Input data:

1. $T = \{t_1, \dots, t_7\}$ — Set of trees.
2. $Y(t) = \{y_{t1}, \dots, y_{tn_t}\}$ — Set of years for which the measurements for the tree t are available, $t \in T$
3. $Y = \bigcup_{t \in T} Y(t)$ — Set of all years for which the measurements are available.
4. $T(y) = \{t_{y1}, \dots, t_{ym_y}\}$ — Set of trees for which the measurements for the year y are availvable, $y \in Y$

$$\left(T \equiv \bigcup_{y \in Y} T(y) \right)$$

5. $e^{raw} = e^{raw}(t, y) = \{e_1^{raw}, \dots, e_\varepsilon^{raw}\}$ — Raw tracheid data where:

$$e_k^{raw} = e_k^{raw}(t, y) \in \{d_k^{raw}, c_k^{raw}\}$$

$d_k^{raw} = d_k^{raw}(t, y)$ — Diameter of the k^{th} cell in a raw tracheid

$c_k^{raw} = c_k^{raw}(t, y)$ — Cell wall thickness of the k^{th} cell in a raw tracheid

$\varepsilon = \varepsilon(t, y)$ — Number of cells in $e^{raw}(t, y)$

$$k = \overline{1, \varepsilon}, t \in T, y \in Y(t)$$

6. N — Number of cells for tracheid normalization.

Normalization procedure description:

For each e^{raw} an intermediate sequence is constructed:

$$e^* = \{\underbrace{e_1^{raw}, \dots, e_1^{raw}}_{N}, \underbrace{e_2^{raw}, \dots, e_2^{raw}}_{N}, \dots, \underbrace{e_\varepsilon^{raw}, \dots, e_\varepsilon^{raw}}_{N}\}$$

And tracheid data $e = \{e_1, \dots, e_N\}$ normalized to N cells are obtained:

$$e_i = \frac{1}{\varepsilon} \sum_{j = \varepsilon \cdot (i-1) + 1}^{\varepsilon \cdot i} e_j^*, i = \overline{1, N}$$

Using this procedure the following was obtained:

$d = \{d_1, \dots, d_N\}$ — data on the tracheid cell diameters normalized to N cells

$c = \{c_1, \dots, c_N\}$ — data on the tracheid cell wall thicknesses normalized to N cells

Normalized tracheid description:

$R(t, y) = d \cup c = \{d_1, \dots, d_N, c_1, \dots, c_N\}$ — Tracheid normalized to N cells. Where:

$d_i = d_i(t, y)$ — Diameter of the i^{th} cell in a normalized tracheid

$c_i = c_i(t, y)$ — Cell wall thickness of the i^{th} cell in a normalized tracheid

$$i = \overline{1, N}, t \in T, y \in Y(t)$$

Description of the methods for forming objects for clustering:

Method A:

$$R^A(y) = \frac{1}{|T(y)|}\sum_{t\in T(y)} R(t,y)\,, y \in Y$$

$$R^A_{mean} = \frac{1}{\sum_{t\in T}|Y(t)|}\sum_{t\in T}\sum_{y\in Y(t)} R(t,y)$$

$$O_A(y) = \frac{R^A(y)}{R^A_{mean}}, y \in Y$$

$O_A(y)$ — object for the year y obtained by *Method A*

Method B:

$$R^B(t) = \frac{1}{|Y(t)|}\sum_{y\in Y(t)} R(t,y)\,, t \in T$$

$$o_B(t,y) = \frac{R(t,y)}{R^B(t)}, t \in T, y \in Y(t)$$

$$O_B(y) = \frac{1}{|T(y)|}\sum_{t\in T(y)} o_B(t,y)\,, y \in Y$$

$O_B(y)$ — object for the year y obtained by *Method B*

Description of the Area index

Input Data:

1. $Y_{clim} = \{y_1, \dots, y_{|Y|}\}$ — Set of years for which the climatic measurements are available.

2. $\mathbb{T}(y) = \{T_1, \dots, T_{366}\}$ — Set of daily temperature for year y, where $T_i = T_i(y)$ — temperature in ith day of the year y.

2. $\mathbb{P}(y) = \{P_1, \dots, P_{366}\}$ — Set of daily precipitation for year y, where $P_i = P_i(y)$ — precipitation in ith day of the year y.

$$i \in \overline{1{,}366}, y \in Y_{clim}$$

If the data for the day are absent it replaced with the 0 for the cumulative sum operation and ignored in other cases.

Preparation description:

1. $\mathbb{P}^C(y) = \{P_1^C, \dots, P_{366}^C\}$ — Set of cumulative sums of presipitation for year \$y\$, where:

$$P_i^C = P_i^C(y) = \sum_{k=1}^{i} P_i(y)$$

$$i \in \overline{1{,}366}, y \in Y_{clim}$$

2. $\mathbb{T}^R(y) = \{T_1^R, \dots, T_{366}^R\},\ \mathbb{P}^R(y) = \{P_1^R, \dots, P_{366}^R\}$ — Sets of temperature and cumulative precipitation the year y, smoothed with 7-day rolling mean (moving average), where:

$$T_i^R = T_i^R(y) = \frac{1}{7}\sum_{k=i-3}^{i+3} T_k(y)$$

$$P_i^R = P_i^R(y) = \frac{1}{7}\sum_{k=i-3}^{i+3} P_k^C(y)$$

$$i \in \overline{1{,}366}, y \in Y_{clim}$$

If k is less than 1: $T_k(y) = T_{366-k}(y-1)$, $P_k^C(y) = P_{366-k}^C(y-1)$

If k is greater than 366: $T_k(y) = T_{k-366}(y+1)$, $P_k^C(y) = P_{k-366}^C(y+1)$

3. $\mathbb{T}^S(y) = \{T_\alpha^S, \dots, T_\omega^S\}$, $\mathbb{P}^S(y) = \{P_\alpha^S, \dots, P_\omega^S\}$ — Sets of temperature and precipitation for the year y scaled with MinMax approach:

$$T_{min} = \min_{y \in Y_{clim}} \min_{i \in \overline{\alpha,\omega}} \{T_i^R(y)\}, T_{max} = \max_{y \in Y_{clim}} \max_{i \in \overline{\alpha,\omega}} \{T_i^R(y)\}$$

$$T_i^S = T_i^S(y) = \frac{T_i^R(y) - T_{min}}{T_{max} - T_{min}}$$

$$P_{min} = \min_{y \in Y_{clim}} \min_{i \in \overline{\alpha,\omega}} \{P_i^R(y)\}, P_{max} = \max_{y \in Y_{clim}} \max_{i \in \overline{\alpha,\omega}} \{P_i^R(y)\}$$

$$P_i^S = P_i^S(y) = \frac{P_i^R(y) - P_{min}}{P_{max} - P_{min}}$$

α — First day of the growth season, ω — Last day of the growth season.

$$i \in \overline{\alpha, \omega}, y \in Y_{clim}$$

Area formula:

$$Area(y) = \sum_{i=\alpha}^{\omega} \left| T_i^S(y) - P_i^S(y) \right|$$