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GENEVA TIMBER AND FOREST DISCUSSION PAPER 33

BIOLOGICAL DIVERSITY, TREE SPECIES COMPOSITION AND ENVIRONMENTAL PROTECTION IN REGIONAL FRA-2000

by

Mr. Nigel Dudley and Ms. Sue Stolton

"Equilibrium", UK

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ECE/TIM/DP/33

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Note

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Abstract

This discussion paper is an attempt to complete and extend the analysis initiated in the FRA-2000 process, namely in the UNECE/FAO Temperate and Boreal Forest Assessment, published as *Forest Resources of Europe, CIS, North America, Australia, Japan and New Zealand.* This objective has been achieved both by publishing data that have so far only been accessible on the web or in the UNECE library, and also by taking this further through the provision of some additional research and analysis. The paper addresses the issues of forests' "naturalness", tree species, forest protected areas, endangered forest-dwelling and invasive species.

Acknowledgements

This discussion paper was prepared by Mr. Nigel Dudley and Ms. Sue Stolton, "*Equilibrium*", United Kingdom, who contributed outstanding analytical skills while addressing the forest biodiversity issues, which are a quite new area of the international forest resources assessments. This analysis is also a contribution to the global and regional international work on promoting sustainable forest management. The forest biodiversity analysis, which is now the focus of research work in many institutions, and the subject of data collection at the local and sub-regional levels, become a very challenging task to address at the international level. The authors made an important contribution for future efforts and findings in this area. The UNECE/FAO Timber Branch (Matt Fonseca) contributed significantly in the layout to the final editing of the document.

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Data quality

It is clear that although country correspondents spent considerable time and effort collecting the data, the breadth of information required and the need for additional research has meant that the quality of information is extremely variable. The fact that there are shortcomings in data should be noted and are discussed in the following text, along with methodological problems that emerged during the assessment.

Preface

The Temperate and Boreal Forest Resource Assessment 2000 (TBFRA) collected a very wide range of information about the state and trends of the forest resource, organized according to the 6 criteria for sustainable forest management. In so doing, it entered a number of areas where comparable international information had never been collected on a large scale before. Most of the resulting information was published in the TBFRA 2000 Main Report and subsequently in other reports issued by ECE's partners FAO or the Ministerial Conference of the Protection of Forests in Europe. However, the richness and complexity of the data collected has meant that some data collected have not yet been published, and other merited further validation and analysis.

As part of the ongoing programme of UNECE and FAO to provide the best possible information on the region's forests, the secretariat has engaged consultants to deepen the analysis and information on one of the most complex issues covered by the data base, forest biodiversity. Six areas in particular merited attention: the "naturalness" of the region's forests, which tree species occurred, in which areas, how well the region's forests are protected, which forest dwelling species (animal and plants) are endangered, the threat posed by invasive species of plants and animals, and the methods used to regenerate forests, which will determine the genetic diversity of the forests of the future. On all the above issues, the TBFRA 2000 database presented the potential of new insights and new information, as well as a database for the use of specialists.

The consultants, Nigel Dudley and Sue Stolton were able to mobilize not only their own knowledge and experience but that of the network of TBFRA correspondents as well as of related academic and NGO communities, notably with the help of the World Wide Fund for Nature (WWF).

We take this opportunity to thank Mr. Dudley and Ms. Stolton, and the whole expert community for their help in enabling the ECE to continue to contribute to improving our knowledge and understanding of the region's forests.

Mrs. Brigita Schmögnerova

Executive Secretary

UN Economic Commission for Europe

List of Acronyms

CBD	Convention on Biological Diversity
FAO	Food and Agricultural Organization of the United Nations
FRA	Forest Resource Assessment(s)
GISP	Global Invasive Species Programme
ISSG	Invasive Species Specialist Group
IUCN	International Union for the Conservation of Nature and Natural Resources
MCPFE	Ministerial Conference on the Protection of Forests in Europe
SSC	Species Survival Commission
TBFRA	Temperate and boreal forests resource assessments
CIS	Commonwealth of Independent States
UNECE	United Nations Economic Commission for Europe
UNEP-WCMC	United Nations Environment Programme -World Conservation Monitoring Centre
WCPA	World Commission on Protected Areas
WRI	World Resources Institute
WWF	World Wide Fund for Nature

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Executive Summary

The major part of the information collected in the process of the UNECE/FAO Forest Resources Assessment 2000 (abbreviated elsewhere in the text as "TBFRA-2000") was published in the Main Report "*Forest Resources of Europe, CIS, North America, Australia, Japan and New Zealand"* and its accompanying papers. Some TBFRA information relating to biodiversity issues, especially where tree species are concerned, required additional analyses. These analyses are presented in this discussion paper. The paper covers aspects of "naturalness" of forests, species "status" and their distribution, information on forest protected areas, as well as forest cover analysis. Below is the synopsis:

- **Naturalness**: Between 40 and 55% of the forests in the TBFRA region can be classified as "undisturbed by man" depending on whether the TBFRA's original figures are used or recalculated using new data from the World Resources Institute. However, over 90 per cent of these are found in the Russian Federation and Canada and mainly in the boreal region. The bulk of the remaining natural forest exists in the United States and Australia with smaller amounts in the Nordic countries, Japan and New Zealand. In the rest of Europe the proportion is usually from zero to less than one per cent, making natural European temperate forests amongst the most highly endangered ecosystems in the world.
- **Tree species**: The highest levels of tree biodiversity are found in the western part of the Pacific Rim, particularly in New Zealand and Australia, while the lowest levels are in the northern boreal regions. In Europe and Central Asia, tree diversity increases towards the south and the east. Diversity in North America is similar to that in Europe, again with an increase towards the south, with marked differences between Canada and the USA. Within Europe, there is a clearly identifiable group of around fifty tree species that have an extremely wide distribution, many being found from boreal regions to Mediterranean and other hot temperate countries.
- **Forest protected areas**: 87% of IUCN Category I-II forest protected areas (the strictest protection) are found in just four countries: the Russian Federation, USA, Australia and Canada, and 23 countries have less than 1000 km2 of forests in Category I-II. When the percentage of forests in protected areas is calculated, 19 countries have less than 2% of their forests in Category I-II protected areas, while 9 countries have more than 10%.
- **Endangered forest-dwelling species**: There is clearly a perception that significant numbers of wild plant and animal species are endangered, despite the existence of a relatively stable forest estate. Mammals and birds seem to be proportionately more endangered than smaller creatures, although this may also be a reflection of data quality. Conversely, trees and other vascular plants appear to be less threatened than ferns, mosses and lichens.
- **Invasive species**: Fifteen countries reported problems with invasive species, such as browsing from introduced deer and invasive plants that hamper regeneration of commercially valuable species.
- **Forest cover**: Forests and other wooded lands are currently expanding in practically all the countries surveyed by TBFRA-2000. Most of the expansion is in Russia and the United States of America, although expansion is also taking place in Europe. Most countries are also actively regenerating their forests through a variety of management techniques, with again the Russian Federation, United States of America and Canada dominating the area being regenerated. Roughly a fifth of the expansion is with non-native species, particularly in Armenia, Denmark, France, Hungary, Moldova, New Zealand (100 per cent) Portugal, and the United Kingdom. In addition, about 1.5 million ha of non-forest land is colonised through natural expansion each year; statistics for natural regeneration are dominated by the Russian Federation, which accounts for over 90% of the total.

The information that is analysed in this document represents, we believe, the largest collection of its type to date. However, there are still substantial gaps and it should therefore be treated with caution. This is particularly true in the case of the lists of tree species; only very partial and incomplete information was obtained from many governments and institutions. The tables included in the document represent a combination of this information augmented by national lists where possible, or failing that, from regional lists of flora. The shortcomings of such an approach will be obvious to the specialist, particularly in the case of many countries in Eurasia - some Central Asian countries for example being represented by a tiny fraction of their full tree flora.

The authors welcome comments and, particularly, sources and information to improve the tables, which are annexed to this paper.

1. Introduction

1.1 Background

The TBFRA-2000 (UNECE/FAO Temperate and Boreal Forest Assessment), published as *Forest Resources of Europe, CIS, North America, Australia, Japan and New Zealand* (Anon 2000), included for the first time considerable data on wider aspects of forest biodiversity, conservation, forest regeneration and status of protection. The plans to include these wider issues were endorsed by an expert meeting of FAO and the UNECE in Kotka, Finland in June 1996 (Nyyssönen and Ahti) and refined by the UNECE FRA Team of Specialists over the next two years into a section of the FRA questionnaire.

Whilst the final report included some analysis of the replies to the country questionnaires, coverage was cursory and some data were omitted, in particular the national lists of native tree species and some details of threatened species. This discussion paper is an attempt to complete and extend the analysis begun in FRA-2000, both by publishing data that have so far only been accessible on the web or in the UNECE library, and also by taking this further through the provision of some additional research and analysis.

The biodiversity questions, which were developed in cooperation with WWF International and the United Nations Environment Programme - World Conservation Monitoring Centre (UNEP-WCMC), focused on a series of issues:

- **Naturalness of forests** – expressed by information on the proportion of forests within a country that can be defined as "undisturbed by man" and as industrial "plantations".
- **Tree species** – countries were asked to supply lists of all tree species, including whether they were native or introduced, scientific and common names and an indication of their frequency.
- **Protection status of forests and other wooded land** – based around the proportion found in protected areas (as defined by IUCN The World Conservation Union protected area categories I-VI).
- **Number of endangered forest-dwelling species** – based on the proportion of total species listed as endangered and the proportion of endemic species listed as endangered.
- Identification of the main **invasive species** in forests in the region.
- **Forest regeneration** – looking at both the area of forests within countries that is under regeneration and some ideas about the regeneration method.

1.2 Results

Although it is clear that country correspondents spent considerable time and effort in collecting data, the breadth of information required and the fact that some clearly needed additional research has meant that the quality of information is extremely variable. The fact that there are shortcomings in data should be noted and are discussed in the following text, along with methodological problems that emerged during the assessment.

Some initial assessment of the data and comparison with other data sets – particularly those from the Ministerial Conference on the Protection of Forests in Europe (MCPFE, formerly known as the "Helsinki Process) and data sets held by UNEP-WCMC (including country "Red Data" lists – has been made by the European Commission (Puumalainen, 2001). These are referred to in the discussion paper where relevant in making overall assessments.

To make up for some of the problems due to lack of data, some additional research has also been undertaken for the current study, particularly with respect to country lists of tree species and the naturalness of forests.

2. Naturalness

2.1 Introduction

Although temperate and boreal forests are generally increasing in area, concern has been expressed that this trend conceals a decline in the amount of "natural" or "authentic" forest, which is increasingly being replaced by intensively managed forests and plantations. Forests are in general becoming ecologically simpler, with fewer species and habitats, and management practices are tending to remove trees before they reach maximum age, leading to a high proportion of young trees, even-aged forest stands and a lack of dead wood. In many countries, "natural" forests, if they exist at all, have been reduced to a few remnant fragments that are either so inaccessible that they remain untouched or have been protected for historical reasons (for example some of the oldest natural forests in the temperate region are around Shinto temples in Japan).

Whilst these conditions may favour timber production, they do not support the full range of biodiversity that would be expected in a natural forest. They may also be poorer in terms of some of the social values traditionally associated with forests, including some non-timber forest products, and some spiritual and aesthetic values. In countries where forests are expected to play a major role as recreational destinations, their appearance is also an increasingly important factor.

Forests that retain the characteristics of a natural ecosystem have important ecological and cultural values that are increasingly under threat even in countries where large areas are still under trees. Setting aside a proportion of the forest estate to maintain or regain such natural characteristics is therefore a major objective of most national conservation strategies in the region and has been the focus of sustained effort by non-governmental organisations, including both through the purchase of land and by political advocacy. The debate has been particularly acute in the western areas of the USA and Canada, the remaining natural forests of Australia and New Zealand and in Scandinavia.

"Naturalness", as used here, refers to the degree to which a forest corresponds to the original ecosystem in terms of ecological processes and species composition. There have been many attempts to define naturalness, a few of which are summarised in Table 1 below.

TABLE 1

Various ways to define natural forest

Definition by degree of disturbance	
Virgin forest	Forests never significantly altered by humans
Forest frontier	Large enough to support full range of indigenous species with structure and function shaped by natural events
Near-natural forests	Forest where most indigenous species and natural ecosystem functions survive
Semi-natural forest	Disturbed or managed forests which still maintain important components of natural ecosystems
Authentic forest	Forest that contains natural components, structure, function and process
Wildwood	Wholly natural woodland unaffected by Neolithic or later civilisation (a definition used in the UK)
Definition by age	
Primary	Forest that has existed continuously since original forest first developed
Old-growth	Forests with mature structural and functional characteristics
Ancient	Forests have primary characteristics but there is no proof that they have never been disturbed (the usual case).
Definition by composition	
Native forests	Forests composed primarily of natural species
Definition by multiple factors	
High Conservation Value Forest	Emerging definition used by the Forest Stewardship Council and others, which includes reference to naturalness along with other social and ecological factors

Source: Dudley (2003)

None of these definitions are precise. The term "old-growth" has gained widespread usage because of the debate about forests in western North America but it has limitations as a general definition, only really applying to forests where catastrophic change (e.g. by fire or hurricane) is rare. Although defined precisely for the Pacific Northwest of the USA, attempts to transfer this definition to other forest types have been less successful.

In practice, because few if any forests have been wholly unaffected by human interference (if only through the impacts of airborne pollutants or climate change), degree of naturalness will have to be judged by the combination of multiple factors, some of which are outlined below.

- The ***composition*** of tree species and other forest-living plant and animal species.
- The ***pattern*** of intraspecific variation, as shown in trees by canopy and stand. structure, age-class, understory etc.
- The ***functioning*** of plant and animal species in the forest.
- The ***process*** by which the forest changes and regenerates itself over time, as demonstrated by disturbance patterns, forest succession etc.
- The ***resilience*** of the forest in terms of tree health, ecosystem health and ability to withstand environmental stress.
- The ***area*** of the forest with respect to actual size, edges, connectivity and degree of fragmentation.

All these components are in turn affected by ***management practices and development patterns***, so for example naturalness can be deliberately suppressed or may be encouraged by mimicking natural ecological processes, leaving some areas to develop old-growth characteristics, etc.

Although such precision is needed to get a picture of naturalness on a stand level, it is clearly impractical to attempt at the level of a region or country. In practice, experienced ecologists should be able to short cut the process by using broad surrogate indicators to pinpoint forests that are likely to show natural characteristics. For example, in the boreal region the pattern of the forest canopy is used, in some temperate forests key indicator species can provide clues to the existence of likely natural forest fragments (for example spotted owls in the western USA or white backed woodpeckers in the broadleaved forests of southern Scandinavia) and the use of GIS imagery to identify likely areas is also becoming increasingly possible. National or international surveys will almost inevitably have to be even coarser in their criteria

2.2 Measuring naturalness

There has, until recently, been little information available about the amount of "natural" forest remaining in most countries. The year 2000 UNECE/FAO Temperate and Boreal Forest Resources Assessment inquired for the first time for information about naturalness of remaining forests. National correspondents were asked to estimate the area of "forest undisturbed by man" as an approximation of "naturalness. The term as used by TBFRA has a reasonably precise definition, see box below.

Forest undisturbed by man: *"forest/other wooded land that shows natural forest dynamics, such as natural tree composition, occurrence of dead wood, natural age structure and natural regeneration processes, the area of which is large enough to maintain its natural characteristics and where there has been no known significant human intervention or where the last significant human intervention was long enough ago to have allowed the natural species composition and processes to have become re-established".*

Forests that appear to be "natural" and have minimal silvicultural intervention today, but that do not satisfy this definition, should be defined as "semi-natural".

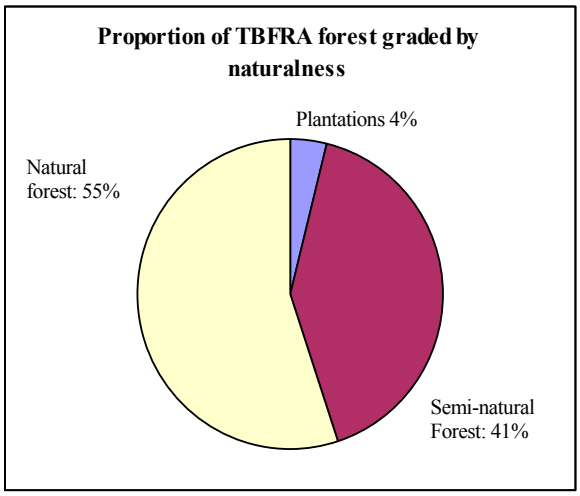
A number of uncertainties remain; we still do not know how long a forest must remain undisturbed to recover a fully natural ecosystem function and species composition (or indeed if this is possible). There is a similar lack of information about the minimum size needed for an area to function as an "undisturbed forest" and the role of small pockets of natural forest surrounded by semi-natural forest. Although country correspondents were in some cases able to draw on recent research, the results reported should be regarded as approximate (and have sometimes subsequently been questioned). They nonetheless present the most comprehensive picture available on the amounts of natural forest remaining in temperate and boreal forests.

Since the TBFRA was completed, additional research has taken place through the World Resources Institute's *Forest Watch* programme, focused particularly on Canada and the Russian Federation – the two countries with the most natural forest but relatively little hard statistical data – and this has added considerably to our overall understanding.

2.3 Results

According to the correspondents, 55% of forest in the TBFRA catchment can still be classified as "undisturbed by man", with 41% "semi-natural" and just 4% of the area covered by plantations (Figure 1).

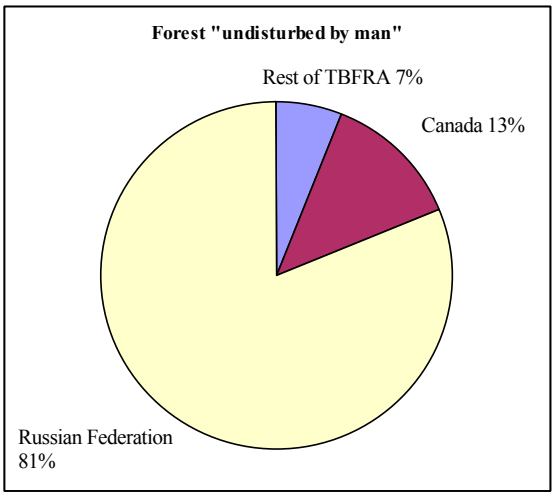
FIGURE 1



Source: TBFRA 2000

However, the results are dominated by forest condition in the Russian Federation and Canada, and therefore on the accuracy of data from these two countries and on the ways in which they distinguish between "undisturbed by man" and "semi-natural" (see Figure 2).

FIGURE 2



Source: TBFRA-2000

Inaccuracies in figures from Canada and, even more, the Russian Federation would seriously distort global statistics and the country correspondents for both countries admitted data were approximate. The World Resources Institute has also developed studies of both countries, and results were compared in developing this paper. The WRI *Forest Watch* results are also approximate and based on slightly different criteria: *frontier forests* are defined by seven criteria relating to size, structure, and composition but are broadly large areas of natural forest and therefore suitable for comparison with TBFRA-2000. Comparison is given in Table 2 below.

TABLE 2

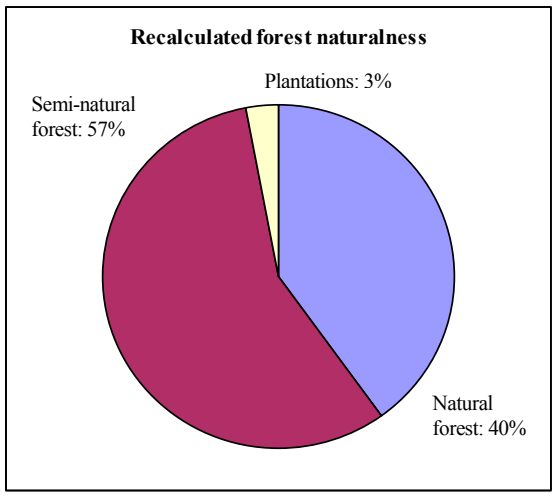
Comparison of forest naturalness in Canada and the Russian Federation from TBFRA and WRI Global Forest Watch

Country	TBFRA	WRI GFW
Area of natural forest given in million hectares and % of current total of all forest		
Canada	297 (71%)	340 (81%)
Russian Federation	819 (92%)	349 (43%)

Sources: TBFRA 2000 and Global Forest Watch

Although the WRI figures are slightly larger than the government's estimate in the case of Canada, they are considerably smaller for the Russian Federation (and note that the two Russian Federation total forest areas are also slightly different). Given the dominance of Russian forests this will have a considerable impact on the overall proportions, which are recalculated and presented in Figure 3 below.

FIGURE 3

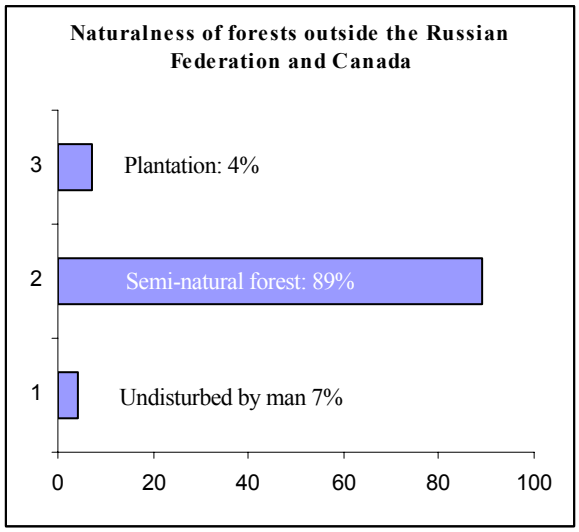


Source: TBFRA-2000

Manipulating the Russian Federation data in line with the Global Forest Watch figures almost precisely realigns the figures, with semi-natural forest now dominant and plantations still a tiny proportion of the total.

Although the figures for the Russian Federation and Canada are important, they are not typical. If relative naturalness is analysed outside these countries, the figure for forest "undisturbed by man" drops to just 7% of the total, as shown below (Figure 4).

