE in the previous September (before the freeze). The SWE was calculated with the same or similar methods as described by Sugimoto et al. (2003), that is, from volumetric soil water content (VSWC, m3/m3) observed using time-domain reflectometry (TDR) by multiplying with layer thickness (mm). The SWE was estimated from regression relationships of TDR measurements between manual (Moisture Point, Environmental Sensors Inc., Canada) and automatic observations. Three automatic measurement systems were used in different years: TRIME IMKO P2 sensors (IMKO Micromodultechnik GmbH, Germany) at 10, 20, and 40 cm depths during 1998, 1999, and 2002–2008; Decagon ECH2O sensors (Meter Environment, USA) at 7.5, 22.5, and 45 cm depths during 2009, 2012, 2013, and 2016–2019; Sentek EnviroSmart (Campbell Scientific Inc, Canada) at 10, 20, 30, 40, 50, and 60 cm depths during 2010, 2014, and 2015. For 2001, SWE observed using Moisture Point is shown. Red lines show estimated values based on comparison with previously observed data.
Figure S3 (continued).
Figure S4. The relationships between the TF NDVI in the transect and ecological parameters: monthly average SWE (mm) in (a) July, (b) August, (c) previous June, (d) previous July, (e) averaged June, July, and August SWE, (f) previous year’s foliar δ¹³C (‰) during 2000–2019, (g) subsequent year’s RWI during 1999–2015. Green circles and blue triangles represent the data before (1999–2006) and after (2008–2019) the wet event and red square represents the data observed in 2007. Labels nearby the data points are observation years of NDVI. Horizontal and vertical error bars represent standard deviations. Green, dark green dotted, and blue solid lines show linear regressions for 1999–2006 (before the wet event), including 2007 (the wet event), and 2008–2019 (after the wet event). In Fig. S4 (e), the dark green dotted line represents the linear regression for 1999–2010. The p-values and $R^2$ describe the significance and the degree of variability of the regression, respectively.
Table S1. Seasonal maximum of NDVI (mean and standards deviation) observed for four forest types (TF, RF-1, RF-2, and DF) within the transect and 10-km plot during 1999–2019. NDVI was calculated from available Landsat 5 Thematic Mapper, Landsat 7 Enhanced Thematic Mapper Plus (ETM+), and Landsat 8 Operational Land Imager images. All the NDVI values from Landsat 5 and 8 were converted to Landsat 7 ETM+ using the methods given by Ju and Masek (2016) and Roi et al. (2016), respectively. The value of $n$ shows the number of quality plots among the 17 (TF), 11 (RF-1), 4 (RF-2), and 2 (DF) plots (total $n = 34$). The $n$ for the 10-km plot shows the percentage of quality pixels among 111,556 pixels.

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Table S2. Larch tree ring width index (RWI) of the typical forest during 1997-2019. By Tei et al. (2019b), the RWI values until 2016 were analyzed from more than fifty paired cores taken from healthy larch trees during the summers of 2011, 2013, and 2017, in the area within around 250-m radius around the flux tower.

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Table S3. The results of the Shapiro–Wilk test, a normality test, for seasonal maximum NDVI data in each forest type, are presented as the test statistic $W$ and its significance level $p$-value. The data distribution was normal at $p > 0.05$ and non-normal at $p < 0.05^*$ (shown in bold font). The dash “−” means no result because of either a small number of samples or no samples in a forest type ($n < 3$).

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Table S4. The results of the *F*-test, a test of equality of variances, for two normally distributed seasonal maximum NDVI datasets of two forest types (see Table S2), presented as the test statistic *F* and its significance level *p*-value. The variances of the two NDVI datasets were equal at *p* > 0.05 and unequal at *p* < 0.05* (shown in bold font). The dash “−” means no result because of a non-normally distributed NDVI dataset in at least one of the two forest types being compared.

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Table S5. Comparisons of seasonal maximum NDVI averaged for each forest type between two different forest types in the years from 1999 to 2019 using two parametric unpaired two-sample tests, such as classical Student’s equal variances t-test and Welch unequal variances t-test, and one non-parametric Wilcoxon rank-sum test. The results of these three tests are presented as their significance values ($p$-values) and test statistics ($t$, $t_w$, and $W$, respectively). Bold font indicates a significant difference flagged as ‘$p < 0.1$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$, and ns – not significant.

