Supporting information from greenhouse gas submissions and sample-based forest inventories for biomass estimation of the Life Terra projects

Life Terra Report - Internal working material of IFER

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Introduction

Life Terra foundation intends to plant 500 million trees by 2025. One of the big challenges of Life Terra is to transparently quantify the carbon and CO_2 equivalents stored in tree biomass by their plantations at age 40 years since planting. Earlier, IFER designed a guiding procedure to assess carbon storage in living biomass for trees and stands to be used in Life Terra foundation. The estimation was specific to biogeographic regions, tree species and/or species groups and types. The estimation used local biomass functions and stand yield tables to the most practicable extent. Although the set of tree biomass equations and stand yield tables used was rather extensive, it remained limited considering the wide geographical scope, site conditions and plant material used in the Life Terra plantation efforts. Hence, the accuracy of biomass and carbon estimation can gradually be increased by using additional local sources of applicable data from the national sample-based forest inventories (NFI) and greenhouse gas (GHG) emission inventories.

In this document, National GHG Inventory Reports (NIR) from the most important countries for the Life Terra planting projects and information from NFI were analyzed with the aim to increase accuracy and transparency of the biomass and carbon estimation in the Life Terra plantations expected at age 40 years since planting.

Methodology

Life Terra plantations by countries

The analysis of NIR and NFI was carried out specifically for the European countries where Life Terra has planted trees. The order of these countries was set according to the number of trees planted (Table 1) as of date of this report (Sep. 2022). The list of tree species by countries can be found in Annex I (Table A1. 1).

Table 1: Number of trees planted by Life Terra in different European countries up to September 29 (2022).

Country code	Country	Number of trees planted	Order
DE	Germany	166 889	1
ES	Spain	159 608	2
PT	Portugal	93 992	3
IT	Italy	71 900	4
NL	The Netherlands	59 232	5
GB	United Kingdom	14 500	6
CZ	Czech Republic	9 765	7
EG	Egypt	7 000	8
RO	Romania	6 350	9
BE	Belgium	5 965	10
IE	Ireland	5 129	11
GR	Greece	2 856	12
FR	France	989	13
MT	Malta	160	14
CR	Costa Rica	25	15
Total		**604 360**	

Tree species used in Life Terra plantations

Life Terra foundation has planted around 600 000 trees in Europe (as of September 2022) since the beginning of the project. The most frequent tree species for Life Terra, as of the above-mentioned date, are shown in Fig. 1. The most frequent tree species was *Pseudotsuga menziesii*

(N≈42 000 trees). The complete list containing the number of trees planted by tree species and countries is shown in Annex I.

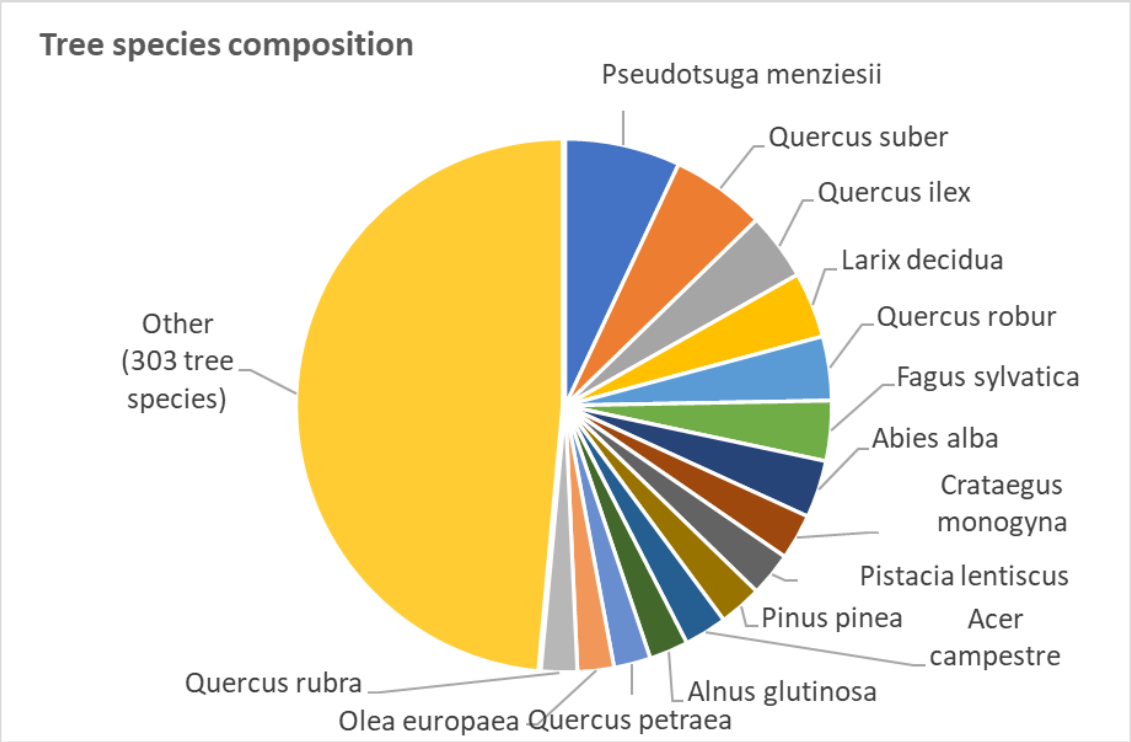

Fig. 1: The most frequent tree species used in Life Terra plantations. Number of trees planted by tree species (N=604 360 trees). Data extracted on September 29, 2022.

National GHG Inventory Reports and NFIs in Europe

The parties to the United Nations Framework Convention on Climate Change (UNFCCC thereon) are required to annually report their GHG emissions and removals by sources and sinks. These GHG reports often include the most up-to-date information on the local NFI and tools for tree and forest biomass estimation used. Cienciala et al. (2008b) evaluated NFI programs in Europe in terms of supplying information needed for emission inventory on forestry under UNFCCC and Kyoto Protocol. They showed that NFI programs in most countries are the major data source on forests. Therefore, they may serve for supplying the essential information in terms of quantifying above-ground biomass (among others) and carbon content that could be applicable for Life Terra.

Yield Tables

Growth and Yield tables are forestry tools describing stand properties for individual species classified by site productivity. They contain stand dimensions such stand mean diameter at breast height (DBH), stand height (H) and number of trees/ha for the expected live-span of these stands. Hence, the stand information attributed to age 40 years can be retrieved. Site index is commonly expressed by stand height that is reached at a given age and tree species. The age of 100 years is often used to assess the site index (Brandl et al., 2018). It should be stressed that yield tables that were published in the last decades may be outdated due to the likely effects of the recent changes in environmental conditions affecting tree and forest productivity in European regions. Therefore, it was assumed that the most likely current productivity in European biogeographic regions is expected to be within the range between average and maximum site index of the yield tables with upper-middle index (labelled P75 thereon).

Obviously, more recent yield tables may have representative stand dimensions closer to the mean values than the P75. Therefore, the most recent yield tables applicable to the regions of interests and verification of productivity with the data reported in the latest NIRs on GHG emissions and NFIs are recommended to be used to aid estimation of the expected tree biomass of Life Terra plantations at age 40 years.

The growth and yield tables that have been analyzed so far are shown in Table 2.

Table 2: Yield tables by country, tree species, sampling level (country or regional) and periods of data collection.

Country	Reference	Specie	Level
AT	Eckmüllner (2004)	*Abies alba*	Regional
AT	Eckmüllner (2004)	*Fagus sylvatica*	Regional
AT	Eckmüllner (2004)	*Larix decidua*	Regional
AT	Eckmüllner (2004)	*Picea abies*	Regional
AT	Eckmüllner (2004)	*Pinus cembra*	Regional
AT	Eckmüllner (2004)	*Pinus sylvestris*	Regional
CZ	Černý et al. (1996)	*Fagus sylvatica*	Country
CZ	Černý et al. (1996)	*Picea abies*	Country
CZ	Černý et al. (1996)	*Pinus sylvestris*	Country
CZ	Černý et al. (1996)	*Quercus robur*	Country
CZ	IFER - internal material (1998)	*Abies alba*	Country
CZ	IFER - internal material (1998)	*Alnus glutinosa*	Country
CZ	IFER - internal material (1998)	*Betula pendula*	Country
CZ	IFER - internal material (1998)	*Carpinus betulus*	Country
CZ	IFER - internal material (1998)	*Fraxinus excelsior*	Country
CZ	IFER - internal material (1998)	*Larix decidua*	Country
CZ	IFER - internal material (1998)	*Populus cul.*	Country
CZ	IFER - internal material (1998)	*Pseudotsuga menziesii*	Country
FR	Decourt (1972)	*Picea abies*	Regional
FR	Bisch (1987)	*Quercus petraea*	Regional
FR	Bouchon & Trencia (1990)	*Quercus petraea*	Regional
FR	Le Moguédec & Dhôte (2012)	*Quercus petraea*	Regional
FR	Décourt 1965	*Pinus nigra*	Regional
FR	Décourt 1965	*Pinus sylvestris*	Regional
DE	Albert et al. (2021)	*Fagus sylvatica*	Regional
DE	Albert et al. (2021)	*Picea abies*	Regional
DE	Albert et al. (2021)	*Pinus sylvestris*	Regional
DE	Albert et al. (2021)	*Pseudotsuga menziesii*	Regional
DE	Albert et al. (2021)	*Quercus robur*	Regional
NL	Jansen & Oosterbaan (2018)	*Acer pseudoplatanus*	Country
NL	Jansen & Oosterbaan (2018)	*Alnus glutinosa*	Country
NL	Jansen & Oosterbaan (2018)	*Betula pendula*	Country
NL	Jansen & Oosterbaan (2018)	*Fagus sylvatica*	Country
NL	Jansen & Oosterbaan (2018)	*Fraxinus excelsior*	Country
NL	Jansen & Oosterbaan (2018)	*Larix kaempferi*	Country
NL	Jansen & Oosterbaan (2018)	*Picea abies*	Country
NL	Jansen & Oosterbaan (2018)	*Pinus nigra subsp. laricio*	Country
NL	Jansen & Oosterbaan (2018)	*Pinus nigra subsp. nigra*	Country

Country	Reference	Specie	Level
NL	Jansen & Oosterbaan (2018)	*Pinus sylvestris*	Country
NL	Jansen & Oosterbaan (2018)	*Populus cul.*	Country
NL	Jansen & Oosterbaan (2018)	*Populus tremula*	Country
NL	Jansen & Oosterbaan (2018)	*Pseudotsuga menziesii*	Country
NL	Jansen & Oosterbaan (2018)	*Quercus robur*	Country
NL	Jansen & Oosterbaan (2018)	*Quercus rubra*	Country
ES	Bautista et al. (2001)	*Pinus nigra*	Regional
ES	García Abejón & Gómez Loranca (1984)	*Pinus sylvestris*	Regional
ES	García Abejón (1981)	*Pinus sylvestris*	Regional
ES	García Abejón et al. (1989)	*Pinus pinaster*	Regional
ES	Gonzalez Molina et al. (1999)	*Pinus nigra*	Regional
ES	Gea Izquierdo et al. (2007)	*Quercus ilex*	Regional
ES	Montero et al. (2008)	*Pinus pinea*	Regional
ES	Montero et al. (2000)	*Pinus halepensis*	Regional

Data extraction and analysis procedure

Three key data sources are analyzed: 1) NIRs containing relevant data for biomass carbon content estimation and representative biomass functions for the country-specific tree species. 2) National sample-based forest inventories, such as NFI, that contain data on tree and stand characteristics and volumetric and/or biomass functions. 3) Yield tables from which the stand dimensions for individual species can be extracted by site productivity classes. The applicable information regarding these three sources is processed according to the guidance on biomass estimation made by Cienciala et al. (2022) to derive the representative site index, survival rate and representative tree and stand dimensions at age 40 years. The steps followed to analyze the information are summarized below.

1. A list of the country-specific tree species for Life Terra was extracted using the Life Terra database, focusing on the countries with largest afforestation area. The extracted data can be found in Annex I.
2. NIRs on GHG emissions and yield tables for each of the countries shown in Table 1 were analyzed. The relevant information regarding tree and stand growth, forest density and biomass functions was extracted.
3. Survival rate and site index by country, tree species, and/or species group type was estimated using available NFI data according to Cienciala et al. (2022). This estimated site index is labelled as a guiding site index thereon.
4. Tree and stand dimensions were retrieved from yield tables using the guiding site index estimated in step 3. When the guiding site index was between two site productivity classes of a given yield table, a linear interpolation to extract the available dimensions at age 40 years was carried out.
5. Available tree and stand dimensions at age 40 years were also extracted from the NFI data. These tree and stand dimensions were compared with the ones retrieved from the yield tables in step 4.

Recommended sources for extracting information

The following links and references were the general sources used for obtaining relevant information about the country-specific NIRs on GHG emissions and NFIs. The sources are the following:

NIR on GHG emissions

The website of the National Inventory Submissions (2022) https://unfccc.int/ghg-inventories-annex-i-parties/2022 was used to extract the NIR of the current year by countries.

NFI

Books: Tomppo et al., (2010) and Vidal et al., (2016). These two books contain summarized relevant information about the country-specific NFI methodology.

Website: http://739uq.w4yserver.at/index.php/members. The contact person responsible for the published NFI results, and relevant links to extract the NFI data are available on the website. Also, general information about the NFI methodology is displayed on the website.

Results

Since this report is extracting country-specific information, the results are ordered by countries.

Germany

Tree species in Life Terra plantations

Tree species composition of Life Terra in Germany is shown in Fig. 2.

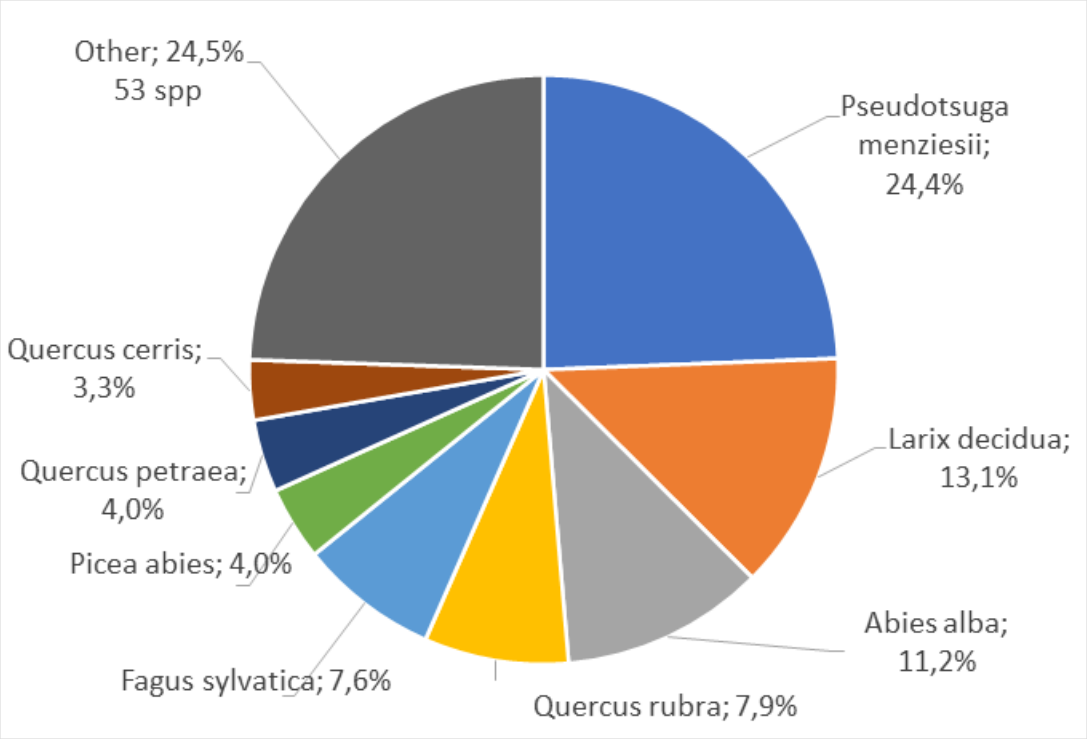

Fig. 2: The most frequent tree species planted by Life Terra in Germany. Number of trees planted by tree species (N=166 889 trees). Data extracted on September 29, 2022.

National Inventory Report on GHG emissions

The latest NIR on GHG emissions reported by Germany (2022), estimated the above-ground biomass (AGB) of principal tree species (*Picea abies*, *Fagus sylvatica*, *Pinus sylvestris*, and *Quercus spp*) using the biomass functions of Kändler & Bösch (2013). Other softwoods are estimated using the biomass functions of Grundner & Schwappach (1952). Tree and stand dimensions, used as independent variables of the biomass functions, were retrieved from their harvest statistics and NFI data.

The AGB functions are applicable for:

- Tree species with diameter at breast-height (DBH) >= 10 cm.
- Tree species with DBH < 10 cm and tree-height (H) >= 1.3 m
- Tree species with H < 1.3 m

The equations for the largest trees (DBH >= 10 cm) are not applicable for the Life Terra biomass estimation since the diameter in cm at 30% of tree-height is needed as independent variable.

In the mentioned NIR on GHG emissions, the below-ground biomass (BGB) of *Picea abies* and *Fagus sylvatica* were estimated using biomass functions of Bolte et al., (2003). For *Pinus* spp, Neubauer & Demant (2016), for *Quercus* spp., Drexhage & Colin (2001)[1], and for soft hardwoods, Johansson & Hjelm (2012).

National Forest Inventory

The German NFI is currently in its fourth inventory cycle with reference date in 2022 (NFI 2022). However, the results are not published yet. The last available NFI of Germany was carried out during the period 2011-2012. The results of the NFI are available at this website: https://www.bundeswaldinventur.de/. Data on tree and stand dimensions by tree species and stand age classes were extracted. The reference for the biomass functions used in this NFI are not available.

Estimated guiding site index from the third German NFI

Lorey's mean height (Lorey-height thereon) in m by stand age classes and tree species was available in the NFI. Lorey-height weights the contribution of trees to the stand height by their basal area. Lorey-height is considered as a stand height by different authors (Nakai et al., 2010). However, to determine site index, the dominant height is commonly used. The dominant height is considered as a stand height estimated as an average height of the 100 biggest trees per ha (h_{100}) in the stand or of 20% of the thickest trees in the stand (Ferezliev et al., 2018). Nakai et al. (2010), did not find significant difference between the Lorey-height and the dominant height in several forest stand inventories. However, Ferezliev et al. (2018) observed dominant heights significantly higher than Lorey-height in *Pseudotsuga menziesii* forest stands. Since the dominant height was not available in the German NFI, Lorey-height was used to estimate the guiding site index of Germany. The results are shown in Fig. 3 and Fig. 4 for broadleaves and coniferous trees, respectively.

[1] Retrieved from Bolte et al., (2003)

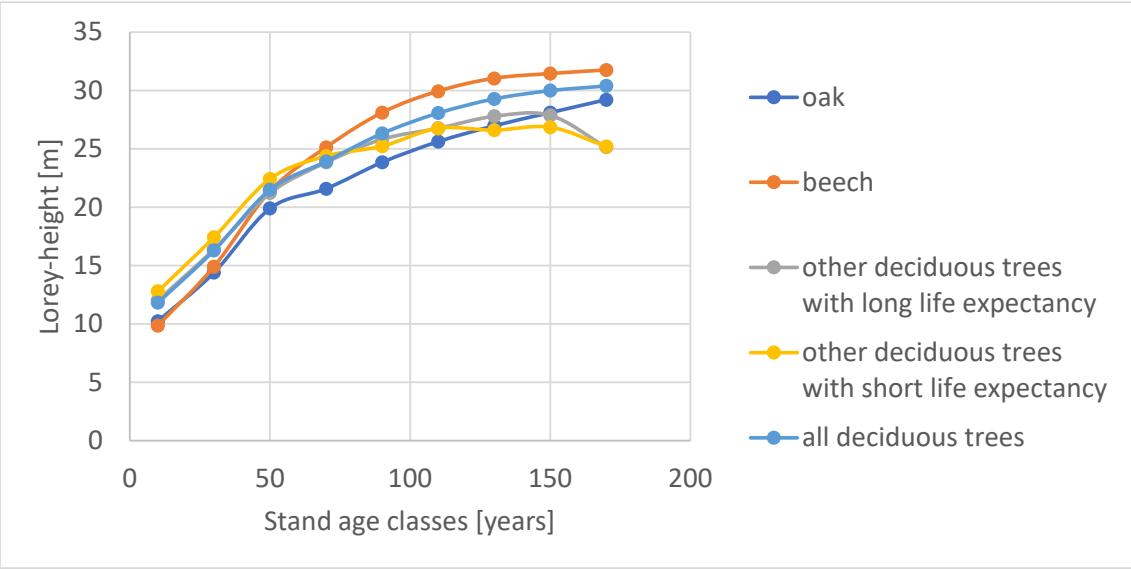

Fig. 3: Lorey-height by stand age classes for broadleaved tree species. Data extracted from the third NFI of Germany (2012).

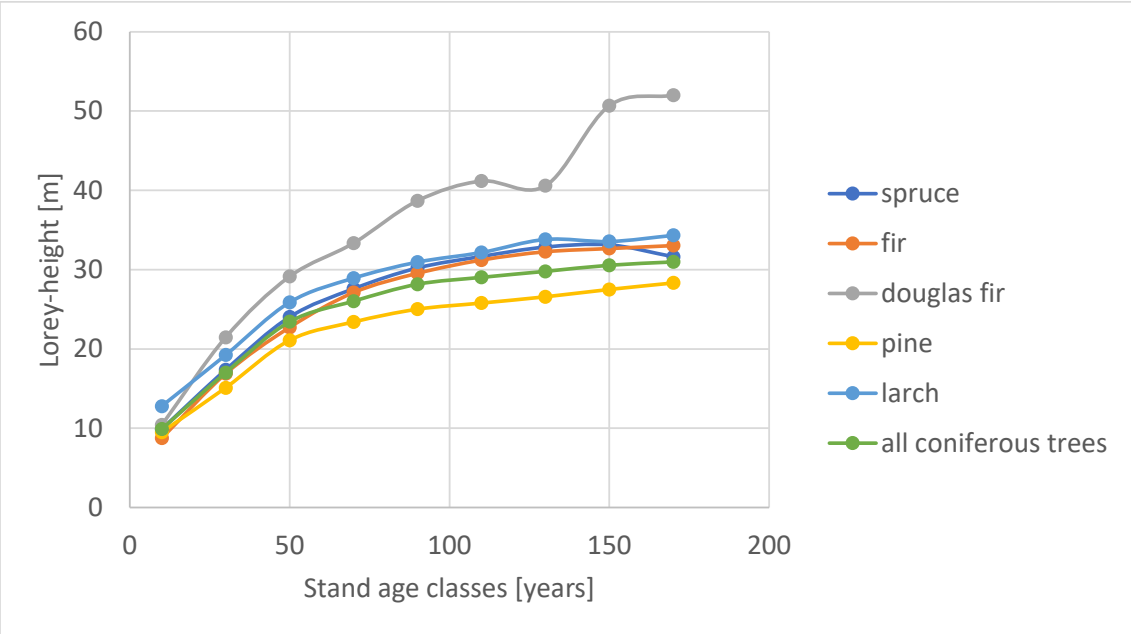

Fig. 4: Lorey-height by stand age classes for coniferous tree species. Data extracted from the third NFI of Germany (2012).

