The European
Integrate Network

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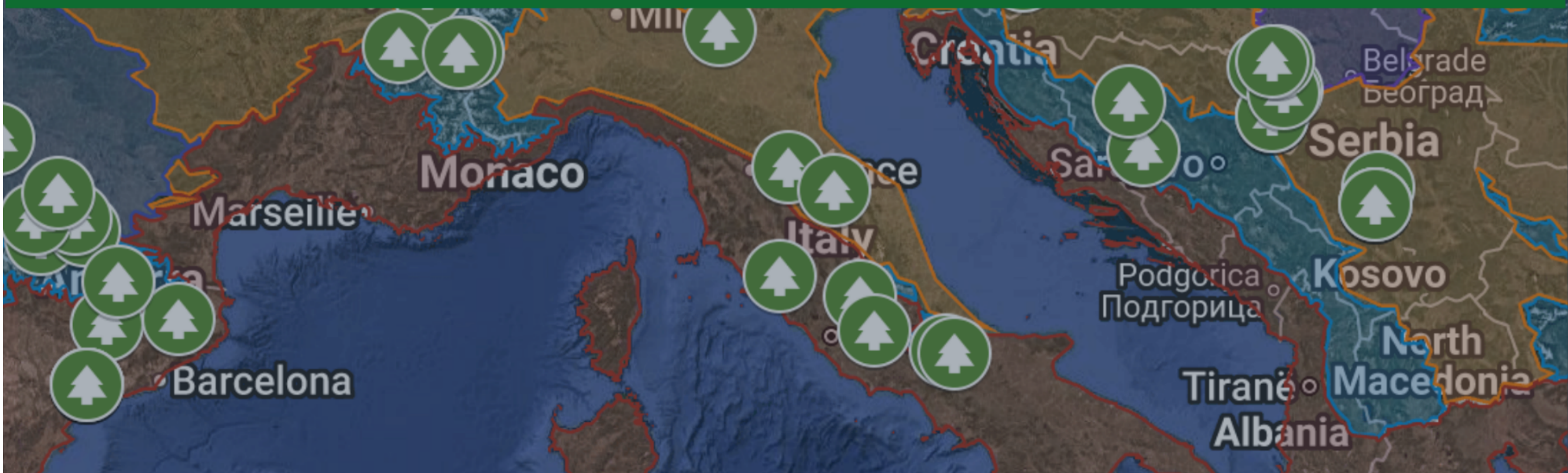
Integrate Network Marteloscopes –
Large scale insights into the growing database



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1. Introduction

The Integrate Network Multi-Donor Trust Fund (hereinafter referred to as "Integrate Network") is an alliance of representatives of various European countries that promotes the integration of nature conservation into sustainable forest management at the policy, practice and research level. The Integrate Network fosters the exchange of effective management practices and experiences among its members. The European Forest Institute (EFI) plays an instrumental role in the process as the secretariat, while also undertaking the task of gathering scientific and practical evidence on the successful implementation, training, and communication of integrative forest management approaches (Integrate Network, 2024). The Network has published numerous studies on forest management and has facilitated a multitude of virtual and in-person events including field visits, underscoring its continuous commitment to its mission.

Marteloscope sites are a key tool of the Integrate Network. They are usually 1-hectare large, rectangular forest sites where all trees are numbered, mapped and recorded. In combination with software running on mobile devices, marteloscopes are used for silvicultural training. Such outdoor learning sites can help in better understanding forest management decisions and foster discussion and knowledge exchange amongst training participants. Starting with around 40 marteloscope sites in the initial phase of 2016 to 2018, the Network has since grown to more than 270 plots in 27 European countries. Due to their demonstration character the selection of plots is based on either availability or demonstration criteria, e.g. representative silvicultural systems for a region, high abundance of habitat structures and others. The selection of plots was also limited by the frequency of future silvicultural intervention (i.e. no intervention for the next 5 to 10 years) and their accessibility. Most of the plots are under public ownership (state and community forests), however, there are also sites located in private forest estates (Kraus et al., 2018). Furthermore, Marteloscope site managers/owners were also asked whether they support the usage of the individual tree data for research, ensuring it is referenced in any resulting output.

1.1 The analysis aim

Even though the individual plot characteristics can be accessed on the interactive map online, a large-scale analysis of the growing database was missing, and its potentials have been unknown. Therefore, the available plots for research have been analyzed by the 7 biogeographical regions designated by the European Environment Agency (EEA, 2016). Approximately 100,000 individual tree records from 26 countries and 249 plots were used for this analysis, compromising various parameters like diameter at breast height (DBH) or tree related microhabitats (TreMs) and offer insights in the region's forests.

The processing of single tree records has been conducted through a series of steps, culminating in the establishment of a geospatial database to facilitate analysis and visualization. The analysis yielded several key insights concerning the distribution of DBH classes and tree species at different spatial scales. Moreover, the occurrence of TreMs, and their corresponding habitat value (which has been derived from TreMs) among different tree species, offer insights into biodiversity within the plot. In conjunction with an estimate of individual tree quality classes and a link to wood prices information, the results provide a pivotal opportunity for discourse on forest management and the integration of nature conservation.

2. Methods and Materials

The methodology builds on previous research with the dataset and has been developed through the opportunities presented by the data.

In order to identify gaps in research using the marteloscope dataset, a review of available literature was conducted with the most relevant being (Asbeck et al., 2021; Cosyns et al., 2020; Kraus et al., 2018; O'Brien et al., 2023, 2022).They were summarized in their key aspects and sorted by type of publication: technical data publication, ecological research and socio-ecological studies. The results will not be presented here and were used to focus the analysis of the data and to visualize aspects that represent the purpose of the Integrate Network: "the integration of nature conservation into sustainable forest management at the level of policy, practice and research." (Integrate Network, 2024) In the following, the data details and the processing workflow are elaborated.

2.1 Data

2.1.1 Marteloscope plots

The analysis used 249 out of 273 marteloscopes with 95,832 trees in 26 countries, while there are more plots, only those available for public display at the end of 2024 were included.

The concept of marteloscopes was originally developed in France. The term is derived from the French word for tree selection ('martelage') and the Greek term "skopein" (look), meaning literally "having a closer look" at a tree selection. The concept was at first mainly applied in private forests, but its potential for field-based training and education for both forestry professionals and students was already recognized in the 1990s (Bruciamacchie, 2006). The use of marteloscope plots found application not only in France but soon after also in its neighboring countries, becoming more known also far beyond. The demonstration project Integrate+ considerably contributed to this development in Europe (Kraus et al. 2016*a*, Schuck et al. 2016).

The standard dimensions for marteloscope plots are usually 1 hectare (100 meters x 100 meters), with a rectangular configuration. However, deviations from this standard size and outline are inevitable due to local conditions. To facilitate orientation and the utilization of data subsets, the plots are divided into four quadrants. All trees within the plot with a diameter at breast height (DBH) greater than 7.5 cm where recorded by the following respective parameters: species, DBH (cm), height (meters), status (alive/dead), date of establishment/inventory, amount and specification of TreMs, tree qualities and wood section prices, local currency, and their location in the local coordinate system calculated from the azimuth and distance to the quadrant centre points (Kraus et al., 2018).