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Table S5 (continue)

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Table S6. Pearson correlation ($r$) between the TF NDVI and ecosystem (or climatic) parameters with 0-, 1-, and 2-year time lag of the TF NDVI before the wet event (1999–2006). Bold font indicates a significant correlation. Significance levels were flagged as $^*p < 0.1$, $^*^*p < 0.05$, $^*^*^*p < 0.01$, and $^*^*^*^*p < 0.001$. The number (n) indicates the sample size in the observed years.

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Table S7. Pearson correlation ($r$) between the TF NDVI and ecosystem (or climatic) parameters with 0-1- and 2-year time lag of the TF NDVI after the wet event (2008-2019). Bold font indicates a significant correlation. Significance levels were flagged as the following: $^\ast p < 0.1$, $^\ast\ast p < 0.05$, $^\ast\ast\ast p < 0.01$, and $^\ast\ast\ast\ast p < 0.001$. The number (n) indicates the sample size of observed years.

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13
Table S8. Pearson correlation ($r$) between the TF NDVI and ecosystem (or climatic) parameters with 0.1- and 2-year time lag of the TF NDVI for the observation period of the TF NDVI (1999-2019). Bold font indicates a significant correlation. Significance levels were flagged as the following: *$p < 0.1$, *$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$. The number (n) indicates the sample size of observed years.

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<td>mm</td>
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<td>0.903</td>
</tr>
<tr>
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<td>mm</td>
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<td>0.903</td>
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<td>Sep prec</td>
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<td>previous Oct - current Apr</td>
<td>mm</td>
<td>0.13</td>
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<td>May</td>
<td>ºC</td>
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</tr>
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<td>ºC</td>
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<td>0.229</td>
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<td>ºC</td>
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Table S9. Pearson correlation ($r$) between foliar $\delta^{13}$C and SWE in the surface layer of 0–60 cm with 0-, 1- and 2-year time lag of foliar $\delta^{13}$C for the three periods: 1999-2007, 2008-2019 and 1999-2019. Bold font indicates a significant correlation. Significance levels were shown as ‘$p < 0.1$, *$p < 0.05$, **$p < 0.01$, and ***$p < 0.001$. The number (n) indicates the sample size of observed years.

<table>
<thead>
<tr>
<th>Period</th>
<th>Soil moisture water equivalent in the current year (i year)</th>
<th>Foliar $\delta^{13}$C</th>
<th></th>
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<td></td>
<td></td>
<td>the current year (i year)</td>
<td>the following year (i+1 year)</td>
<td>two years later (i+2 year)</td>
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<td></td>
<td></td>
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<td>$r$</td>
<td>p-value</td>
<td>$n$</td>
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<td>1999-2007</td>
<td>June SWE</td>
<td>-0.63</td>
<td>0.093*</td>
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<td>0.042**</td>
<td>9</td>
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<td>2008-2019</td>
<td>June SWE</td>
<td>-0.74</td>
<td>0.009**</td>
<td>11</td>
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<td>-0.79</td>
<td>0.004**</td>
<td>11</td>
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<td>-0.70</td>
<td>0.016*</td>
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<td>0.002**</td>
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<td>&lt;0.001***</td>
<td>19</td>
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<td>July SWE</td>
<td>-0.74</td>
<td>&lt;0.001***</td>
<td>20</td>
<td>-0.32</td>
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<td>Aug SWE</td>
<td>-0.63</td>
<td>0.004**</td>
<td>19</td>
<td>-0.62</td>
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<td></td>
<td>summer SWE</td>
<td>-0.74</td>
<td>&lt;0.001***</td>
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<td>-0.27</td>
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Table S10. Pearson correlation ($r$) between foliar C/N and SWE in the surface layer of 0-60 cm with 0-, 1- and 2-year time lag of foliar C/N for the three periods, 1999-2006, 2008-2018 and 1999-2019. Bold font indicates a significant correlation. Significance levels were shown as ’p <0.1, *p <0.05. The sample size (n) indicates the number of observed years.

<table>
<thead>
<tr>
<th>Period</th>
<th>Soil moisture water equivalent in the current year (i year)</th>
<th>Foliar C/N</th>
</tr>
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<tr>
<td></td>
<td></td>
<td>the current year (i year)</td>
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<tr>
<td></td>
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<td>$r$</td>
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<td>1999-2006</td>
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