The guiding site index by tree species was estimated as the average Lorey-height of two age classes (81-100 and 101-120). The results are shown in Table 3.

Table 3: Lorey-height in m and estimated guiding site index (SI) in m by tree species and age classes in years. Data retrieved from the third German NFI (2012).

	Age classes [years]		
Tree species group	**81 - 100**	**101 - 120**	**SI [m]**
Quercus spp.	23.8	25.6	24.7
Fagus sylvatica	28.1	29.9	29.0
Other deciduous trees with long life expectancy	25.8	26.8	26.3
Other deciduous trees with short life expectancy	25.2	26.8	26.0
All deciduous trees	26.3	28.1	27.2

Tree species group	Age classes [years] 81 - 100	101 - 120	SI [m]
Picea abies	30.2	31.7	30.9
Abies alba	29.5	31.2	30.4
Pseudotsgua menziesii	38.7	41.2	39.9
Pinus spp.	25.0	25.8	25.4
Larix decidua	31.0	32.2	31.6
All coniferous trees	28.2	29.0	28.6

Derived survival rate

Stand density by tree species and age classes was retrieved from the third NFI of Germany (2012). The results are shown for broadleaved and coniferous tree species in Fig. 5 and Fig. 6, respectively.

Fig. 5: Stand density [trees/ha] by stand age classes [years] for broadleaved tree species. Data extracted from the third NFI of Germany (2012).

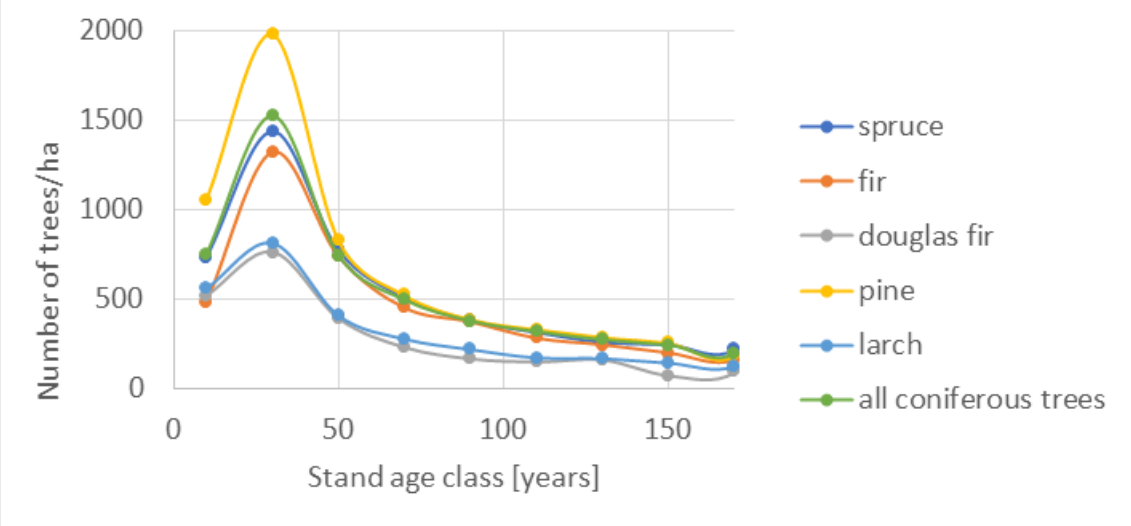

Fig. 6: Stand density [trees/ha] by stand age classes [years] for conifer tree species. Data extracted from the third NFI of Germany (2012).

Both broadleaved and coniferous stands showed a lower number of trees per hectare at age class 10 (0 to 20 years) than at 30 (21 to 40 years). Since the stand density is expected to exponentially decrease over stand age classes [years], this observation at age class 10 could affect the estimation of survival rate. Therefore, stand density at age class 10 years was omitted to derive survival rate. The number of trees per hectare by species group type was derived at three different stand age classes and an exponential trend was used to estimate the survival rate (Fig. 7). The derived survival rate was 36.8% and 32.6% for broadleaved and coniferous trees, respectively.

Fig. 7: Exponential trend of stand density over time. Data extracted from the third NFI of Germany (2012).

Tree and stand dimensions at age 40 years

Tree and stand dimensions from the yield table models (Albert et al., 2021) by tree species and guiding site index are shown in Table 4. When the guiding site index, derived from NFI data, was between two site index classes of the yield table models, a linear interpolation was carried out to extract the available dimensions. Since the allometric equations used by the last NIR on GHG emissions of Germany (2022) were not applicable for the Life Terra biomass estimations, the allometric equations of Vonderach et al. (2018) were used to estimate above-ground biomass. Below-ground biomass was estimated using suitable expansion factors from the table 4.4 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006).

Table 4: Tree-dimensions and biomass at age 40 years by tree species and guiding site index (SI). Stand density (N) in number of trees per hectare, diameter at breast height (DBH) in cm, tree-height (H) in m, and living biomass (LB) in t/tree.

Species	SI [m]	N [trees/ha]	DBH [cm]	H [m]	LB [t/tree]
Fagus sylvatica	29.0	2 975	7.8	9.9	0.021
Picea abies	30.9	1 386	14.5	14.1	0.077
Pinus sylvestris	25.4	1 838	12.8	13.6	0.051
Pseudotsuga menziesii	39.9	703	24.9	21.2	0.284
Quercus robur	24.7	1 088	13.3	12.9	0.079

The tree dimensions of *Fagus sylvatica* retrieved from the yield table models were lower than those observed in other broadleaved trees as *Quercus robur* (Table 4). This difference is corresponding to stand density.

Discussion

The low number of trees per hectare at age class 10 (Fig. 5 and Fig. 6) could be explained by the small tree dimensions at this age and the NFI methodology for measuring and/or counting trees. Most commonly, sample-based forest inventories measure and/or count the trees with DBH bigger than 5-6.9 cm, especially if the inventory is estimating merchantable wood volume.

The derived survival rate (36.8% and 32.6% for broadleaved and coniferous trees, respectively) showed similar results as estimated by Cienciala et al. (2022). These authors estimated survival rates around 34% and 31% at age 40 years for broadleaved and coniferous trees under Continental biogeographic conditions, respectively.

A more accurate assessment of guiding site index could be carried out by using dominant heights instead of Lorey-heights (Fig. 3 and Fig. 4).

Spain

Tree species in Life Terra plantations

Tree species composition of Life Terra in Spain is shown in Fig. 8.

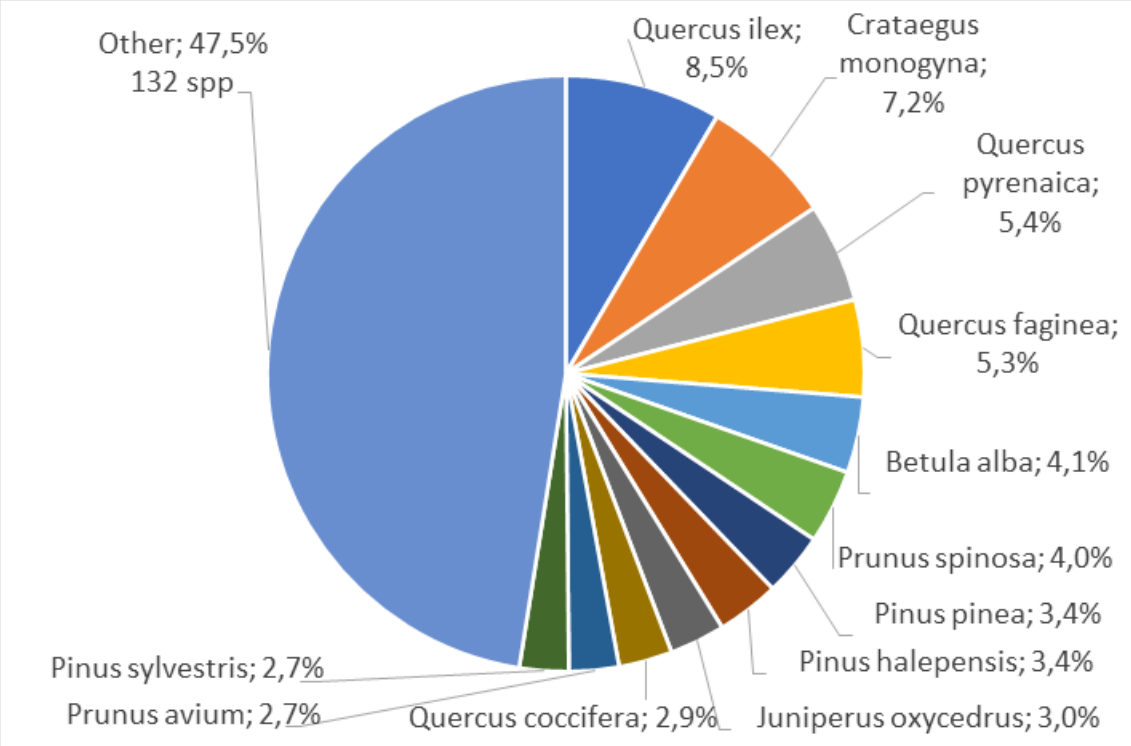

Fig. 8: The most frequent tree species planted by Life Terra in Spain. Number of trees planted by tree species (N=159 608 trees). Data extracted on September 29, 2022.

National Inventory Report on GHG emissions

The biomass estimation reported by the latest Spanish NIR on GHG emissions (2022) was based on volumetric functions, wood density and expansion factors. The input data for the volumetric functions was retrieved from the Spanish NFIs. An important source of information on biomass

estimates at tree-level was cited in NIR as Montero et al. (2005) This study contains biomass equations for many Spanish tree species.

National Forest Inventory

The Spanish NFI results can be found in this website:
https://www.miteco.gob.es/es/biodiversidad/temas/inventarios-nacionales/inventario-forestal-nacional/default.aspx

Since the area of Spain is very extensive, the NFI estimated tree biomass by provinces. The 4th NFI is the last Spanish NFI and the results of 24 provinces (N=50) were available (as of Sep. 2022). Ruiz-Peinado (2013) prepared a list of representative provinces and/or localities to parameterize species-specific biomass functions according to their natural distribution in Spain (Table 5). Biomass functions published by this author are used in the last Spanish NFI to estimate tree biomass. A similar list of provinces for sampling trees to estimate tree biomass by tree species was made by Montero et al. (2005).

Table 5: Provinces and localities sampled for parameterizing biomass equations by tree species in Spain. Extracted from Ruiz-Peinado (2013)

Province and/or locality of Spain	**Tree species**
The Pyrenees	*Abies alba*
Sierra de Grazalema & Sierra de las Nieves	*Abies pinsapo*
The Pyrenees	*Alnus glutinosa*
Central system and Sierra de Ronda	*Castanea sativa*
Sierra de las Nieves	*Ceratonia siliqua*
Huelva	*Eucalyptus globulus*
Cordillera Cantábrica and The Pyrenees	*Fagus sylvatica*
The Pyrenees and Los Alcornocales Natural Park	*Fraxinus angustifolia*
Guadalajara	*Juniperus thurifera*
Cádiz	*Olea europaea*
Tenerife Island	*Pinus canariensis*
Sierra de Segura	*Pinus halepensis*
Iberian System	*Pinus nigra*
Iberian System	*Pinus nigra*
Guadalajara and Ciudad Real	*Pinus pinaster*
Meseta Norte and Huelva	*Pinus pinea*
Madrid and Segovia	*Pinus sylvestris*
The Pyrenees	*Pinus uncinata*
Soria, Segovia and Salamanca	*Populus x euramericana*
Los Alcornocales Natural Park	*Quercus canariensis*
Guadalajara	*Quercus faginea*
Extremadura and Madrid	*Quercus ilex*
Extramadura, Cordillera Cantábrica and Central System	*Quercus pyrenaica*
Los Alcornocales Natural Park and Sierra de San Pedro	*Quercus suber*

Relevant information from the Spanish NFI

A brief analysis of the province of Madrid using data from the 4th Spanish NFI is described. Madrid was selected as the study province because the natural distribution of important Mediterranean tree species such as *Quercus ilex*, *Quercus pyrenaica*, and *Pinus sylvestris* covers this province (Ruiz-Peinado, 2013). Furthermore, these tree-species are quite frequently planted by Life Terra (Fig. 8) and the results of the last Spanish NFI are already available for this province.

The available data that can be extracted from the Spanish NFI website[2] is divided in three broad categories: i) "Base de datos de campo" (Field-database thereon), ii) "Base de datos sig" (Sig-database thereon) and iii) "Resultados" (Results-database thereon). All these database categories are available by provinces.

In the field-database, there are different tables that contain data from field survey. Probably the most useful tables available in this database to proceed with the biomass estimation are the following:

- Table "PCEspParc". In this table, there is available information about the stand characteristics at plot level. The stand age "Edad" in years, and the name of the plot "Estadillo", are available in this table. Note that the stand age is estimated by coring one representative tree of the stand, and it is only estimated in even-aged stands.
- Table "PCMayores". In this table, there is information at tree level. The name of the plot is also recorded, so it is possible to link this table with "PCEspParc". Information at tree level includes, i. a., tree diameter, tree height and tree species.

An important thing to mention is that the radius of the Spanish NFI plots is variable. The size of the plot depends on the diameter class that is to be measured. The radius of the plot by diameter classes and the corresponding expansion factor to derive stand density [trees/ha] is shown in Table 6. The expansion factor is simply a relation of plot size to hectare.

Table 6: Diameter classes and expansion factors to estimate stand density in the 4th Spanish NFI

DBH range used in the NFI [mm]	Diameter class [cm]	Radius [m]	Expansion factor
75 - 124,5	10	5	127.3
125 - 174.5	15	10	31.8
175 - 224,5	20	10	31.8
225 - 274,5	25	15	14.2
275 - 324,5	30	15	14.2
325 - 374,5	35	15	14.2
375 - 424,5	40	15	14.2
425 - 474,5	45	25	5.1
475 - 524,5	50	25	5.1
525 - 574,5	55	25	5.1
575 - 624,5	60	25	5.1
625 - 674,5	65	25	5.1
>675	70	25	5.1

In results-database, for a given province, there are several tables that contain results and explanations about the Spanish NFI estimations, e.g., biomass functions used for biomass estimates. The table "Dendrometría" contains a sub-table XX-409, where *XX* is the Spanish province code. In this interactive sub-table, the coefficients of the allometric functions of Ruiz-Peinado (2013) are available allowing input of the independent variables, DBH and tree-height by tree species, to estimate tree biomass components.

[2] https://www.miteco.gob.es/es/biodiversidad/temas/inventarios-nacionales/inventario-forestal-nacional/cuarto_inventario.aspx

A list of tree and shrub-species used in the Spanish NFI could be useful for Life Terra to distinguish tree-species from shrubs as the difference between them is sometimes doubtful. This list of species can be found in Annex II (Table A2. 1).

Estimated guiding site index

The guiding site index is derived as the percentile 90 (%90) of the tree heights by tree species using data from the 4th Spanish NFI filtered by age from 90 to 99 years in the province of Madrid. General guiding site index for broadleaved and coniferous trees was estimated as the average by group type. The results are shown in Table 7.

Table 7: Maximum tree height in m and estimated guiding site index in m by tree species and group type.

Tree species	Group type	Province	Max H [m]	SI [m]	N	
Betula spp.	Broadleaved	Madrid	21.5	19,9	7	
Cedrus atlantica	Conifers	Madrid	19.3	19,3	4	
Crataegus monogyna	Broadleaved	Madrid	8.4	8,1	11	
Cupressus arizonica	Conifers	Madrid	18.6	16,5	5	
Cupressus sempervirens	Conifers	Madrid	14.5	14,2	2	
Fagus sylvatica	Broadleaved	Madrid	27	20,4	24	
Fraxinus angustifolia	Broadleaved	Madrid	18.2	13,0	211	
Juniperus oxycedrus	Conifers	Madrid	5.8	5,6	18	
Juniperus phoenicea	Conifers	Madrid	9.4	8,4	7	
Pinus sylvestris	Conifers	Madrid	28	23,3	294	*
Populus nigra	Broadleaved	Madrid	14	14,0	1	
Quercus ilex ssp. ballota	Broadleaved	Madrid	12	10,4	44	*
Quercus pyrenaica	Broadleaved	Madrid	20.3	18,2	35	*
Salix alba	Broadleaved	Madrid	17.1	14,1	12	
General broadleaved trees		Madrid	17,3	14.8		
General coniferous trees		Madrid	15,9	14.5		

* Tree species sampled by Ruiz-Peinado (2013) in Madrid to parameterize biomass functions; N = Number of observations

Derived survival rate

The stand density results were analyzed by plots, stand age classes (30, 50 and 70), and species group type, using data of the last Spanish NFI. However, the number of trees per hectare was not exponentially decreasing across stand age classes. Therefore, the survival rate for the Spanish conditions could not be derived precisely from the sample data of Madrid province.

The yield table models of *Pinus halepensis* at fertility class Q14 are representative to estimate the stand density dynamics for conifer-dominated Mediterranean forests (Montero et al. 2001). These yield tables have been used to estimate coniferous forest dynamics in the last NIR on GHG emissions of Malta (2022). The survival rate of *Pinus halepensis* at age 40 years, derived from the mentioned yield table and according to the procedure of Cienciala et al. (2022), was 55.1%. The stand density by stand age classes is shown in Fig. 24 (example of Malta). Stand density for Spanish broadleaved-dominated forests by stand age classes was not available.

Estimated DBH and height at age 40 years using NFI data

All the available measured plots by the latest Spanish NFI in the province of Madrid were filtered by age from 35-45 years to derive the tree dimensions by species at age 40 years. The results

are shown in Table 8. Outliers, defined as data points that are located outside the whiskers of a box plot, were omitted (*Pinus pinea* and *Populus nigra*).

Table 8: Mean tree dimensions at age 40 years using data from the 4th NFI of Spain.

Specie	Province	mean DBH [cm]	mean H [m]	N	
Acer monspessulanum	Madrid	12.9	6.1	1	
Alnus glutinosa	Madrid	13.6	5.4	7	
Crataegus monogyna	Madrid	9.6	5.3	2	
Fraxinus angustifolia	Madrid	23.9	9.0	83	
Juniperus communis	Madrid	11.5	3.9	5	
Juniperus oxycedrus	Madrid	12.9	4.0	46	
Juniperus phoenicea	Madrid	18.2	5.5	2	
Juniperus thurifera	Madrid	20.5	5.6	2	
Pinus halepensis	Madrid	22.6	11.3	30	
Pinus nigra	Madrid	18.6	8.9	148	
Pinus pinaster	Madrid	25.5	10.6	888	
Pinus sylvestris	Madrid	21.5	10.4	2 289	*
Pinus uncinate	Madrid	15.5	6.2	76	
Populus tremula	Madrid	28.7	14.5	5	
Quercus faginea	Madrid	19.2	6.7	6	
Quercus ilex ssp. ballota	Madrid	13.7	5.3	215	*
Quercus pyrenaica	Madrid	14.4	8.8	589	*
Quercus suber	Madrid	16.7	5.3	2	
Salix atrocinerea	Madrid	19.5	10.7	51	
Salix spp.	Madrid	31.3	7.5	1	
Sorbus torminalis	Madrid	7.7	7.3	1	

* Tree species sampled by Ruiz-Peinado (2013) in Madrid to parameterize biomass functions; N = Number of observations

Comparison between Montero et al. (2005) and Ruiz-Peinado (2013) biomass equations

Since the NFI and NIR on GHG emissions of Spain cite different biomass functions, Ruiz-Peinado (2013) and Montero et al. (2005), respectively. The biomass equations of both authors were compared. The mean dimensions shown in Table 8, with n >= 30, were used as input variables of these biomass equations. Outliers were discarded, i.e., *Fraxinus angustifolia* (0.488 t/tree). The estimated biomass of *Salix atronicera* at age 40 years (0.343 t/tree) was also discarded since it was around three times larger than other broadleaved trees, i.e., *Quecus ilex* and *Q. pyrenaica*. The results are shown in Fig. 9.

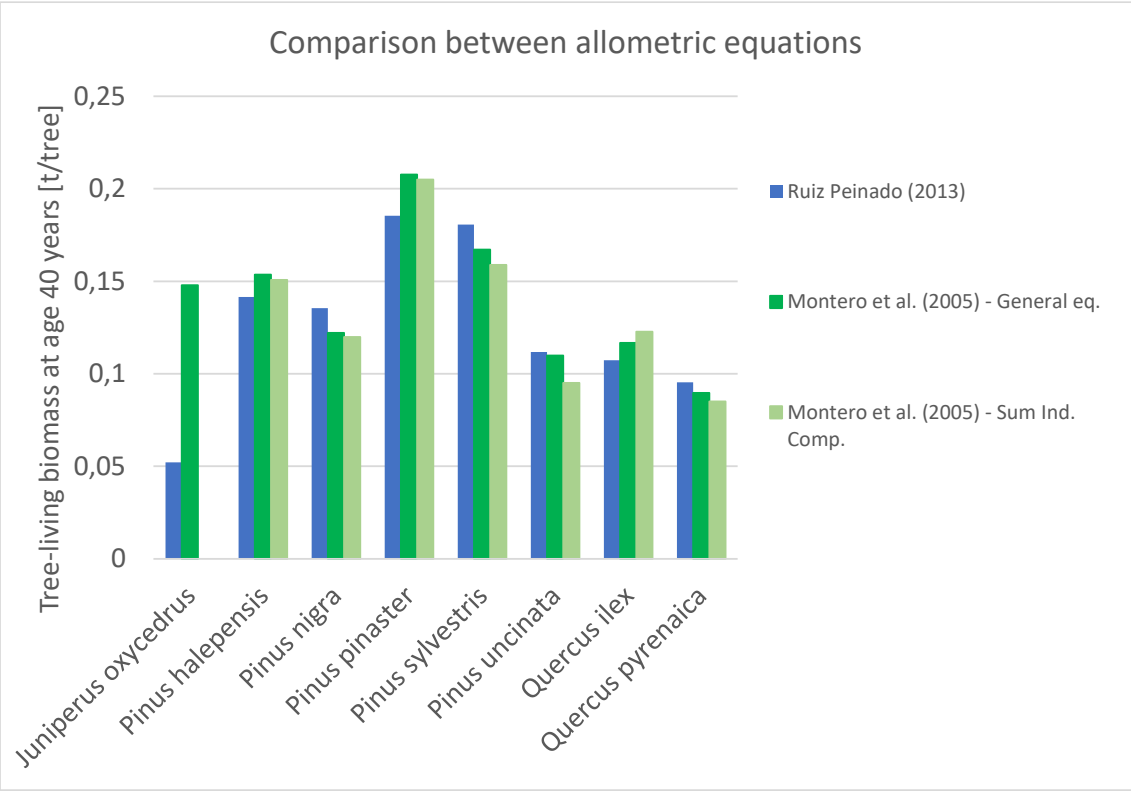

Fig. 9: Comparison between biomass functions published by Ruiz-Peinado (2013) and Montero et al. (2005). "Sum Ind. Comp." = sum of individual biomass components.