Table 1 Parameters recorded from Kraus et al. 2018

Type	Unit
Tree species	Fagus sylvatica (Fasy), Abies alba (Abal) etc.
Tree location*	polar coordinates
Tree status	dead (0), alive (1)
Diameter at breast height	dbh [cm] (>7.5 cm)
Tree height	h [m]
Crown base height	h_{cb} [m]
Timber quality	Class (A, B, C, D/IT, F for fuelwood) and section length [m]
TreMs	abundance

2.1.2 Tree Microhabitats

One of the main indicators for the integration of biodiversity in the Integrate marteloscopes are the tree-related microhabitats (TreMs). These are keystone structures for forest ecosystems and provide a broad array of specific conditions to specialized taxa, including microclimatic conditions and substrates that facilitate sheltering, foraging, or breeding (Asbeck et al., 2021). Also, they are dynamic and can change from one type to another over time supplying different conditions (missing bark evolving to a mould cavity), be periodically unavailable such as water-filled tree holes (dentrotelmata) without water in dry periods or disappear when a tree either dies or a microhabitat bearing tree is removed (Larrieu et al., 2014). Consequently, they have been selected as a parameter to be recorded in marteloscopes. A catalogue of tree microhabitats for field assessments was compiled for the purpose of evaluating the TreM abundance and characteristics. It encompasses 64 saproxylic and epixylic microhabitat types such as cavities, injuries, cracks, loose bark or nests (Kraus et al., 2016). The TreM categories are classified by codes consisting of the group of microhabitats and the specification of the subclass e.g. EP33 for epiphytic lianas like common ivy (Hedera helix). In the following, the general TreM groups and their abundance are addressed. Species specific or spatial analysis of TreMs is subject to multiple publications (Dutta et al., 2025; Larrieu et al., 2024, 2014; Mamadashvili et al., 2023).

Habitat value

The habitat value (habval) of each tree is calculated by the number of TreMs and a simple scoring system developed by experts for training purposes. It considers the relative rarity of TreMs, the time for them to develop and their size in a near-natural forest (Table 2). Equation 1 describes the calculation of the habitat score.

Equation 1 Habitat value from Kraus et al. 2018

$$H_i = \sum_{j=1}^{n} N_j \times s_j \times (R_j + D_j)$$

In this equation H_i is the habitat value of tree *i*, N_j the number of microhabitat type *j*, *R* is a value for the rarity of a TreM, *D* is a value for the time a microhabitat takes to develop or is available, and s is a size score. In table 2 below, the exemplary values for the equation of rarity and development time can be found. To enable easy application, the values are set for each TreM, and practitioners only record the TreM type with a catalogue of TreMs in inventory. The resulting score is used in this analysis together with species composition to give an insight into biodiversity of the Marteloscope plots and enables comparison (Kraus et al., 2016).

Table 2 Factors for the calculation of the habitat value from Kraus et al., 2018

Rarity gradient in near-natural forests (R-value)		Development time (D-value)	
very common	1	fast or linked to very common event	1
common	2	fairly fast or linked to fairly common event	2
fairly rare	3	from fairly slow to slow or linked to uncommon event	3
rare	4	slow or linked to rare event	4
very rare	5	very slow or linked to very rare event	5

2.1.3 Biogeographical regions

The utilization of the 11 biogeographical regions delineated by the EEA was to ensure a standardized approach in the categorization of marteloscopes, with the objective of distinguishing variations of climate and forest ecosystem composition. Notably, 7 of these regions encompass the Integrate marteloscopes and are analyzed.

The dataset under consideration contains the official delineations employed in the Habitats Directive (92/43/EEC) and the EMERALD Network established under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention). The biogeographical boundaries in question were obtained from the EU Member States and the Emerald Network countries, unbound by the constraints of political boundaries (EEA, 2016).

2.2 Processing

First, the marteloscope data sets were obtained from the Integrate+ Central Repository, standardized, combined, translated into English, and formatted in Microsoft Excel by the CSV format (Comma Separated Values) to ensure full accessibility for further processing. All recorded tree features (mentioned in plots chapter) are maintained for each individual tree, except for the details on wood quality sections and wood prices. They are summarized by total worth as the tree economic value (later mentioned as econval).

The complete CSV table was then imported into a geospatial database, along with a separate table with plot metadata, which contained the plot ID, the left-bottom coordinates of each plot, soil type and species community information. A third table was created with the mean non-euro currency conversion factors of the European Central Bank and the plot IDs. This allowed for the possibility to calculate economic values in the database for all individual trees in Euros at a later stage if needed (European Central Bank, 2023).

The currency conversions and timber prices in the marteloscopes usually reflect actual and local/regional prices that were available at the time of site establishment. As timber prices are subject to change, they are only approximations and should be seen in that light. Also, currency conversions are linked to the date of conversion.

2.2.1 Georeferencing

The inventory measured the distance and azimuth of trees in four quadrants and recorded via GPS the left bottom corner reference point. While the conversion to local coordinates happened automatically when the inventory is submitted, the global ones are missing and were calculated in PostgreSQL Query with the lower left corner coordinate as reference point globally. Therefore, the following equations 2 and 3 were used:

Equation 2 simplified formula to calculate longitudinal individual global tree coordinates

$$x_{global} = x_0 + \frac{x_{local}}{111320 * \cos(rad(y_0))}$$

Equation 3 simplified formula to calculate latitudinal individual global tree coordinates

$$y_{global} = y_0 + \frac{y_{local}}{111320}$$

The formulas calculate the global position of the trees with their longitudinal and latitudinal values from local coordinates (x_{local} and y_{local}) using the coordinates of the lower left corner of the plot (x_0 and y_0 These equations represent a practical approximation based on spherical Earth projections to effectively convert local tree coordinates to global geographic coordinates. The formulas incorporate a distance-to-degree conversion where the denominator 111320 represents the approximate number of meters in one degree of latitude at the equator 111.32 km (Rosenberg, 2024). This constant provides a simplified conversion from metric measurements to decimal degrees, since the degree of latitude changes with distance from the equator (Geosciences LibreTexts, 2023).

In addition, the cosine term in the longitude (x_{global}) equation 2 accounts for the convergence of meridians toward the poles. This is a necessary correction factor that accounts for Earth's spherical geometry because the distance covered by one degree of longitude decreases from the equator to the poles. This method balances computational efficiency with acceptable accuracy for forestry applications for automated georeferencing (Fol et al., 2023).

Note the relative accuracy of the lower left corner coordinates, which in some cases are not accurately recorded due to technical and operational challenges. However, for the purposes of the project, plot-level accuracy is more important than absolute global accuracy, and the cosine adjustment adequately compensates for the main source of distortion (longitude convergence).