FIGURE 4



Source: TBFRA-2000

Closer examination shows further concentration of natural forest. The bulk of the remaining natural forest is in the United States and Australia with smaller amounts in the Nordic countries, Japan and New Zealand; in the rest of Europe the proportion is usually from 0-1%. Nonetheless, in Europe as a whole, almost 9 million ha are defined as "undisturbed by man". While over half of this is in Sweden and much of the rest in Norway and Finland, many former Soviet states apparently contain important remnant areas (see Table 3).

These data must be treated with caution. While some countries have carried out careful studies of forest naturalness, these are in the minority and we can assume that some correspondents had to make judgements using relatively poor data. For example, France identified 30,000 hectares as natural, or 0.2 per cent of current forest area, but other researchers have argued that this proportion was reached through extrapolation from an incomplete survey. Less than 10 000 ha of ancient forests (undisturbed for over 50 years) have been identified in state managed forests and the figure of 30 000 ha should therefore be considered as a maximum and the real proportion is likely to be less.

TABLE 3

Forest "undisturbed by man"

Country	Percentage of forest
Europe	
Albania	8.2
Austria	0.9
Belgium	0.0
Bosnia and Herzegovina	0.0
Bulgaria	7.1
Croatia	0.1
Cyprus	0.0
Czech Republic	0.0
Denmark	0.1
Estonia	0.1
Finland	5.8
France	0.2
Germany	0.0
Greece	N/a
Hungary	0.0
Iceland	0.0
Ireland	0.2
Israel	0.0
Italy	0.1
Latvia	0.1
Liechtenstein	21.7
Lithuania	0.6
Luxembourg	0.0
Malta	0.0
Netherlands	0.0
Norway	2.9
Poland	1.6
Portugal	1.6
Romania	3.7
Slovakia	1.0
Slovenia	4.5
Spain	0.0
Sweden	16.1
Switzerland	0.6
The FYR of Macedonia	0.0
Turkey	1.9
United Kingdom	0.0
Yugoslavia	0.1
Commonwealth of Independent States	
Armenia	85.0
Azerbaijan	42.8
Belarus	0.6
Georgia	18.4
Kazakhstan	0.0
Kyrgyzstan	13.7
Republic of Moldova	0.0
Russian Federation	91.8 (WRI GFW = 43)
Tajikistan	5.3
Turkmenistan	0.0
Ukraine	0.6
Uzbekistan	10.5
North America	
Canada	50.7 (WRI GFW = 81)
United States of America	8.8
Other TBFRA countries	
Australia	12
Japan	12.7
New Zealand	20.1

Source: TBFRA-2000

Analysis of "naturalness" in "other wooded land" shows a similar distribution to that of forests, with Canada and the Russian Federation dominating the results and in this case Canada recording the highest amount. In general, boreal countries have the majority of other wooded land "undisturbed by man". The top six countries in this category all have substantial boreal forests: in descending order: Canada, the Russian Federation, the United States of America (presumably much of it in Alaska), Sweden, Finland and Norway. Here figures given tend to be more approximate than in the case of forest, suggesting that information was even more difficult to find.

Only 3-4% of the total forest area in TBFRA countries is currently under plantations (depending on which data is used for the Russian Federation). Over 90% of plantations in the TBFRA countries are found in just ten countries, dominated by the Russian Federation, the United States and Japan (see Table 4). This may reflect choices about forest management; for example Canada identified no plantations at all and defined all its managed forests as "semi-natural".

TABLE 4

90% of plantations are in ten countries

Country	Plantation (thousand ha)
Bulgaria	968
Australia	1 043
United Kingdom	1 400
New Zealand	1 542
Turkey	1 854
Spain	1 904
Ukraine	4 425
Japan	10 682
United States of America	13 687
Russian Federation	17 340

Source: TBFRA-2000

2.4 Results from other temperate regions

The TBFRA only covers some of the world's temperate forests. Results from other temperate countries remain fragmentary, but are important in terms of developing a picture of the global situation.

In Eurasia, temperate forests are also found in parts of China, the Indian subcontinent and the Koreas. Although China still retains large temperate forests (in contrast with its tropical forests, which have been badly degraded), most accessible areas have been managed, often for thousands of years: even most strictly protected nature reserves have been managed in the past and in many of them indigenous uses (mainly fuelwood extraction) continue today. A similar situation occurs in the temperate regions of the Indian subcontinent, where net forest cover also continues to decline. Although no studies of natural forest cover in either North or South Korea have been found, in the latter much of the forest has been replanted, suggesting that "forest undisturbed by man" is scarce.

Some of the forests in the temperate Southern Cone countries of Chile and Argentina remain in a natural state (some inland forests apparently never being settled by the now extinct indigenous peoples) although their status is changing rapidly. Global Forest Watch suggests that 45% of Chile's forests is "mature" and 34% is mature forest existing in areas of 5000 hectares or more (Neira et al, 2002); this designation, whilst not the same as that used by UNECE, is roughly analogous. Uruguay, although largely deforested (and with a major plantation development) retains important temperate forest fragments (Carrere, 2000). Although 30 million ha of temperate forest are recorded for Mexico, the amount that remains in a natural state is unknown.

Within the TBFRA catchment, data for central Asia remain fragmentary; this is a pity because the area contains important forest areas and generally higher tree diversity.

2.5 Discussion of results

Whilst the results must continue to be treated with caution and as a starting point for further studies, they nonetheless allow some general conclusions to be drawn.

The most telling observation is that figures for the area as a whole give a very false impression of the condition in most forest types. A global total of temperate and boreal forest "undisturbed by man" of somewhere between 40 and 55% disguises the fact that the bulk of this is concentrated in a few, mainly northern boreal forest ecosystem types and that many temperate forests ecosystems have little or no natural forest remaining.

It is clear that whatever final figures emerge for the Russian Federation and Canada, they dominate the region in terms of their possession of natural forest (indeed the World Resources Institute calculates that the Russian Federation has close to a quarter of all the world's large areas of natural forest). Any decision to maintain large areas of completely natural forest within the TBFRA

countries must inevitably focus on these two nations.

However, these are also countries, particularly in the areas where the bulk of natural forests remain, where there are relatively homogenous forests with relatively few species, particularly in the boreal regions. Other relatively large areas of undisturbed forest in Scandinavia and the Alaska are also boreal. It appears that we still possess large and relatively untouched areas of boreal forest and high latitude temperate forests.

For many other areas, the situation is dramatically different. For a substantial number of countries (and by implications for whole forest ecoregions) there are now no forest areas large enough or natural enough for country correspondents to consider them worth recording. Seventeen countries recorded no forest at all that is "undisturbed by man" and a further 12 recorded less than 1 per cent. Ecoregions such as the Western Evergreen Broadleaved Forests, Pyrenees Conifer and Mixed Forests, Atlantic Mixed Forests and many in southern and eastern parts of the United States and Canada no longer exist in a natural state at a size likely to be ecologically viable. This issue has many important implications for conservation action, including increasing the arguments for forest landscape restoration.

Some of the results require further scrutiny. It should be noted that some of the countries recording high proportions of natural forests (for example Armenia and Uzbekistan) also have very small total areas of forest and rapid rates of forest loss. Any remaining natural forests will consequently be under severe pressure.

Most of the other forest in the area is semi-natural. Although plantations do appear to be increasing in area, it seems that the rate of increase is not as fast as in the tropics, where growing conditions favour more rapid return on investment. Whilst the temperate countries included in the TBFRA have lost most of their natural forests, future options seem to focus more on managing semi-natural forest than on establishing large areas of plantations.

2.5.1 Comparison with other figures

Early comparison was made with the Global Forest Watch figures for the Russian Federation and Canada because of their impact on global figures. However, a number of other studies have also been made of naturalness and where possible these have been compared with those reported in TBFRA-2000.

Of particular importance are a series of studies under a European Commission COST Action project looking at natural forest reserves in Europe and studies undertaken by the Institute of Biology in the USA. Figures from the COST Action study (Parviainen et al, 1999) add little to the overall picture developed by TBFRA (and were almost certainly used by most countries in drawing together their own figures).

Comparative figures from Global Forest Watch for the United States of America were roughly equivalent – suggesting that 6% of forests in the lower 48 were still in a relatively undisturbed state, mainly in the west (Noguerón et al 2002).

3. Tree Species

3.1 Introduction

Biodiversity is a shortened term for biological diversity. Biological diversity is the "total variety of genetic strains, species and ecosystems" Biodiversity is continually changing as new species evolve and others disappear. Human activities are now accelerating the genetic depletion and extinction of species, and biodiversity conservation is perhaps the largest single driver for the global conservation movement.

The importance of temperate and boreal forests has consistently been underestimated (until recently often ignored) in global surveys of biodiversity. Indeed, the fears about threats to the enormous genetic diversity found in tropical moist forests means that other habitats have tended to be undervalued. Forests in general are the richest terrestrial sources of biodiversity, and although the majority of species exist in the tropics, some terrestrial forests are both very diverse and, as outlined in the previous chapter, are under considerable threat. Indeed, some of the most highly threatened species in the world are confined to temperate and boreal forests.

Although biodiversity assessments are still in their infancy in many countries, some indicators are being developed. (Note that these generalisations refer to "species richness" and far less is known about within species genetic variability.) Levels of biodiversity appear to be affected by a combination of different factors, including:

- ***Temperature and humidity*** – biodiversity appears to increase with both temperature and humidity, making tropical moist forests the richest habitats on earth, but also meaning that temperate rainforests such as the Alaskan Tongass forest and hot dry forests such as those found in the Mediterranean can also have relatively high levels of species and genetic variation. Boreal forests, on the other hand, tend to be species poor.
- ***Isolation*** – although not strictly related to richness, long-term habitat isolation often results in a high degree of endemism and thus unique biodiversity. This is currently found for example on islands such as the Canaries and Madeira, and in temperate fragments of the ancient continent of Gondwana such as in New Zealand. The greatest national diversity of tree species within the TBFRA is in Australia.
- ***Age*** – habitats that have been untouched by major environmental and climatic change, or major human disturbances, for the longest periods tend to have relatively high levels of biodiversity. The focus on conservation of old-growth forests is one response to this factor. Areas that remained free of ice during the last great ice age are often particularly rich.
- ***Past isolation or other factors encouraging speciation*** – factors behind the development of particular species "hotspots" often remain unknown, but islands of high speciation or genetic diversity occur in many different habitats and are often only found after careful study. Two key factors are likely to be past human disturbance and local or regional climatic factors.

Certain temperate forests are thought to be as diverse, or even more diverse, than their tropical counterparts with respect to some plant and animal groups. For example, leaf litter arthropods in old-growth conifer forests in Oregon, USA had diversity approaching 250 species per square metre, while oribatid mites reached populations of 120,000 per square metre, representing over 90 genera. Over 150 different species of mycorhizzal fungi have been found on the roots of a single Douglas fir in the same region (Moldenke and Lattin 1990).

In addition, number of species may not always accurately measure genetic diversity. The high diversity of tree species in tropical moist forests is, at least in part, explained by reproductive strategies. Increasing knowledge about genetic variation within species has led some ecologists to suggest that variation *between* species in a tropical forest may be mirrored to some extent by variation *within* species in temperate forests. Such research, while still incomplete, suggests the possibility that species-poor habitats such as boreal forests exhibit their diversity through intra-specific variation instead on inter-specific variation, with major implications for approaches to management and conservation.

3.2 The survey

Although information on biodiversity remains incomplete, knowledge about tree species in the TBFRA catchment is now quite good. One important information gap identified in the TBFRA planning discussions was a centralised set of data

on presence and abundance of tree species in different countries. Such a data source would provide comparative information on biodiversity, commercial opportunities, conservation status and the broad geographical spread of species and families. Accordingly, correspondents were asked to provide information on tree species in the country, including:

- scientific and common names of all tree species;
- an estimation of their abundance;
- an indication of whether they are native or introduced.

In theory, most of the information should be fairly unambiguous and well known in the countries in the TBFRA, although some questions remain open for interpretation by correspondents, including the following:

- How can correspondents be certain that a particular species has been introduced? In some cases where a species has been present for many centuries it is impossible to be certain if it was originally native. For example this is true of the sycamore (*Acer pseudoplatanus*) in the UK, and for several fruit tree species in the Mediterranean.
- What is the status of species that are native in one part of a country but have been planted elsewhere? This is particularly significant in the larger countries, where some species have been introduced into radically different habitats thousands of miles away from the original source.
- How can correspondents standardise estimations of abundance?
- How are naturalised species to be classified? (While the instructions were clear, these have not always been adhered to in practice.)

The resulting listing is probably the single largest comparison of country tree species lists assembled for the region. In complete form, it would provide a unique data source. Unfortunately, it is also one of the least satisfactorily completed sections of the TBFRA and few countries actually produced complete lists. Some countries listed genera rather than species. Many synonyms were used, making crosschecking difficult. Indeed in the large majority of cases the number of tree species listed in this section of the report varied from the total listed later in answer to the question about number of forest species. Some countries have also clearly included introduced species within their list of "natural" species and there is some confusion about the status of naturalised species. Few countries listed the status of the species or identified endangered species.

Although considerable work has gone into cross checking these lists, and additions and subtractions made, the current lists (see Annexes 1-5) remain, sometimes dramatically, variable and prone to inaccuracy, particularly in Eurasia. Some countries have highly incomplete lists, which have been drawn together by the author from various sources.

Nonetheless, bearing all these various qualifications in mind, enough information is available to draw general conclusions about tree species biodiversity in the TBFRA region.

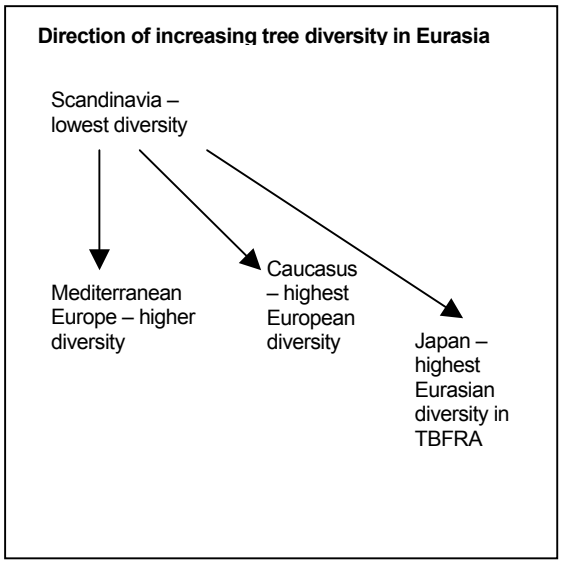
3.3 Biodiversity and distribution of tree species in the TBFRA region

Data were compared to identify broad regional trends in diversity. The highest levels of tree biodiversity are found in the western part of the Pacific Rim, and particularly in the long-isolated islands of New Zealand and Australia, while the lowest levels occur in the northern boreal regions. In Europe and Central Asia (an area where small countries result in smaller sample units) tree diversity increases towards the south and the east (see Figure 6). Higher levels of diversity in Japan suggest that, if the temperate forests of the Indian subcontinent and China had been included, this trend would have continued east. Diversity in North America is similar to that in Europe, again with an increase towards the south, with marked differences between Canada and the USA and also within the United States (although the latter did not emerge from the survey because a single list for the whole country was requested.

Comparison of species and genera also found clear patterns of diversity running throughout Eurasia and also across the Atlantic into North America, where species of different genera remain remarkably similar to those found in the Old World. Australia and New Zealand showed marked differences from the rest of the TBFRA, both because of their long isolation and their trees' origins in the ancient Gondwana flora.

FIGURE 5

Tree Diversity in Eurasia



3.4 Key species within Eurasia

Within Europe, while there is dramatic variation in numbers of species, there is also a clearly identifiable group of around fifty tree species that have an extremely wide distribution, many being found from boreal right through to Mediterranean and other hot temperate climates. Their distribution amongst 37 countries of the region is summarised in the table in Annex 2 and their names, with the English equivalent, are listed in Table 5 below.

TABLE 5

Key tree species of Europe

Abies alba	*Common silver fir*
Acer campestre	*Field maple*
Acer platanoides	*London plane*
Acer pseudoplatanus	*Sycamore*
Alnus glutinosa	*Alder*
Alnus incana	*Grey alder*
Alnus viridis	*Green alder*
Betula pendula	*Silver birch*
Betula pubescens	*Downy birch*
Carpinus betulus	*Hornbeam*
Castanea sativa	*Sweet chestnut*
Corylus avellana	*Common hazel*
Crataegus monogyna	*Hawthorn*
Euonymus europaea	*Spindle tree*
Fagus sylvatica	*Common beech*
Frangula alnus	*Alder buckthorn*
Fraxinus excelsior	*Common ash*
Hippophae rhamnoides	*Sea buckthorn*
Ilex aquifolium	*Holly*
Juglans regia	*Walnut*
Juniperus communis	*Common juniper*
Larix decidua	*Larch*
Malus sylvestris	*Crab apple*
Picea abies	*Norway spruce*
Pinus nigra	*Black pine*
Pinus sylvestris	*Scots pine*
Populus alba	*White poplar*
Populus nigra	*Black poplar*
Populus tremula	*Aspen*
Prunus avium	*Wild cherry*
Prunus padus	*Bird cherry*
Quercus petraea	*Sessile oak*
Quercus robur	*English oak*
Rhamnus catharticus	*Buckthorn*
Salix alba	*White willow*
Salix caprea	*Pussy willow*
Salix cinerea	*Grey willow*
Salix fragilis	*Crack willow*
Salix pentandra	*Bay willow*
Salix triandra	*Almond willow*
Sambucus nigra	*Elder*
Sorbus aucuparia	*Mountain ash*
Sorbus torminalis	*Wild service tree*
Taxus baccata	*Yew*
Tilia cordata	*Small-leaved lime*
Tilia platyphyllos	*Large-leaved lime*
Ulmus glabra	*Wych elm*
Ulmus laevis	*European white elm*
Ulmus minor	*Smooth-leaved elm*

The preliminary lists are given in annexes to the current paper:

Annex 1 – trees of Eurasia

Annex 2 – key tree species in Eurasia

Annex 3 – tree species of Japan

Annex 4 – tree species of North America

Annex 5 – tree species of New Zealand

The full list of Australian trees is too long to reproduce here. It can be accessed via the online Australian Plant Name Index.

4. Protection status

4.1 Background

Concern about a decline in natural forests and the associated biodiversity has created political momentum for an increase in protected forest areas. At the Fourth World Congress on National Parks and Protected Areas (Caracas, 1992), The IUCN (World Conservation Union) suggested that 10 per cent of the Earth's land surface should be in protected areas to conserve a full complement of biodiversity. Other professional conservation biologists believe this to be too low. Research by UNEP-WCMC suggests that around 10 per cent of the world's forests are now under some kind of official protection (UNEP-WCMC, 2000), although this includes protected areas that have been recognised but not legally gazetted (so-called "paper parks") and the study does not consider how effectively such areas are managed or whether they are really maintaining biodiversity and cultural values.

It has also become clear that the distribution of protected areas is by no means evenly spread and that protection of some forest types far exceeds others: generally it has proven easier to place remote and economically less valuable forests under protection than those in areas of dense human settlement or with high commercial value. Some forest types have less than 1% of their remaining area in protected areas. Even forests within protected areas are not necessarily free from disturbance. Commercial logging still continues, with government sanction, in some of the world's protected areas, and illegal logging in an even greater proportion (Carey et al, 2000). A shift to broader-scale approaches to conservation, such as ecoregional or bioregional approaches, has increased calls for further protection.

These issues are, in some countries, extremely emotive and there is a need for clear and accurate information on this subject. Many TBFRA countries are already collecting information for other purposes, including fulfilment of existing obligations (such as reporting to the Pan European and the Montreal Processes) and addressing national policy goals.

TBFRA-2000 requested information on forest protected areas, thus asking for data on a sub-set of national protected areas.

The definition used by TBFRA-2000 is based on that of IUCN – i.e., "an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means".

This is subdivided into six categories depending on degree of protection and primary management objective, ranging from strictly protected areas where human access is severely curtailed, to working landscapes with protection taking place alongside human communities continuing their everyday lives (see table 6). Protected areas falling into the more general categories, particularly Categories V and VI, differ from the popular concept of an uninhabited landscape set aside for wildlife (Anon, 1994).

TABLE 6

IUCN Categories of protected areas

- **Category Ia:** Strict nature reserve/wilderness protection area managed mainly for science or wilderness protection
- **Category Ib**: Wilderness area: protected area managed mainly for wilderness protection
- **Category II**: National park: protected area managed mainly for ecosystem protection and recreation
- **Category III**: Natural monument: protected area managed mainly for conservation of specific natural features
- **Category IV**: Habitat/Species Management Area: protected area managed mainly for conservation through management intervention
- **Category V**: Protected Landscape/Seascape: protected area managed mainly for landscape/seascape conservation or recreation
- **Category VI**: Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural

Source: IUCN

4.2 Ambiguities in the data

Although IUCN provides a substantial book on how to interpret the protected area categories, this first attempt to use them for a specific sub-set of protected areas created some problems, which affected the quality of the results:

- There was considerable confusion, and some disagreement, about when forest should be suitable for categorisation under various IUCN protected area categories, with some countries classifying *all* their forests as falling within one or other of the categories (which was probably a misunderstanding) and others arguing that *most* of their forests fitted into the categories whether or not they were officially in protected areas (which suggests a more philosophical question about the nature of protection).
- There was uncertainty about how to measure protected areas that are partially forested, leading

to a debate that extended beyond the UNECE about what we mean by "forest protected area", or protected areas that can be subdivided into a number of different categories.

- The status of "unofficial" protected areas (e.g. land owned by companies or charitable trusts) remained uncertain and was generally not included within the survey, although in some countries this can be a large proportion of the total.
- The status of commercial forests in Category V protected areas was confusing. Many European national parks contain commercially managed forests and even plantations of exotic species. Some countries counted these as "forest protected areas", because they were forests within protected areas, while others noted that they clearly fulfilled no significant biodiversity function and therefore omitted them.
- There was disagreement about the treatment of protected forests that are not forest protected areas – e.g., forests that are set aside from commercial exploitation for avalanche control, watershed protection or for military reasons

To some extent, these discrepancies reflect changing attitudes towards protected areas and perhaps increasing confusion about where exactly a protected area begins and ends. Protected areas are becoming more flexible in their aims and management approaches, with an increasingly strong emphasis on protection of environmental processes – like watershed protection, soil stabilisation and buffering against the impacts of climate change as well as the protection of species. In some parts of the world, protected areas are also increasingly seen as a way of protecting vulnerable human communities, spiritual sites and cultural values. The integration of multiple functions has encouraged formation of new protected areas, as a wider section of society appreciates their potential benefits, but has also challenged some traditional protected area functions.