The tree biomass estimated by the equations of Montero et al. (2005) and the equations of Ruiz-Peinado (2013) showed very similar results for most of the tree species analyzed (Fig. 9). However, a significant difference was found in the tree biomass estimations of *Juniperus oxycedrus*, being the estimations of Montero et al. (2005) much higher than the estimations of Ruiz Peinado (2013).

Tree and stand dimensions at age 40 years

Tree and stand dimensions from the Spanish yield table models (references in Table 2) by tree species and guiding site index were retrieved. The guiding site index shown in Table 7 and dimensions shown in Table 8 with a sample size N>=30 are used. The tree species *Fraxinus angustifolia* and *Salix atronicera* were discarded for the aforementioned reason when comparing the biomass functions of Ruiz Peinado (2013) and Montero et al. (2005). Linear interpolations are carried out to extract the available dimensions from the yield table models when the guiding site index is between two site productivity classes. The guiding site index of *Pinus sylvestris* is used for all *Pinus spp.*, i.e., 23.3 m. To estimate individual-tree biomass, the equations of Ruiz Peinado (2013) are used. The results are shown in Table 9.

Despite the fact that yield table models of *Quercus ilex* are available (Gea Izquierdo et al., 2007), they cannot be readily used because the site productivity conditions were assessed by these authors as the mean diameter in cm that this tree species reaches at age 75 years. This is not directly comparable with site productivity conditions (guiding site index) estimated according to Cienciala et al. (2022).

Table 9: Mean dimensions at age 40 years. Guiding site index (SI) in m, diameter at breast height (DBH) in cm, tree-height (H) in m, stand density (N) in trees per hectare, and living biomass (LB) in t/tree.

	Derived from NFI data				Derived from yield tables				
Species	**SI**	**DBH**	**H**	**LB**	**N**	**DBH**	**H**	**LB**	
Juniperus oxycedrus	NA	12.9	4.0	0.052	NA	NA	NA	NA	
Pinus halepensis	23.3	22.6	11.3	0.142	658	23.0	11.9	0.152	
Pinus nigra	23.3	18.6	8.9	0.135	873	24.4	15.5	0.310	
Pinus pinaster	23.3	25.5	10.6	0.185	723	22.1	11.3	0.136	
Pinus sylvestris	23.3	21.5	10.4	0.181	2664	13.3	9.1	0.065	*
Pinus uncinata	23.3	15.5	6.2	0.112	NA	NA	NA	NA	
Quercus ilex ssp. ballota	10.4	13.7	5.3	0.107	NA	NA	NA	NA	*
Quercus pyrenaica	18.2	14.4	8.8	0.095	NA	NA	NA	NA	*

* Tree species sampled by Ruiz-Peinado (2013) in Madrid to parameterize biomass functions; NA = Not available and/or not applicable

The mean DBH of *Pinus sylvestris* retrieved from NFI was around 8 cm greater than the mean DBH retrieved from the yield table models, which can be explained by differences in strand densities (see below). On the contrary, *Pinus nigra* showed higher values of DBH and height from the yield table models than the NFI. Other tree species had similar values retrieved from the yield table models as the values retrieved from the NFI.

Discussion

Despite the fact that survival rate for broadleaved trees could not be estimated for Spanish conditions, other Mediterranean countries as such as Malta have published similar results on mortality for both broadleaved and coniferous dominated stands (last NIR on GHG emission of Malta, 2022). Therefore, the survival rate estimated for *P. halepensis* (55.1%) could be assumed representative also for broadleaved trees until other empirical evidence is available.

The biomass estimations of Ruiz-Peinado (2013) for *Juniperus oxycedrus* (Fig. 9) seem to be more reliable than those by the Montero et al. (2005) since this tree species usually does not reach the growth rate of pine trees at age 40 years as the comparison in Fig. 9 would imply .

The variability of DBH values retrieved from yield tables for the *Pinus spp.* (Table 9) corresponds generally to stand density.

The retrieved DBH from the NFI data for *Quercus ilex* at age 40 years (around 14 cm, Table 9) is within the range of DBH at age 40 years published by Gea Izquierdo et al. (2007) (9 to 27 cm).

It is important to mention that the site index of some Mediterranean tree species is established by different authors as the dominant height that the stand reaches at age 80 years e.g., *Pinus halepensis* by Montero et al. (2000).

Portugal

Tree species in Life Terra plantations

Tree species composition of Life Terra in Portugal is shown in Fig. 10.

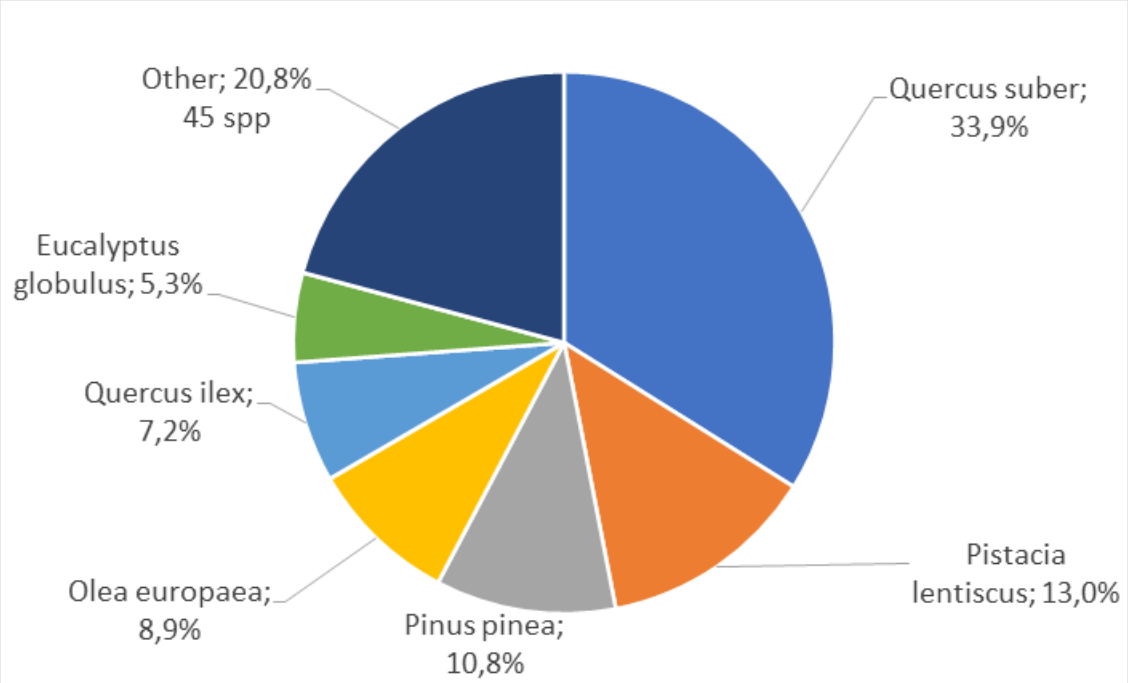

Fig. 10: The most frequent tree species planted by Life Terra in Portugal. Number of trees planted by tree species (N=93 992). Data extracted on September 29, 2022.

National Inventory Report on GHG emissions

The above and below ground biomass equations used in the latest Portuguese NIR on GHG emissions were retrieved from the fifth NFI of Portugal (5NFI thereon). The biomass equations used in the NFI5 are described in an Annex called "Anexo Técnico" section D, pages 182-186 (available in Portuguese language only).

National Forest Inventory

The 6th NFI of Portugal is its latest NFI published. In Table 10, references for the biomass functions used in this NFI are shown.

Table 10: Biomass function used in the 6th NFI of Portugal. Extracted from (Sousa Uva & Pacheco Faias, 2019).

Tree species	Biomass component	Set of biomass equations
Pinus pinaster and other coniferous	AGB	Tomé et al., 2007a
Pinus pinaster and other coniferous	BGB	Tomé et al., 2007a
Eucalyptus spp.	AGB	Tomé et al. 2007a
Eucalyptus spp.	BGB	Soares & Tomé, 2004
Quercus spp. And other broadleaves	AGB	Mendes, 2011
Quercus spp. And other broadleaves	BGB	Montero et al., 2005
Quercus suber	AGB	Tomé et al., 2007a
Quercus suber	BGB	Montero et al., 2005
Quercus ilex	AGB	Paulo & Frederico, 2003
Quercus ilex	BGB	Montero et al., 2005
Pinus pinea	AGB	Tomé et al., 2007a
Pinus pinea	BGB	Tomé et al., 2007a

Tree species	Biomass component	Set of biomass equations
Chestnut and acacia trees	AGB	Patrício, 2006
Chestnut and acacia trees	BGB	Montero et al., 2005
Ceratonia siliqua	AGB	Ruiz-Peinado, 2013
Ceratonia siliqua	BGB	Ruiz-Peinado, 2013
AGB = Above-ground biomass; BGB = Below-ground biomass		

Results from this NFI can be found in this website:
https://www.icnf.pt/florestas/flestudosdocumentosestatisticasindicadores?m=draft

There is a free-software called "FLORESTAT", which can be used to extract the results from the 5NFI. However, mean DBH and/or tree-height by tree species and stand age classes were not available.

Several species-specific models to estimate tree dimensions have been published in Portugal, e.g., DBH-height models for maritime pine (Tomé et al., 2007b), for Eucalyptus (Tomé et al. 2007c), for chestnut (Patricio, 2006), for oaks (Carvalho, 2000). For other tree species a DBH-height model could be made with the data of the 4NFI (Tomppo et al., 2010). It is important to mention that the biomass functions of *Quercus suber* could have the DBH under cork as independent variable. A model to estimate this DBH (under cork) was published by Tomé (2004).

Discussion

Guiding site index could not be derived since the tree-dimensions by species and stand age classes were not available. However, a set of references used in the latest NFI of Portugal for estimating biomass were summarized and could be useful for the Life Terra projects in future.

Italy

Tree species in Life Terra plantations

Tree species composition of Life Terra in Italy is shown in Fig. 11.

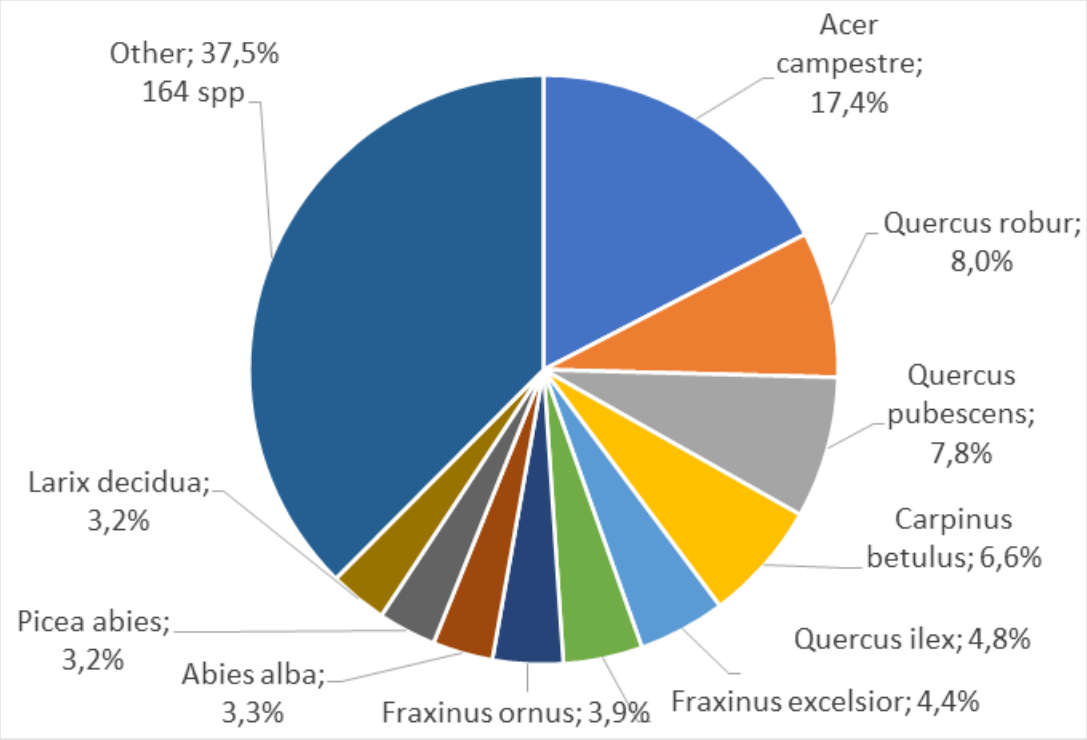

Fig. 11: The most frequent tree species planted by Life Terra in Italy. Number of trees planted by tree species (N=71 900). Data extracted on September 29, 2022.

National Inventory Report on GHG emissions

The latest Italian NIR on GHG emissions (2022) used tree-specific volumetric functions, expansion factors, and wood-density coefficients to estimate tree-biomass at stand level. Tree and stand dimensions were retrieved from the NFI.

National Forest Inventory

Information about the last NFI (2015) can be found in this website:
https://www.sian.it/inventarioforestale/jsp/q_features.jsp

To retrieve tree and stand dimensions, this website can be used (registration needed) https://www.inventarioforestale.org/en/node/13 . However, the stand age classes [years] and biomass results are missing.

The book written by Gasparini et al. (2022) contains detailed information on the NFI methodology for processing its data to obtain regional and national results, including references for estimating tree biomass. These mentioned references are Tabacchi et al. (2011a) and Tabacchi et al. (2011b).

Derived survival rate

Data on stand density by age classes could not be directly extracted from the published results of the Italian NFI. However, this information could be extracted from the latest NIR on GHG emissions of Malta (example of Malta) for sclerophylls, i.e., Mediterranean broadleaved tree-species which are adapted to adapted to long periods of dryness and heat. The stand density by stand age classes is shown in Fig. 24. The derived survival rate of broadleaved stands at age 40

years was 60.3%. Stand density for Italian coniferous-dominated forests by stand age classes was not available.

Other useful information

A list of tree and shrub-species used in the Italian NFI could be useful for Life Terra to distinguish tree-species from shrubs as the difference between them is sometimes doubtful. This list of species can be found in Annex II (Table A2. 1).

Discussion

Guiding site index could not be derived since the tree-dimensions by species and stand age classes were not available. However, a set of references used in the latest NFI of Portugal for estimating biomass were summarized and could be useful for the Life Terra projects in future.

The survival rate of broadleaved tree-species (60.3%) was similar as the estimated for *Pinus halepensis* in Spain (55.1%). Both, broadleaved species in Italy and *Pinus halepensis* in Spain are under Mediterranean climate conditions with long periods of dryness and heat.

The Netherlands

Tree species in Life Terra plantations

Tree species composition of Life Terra in the Netherlands is shown in Fig. 12.

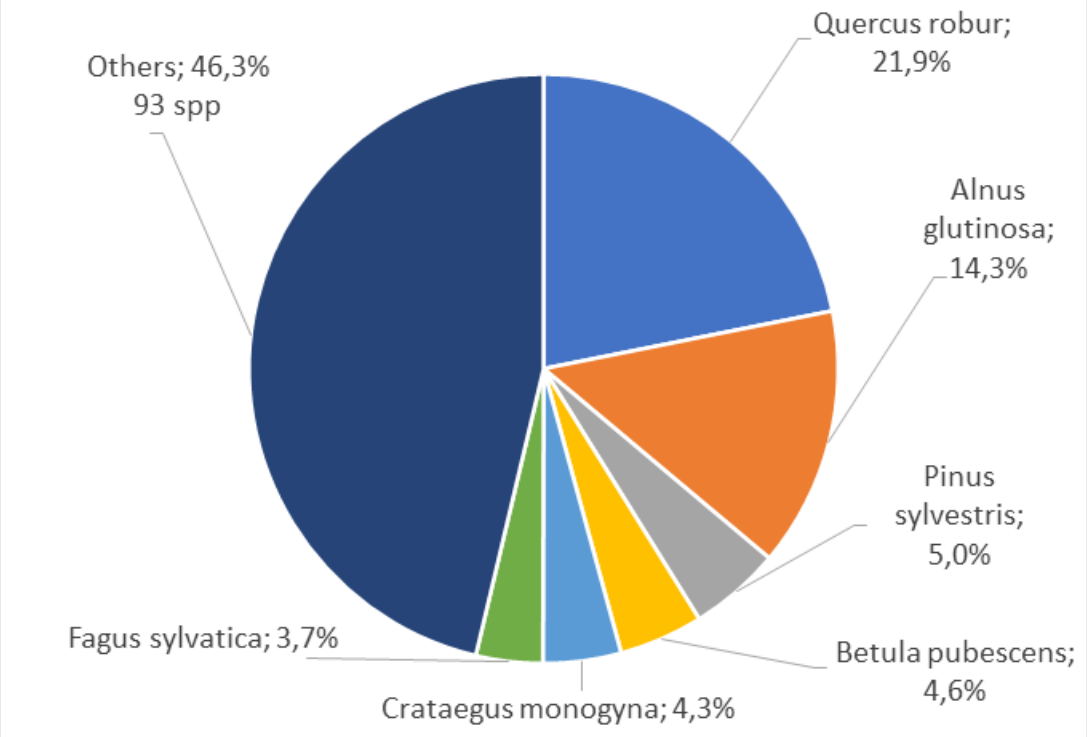

Fig. 12: The most frequent tree species planted by Life Terra in the Netherlands. Number of trees planted by tree species (N=59 232). Data extracted on September 29, 2022.

National Inventory Report on GHG emissions

The latest NIR on GHG emissions of the Netherlands (2022) estimated tree biomass as the sum of all individual tree-biomass components. The stem-biomass component was estimated using volumetric functions and wood-density coefficients. Biomass functions of Forrester et al. (2017) were used to estimate the rest of the tree-biomass components, i.e., foliage, branches, and roots. Tree and stand dimensions were retrieved from the NFI.

National Forest Inventory

The latest NFI in the Netherlands was conducted during years 2017-2022 (7th NFI). The dataset is available at this website https://www.probos.nl/publicaties/overige/1094-mfv-2006-nbi-2012. The dataset of this NFI and its procedure to estimate tree-biomass is available only in Dutch language.

A brief analysis of the NFI data was performed. However, the estimated guiding site index did not seem to be reliable, e.g., the guiding site index of *Picea abies*, estimated as the %90 of tree-height filtered by age classes from 90-110 years, was 16.4 m (N=37). This low guiding site index is the result of a probably incorrect selection of the variables as the information could not be directly extracted in English language.

Discussion

The Netherlands NFI contains very detailed available data. However, that information could not be directly extracted in English language. The reference for biomass equations of different tree-biomass components were summarized, except for the stem component, as it was estimated using volumetric functions.

United Kingdom of Great Britain

Tree species in Life Terra plantations

Tree species composition of Life Terra in the United Kingdom of Great Britain is shown in Fig. 13.

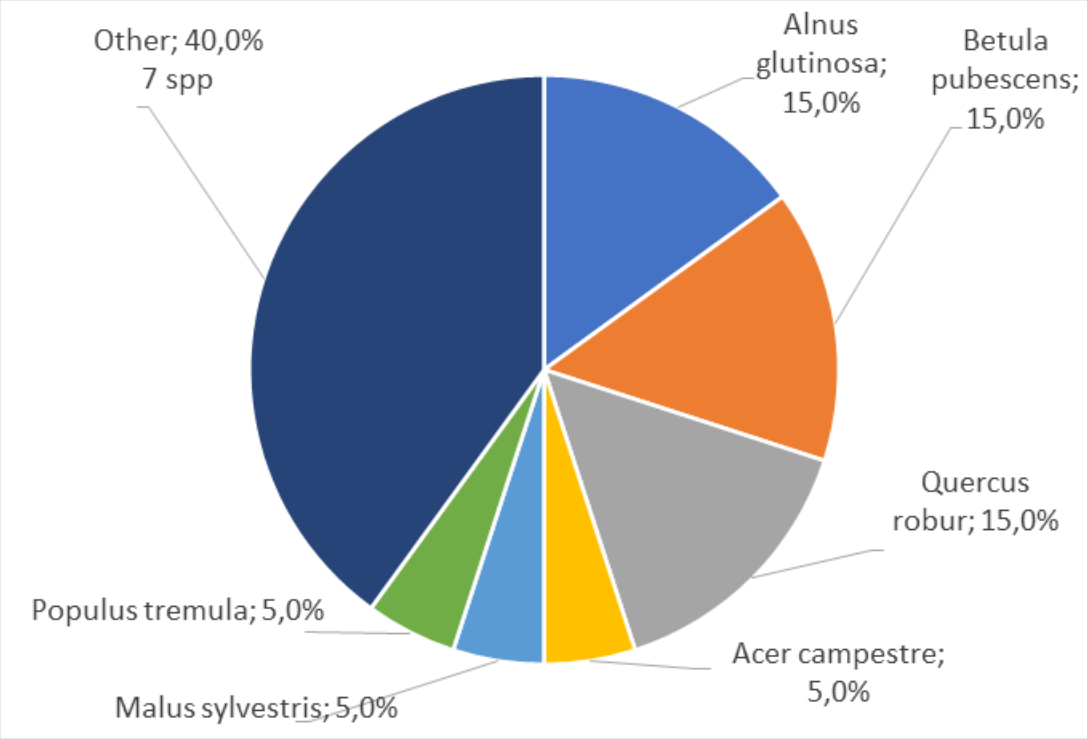

Fig. 13: The most frequent tree species planted by Life Terra in Great Britain. Number of trees planted by tree species (N=14 500). Data extracted on September 29, 2022.

National Inventory Report on GHG emissions

The latest NIR of Great Britain derived stem biomass from the stem volume. Tree and stand characteristics were retrieved from Forestry Statistics[3], supplemented by information from the National Forest Inventory (NFI) field survey and the Northern Ireland Woodland Register. More information was extracted from the National Forestry Accounting Plan 2021-2025[4]. Yield table models originally produced by the British Forestry Commission were also used (Matthews et al., 2016a, 2016b). The guiding tree species used in the last NIR of the UK include tree species of the mentioned yield table models.

The yield tables of Matthews et al. (2016b) contain a set of growth curves with respect to stand age. Unfortunately, these yield tables are only available in a paid software called "Forest Yield: a PC-based yield model for forest management in Britain". The price of this software is £50 + VAT.

National Forest Inventory

Information about the NFI of Great Britain is shown in this website
https://www.forestresearch.gov.uk/tools-and-resources/national-forest-inventory/

The NFIs of Great Britain are carried out in 10–15-year intervals since 1924. The NFI which started in 2009, is the latest of these periodic surveys. The reference of biomass functions and stand characteristics of this NFI could not be extracted.

Discussion

The latest NIR on GHG emissions of Great Britain used wood volume to estimate tree biomass. Yield table models were only available in a paid software. Tree and stand dimensions from the NFI could not be extracted.

[3] https://www.forestresearch.gov.uk/tools-and-resources/statistics/forestry-statistics/forestry-statistics-2021

[4] https://www.gov.uk/government/publications/uk-national-forestry-accounting-plan-2021-to-2025

Czech Republic

Tree species in Life Terra plantations

Tree species composition of Life Terra in the Czech Republic is shown in Fig. 14.