2.2.2 Dynamic tree coordinates

As the Integrate Network is a multi-donor trust fund, the project is ongoing, and new marteloscopes are constantly being submitted for inclusion in the network. A database has been created in PostgreSQL to store, update and insert geospatial data from approximately 100,000 trees and 249 plots.

PostgreSQL is a popular open-source object-relational database management system that uses and extends the SQL language with many features for storing and scaling data workloads. It was also chosen for its add-on PostGIS geodatabase extender in QGIS 3.38 Grenoble (The PostgreSQL Global Development Group, 1996).

The presented analysis is an example and first attempt to develop a 'bridge' between the central repository and research applications based on locations.

After importing the CSV tables of plot information, single tree records and currency conversion factors, the workflow in the database query tool was the following to ensure future accuracy and additions from the central repository:

1. A foreign key and index are set to link all tables by plotID with the plot table as basis to ensure integrity.
2. In the tree level table, all global coordinates of trees were calculated with the above-mentioned equations 2 and 3, with the lower left corner coordinates of the plot table and the local coordinates of the tree table linked by the plot ID.
3. A trigger has been attached to the plot and tree table which automatically activates the linked function when the lower left corner coordinates of the plot are changed. This function recalculates the global coordinates for each tree using the same equations 2 and 3.
4. Furthermore, given that this is a geospatial database, which is directly connected to a QGIS project, additional triggers have been established to implement a function that modifies the geometries of the plot table and the tree table. This is necessary since the tables require their own geometry column to store bottom-left coordinates spatially and to facilitate direct transfer to the QGIs project.
5. Additionally, the insertion of new plots and trees is accompanied by the implementation of additional triggers. These triggers ensure that the functions of calculating coordinates and geometries are applied directly. The purpose of this is to avoid manual calculation and to ensure a standardised process.

All those configurations will be updated / re-developed to serve other research projects, if needed.

3. Outputs

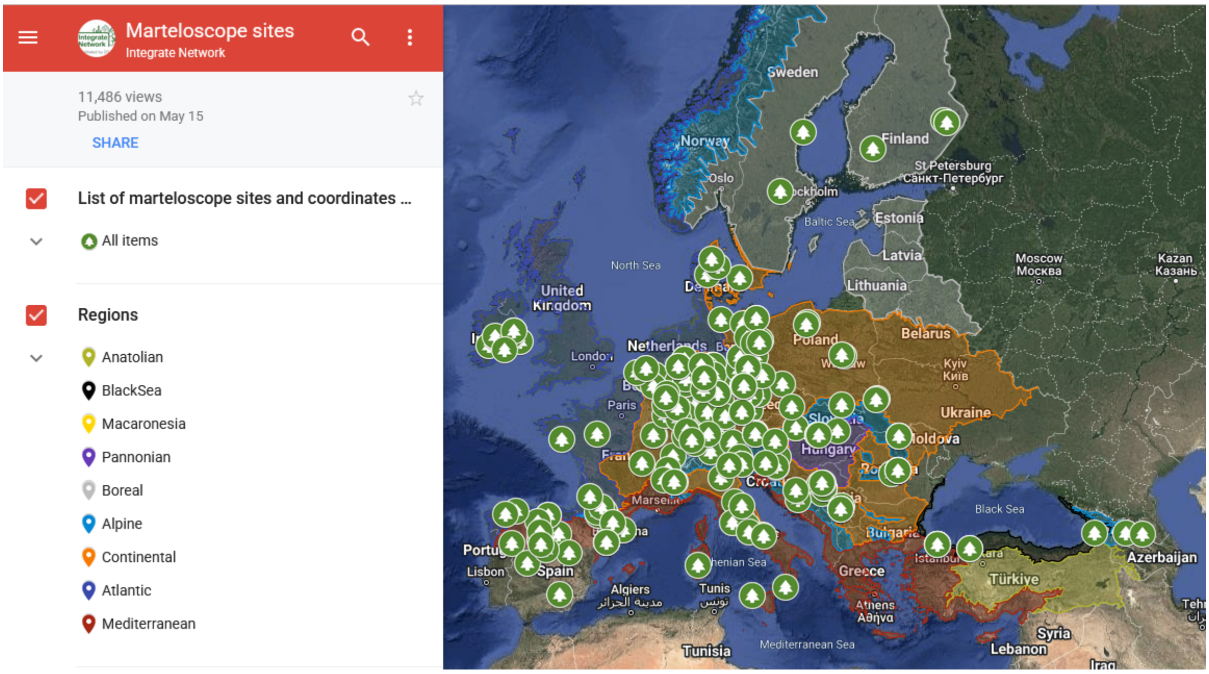

Figure 1 The interactive map of marteloscope sites with the new feature of biogeographical regions and their respective results of analysis

In the following, the exemplary results of the marteloscope dataset analysis are visualized by 72 graphs. Those are publicly available on the interactive marteloscope site map which encompasses individual site-specific information and the biogeographical regions analysis results (Figure 1).

The analysis of the plots and the graphs highlights different aspects of European forests and their management and what possibilities the dataset may offer for research. Most importantly they offer room for dialogue from plot to biogeographical regions' scale. The results are not intended to be representative of a biogeographical region, as the number of plots covered in each region varies, and this is neither systematic nor randomized.

3.1 Diameter and species composition

The initial graph illustrates the diameter at breast height (DBH), which is the most prevalent measurement employed in forest inventories. The data provided offers insight into the vertical structure, as well as, to a certain extent, the age, growth patterns and future productivity of the subject.

In general, the regions differ slightly in the distribution between classes and the recorded trees are mostly located in the first three DBH classes.