It would be fair to say that the problems encountered in TBFRA-2000 created a small crisis with respect to definitions of protected areas and the interpretation of the IUCN categories. In the following section, the results are discussed and some assessments attempted, despite the uncertainty of some of the information. In a final section, some of the implications for future assessments are discussed in light of events that have taken place since the publication of the final report

4.3 Results of the survey

Table 7 below shows the total amount of forest protected area (Categories I-VI) recorded by countries, in ascending order.

TABLE 7

Total forest protected areas by country, listed in ascending order

Country	Total (1000 hectares)
Malta	0.04
Luxembourg	0.70
Liechtenstein	1.50
Iceland	2.00
Ireland	6.00
Switzerland	41.90
Republic of Moldova	44.10
Slovenia	78.70
Netherlands	80.00
Denmark	91.09
Armenia	102.00
Georgia	111.00
Turkmenistan	114.40
Cyprus	117.00
Albania	142.30
Belgium	178.17
Estonia	183.00
Turkey	186.00
Lithuania	295.70
Hungary	361.54
Tajikistan	400.00
Croatia	411.00
Romania	468.90
Latvia	471.00
Portugal	585.00
Kyrgyzstan	629.00
Czech Republic	646.00
Belarus	719.30
Austria	775.00
United Kingdom	792.00
Slovakia	831.12
Azerbaijan	935.50
Ukraine	973.00
Greece	976.00
Bulgaria	1353.60
Poland	1405.00
New Zealand	1663.00
Japan	1751.00
Uzbekistan	1830.00
Italy	1855.00
Norway	2254.00
Finland	2389.00
France	2716.00
Yugoslavia	2894.38
Spain	3211.00
Germany	7205.00
Kazakhstan	10504.00
Canada	19303.00
Australia	23654.00
Russian Federation	24751.40
United States of America	64101.00

Source: TBFRA-2000 (No figures for Bosnia and Herzegovina, Israel, Sweden and the FYR of Macedonia)

The above figures must be treated with considerable caution. For example, the USA includes all its National Forests amongst Category VI protected areas (despite much of the land being logged commercially) while Canada and the Russian Federation do not. As a result the USA reports 38.9 per cent of its forests in protected areas while for example Canada reports just 7.9 per cent protected. These statistics may not reflect real differences in level of protection between the countries. Again, Germany included most of its forests as "protected areas" even though most do not have the status of officially protected areas, and would probably not be interpreted as protected areas by the IUCN.

Another way of presenting data is to focus on protected areas in Categories I and II – (the strictest protection areas). There is likely to be less debate about what is included, although such an analysis also tends to bias results against areas where strong emphasis has been put into the development of Category V protected areas, such as the European national parks system. Table 8 summarises data for strictly protected nature reserves.

TABLE 8

Total forest protected areas in IUCN categories I and II by country, listed in ascending order

Country	Total (in 1000 ha)
Luxembourg	0
Malta	0.01
Cyprus	1
Liechtenstein	1.5
Iceland	2
Austria	2
Ireland	3
Netherlands	3
Belgium	4.06
Denmark	5.09
Switzerland	8.5
Turkmenistan	14.4
Tajikistan	21
Slovenia	22.4
Albania	24.40
Kazakhstan	29
United Kingdom	30
Armenia	35
France	39
Republic of Moldova	44.1
Estonia	52
Greece	55
Hungary	62.43
Croatia	65
Azerbaijan	72
Germany	105
Latvia	106
Czech Republic	109
Georgia	111
Lithuania	111.5
Norway	114
Kyrgyzstan	120
Yugoslavia	137.46
Ukraine	173
Poland	173
Turkey	177
Belarus	208.5
Spain	216
Bulgaria	290
Uzbekistan	330
Slovakia	373.14
Romania	397.4
Portugal	541
Finland	979
Italy	1,105.00
Japan	1,260.00
New Zealand	1,599.00
Canada	11,106.00
Australia	13,758.00
United States of America	13,904.00
Russian Federation	23,691.20

Source: TBFRA-2000

Table 9 shows the twenty countries with the highest levels of Category III-VI protected areas (listed in ascending order).

TABLE 9

Total forest protected areas in IUCN categories III-VI by country

Country	Total (in 1000 ha)
Italy	750
United Kingdom	762
Austria	773
Ukraine	800
Azerbaijan	863.5
Greece	921
Russian Federation	1,060.20
Bulgaria	1,063.60
Poland	1,232.00
Finland	1,410.00
Uzbekistan	1,500.00
Norway	2,140.00
France	2,677.00
Yugoslavia	2,756.92
Spain	2,995.00
Germany	7,100.00
Canada	8,197.00
Australia	9,896.00
Kazakhstan	10,475.00
United States of America	50,197.00

Source: TBFRA-2000

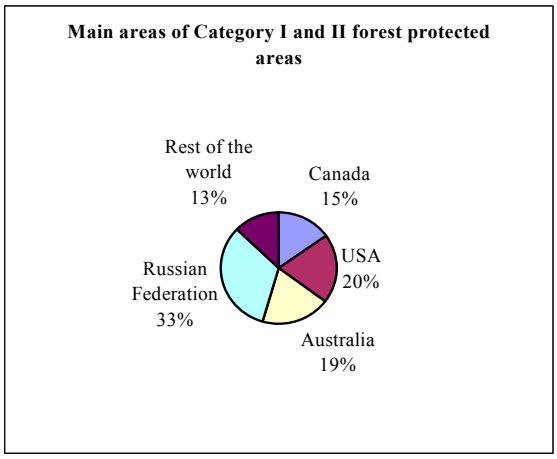
4.4 Assessment of results

For all their shortcomings, the results of the TBFRA-2000 survey of forest protected areas show some interesting results

- 87% of Category I-II forest protected areas are found in just four countries: the Russian Federation, USA, Australia and Canada, as outlined in figure 7.

FIGURE 6

Category I-II Forest Protected Areas



- 23 countries have less than 1000 km^2 in Category I-II forest protected areas
- When the percentage of forests in protected areas is calculated (see table 10), 19 countries have less than 2% of their forests in Category I-II protected areas, while 9 countries have more than 10%.

TABLE 10

Percentage of total forest in IUCN Category I-II forest protected areas by country

Country	Percentage of forests in PA categories I or II
Luxembourg	0
Austria	0.1
France	0.2
Kazakhstan	0.2
Turkmenistan	0.4
Ireland	0.5
Belgium	0.6
Switzerland	0.7
Cyprus	0.9
Netherlands	0.9
Germany	1.0
Denmark	1.1
United Kingdom	1.2
Norway	1.3
Greece	1.6
Spain	1.6
Turkey	1.8
Ukraine	1.8
Poland	1.9
Slovenia	2.0
Albania	2.4
Estonia	2.6
Belarus	2.7
Malta	2.9
Russian Federation	2.9
Hungary	3.5
Croatia	3.7
Georgia	3.7
Latvia	3.7
Czech Republic	4.1
Canada	4.5
Finland	4.5
Yugoslavia	4.8
Japan	5.2
Tajikistan	5.2
Lithuania	5.6
Romania	6.3
United States of America	6.4
Iceland	6.6
Azerbaijan	7.7
Bulgaria	8.1
Australia	8.8
Armenia	10.5
Italy	11.2
Republic of Moldova	13.6
Portugal	15.9
Kyrgyzstan	16.4
Uzbekistan	17.2
Slovakia	18.5
New Zealand	20.1
Liechtenstein	21.7

Source: TBFRA-2000

Table 10 shows that the dominance of the "big four" is not due to protecting a greater proportion of their forests – with the exception of Australia (8.8% of forests in categories I-II), these countries only protect a relatively small proportion of their forests.

4.5 Implications for IUCN protected area categories

Considerable discussions have been conducted regarding the problems of interpreting the IUCN protected area categories for forests. While some of the questions might have been addressed if correspondents had received more detailed instruction from the IUCN guidelines, other more fundamental questions emerged. The UNECE

sought advice from the IUCN but felt that the issue remained unresolved and consequently set up a series of meetings and working groups to address the issue. Eventually the TBFRA team coordinated with members of the Ministerial Conference on Protection of Forests in Europe (the MCPFE – formerly known as the Pan-European Process), which is also collecting information about forest protected areas in Europe and has faced similar problems. The MCPFE group proposed developing a new set of categories specifically for use in Europe, which are compared to IUCN categories and those of the European Environmental Agency shown in table 11.

Table 11

Classification system being applied by the Ministerial Conference for the Protection of Forests in Europe and the UNECE/FAO

MCPFE classes		EEA	IUCN
1. Main management objective: "biodiversity"	1.1 No active intervention	A	I
	1.2 Minimum intervention	A	II
	1.3 Conservation through active management	A	IV
2. Main management objective: "protection on landscapes and specific natural elements"		B	III, V, VI
3. Main management objective: "protective functions"		(B)	n/a

EEA = European Environment Agency classification
IUCN = IUCN protected area categories

The IUCN expressed concern that the proposed MCPFE categories would undermine the IUCN categories as a global system. An emergency IUCN resolution agreed at a European meeting of the World Commission on Protected Areas (WCPA) in Austria in 2002, pointed out the potential confusion. In July 2002, a meeting between representatives of the UNECE TBFRA , the MCPFE group, the WWF, and the IUCN, took place at the IUCN headquarters in Gland, Switzerland. It was agreed to work towards a shared understanding of how the IUCN categories could be interpreted for use in forest statistics and could be harmonised with the work of the MCPFE and some changes were made to the proposed MCPFE system so that it was more compatible with that being used by IUCN.

At the time of writing, IUCN is preparing guidelines for the use of IUCN protected area categories in forest protected areas. However, the MCPFE system has already been adopted by member countries in Europe and a twin approach now seems inevitable. In May 2003, the MCPFE produced it first report using the new classification system: *State of Europe's Forests 2003*, in association with UNECE/FAO. The MCPFE system stresses the distinction between protected and protective forests and reports on these separately.

The report also highlights a continuing confusion about the nature of protection in European forests. Unfortunately from a comparative perspective, figures for protection from the TBFRA and MCPFE are dramatically different: MCPFE found 11.7 per cent of the total forest and other wooded land has the management objective to conserve biodiversity or to protect the landscape and natural monuments and a further 11.5 per cent is designated to protect soil, water, ecosystem function and infrastructure and managed resources. These tables are reproduced in Annexe 6 of the current paper.

Perhaps more significantly than the average figures – which might be explained by the differences in understanding about what constitutes "protected" – are differences between what countries reported for IUCN protected area categories I and II and MCPFE classes 1.1 and 1.2, which are supposed to be directly analogous. Out of those countries that reported both sets of figures only Luxembourg (which reported zero in both cases), Denmark and Croatia reported the same figures. In some cases figures were dramatically different, for instance Turkey reported six times the area of IUCN Category I and II as compared to MCPFE classes 1.1 and 1.2.

These results show clearly that further work is needed on statistical analysis and that any figures for forest protection in Europe must currently be treated with considerable caution. They also show the extent to which the concepts of protected forests and protective forests are still being developed: MCPFE found literally hundreds of different terms being used to describe forests with some kind of protected status within the continent.

5. Endangered forest-dwelling species

5.1 Background

Current threats of higher than average rates of species extinction have gained international recognition, e.g. through the signing of the Convention on Biological Diversity (CBD). Information on levels of threat is sought through both the CBD and through other reporting requirements such as the regional forest criteria and indicator processes (in the TBFRA catchment, the Montreal Process, and the Ministerial Conference on the Protection of Forests in Europe).

Whilst the majority of threatened forest-occurring species exist in the tropics, concern has also been expressed about the status of some forest-occurring species in temperate and boreal regions. Indeed, as outlined in chapter two of the current report, a number of natural forest ecosystems in the TBFRA catchment are considerably more at risk than most tropical forest ecosystems.

The TBFRA asked for information on the number of forest-occurring plant and animal species that are judged to be endangered. Data were sought on a range of plant and animal groups (trees, other vascular plants, ferns, mosses, lichens, mammals, birds, other vertebrates and butterflies and moths), both for the country as a whole and as a subset referring specifically to forest-occurring species.

In each case, questions asked for information on the following:

- total species
- *of which* endangered
- endemic species
- *of which* endangered

Precise status categories were suggested for the term "endangered", using the ranking system of IUCN's Species Survival Commission (SSC). For countries with an existing IUCN "Red Data Book" of threatened species such information is accessible (this is the case for most European, North American and Pacific countries, but not for all the nations of Central Asia); in other cases, correspondents would have to draw together information from regional or global red data books referring to specific groups or use judgements by national experts.

5.2 Quality of data

Information was patchy and to some extent inconsistent. In an analysis for the European Commission, Janna Puumalainen found that correspondents in TBFRA-2000 generally reported more threatened species in Europe than similar surveys by UNEP-WCMC or the MCPFE data (Puumalainen, 2001).

Listed below are a number of reasons for this:

- Some countries including species listed in special national categories that fall below the level of threat identified by SSC.
- Some countries omitting a number of the requested categories, e.g. not listing species that are extinct, (which would conversely reduce the overall results).
- The fact that different classification schemes make direct comparisons difficult.
- The problem of deciding what constitutes a "forest-dwelling species" in drawing information from a national red list.
- Differences in opinion about the "total" number of forest dwelling species – which were marked in comparing different results reported by some countries and also affecting the number of endangered species.
- Clear differences in opinion about level of risk, with some countries listing huge numbers of plants and animals as being in the threatened category while other similar countries only considered one or two to be threatened.

None of these problems necessarily invalidate the results; identification of species at risk is notoriously difficult and can only ever be approximate. However, the data sets were incomplete; a number of countries not listing threatened or endangered species at all and relatively few correspondents being able to fill in every line of the various tables.

5.3 Results

Perhaps the most significant results in the current context refer to the number of species that are threatened and to information about endemic species. In Tables 12 and 13 below data on number of threatened forest dwelling species of plants and animals are summarised for those countries providing responses.

TABLE 12

Number of forest dwelling plant species considered endangered by country

Country	Trees	Other vascular plants	Ferns	Mosses	Lichens
Albania	21	38			
Austria	9	271	11	498	200
Belgium	3	37			
Cyprus	1	22	0		
Czech Republic	14	83	15	180	500
Denmark	7	50	8		218
Estonia	13	69	6	25	55
Finland	8	35	3	37	62
France	0	11	0		
Germany	0	6	2	3	
Hungary	4	5	1	20	31
Iceland	0	1	0	3	15
Ireland	0	8	3		
Israel	10	408	4		
Latvia	2	94	17	41	17
Lithuania	2	102	5	13	13
Malta	0	0	0		
Netherlands	27	72	1	55	
Norway	2	60		90	50
Poland	1				
Portugal	5	16	3	11	
Slovakia	7	360	15	270	480
Slovenia	5		47		
Sweden	6	96	12	138	198
Switzerland	4	110	8	136	
Yugoslavia		217		8	12
Azerbaijan	12	35	36	35	56
Belarus	2	107	3	6	12
Kazakhstan	0	147	3	2	1
Republic of Moldova	7	18			
Russian Federation	4	30	0	0	0
Ukraine	14	200	2	8	12
Canada	8	25	1	1	4
United States of America	4	210	7		
New Zealand	180		15		

Source: TBFRA-2000

TABLE 13

Number of forest dwelling animal species considered endangered by country

Country	Mammals	Birds	Other vertebrates	Butterflies and moths
Albania	27	43	27	42
Austria	28	43	25	560
Belgium	6	7	0	11
Cyprus	1	0	1	0
Czech Republic	31	125	25	
Denmark	11	3	2	
Estonia	14	38	2	34
Finland	7	13	0	47
France	21	13	10	
Germany	10	10	3	32
Hungary				20
Iceland	0	0	0	0
Ireland	0	7	0	
Israel	59	193	49	
Latvia	15	25	8	19
Lithuania	16	42	5	20
Luxembourg		21		
Netherlands	5	2	1	14
Norway	16	18	4	200
Portugal	16	3	0	0
Slovakia	23	31	23	
Slovenia	26	46	21	750
Sweden	16	39	8	145
Switzerland	2	28	3	17
Yugoslavia	35	185		45
Azerbaijan	3	6	3	30
Belarus	14	75	8	31
Kazakhstan	28	23	7	0
Russian Federation	10	10	1	8
Ukraine	24	30	13	42
Canada	20	16		
United States of America	35	54	89	9
Japan	30	25	15	23
New Zealand		37	39	

Data for endemic species, and endemic species at risk, were incomplete. Tables 14 and 15 can only give an indication of information from some countries as there has clearly been a difference of opinion about what is “endemic” (Austria lists 100 endemic lichens for example while neighbouring Slovakia listed just 2).

TABLE 14

Endemic species of plants per country, with numbers considered endangered given in brackets

Country	Trees	Other vascular plants	Ferns	Mosses	Lichens
Austria	0	21 (11)	0	1 (1)	100 (100)
Cyprus	2 (1)	127 (18)	0		
Czech Rep	3 (3)	8 (8)	0	0	0
France	0	10 (10)	0		
Germany	6 (0)	0	0	0	0
Hungary	1 (1)				
Israel	0	37 (15)	0		
Malta	1 (0)	0	0		
Norway	1 (1)	0			1 (1)
Poland	5 (1)				
Portugal	12 (5)	44 (14)	13 (3)	2 (1)	
Slovakia	0	30 (30)	1 (1)	3 (3)	2 (2)
Sweden	0	0	0	0	2 (2)
Yugoslavia		87		7	174
Azerbaijan	1 (1)	0	0	0	2 (1)
Kazakhstan	2 (0)	393 (147)	6 (3)	3 (2)	2 (1)
Moldova	20	71 (23)		10	16
Ukraine	(4)	(50)			
USA	(4)	(203)			
New Zealand	549 (180)		193 (15)	20	1,300

Source: TBFRA-2000

TABLE 15

Endemic species of animals per country, with numbers considered endangered given in brackets

Country	Mammals	Birds	Other vertebrates	Butterflies and moths
Austria	57 (28)	0	0	280 (280)
Cyprus	1 (1)	7	4 (1)	9 (0)
France	0	1	0	
Ireland	1 (1)	0	0	
Israel	0	0	2 (2)	
Portugal	5	9 (2)	3 (0)	3 (0)
Sweden	0	0	0	2 (2)
Kazakhstan	17 (17)	27 (23)	7 (7)	0
Republic of Moldova	11 (n/a)	36	50 (n/a)	
Ukraine		0		(1)
USA		(37)		(7)
Japan	42 (26)	15 (11)	85 (13)	13
New Zealand	2 (2)	50	90 (39)	

Source: TBFRA-2000

5.4 Analysis

Despite the fragmentary nature of the information, some general conclusions can be drawn:

- There is clearly a perception that significant numbers of wild plant and animal species are endangered, despite the existence of a relatively stable forest estate.
- This includes significant numbers of endangered species in all the groups included: mammals, birds, other vertebrates, butterflies and moths, lichens, mosses, trees and other vascular plants.
- Larger animals (particularly mammals and birds) seem to be proportionately more endangered than smaller creatures, although this may also be a reflection of data quality.
- Trees and other vascular plants appear to be less threatened than ferns, mosses and lichens.
- There appears to be a tendency for more threats to forest-dwelling species in Western Europe than further east, although lack of data from some central and eastern European countries and Central Asian countries means that this apparent trend should be treated with caution
- Lack of data means that it is difficult to assess the links between loss of forest and endangered species, although there is clearly no simple equivalence: for example, New Zealand has relatively high proportions of remaining natural forest and protected areas, but also records high levels of risk.

6. Invasive species

As an adjunct to the analysis of endangered species, countries were asked to list significant numbers of *invasive* species. Only 15 correspondents answered this question – it was not clear whether it had been ignored because there was no perception of the problem, because data were unavailable, or because time was lacking.

6.1 Information supplied on invasive species

Australia: There are 48 exotic plant species that are serious pests in native production forests, including blackberry (*Rubus vulgaris)*, gorse (*Ulex europaeaus*), lantana (*Lantana camara*), and pampas grass (*Cortaderia* spp.) Cats, dogs, introduced deer, donkeys, horses, goats, hares, rats, mice and foxes all also represent a serious threat to forested ecosystems. Foxes are probably the most widespread exotic animal damaging forests and have severely limited ground-living mammals.

Belgium: Several invasive species are listed as preventing other tree species from regenerating, including *Prunus serotina*, *Rhododendron ponticum* and *Amelanchier lamarkii*. *Eutamias sibiricus* threatens populations of small songbirds and *Psittacula krameri* is out-competing indigenous species that have the same nesting sites.

Canada: In total, 25 exotic insect pests, 10 introduced fungi and 27 other exotic plant species are listed as problematic, along with the threats that they pose. Major invasive species include garlic mustard (*Alliaria petiolata*) which threatens the endangered wood poppy, Scotch broom (*Cytisus scoparius*) which is invading threatened Garry oak habitats in British Columbia, and Tartarian honeysuckle (*Lonicera tatarica*) in Ontario.

Denmark: The sycamore (*Acer pseudoplatanus*) can sometimes inhibit natural regeneration of tree species such as beech (*Fagus sylvatica*).

Estonia: Introduced species have not created problems for forest ecosystems.

Hungary: Three species were mentioned: the locust tree (*Robinia pseudacacia*) is aggressive, outcompeting indigenous species; the box-elder (*Acer negundo*) is invasive and *Asclepias syriaca* hinders regeneration and afforestation

Ireland: Two plant species were identified as invasives inhibiting regeneration: the rhododendron (*Rhododendron ponticum*) and the cherry laurel (*Prunus laurocerasus*). In addition, three invasive mammals cause direct damage to plantations: the sika deer (*Cervus nippon nippon*), rabbit (*Oryctolagus cuniculus*) and the grey squirrel (*Neosciurus carolinensis*).

Israel: *Acacia cyanofila* is invasive on agricultural lands and *Hiteroteca subaxilaris* is invasive in coastal sand areas.

Kazakhstan: one species mentioned.