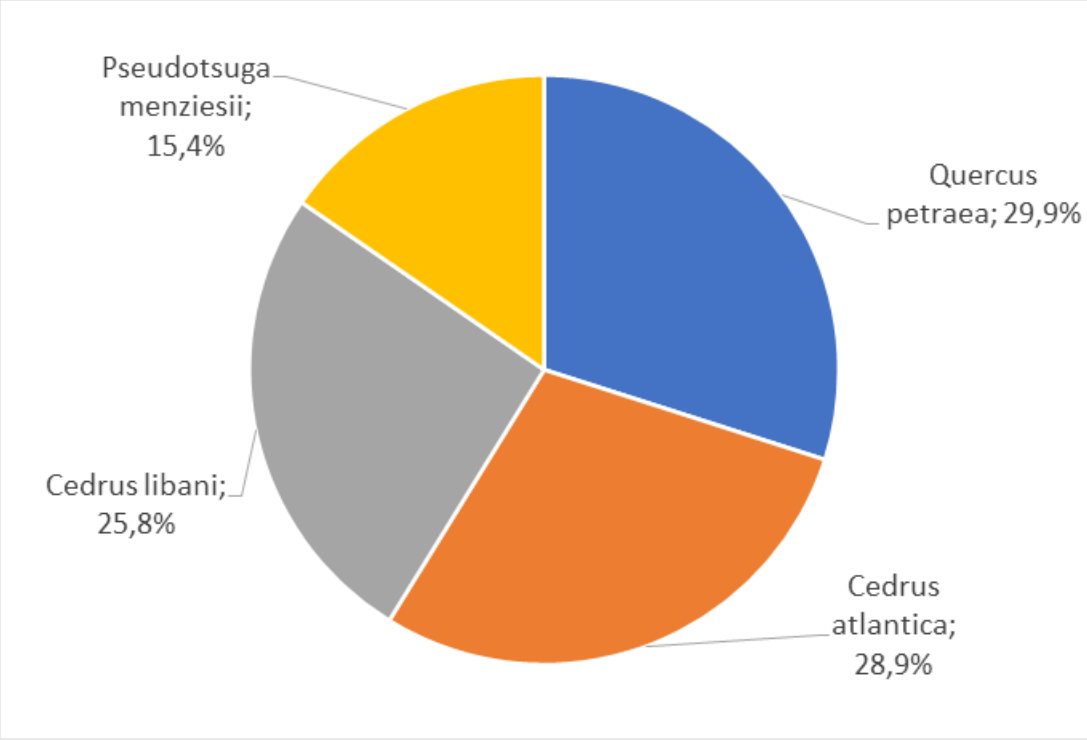

Fig. 14: The most frequent tree species planted by Life Terra in Czech Republic. Number of trees planted by tree species (N=9 765). Data extracted on September 29, 2022.

National Inventory Report on GHG emissions

The latest NIR on GHG emissions of the Czech Republic (2022) estimated tree-biomass using the following sources of allometry: beech (Vonderach et al., 2018, Wutzler et al., 2008 for leaves only), oak (Cienciala et al., 2008a), pine (Cienciala et al. 2006), spruce (Vonderach et al. 2018) and complementarily birch (Marklund, 1988, Repola, 2008 for leaves only). The individual tree-biomass of other tree species was estimated using the following tree-species groups: i-beech: all broadleaved species except oaks, ii-oak: all oak species, iii-pines: all pine species, iv-spruce: all conifers except pines.

National Forest Inventory

Information about the Czech NFI can be found in this website: https://nil.uhul.cz/en/nfi-methodology/elementary-information

The latest NFI in the Czech Republic was carried out from 2016-2021. This NFI corresponds to the third NFI cycle in the Czech Republic. However, the results of this NFI are not available. Kučera & Adolt (2019) published the results of the second Czech NFI, which was carried out during the period 2011-2014. Summarized information about the procedure for estimating biomass was also described by these authors. Biomass was estimated at level of each individual tree using allometric equations for the four main economic tree species - Norway spruce, Scots pine, beech, and oak (winter and summer). Other tree species were matched to these main economic tree species based on similarity of wood density. Tree-biomass is estimated using the following allometric equations:

- The allometric equation according to the Research Institute of Forestry and Hunting (VÚLHM, 2016) was applied to determine the above-ground biomass of the Norway spruce group. The equation uses the following input parameters: D - calculated stem thickness and H – tree-height.
- The allometric equation applied to estimate the above-ground biomass of the Scots pine tree group was according to Cienciala et al. (2006) using the input parameters: D – diameter at breast height, H – tree-height and Z – elevation.
- The allometric equation used to estimate the above-ground biomass of the beech forest tree group was according to Vejpustková et al. (2013) with input parameters: D – diameter at breast height, H – tree-height and N – elevation.
- To estimate the above-ground biomass of the oak group, the allometric equations of Cienciala et al. (2008,) were used. Input parameters D – diameter at breast height and H – tree-height.

The above equations do not include stump biomass. The volume of each stump was estimated separately according to a dendrometry model published by Pařez et al. (1990). The proportion of stump volume to total stem volume varies from 1.5 to 3 % depending on the species and the tree-DBH. The conversion of stump volume to biomass was carried out using the average wood-density coefficients.

Other National Sample-Based Forest Inventories

Tree and stand dimensions by age classes obtained from the country-level landscape inventory project CzechTerra (Cienciala et al., 2016) were also analyzed. This inventory runs in parallel with the NFI. The CzechTerra project includes the same principal tree species as the NIR on GHG emissions plus *Larix decidua.* The stand height was estimated by the CzechTerra project as the mean tree-height weighted by tree dimensions (Fig. 15).

Estimated guiding site index

The guiding site index was estimated as the averaged stand height of two age classes (91-100 and 101-110 years) using data from the CzechTerra project. The results showed that the guiding site index was around 29 and 27 m for coniferous and broadleaved tree species, respectively (Fig. 15). The guiding site index by species are shown in Table 11.

Table 11: Stand height in m and estimated guiding site index (SI) in m by tree species in Czech Republic.

	Stand height by age classes		
Tree species	**91-100**	**101-110**	**SI [m]**
Picea abies	29.8	30.2	30.0
Pinus sylvestris	26.3	27.9	27.1
Larix decidua	30.6	31.6	31.1
Quercus robur	24.6	21.5	23.1
Fagus sylvatica	27.2	29.3	28.3

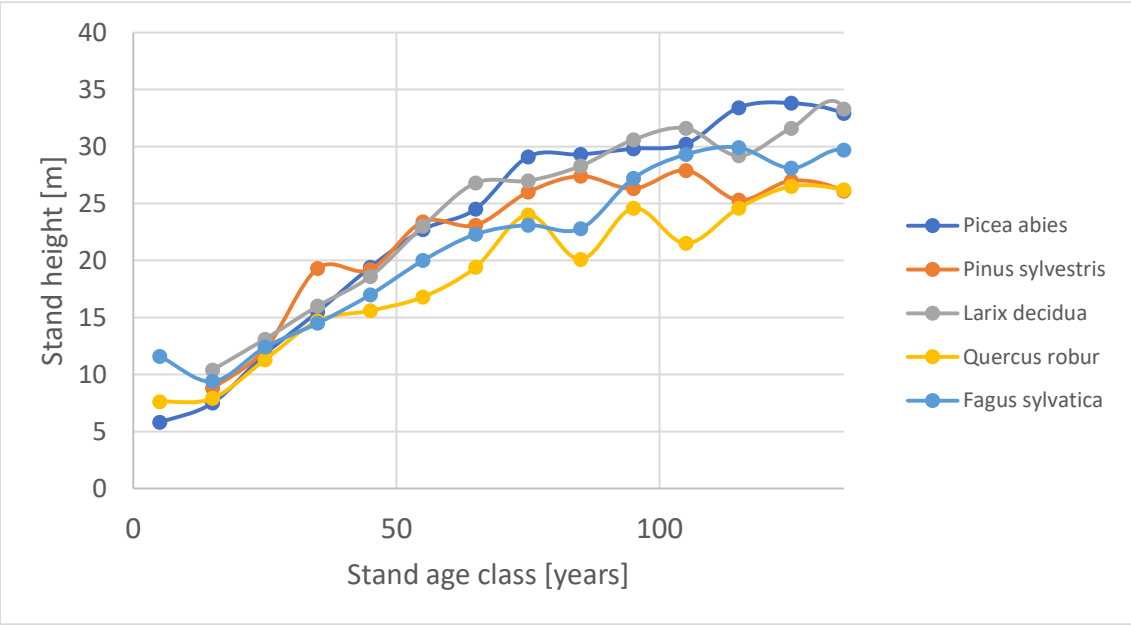

Fig. 15: Stand height in m by stand age classes in Czech Republic. Data from the CzechTerra project.

Derived survival rate

The same procedure as did in the example of Germany was applied to derive survival rate. Stand density, retrieved from the CzechTerra project, is shown in Fig. 16. The exponential trend of stand density by stand age classes is shown in Fig. 17. The derived survival rate was 43.2% and 41.5% for broadleaved and coniferous stands, respectively.

Fig. 16: Number of trees/ha by stand age in the Czech Republic. Data from the CzechTerra project.

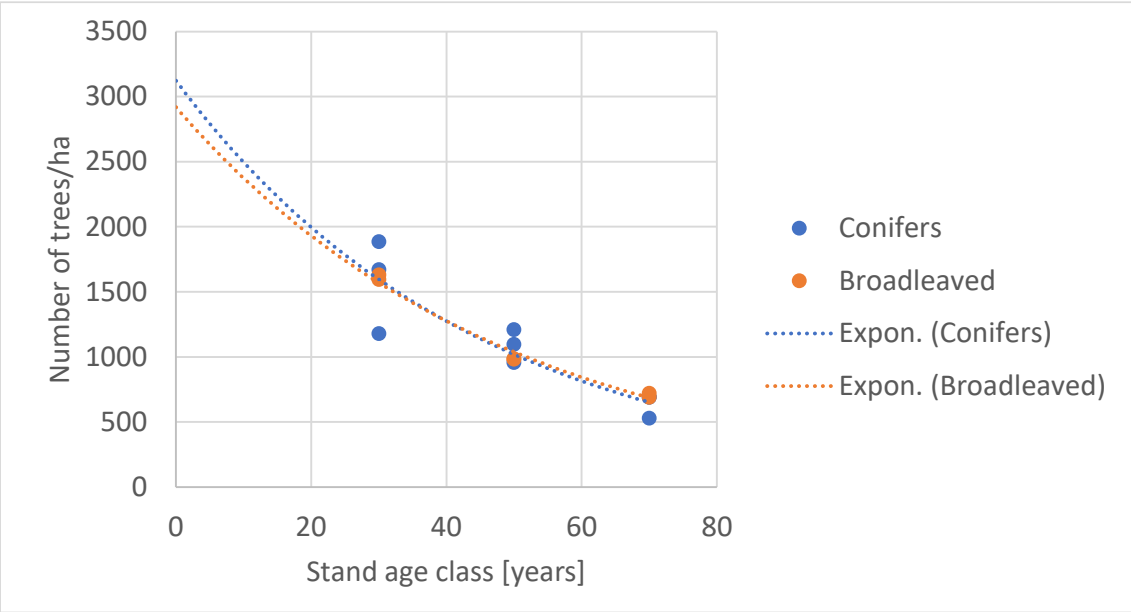

Fig. 17: Stand density by stand age classes for broadleaved and coniferous species in Czech Republic.

Representative DBH and height at age 40 years

Mean tree-height and mean DBH at age 40 years was estimated using data from the CzechTerra project (Fig. 15 and Fig. 18, respectively). The procedure used for estimating these mean dimensions at age 40 years was the same as in the example of Germany. The results are shown in Table 12.

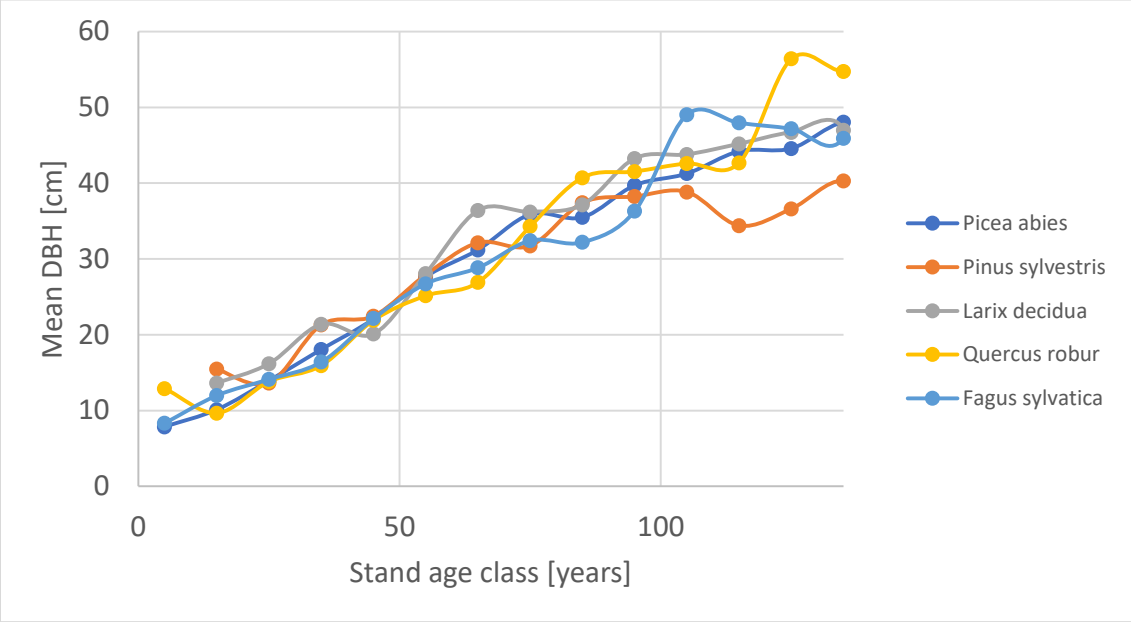

Fig. 18: Mean diameter at breast-height (DBH) in cm by stand age classes. Data extracted from the CzechTerra project.

Table 12: Mean tree dimensions at age 40 years and guiding site index (SI) in m by tree species in the Czech Republic.

Tree species	SI [m]	DBH [cm]	Tree-height [m]
Picea abies	30,0	20,1	17,5
Pinus sylvestris	27,1	21,9	19,3
Larix decidua	31,1	20,7	17,3

Tree species	SI [m]	DBH [cm]	Tree-height [m]
Quercus robur	23,1	18,9	15,2
Fagus sylvatica	28,3	19,3	15,8

Tree and stand dimensions at age 40 years

Tree and stand dimensions at age 40 years were retrieved from yield table models (Černý et al., 1996 and IFER-internal report, 1998) by tree species and guiding site index. When the guiding site index, derived from NFI data, was between two site index classes of the yield table models, a linear interpolation was carried out to extract the available dimensions. The biomass equations used in the latest Czech NIR on GHG emissions (2022) were applied for the principal tree species of the Czech Republic. Jagodziński et al. (2018) equations were used to estimate tree biomass of *Larix decidua*. Suitable below-ground biomass components retrieved from the table 4.4 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006) were used to estimate below-ground biomass. The results are shown in Table 13.

Table 13: Mean dimensions at age 40 years. Stand density (N) in trees per hectare, diameter at breast height (DBH) in cm, tree-height (H) in m, and living biomass (LB) in t/tree.

	Determined with NSBFI data				Determined with yield table			
Species	**SI**	**DBH**	**H**	**LB**	**N**	**DBH**	**H**	**LB**
Fagus sylvatica	28.3	19.3	15.8	0.226	1 937	12.9	15.8	0.092
Larix decidua	31.1	20.7	17.3	0.160	738	21.0	19.8	0.189
Picea abies	30.0	20.1	17.5	0.169	1 577	16.9	17.3	0.120
Pinus sylvestris	27.1	21.9	19.3	0.191	1 246	18.6	17.9	0.131
Quercus robur	23.1	18.9	15.2	0.195	1 920	12.3	14.1	0.075
NSBFI = National sample-based forest inventory (Data from the CzechTerra project)								

Larix decidua, *Picea abies*, and *Pinus sylvestris* showed higher mean DBH values retrieved from the CzechTerra project than the values retrieved from the yield table models (up to 3.3 cm). This difference was greater for *Fagus sylvatica* and *Quercus robur* (up to 6.6 cm). This variation on tree dimensions corresponds to stand density.

Discussion

A more accurate assessment of guiding site index could be carried out by using stand height from dominant height instead of mean tree-height weighted by tree dimensions (Fig. 15).

The variation of the tree dimensions retrieved from the yield table models is corresponding to stand density (Table 13).

Romania

Tree species in Life Terra plantations

6 350 beech trees (*Fagus sylvatica*) were planted in Romania up to September 29, 2022.

National Inventory Report on GHG emissions

The latest NIR on GHG emissions of Romania (2022) estimated biomass using volumetric functions, expansion factors, wood-density coefficients and data from the National Forest Fund Inventory (NFFI), NFI, and country-specific yield tables (Giurgiu et al. 2004; Giurgiu & Draghiciu 2004). More detailed information about the NFI is shown below. The mentioned yield table models were only available on a paying basis.

National Forest Inventory

The first NFI of Romania started in 1948. After continuous improvements on the methodology, the NFI of Romania is designed as two-phase inventory with a 5-year cycle. Tree and stand dimensions by species and stand age were not available.

More detailed information about the NFI can be extracted using this website:
https://roifn.ro/site/what-is-the-nfi/

Discussion

Yield tables used in the latest NIR of Romania could be useful for estimating tree and stand dimensions by age class and tree species. However, these models were only available on a paying basis.

Belgium

Tree species in Life Terra plantations

Tree species composition of Life Terra in Belgium is shown in Fig. 19.

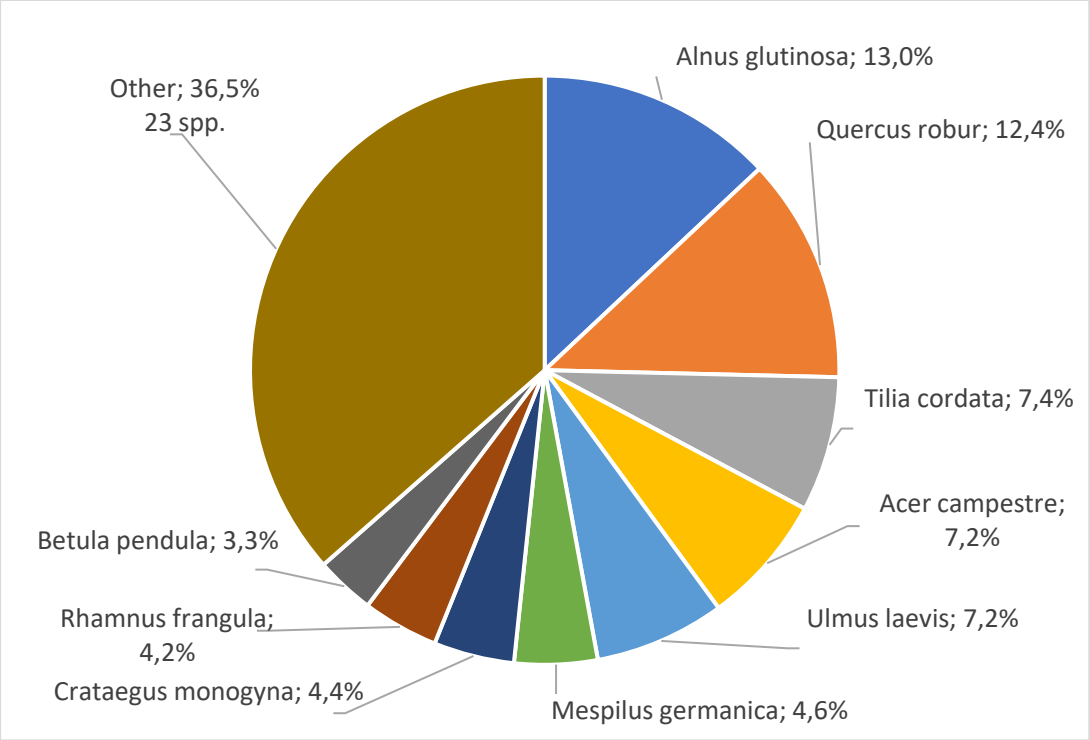

Fig. 19: The most frequent tree species planted by Life Terra in Belgium. Number of trees planted by tree species (N=5 965). Data extracted on September 29, 2022.

National Inventory Report on GHG emissions

The latest NIR on GHG emissions of Belgium estimated biomass using volumetric functions, expansion factors, wood-density coefficients, and data from the NFI.

National Forest Inventory

Belgium is organized as a federal state and forest inventories are the responsibility of the regions (Wallonia 75.4%, Flanders 24.3%, and Brussels 0.3%; percentage values according to the total Belgian forest area). Each region has developed its own inventory procedures more or less independently. However, the first regional inventory launched by the Walloon region provided

the main elements in terms of sampling design and basic variables to be measured (Tomppo et al., 2010).

Available results from the inventory of Walloon forests, based on data from the entire 1st measurement cycle (1994 to 2008), were published in 2015. Their 2nd measurement cycle (2008-2012) is still ongoing.

Tree and stand dimensions by tree species and age classes were not available on the Belgian NFI website: http://iprfw.spw.wallonie.be/intro-resultats.php

Discussion

Biomass functions could not be retrieved from the NIR on GHG emissions of Belgium. NFI data could not be retrieved from the Belgian website.

Ireland

Tree species in Life Terra plantations

Tree species composition of Life Terra in Ireland is shown in Fig. 20.

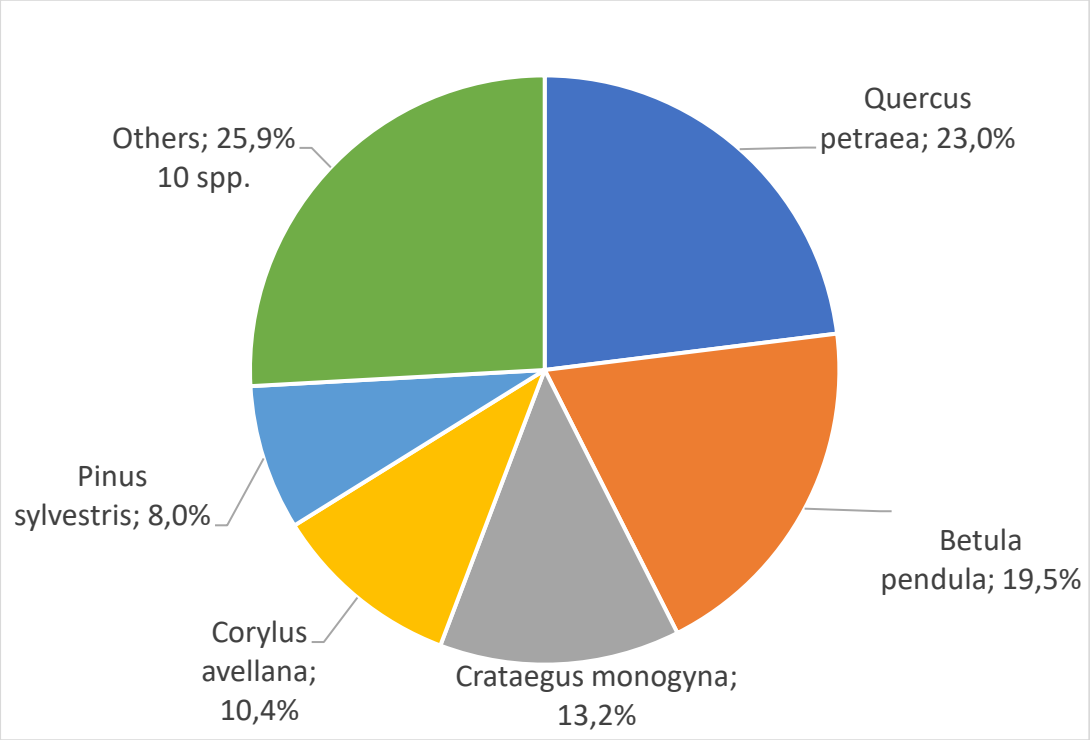

Fig. 20: The most frequent tree species planted by Life Terra in Ireland. Number of trees planted by tree species (N=5 129). Data extracted on September 29, 2022.