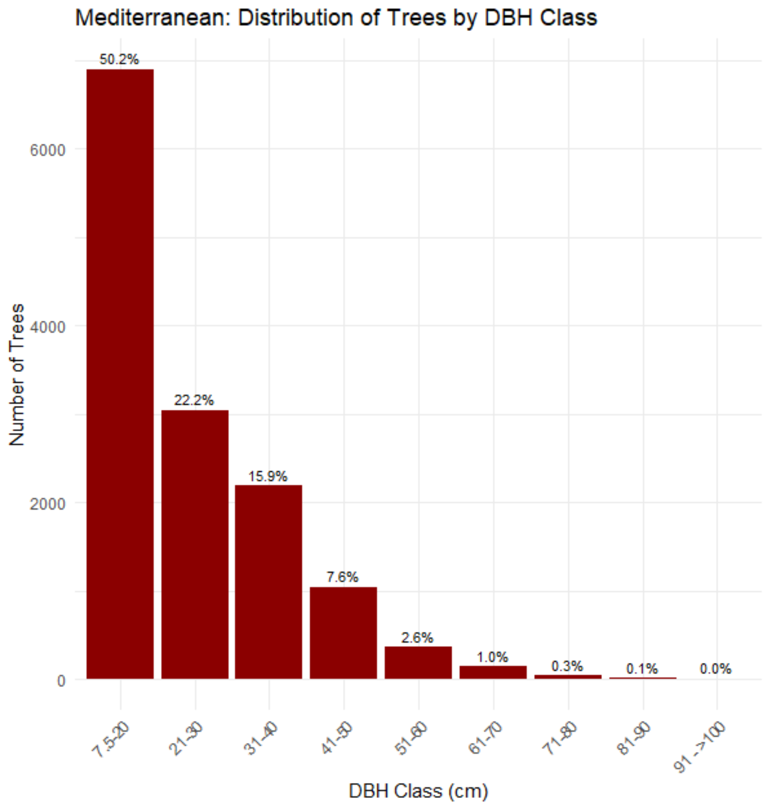

Figure 2 DBH distribution of all marteloscope plots in the mediterranean region

Figure 1 illustrates the distribution of the DBH for the 26 marteloscope sites with over 14.000 recorded trees in the mediterranean region. In this region the majority of trees recorded within the marteloscopes are found in the DBH classes of 7.5 to 30 cm. Approximately 28% of the trees exceed a diameter at breast height (DBH) of 30 cm, suggesting that they are likely to be part of the overstorey.

For a more detailed insight, the distribution of tree genera by diameter class was analyzed by each biogeographical region. The species were grouped by genus to ensure accuracy, as for some datasets species information was missing and the shares of genera by diameter class were calculated to obtain information of the region's stand structures.

As illustrated in Figure 2, the graph is an exemplary representation of the Mediterranean region. In this region, the initial two DBH classes (7.5-20 cm and 21-30 cm), constituting 73% of all trees, are predominantly comprised of oak, pine, and maple. The higher DBH classes, primarily the overstory, consist of pine, beech and fir.

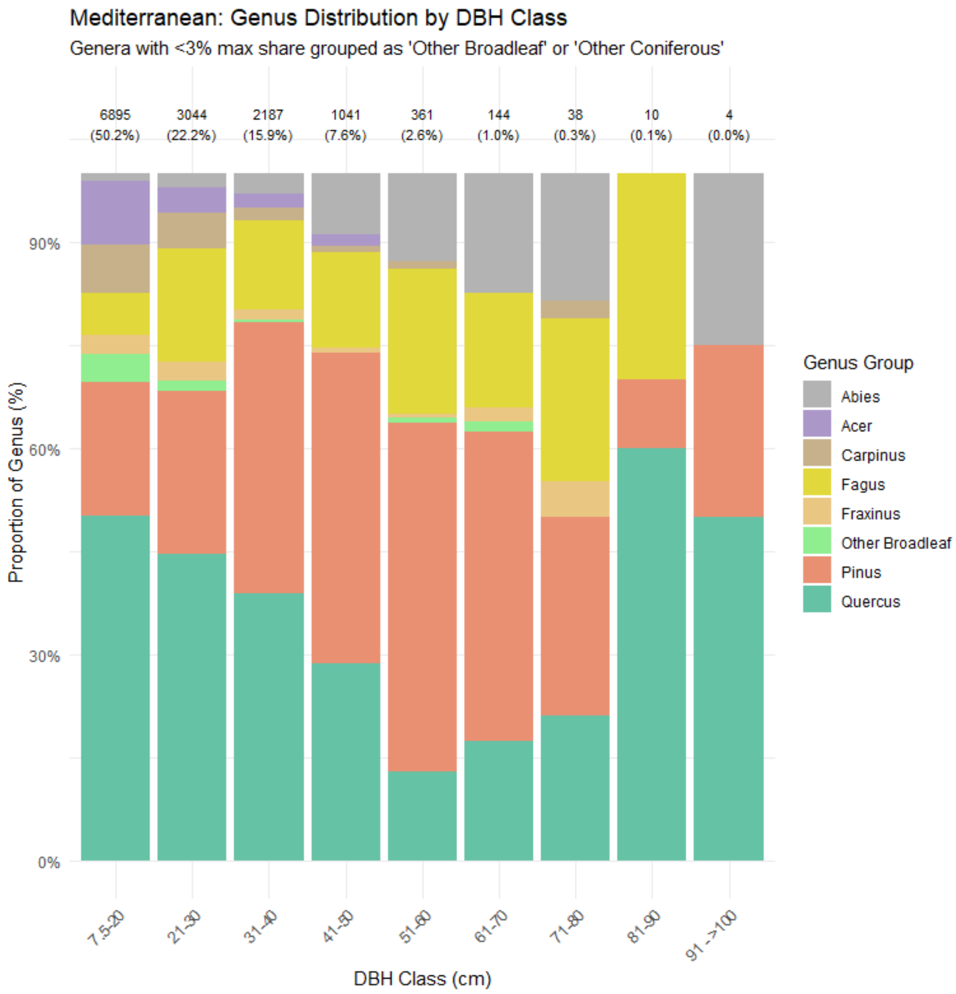

Figure 3 Mediterranean genus distribution by DBH class

The graph depicting the regions demonstrates variations in the composition of tree species due to biogeographical differences. A notable commonality across all regions is the prevalence of pioneer species, such as birch (Betula), maple (Acer), pine (Pinus), oak (Quercus) and hornbeam (Carpinus), in the lower diameter-to-height (DBH) classes, whereas oak and fir (Abies) are more prevalent in the higher classes. Beech (Fagus) and spruce (Picea) are consistently present within the DBH classes. Genus composition by DBH may also provide some insight into regional stand history and forest management practices.

3.2 Tree microhabitats

The TreM categories are classified by codes consisting of microhabitat types, with EP (epiphytes) being the overall category, EP3 representing the group of epiphytic crypto- and phanerogams and then divided into subclasses such as EP33 for epiphytic lianas like common ivy (Hedera helix). For visualization of the results, the TreM classes were grouped by an overall category e.g. here "EP".

The exemplary bar graph (Figure 3) illustrates the distribution of TreM abundance for the 28 plots of the alpine region. This region is characterized by a high abundance of injuries and wounds (IN), which may result from windthrow, or damage caused by tree felling. Cavities (CV) are also quite common, along with growth deformations (GR).