Latvia: Three species are listed: Indian balsam (*Impatiens glandulifera*), small balsam (*Impatiens parviflora*) and *Amelanchier spicata* (rose family). Amongst the mammals, the North American mink (*Mustela vison*) is identified as an important pest.

Lithuania: Introduced species have not created problems for forest ecosystems.

Moldova: The box-elder (*Acer negundo*) is listed as a problematic invasive species.

New Zealand: 116 problematic invasive plant species are listed, including 12 that are known to be affecting the dominant structure, species composition or regeneration of several high conservation sites within the country. These are: smilax (*Asparagus asparagoides* and *A scandens*), buddleia (*Buddleia davidii*), old-man's beard (*Clematis vitalba*), kahili ginger (*Hedychium gardnerianum*), hawkweed (*Hieracium* spp.), Japanese honeysuckle (*Lonicera japonica*), lodgepole pine (*Pinus contorta*), wilding pine (*Pinus* spp.), wandering willie (*Tradescantia fluminensis*) and gorse (*Ulex europaeus*). In addition, 14 problematic introduced mammals are listed, including cats, dogs, two species of rats, three species of mustelids, goats, tahr, deer, pigs and horses. The most serious pest, occupying more than 90 per cent of the country, is the possum (*Trichosurus vulpecula*).

Netherlands: *Prunus serotina* is invasive especially on poor sandy soils and is suppressing natural regeneration. Invasion is more or less under control through forest management. Red oak (*Quercus rubra*) is invasive in pine forests on sandy soils but does not compete with other species.

Slovenia: Fallow deer (*Cervus dama*) and mouflon (*Ovis ammon*) are causing damage in regenerating forests. Two other introduced species – the Alpine steinbock (*Capra ibex*) and the Alpine marmot (*Marmota marmota*) are not causing damage.

6.1 Assessment

The relative lack of information about invasive species is somewhat surprising given the degree of alarm expressed by many botanists, about the level of threat posed by invasive species.

Deliberate introductions into Australia and New Zealand have left a legacy of problems for governments and NGOs to tackle, and here awareness is high, as shown by the detailed response from both countries.

Most of those correspondents who did reply confined their remarks to invasive species that would have a direct impact on forest trees (for example on regeneration) and any further surveys might usefully stress the importance of information on species that play a role in upsetting forest ecology in a more general way.

With the exception of Canada, correspondents did not mention introduced pests and diseases. These may well be the most important invasive species in the long term, and again stressing the importance of reporting on these might also be worthwhile.

6.2 Further work

The IUCN has set up the Invasive Species Specialist Group (ISSG) within the Species Survival Commission to monitor invasive species and to develop policy and practical guidance for their control. Their Global *Invasive Species Database* was developed as part of the global initiative on invasive species led by the Global Invasive Species Programme (GISP). It provides global information on invasive alien species to agencies, resource managers, decision-makers, and interested individuals. The database focuses on invasive species that threaten biodiversity and covers all taxonomic groups from micro-organisms to animals and plants. Species information is supplied by expert contributors from around the world and includes; species' biology, ecology, native and alien range, references, contacts, links and images. Although still under development, the database should be a future source of information for (and in turn draw information from) the UNECE/FAO (Geneva) Forest Resource Assessment.

7. Forest regeneration

7.1 Background

Throughout much of the TBFRA region, forest cover is expanding following past deforestation. Analysis of historical records, old maps and even landscape paintings shows that much of what we now regard as natural forest has been restored or regenerated over the last century and in addition, rapid expansion of plantations is increasing tree cover in many countries.

The type of expansion changes from one country to another, ranging from the establishment of plantations of introduced species to natural re-colonisation of abandoned farmland. Current changes in approaches to forest management also means that the choice of regeneration method is changing in many areas.

From both an ecological and a commercial perspective, the nature of regeneration is important. Correspondents were asked to provide information on the extent of regeneration over a recent 10-year period by natural and artificial means, in order to assess types of management methods and likely changes in genetic composition. The questionnaire distinguished three main ways in which forest cover can be extended, each of which has a number of management methods shown in table 16.

TABLE 16

Questions regarding forest regeneration

Way in which forest cover can be extended	Explanation
- Regeneration of forest land	Reforestation of land that has recently been forested
- Natural regeneration	Regeneration without planting through natural seeding (sometimes through preservation of seed trees)
- Natural regeneration enhanced by planting	For example to change composition or to increase rate of growth or total biomass
- Coppice sprouting	Regular cutting of trees and allowing them to re-grow from the base
- Planting or seeding	Deliberate seeding, often accompanied by suppression of natural regeneration
- Extension of forest	Establishment of forest on land that has not recently been forested (afforestation) or conversion of other wooded land to forest
- Natural colonisation	For example, natural regeneration on abandoned agricultural land.
- Natural conversion of other wooded land to forest	For example, as a result of reduced grazing pressure.
- Planting or seeding of non-forest land	For example, re-establishment on land that lost forest long in the past, reclamation of industrial sites etc.
- Planting or seeding of other wooded land	Deliberate conversion of other wooded land to forest.
- Natural colonisation of non-forest land to other wooded land	Development of other wooded land as a result of, for example, changes in agricultural practice or climatic variation.s

Source: TBFRA-2000

Despite the detailed definitions, some ambiguity remains for correspondents, including for example:

- How are forests classified when several regeneration and extension systems are operating simultaneously?
- How long must land be free of forest cover to classify as afforestation rather than reforestation?

Results should therefore be treated with caution. Nonetheless, enough information was recorded to allow some general trends to be identified.

7.2 Results

In Table 17, results have been simplified to show average forest expansion per country through regeneration of existing forest, deliberate expansion into non-forested areas and natural colonisation; in each case the amount of land covered with non-native species is indicated in brackets after the main figure (when known).

Coverage was generally fairly good although some countries are missing and others reported approximate figures (note that the figures quoted below are recent ten-year averages but that the ten year periods chosen differ between countries).

TABLE 17

Different types of regeneration per country, in 1000 ha, with amounts of non-native species given in brackets

Country	Regeneration:	Extension:	Natural colonisation
Albania	36 (0)	5 (0.4)	0
Austria	50 (0)	2 (0)	0
Belgium	7 (5)	0.1	0
Bulgaria	28 (2)		
Croatia	39 (0.6)	2 (0)	0
Cyprus	0.5 (0)		
Czech Republic	24 (1)	1 (0)	0
Denmark	6 (5)	2 (1.3)	0.25 (0.15)
Estonia	6	10	4.4
Finland	167 (2)	21 (0)	
France	107 (33)	10 (5)	76 (0)
Germany	70 (5)	7 (0.4)	0
Hungary	21 (13)	7 (4.6)	
Iceland	0	0.6 (0.5)	
Ireland	4 (4)	17 (16)	0
Israel	0.4 (0.4)	2 (2)	2
Italy	143		
Latvia	8 (0.04)	0.00 (0)	0
Liechtenstein	0.03	0.01	0
Lithuania	11 (0)	2 (0)	0.2 (0)
Malta	0	0	0
Netherlands	2.1 (0.44)	1 (0.2)	0
Norway	47 (1)	31 (0)	26 (0)
Poland	59 (0)	10 (0)	
Portugal	75 (40)	58	0
Slovakia	16 (1.5)	0.3 (0)	0
Slovenia	7.5 (0)	4 (0)	0.5 (0)
Sweden	204 (16)	2	
Switzerland	21 (0)	7	1.7
Turkey	54	66 (3)	
United Kingdom	15 (11)	23 (16)	0
Yugoslavia	10 (0.39)	6 (1)	0
Armenia	22 (10)	4 (2)	0
Azerbaijan	3 (0)	2 (0)	0
Belarus	26 (0.1)	0.6 (0)	0
Georgia	19		
Kazakhstan	67 (0)	0	0
Kyrgyzstan	23 000		
Republic of Moldova	4 (3)	1.2 (0.6)	
Russian Federation	2 026 (0)	0	1,316 (0)
Ukraine	39 (5.0)	14 (7)	0
Canada	693	0	
USA	4 372 (4)	1,868	
Japan	170 (0)	5 (0)	
New Zealand	20 (20)	53 (43)	10 (0)

Source: TBFRA-2000

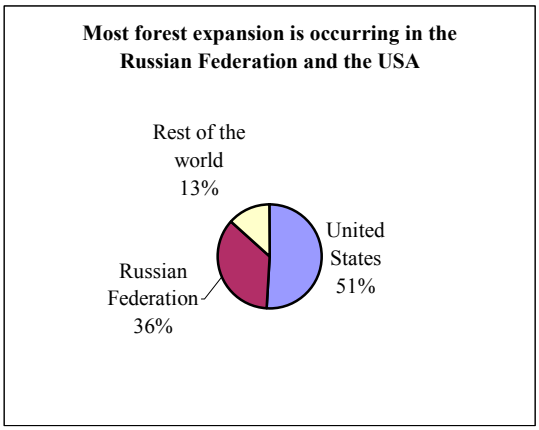
7.3 Assessment of results

The results shown in table 17 are striking, particularly when compared with figures from other parts of the world (Anon 2001)

- Forest cover is currently expanding in all the countries surveyed. Although some central and east European countries have previously expressed concern about the possibility of net deforestation as a result of fuel shortages and illegal logging (following the end of the Soviet Union). Results however, suggest that the net result is still an expansion. Most countries also still remain far below the original forest cover before human settlement and the development of agriculture.
- Most of the expansion is in Russia and the United States of America, although expansion is also taking place in Europe (see figure 8).

FIGURE 7

Expansion of forest cover by country

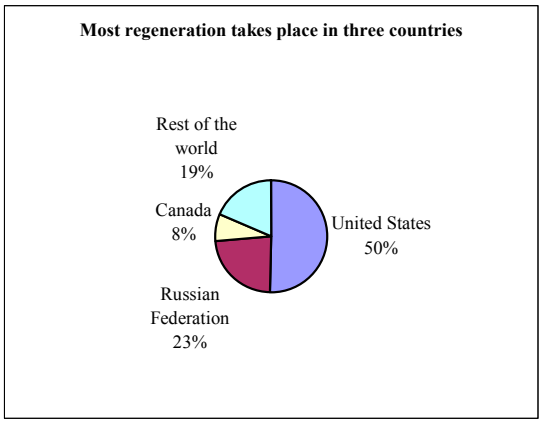


Source: TBFRA-2000

- Most countries are also actively regenerating their forests through a variety of management techniques, with again the Russian Federation, United States of America and Canada dominating the area being regenerated, but regeneration taking place throughout the catchment of TBFRA (see figure 9) .

FIGURE 8

Regeneration of forest by country

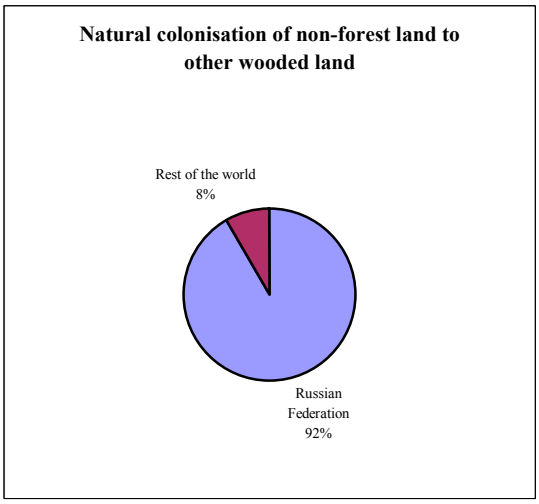


Source: TBFRA-2000

- Roughly a fifth (20.9%) of the expansion is with non-native species. Distribution is uneven, with some countries dominating the use of exotic species, including Armenia, Denmark, France, Hungary, Moldova, New Zealand (100 per cent), Portugal, and the United Kingdom. The temperate and boreal countries with the largest forest estates and largest regeneration (Russian Federation, United States of America and Canada) use almost entirely native species.
- In addition, about 1.5 million ha of non-forest land is colonised through natural expansion each year. Despite much debate in Europe about the impacts of farm abandonment in allowing forest regeneration (and the historical impacts of this in parts of the USA), statistics for natural regeneration are dominated by the Russian Federation, which accounts for over 90 per cent of the total (see Figure 10 below)

FIGURE 9

Natural colonisation of non-forest land



Source: TBFRA-2000

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The librarians at the Linnaean Society in London are also to be thanked for allowing me to use the library to check other sources of information about distribution of tree species

Annexes

In the following tables, information about trees species is listed according to the main regions covered. Abbreviations used in the tables are as follows:

A = Abundant

F = Frequent

O = Occasional

R = Rare

D = Domesticated

A shaded square suggests that a species is present in a particular country – if no further information is given, status was not reported

Annex table 1: Trees of Eurasia

	Albania	Armenia	Austria	Azerbaijan	Belarus	Belgium	Bosnia-Herz	Bulgaria	Croatia	Cyprus	Czech	Denmark	Estonia	Finland	France	Georgia	Germany	Greece	Hungary	Iceland	Ireland	Israel	Italy	Kazakstan	Kyrgyzstan	Latvia	Liechenstein	Lithuania	Luxembourg	Malta	Moldova	Netherlands	Norway	Poland	Portugal	Romania	Russia	Slovakia	Slovenia	Spain	Sweden	Switzerland	Tajikistan	Turkmenistan	Turkey	Ukraine	UK	Uzbekistan	Yugoslavia
Total																																																	
Abies alba			A			R		R	A		R	F			A				R				A			R	F	R				F	O	D	R	D		O	F		O	A				A	O		F
Abies bornmullerana																																												F				
Abies cephalonica																		R																														
Abies cilicica																																												F				
Abies equi-trojani																																												R				
Abies holophylla																										R																						
Abies koreana																																																
Abies mayriana																										R																						
Abies nebrodensis																							R																								
Abies nephrolepis																										R																						
Abies nordmanniana											R	F			F											R		R																	F				R
Abies pinsapo									R						R																				R												
Abies sachalinensis																										R		R																				
Abies semenovii																																																
Abies sibirica													R	O												R		R																				
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Acer babinerve																																																
Acer campestre						R		F	F		O	R			F				F		F		F			R		R				R		F	R			O	F		R	F			F		F		F
Acer cappadocicum																																													R				
Acer divergens																																													R				
Acer ginnala																										R		F																				
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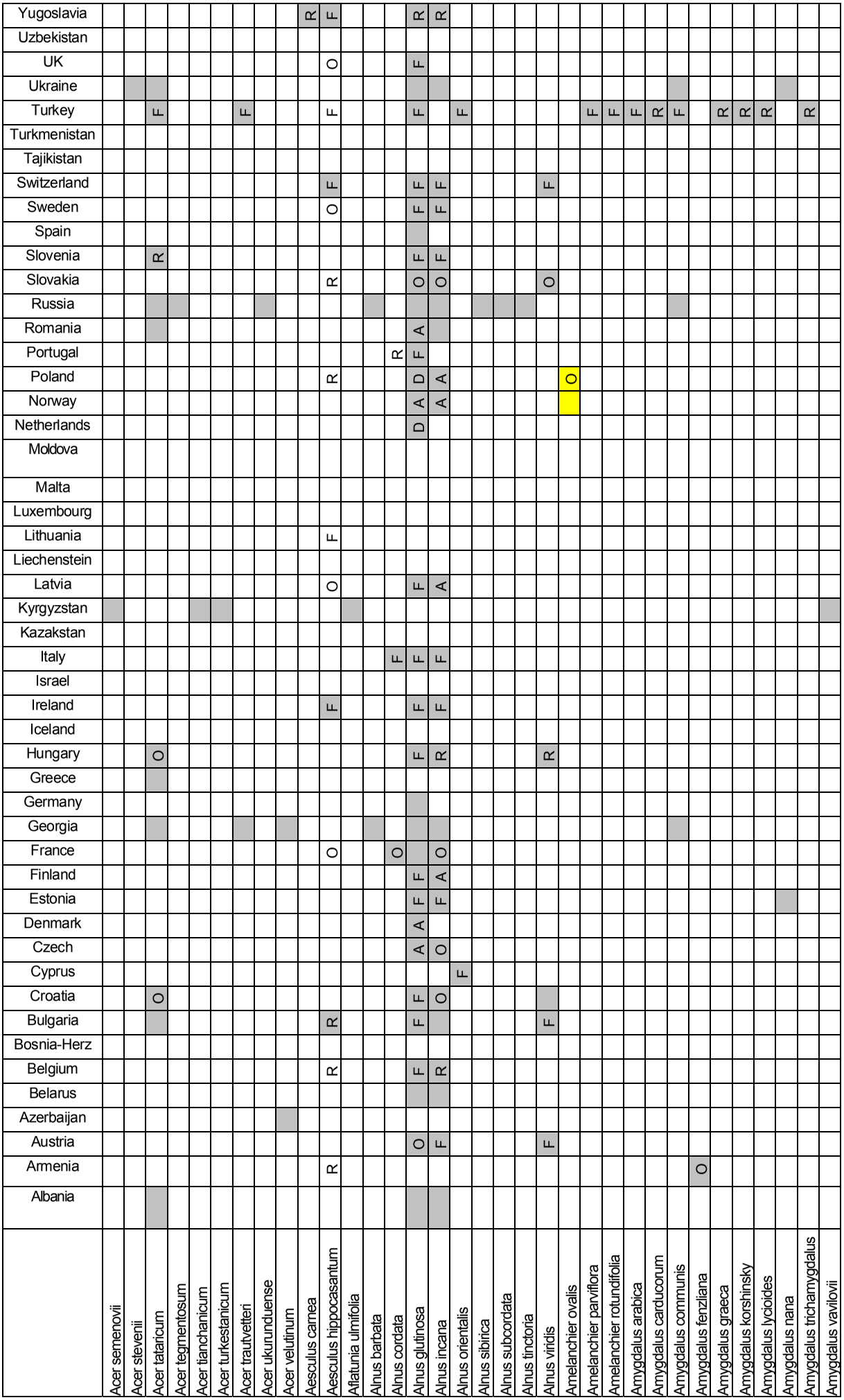
Acer obtusatum									O	F																													R									
Acer opalus															O																											O						
Acer platanoides			O			R		F	O		A	R	F	O	O				F		F		F			F	R	F					F	A	O			O	R		F	F			F		O		R
Acer pseudoplatanus			F			A		F	O		F	F		R	O				F		F		F			R	F	F				A	F	F	O			O	F		O	A			F		A		
Acer pseudosieboldianum																																																
Acer sempervirens																																													R				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Uzbekistan
UK
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Switzerland
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Acer velutinum
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Aesculus hippocasantum
Aflatunia ulmifolia
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Alnus cordata
Alnus glutinosa
Alnus incana
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Alnus viridis
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Amelanchier parviflora
Amelanchier rotundifolia
Amygdalus arabica
Amygdalus carducorum
Amygdalus communis
Amygdalus fenzliana
Amygdalus graeca
Amygdalus korshinsky
Amygdalus lycioides
Amygdalus nana
Amygdalus trichamygdalus
Amygdalus vavilovii