National Inventory Report on GHG emissions

The biomass functions used in the latest NIR on GHG emissions (2022) of Ireland are grouped into 6 different tree species categories (spruces, pines, larches, other conifers, fast growing broadleaves and slow growing broadleaves). Each biomass function is shown by species group and biomass component in the Table 3.4.B.3-1 of the mentioned NIR on GHG emissions.

A brief summary of the references is shown below:

1. National research harvested tree database (COFORD funded project CARBiFOR)
2. Black et al., (in prep)

3. Forest Research pulled tree database (Brice Nicholl, NRS, Forest Research, UK)
4. Brown (2002)
5. Johansson (1999).
6. Bartelink (1997)
7. Black et al. (2004)

National Forest Inventory

The latest NFI in Ireland began in 2015 and was completed in 2017. However, the results were not available on their website: https://www.gov.ie/en/publication/65294-irelands-national-forest-inventory/?referrer=http://www.agriculture.gov.ie/nfi/

Above and below-ground biomass functions were parameterized following Black et al. (2004), (2007), Black & Farrel (2006), and COST Action E21 (2009) using DBH and tree-height data from NFI plots (Tomppo et al., 2010).

Discussion

Equations for estimating tree-specific biomass in Ireland can be obtained from the latest NIR on GHG emissions of Ireland (2022). NFI data could be useful for estimating tree and stand dimensions at age 40 years. Unfortunately, this information was not available in the above-mentioned website.

Greece

Tree species in Life Terra plantations

Tree species composition of Life Terra in Greece is shown in Fig. 21.

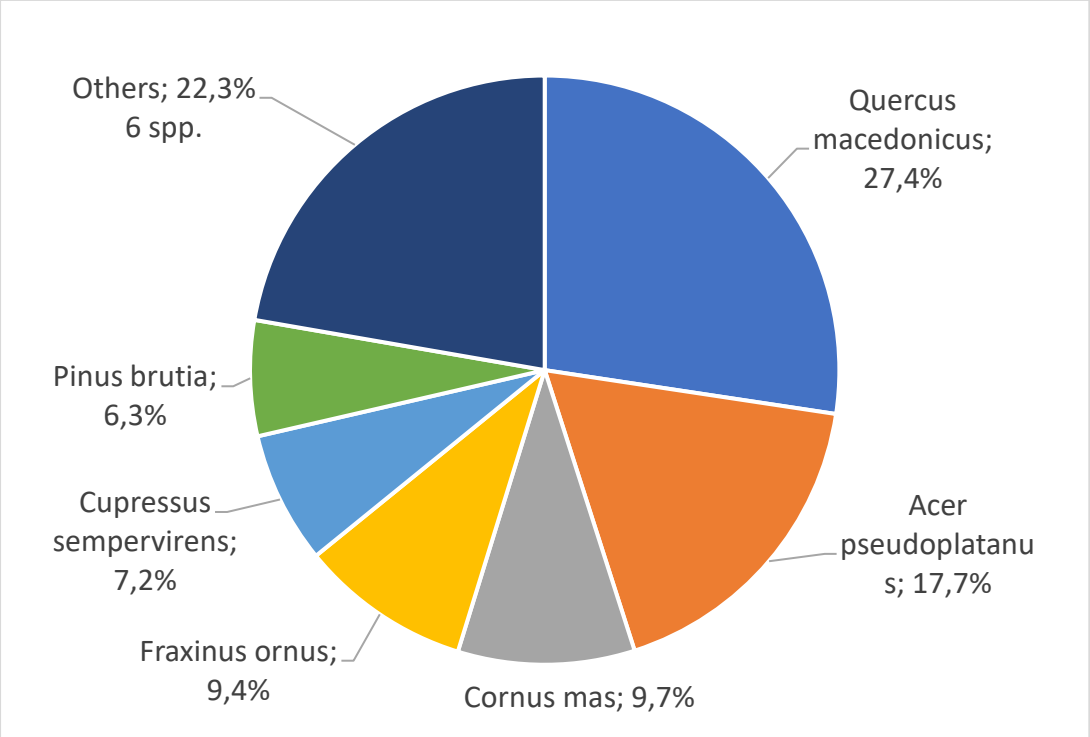

Fig. 21: The most frequent tree species planted by Life Terra in Greece. Number of trees planted by tree species (N=2 856). Data extracted on September 29, 2022.

National Inventory Report on GHG emissions

The latest NIR on GHG emissions of Greece (2022) estimated tree-biomass using volumetric functions, expansions factors, wood-density coefficients and data from the first NFI of Greece.

National Forest Inventory

The first NFI in Greece was launched in 1963. This NFI was conducted as a joint project between the Hellenic Forest Service and the Food and Agriculture Organization of the United Nations (FAO). The results of this NFI were published by the Ministry of Agriculture in 1992. The users of the NFI results are the Hellenic Forest Service and the Hellenic Statistical Service. The usability of the results is uncertain because of the large gap between the evaluation and the publication. Therefore, the results can be used as a general indication of forest conditions in Greece (Tomppo et al., 2010). Vidal et al., (2016) noted that after Greece joined the European Union, the main objective for the creation of the Greek NFI was to define and report on common forest definitions. The Greek NFI would facilitate scientific research and produce results that would be comparable at European level. However, the results from the mentioned NFI could not be extracted.

Discussion

Information on biomass functions, tree and stand dimensions in Greece could not be extracted.

France

Tree species in Life Terra plantations

Tree species composition of Life Terra in France is shown in Fig. 22.

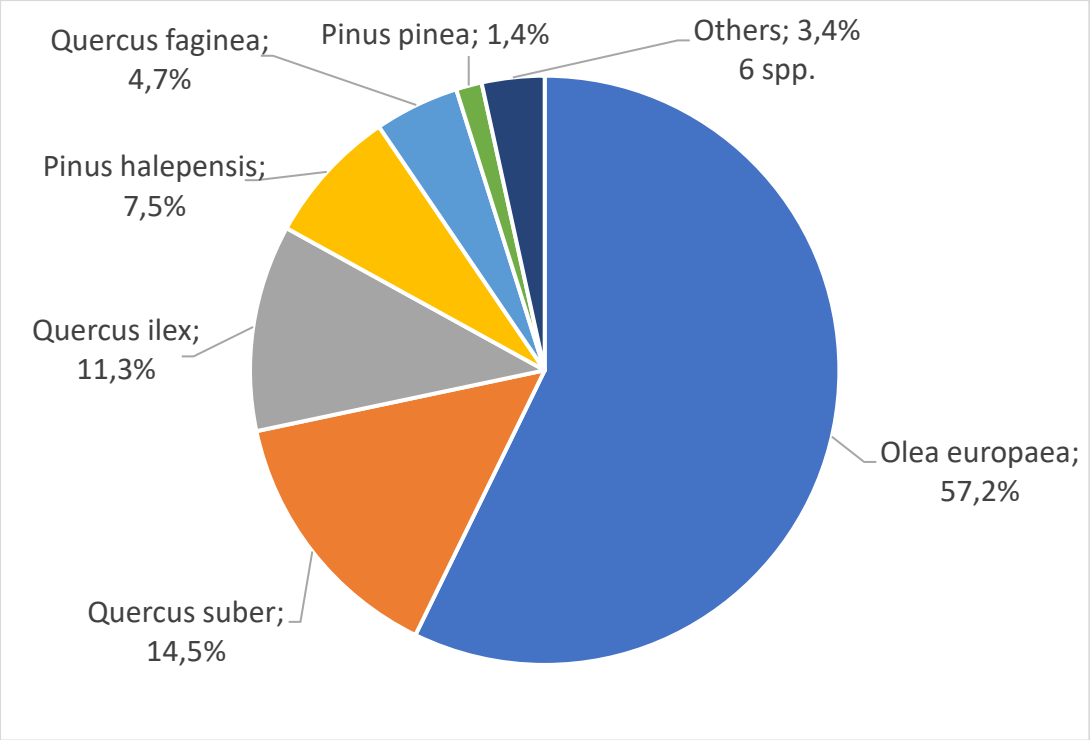

Fig. 22: The most frequent tree species planted by Life Terra in France. Number of trees planted by tree species (N=989). Data extracted on September 29, 2022.

National Inventory Report on GHG emissions

The latest NIR on GHG emissions of France (2022) retrieved the information on above-ground biomass from the NFI carried out by the Institut national de l'information géographique et

forestière (IGN). The IGN provides data in tonnes, on production, mortality, and removals from the forest. No references on allometric equations were available. The biomass estimation is probably estimated by converting wood-volume to dry mass using density and expansion factors.

National Forest Inventory

NFI website: http://inventaire-forestier.ign.fr/

All results of the NFI and the raw data can be downloaded from this website https://inventaire-forestier.ign.fr/dataifn/DonneesBrutes/afficherDonnees

Information on tree species, age, circumference of the tree at 1.3 m from the ground, and tree-height among other variables are available on the above-mentioned website. The latest available information corresponds to the period 2016-2020. The following plot size is used depending on tree-dimensions:

- 6 m radius: measurement of trees with a circumference larger than 23.5 cm at a height of 1.3 m.
- 9 m radius: measurement of trees with a circumference larger than 70.5 cm at a height of 1.3 m.
- 15 m radius: measurement of trees with a circumference larger than 117.5 cm at a height of 1.3 m

No biomass results or methodology about its estimation were available.

It is important to mention that the age of individual trees is estimated by coring at 1.3 m of tree-height. This age is assumed to be the age of the tree. Probably, only dominant trees are selected for coring (tbc). This information can be useful for estimating site index but is not representative for mean dimensions. Also, the survival rate could not be derived since the age of the stand was missing.

Representative site index

The tree-heights extracted from the French NFI (period 2010-2021) were filtered by tree species aged 90-110 years. Site index was estimated as the %90 of the tree-height (Table 14).

Table 14: Guiding site index (SI) in m and maximum tree-height in m by tree species. Data obtained from the French NFI (period: 2010-2021)

Tree species	Maximum height	SI (%90 of height)	N
Abies alba	40.0	34.0	689
Abies pinsapo	23.9	23.9	1
Acer campestre	28.0	24.2	65
Acer monspessulanum	18.2	15.0	10
Acer opalus subsp. opalus	21.0	19.3	29
Acer platanoides	32.0	30.5	19
Acer pseudoplatanus	34.1	28.4	104
Aesculus hippocastanum	33.9	30.7	4
Alnus cordata	18.1	17.8	3
Alnus glutinosa	34.8	28.5	27
Arbutus unedo	6.8	6.8	1
Betula pendula	31.9	28.5	50
Betula pubescens	26.2	25.1	6

Tree species	Maximum height	SI (%90 of height)	N
Buxus sempervirens	5.8	5.8	1
Carpinus betulus	33.8	27.5	360
Castanea sativa	31.9	25.8	182
Cedrus atlantica	34.2	31.8	3
Fagus sylvatica	39.6	32.3	2 166
Fraxinus angustifolia subsp. angustifolia	26.4	25.9	4
Fraxinus excelsior	39.6	33.4	464
Fraxinus ornus subsp. ornus	19.6	19.6	1
Chamaecyparis lawsoniana	21.0	21.0	1
Juglans regia	19.2	18.5	2
Juniperus communis subsp. communis	10.7	10.1	2
Juniperus oxycedrus subsp. oxycedrus	5.5	5.1	10
Larix decidua subsp. decidua	34.8	30.7	132
Olea europaea var. sylvestris	9.0	8.7	3
Phillyrea latifolia	4.6	4.6	1
Picea abies subsp. abies	40.0	35.5	380
Pinus cembra	13.5	13.0	2
Pinus halepensis	30.2	19.4	67
Pinus mugo subsp. uncinata	22.5	17.0	67
Pinus nigra subsp. nigra	31.6	25.8	108
Pinus nigra var. corsicana	34.7	32.5	28
Pinus pinaster subsp. pinaster	36.0	30.4	132
Pinus pinea	11.0	11.0	1
Pinus strobus	37.7	36.4	3
Pinus sylvestris	37.3	28.0	727
Platanus occidentalis	29.2	28.5	3
Platanus x hispanica	28.3	28.3	1
Populus	39.9	39.5	4
Populus alba	30.0	28.3	2
Populus nigra subsp. betulifolia	38.4	37.3	10
Populus tremula	32.2	31.6	19
Populus x canescens	36.6	35.6	3
Prunus avium	32.5	30.5	27
Pseudotsuga menziesii	38.6	38.6	7
Pyrus communis subsp. pyraster	9.5	9.5	1
Quercus cerris	34.6	34.5	3
Quercus ilex	18.5	16.4	62
Quercus petraea subsp. petraea	39.0	30.1	2 696
Quercus pubescens	30.7	21.8	791
Quercus pyrenaica	34.5	26.2	73
Quercus robur var. robur	38.3	28.8	2 719
Quercus rubra	29.0	28.6	6
Quercus suber	13.8	11.5	51
Robinia pseudoacacia	28.0	25.9	10
Salix alba	32.9	29.5	4
Salix caprea	20.5	20.5	1
Salix cinerea	10.9	10.9	1

Tree species	Maximum height	SI (%90 of height)	N
Sorbus aria	22.2	21.4	7
Sorbus domestica	15.2	15.2	2
Sorbus torminalis	21.8	20.0	5
Taxus baccata	14.2	14.2	1
Tilia cordata	33.5	30.2	50
Tilia platyphyllos subsp. platyphyllos	30.0	27.0	51
Ulmus glabra f. glabra	23.0	23.0	1
Ulmus minor	17.6	17.6	1
N = Number of observations			

Tree and stand dimensions at age 40 years

Tree and stand dimensions were retrieved from yield table models (references in Table 2) by tree species and guiding site index. When the guiding site index, derived from NFI data, was between two site index classes of the yield table models, a linear interpolation was carried out to extract the available dimensions. Allometric equations of Vonderach et al. (2018) were used to estimate above-ground biomass of trees at age 40 years. Suitable below-ground biomass components retrieved from the table 4.4 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006) were used to estimate below-ground biomass. The results are shown in Table 15.

Table 15: Guiding site index (SI) in m, stand density (N) in trees per hectare, diameter at breast height (DBH) in cm, tree-height in m, and living biomass (LB) in t per tree at age 40 years

Tree species	SI [m]	N [trees/ha]	DBH [cm]	H [m]	LB [t/tree at age 40 years]
Picea abies	36	1455	19.6	18.7	0.170
Pinus sylvestris	28	1140	17.3	14.0	0.098

Tree dimensions at age 40 years of *Quercus petraea* and *Pinus nigra* could not be extracted for the given guiding site index. Therefore, it was not possible to estimate their living biomass at this age. The reason why it could not be extracted was the lack of data in the yield tables and/or that the guiding site index was below the available range of the mentioned yield tables.

Discussion

The biomass of trees at age 40 years of important coniferous tree species was estimated using NFI data. The species list should be expanded to estimate broadleaved tree species as well. For this purpose, more yield tables should be analyzed. Unfortunately, the availability of these tables (in open access) is limited.

Malta

Tree species in Life Terra plantations

Tree species composition of Life Terra in Malta is shown in Fig. 23.

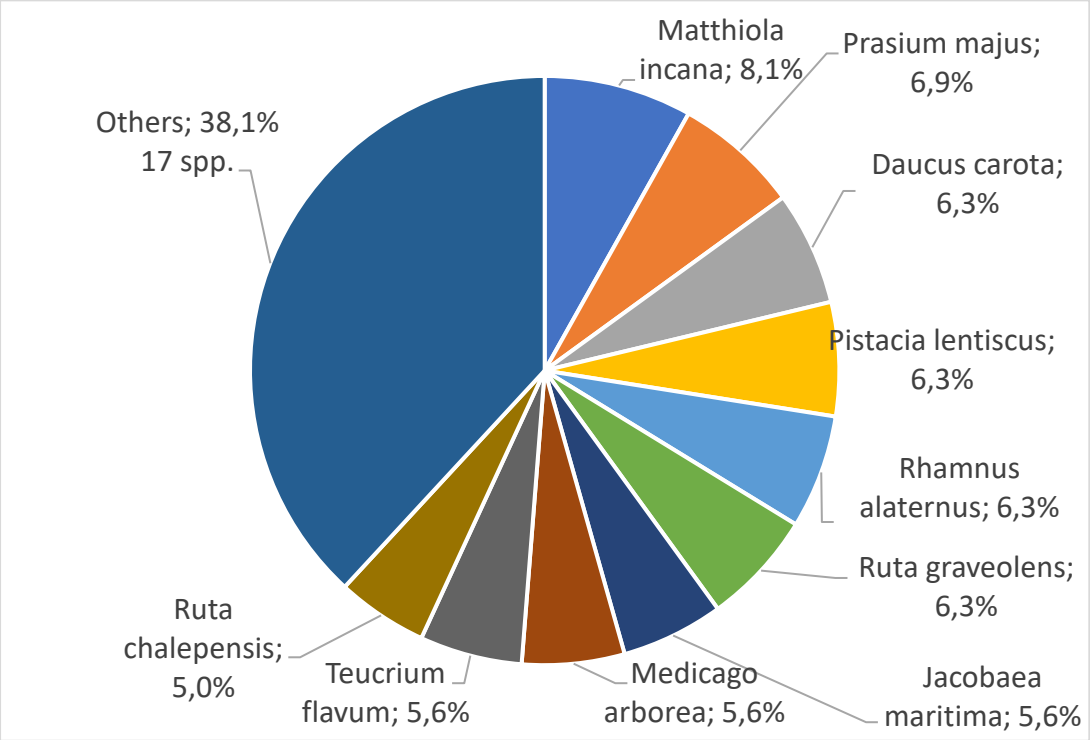

Fig. 23: The most frequent tree species planted by Life Terra in Malta. Number of trees planted by tree species (N=160). Data extracted on September 29, 2022.

National Inventory Report on GHG emissions

The latest NIR on GHG emissions of Malta (2022) estimated above-ground biomass using age-dynamic forest models. The model for coniferous stands was retrieved from the yield table for *Pinus halepensis* stands at fertility class Q14 of Montero et al. (2001). Also, the mortality model published by Ruiz-Benito et al. (2013) was used to estimate mortality without the effect of management interventions (Fig. 24). The model for broadleaved stands was derived from the data of the Italian National Forest Inventory (INFC 2005). The information extracted from the yield table and the Italian NFI by the latest NIR on GHG emissions of Malta are shown in Table 16 and Table 17, respectively. The biomass was estimated from tree volume using expansion factors and wood-density coefficients.

Table 16: Stand density and tree size by age classes for Pinus halepensis *stands at fertility class Q14. Adopted from Montero et al. (2001)*

Age class [years]	Stand density [trees/ha]	Tree size [m3/tree]
20	1 482	0.02
30	1 342	0.04
40	1 006	0.08
50	997	0.11
60	797	0.16
70	684	0.20
80	608	0.25
90	554	0.29

Age class [years]	Stand density [trees/ha]	Tree size [m3/tree]
100	515	0.32
110	486	0.36

Table 17: Stand density for mixed Mediterranean broadleaves forest "sclerophylls" in age classes. Adapted from the NIR on GHG emissions of Malta (2022). Original data from the Italian NFI (CFS-CRA 2005. Italian National Inventory of Forests and Carbon stock (INFC 2005))

Age class [years]	Stand density [trees/ha]	Tree size [m3/tree]
20	1 800	0.01
30	1 600	0.03
40	1 400	0.06
41-80	1 200	0.15
81-120	800	0.28

National Forest Inventory

According to the latest NIR on GHG emissions of Malta (2022), there should be a National Forest Accounting Plan (NFAP) of Malta (2019). However, this NFAP could not be extracted. Other information on national sample-based forest inventories in Malta could not be obtained.

Derived survival rate

The survival rate at age 40 years for coniferous tree species was derived according to Cienciala et al. (2022) using the mentioned yield tables of *Pinus halepensis*. Also, the mentioned mortality model of Ruiz-Benito et al. (2013) was used to compare the survival rate estimated from the yield table. For broadleaved tree species, the data on stand density dynamics of the mentioned INFC (2005) was used (Fig. 24).

The results showed a survival rate at age 40 years of 55.1% and 58.8% for *Pinus halepensis* with and without management interventions, respectively. The survival rate of broadleaved trees was 60.3%.

Fig. 24: Stand density dynamics in Mediterranean conditions. Pinus halepensis *with and without management interventions retrieved from Montero et al. (2001) and a model of Ruiz-Benito (2013), respectively. Mediterranean broadleaved retrieved from the INFC (2005). All data retrieved from the last NIR of Malta 2022*

Discussion

The stand density by age classes of *Pinus halepensis* with management interventions was slightly lower than the simulated stand density without management interventions (Fig. 24). These results are reliable since the studied fertility class of *Pinus halepensis* was under light thinning interventions.

Summary of the results

A list with the results of guiding site index, stand density and tree-biomass at age 40 years by country and tree species is shown in Table 18.

Table 18: Summary of the results. Guiding site index (SI), stand density (N), living biomass at age 40 years (LB) by country and tree species.