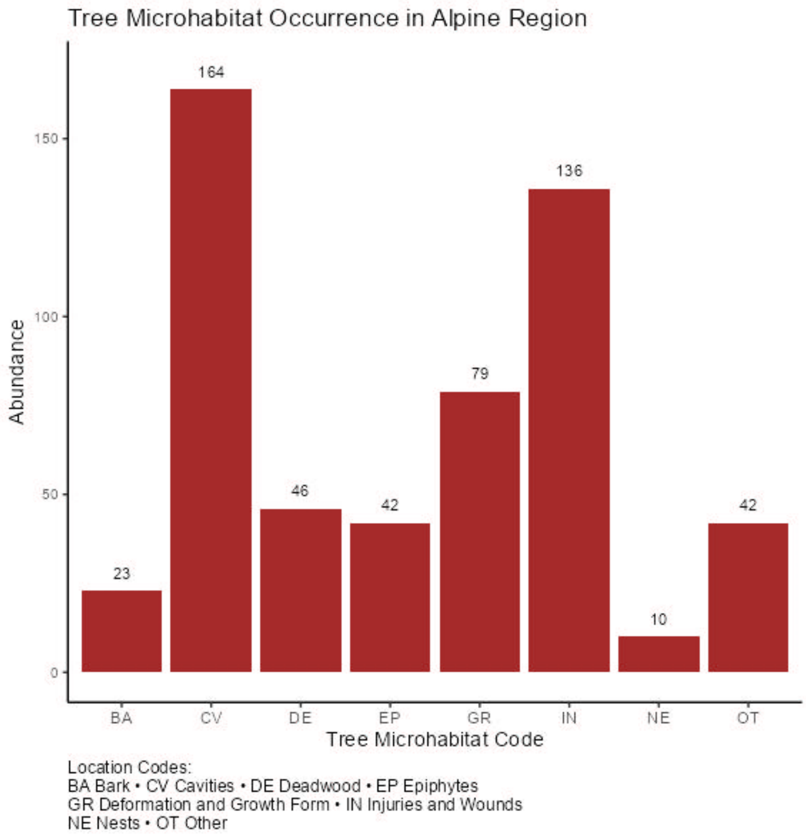

Figure 4 Alpine distribution of Tree Microhabitats

The seven regions generally differ in abundance (due to different amounts of recorded trees) and trends in TreMs. Proportionally most growth deformations were found in the black sea region, as well as a high share in the plots of the alpine, boreal and continental regions. Cavities highest shares have been found in the mediterranean region and deadwood was most recorded as TreM in the Pannonian region. For the class of Epiphytes, the Atlantic region has recorded proportionally the highest amount, as well as the mediterranean and boreal region.

3.3 Habitat value

The habitat value of each tree is calculated by the former explained equation 1. Here the mean habitat value is analyzed by each tree genus to identify patterns in the plots (trees with 0 a value of 0 were excluded). Figure 5 shows the mean habitat value by tree genus for the continental region, colored by the genera's total abundance and the expected standard error (due to differing recorded abundances only genera over 100 were used for producing the mean). Birch (Betula),

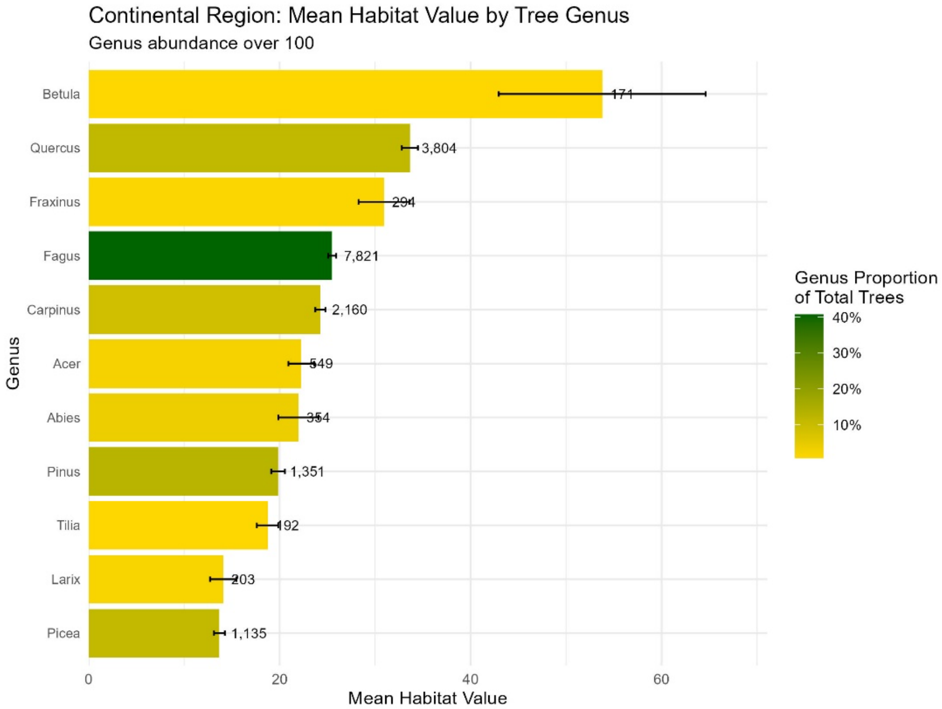

Figure 5 Continental distribution of mean habitat value by genus

oak (Quercus) and ash (Fraxinus) seem to have the highest mean habitat values ranging between 30 and 40, while coniferous tree genera seem to have less habitat value recorded.

In total, the region's highest mean habitat values genus are birch, hornbeam (Carpinus), cherry (Prunus), oak, ash and beech (Fagus) with a mean habitat value approx. 30. It is notable that the mean of cherry and birch were derived from a low amount of TreM-bearing trees (same applies to their total share) but high means compared to oak and hornbeam with over 3000 TreM bearing trees. In the middle to lower part are maple (Acer) and pine (Pinus) with a mean value of 20. Lower mean values can be found in larch (Larix), spruce (Picea) and linden (Tilia) with values under 20.

Although the values of habitats can range up to three digits, indicating higher value for biodiversity, most range in the lower two digits. The highest means around 30 are nevertheless quite high values given that many recorded trees do not have TreMs.

In Figure 6, the mean habitat value is grouped by DBH class smaller and bigger than 50 cm and provides more insights into the structural distribution. The tree genera bars are colored as well by their total abundance in the dataset and depict their standard error.

The distribution of the species between the two DBH classes shows that many tree microhabitats appear in the lower DBH classes in birch, ash and hornbeam with a mean in the mid 20 points, except for the mean of birch close to 60. These results are not surprising due to the shorter lifespan of the species concerned and their characteristics as pioneer species. The DBH classes over 50 cm have a higher mean habitat value, even though those are less abundant. Oak, pine and beech seem to carry valuable TreMs in the continental region. Habitat values can range up to the three-digit range, but most are in the two digits.