	Amygdalus webbii	Appolonias barbujana	Aralia sibirica	Arbutus andrachne	Arbutus canariensis	Arbutus unedo	Ardusia excelsa	Armeniaca mandschurica	Armeniaca siberica	Armeniaca vulgaris	Astragalus caucasicus	Berberis iberica	Berberis orientalis	Berberis vulgaris	Betula spp	Betula alba	Betula borysthenica	Betula browicziama	Betula celtiberica	Betula costata	Betula davurica	Betula ermanii	Betula lanata	Betula litwinowii	Betula kiokovii	Betula maximowicziana	Betula medwediewii	Betula megrelica	Betula microphyllae	Betula nana	Betula obscura	Betula oycoviensis	Betula pendula	Betula platyphylla
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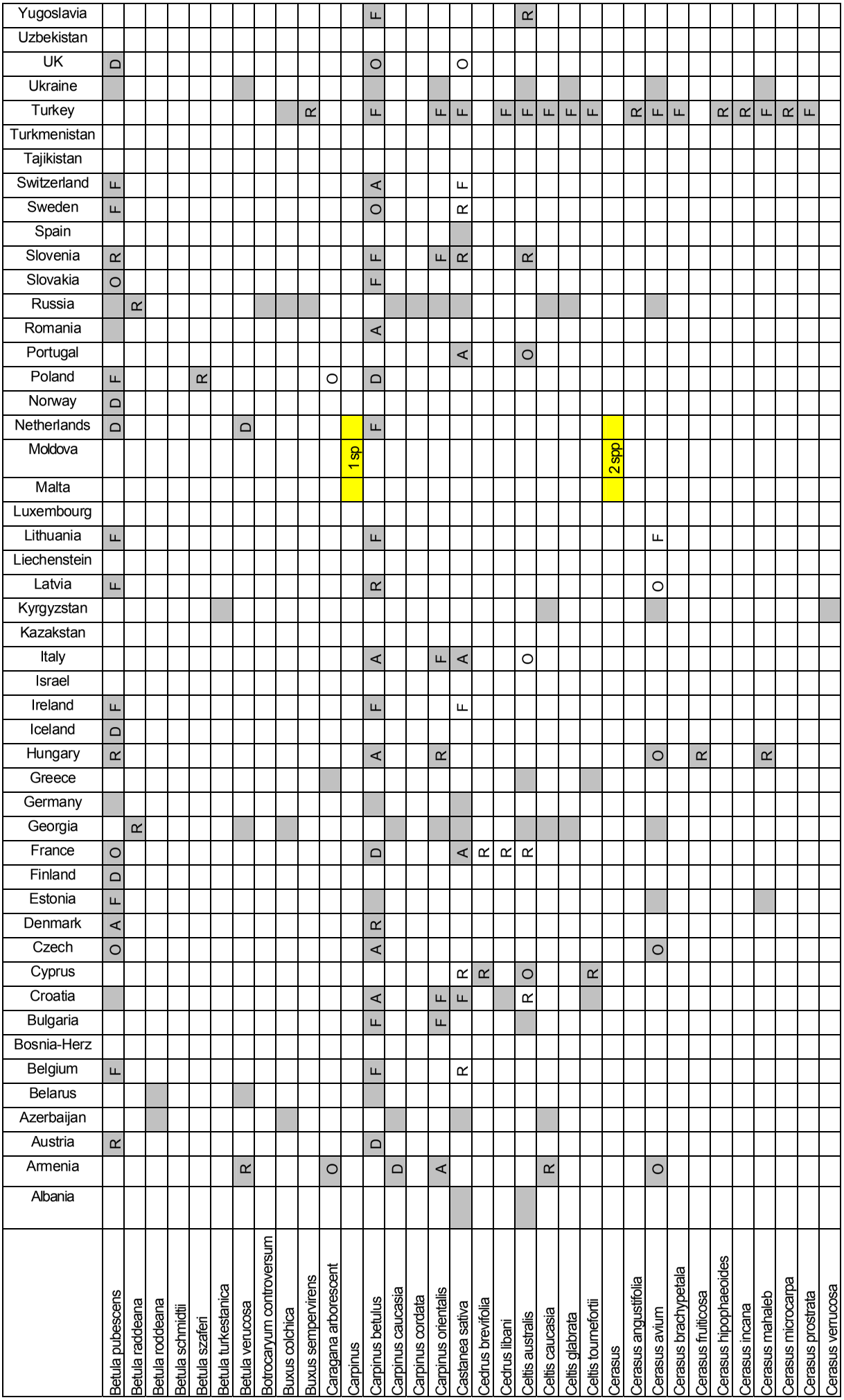
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Carpinus orientalis
Castanea sativa
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Celtis caucasia
Celtis glabrata
Celtis tournefortii
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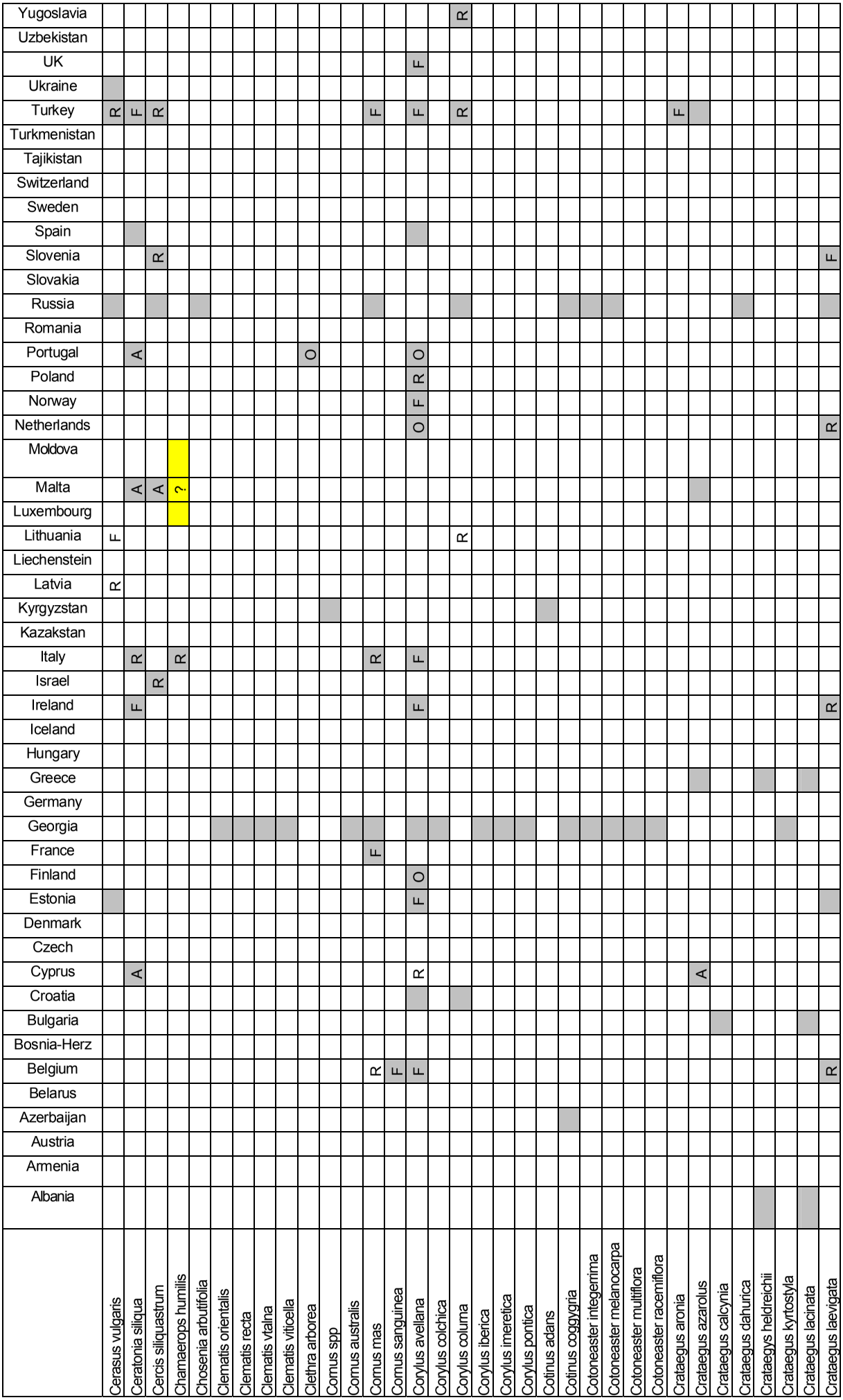
Cerasus prostrata
Cerasus verrucosa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Clethra arborea
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Cornus australis
Cornus mas
Cornus sanguinea
Corylus avellana
Corylus colchica
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Corylus iberica
Corylus imeretica
Corylus pontica
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Crataegus laevigata

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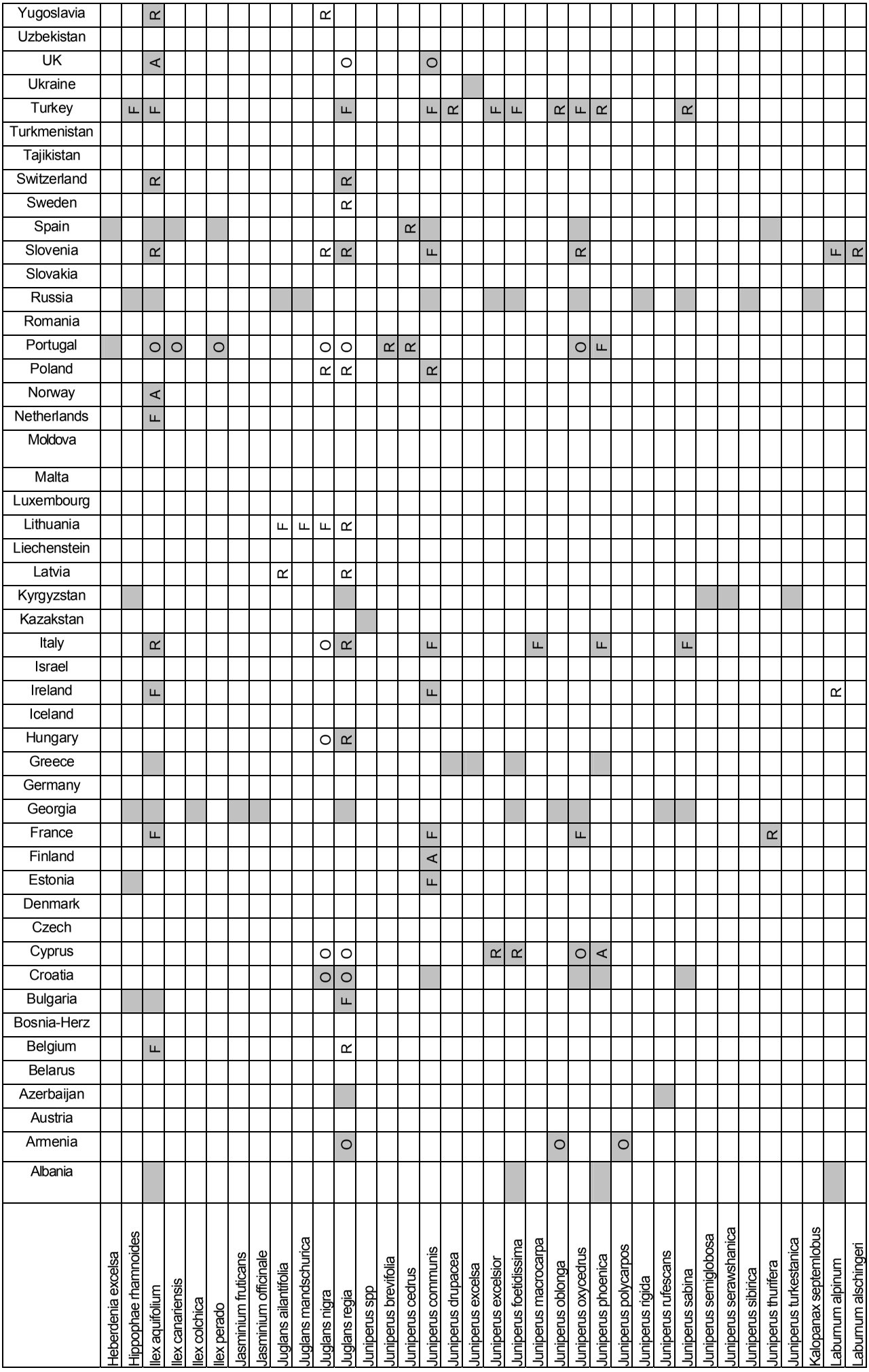
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Juniperus macrocarpa
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Juniperus oxycedrus
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Juniperus polycarpos
Juniperus rigida
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Juniperus semiglobosa
Juniperus serawshanica
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Juniperus turkestanica
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Laburnum alpinum
Laburnum alschingeri

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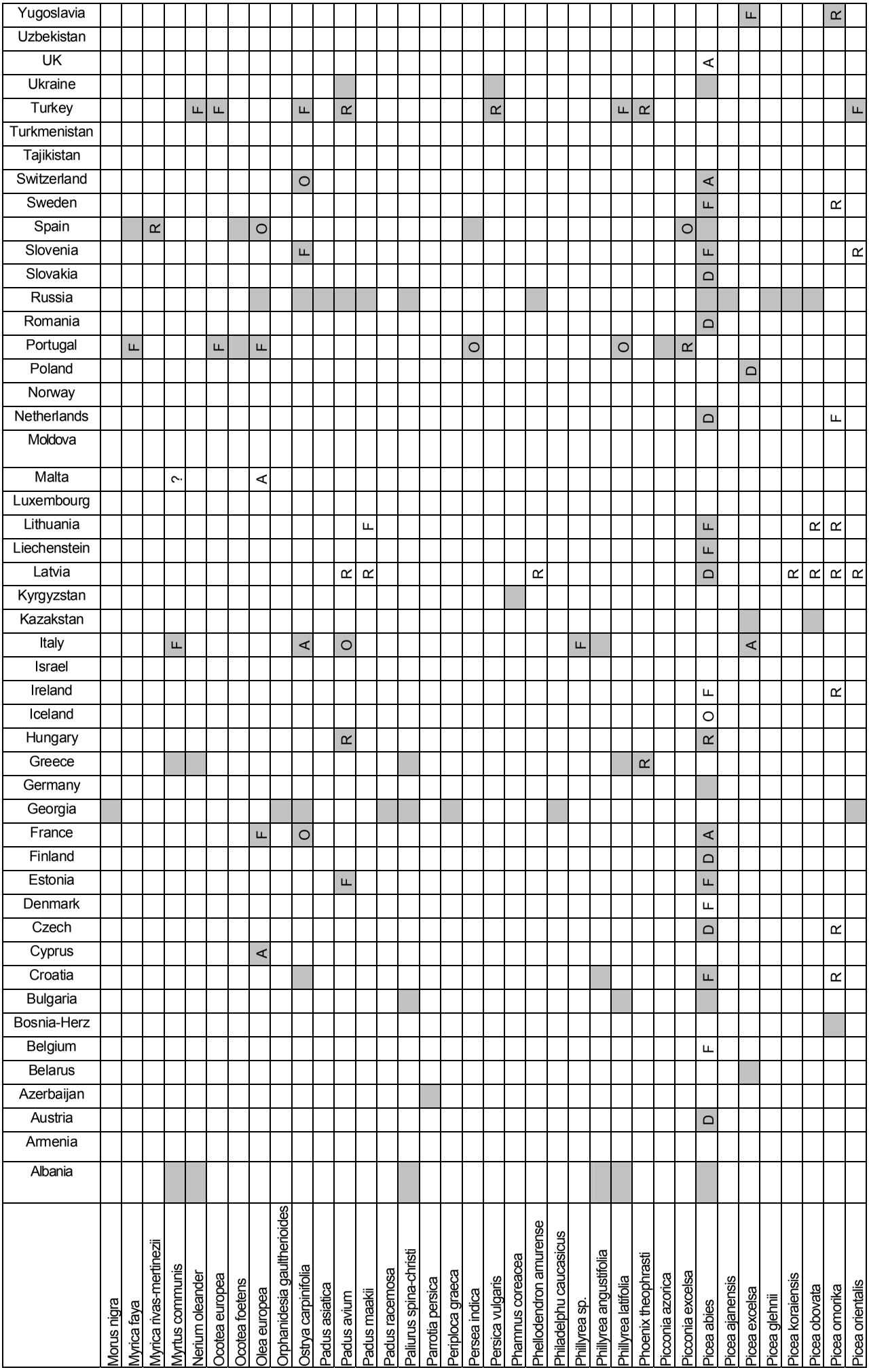
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Myrica rivas-mertinezii
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Ocotea foetens
Olea europea
Orphanidesia gaultherioides
Ostrya carpinifolia
Padus asiatica
Padus avium
Padus maakii
Padus racemosa
Paliurus spina-christi
Parrotia persica
Periploca graeca
Persea indica
Persica vulgaris
Phamnus coreacea
Phellodendron amurense
Philadelphu caucasicus
Phillyrea sp.
Phillyrea angustifolia
Phillyrea latifolia
Phoenix theophrasti
Picconia azorica
Picconia excelsa
Picea abies
Picea ajanensis
Picea excelsa
Picea glehnii
Picea koraiensis
Picea obovata
Picea omorika
Picea orientalis

	Albania	Armenia	Austria	Azerbaijan	Belarus	Belgium	Bosnia-Herz	Bulgaria	Croatia	Cyprus	Czech	Denmark	Estonia	Finland	France	Georgia	Germany	Greece	Hungary	Iceland	Ireland	Israel	Italy	Kazakstan	Kyrgyzstan	Latvia	Liechenstein	Lithuania	Luxembourg	Malta	Moldova	Netherlands	Norway	Poland	Portugal	Romania	Russia	Slovakia	Slovenia	Spain	Sweden	Switzerland	Tajikistan	Turkmenistan	Turkey	Ukraine	UK	Uzbekistan	Yugoslavia
Picea schrenkiana																																																	
Picea tianschanica																																																	
Pinus spp.																																																	
Pinus brutia									O	D					R							F	R																						F				
Pinus canariensis																						F													O														
Pinus cembra			F											O	O					R			O			R		R						O				R	F		R	F							
Pinus densiflora																																																	
Pinus eldarica															R																														R				
Pinus excelsa								F																																									
Pinus friesiana																																																	
Pinus halepensis									F	O					A							F	F							A					F				R						R				R
Pinus heldreichii																																																	R
Pinus koraiensis																										R																							
Pinus kochiana		O																																															
Pinus larico								F																																									
Pinus leucodermis								R	R														R																										
Pinus maritima									O																																								
Pinus montana			R					R															F																										
Pinus mugo			F						R		O		R		O											O	F	F					O	F				O	F		O	F							R
Pinus nigra			F			R				O	O				O				A		R		A			R	R	R				F		F	R			O	F		O	R			F		A		F
Pinus pallasiana																																																	
Pinus peuce	R							F	R									R								R		R																					R
Pinus pinaster						R									A								A									R			D										F				R
Pinus pinea									O	O					F							F	A												A										F				
Pinus pityusa																																																	
Pinus pumila																																																	
Pinus sibirica																										R		R																					
Pinus stankewiczii																																																	
Pinus sylvestris			D			F		F	F		A	A	F	D	A				R		F		F			D	F	F				D	D	D	F			A	F		F	A			F	D	D		F
Pinus uncinata															F					R																			R										
Pirus malus																							F																										
Pistacia atlantica										O												F																							F				
Pistacia eurycarpa																																													R				
Pistacia khinjuk																																													R				
Pistacia lentiscus									O	A													F							?																			
Pistachia mutica		O																																															

	Pistacia palaestina	Pistacia terebinthus	Pistacia vera	Pittosporum coriaceum	Platanus spp	Platanus digitifolia	Platanus orientalis	Platycladus orientalis	Populus spp	Populus afganica	Populus alba	Populus balsamifera	Populus canescens	Populus davidiana	Populus deltoides	Populus euphratica	Populus gracilis	Populus hybrida	Populus italica	Populus laurifolia	Populus nigra	Populus pseudonivea	Populus suaveolens	Populus transcaucasica	Populus tremula	Populus tristis	Populus usbekistanica	Prunus spp	Prunus amygdalus	Prunus avium	Prunus caspica	Prunus cerasifera	Prunus cerasus	Prunus cocomilla	Prunus divaricata	Prunus dulcis
Albania							native																													
Armenia											O										F															
Austria																								R												
Azerbaijan																																				
Belarus																																				
Belgium													R								R			F						F		R				
Bosnia-Herz																																				
Bulgaria											F										F			F												
Croatia		O									F										F			F						O						
Cyprus		A					F														O															
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Estonia																								F												
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Israel	F																																			
Italy		F									F										F			F						O						
Kazakstan																																				
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Latvia											O	O								R	R			A								O				
Lithuania											F	F			F					F	F		F													
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Switzerland											O		O								O			O						F						
Turkey		F	F				F				F		R			R					F			F		F								F		
Turkmenistan																																				
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Uzbekistan																																				
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Ukraine																																				
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	Pistacia palaestina	Pistacia terebinthus	Pistacia vera	Pittosporum coriaceum	Platanus spp	Platanus digitifolia	Platanus orientalis	Platycladus orientalis	Populus spp	Populus afganica	Populus alba	Populus balsamifera	Populus canescens	Populus davidiana	Populus deltoides	Populus euphratica	Populus gracilis	Populus hybrida	Populus italica	Populus laurifolia	Populus nigra	Populus pseudonivea	Populus suaveolens	Populus transcaucasica	Populus tremula	Populus tristis	Populus usbekistanica	Prunus spp	Prunus amygdalus	Prunus avium	Prunus caspica	Prunus cerasifera	Prunus cerasus	Prunus cocomilla	Prunus divaricata	Prunus dulcis

	Prunus fruticosa	Prunus kurdica	Prunus laurocerasus	Prunus lusitanica	Prunus mahaleb	Prunus moldavica	Prunus padus	Prunus prostrata	Prunus pseudarmenica	Prunus ramburii	Prunus sogdiana	Prunus spinosa	Prunus stepposa	Prunus tenella	Pterocarya fraxinifolia	Pterocarya pterocarpa	Punica granatum	Pyracantha coccinea	Pyrus	Pyrus amygdaliformis	Pyrus anatolica	Pyrus boissieriana	Pyrus bourgaeana	Pyrus bucharica	Pyrus bulgarica	Pyrus caucasia	Pyrus communis	Pyrus cordata	Pyrus elaeagrifolia	Pyrus georgica	Pyrus hakkiarica	Pyrus magyarica	Pyrus malus	Pyrus nivalis	Pyrus pyraster	Pyrus regelii
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Switzerland							R																				R									
Turkmenistan																																				
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Ukraine																																				
UK							F																													
Uzbekistan																																	R			
Yugoslavia									R																										R	