Country	Species	SI [m]	N [trees/ha]	LB [t/tree]	Stand dimens. from
DE	*Fagus sylvatica*	29	2 975	0.021	Yield model
DE	*Picea abies*	30.9	1 386	0.077	Yield model
DE	*Pinus sylvestris*	25.4	1 838	0.051	Yield model
DE	*Pseudotsuga menziesii*	39.9	703	0.284	Yield model
DE	*Quercus robur*	24.7	1 088	0.079	Yield model
FR	*Picea abies*	36	1455	0.170	Yield model
FR	*Pinus sylvestris*	28	1140	0.098	Yield model
ES	*Juniperus oxycedrus*	NA	NA	0.052	NFI
ES	*Pinus halepensis*	23.3	658	0.152	Yield model
ES	*Pinus nigra*	23.3	873	0.310	Yield model
ES	*Pinus pinaster*	23.3	723	0.136	Yield model
ES	*Pinus sylvestris*	23.3	2 664	0.065	Yield model
ES	*Pinus uncinata*	23.3	NA	0.112	NFI

Country	Species	SI [m]	N [trees/ha]	LB [t/tree]	Stand dimens. from
ES	*Quercus ilex ssp. ballota*	10.4	NA	0.107	NFI
ES	*Quercus pyrenaica*	18.2	NA	0.095	NFI
CZ	*Fagus sylvatica*	28.3	1 937	0.092	Yield model
CZ	*Larix decidua*	31.1	738	0.189	Yield model
CZ	*Picea abies*	30	1 577	0.120	Yield model
CZ	*Pinus sylvestris*	27.1	1 246	0.131	Yield model
CZ	*Quercus robur*	23.1	1 920	0.075	Yield model
NA = not available; Stand dimens. = stand dimensions					

All pines in Spain showed the same value on guiding site index because it was assumed to be as estimated for *Pinus sylvestris*. Tree-biomass at age 40 years of *Pinus nigra* was around three times larger than other coniferous trees in Spain. *Quercus ilex* and *Quercus pyrenaica* in Spain showed greater biomass at age 40 years than other *Quercus spp* in the Czech Republic, and Germany. This difference could correspond to wood-density and stand density (tbc.).

Guiding site index by country and species group type is shown in Fig. 25. Conifers showed higher values of guiding site index than broadleaves. Czech Republic, France, and Germany showed higher values of guiding site index than Spain for both, broadleaved and coniferous tree species.

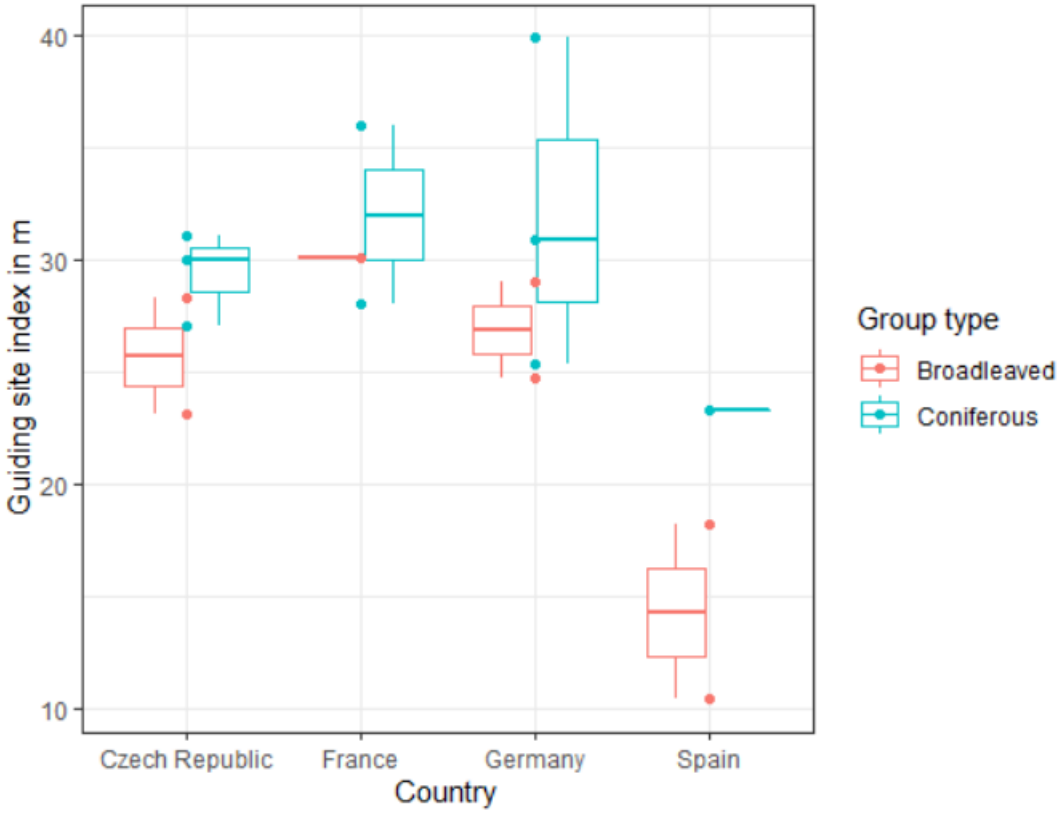

Fig. 25: Guiding site index (SI) in m by country and species group type.

A summarized list with the derived survival rate by country and species group type is shown in Table 19. Mediterranean countries such as Italy, Malta, and Spain, showed higher values of survival rate than Continental countries, i.e., Czech Republic and Germany.

Table 19: Survival rate in % by countries and species group type.

Country	Group type	Survival rate	Source
DE	Broadleaved	36.8	German NFI
DE	Coniferous	32.6	German NFI
ES	Broadleaved	NA	NA
ES	Coniferous	55.1	Montero et al. (2001)
CZ	Broadleaved	43.2	CzechTerra project
CZ	Coniferous	41.5	CzechTerra project
IT	Coniferous	NA	NA
IT	Broadleaved	60.3	Italian National Forest Inventory (INFC 2005)
MT	Broadleaved	60.3	derived from the NIR on GHG Malta (2022)
MT	Coniferous	55.1	derived from the NIR on GHG Malta (2022)
NA = Not available			

Survival rate at age 40 years seemed to be around 30-40% under Continental climate conditions (Czech Republic and Germany), whiles in Mediterranean climate conditions (Spain) is around 50-60%. This deviation could correspond to management interventions, i.e., low effect of management interventions affecting mortality in the studied stands of Spain (Fig. 24).

Discussion

Biomass estimates – issues to consider

Guiding site index considerations

Country level site index is a suitable indicator for large-scale forest production assessments and intercomparison of growth performance among sites and regions. This assessment requires the analysis of National Sample-based Forest Inventories that are the major data source on European forests. The estimated guiding site index showed trustable results since forest productivity in Mediterranean climate-conditions (Spain) is usually lower than in Atlantic and/or Continental climate-conditions (Czech Republic, France, and Germany) (Fig. 25).

Tree-biomass considerations

There is a wealth of published approaches to estimate biomass of trees, especially for those with merchantable dimensions. Several countries of Europe are using biomass functions to estimate the biomass of their forests and submit the results in their annual GHG emission reports. These biomass functions, yield table models, and National Sample-based Forest Inventories were summarized and used in this study for estimating tree-biomass of the Life Terra plantations in a 40-years period since planting.

It is important to stress that tree-biomass at age 40 years of *Pinus nigra* in Spain should be used with care or avoided, since its value was almost three times larger than observed in other coniferous tree species in this country (Table 18). A better estimation could be carried out by determining the guiding site index of this tree species using NFI data in more provinces of Spain, especially those that belongs to the Iberian System (Table 5).

Moreover, the higher values of tree-biomass at age 40 years in Mediterranean broadleaves (*Quercus ilex* and *Q. pyrenaica*) than in Continental (*Fagus sylvatica* and *Quercus robur*) could correspond to wood density and stand density (tbc.).

Survival rate and management considerations

Since the estimation described in this text is focusing on the biomass that trees would have at age 40 years, it is important to consider the uncertainty associated with the assumed tree mortality and management interventions reducing the stand density over time.

In the adopted methodology, it is assumed that the plantations of Life Terra would have the same stand density at planting as the analyzed in the yield table models. However, this assumption does not always correspond to reality. As written in Guidance on Biomass Estimation (Cienciala et al. 2022), the correction of biomass estimates due to mortality based on yield tables can only be used for plantations that use the expected planting density. If the actual planting is significantly smaller (less than ½ of the derived planting density), the mortality correction is not applicable. In such cases the default LifeTerra assumption of 40 % mortality for tree plantations should be used if no better evidence is available.

Conclusion

Supporting information from greenhouse gas submissions and sample-based forest inventories to assess biomass growth and mortality for Life Terra plantations at assumed age 40 years is presented. It describes the specific methodological steps to extract useful information from National Inventory Reports (NIR) on greenhouse gas emissions and National Sample-based Forest Inventories (NFI) to assess the likely biomass and survival rate specific to countries and species type. It also provides a list of species to distinguish between trees and shrubs according to current methodologies used in National Forest inventories of Spain and Italy. The recommendations on applying the above information for biomass estimation is provided.

It should be noted that this report used some qualitative and quantitative information that is actual with respect to the date of this report (November 2022). It will be gradually updated and revised in line with the available source material used for the estimation.

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Annex I

Table A1. 1: Number of trees planted by Life Terra by countries and tree species as of Sep. 2022

Country	Tree species	Number of trees planted
Belgium	*Acer campestre*	427
Belgium	*Alnus glutinosa*	776
Belgium	*Betula pendula*	194
Belgium	*Castanea sativa*	117
Belgium	*Cedrus atlantica*	40
Belgium	*Cornus mas*	117
Belgium	*Corylus avellana*	148
Belgium	*Crataegus monogyna*	264
Belgium	*Euonymus europaeus*	155
Belgium	*Fagus sylvatica*	117
Belgium	*Mespilus germanica*	272
Belgium	*Pinus sylvestris*	40
Belgium	*Populus alba*	78
Belgium	*Populus nigra*	117
Belgium	*Populus tremula*	117
Belgium	*Prunus avium*	39
Belgium	*Prunus padus*	155
Belgium	*Prunus spinosa*	16
Belgium	*Pseudotsuga menziesii*	40
Belgium	*Pyrus pyraster*	117
Belgium	*Quercus petraea*	39
Belgium	*Quercus pubescens*	41
Belgium	*Quercus robur*	738
Belgium	*Rhamnus frangula*	249
Belgium	*Rosa canina*	23
Belgium	*Salix alba*	155
Belgium	*Salix viminalis*	155
Belgium	*Sambucus nigra*	78
Belgium	*Sorbus aucuparia*	117
Belgium	*Tilia cordata*	442
Belgium	*Ulmus laevis*	427
Belgium	*Viburnum opulus*	155
Costa Rica	*Adonidia merrillii*	4
Costa Rica	*Bougainvillea spectabilis*	5
Costa Rica	*Delonix regia*	3
Costa Rica	*Ixora coccinea*	3
Costa Rica	*Lonchocarpus salvadorensis*	1
Costa Rica	*Mussaenda erythrophylla*	1
Costa Rica	*Mussaenda¡ philippica*	1
Costa Rica	*Persea americana*	2
Costa Rica	*Roystonea regia*	3
Costa Rica	*Tabebuia ochracea*	1
Costa Rica	*Tabebuia rosea*	1
Czech Republic	*Cedrus atlantica*	2820

Country	Tree species	Number of trees planted
Czech Republic	*Cedrus libani*	2520
Czech Republic	*Pseudotsuga menziesii*	1502
Czech Republic	*Quercus petraea*	2923
Germany	*Abies alba*	18650
Germany	*Abies grandis*	1650
Germany	*Abies nordmanniana*	3500
Germany	*Abies procera*	800
Germany	*Acer campestre*	400
Germany	*Acer platanoides*	300
Germany	*Acer pseudoplatanus*	3000
Germany	*Aesculus hippocastanum*	400
Germany	*Alnus glutinosa*	610
Germany	*Amelanchier lamarckii*	1
Germany	*Aronia melanocarpa*	20
Germany	*Asimina triloba*	1
Germany	*Berberis vulgaris*	13
Germany	*Betula pendula*	1900
Germany	*Betula pubescens*	2
Germany	*Carpinus betulus*	500
Germany	*Castanea sativa*	1000
Germany	*Cedrus atlantica*	1700
Germany	*Cedrus libani*	1000
Germany	*Citrus x junos*	1
Germany	*Cornus mas*	21
Germany	*Corylus avellana*	419
Germany	*Crataegus monogyna*	2
Germany	*Cryptomeria japonica*	1900
Germany	*Cydonia oblonga*	4
Germany	*Decaisnea fargesii*	1
Germany	*Elaeagnus angustifolia*	4
Germany	*Fagus sylvatica*	12750
Germany	*Hippophae rhamnoides*	20
Germany	*Humulus lupulus*	4
Germany	*Juglans nigra*	400
Germany	*Larix decidua*	21822
Germany	*Larix eurolepis*	4500
Germany	*Malus domestica*	4
Germany	*Mespilus germanica*	1
Germany	*Metasequoia glyptostroboides*	700
Germany	*Morus alba*	1
Germany	*Morus nigra*	1
Germany	*Picea abies*	6750
Germany	*Prunus avium*	1901
Germany	*Prunus domestica*	3
Germany	*Pseudotsuga menziesii*	40710
Germany	*Quercus cerris*	5500
Germany	*Quercus ilex*	900

Country	Tree species	Number of trees planted
Germany	*Quercus petraea*	6650
Germany	*Quercus pyrenaica*	1400
Germany	*Quercus robur*	1400
Germany	*Quercus rubra*	13244
Germany	*Ribes nidigrolaria*	2
Germany	*Ribes uva-crispa*	3
Germany	*Rubus idaeus*	5
Germany	*Salix viminalis*	1
Germany	*Sambucus nigra*	4
Germany	*Sambucus racemosa*	2
Germany	*Sequoia sempervirens*	2400
Germany	*Sequoiadendron giganteum*	2400
Germany	*Sorbus aucuparia*	5
Germany	*Thuja plicata*	5500
Germany	*Tilia cordata*	100
Germany	*Vaccinum myrtillus*	6
Germany	*Zanthoxylum piperitum*	1
Egypt	*Acacia retinodes*	650
Egypt	*Albizia lebbeck*	50
Egypt	*Casuarina sp.*	2660
Egypt	*Dalbergia sissoo*	650
Egypt	*Eucalyptus camaldulensis*	2660
Egypt	*Styphnolobium japonicum*	165
Egypt	*Vachellia seyal*	165
Spain	*Abelia grandiflora*	9
Spain	*Acer campestre*	1094
Spain	*Acer monspessulanum*	519
Spain	*Acer opalus*	71
Spain	*Acer pseudoplatanus*	225
Spain	*Alnus glutinosa*	251
Spain	*Amelanchier ovalis*	20
Spain	*Arbutus unedo*	2430
Spain	*Atriplex halimus*	81
Spain	*Betula alba*	6580
Spain	*Betula pendula*	300
Spain	*Bougainvillea glabra*	5
Spain	*Bougainvillea spectabilis*	5
Spain	*Buxus sempervirens*	55
Spain	*Carya illinoinensis*	9
Spain	*Castanea sativa*	832
Spain	*Celtis australis*	1106
Spain	*Ceratonia siliqua*	665
Spain	*Cercis siliquastrum*	20
Spain	*Cistus albidus*	90
Spain	*Cistus ladanifer*	16
Spain	*Cistus salviifolius*	90
Spain	*Citrus japonica*	30

Country	Tree species	Number of trees planted
Spain	*Citrus limon*	9
Spain	*Citrus reticulata*	9
Spain	*Citrus sinensis*	9
Spain	*Cornus sanguinea*	21
Spain	*Corylus avellana*	2075
Spain	*Crataegus monogyna*	11448
Spain	*Cupressus sempervirens*	362
Spain	*Cytisus proliferus*	160
Spain	*Cytisus scoparius*	10
Spain	*Diospyros kaki*	19
Spain	*Diospyros virginiana*	11
Spain	*Elaeagnus angustifolia*	45
Spain	*Eucalyptus camaldulensis*	163
Spain	*Eucalyptus nitens*	75
Spain	*Euonymus europaeus*	30
Spain	*Fagus sylvatica*	11
Spain	*Ficus carica*	59
Spain	*Flueggea tinctoria*	192
Spain	*Forsythia x intermedia*	16
Spain	*Frangula alnus*	241
Spain	*Fraxinus angustifolia*	1671
Spain	*Fraxinus excelsior*	786
Spain	*Fraxinus ornus*	45
Spain	*Genista monosperma*	1
Spain	*Genista scorpus*	46
Spain	*Hibiscus rosa-sinensis*	5
Spain	*Hippophae rhamnoides*	1054
Spain	*Chamaerops humilis*	56
Spain	*Ilex aquifolium*	1882
Spain	*Jasminum fruticans*	107
Spain	*Juglans regia*	1275
Spain	*Juniperus communis*	401
Spain	*Juniperus oxycedrus*	4807
Spain	*Juniperus phoenicea*	1964
Spain	*Juniperus thurifera*	3587
Spain	*Lagerstroemia indica*	10
Spain	*Laurus nobilis*	73
Spain	*Ligustrum vulgare*	13
Spain	*Lonicera implexa*	20
Spain	*Lycium barbarum*	20
Spain	*magnolia Liliiflora*	5
Spain	*magnolia stellata*	5
Spain	*Malus domestica*	10
Spain	*Malus sylvestris*	1542
Spain	*Medicago arborea*	160
Spain	*Morus alba*	583
Spain	*Morus nigra*	5

Country	Tree species	Number of trees planted
Spain	*Nerium oleander*	386
Spain	*Olea europaea*	4220
Spain	*Paulownia tomentosa*	5
Spain	*Phyllirea angustifolia*	1184
Spain	*Phyllirea latifolia*	160
Spain	*Pinus halepensis*	5434
Spain	*Pinus nigra*	692
Spain	*Pinus pinaster*	925
Spain	*Pinus pinea*	5466
Spain	*Pinus sylvestris*	4255
Spain	*Pistacia lentiscus*	2135
Spain	*Pistacia terebinthus*	2575
Spain	*Pistacia vera*	20
Spain	*Populus alba*	506
Spain	*Populus nigra*	2790
Spain	*Populus tremula*	1552
Spain	*Prunus armeniaca*	20
Spain	*Prunus avium*	4308
Spain	*Prunus cerasifera*	104
Spain	*Prunus domestica*	9
Spain	*Prunus dulcis*	2225
Spain	*Prunus insititia*	200
Spain	*Prunus mahaleb*	3591
Spain	*Prunus mira*	9
Spain	*Prunus persica*	29
Spain	*Prunus spinosa*	6409
Spain	*Punica granatum*	32
Spain	*Pyrus bourgaeana*	676
Spain	*Pyrus communis*	570
Spain	*Pyrus pyraster*	1706
Spain	*Quercus coccifera*	4631
Spain	*Quercus faginea*	8395
Spain	*Quercus ilex*	13487
Spain	*Quercus petraea*	2556
Spain	*Quercus pubescens*	38
Spain	*Quercus pyrenaica*	8586
Spain	*Quercus robur*	353
Spain	*Quercus suber*	2576
Spain	*Retama sphaerocarpa*	1561
Spain	*Rhamnus alaternus*	500
Spain	*Rhamnus alpina*	1755
Spain	*Rhamnus lycioides*	1652
Spain	*RIbes rubrum*	10
Spain	*Rosa canina*	1457
Spain	*Rosa sempervirens*	83
Spain	*Rubus fruticosus*	30
Spain	*Rubus idaeus*	50

Country	Tree species	Number of trees planted
Spain	*Ruscus aculeatus*	147
Spain	*Salix alba*	457
Spain	*Salix atrocinerea*	807
Spain	*Salix caprea*	450
Spain	*Salix eleagnos*	42
Spain	*Salix fragilis*	210
Spain	*Salix purpurea*	79
Spain	*Salix salviifolia*	345
Spain	*Sambucus nigra*	313
Spain	*Sambucus racemosa*	30
Spain	*Sorbus aria*	2196
Spain	*Sorbus aucuparia*	470
Spain	*Sorbus domestica*	339
Spain	*Sorbus torminalis*	1830
Spain	*Spartium junceum*	144
Spain	*Syringa vulgaris*	10
Spain	*Tamarix africana*	7
Spain	*Tamarix gallica*	129
Spain	*Taxus baccata*	54
Spain	*Tilia cordata*	8
Spain	*TIlia platyphyllos*	24
Spain	*Ulex europaeus*	32
Spain	*Ulex parviflorus*	27
Spain	*Ulmus minor*	1708
Spain	*Vaccinum myrtillus*	10
Spain	*Viburnum tinus*	209
Spain	*Vitex agnus-castus*	17
France	*Acer davidii*	5
France	*Liquidambar styraciflua*	6
France	*Liriodendron tulipifera*	7
France	*Malus domestica*	1
France	*Olea europaea*	566
France	*Pinus halepensis*	74
France	*Pinus pinea*	14
France	*Pseudocydonia sinensis*	7
France	*Quercus faginea*	46
France	*Quercus ilex*	112
France	*Quercus suber*	143
France	*Sequoia sempervirens*	8
United Kingdom	*Acer campestre*	725
United Kingdom	*Alnus glutinosa*	2175
United Kingdom	*Betula pubescens*	2175
United Kingdom	*Corylus avellana*	580
United Kingdom	*Crataegus monogyna*	580
United Kingdom	*Euonymus europaeus*	580
United Kingdom	*Frangula alnus*	580
United Kingdom	*Ilex aquifolium*	290

Country	Tree species	Number of trees planted
United Kingdom	*Malus sylvestris*	725
United Kingdom	*Populus tremula*	725
United Kingdom	*Prunus avium*	725
United Kingdom	*Quercus robur*	2175
United Kingdom	*Sorbus aucuparia*	725
United Kingdom	*Tilia cordata*	725
United Kingdom	*Ulmus glabra*	725
United Kingdom	*Viburnum opulus*	290
Greece	*Acer pseudoplatanus*	505
Greece	*Carpinus betulus*	89
Greece	*Celtis australis*	118
Greece	*Cornus mas*	277
Greece	*Cupressus sempervirens*	207
Greece	*Fagus sylvatica*	133
Greece	*Fraxinus ornus*	268
Greece	*Pinus brutia*	181
Greece	*Pinus nigra*	151
Greece	*Platanus orientalis*	143
Greece	*Populus nigra*	2
Greece	*Quercus macedonicus*	782
Ireland	*Alnus glutinosa*	399
Ireland	*Betula pendula*	1002
Ireland	*Betula pubescens*	22
Ireland	*Corylus avellana*	533
Ireland	*Crataegus monogyna*	677
Ireland	*Euonymus europaeus*	88
Ireland	*Fagus sylvatica*	18
Ireland	*Ilex aquifolium*	108
Ireland	*Malus sylvestris*	251
Ireland	*Pinus sylvestris*	409
Ireland	*Prunus avium*	93
Ireland	*Prunus spinosa*	44
Ireland	*Quercus petraea*	1181
Ireland	*Sorbus aucuparia*	246
Ireland	*Viburnum opulus*	58
Italy	*Abies alba*	2381
Italy	*Acacia dealbata*	1
Italy	*Acacia retinodes*	2
Italy	*Acer campestre*	12505
Italy	*Acer opalus*	24
Italy	*Acer platanoides*	22
Italy	*Acer pseudoplatanus*	35
Italy	*Acer rubrum*	3
Italy	*Acer saccharinum*	8
Italy	*Aesculus hippocastanum*	4
Italy	*Albizia julibrissin*	3
Italy	*Alnus glutinosa*	1451