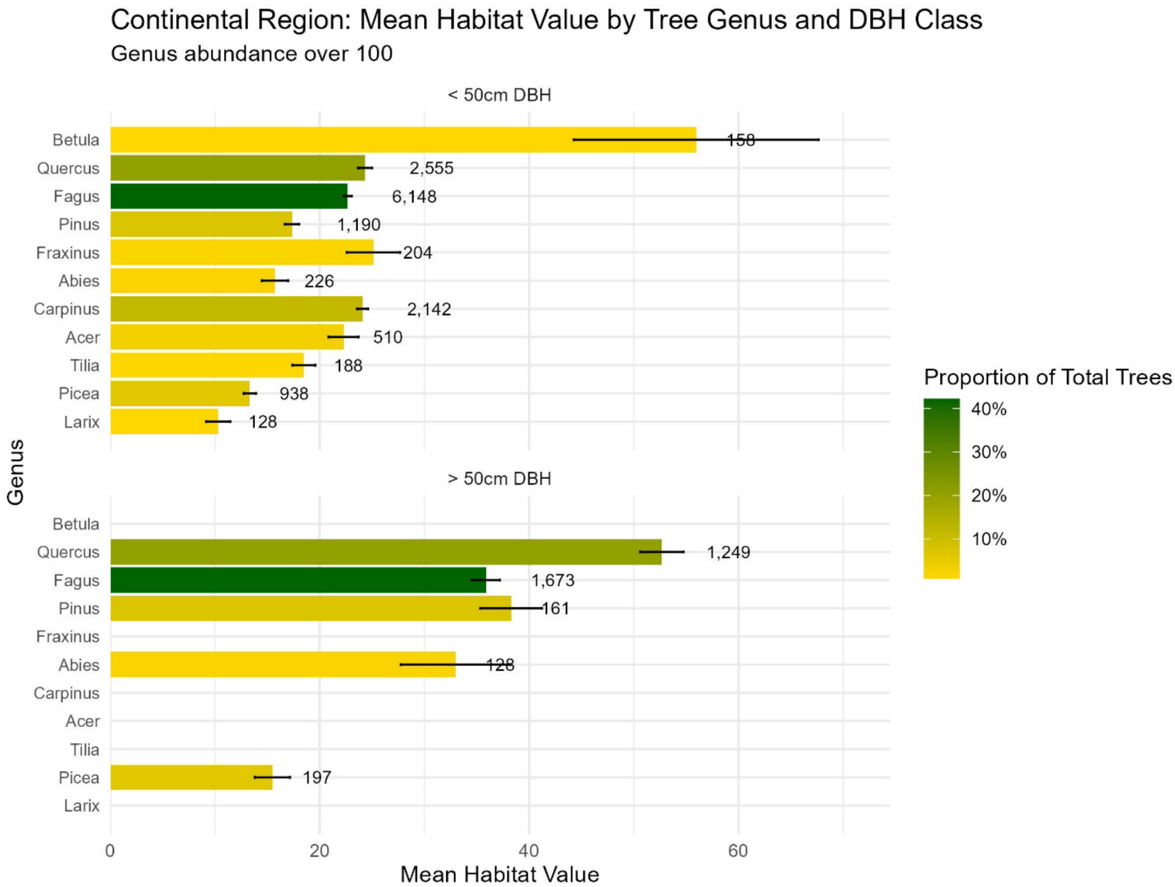

Figure 6 Continental distribution of mean habitat value by genus under and over 50cm DBH class

3.4 Dialogue plots

Another aspect of the data which can be assessed is how the habitat value and the economic value interact on the plot scale for each region. In order to exhibit more aspects of biodiversity than the habitat value itself, the species richness, Shannon index and evenness were calculated. The species richness is derived by the sum of species and represents the alpha biodiversity by each site (Wilson and Gownari, 2022).

The Shannon index was calculated for all plots with Equation 4 where p is the proportion of individuals in the i for individual species. Their negative sum results in positive values.

Equation 4 Formula for the Shannon Wiener Index

$$H = -\Sigma\, p_i * \ln(p_i)$$

As the species richness does not reflect the abundances, Pielou's evenness index (J) was calculated as well for each site. The index measures how evenly individuals are distributed across the different species in a community and is calculated with Equation 5. Here S is the species richness and H is the Shannon diversity index.

Equation 5 Formula for calculating Pielou's Evenness

$$J = \frac{\ln(S)}{H}$$

The resulting evenness ranges from 0 to 1, where 1 indicates complete evenness (Pyron, 2010; Wilson and Gownari, 2022).

Finally, since the plots exhibit very different characteristics of biodiversity the Shannon index needed to be normalized to enable comparison and was calculated using Equation 6 where H is the Shannon index and S is species richness:

Equation 6 Formula for normalized Shannon Index

$$H' = \frac{H}{\ln(S)}$$

Such indicators offer insights into characteristics of the marteloscopes concerning biodiversity and former management focus before marteloscope site establishment.

An exemplary result is displayed in Figure 7 for the Atlantic region, where each point represents a plot. Their position in the graph is determined by the sum of the habitat and economic value (note that the timber prices vary by quality class and species and usually refer to the year in which the marteloscope was established and not to the current situation). The color indicates the species richness from a low number colored yellow to green, a higher richness. The size of circles depends on the Normalized Shannon Index, where smaller values indicate proportionately higher biodiversity.