	Pyrus salicifolia	Pyrus syriaca	Pyrus usseriensis	Quercus spp	Quercus aegilops	Quercus alnifolia	Quercus aucheri	Quercus boissieri	Quercus borealis	Quercus brantii	Quercus bornmulleriana	Quercus brachyphylla	Quercus calliprinos	Quercus canariensis	Quercus castaneifolia	Quercus cendorum	Quercus cerrioides	Quercus cerris	Quercus coccifera	Quercus conferta	Quercus crenata	Quercus crispula	Quercus dalechampii	Quercus dentata	Quercus dschorochensis	Quercus esculiformis	Quercus eucifolia	Quercus faginea	Quercus frainetto	Quercus hartwissiana	Quercus haas	Quercus iberica	Quercus ilex	Quercus imeritina	Quercus infectoria	Quercus ithaburensis
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Croatia																	F	R											R				F			
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Ukraine																																				
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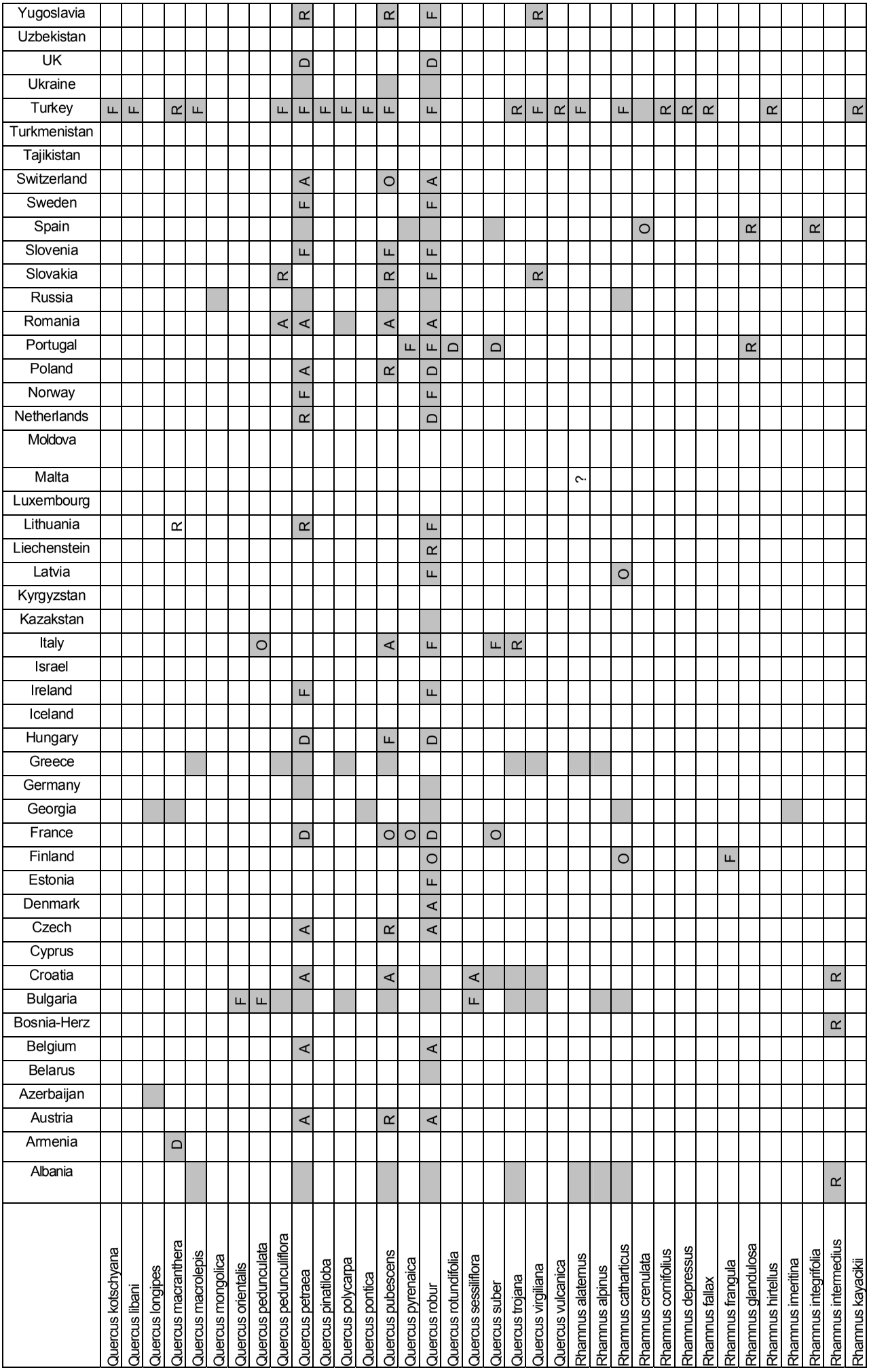
Pyrus salicifolia, Pyrus syriaca, Pyrus usseriensis, Quercus spp, Quercus aegilops, Quercus alnifolia, Quercus aucheri, Quercus boissieri, Quercus borealis, Quercus brantii, Quercus bornmulleriana, Quercus brachyphylla, Quercus calliprinos, Quercus canariensis, Quercus castaneifolia, Quercus cendorum, Quercus cerrioides, Quercus cerris, Quercus coccifera, Quercus conferta, Quercus crenata, Quercus crispula, Quercus dalechampii, Quercus dentata, Quercus dschorochensis, Quercus esculiformis, Quercus eucifolia, Quercus faginea, Quercus frainetto, Quercus hartwissiana, Quercus haas, Quercus iberica, Quercus ilex, Quercus imeritina, Quercus infectoria, Quercus ithaburensis


Yugoslavia
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Quercus kotschyana
Quercus libani
Quercus longipes
Quercus macranthera
Quercus macrolepis
Quercus mongolica
Quercus orientalis
Quercus pedunculata
Quercus pedunculiflora
Quercus petraea
Quercus pinatiloba
Quercus polycarpa
Quercus pontica
Quercus pubescens
Quercus pyrenaica
Quercus robur
Quercus rotundifolia
Quercus sessiliflora
Quercus suber
Quercus trojana
Quercus virgiliana
Quercus vulcanica
Rhamnus alatemus
Rhamnus alpinus
Rhamnus catharticus
Rhamnus crenulata
Rhamnus comifolius
Rhamnus depressus
Rhamnus fallax
Rhamnus frangula
Rhamnus glandulosa
Rhamnus hirtellus
Rhamnus imeritina
Rhamnus integrifolia
Rhamnus intermedius
Rhamnus kayacikii

	Rhamnus kuricus	Rhamnus lycioides	Rhamnus microcarpus	Rhamnus nitidus	Rhamnus oleoides	Rhamnus orbiculatus	Rhamnus pallasii	Rhamnus persicifolius	Rhamnus pichleri	Rhamnus punctatus	Rhamnus pyrellus	Rhamnus rhodopeus	Rhamnus saxatalis	Rhamnus sibthorpianus	Rhamnus thymifolius	Rhododendron caucasicum	Rhododendron flavum (luteum)	Rhododendron ponticum	Rhus coriaria	Salix spp	Salix acmophylla	Salix acutifolia	Salix aegyptiaca	Salix alba	Salix appendiculata	Salix apoda	Salix aria	Salix arbuscula	Salix armenorossica	Salix atrocinerea	Salix aurita	Salix babylonica	Salix borealis	Salix canariensis	Salix caprea	Salix caucasica
Albania																																			
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Uzbekistan																																			
Yugoslavia																							R												

R – Rare; F – Frequent; A – Abundant; O – Occasional; ? – Unknown

	Salix cinerea	Salix daphnoides	Salix dasyclados	Salix elaeagnos	Salix elbursensis	Salix excelsa	Salix fedtschenkoi	Salix ferganensis	Salix fragilis	Salix herbacea	Salix incana	Salix lapponum	Salix livida	Salix myrsinifolia	Salix myrtilloides	Salix offiinalis	Salix pedicellata	Salix pentandra	Salix penandroides	Salix phyllicifolia	Salix pseudodepressa	Salix pseudomedemii	Salix purpurea	Salix pyrofolia	Salix repens	Salix rupicola	Salix salvifolia	Salix schwerenii	Salix starkeana	Salix tarraconensis	Salix trabzonica	Salix triandra	Salix viminalis	Salix wilmensiana	Sambucus maderensis	Sambucus nigra
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	Sambucus palmensis	Sambucus racemosa	Sideroxylon mermulana	Smilax excelsa	Sorbus spp	Sorbus alborii	Sorbus anglica	Sorbus aria	Sorbus arranensis	Sorbus aucuparia	Sorbus austriaca	Sorbus badensis	Sorbus boissieria	Sorbus bordsii	Sorbus bristoliensis	Sorbus busechiana	Sorbus caucasica	Sorbus caucasigena	Sorbus chamaemespilus	Sorbus colchica	Sorbus dacica	Sorbus decipiens	Sorbus domestica	Sorbus eminens	Sorbus franconica	Sorbus heilingensis	Sorbus hybrida	Sorbus gracea	Sorbus intermedia	Sorbus kusnetzovii	Sorbus lancastrianus	Sorbus lancifolia	Sorbus latifolia	Sorbus leptophylla	Sorbus levana	Sorbus luristanica
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Slovakia								R		R																										
Slovenia								F		F													R													
Spain	R		R																																	
Sweden										F																		F							
Switzerland										O													R													
Turkey										F													F							F						R
Turkmenistan																																				
Tajikistan																																				
Ukraine																																				
UK					R		R	F	R	A					R									R						R			R	R		
Yugoslavia								R		R																										
Uzbekistan																																				
	Sambucus palmensis	Sambucus racemosa	Sideroxylon mermulana	Smilax excelsa	Sorbus spp	Sorbus alborii	Sorbus anglica	Sorbus aria	Sorbus arranensis	Sorbus aucuparia	Sorbus austriaca	Sorbus badensis	Sorbus boissieria	Sorbus bordsii	Sorbus bristoliensis	Sorbus busechiana	Sorbus caucasica	Sorbus caucasigena	Sorbus chamaemespilus	Sorbus colchica	Sorbus dacica	Sorbus decipiens	Sorbus domestica	Sorbus eminens	Sorbus franconica	Sorbus heilingensis	Sorbus hybrida	Sorbus gracea	Sorbus intermedia	Sorbus kusnetzovii	Sorbus lancastrianus	Sorbus lancifolia	Sorbus latifolia	Sorbus leptophylla	Sorbus levana	Sorbus luristanica

	Sorbus maderensis	Sorbus meinchii	Sorbus migarica	Sorbus mougeoti	Sorbus multicrenata	Sorbus neglecta	Sorbus norvegica	Sorbus obtusidentata	Sorbus parumlobata	Sorbus paxiana	Sorbus persica	Sorbus pseudofennica	Sorbus pseudothuringiaca	Sorbus roopiana	Sorbus rupicola	Sorbus sibirica	Sorbus subarranensis	Sorbus subcordata	Sorbus subcuneata	Sorbus subfusca	Sorbus subpinnata	Sorbus subsimilis	Sorbus subtomentosa	Sorbus takhtajanii	Sorbus tamaschjanae	Sorbus taurica	Sorbus toederi	Sorbus torminalis	Sorbus umbellata	Sorbus velebitica	Sorbus velutina	Sorbus vexans	Sorbus wilmottiana	Sorbusa rupicola	Staphylea colchica	Staphylea pinnata
Albania																																				
Armenia																																				
Austria																																				
Azerbaijan																																				
Belarus																																				
Belgium																																				
Bosnia-Herz																																				
Bulgaria																												R								
Croatia																														R						
Cyprus																																				
Czech																												O								
Denmark																																				
Estonia																																				
Finland																											R									
France				O																								F								
Georgia																																				
Germany					R				R				R				R																			
Greece																																				
Hungary																												R								
Iceland																																				
Ireland																																				
Israel																												F								
Italy																																				
Kazakstan																																				
Kyrgyzstan																																				
Latvia																																				
Liechenstein																																				
Lithuania																																				
Luxembourg																																				
Malta																																				
Moldova																																				
Netherlands																																				
Norway		R				R	R								R		R				R	R														
Poland																												O								
Portugal	R																																			
Romania																																				
Russia																																				
Slovakia																												R								
Slovenia																												R								
Spain																																				
Sweden							R																				R						R			
Switzerland																												R								
Turkmenistan																																				
Tajikistan																																				
Turkey											R		R							R				R	R			F	F							F
Ukraine												R							R													R	R			
UK																																				
Uzbekistan																																				
Yugoslavia																												R								

	Swida darvasica	Syringia amurensis	Syringia villosa	Tamarix africana	Tamarix dalmatica	Tamarix gallica	Tamarix gracilis	Tamarix hampeana	Tamarix hohenackeri	Tamarix parviflora	Tamarix ramosissima	Tamarix smyrnensis	Tamarix tetragyna	Tamarix tetrandra	Taxus baccata	Taxus cuspidata	Tetraclinis articulata	Tilia	Tilia argentea	Tilia amurensis	Tilia begonifolia	Tilia caucasia	Tilia cordata	Tilia dasystyla	Tilia europea	Tilia grandifolia	Tilia mandschurica	Tilia parvifolia	Tilia platyphyllos	Tilia rubra	Tilia sinirica	Tilia taquetii	Tilia tomentosa	Trollius europaeus	Ulmus spp	Ulmus campestre
Albania																					O	O														
Armenia														R	R							O	O													
Austria																																			
Azerbaijan																																			
Belarus																																			
Belgium															R							F							R						
Bosnia-Herz																																			
Bulgaria																									F		F								R
Croatia																									R		F								
Cyprus												F	O																						
Czech															R																				
Denmark																																			
Estonia															R							F													
Finland															R																				
France						F									O							F						F							
Georgia																																			
Greece															R							F													
Germany																																			
Hungary															R							F							F						F
Iceland																																			
Ireland															F							F		F											
Israel																																			
Italy															R							R													R
Kazakstan																																			
Kyrgyzstan																																			
Latvia																						F	R						R						
Liechenstein																						F	R												
Lithuania															R							F							F						
Luxembourg																																			
Malta				A													R	2 spp															3 spp		
Moldova																																			
Netherlands															R							R							R						
Norway															F							F							O						
Poland															R							F							O						
Portugal															R							R							R						
Romania																						A													
Russia																																			
Slovakia																						O							R						
Slovenia																						F							F						
Spain																	R																		
Switzerland																R						F							F						
Sweden															R							F							R						
Tajikistan																																			
Turkmenistan																																			
Turkey							R	R		F		F		R	R				F			R						R	F						
Ukraine																																			
UK															F			O																O	
Uzbekistan																									F		F								
Yugoslavia															R				F						F								R		

	Swida darvasica	Syringia amurensis	Syringia villosa	Tamarix africana	Tamarix dalmatica	Tamarix gallica	Tamarix gracilis	Tamarix hampeana	Tamarix hohenackeri	Tamarix parviflora	Tamarix ramosissima	Tamarix smyrnensis	Tamarix tetragyna	Tamarix tetrandra	Taxus baccata	Taxus cuspidata	Tetraclinis articulata	Tilia	Tilia argentea	Tilia amurensis	Tilia begonifolia	Tilia caucasia	Tilia cordata	Tilia dasystyla	Tilia europea	Tilia grandifolia	Tilia mandschurica	Tilia parvifolia	Tilia platyphyllos	Tilia rubra	Tilia sinirica	Tilia taquetii	Tilia tomentosa	Trollius europaeus	Ulmus spp	Ulmus campestre

	Ulmus canescens	Ulmus carpinifolia	Ulmus effusa	Ulmus elliptica	Ulmus foliacea	Ulmus glabra	Ulmus laevis	Ulmus minor	Ulmus montana	Ulmus procera	Ulmus pumila	Ulmus scabra	Ulmus suberosa	Ulmus wyssotzkyi	Viburnum lanata	Viburnum opulus	Viburnum sargentii	Viburnum tinus	Visnea mocanera	Vitex agnus-castus	Vitis silvestris	Zelkova abelicea	Zelkova carpinifolia	Zelkova sicula	Ziziphus jujuba
Yugoslavia			R					R	R																
Uzbekistan																									
UK						F				F															
Ukraine																									
Turkey						R	R	R															R		
Turkmenistan																									
Tajikistan																									
Switzerland						F	F																		
Sweden						F	R	O																	
Spain																		O							
Slovenia						R	R	R																	
Slovakia						R	R	R																	
Russia																									
Romania																									
Portugal								O		O								R							
Poland						F	A	F																	
Norway						F																			
Netherlands						R	R	F																	
Moldova																									
Malta																			?						
Luxembourg																									
Lithuania		F				F	F				R														
Liechenstein																									
Latvia						F	F	R		O	R														
Kyrgyzstan																									
Kazakstan																									
Italy									F															R	
Israel																									
Ireland						R		R		R															
Iceland																									
Hungary						R	O				O														
Greece																						R			
Germany																									
Georgia																							R		
France							R	R																	
Finland						R	R																		
Estonia						F	R																		
Denmark																									
Czech						O	O	O																	
Cyprus	O																								
Croatia		O							R									O							
Bulgaria			R						R																
Bosnia-Herz																									
Belgium						F		F																	
Belarus																									
Azerbaijan																							R		
Austria						R	R	R																	
Armenia							O																R		
Albania																									

Annex table 2: Common tree species of Europe

	Albania	Austria	Belarus	Belgium	Bosnia-Herz	Bulgaria	Croatia	Czech	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Ireland	Italy	Latvia	Liechenstein	Lithuania	Luxembourg	Moldova	Netherlands	Norway	Poland	Portugal	Romania	Russia	Slovakia	Slovenia	Spain	Sweden	Switzerland	Turkey	Ukraine	UK	Yugoslavia
Abies alba		A		*R*		R	A	R	*F*			A			R		A	*R*	F	*R*			*F*	*O*	D	*R*	D		O	F		*O*	A		A	*O*	F
Acer campestre				R		F	F	O	R			F			F	F	F	*R*		*R*			R		F	*R*			O	F		R	F	F		F	F
Acer platanoides		O		R		F	O	A	R	F	O	O			F	F	F	F	R	F				F	A	*O*			O	R		F	F	F		*O*	R
Acer pseudoplatanus		F		A		F	O	F	*F*		*R*	O			F	F	F	*R*	F	*F*			A	*F*	F	O			O	F		*O*	A	F		*A*	
Alnus glutinosa		O		F		F	F	A	A	F	F				F	F	F	F					D	A	D	F	A		O	F		F	F	F		F	R
Alnus incana		F		R			O	O		F	A	O			R	F	F	A						A	A				O	F		F	F				R
Alnus viridis		F				F									R														O				F				
Betula pendula		F		F			O	A	A	F	D	A			O	F		D		F				A	D				O	F		F	A	R		A	R
Betula pubescens		R		F				O	A	F	D	O			R	F		F		F			D	D	F				O	R		F	F			D	
Carpinus betulus		D		F		F	A	A	R			D			A	F	A	R		F			F		D		A		F	F		O	A	F		O	F
Castanea sativa				*R*			F					A				*F*	A									A				R		*R*	*F*	F		*O*	
Corylus avellana				F						F	O					F	F						O	F	R	O								F		F	
Crataegus monogyna				F							O	F				F							F		R	F				F				F		A	
Euonymus europaea																R																	F			
Fagus sylvatica		D		A		F	D	A	A			A			A	F	A	*O*	F	*F*			A		D	*O*	D		D	F		F	A	R		A	
Frangula alnus				F												R																				
Fraxinus excelsior		O		A		F	O	A	A	F	O	F			F	F	F	A	F	F			F	F	F				O	F		F	A	F		D	R
Hippophae rhamnoides																																		F			
Ilex aquifolium				F								F				F	R						F	A		O				R			R	F		A	R
Juglans regia				*R*		F	O								R		R	*R*		*R*					*R*	*O*				R		*R*	*R*	F		*O*	
Juniperus communis										F	A	F				F	F								R					F				F		O	
Larix decidua		D		*R*				A		*F*	*O*	F			*O*	*F*	F	*O*	F	*F*			*A*	*F*	A				O	F		*F*	F				*R*
Malus sylvestris				R				O		R	R	F			R	R		R		R			R		O	O				R		O	R	F			
Picea abies		D		*F*			F	D	*F*	F	D	A			R	*F*		D	F	F			D				D		D	F		F	A			*A*	
Pinus nigra		F		*R*				*O*				*O*			*A*	*R*	A	*R*	*R*	*R*			*F*		*F*	*R*			*O*	F		*O*	*R*	F		*A*	F
Pinus sylvestris		D		F		F	F	A	A	F	D	A			R	F	F	D	F	F			D	D	D	F			A	F		F	A	F	D	D	F
Populus alba		O				F	F	O				O			R	R	F	*O*		*F*					F	F			O	R		*O*	O	F			R
Populus nigra		F		R		F	F	O				R			R	R	F	*R*		*F*			R		O	F			O	R		*R*	O	F		R	R
Populus tremula		R		F		F	F	A		F	A	O			O	F	F	A		F			A	A	A				O	F		F	O	F		O	R
Prunus avium				F			O					F				F	O						R	A	O	O				F		F	F			F	R
Prunus padus				R							F	O				R							F	A	O	R				F		F	R			F	
Quercus petraea		A		A			A	A				D			D	F				R			R	F	A		A			F		F	A	F		D	R
Quercus robur		A		A				A	A	F	O	D			D	F	F	F	R	F			D	F	D	F	A		F	F		F	A	F		D	F
Rhamnus catharticus											O							O															F				
Salix alba				F		F	F	A		F	*O*	F			A	R	F	O		F			A		F	O			O	F		*O*		F			R
Salix caprea				F		F		A		F	A	R			R	R	F						A	F	F				O	F		F		F			
Salix cinerea				F												R							A										R			
Salix fragilis				F		F		A				F			R	*R*		O		F			A		F	*O*			O	R				R			R
Salix pentandra								O		F	A	R				R							R	F	F									R			
Salix triandra				R							R					R							A		R					R				F			R
Sambucus nigra				F								F				F										F										F	
Sorbus aucuparia				F		R	O	A		F		O			R	F	F	F					D	A	F	O			R	F		F	O	F		A	R
Sorbus torminalis						R		O				F			R		F								O				R	R			R	F			R
Taxus baccata		R		*R*				R		R	R	O			R	F	R			*R*			R	F	R	R						R		R		F	R
Tilia cordata		O		F						F		F			F	F	R	F	R	F			R	F	F	*R*	A		O	F		F	F	R			
Tilia platyphyllos		O		R								F			F			*R*		*F*			R	*O*	O	*R*			R	F		R	F	R			
Ulmus glabra		R		F				O		F	R				R	R		F		F			R	F	F				R	R		F	F	R			
Ulmus laevis		R						O		R	R	R			O			F		F			R		A				R	R		R		R			
Ulmus minor		R		F		R		O				R				R		*R*					F		F	O			R	R		O	R	R			R

Annex table 3: Tree species of Japan

Abelia
A integrifolia
A spathulata
A tetrasepala
Abies
A firma
A homolepis
A mariesii
A sachalinensis
A veitchii
Abrus
A precatorius
Acanthopanax
A hypoleucus
A japonicus
A sciadophylloides
A senticosus
A spinosus
A trichodon
Acer
A amoenum
A argutum
A australe
A buergerianum
A capillipes
A carpinifolium
A cissifolium
A crataegifolium
A diabolicum
A distylum
A ginnala
A insulare
A japonicum
A micranthum
A miyabei
A morifolium
A nikoense
A nipponicum
A palmatum
A pycnanthum
A rufinerve
A shirasawanum
A sieboldianum
A tenuifolium
A tschonoskii
A ukurunduense
Achinidia
A hypoleuca
Actinidia
A arguta
A chinensis
A kolomikta
A polygama
A rufa
Adenanthera
A pavoniana
Adina
A pilulifera
Adinandra
A ryukyuensis
A yaeyamensis
A zen-tashiroi
Aesculus
A turbinate
Ailanthus
A altissima
Akebia
A clematifolia
A quinata
A trifoliata
Alangium
A kurzii
A platanifolium
A premnifolium
Albizia
A glabrior
A julibrissin
A kalkora
A lebbeck
A retusa
Alchornea
A davidii
A liukiuensis
A ulmifolia
Aleurites
A moluccana
A montana
Allophyllus
A timorensis
Alnaster
A firma
A maximowiczii
A pendula
Alnus
A fauriei
A firma
A hakkodensis
A hirsuta
A incana
A inokumae
A japonica
A matsumurae
A maximowiczii
A nagurae
A pendula
A serrulatoides
A sibirica
A sieboldiana
A trabeculosa
Amelanchier
A asiatica
A sinica
Ampelopsis
A leeoides
Anodendron
A affine
Antidesma
A japonicum
A kuroiwai
A pentandrum
Aphananthe
A aspera
Aralia
A bipinnata
A elata
Ardisia
A crenata
A crispa
A japonica
A pusilla
A sieboldii
Arenga
A engleri
A pinnata
A tremula
Argusia
A argentea
Arundinaria
A ramose
Aucuba
A japonica
Avicennia
A marina
Bambusa
B liukiuensis
B multiplex
Barringtonia
B asiatica
B racemosa
Bauhinia
B japonica
B purpurea
B variegata
Beilschmiedia
B erythrophloia
Benthamidia
B florida
Berberis
B amurensis
B bretschneideri
B sieboldii
B thunbergii
B tschonoskyana
Berchemia
B berchemiaefolia
B huana
B lineata
B longeracemosa
B magna
B ohwii
B pauciflora
B racemosa
B berchemiaefolia
Betula
B apoiensis
B chichibuensis
B chinensis
B corylifolia
B davurica
B ermanii
B globispica
B grossa
B incisa
B maackii
B maximowicziana
B nikoensis
B platyphylla
B schmidtii
B shikokiana
B tatewakiana
B tauschii
B ulmifolia
B yoshimurae
Biota
B orientalis
Bischofia
B javanica
Bischofiaceae
Blastus
B cochinchinensis
Boehmeria
B boninensis
B densiflora
Boninia
B glabra
B grisea
Bredia
B hirsuta
B okinawensis
Breynia
B formosana
B officinalis