Country	Tree species	Number of trees planted
Italy	*Arbutus unedo*	1113
Italy	*Betula pendula*	102
Italy	*Buxus sempervirens*	37
Italy	*Carpinus betulus*	4754
Italy	*Castanea sativa*	81
Italy	*Casuarina sp.*	11
Italy	*Celtis australis*	833
Italy	*Ceratonia siliqua*	79
Italy	*Cercis siliquastrum*	860
Italy	*Cinnamomum camphora*	13
Italy	*Citrus × bergamia*	1
Italy	*Citrus × clementina*	1
Italy	*Citrus × paradisi*	1
Italy	*Citrus × tangelo*	1
Italy	*Citrus japonica*	3
Italy	*Citrus limon*	37
Italy	*Citrus reticulata*	1
Italy	*Citrus sinensis*	17
Italy	*Cornus mas*	145
Italy	*Cornus sanguinea*	168
Italy	*Corylus avellana*	1494
Italy	*Cotinus coggygria*	8
Italy	*Cotoneaster horizontalis*	15
Italy	*Cotoneaster tomentosus*	4
Italy	*Crataegus monogyna*	886
Italy	*Cupressus sempervirens*	10
Italy	*Cytisus scoparius*	2
Italy	*Diospyros kaki*	5
Italy	*Elaeagnus umbellata*	16
Italy	*Erica arborea*	17
Italy	*Erica canaliculata*	2
Italy	*Escallonia donard*	10
Italy	*Euonymus europaeus*	93
Italy	*Euonymus latifolius*	3
Italy	*Fagus sylvatica*	464
Italy	*Ficus carica*	7
Italy	*Frangula alnus*	71
Italy	*Fraxinus angustifolia*	465
Italy	*Fraxinus excelsior*	3133
Italy	*Fraxinus ornus*	2777
Italy	*Ginkgo biloba*	3
Italy	*Grevillea robusta*	11
Italy	*Helichrysum italicum*	1
Italy	*Chamaecyparis lawsoniana*	30
Italy	*Chamaerops humilis*	21
Italy	*Chimonanthus praecox*	1
Italy	*Ilex aquifolium*	23

Country	Tree species	Number of trees planted
Italy	*Juglans regia*	149
Italy	*Juniperus communis*	9
Italy	*Juniperus chinensis*	4
Italy	*Juniperus oxycedrus*	12
Italy	*Laburnum alpinum*	3
Italy	*Laburnum anagyroides*	19
Italy	*Lagerstroemia indica*	2
Italy	*Larix decidua*	2280
Italy	*Laurus nobilis*	471
Italy	*Lavandula angustifolia*	55
Italy	*Ligustrum japonicum*	26
Italy	*Ligustrum sinense*	3
Italy	*Ligustrum texanum*	8
Italy	*Ligustrum vulgare*	285
Italy	*Liquidambar styraciflua*	13
Italy	*Lonicera caprifolium*	12
Italy	*Malus domestica*	152
Italy	*Malus sylvestris*	120
Italy	*Melia azedarach*	11
Italy	*Mespilus germanica*	58
Italy	*Morus alba*	41
Italy	*Morus nigra*	25
Italy	*Myrtus communis*	661
Italy	*Nerium oleander*	2
Italy	*Olea europaea*	158
Italy	*Osmanthus heterophyllus*	1
Italy	*Ostrya carpinifolia*	141
Italy	*Paliurus spina-christi*	20
Italy	*Passiflora caerulea*	1
Italy	*Paulownia tomentosa*	11
Italy	*Phyllirea angustifolia*	1004
Italy	*Phyllirea latifolia*	500
Italy	*Picea abies*	2290
Italy	*Pinus halepensis*	14
Italy	*Pinus heldreichii*	100
Italy	*Pinus pinea*	192
Italy	*Pinus sylvestris*	350
Italy	*Pistacia lentiscus*	1690
Italy	*Pittosporum tobira*	40
Italy	*Plantago major*	6
Italy	*Platanus hispanica*	1
Italy	*Platanus hybrida*	890
Italy	*Platanus occidentalis*	5
Italy	*Platanus orientalis*	5
Italy	*Polygala flavescens*	6
Italy	*Polygala myrtifolia*	4
Italy	*Populus alba*	1134

Country	Tree species	Number of trees planted
Italy	*Populus nigra*	33
Italy	*Prunus armeniaca*	6
Italy	*Prunus avium*	559
Italy	*Prunus domestica*	9
Italy	*Prunus dulcis*	12
Italy	*Prunus laurocerasus*	40
Italy	*Prunus mahaleb*	204
Italy	*Prunus padus*	72
Italy	*Prunus persica*	8
Italy	*Prunus spinosa*	289
Italy	*Punica granatum*	55
Italy	*Pyracantha coccinea*	45
Italy	*Pyrus calleryana*	1
Italy	*Pyrus communis*	43
Italy	*Pyrus pyraster*	125
Italy	*Quercus cerris*	544
Italy	*Quercus coccifera*	16
Italy	*Quercus dalechampii*	3
Italy	*Quercus ilex*	3440
Italy	*Quercus macedonicus*	6
Italy	*Quercus pubescens*	5584
Italy	*Quercus robur*	5768
Italy	*Quercus suber*	154
Italy	*Rhamnus alaternus*	34
Italy	*Rhamnus cathartica*	58
Italy	*Rhamnus frangula*	3
Italy	*RIbes rubrum*	3
Italy	*Rosa agrestis*	10
Italy	*Rosa banksiae*	1
Italy	*Rosa canina*	116
Italy	*Rosa korbin*	250
Italy	*Rubus idaeus*	3
Italy	*Salix alba*	712
Italy	*Salix atrocinerea*	20
Italy	*Salix caprea*	12
Italy	*Salix cinerea*	2
Italy	*Salix purpurea*	6
Italy	*Salix viminalis*	5
Italy	*Salvia officinalis*	59
Italy	*Salvia rosmarinus*	222
Italy	*Sambucus nigra*	1275
Italy	*Schinus molle*	4
Italy	*Sorbus aria*	10
Italy	*Sorbus aucuparia*	107
Italy	*Sorbus domestica*	19
Italy	*Sorbus torminalis*	23
Italy	*Spartium junceum*	68

Country	Tree species	Number of trees planted
Italy	*Strelitzia*	401
Italy	*Tamarix gallica*	100
Italy	*Tamarix ramosissima*	11
Italy	*Taxodium distichum*	2
Italy	*Taxus baccata*	1
Italy	*Teucrium fruticans*	10
Italy	*Thuja occidentalis*	17
Italy	*Thymus vulgaris*	7
Italy	*Tilia cordata*	444
Italy	*TIlia platyphyllos*	15
Italy	*Tilia tomentosa*	200
Italy	*Tilia x europaea*	501
Italy	*Ulmus laevis*	125
Italy	*Ulmus minor*	2146
Italy	*Ulmus x Sapporo*	3
Italy	*Vaccinum myrtillus*	1
Italy	*Viburnum lantana*	118
Italy	*Viburnum opulus*	64
Italy	*Viburnum tinus*	435
Italy	*Vitis labrusca*	1
Italy	*Vitis vinifera*	7
Malta	*Anagyris foetida*	2
Malta	*Ceratonia siliqua*	2
Malta	*Cercis siliquastrum*	5
Malta	*Crithmum maritimum*	3
Malta	*Cupressus sempervirens*	7
Malta	*Daucus carota*	10
Malta	*Drimia pancration*	3
Malta	*Glaucium flavum*	4
Malta	*Chamaerops humilis*	2
Malta	*Jacobaea maritima*	9
Malta	*Laurus nobilis*	3
Malta	*Matthiola incana*	13
Malta	*Medicago arborea*	9
Malta	*Myrtus communis*	6
Malta	*Olea europaea*	4
Malta	*Pinus halepensis*	2
Malta	*Pistacia lentiscus*	10
Malta	*Prasium majus*	11
Malta	*Prunus dulcis*	7
Malta	*Punica granatum*	2
Malta	*Quercus ilex*	2
Malta	*Rhamnus alaternus*	10
Malta	*Ruta graveolens*	10
Malta	*Ruta chalepensis*	8
Malta	*Teucrium flavum*	9
Malta	*Teucrium fruticans*	4

Country	Tree species	Number of trees planted
Malta	*Vitex agnus-castus*	3
The Netherlands	*Acer campestre*	538
The Netherlands	*Acer pseudoplatanus*	75
The Netherlands	*Acer tataricum*	5
The Netherlands	*Actinidia arguta*	166
The Netherlands	*Alnus cordata*	140
The Netherlands	*Alnus glutinosa*	8445
The Netherlands	*Alnus incana*	140
The Netherlands	*Alnus viridis*	17
The Netherlands	*Amelanchier alnifolia*	81
The Netherlands	*Amelanchier lamarckii*	198
The Netherlands	*Arbutus unedo*	5
The Netherlands	*Aronia melanocarpa*	91
The Netherlands	*Asimina triloba*	4
The Netherlands	*Berberis thunbergii*	4
The Netherlands	*Berberis vulgaris*	13
The Netherlands	*Betula pendula*	1432
The Netherlands	*Betula pubescens*	2735
The Netherlands	*Carpinus betulus*	553
The Netherlands	*Castanea sativa*	577
The Netherlands	*Cornus kousa*	17
The Netherlands	*Cornus mas*	29
The Netherlands	*Cornus sanguinea*	180
The Netherlands	*Corylus avellana*	1524
The Netherlands	*Corylus colurna*	61
The Netherlands	*Cotoneaster bullatus*	11
The Netherlands	*Cotoneaster dielsianus*	58
The Netherlands	*Crataegus ellwangeriana*	1
The Netherlands	*Crataegus monogyna*	2537
The Netherlands	*Cydonia oblonga*	300
The Netherlands	*Cytisus scoparius*	25
The Netherlands	*Diospyros kaki*	6
The Netherlands	*Elaeagnus angustifolia*	60
The Netherlands	*Elaeagnus submacrophylla*	80
The Netherlands	*Elaeagnus umbellata*	130
The Netherlands	*Euonymus europaeus*	540
The Netherlands	*Fagus sylvatica*	2171
The Netherlands	*Ficus carica*	81
The Netherlands	*Frangula alnus*	60
The Netherlands	*Fraxinus excelsior*	155
The Netherlands	*Hibiscus syriacus*	5
The Netherlands	*Hippophae rhamnoides*	94
The Netherlands	*Ilex aquifolium*	39
The Netherlands	*Juglans cinerea*	2
The Netherlands	*Juglans regia*	5
The Netherlands	*Laurus nobilis*	40
The Netherlands	*Ligustrum vulgare*	50

Country	Tree species	Number of trees planted
The Netherlands	*Lonicera caerulea*	269
The Netherlands	*Mahonia aquifolium*	35
The Netherlands	*Malus domestica*	42
The Netherlands	*Malus sylvestris*	1025
The Netherlands	*Mespilus germanica*	315
The Netherlands	*Pinus sylvestris*	2980
The Netherlands	*Platanus hispanica*	82
The Netherlands	*Platanus occidentalis*	19
The Netherlands	*Populus nigra*	380
The Netherlands	*Prunus armeniaca*	1
The Netherlands	*Prunus avium*	1441
The Netherlands	*Prunus cerasus*	10
The Netherlands	*Prunus domestica*	318
The Netherlands	*Prunus dulcis*	3
The Netherlands	*Prunus insititia*	15
The Netherlands	*Prunus padus*	1017
The Netherlands	*Prunus persica*	1
The Netherlands	*Prunus spinosa*	1513
The Netherlands	*Pyrus communis*	164
The Netherlands	*Pyrus pyraster*	650
The Netherlands	*Quercus petraea*	122
The Netherlands	*Quercus robur*	12943
The Netherlands	*Quercus rubra*	5
The Netherlands	*Rhamnus cathartica*	801
The Netherlands	*Rhamnus frangula*	1756
The Netherlands	*Rheum rhabarbarum*	219
The Netherlands	*Ribes nigrum*	20
The Netherlands	*Ribes odoratum*	3
The Netherlands	*RIbes rubrum*	191
The Netherlands	*Ribes uva-crispa*	249
The Netherlands	*Rosa canina*	1114
The Netherlands	*Rosa rubiginosa*	175
The Netherlands	*Rosa rugosa*	11
The Netherlands	*Rubus fruticosus*	337
The Netherlands	*Rubus idaeus*	1278
The Netherlands	*Rubus occidentalis*	78
The Netherlands	*Salix alba*	110
The Netherlands	*Salix babylonica*	2
The Netherlands	*Salix caprea*	390
The Netherlands	*Salix cinerea*	210
The Netherlands	*Salix fragilis*	10
The Netherlands	*Salix purpurea*	196
The Netherlands	*Salix trianda*	46
The Netherlands	*Salix viminalis*	456
The Netherlands	*Sambucus nigra*	609
The Netherlands	*Sequoia sempervirens*	2
The Netherlands	*Sorbus aucuparia*	551

Country	Tree species	Number of trees planted
The Netherlands	*Sorbus torminalis*	5
The Netherlands	*Tilia cordata*	1829
The Netherlands	*TIlia platyphyllos*	164
The Netherlands	*Ulmus glabra*	25
The Netherlands	*Ulmus laevis*	691
The Netherlands	*Viburnum opulus*	874
Portugal	*Alnus glutinosa*	200
Portugal	*Arbutus unedo*	1888
Portugal	*Castanea sativa*	92
Portugal	*Casuarina sp.*	27
Portugal	*Cedrus atlantica*	24
Portugal	*Celtis australis*	295
Portugal	*Ceratonia siliqua*	1773
Portugal	*Cistus ladanifer*	10
Portugal	*Corymbia citriodora*	4984
Portugal	*Crataegus monogyna*	346
Portugal	*Cupressus sempervirens*	1540
Portugal	*Cytisus proliferus*	391
Portugal	*Eucalyptus globulus*	5016
Portugal	*Ficus carica*	2500
Portugal	*Fraxinus angustifolia*	884
Portugal	*Ilex aquifolium*	25
Portugal	*Juglans regia*	100
Portugal	*Juniperus oxycedrus*	300
Portugal	*Malus sylvestris*	100
Portugal	*Medicago arborea*	188
Portugal	*Melia azedarach*	50
Portugal	*Myrtus communis*	500
Portugal	*Olea europaea*	8388
Portugal	*Pinus halepensis*	275
Portugal	*Pinus pinaster*	575
Portugal	*Pinus pinea*	10118
Portugal	*Pistacia lentiscus*	12248
Portugal	*Pistacia terebinthus*	100
Portugal	*Populus alba*	24
Portugal	*Populus nigra*	62
Portugal	*Populus tremula*	50
Portugal	*Prunus avium*	300
Portugal	*Punica granatum*	100
Portugal	*Pyrus communis*	25
Portugal	*Quercus coccifera*	315
Portugal	*Quercus faginea*	103
Portugal	*Quercus ilex*	6771
Portugal	*Quercus petraea*	25
Portugal	*Quercus pyrenaica*	25
Portugal	*Quercus robur*	108
Portugal	*Quercus suber*	31878

Country	Tree species	Number of trees planted
Portugal	*Retama sphaerocarpa*	525
Portugal	*Salix atrocinerea*	19
Portugal	*Salix eleagnos*	30
Portugal	*Salix purpurea*	25
Portugal	*Salix sp.*	30
Portugal	*Taxus baccata*	25
Portugal	*Tetraclinis articulata*	540
Portugal	*Ulmus glabra*	25
Portugal	*Ulmus minor*	25
Portugal	*Ulmus pumila*	25
Romania	*Fagus sylvatica*	6350
Total		**604360**

Annex II

Table A2. 1: Tree and shrub species used in the Spanish and Italian NFI methodologies

Country	Specie	Tree/shrub
Spain	*Heberdenia bahamensis*	Tree
Spain	*Acacia spp.*	Tree
Spain	*Phillyrea latifolia*	Tree
Spain	*Ailanthus altissima*	Tree
Spain	*Malus sylvestris*	Tree
Spain	*Celtis australis*	Tree
Spain	*Taxus baccata*	Tree
Spain	*Crataegus spp.*	Tree
Spain	*Pyrus spp.*	Tree
Spain	*Cedrus atlantica*	Tree
Spain	*Chamaecyparis lawsoniana*	Tree
Spain	*Otras coníferas*	Tree
Spain	*Pinus sylvestris*	Tree
Spain	*Pinus uncinata*	Tree
Spain	*Pinus pinea*	Tree
Spain	*Pinus halepensis*	Tree
Spain	*Pinus nigra*	Tree
Spain	*Pinus pinaster*	Tree
Spain	*Pinus canariensis*	Tree
Spain	*Pinus radiata*	Tree
Spain	*Other pines*	Tree
Spain	*Abies alba*	Tree
Spain	*Abies pinsapo*	Tree
Spain	*Picea abies*	Tree
Spain	*Pseudotsuga menziesii*	Tree
Spain	*Larix spp.*	Tree
Spain	*Cupressus sempervirens*	Tree
Spain	*Juniperus communis*	Tree
Spain	*Juniperus thurifera*	Tree
Spain	*Juniperus phoenicea*	Tree
Spain	*Quercus robur*	Tree
Spain	*Quercus petraea*	Tree
Spain	*Quercus pyrenaica*	Tree
Spain	*Quercus faginea*	Tree
Spain	*Quercus ilex ssp. Ballota*	Tree
Spain	*Quercus suber*	Tree
Spain	*Quercus canariensis*	Tree
Spain	*Quercus rubra*	Tree
Spain	*Other quercus*	Tree
Spain	*Populus alba*	Tree
Spain	*Populus tremula*	Tree
Spain	*Tamarix spp.*	Tree
Spain	*Alnus glutinosa*	Tree
Spain	*Fraxinus angustifolia*	Tree

Country	Specie	Tree/shrub
Spain	*Ulmus minor*	Tree
Spain	*Salix spp.*	Tree
Spain	*Populus nigra*	Tree
Spain	*Other riparian trees*	Tree
Spain	*Eucalyptus globulus*	Tree
Spain	*Eucalyptus camaldulensis*	Tree
Spain	*Other Eucalyptus spp.*	Tree
Spain	*Eucalyptus nitens*	Tree
Spain	*Ilex aquifolium*	Tree
Spain	*Olea europaea*	Tree
Spain	*Ceratonia siliqua*	Tree
Spain	*Arbutus unedo*	Tree
Spain	*Phoenix spp.*	Tree
Spain	*Fagus sylvatica*	Tree
Spain	*Castanea sativa*	Tree
Spain	*Betula spp.*	Tree
Spain	*Corylus avellana*	Tree
Spain	*Juglans regia*	Tree
Spain	*Acer campestre*	Tree
Spain	*Tilia spp.*	Tree
Spain	*Sorbus spp.*	Tree
Spain	*Platanus hispanica*	Tree
Spain	*Myrica faya*	Tree
Spain	*Ilex canariensis*	Tree
Spain	*Erica arborea*	Tree
Spain	*Persea indica*	Tree
Spain	*Sideroxylon marmulano*	Tree
Spain	*Picconia excelsa*	Tree
Spain	*Ocotea phoetens*	Tree
Spain	*Apollonias barbujana*	Tree
Spain	*Otras laurisilvas*	Tree
Spain	*Robinia pseudoacacia*	Tree
Spain	*Laurus nobilis*	Tree
Spain	*Prunus spp.*	Tree
Spain	*Rhus coriaria*	Tree
Spain	*Sambucus nigra*	Tree
Spain	*Carpinus betulus*	Tree
Spain	*Other broadleaves*	Tree
Spain	*Acacia melanoxylon*	Tree
Spain	*Crataegus monogyna*	Tree
Spain	*Cedrus deodara*	Tree
Spain	*Tetraclinis articulata*	Tree
Spain	*Larix decidua*	Tree
Spain	*Cupressus arizonica*	Tree
Spain	*Juniperus oxycedrus*	Tree
Spain	*Juniperus turbinata*	Tree
Spain	*Quercus pubescens*	Tree

Country	Specie	Tree/shrub
Spain	*Quercus lusitanica*	Tree
Spain	*Quercus ilex ssp. ilex*	Tree
Spain	*Tamarix canariensis*	Tree
Spain	*Fraxinus excelsior*	Tree
Spain	*Ulmus glabra*	Tree
Spain	*Salix alba*	Tree
Spain	*Populus x canadensis*	Tree
Spain	*Eucalyptus viminalis*	Tree
Spain	*Arbutus canariensis*	Tree
Spain	*Betula alba*	Tree
Spain	*Juglans nigra*	Tree
Spain	*Acer*	Tree
Spain	*monspessulanum*	Tree
Spain	*Tilia cordata*	Tree
Spain	*Sorbus aria*	Tree
Spain	*Platanus orientalis*	Tree
Spain	*Myrica rivasmartinezii*	Tree
Spain	*Ilex platyphylla*	Tree
Spain	*Erica scoparia*	Tree
Spain	*Pleiomeris canariensis*	Tree
Spain	*Sophora japonica*	Tree
Spain	*Pistacia atlantica*	Tree
Spain	*Laurus azorica*	Tree
Spain	*Ficus carica*	Tree
Spain	*Acacia dealbata*	Tree
Spain	*Crataegus laevigata*	Tree
Spain	*Cedrus libani*	Tree
Spain	*Thuja spp.*	Tree
Spain	*Larix leptolepis*	Tree
Spain	*Cupressus lusitanica*	Tree
Spain	*Juniperus cedrus*	Tree
Spain	*Quercus alpestris*	Tree
Spain	*Fraxinus ornus*	Tree
Spain	*Ulmus pumila*	Tree
Spain	*Salix atrocinerea*	Tree
Spain	*Eucalyptus gomphocephalus*	Tree
Spain	*Betula pendula*	Tree
Spain	*Acer negundo*	Tree
Spain	*Tilia platyphyllos*	Tree
Spain	*Sorbus aucuparia*	Tree
Spain	*Rhamnus glandulosa*	Tree
Spain	*Gleditsia triacanthos*	Tree
Spain	*Prunus avium*	Tree
Spain	*Morus spp.*	Tree
Spain	*Crataegus laciniata*	Tree
Spain	*Larix x eurolepis*	Tree
Spain	*Cupressus macrocarpa*	Tree

Country	Specie	Tree/shrub
Spain	*Fraxinus spp.*	Tree
Spain	*Ulmus spp.*	Tree
Spain	*Salix babylonica*	Tree
Spain	*Eucalyptus robusta*	Tree
Spain	*Phoenix canariensis*	Tree
Spain	*Acer opalus*	Tree
Spain	*Sorbus domestica*	Tree
Spain	*Visnea mocanera*	Tree
Spain	*Prunus lusitanica*	Tree
Spain	*Morus alba*	Tree
Spain	*Crataegus azarolus*	Tree
Spain	*Salix cantabrica*	Tree
Spain	*Dracaena draco*	Tree
Spain	*Hacer pseudoplatanus*	Tree
Spain	*Sorbus torminalis*	Tree
Spain	*Prunus padus*	Tree
Spain	*Morus nigra*	Tree
Spain	*Salix caprea*	Tree
Spain	*Hacer platanoides*	Tree
Spain	*Sorbus latifolia*	Tree
Spain	*Salix latifolia*	Tree
Spain	*Salix elaeagnos*	Tree
Spain	*Acer spp.*	Tree
Spain	*Sorbus chamaemespilus*	Tree
Spain	*Salix fragilis*	Tree
Spain	*Salix canariensis*	Tree
Spain	*Salix purpurea*	Tree
Spain	*Cistus spp.*	Shrub
Spain	*Erica spp.*	Shrub
Spain	*Other high papilionoids*	Shrub
Spain	*Other low papilionoids*	Shrub
Spain	*Quercus coccifera*	Shrub
Spain	*Calluna vulgaris*	Shrub
Spain	*Arctostaphylos uva-ursi*	Shrub
Spain	*Lavandula spp.*	Shrub
Spain	*Daphne spp.*	Shrub
Spain	*Pistacia lentiscus*	Shrub
Spain	*Ligustrum vulgare*	Shrub
Spain	*Phillyrea angustifolia*	Shrub
Spain	*Rosmarinus*	Shrub
Spain	*officinalis*	Shrub
Spain	*Viburnum spp.*	Shrub
Spain	*Berberis vulgaris*	Shrub
Spain	*Halimium spp.*	Shrub
Spain	*Cotoneaster spp.*	Shrub
Spain	*Rosa spp.*	Shrub
Spain	*Daboecia cantabrica*	Shrub