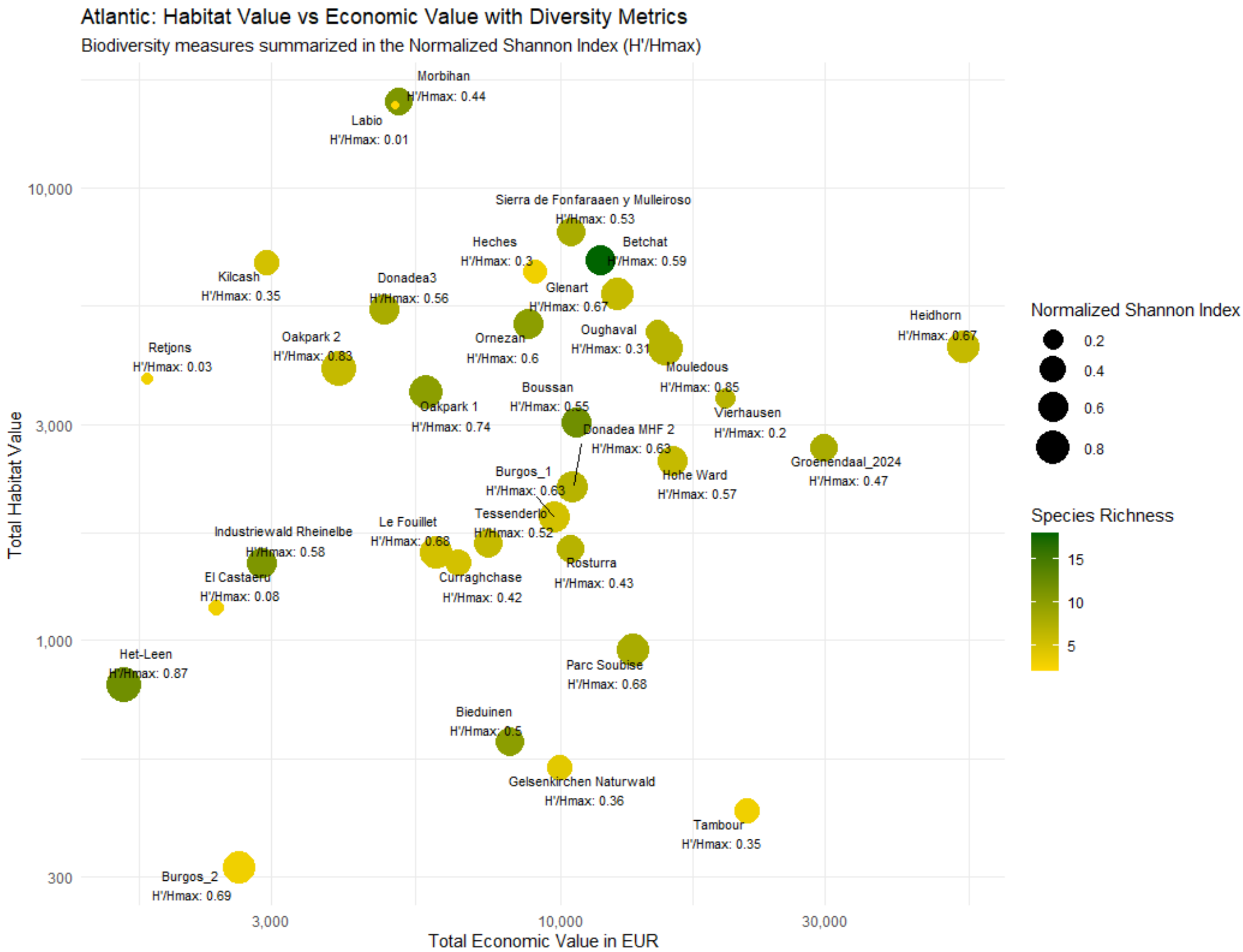

Figure 7 Atlantic dialogue plot

Since the regions contain different numbers of plots, a normalized score was calculated to filter the highest scoring plots of economic as well as habitat value. For the visualization of the plots, a data transformation was performed to create a score from normalized habitat and economic value scores and a composite biodiversity metric.

This score was used to visualize the 33% highest scoring plots in the Atlantic region depicted in Figure 8. For insights into biodiversity besides TreMs as an indicator, common metrics were calculated with the colors denoting species richness from yellow as low to green, for high richness. The size of the circles indicates evenness, with “1” representing the most even distribution of different species.

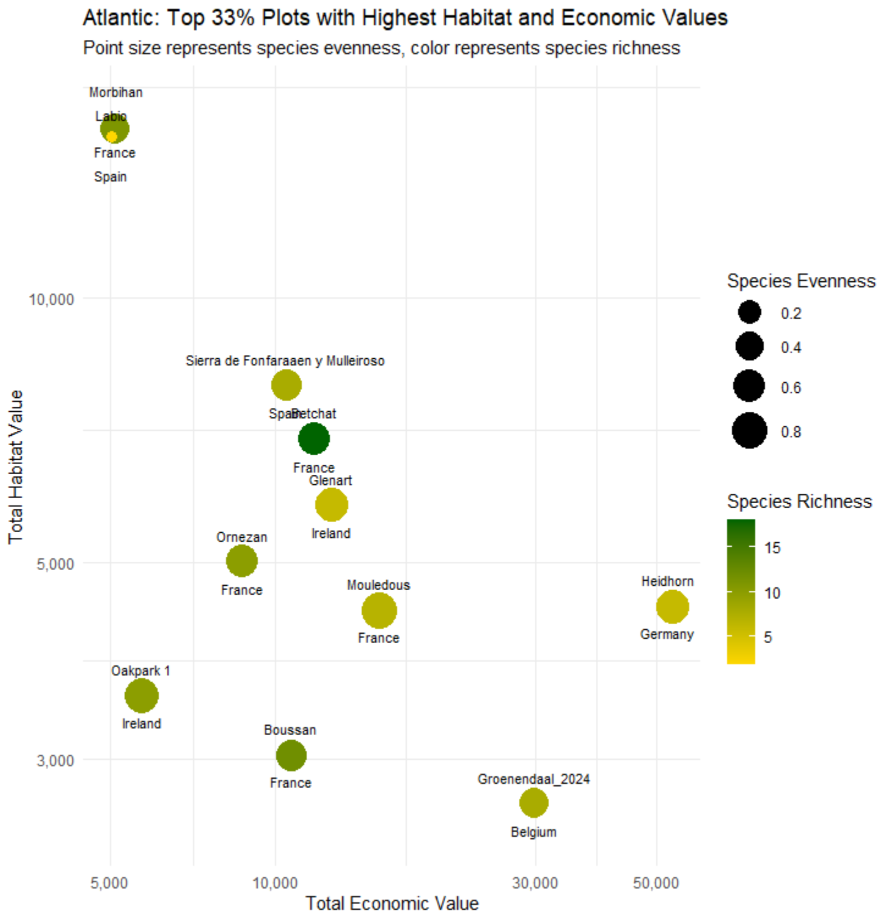

Figure 8 Atlantic plot for habitat and economic value of plots

The plots are presented along both axes, without a clear pattern and visualize the diversity of plots influenced by various factors. Thereby they may facilitate a dialogue about the differences of tree species, former site management, or local factors like soil and climate.

3.5 Dialogue trees

Adding to the former plot perspective, the analysis of dialogue trees zooms to an individual tree perspective. Dialogue trees are trees which have conflict of interest between habitat and economic value. Those were calculated by normalizing the habitat and economic value by each tree in the region and finally factor them to receive a conflict score. For visualization the highest 5% were filtered.

Exemplary the graph in Figure 9 of the black sea region, the highest scoring individual trees for both economic and ecological aspects can stimulate important dialogue during marteloscope training sessions on the impact of either removing or retaining such trees. Most often trees from plots with high scores are also the ones with individual high scoring trees.