Bridelia
B balansae
Broussonetia
B kaempferi
B kazinoki
Bruguiera
B gymnorrhiza
Buckleya
B lanceolata
Buddleja
B curviflora
B davidii
B japonica
Buxus
B liukiuensis
B microphylla
Caesalpinia
C bonduc
C decapetala
C globulorum
Callicarpa
C dichotoma
C glabra
C japonica
C kochiana
C oshimensis
C shikokiana
C subpubescens
C taiwaniana
C takakumensis
C yakushimensis
C zollingeriana
Calophyllum
C inophyllum
Camellia
C japonica
C lutchuensis
C rusticana
C sasanqua
Cananga
C odorata
Carmona
C microphylla
Carpinus
C carpinus
C cordata
C distegocarpus
C falcatibracteata
C japonica
C laxiflora
C tschonoskii
C turczaninovii
C yedoensis
Castanea
C crenata
Castanopsis
C cuspidata
C lutchuensis
C sieboldii
Casuarina
C cunninghamiana
Catalpa
C ovata
Cedrus
C deodara
Celastrus
C alatus
C articulatus
C flagellaris
C orbiculatus
C punctatus
C stephanotifolius
C striatus
C strigillosus
Celtis
C biondii
C boninensis
C jessoensis
C leveillei
C liukiuensis
C sinensis
Cephalotaxus
C harringtonia
Cerasus
C incisa
Cercidiphyllum
C japonicum
Cercis
C chinensis
Chaenomeles
C japonica
C sinensis
Chamaecyparis
C obtusa
C pisifera
Chamaedaphne
C calyculata
Chamaerops
C fortunei
Cinnamomum
C daphnoides
C doederleinii
C japonicum
C okinawense
C sieboldii
Citrus
C depressa
C tachibana
Cladothamnus
C bracteatus
Cladrastis
C platycarpa
C sikokiana
Claoxylon
C centinarium
Clathra
C barvinervis
Clematis
C trifoliata
Clerodendrum
C bungei
C inerme
C japonicum
Cleyera
C ochnacea
Clinostigma
C savoryanum
Cocculus
C laurifolius
Colubrina
C asiatica
Cordia
C cumingiana
C dichotoma
C kanehirae
Coriaria
C japonica
Cornus
C brachypoda
C controversa
C florida
C kousa
C macrophylla
C officinalis
Corylopsis
C glabrescens
C gotoana
Corylus
C heterophylla
C mandshurica
C sieboldiana
Corypha
C japonica
Crataegus
C chlorosarca
C cuneata
Crataeva
C falcata
C religiosa
Crepidiastrum
C ameristophyllum
Croton
C cascarilloides
C tiglium
Cryptocarya
C chinensis
Cryptomeria
C japonica
Cyclobalanopsis
C acuta
C gilva
C glauca
C hondae
C miyagii
C myrsinaefolia
C salicina
C sessilifolia
Cydonia
C oblonga
Cyphokentia
C savoryana
Cyrta
C japonica
Dalbergia
D candenatensis
D cochinchinensis
Damnacanthus
D biflorus
D indicus
D macrophyllus
D okinawensis
Daphne
D jezoensis
D kamtschatica
D kiusiana
D miyabeana
D odora
D pseudomezereum
Daphnimorpha
D capitellata
D kudoi
Daphniphyllum
D amamiense
D himalense
D macropodum
Datura
D suaveolens
Decavenia
D hispida
Dendrocacalia
D crepidifolia
Dendrolobium
D umbellatum
Dendropanax
D trifidus
Derris
D elliptica
D trifoliata
Desmodium
D gangeticum
D triquetrum
D umbellatum

Deutzia
D amanoi
D crenata
D gracilis
D hypoleuca
D kiushiana
D microcarpa
D scabra
D taradakensis
D uniflora
D yaeyamensis
D zentaroana
Diospyros
D eriantha
D hayatai
D japonica
D kaki
D liukiuensis
D lotus
D morrisiana
D nipponica
D odashimai
Diplomorpha
D phymatoglossa
D sikokiana
D trichotoma
D yakushimensis
Disanthus
D cercidifolius
Discocleidion
D ulmifolium
Distegocarpus
D carpinus
D laxiflora
Distylium
D lepidotum
Dodonaea
D viscosa
Drypetes
D integerrima
D matsumurae
Edgeworthia
E chrysantha
Ehretia
E buxifolia
E dichotoma
E dicksonii
E microphylla
E ovalifolia
E philippinensis
E takaminei
E timorensis
Elaeagnus
E arakiana
E epitricha
E glabra
E hisauchii
E hypoargentea
E isensis
E nikoensis
E numajiriana
E pungens
E rotundata
E takeshitai
E umbellata
E yakusimensis
E yoshinoi
Elaeocarpus
E arthropus
E ellipticus
E japonicus
E kobanmochi
E multiflorus
E pachycarpus
E photiniaefolius
E sylvestris
Elaeodendron
E japonicum
E fortunei
Eleutherococcus
E japonicus
E sciadophylloides
E senticosus
E spinosus
E trichodon
Enkianthus
E campanulatus
E cernuus
E nudipes
E perulatus
E sikokianus
E subsessilis
Eriobotrya
E japonica
Erythrina
E crista-galli
E herbacea
Euchresta
E japonica
Euodia
E nishimurae
E rutaecarpa
Euonymus
E batakanensis
E carnosus
E chibae
E fungous
E japonicus
E lutchuensis
E melananthus
E oligospermus
E planipes
E sieboldianus
E tanakae
E trichocarpus
Euptelea
E polyandra
Eurya
E boninensis
E emarginata
E japonica
E osimensis
E ryukyuensis
E sakishimensis
E yakushimensis
E zigzag
Excoecaria
E agallocha
E formosana
Fagus
F crenata
F japonica
Fatsia
F japonica
F oligocarpella
Ficus
F ampelas
F bengutensis
F carica
F caulocarpa
F erecta
F iidaiana
F irisana
F pumila
F septica
F thunbergii
F variegata
Flemingia
F philippinensis
F strobilifera
Forsythia
F japonica
F koreana
F suspensa
F togashii
F viridissima
Fraxinus
F apertisquamifera
F borealis
F floribunda
F formosana
F griffithii
F insularis
F lanuginosa
F longicuspis
F mandshurica
F platypoda
F pubinervis
F spaethiana
Freycinetia
F formosana
Galphimia
G gracilis
Gardenia
G boninensis
G jasminoides
G insularis
Geniostoma
G batanense
G kasyotense
Ginkgo
G biloba
Glochidion
G puberum
G rubrum
G zeylanicum
Glycosmis
G citrifolia
Gordonia
G wallichii
Grewia
G rhombifolia
Guettarda
G speciosa
Gulubia
G liukiuensis
Gymonosporia
G diversifolia
Halesia
H corymbosa
H hispida
Hamamelis
H japonica
Hedera
H rhombea
Helicteres
H angustifolia
Helwingia
H japonica
Heritiera
H littoralis
Hernandia
H nymphaeifolia
Hibiscus
H glaber
H hamabo
H makinoi
H mutabilis
H syriacus
Hosiea
H japonica
Hovenia
H tomentella

Hydrangea
H chinensis
H grosseserrata
H involucrata
H kawagoeana
H liukiuensis
H luteo-venosa
H macrophylla
H opuloides
H paniculata
H petiolaris
H scandens
H serrata
H sikokiana
H yayeyamensis
Hyphear
H europaeum
H tanakae
Idesia
I polycarpa
Ilex
I buergeri
I chinensis
I crenata
I dimorphophylla
I geniculata
I goshiensis
I integra
I leucoclada
I liukiuensis
I macrocarpa
I macropoda
I matanoana
I maximowicziana
I mertensii
I micrococca
I nipponica
I pedunculosa
I rotunda
I rugosa
I serrata
I sugerokii
I warburgii
Illicium
I anisatum
I religiosum
I tashiroi
Illigera
I luzonensis
Indigofera
I kotoensis
I zollingeriana
Intsia
I bijuga
I tashiroi
Itea
I japonica
Ixora
I chinensis
Jasminum
J sinense
J superflorum
Jugians
J mandshurica
J regia
Juniperus
J chinensis
J communis
J conferta
J rigida
J taxifolia
Kadsura
K chinensis
Kandelia
K candel
Kerria
K japonica
Koelreuteria
K paniculata
Lagerstroemia
L indica
L subcostata
Lantana
L camara
Lasianthus
L curtisii
L japonicus
L wallichii
Laurocerasus
L spinulosa
L zippeliana
Laurus
L nobilis
Leptodermis
L pulchella
Leucothoe
L grayana
L keiskei
Ligustrum
L ciliatum
L liukiuense
L lucidum
L mayebaranum
L micranthum
L obtusifolium
L ovalifolium
L salicinum
L yezoense
Lindera
L citriodora
L communis
L erythrocarpa
L glauca
L lancea
L obtusiloba
L praecox
L sericea
L strychnifolia
L subsericea
Liodendron
L matsumurae
L tulipifera
Lithocarpus
L edulis
L glabra
Litsea
L acuminata
L citriodora
L coreana
L japonica
Livistona
L chinensis
L subglobosa
Lobelia
L boninensis
Lonicera
L affinis
L caerulea
L chamissoi
L chrysantha
L demissa
L gracilipes
L harai
L hypoglauca
L jappnica
L linderifolia
L maackii
L maximowiczii
L mochidzukiana
L morrowii
L praeflorens
L ramosissima
L strophiophora
L tachonoskii
L vidalii
Loropetalum
L chinense
Lumnitzera
L racemosa
Lycium
L sandwicense
Lyonia
L ovalifolia
Maackia
M amurensis
M floribunda
M taiwanensis
M tashiroi
Macaranga
M tanarius
Machilus
M boninensis
M japonica
M kobu
M thunbergii
Maclura
M tricuspidata
Maesa
M japonica
M tenera
Magnolia
M grandiflora
M heptapeta
M hypoleuca
M liliflora
M parviflora
M praecocissima
M pseudokbus
M salicifolia
M sieboldii
M stellata
M tomentosa
Mahonia
M fortunei
Mallotus
M japonicus
M paniculatus
M philippensis
Malus
M baccata
M halliana
M hupehensis
M micromalus
M prunifolia
M sieboldii
M spectabilis
M spontanea
M toringo
Manglilla
M maximowiczii
M okabeana
Margaritaria
M indica
Maytenus
M diversifolia
Melanolepis
M multigandulosa
Melastoma
M candidum
M pentapetalm
M tetramerum
Melia
M azedarach
M toosendan
Melicope
M triphylla

Meliosma
M hachijoensis
M lutchuensis
M myriantha
M oldhamii
M rhoifolia
M rigida
M squamulata
M tenuiflora
M tenuis
Menziesia
M cilicalyx
M goyozanensis
M katsumatae
M pentandra
M purpurea
M yakushimensis
Messerschmidia
M argentea
Metasequoia
M glyptostroboides
Meterosideros
M boninensis
M collina
M polymorpha
Micromeles
M alnifolia
M japonica
Microtropis
M japonica
Moghania
M strobilifera
Morinda
M umbellata
Morus
M alba
M australis
M cathayana
M kagayamae
M mongolica
Mucuna
M ferruginea
M gigantea
M iriomotensis
M japonica
M macrocarpa
M membranacea
M nigricans
M sempervirens
M subferruginea
M toyoshimae
Murraya
M paniculata
Musa
M balbisiana
M likiuensis
Mussaenda
M parviflora
Myoporum
M bontioides
Myrica
M rubra
Myrsine
M maximowiczii
M seguinii
M stolonifera
Nandina
N domestica
Natsiatum
N japonicum
Negundo
N cissifolium
Neolitsea
N aciculata
N boninensis
N sericea
Nerium
N indicum
Nerium oleander
Nypa
N fruticans
Ochrosia
O hexandra
O iwasakiana
O nakaiana
O oppositifolia
Oreocnide
O fruticosa
O pedunculata
Orixa
O japonica
Osmanthus
O fragrans
O hachijoensis
O heterophyllus
O ilicifolius
O okinawensis
O rigidus
O sinensis
Osteomeles
O anthyllidifolia
O boninensis
O subrotunda
Ostrya
O japonica
Pabus
P buergeriana
P racemosa
P ssiori
Paliurus
P ramosissimus
Pandanus
P boninensis
P tectorius
Parthenocissus
P heterophylla
P tricuspidata
Pasania
P glabra
Paulownia
P fortunei
P tomentosa
Pemphis
P acidula
Persica
P vulgaris
Phellodendron
P amurense
Philadelphus
P satsumi
Photinia
P glabra
P serratifolia
P serrulata
P villosa
P wrightiana
Phyllanthus
P indicus
P leptoclados
P liukiuensis
P reticulatus
Phyllodium
P pulchellum
Phyllostachys
P bambusoides
P henonis
P heterocycla
P nigra
Picea
P bicolor
P glehnii
P jezoensis
P koyamae
P maximowiczii
P polita
P senanensis
P shirasawae
Picrasma
P quassioides
Pieris
P japonica
P koidzumiana
Pileostegia
P viburnoides
Pinus
P armandii
P densiflora
P koraiensis
P luchuensis
P parviflora
P Pumila
P thunbergii
Pipturus
P arborescens
Pisonia
P aculeata
P grandis
P umbellifera
Pithecellobium
P lucidum
Pittosporum
P boninense
P chichijimense
P denudatum
P illicioides
P parvifolium
P tobira
Platanus
P occidentalis
P orientalis
Platycarya
P strobilacea
Platycrater
P arguta
Pleioblastus
P argenteostriatus
P chino
P distichus
P hindsii
P humilis
P linearis
Poncirus
P trifoliata
Pongamia
P pinnata
Populus
P alba
P koreana
P nigra
P sieboldii
Pouteria
P boninensis
P obovata
Premna
P corymbosa
P japonica
P nauseosa
P obtusifolia

Prunus
P apetala
P armeniaca
P avium
P bracteata
P buergeriana
P campanulata
P cerasoides
P crenata
P domestica
P glandulosa
P grayana
P hisauchiana
P iwagiensis
P koshiensis
P leveilleana
P mume
P pendula
P persica
P pseudo-cerasus
P sacra
P sargentii
P speciosa
P spinulosa
P ssiori
P subhirtella
P tomentosa
P verecunda
P zippeliana
Pseudocydonia
P sinensis
Pseudosasa
P japonica
P owatarii
P japonica
Psidium
P guajava
P littorale
Psychotria
P boninesis
P homalosperma
P serpens
Ptelea
P viscosa
Pterocarpus
P macrocarpus
Pterocarya
P rhoifolia
Pterostyrax
P corymbosa
P micranthum
Putranjiva
P integerrima
Pycnospora
P lutescens
Pyrus
P calleryana
P pyrifolia
P ussuriensis
Quercus
Q acuta
Q acutidentata
Q acutissima
Q crispula
Q dentata
Q hondae
Q miyagii
Q mongolica
Q serrata
Q sessilifolia
Q variabilis
Q yaeyamensis
Rajania
R hexaphylla
R quinata
Randia
R canthioides
R cochinchinensis
Rapanaea
R neriifolia
Rhamnus
R calicicola
R chugokuensis
R crenata
R japonica
R kanagusukii
R liukiuensis
R schneideri
R sieboldiana
R utilis
R yoshinoi
Rhaphidophora
R liukiuensis
Rhaphidophora
R pinnata
Rhaphiolepis
R indica
R umbellata
Rhapis
R excelsa
R humilis
Rhizophora
R mucronata
Rhododendron
R albrechtii
R amagianum
R amakusaense
R amamiense
R amanoi
R aureum
R boninense
R brachycarpum
R dilatatum
R eriocarpum
R indicum
R keiskei
R kiusianum
R kiyosumense
R komiyamae
R lagopus
R lapponicum
R macrosepalum
R makinoi
R mayebarae
R mucronulatum
R nipponicum
R nudipes
R obtusum
R osuzuyamense
R pentaphyllum
R scabrum
R serpyllifolium
R simsii
R tosaense
R tschonoskii
R wadanum
R yakuinsulare
Rhodotypos
R scandens
Rhus
R ambigua
R javanica
R succedanea
R sylvestris
R trichocarpa
R verniciflua
Ribes
R ambiguum
R fasciculatum
R grossularia
R latifolium
R maximowiczianum
R nigrum
R sachalinense
R sinanense
R sylvestre
R triste
R uva-crispa
Robinia
R hispida
R pseudoacacia
Rosa
R acicularis
R borboniana
R bracteata
R chinensis
R fujisanensis
R hirtula
R marretii
R microonoei
R nipponensis
R paniculigera
R rugosa
R sambucina
R wichuraiana
R yaku-alpina
Rubus
R amamianus
R amphidasys
R buergeri
R chingii
R corchorifolius
R coreanus
R crataegifolius
R croceacanthus
R fauriei
R hachijoensis
R hakonensis
R hatsushimae
R hirsutus
R illecebrosus
R incisus
R iraeneus
R kanayamensis
R kiusianus
R koehneanus
R lambertianus
R matsumuranus
R mesogaeus
R microphyllus
R minusculus
R nakaii
R ohsimensis
R okinawensis
R pacificus
R palmatus
R pectinellus
R phoenicolasius
R sachalinensis
R siebodii
R spectbilis
R sumatranus
R swinhoei
R toyorensis
R trifidus
R tuyamae
R vernus
R yabei
R yakumontanus
R yatabei
Ryssopterys
R timoriensis
Sabia
S japonica
Sakakia
S ochnacea

Salix
S alopochroa
S babylonica
S bakko
S chaenomeloides
S cyclophylla
S futura
S gilgiana
S glandulosa
S gracilistyla
S hidewoi
S hukaoana
S hultenii
S japonica
S jessoensis
S kangensis
S kinuyanagi
S miyabeana
S nakamurana
S nipponica
S paludicola
S pauciflora
S pet-susu
S reinii
S rorida
S sachalinensis
S serissaefolia
S shiraii
S sieboldiana
S subfragilis
S subopposita
S vulpina
S yoshinoi
Santalum
S album
Sapindus
S boninensis
S mukorossi
Sapium
S sebiferum
Saribus
S subglobosa
Sasa
S nipponica
S palmata
Sasamorpha
S mollis
Satakentia
S liukiuensis
Saurauia
S tristyla
Scaevola
S sericea
S taccada
Schefflera
S octophylla
Schima
S noronhae
S wallichii
Schoepfia
S jasminodora
Sciadopityaceae
Sciadopitys
S verticillata
Scurrula
S loniceriifolius
S yadoriki
Securinega
S suffruticosa
Semiarundinaria
S okuboi
S yashadake
Serissa
S japonica
S serissoides
Shibataea
S chinensis
S kumasaca
Shiia
S cuspidata
Sida
S insularis
Sinoadina
S racemosa
Sinobambusa
S tootsik
Skimmia
S japonica
Solanum
S angivi
S erianthum
S torvum
Sonneratia
S alba
Sophora
S franchetiana
S japonica
S tomentosa
Sorbaria
S sorbaria
Sorbus
S alnifolia
S americana
S commixta
S matsumurana
S sambucifolia
Sphaerostemma
S japonica
Spiraea
S betulifolia
S blumei
S cantoniensis
S dasyantha
S japonica
S miyabei
S nipponica
S prunifolia
S ribisoidea
S salicifolia
S sericea
Stachyurus
S praecox
Stauntonia
S hexaphylla
Stemonurus
S foetidus
Stephanandra
S incisa
S tanakae
Stewartia
S monadelpha
S sericea
Styrax
S obassia
S shiraiana
Swida
S controversa
Symplocos
S confusa
S coreana
S cratagioides
S kotoensis
S lancifolia
S lithocarpoides
S liukiuensis
S lucida
S microcalyx
S morrisonicola
S myrtacea
S pergracilis
S prunifolia
S sozanensis
S stellaris
S tanakae
S tanakana
S tashiroi
S theophrastiifolia
S yaeyamensis
Syringa
S japonica
S reticulata
S vulgaris
Syzygium
S buxifolium
S cleyeraefolium
S jambos
Tadehagi
T triquetrum
Tarenna
T gracilipes
T kotoensis
T subsessilis
Tashiroea
T okinawensis
T yaeyamensis
Taxillus
T kaempferi
Taxus
T cuspidata
Terminalia
T catappa
T nitens
Ternstroemia
T gymnanthera
Tetragonocalamus
T quadrangularis
Tetrapanax
T papyriferus
Tetrastigma
T dentatum
Thea
T hozanensis
T miyagii
T nakaii
T sinensis
T tegmentosa
T virgata
Thespesia
T populnea
Thuja
T orientalis
T standishii
Thujopsis
T dolabrata
Tilia
T japonica
T kiusiana
T mandschurica
T maximowicziana
Toddalia
T asiatica
Toisusu
T urbaniana
Torreya
T nucifera
Tournefortia
T argentea
Trachelospermum
T asiaticum
T gracilipes
T jasminoides
Trachycarpus
T fortunei
T wagnerianus
Trema
T cannabina
T orientalis