Country	Specie	Tree/shrub
Spain	*Rubus spp.*	Shrub
Spain	*Rhamnus spp.*	Shrub
Spain	*Bupleurum spp.*	Shrub
Spain	*Artemisia spp.*	Shrub
Spain	*Santolina rosmarinifolia*	Shrub
Spain	*Helichrysum stoechas*	Shrub
Spain	*Thymus spp.*	Shrub
Spain	*Ruscus aculeatus*	Shrub
Spain	*Ribes spp.*	Shrub
Spain	*Clematis spp.*	Shrub
Spain	*Atriplex spp.*	Shrub
Spain	*Spiraea spp.*	Shrub
Spain	*Osyris spp.*	Shrub
Spain	*Chamaesparti um tridentatum*	Shrub
Spain	*Vaccinium myrtillus*	Shrub
Spain	*Asparagus spp.*	Shrub
Spain	*Coriaria myrtifolia*	Shrub
Spain	*Globularia alypum*	Shrub
Spain	*Hedera helix*	Shrub
Spain	*Helianthemum spp.*	Shrub
Spain	*Jasminum fruticans*	Shrub
Spain	*Lonicera spp.*	Shrub
Spain	*Medicago arborea*	Shrub
Spain	*Nerium oleander*	Shrub
Spain	*Prunus mahaleb*	Shrub
Spain	*Smilax aspera*	Shrub
Spain	*Thymelaea spp.*	Shrub
Spain	*Coronilla emerus*	Shrub
Spain	*Cytisophyllum sessilifolium*	Shrub
Spain	*Dorycnium pentaphyllum*	Shrub
Spain	*Genista spp.*	Shrub
Spain	*Ononis tridentata*	Shrub
Spain	*Ulex parviflorus*	Shrub
Spain	*Echium spp.*	Shrub
Spain	*Euphorbia spp.*	Shrub
Spain	*Teline spp.*	Shrub
Spain	*Cytisus arboreus*	Shrub
Spain	*Aphyllanthes monspeliensis*	Shrub
Spain	*Phlomis spp.*	Shrub
Spain	*Ephedra spp.*	Shrub
Spain	*Vitis vinifera*	Shrub
Spain	*Echinospartu m spp.*	Shrub
Spain	*Teucrium spp.*	Shrub
Spain	*Sideritis spp.*	Shrub
Spain	*Securinega tinctoria*	Shrub
Spain	*Lithodora spp.*	Shrub
Spain	*Salsola spp.*	Shrub

Country	Specie	Tree/shrub
Spain	*Amelanchier ovalis*	Shrub
Spain	*Frangula alnus*	Shrub
Spain	*Rhamnus alaternus*	Shrub
Spain	*Euonymus europaeus*	Shrub
Spain	*Myrtus communis*	Shrub
Spain	*Cornus sanguinea*	Shrub
Spain	*Prunus mahaleb*	Shrub
Spain	*Cistus ladanifer*	Shrub
Spain	*Erica arborea*	Shrub
Spain	*Ulex spp.*	Shrub
Spain	*Erinacea spp.*	Shrub
Spain	*Lavandula latifolia*	Shrub
Spain	*Daphne gnidium*	Shrub
Spain	*Halimium halimifolium*	Shrub
Spain	*Rubus caesius*	Shrub
Spain	*Rhamnus lycioides*	Shrub
Spain	*Bupleurum fruticosum*	Shrub
Spain	*Santolina spp.*	Shrub
Spain	*Thymus mastichina*	Shrub
Spain	*Ribes alpinum*	Shrub
Spain	*Clematis flammula*	Shrub
Spain	*Spiraea hypericifolia*	Shrub
Spain	*Osyris alba*	Shrub
Spain	*Vaccinium spp.*	Shrub
Spain	*Asparagus acutifolius*	Shrub
Spain	*Juniperus sabina*	Shrub
Spain	*Lonicera etrusca*	Shrub
Spain	*Dorycnium hirsutum*	Shrub
Spain	*Genista hirsuta*	Shrub
Spain	*Adenocarpus decorticans*	Shrub
Spain	*Retama sphaerocarpa*	Shrub
Spain	*Erinacea anthyllis*	Shrub
Spain	*Cytisus scoparius*	Shrub
Spain	*Vella spinosa*	Shrub
Spain	*Phlomis lychnitis*	Shrub
Spain	*Teucrium fruticans*	Shrub
Spain	*Cytisus striatus*	Shrub
Spain	*Cytisus villosus*	Shrub
Spain	*Erica tetralix*	Shrub
Spain	*Genista anglica*	Shrub
Spain	*Genista cinerascens*	Shrub
Spain	*Genista falcata*	Shrub
Spain	*Genista florida*	Shrub
Spain	*Genista hispanica*	Shrub
Spain	*Emerus major*	Shrub
Spain	*Medicago arborea*	Shrub
Spain	*Paliurus spinachristi*	Shrub

Country	Specie	Tree/shrub
Spain	*Pyracantha coccinea*	Shrub
Spain	*Rhododendron ferrugineum*	Shrub
Spain	*Teline linifolia*	Shrub
Spain	*Genista hystrix*	Shrub
Spain	*Cistus populifolius*	Shrub
Spain	*Erica australis*	Shrub
Spain	*Adenocarpus spp.*	Shrub
Spain	*Calicotome spinosa*	Shrub
Spain	*Calicotome spp.*	Shrub
Spain	*Lavandula stoechas*	Shrub
Spain	*Daphne laureola*	Shrub
Spain	*Cistus psilosepalus*	Shrub
Spain	*Viburnum tinus*	Shrub
Spain	*Rubus idaeus*	Shrub
Spain	*Rhamnus saxatilis*	Shrub
Spain	*Bupleurum fruticescens*	Shrub
Spain	*Santolina chamecypariss*	Shrub
Spain	*Helichrysum spp.*	Shrub
Spain	*Ribes rubrum*	Shrub
Spain	*Clematis vitalba*	Shrub
Spain	*Osyris quadripartita*	Shrub
Spain	*Asparagus albus*	Shrub
Spain	*Lonicera implexa*	Shrub
Spain	*Coronilla minima*	Shrub
Spain	*Genista triacanthos*	Shrub
Spain	*Ulex baeticus*	Shrub
Spain	*Retama monosperma*	Shrub
Spain	*Cytisus cantabricus*	Shrub
Spain	*Phlomis purpurea*	Shrub
Spain	*Cotoneaster integerrimus*	Shrub
Spain	*Echinospartu m horridum*	Shrub
Spain	*Emerus major*	Shrub
Spain	*Lonicera pyrenaica*	Shrub
Spain	*Rhododendron ferrugineum*	Shrub
Spain	*Buxus balearica*	Shrub
Spain	*Prunus spinosa*	Shrub
Spain	*Sambucus racemosa*	Shrub
Spain	*Cistus albidus*	Shrub
Spain	*Erica vagans*	Shrub
Spain	*Spartium spp.*	Shrub
Spain	*Calicotome villosa*	Shrub
Spain	*Lavandula lanata*	Shrub
Spain	*Daphne mezereum*	Shrub
Spain	*Viburnum lantana*	Shrub
Spain	*Halimium lasianthum*	Shrub
Spain	*Rubus ulmifolius*	Shrub
Spain	*Rhamnus alpinus*	Shrub

Country	Specie	Tree/shrub
Spain	*Lonicera periclymenum*	Shrub
Spain	*Coronilla juncea*	Shrub
Spain	*Genista scorpius*	Shrub
Spain	*Adenocarpus telonensis*	Shrub
Spain	*Ulex minor*	Shrub
Spain	*Cytisus multiflorus*	Shrub
Spain	*Chamaerops humilis*	Shrub
Spain	*Juniperus communis*	Shrub
Spain	*Cistus clusii*	Shrub
Spain	*Erica multiflora*	Shrub
Spain	*Retama spp.*	Shrub
Spain	*Cytisus spp.*	Shrub
Spain	*Lavandula pedunculata*	Shrub
Spain	*Viburnum opulus*	Shrub
Spain	*Halimium atripicifolium*	Shrub
Spain	*Rhamnus oleoides*	Shrub
Spain	*Lonicera pyrenaica*	Shrub
Spain	*Genista tridentata*	Shrub
Spain	*Cytisus oromediterraneus*	Shrub
Spain	*Cistus monspeliensis*	Shrub
Spain	*Erica cinerea*	Shrub
Spain	*Sarothamnus vulgaris*	Shrub
Spain	*Coronilla spp.*	Shrub
Spain	*Halimium ocymoides*	Shrub
Spain	*Lonicera xylosteum*	Shrub
Spain	*Genista balansae*	Shrub
Spain	*Cistus salvifolius*	Shrub
Spain	*Erica scoparia*	Shrub
Spain	*Ulex europaeus*	Shrub
Spain	*Astragalus spp.*	Shrub
Spain	*Halimium umbellatum*	Shrub
Spain	*Rhamnus alaternus*	Shrub
Spain	*Cistus crispus*	Shrub
Spain	*Erica umbellata*	Shrub
Spain	*Colutea arborescens*	Shrub
Spain	*Dorycnium spp.*	Shrub
Spain	*Genista umbellata*	Shrub
Spain	*Emerus major*	Shrub
Spain	*Medicago arborea*	Shrub
Spain	*Rhododendron ferrugineum*	Shrub
Spain	*Cistus laurifolius*	Shrub
Spain	*Erica ciliaris*	Shrub
Spain	*Sarothamnus scoparius*	Shrub
Spain	*Ononis spp.*	Shrub
Spain	*Genista cinerea*	Shrub
Spain	*Echinospartu m horridum*	Shrub
Spain	*Buxus balearica*	Shrub

Country	Specie	Tree/shrub
Spain	*Buxus sempervirens*	Shrub
Spain	*Erica erigena*	Shrub
Spain	*Spartium junceum*	Shrub
Spain	*Genistella spp.*	Shrub
Spain	*Linum suffruticosum*	Shrub
Spain	*Salvia lavandulifolia*	Shrub
Spain	*Echinospartu m barnadesii*	Shrub
Spain	*Linum suffruticosum*	Shrub
Spain	*Pistacia terebinthus*	Shrub
Spain	*Teline monspessulana*	Shrub
Italy	*Abies alba*	tree
Italy	*Abies nebrodensis*	tree
Italy	*Abies cephalonica*	tree
Italy	*Abies sp.*	tree
Italy	*Picea abies*	tree
Italy	*Picea sp.*	tree
Italy	*Acer negundo*	tree
Italy	*Acer campestre*	tree
Italy	*Acer gr. opalus*	tree
Italy	*Acer lobelii*	tree
Italy	*Acer pseudoplatanus*	tree
Italy	*Acer monspessulanum*	tree
Italy	*Acer platanoides*	tree
Italy	*Ilex aquifolium*	tree
Italy	*Ailanthus altissima*	tree
Italy	*Cinnamomum camphora*	tree
Italy	*Cercis siliquastrum*	tree
Italy	*Laurus nobilis*	tree
Italy	*Celtis sp.*	tree
Italy	*Betula pendula*	tree
Italy	*Betula pubescens*	tree
Italy	*Betula sp.*	tree
Italy	*Carpinus betulus*	tree
Italy	*Ostrya carpinifolia*	tree
Italy	*Carpinus orientalis*	tree
Italy	*Ceratonia siliqua*	tree
Italy	*Castanea sativa*	tree
Italy	*Catalpa bignonioides*	tree
Italy	*Cedrus sp.*	tree
Italy	*Pinus cembra*	tree
Italy	*Prunus cerasifera*	tree
Italy	*Quercus cerris*	tree
Italy	*Quercus crenata*	tree
Italy	*Sorbus torminalis*	tree
Italy	*Prunus avium*	tree
Italy	*Cupressus sempervirens*	tree
Italy	*Cupressus arizonica*	tree

Country	Specie	Tree/shrub
Italy	*Taxodium distichum*	tree
Italy	*Chamaecyparis lawsoniana*	tree
Italy	*Cupressus sp.*	tree
Italy	*Quercus gr. coccifera*	tree
Italy	*Arbutus unedo*	tree
Italy	*Cryptomeria japonica*	tree
Italy	*Eucalyptus sp.*	tree
Italy	*Fagus sylvatica*	tree
Italy	*Quercus frainetto*	tree
Italy	*Quercus robur*	tree
Italy	*Ficus carica*	tree
Italy	*Quercus trojana*	tree
Italy	*Fraxinus excelsior*	tree
Italy	*Fraxinus oxycarpa*	tree
Italy	*Morus sp.*	tree
Italy	*Broussonetia papyrifera*	tree
Italy	*Genista sp.*	tree
Italy	*Phillyrea latifolia*	tree
Italy	*Phillyrea angustifolia*	tree
Italy	*Aesculus hippocastanum*	tree
Italy	*Larix decidua*	tree
Italy	*Larix kaempferi (L. leptolepis)*	tree
Italy	*Quercus ilex*	tree
Italy	*Liriodendron tulipifera*	tree
Italy	*Maclura pomifera*	tree
Italy	*Malus sp.*	tree
Italy	*Punica granatum*	tree
Italy	*Mespilus germanica*	tree
Italy	*Juglans regia*	tree
Italy	*Juglans nigra*	tree
Italy	*Olea europaea*	tree
Italy	*Elaeagnus angustifolia*	tree
Italy	*Ulmus minor*	tree
Italy	*Ulmus glabra*	tree
Italy	*Ulmus sp.*	tree
Italy	*Alnus incana*	tree
Italy	*Alnus cordata*	tree
Italy	*Alnus glutinosa*	tree
Italy	*Fraxinus ornus*	tree
Italy	*Prunus padus*	tree
Italy	*Paulownia tomentosa*	tree
Italy	*Pyrus sp.*	tree
Italy	*Pinus brutia*	tree
Italy	*Pinus halepensis*	tree
Italy	*Pinus canariensis*	tree
Italy	*Pinus pinea*	tree
Italy	*Pinus excelsa (P.wallichiana)*	tree

Country	Specie	Tree/shrub
Italy	*Pinus laricio*	tree
Italy	*Pinus leucodermis*	tree
Italy	*Pinus pinaster*	tree
Italy	*Pinus uncinata*	tree
Italy	*Pinus nigra*	tree
Italy	*Pinus radiata*	tree
Italy	*Pinus sylvestris*	tree
Italy	*Pinus strobus*	tree
Italy	*Pinus sp.*	tree
Italy	*Populus sp.*	tree
Italy	*Populus alba*	tree
Italy	*Populus canescens*	tree
Italy	*Thuja sp.*	tree
Italy	*Quercus macrolepis*	tree
Italy	*Populus xcanadensis*	tree
Italy	*Populus nigra*	tree
Italy	*Populus tremula*	tree
Italy	*Platanus hybrida*	tree
Italy	*Platanus orientalis*	tree
Italy	*Prunus serotina*	tree
Italy	*Pseudotsuga menziesii*	tree
Italy	*Quercus rubra*	tree
Italy	*Quercus sp.*	tree
Italy	*Robinia pseudacacia*	tree
Italy	*Quercus petraea*	tree
Italy	*Quercus pubescens*	tree
Italy	*Salix alba*	tree
Italy	*Salix sp.*	tree
Italy	*Salix caprea*	tree
Italy	*Sequoia sempervirens*	tree
Italy	*Sorbus aucuparia*	tree
Italy	*Sorbus domestica*	tree
Italy	*Sorbus aria*	tree
Italy	*Sorbus sp.*	tree
Italy	*Quercus suber*	tree
Italy	*Tamarix sp.*	tree
Italy	*Taxus baccata*	tree
Italy	*Tilia platyphyllos*	tree
Italy	*Tilia cordata*	tree
Italy	*Tilia sp.*	tree
Italy	*Tsuga sp.*	tree
Italy	*Acacia sp.*	shrub
Italy	*Vitex agnus-castus*	shrub
Italy	*Ilex aquifolium*	shrub
Italy	*Rhamnus alaternus*	shrub
Italy	*Atriplex halimus*	shrub
Italy	*Laurus nobilis*	shrub

Country	Specie	Tree/shrub
Italy	*Artemisia arborescens*	shrub
Italy	*Crataegus sp.*	shrub
Italy	*Buxus sp.*	shrub
Italy	*Calluna vulgaris*	shrub
Italy	*Buddleja davidii*	shrub
Italy	*Bupleurum fruticosum*	shrub
Italy	*Arundo donax*	shrub
Italy	*Phragmites australis*	shrub
Italy	*Lonicera sp.*	shrub
Italy	*Ceratonia siliqua*	shrub
Italy	*Cistus sp.*	shrub
Italy	*Cytisus sp.*	shrub
Italy	*Teline sp.*	shrub
Italy	*Lembotropis nigricans*	shrub
Italy	*Clematis sp.*	shrub
Italy	*Quercus gr. coccifera*	shrub
Italy	*Prunus cocomilia*	shrub
Italy	*Arbutus unedo*	shrub
Italy	*Coriaria myrtifolia*	shrub
Italy	*Coronilla sp.*	shrub
Italy	*Cornus sanguinea*	shrub
Italy	*Cornus mas*	shrub
Italy	*Cotoneaster sp.*	shrub
Italy	*Berberis sp.*	shrub
Italy	*Daphne sp.*	shrub
Italy	*Solanum dulcamara*	shrub
Italy	*Hedera helix*	shrub
Italy	*Ephedra sp.*	shrub
Italy	*Medicago arborea*	shrub
Italy	*Erica arborea*	shrub
Italy	*Erica multiflora*	shrub
Italy	*Erica scoparia*	shrub
Italy	*Erica sp.*	shrub
Italy	*Euphorbia dendroides*	shrub
Italy	*Euphorbia sp.*	shrub
Italy	*Opuntia ficus-indica*	shrub
Italy	*Frangula sp.*	shrub
Italy	*Euonymus sp.*	shrub
Italy	*Juniperus oxycedrus*	shrub
Italy	*Juniperus communis*	shrub
Italy	*Juniperus virginiana*	shrub
Italy	*Juniperus phoenicea*	shrub
Italy	*Juniperus nana*	shrub
Italy	*Spartium junceum*	shrub
Italy	*Adenocarpus complicatus*	shrub
Italy	*Genista sp.*	shrub
Italy	*Osyris alba*	shrub

Country	Specie	Tree/shrub
Italy	*Ulex europaeus*	shrub
Italy	*Hibiscus syriacus*	shrub
Italy	*Phillyrea latifolia*	shrub
Italy	*Phillyrea angustifolia*	shrub
Italy	*Amorpha fruticosa*	shrub
Italy	*Hypericum sp.*	shrub
Italy	*Yucca aloifolia*	shrub
Italy	*Rubus idaeus*	shrub
Italy	*Prunus laurocerasus*	shrub
Italy	*Viburnum tinus*	shrub
Italy	*Lavandula sp.*	shrub
Italy	*Quercus ilex*	shrub
Italy	*Anagyris foetida*	shrub
Italy	*Pistacia lentiscus*	shrub
Italy	*Ligustrum vulgare*	shrub
Italy	*Humulus lupulus*	shrub
Italy	*Laburnum sp.*	shrub
Italy	*Prunus mahaleb*	shrub
Italy	*Lavatera sp.*	shrub
Italy	*Paliurus spina-christi*	shrub
Italy	*Vaccinium sp.*	shrub
Italy	*Myrtus communis*	shrub
Italy	*Pinus mugo*	shrub
Italy	*Mespilus germanica*	shrub
Italy	*Corylus sp.*	shrub
Italy	*Nerium oleander*	shrub
Italy	*Olea europaea*	shrub
Italy	*Elaeagnus angustifolia*	shrub
Italy	*Hippophae rhamnoides*	shrub
Italy	*Ononis sp.*	shrub
Italy	*Alnus viridis*	shrub
Italy	*Prunus padus*	shrub
Italy	*Viburnum opalus*	shrub
Italy	*Chamaerops humilis*	shrub
Italy	*Periploca graeca*	shrub
Italy	*Amelanchier ovalis*	shrub
Italy	*Pinus pumilio*	shrub
Italy	*Arctostaphylos uva-ursi*	shrub
Italy	*Colutea arborescens*	shrub
Italy	*Viburnum lantana*	shrub
Italy	*Vitis sp.*	shrub
Italy	*Parthenocissus sp.*	shrub
Italy	*Pyracantha coccinea*	shrub
Italy	*Pittosporum tobira*	shrub
Italy	*Prunus spinosa*	shrub
Italy	*Prunus sp.*	shrub
Italy	*Prunus brigantiaca*	shrub

Country	Specie	Tree/shrub
Italy	*Ruscus aculeatus*	shrub
Italy	*Rhamnus alpinus*	shrub
Italy	*Rhamnus sp.*	shrub
Italy	*Retama raetam*	shrub
Italy	*Ribes sp.*	shrub
Italy	*Rubia peregrina*	shrub
Italy	*Rhododendron hirsutum*	shrub
Italy	*Rhododendron ferrugineum*	shrub
Italy	*Rosa sp.*	shrub
Italy	*Rosmarinus officinalis*	shrub
Italy	*Rubus sp.*	shrub
Italy	*Juniperus sabina*	shrub
Italy	*Salix sp.*	shrub
Italy	*Phlomis sp.*	shrub
Italy	*Sambucus nigra*	shrub
Italy	*Sambucus racemosa*	shrub
Italy	*Cotinus coggygria*	shrub
Italy	*Syringa vulgaris*	shrub
Italy	*Rhus sp.*	shrub
Italy	*Sorbus chamaemespilus*	shrub
Italy	*Sorbus aria*	shrub
Italy	*Calicotome sp.*	shrub
Italy	*Thymelaea sp.*	shrub
Italy	*Sarcopoterium spinosum*	shrub
Italy	*Lycium europaeum*	shrub
Italy	*Gleditsia triacanthos*	shrub
Italy	*Rhamnus catharticus*	shrub
Italy	*Staphylea pinnata*	shrub
Italy	*Styrax officinalis*	shrub
Italy	*Smilax aspera*	shrub
Italy	*Sideritis sp.*	shrub
Italy	*Tamarix sp.*	shrub
Italy	*Myricaria germanica*	shrub
Italy	*Pistacia terebinthus*	shrub
Italy	*Teucrium sp.*	shrub
Italy	*Prasium majus*	shrub
Italy	*Cneorum tricoccon*	shrub
Italy	*Anthyllis barba-jovis*	shrub