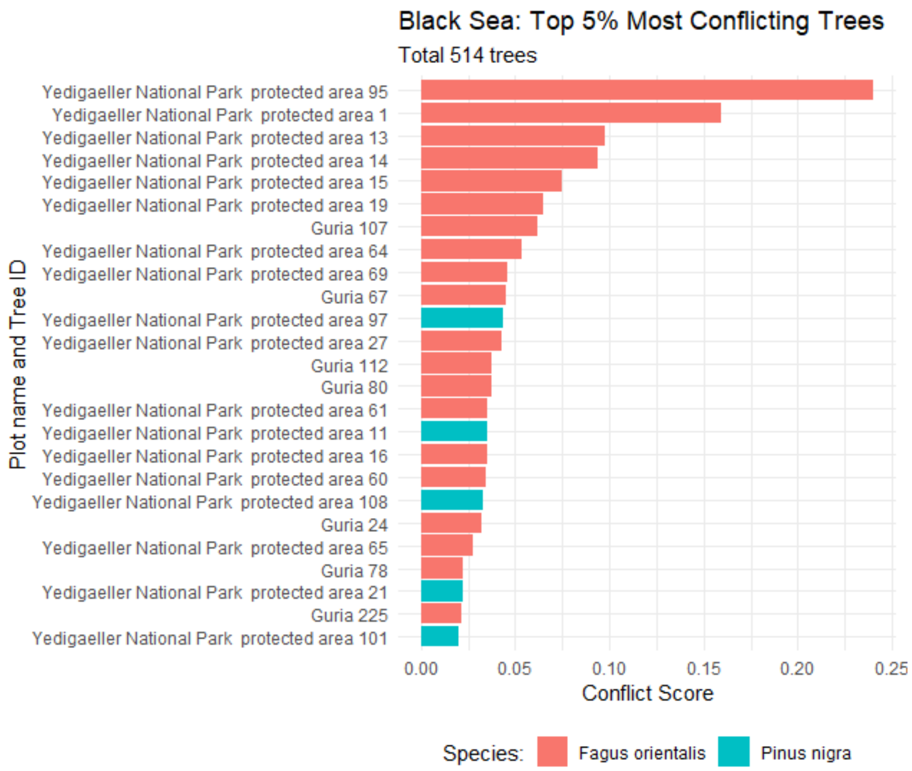

Figure 9 Black Sea dialogue trees

3.6 Slenderness

The h/DBH ratio is often used in forest management to indicate stand stability in the event of extreme weather and to provide insights into stand structure. To calculate the h/d value, the height of a tree (h in meter) is divided by its DBH (in cm). As well as tree growth characteristics, stand stability depends on other factors such as wind exposure, density, stand edge, forest damage and site conditions. In general, a value of 0.7 to 1 indicates a risk of windthrow (Wang et al., 2011). Another characteristic of individual tree stability is the crown percentage, which will not be covered here due to data inconsistency.

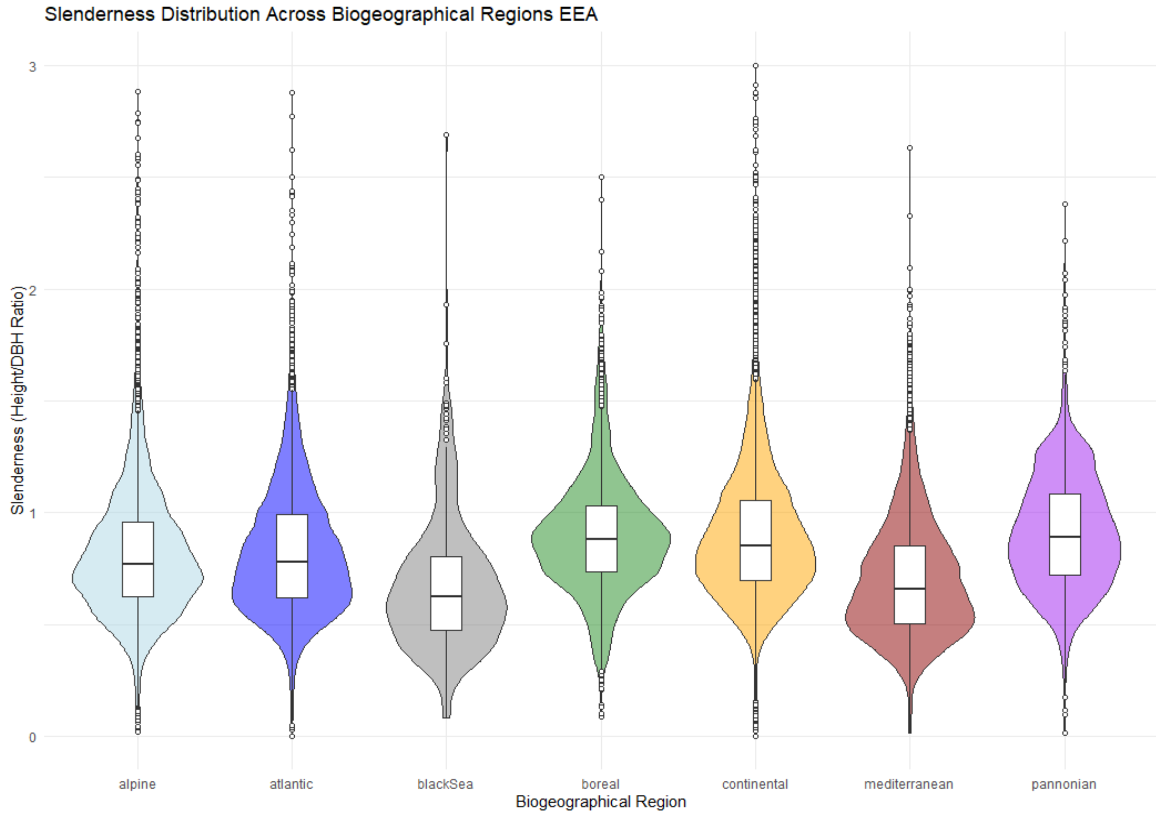

Figure 10 Slenderness coefficient also known as H/DBH value for all plots by biogeographical region

The distribution of slenderness across the biogeographical regions is presented in the violin boxplot in Figure 10. The results, and especially comparisons, should be regarded with caution since the number of plots by region differs considerably, and the locations were not sampled systematically.

The highest mean ratios are observed in the boreal, alpine, continental and Pannonian regions, where the ratio is approx. 0.8. Despite the similarities in the methods employed, the violin boxplot reveals notable disparities in terms of the number of records. For instance, the third quartile of the boreal region exhibits the highest number of records and approaches an h/d value of 1, while the continental region records are most abundant in the second quartile. The black sea and mediterranean regions' mean is around 0.6 indicating that the recorded trees are more resilient against wind effects as compared to other regions. Peak abundance for the mediterranean region lies between the 2nd and 3rd quartile while those of the black sea region are more evenly distributed.

The outliers may be explained by the fact that this graphic is neither species- nor age-specific, which is usually the case and can alter the insights, since some species grow taller or have larger diameters.

Interactive Map

The presented exemplary results are displayed in more detail in an interactive map which is hosted on the Integrate Networks' website. The interactive map allows a detailed view by biogeographical region, with some selected results/graphs highlighted and explained of this paper. The presentation of the marteloscope data in the format of an interactive map gives insight into how the marteloscope dataset can be applied e.g. in science or for educational purposes.

Through the display of the marteloscope dataset, we hope to encourage researchers, practitioners, policy makers, training instructors and students to either apply the data in research or to maybe consider establishing (or visiting) marteloscopes as training and learning sites. Further, this may even lead to adding data to the continuously growing and valuable dataset.

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2. *Marteloscope data repository, 2025*. Dataset (2022-2025) hosted at the European Forest Institute for the Integrate Network Multi Donor Trust Fund. ***Full list of data providers/institutions***.

The first set of marteloscope data (sites established between 2014-2020; including updates until August 2022) is hosted at the Global Biodiversity Information Facility (GBIF) and available for download. The second marteloscope dataset (from September 2022 onwards) is available at the European Forest Institute. For access to this dataset, please contact efisec@efi.int for more information.

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