Tricalysia
T dubia
Tripterygium
T doianum
T regelii
Tristellateia
T australasiae
Triumfetta
T procumbens
T repens
Trochodendron
T aralioides
Tsuga
T diversifolia
T sieboldii
Turpinia
T ternata
Tutcheria
T virgata
Ulmus
U laciniata
U parvifolia
Uncaria
U rhynchophylla
Uraria
U crinita
U lagopodioides
U picta
Uvaria
U japonica
Vaccomoim
V boninense
V bracteatum
V ciliatum
V emarginatum
V japonicum
V myrtillus
V oldhamii
V ovalifolium
V shikokianum
V smallii
V uliginosum
V wrightii
V yatabei
Vernicia
V cordata
V fordii
V montana
Viburnum
V carlesii
V dilatatum
V erosum
V japonicum
V koreanum
V phlebotrichum
V siebokdii
V suspensum
V tashiroi
Viburnum urceolatum
V wrightii
Vitex
V iriomotensis
V rotundifolia
V trifolia
Vitis
V amurensis
V flexuosa
V kiusiana
V pentagona
V saccharifera
V shiragai
V thunbergii
Weigela
W decora
W floribunda
W florida
W hortensis
W hortensis f.albiflora
W japonica
W middendorffiana
Wikstroemia
W albiflora
W capitellata
W ganpi
W kudoi
W sikokiana
W trichotoma
W yakushimensis
Wisteria brachybotrys
Wisteria
W floribunda
W sinensis
Xylosma
X congestum
Zabelia
Zanthoxylm
Z ailanthoides
Z beecheyanum
Z fauriei
Z nitidum
Z piperitum
Z pteropoda
Z scandens
Z schinifolium
Z simulans
Zelkova
Z serrata

Annex table 4: Native tree species of North America

Listed in alphabetical order by genera in four columns: distribution is indicated – U = USA; C = Canada

Abies amabilis U C
A balsamea U C
A bracteata U
A concolor U
A fraseri U
A grandis U C
A lasiocarpa U C
A magnifica U
A procera U
Acacia berlandieri U
A choriophylla U
A farnesiana U
A greggii U
A macracantha U
A rigidula U
A roemeriana U
A tortuosa U
A wrightii U
Acer barbatum U
A circinatum U C
A glabrum U C
A grandidentatum U
A leucoderme U
A macrophyllum U C
A negundo U C
A nigrum U C
A pensylvanicum U C
A rubrum U C
A saccharinum U C
A saccharum U C
A spicatum U C
Acoelorraphe wrightii U
Adenostoma sparsifolium U
Aesculus californica U
A flava U
A glabra U
A parviflora U
A pavia U
A sylvatica U
Alnus incana U C
Alnus maritima U
Alnus oblongifolia U
Alnus rhombifolia U
A rubra U C
A serrulata U C
A viridis U C
Alvaradoa amorphoides U
Amelanchier alnifolia U
A arborea U
A bartramiana C
A florida C
A laevis C
A sanguinea U
A utahensis U
Amphitecna latifolia U
Amyris balsamifera U
A elemifera U
Annona glabra U
Aralia spinosa U
Arbutus arizonica U
A menziesii U C
A xalapensis U
Arctostaphylos glauca U
A pringlei U
A viscida U
Ardisia escallonoides U
Artemisia tridentata U
Asimina obovata U
A parviflora U
A triloba U C
Avicennia germinans U
Baccharis halimifolia U
Betula alleghaniensis U C
B cordifolia C
B kenaica C
B lenta U C
B neoalaskana U C
B nigra U
B occidentalis U C
B papyrifera U C
B populifolia U P
B uber U
B X utahensis U
Bourreria ovata U
B radula U
B succulenta U
Bursera fagaroides U
B microphylla U
B simaruba U
Byrsonima lucida U
Calocedrus decurrens U
Calyptranthes pallens U
Calyptranthes zuzygium U
Canella winteriana U
Canotia
C holacantha U
Capparis cynophallophora U
Carnegia flexuosa U
C gigantea U
Carpinus caroliniana U C
Carya alba U
C aquatica U
C carolinae-septentrionalis U
C cordiformis U C
C floridana U
C glabra U C
C illinoinensis U
C laciniosa U C
C myristiciformis U
C ovalis U
C ovata U C
C pallida U
C texana U
Casasia clustifolia U
Castanea crenata U
C dentata U C
C pumila U
Castanopsis chrysophylla U
Castela emoryi U
Catalpa bignonioides U
C speciosa U
Ceanothus arboreus U
C spinosus U
C thyrsiflorus U
Celtis laevigata U
C lindheimeri U
C occidentalis U C
C tenuifolia U C
Cephalanthus occidentalis U C
Cercis canadensis U C
Cercocarpus ledifolius U
C montanus U
C traskiae U
Chamaecyparis lawsoniana U
C nootkatensis U C
C thyoides U
Chilopsis linearis U
Chionanthus virginicus U
Chrysobalanus icaco U
C chrysophylla U
C oliviforme U
Citharexylum berlandieri U
C fruticosum U
Cladrastis kentukea U
Clethra acuminata U
Cliftonia monophylla U
Clusia rosea U
Coccoloba diversifolia U
C uvifera U
Coccothrinax argentata U
Colubrina arborescens U
C cubensis U
C elliptica U
Condalia globosa U
C hookeri U
Conocarpus erectus U
Cordia boissieri U
Cornus alternifolia U C
C drummondii U
C florida U C
C foemina U
C glabrata U
C nuttallii U C
C racemosa U
C rugosa U
C sericea U
C sessilis U
Corylus cornuta U
Cotinus obovatus U
Crataegus aestivalis U
C berberifolia U
C brachyacantha U
C brainerdii U
C calpodendron U C
C chrysocarpa U C
C chrysophyta U
C coccinea C

C coccinioides U
C columbiana C
C compacta C
C crus-galli U C
C dilatata U
C dodgei C
C douglasii U C
C erythropoda U
C flabellata U C
C flava U
C greggiana U
C harbisonii U
C holmesiana C
C intricata U
C lacrimata U
C macrantha C
C macrosperma C
C marshallii U
C mollis U C
C opaca U
C pedicellata U
C phaenopyrum U
C pringlei C
C pruinosa U C
C pulcherrima U
C punctata U C
C reverchonii U
C saligna U
C schuettei C
C spathulata U
C submolis C
C succulenta U C
C tenax C
C texana U
C tracyi U
C triflora U
C uniflora U
C viridis U
Crossopetalum rhacoma U
Cupania glabra U
Cupressus abramsiana U
C arizonica U
C bakeri U
C forbesii U
C goveniana U
C macnabiana U
C macrocarpa U
C sargentii U
Cyrilla parvifolia U
C racemiflora U
Diospyros texana U
D virginiana U
Dodonaea viscosa U
Drypetes diversifolia U
D lateriflora U
Ehretia anacua U
Eleagnus commutata C
Elliottia racemosa U
Erythrina flabelliformis U
E herbacea U
Esenbeckia berlandieri U
Eugenia axillaris U
E confusa U
E foetida U
E rhombea U
Euonymus atropurpurea U C
E occidentalis U
Exostema caribaeum U
Exothea paniculata U
Eysenhardtia **polystachya** U
E texana U
Fagus grandifolia U C
Ficus aurea U
F citrifolia U
Forestiera acuminata U
F angustifolia U
F segregata U
F shrevei U
Fragula betultfolia U
F caroliniana U
F purshiana U
F californica U
Franklinia alatamaha U
Fraxinus americana U C
F anomala U
F anomala U
F berlandieriana U
F caroliniana U
F cuspidata U
F dipetala U
F gooddingii U
F greggii U
F latifolia U C
F nigra U C
F papillosa U
F pennsylvanica U C
F profunda U C
F quadrangulata U C
F texensis U
F velutina U
Fremontodendron californicum U
F mexicanum U
Garrya elliptica U
Gleditsia aquatica U
G triacanthos U C
Gordonia lasianthus U
Guajacum angustifolium U
G sanctum U
Guapira discolor U
Guettarda elliptica U
G scabra U
Gyminda latifolia U
Gymnanthes lucida U
Gymnocladus dioicus U C
Halesia carolina U
H diptera U
H parviflora U
Hamamelis virginiana U C
Hamelia patens U
Harvardia pallens U
Heteromeles arbutifolia U
Hypelate trifoliata U
Ilex ambigua U
I amelanchier U
I cassine U
I coriacea U
I decidua U
I krugiana U
I laevigata U
I longipes U
I montana U
I myrtifolia U
I nitida U
I opaca U
I verticillata U C
I vomitoria U
Illicium floridanum U
I parviflorum U
Jacquinia keyensis U
Juglans californica U
J cinerea U C
J major U
J microcarpa U
J nigra U C
Juniperus ashei U
J californica U
J deppeana U
J erythrocarpa U
J flaccida U
J monosperma U
J occidentalis U
J osteosperma U
J pinchotii U
J scopulorum U C
J virginiana U C
Kalmia latifolia U
Koeberlinia spinosa U
Krugiodendron ferreum U
Laguncularia racemosa U
Larix laricina U C
Larix lyallii U C
Larix occidentalis U C
Leitneria floridana U
Leucaena pulverulenta U
L retusa U
Licaria triandra U
Liquidambar styraciflua U
Liriodendron tulipifera U
Lithocarpus densiflorus U
Lyonia ferruginea U
Lyonothamnus floribundus U
Lysiloma latisiliquum U
L watsonii U
Maclura pomifera U
Magnolia acuminata U C
M ashei U
M fraseri U
M grandiflora U
M macrophylla U
M pyramidata U
M tripetala U
M virginiana U
Malosma laurina U
Malus angustifolia U
M coronaria U C
M fusca U C
M ioensis U
Manilkara jaimiqui C
Maytenus phyllanthoides U
Metopium toxiferum U
Morella californica U
M caroliniensis U
M cerifera U
M inodora U
M pensylvanica U
Morus microphylla U
M rubra C
Myrica californica C
Myrcianthes fragrans U
Myrsine floridana U
Nemopanthus mucronatus U C
Nolina bigelovii U
Nyssa aquatica U

N biflora U
N ogeche U
N sylvatica U C
Ocotea coriacea U
Olneya tesota U
Opuntia fulgida U
Osmanthus americanus U
Ostrya knowltonii U
O virginiana U C
Oxydendrum arboreum U
Parkinsonia aculeata U
P florida U
P microphylla U
P texana U
Persea borbonia U
P humilis U
P palustris U
Picea breweriana U
P engelmannii U C
P glauca U C
P mariana U C
P pungens U
P rubens U C
P sitchensis U C
Picramnia pentandra U
Pilosocereus robinii U
Pinckneya braecata U
Pinus albicaulis U C
P aristata U
P arizonica U
P attenuata U
P balfouriana U
P banksiana U C
P cembroides U
P clausa U
P contorta U C
P coulteri U
P echinata U
P edulis U
P elliottii U
P engelmannii U
P flexilis U C
P glabra U
Pinus jeffreyi U
P lambertiana U
P leiophylla U
P longaeva U
P monophylla U
P monticola U C
P muricata U
P palustris U
P ponderosa U C
P pungens U
P quadrifolia U
P radiata U
P resinosa U C
P rigida U C
P sabiniana U
P serotina U
P strobiformis U
P strobus U C
P taeda U
P torreyana U
P virginiana U
P washoensis U
Piscidia piscipula U
Pisonia rotundata U
Pistacia texana U
Pithecellobium ebano U
P keyense U
P unguis-cati U
Planera aquatica U
Platanus occidentalis U C
P racemosa U
P wrightii U
Populus angustifolia U C
P balsamifera U C
P deltoides U C
P fremontii U
P grandidentata U C
P heterophylla U
P tremuloides U C
P trichocarpa C
Prosopis glandulosa U
P pubescens U
P velutina U
Prunus alabamensis U
P alleghaniensis U
P americana U C
P angustifolia U
P caroliniana U
P emarginata U C
P fremontii U
P hortulana U
P ilicifolia U
P maackii C
P mexicana U
P munsoniana U
P myrtifolia U
P nigra U C
P pensylvanica U C
P serotina U C
P subcordata U
P umbellata U
P virginiana U C
Pseudophoenix sargentii U
Pseudotsuga macrocarpa U
P menziesii U C
Psidium longipes U
Psorothamus spinosa U
Ptelea crenulata U
P trifoliata U C
Purshia mexicana U
Quercus agrifolia U
Q alba U C
Q arizonica U
Q arkansana U
Q bicolor U C
Q chapmanii U
Q chrysolepis U
Q coccinea U
Q douglasii U
Q dunnii U
Q ellipsoidalis U C
Q emoryi U
Q engelmannii U
Q falcata U
Q fusiformis U
Q gambelii U
Q garryana U C
Q geminata U
Q georgiana U
Q graciliformis U
Q gravesii U
Q grisea U
Q havardii U
Q hypoleucoides U
Q ilicifolia U
Q imbricaria U
Q incana U
Q kelloggii U
Q laceyi U
Q laevis U
Q laurifolia U
Q lobata U
Q lyrata U
Q macrocarpa U C
Q margarettiae U
Q marilandica U
Q michauxii U
Q mohriana U
Q muehlenbergii U C
Q myrtifolia U
Q nigra U
Q oblongifolia U
Q oglethorpensis U
Q pagoda U
Q palustris U C
Q phellos U
Q prinoides U C
Q prinus U
Q pungens U
Q rubra U C
Q rugosa U
Q shumardii U C
Q similis U
Q sinuata U
Q stellata U
Q tardifolia U
Q texana U
Q tomentella U
Q toumeyi U
Q turbinella U
Q velutina U C
Q virginiana U
Q wislizeni U
Q X macdonaldii U
Reynosia septentrionalis U
Rhamnus cathartica U
R crocea U
R purshiana C
Rhizophora mangle U
Rhododendron catawbiense U
R macrophyllum U
R maximum U
Rhus choriophylla
R copallinum C
R glabra U
R hirta U
R integrifolia U
R kearneyi U
R lanceolata U
R microphylla U
R ovata U
R typhinia C
R virens U
Robinia hispida U
R neomexicana U
R pseudoacacia U
R viscosa U
Roystonea elata U
Sabal mexicana U
S minor U
S palmetto U
Salix alaxensis U C
S amygdaloides U C
S arbusculoides U C
S bebbiana U C
S bonplandiana U
S caroliniana U
S discolor U C
S eriocephela C
S exigua U
S floridana U

S geyeriana U
S hindsiana U
S hookeriana U C
S lasiolepis U
S lucida U C
S melanopsis U
S monticolor C
S nigra U C
S pellita U C
S petiolaris U C
S prolixa U C
S pyrifolia U C
S scouleriana U C
S sericea U
S sessilifolia U C
S sitchensis U C
S taxifolia U
Sambucus callicarpa C
S canadensis C
S cerulea C
S nigra U
S racemosa U
Sapindus saponaria U
Sapium biloculare U
Sassafras albidum U C
Savia bahamensis U
Schaefferia frutescens U
Schoepfia schreberi U
Sequoia sempervirens U
Sequoiadendron giganteum U
Serenoa repens U
Shepherdia argentea U C
Sideroxylon celastrinum U
S foetidissimum U
S lanuginosum U
S lycioides U
S salicifolium U
S tenax U
Simarouba glauca U
Solanum erianthum U
Sophora affinis U
S secundiflora U
Sorbus americana U C
S decora U C
S scopulina U
Sorbus sitchensis U C
Staphylea bolanderi U
S trifolia U
Stewartia malacodendron U
S ovata U
Styrax americanus U
S grandifolius U
S platanifolius U
Suriana maritima U
Swietenia mahagoni U
Symplocos tinctoria U
Taxodium ascendens U
T distichum U
T mucronatum U
Taxus brevifolia U C
T floridana U
Tecoma stans U
Tetrazygia bicolor U
Thrinax morrisii U
T radiata U
Thuja occidentalis U C
T plicata U C
Tilia americana U C
Torreya californica U
T taxifolia U
Toxicodendron vernix U
Trema lamarckianum U
T micranthum U
Tsuga canadensis U C
T caroliniana U
T heterophylla U C
T mertensiana U C
Ulmus alata U
U americana U C
U crassifolia U
U rubra U C
U serotina U
U thomasii U C
Umbellularia californica U
Ungnadia speciosa U
Vaccinium arboreum U
Vauquelinia californica U
Viburnum lentago U C
V nudum U
V obovatum U
V prunifolium U
V rufidulum U
Washingtonia filifera U
Ximenia americana U
Yucca aloifolia U
Y brevifolia U
Y elata U
Y faxoniana U
Y gloriosa U
Y schidigera U
Y schottii U
Y torreyi U
Y treculeana U
Zanthoxylum americanum U C
Z clava-herculis U
Z coriaceum U
Z fagara U
Z flavum U
Z hirsutum U

Annexe 5: Native tree species of New Zealand

Ackama rosifolia
Agathis australis
Alectryon excelsus
Aristotelia serrata
Ascarina lucida
Avicennia resinifera
Beilschmieda tarairi
B tawa
B tawaroa
Brachyglottis arborescens
B huntii
B repanda
B rotundifolia
B stewartiae
Carmichaelia australis
C silvatica
Carpodetus serratus
Chordospartium maurtai
Coprosma acutifolia
C arborea
C chathamica
C grandifolia
C linariifolia
C macrocarpa
C petiolata
Cordyline australis
C indivisa
Corynocarpus leavigatus
Cyanthea cunninghamii
C dealbata
C kermadecensis
C medullaris
C milnei
C smithii
Dacrycarpus dacrydioides
Dacrydium cupressinum
Dicksonia fibrosa
D squarrosa
Discaria toumatou
Dodonaea viscosa
Dracophyllum traversii
Dysoxylum specitabile
Elaeocarpus dentatus
E hookerianus
Enlingamita johnsonii
Entelea arborescens
Fuschsia excorticata
Griselinia littoralis
G lucida
Halocarpus biformis
H kirkii
Hedycarya arborea
Hoheria angustifolia
H glabrata
H lyallii
H populnea
H sextylosa
Homalanthus polyandrus
Ixerba brexioides
Knightia excelsa
Kunzea ericoides
Lagarostrobos colensoi
Laurelia novae-zelandiae
Lepidothamnus intermedius
Leptospermum scoparium
Libocedrus bidwillii
L plumosa
Litsea calicaris
Macropiper excelsum
Melicope ternata
Melicytus ramiflorus
Metrosideros bartletii
M excelsa
M kermadecensis
M robusta
M umbellata
Mida salicifolia
Monocotyledones
Myoporium kermadecense
M laetum
Myrsine australis
M oliveri
M salicina
Nestegis apetala
N cunninghamii
N lanceolata
N montana
Nothofagus fusca
N menziesii
N solandri
N truncata
Olearia albida
O avicenniifolia
O furfuracea
O ilicifolia
O lyallii
O paniculata
O rani
O townsonii
O traversii
O xmacrodonta
Pennantia baylisiana
P corymbosa
Phyllocladus aspleniifolius
P glaucus
P trichomanoides
Pisonia brunoniana
Pittosporum buchananii
P colensoi
P crassifolium
P dallii
P ellipticum
P eugeniodes
P fasciculatum
P huttonianum
P patulum
P tenuifolium
P turneri
P umbellatum
P virgatum
Plagianthus regius
Planachonella costat

Some facts about the Timber Committee

The Timber Committee is a principal subsidiary body of the UNECE (United Nations Economic Commission for Europe) based in Geneva. It constitutes a forum for cooperation and consultation between member countries on forestry, forest industry and forest product matters. All countries of Europe; the former USSR; United States, of America, Canada and Israel are members of the UNECE and participate in its work.

The UNECE Timber Committee shall, within the context of sustainable development, provide member countries with the information and services needed for policy- and decision-making regarding their forest and forest industry sector ("the sector"), including the trade and use of forest products and, when appropriate, formulate recommendations addressed to member Governments and interested organizations. To this end, it shall:

i. With the active participation of member countries, undertake short-, medium- and long-term analyses of developments in, and having an impact on, the sector, including those offering possibilities for the facilitation of international trade and for enhancing the protection of the environment;
ii. In support of these analyses, collect, store and disseminate statistics relating to the sector, and carry out activities to improve their quality and comparability;
iii. Provide the framework for cooperation e.g. by organizing seminars, workshops and ad hoc meetings and setting up time-limited ad hoc groups, for the exchange of economic, environmental and technical information between governments and other institutions of member countries that is needed for the development and implementation of policies leading to the sustainable development of the sector and to the protection of the environment in their respective countries;
iv. Carry out tasks identified by the UNECE or the Timber Committee as being of priority, including the facilitation of subregional cooperation and activities in support of the economies in transition of central and eastern Europe and of the countries of the region that are developing from an economic point of view;
v. It should also keep under review its structure and priorities and cooperate with other international and intergovernmental organizations active in the sector, and in particular with the FAO (Food and Agriculture Organization of the United Nations) and its European Forestry Commission and with the ILO (International Labour Organisation), in order to ensure complementarities and to avoid duplication, thereby optimizing the use of resources.

More information about the Committee's work may be obtained by writing to:

Timber Section
Trade Development and Timber Division
UN Economic Commission for Europe
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Fax: + 41 22 917 0041
E-mail: info.timber@unece.org

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2. Forest Products Statistics, 1997-2001 (database since 1964 on website)
3. Forest Products Annual Market Review, 2001-2002
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The Discussion Papers are available on request from the secretariat. Those interested in receiving these Discussion Papers on the continuing basis should contact the secretariat as well. Your comments are most welcome and will be referred to the authors:

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Biological Diversity, Tree Species Composition and Environmental Protection In Regional Fra-2000

This discussion paper is an attempt to complete and extend the analysis initiated in the FRA-2000 process, namely in the UNECE/FAO Temperate and Boreal Forest Assessment, published as *Forest Resources of Europe, CIS, North America, Australia, Japan and New Zealand.* This objective has been achieved both by publishing data that have so far only been accessible on the web or in the UNECE library, and also by taking this further through the provision of some additional research and analysis. The paper addresses the issues of forests' "naturalness", tree species, forest protected areas, endangered forest-dwelling and invasive species.

UNECE Timber Committee and FAO European Forestry Commission

Further information about forests and forest products, as well as information about the UNECE Timber Committee and the FAO European Forestry Commission is available on the website www.unece.org/trade/timber. Information about the UNECE may be found at www.unece.org and information about FAO may be found at www.fao.org.

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