

### Indicator 4.6 Genetic Resources

*Area managed for the conservation and utilization of forest tree genetic resources (in situ and ex situ genetic conservation) and area managed for seed production*

#### Introduction

The conservation and use of forest genetic resources is a vital component of sustainable forest management. Genetic diversity ensures that forest trees can survive, adapt and evolve under changing environmental conditions. Genetic diversity is also needed to maintain the vitality of forests and cope with pests and diseases. Forest management in Europe is largely based on the management of wild or semi-wild tree populations; the establishment of new forests through artificial or natural regeneration always involves the deployment of genetic material.

Following the establishment of the European Information System on Forest Genetic Resources (EUFGIS) in 2010, 34 European countries started to implement the “pan-European minimum requirements for dynamic genetic conservation units of forest trees” for the data reported as “area managed for *in situ* conservation”. The minimum requirements are based on the concept of the dynamic conservation of genetic diversity, which emphasizes the maintenance of evolutionary processes within tree populations to safeguard their potential for continuous adaptation.

*Ex situ* genetic conservation units consist of stands and clone collections established with collected or multiplied genetic material. Seeds from forest trees are produced in specific areas established (seed orchards) or selected (seed stands) for this purpose. Data on areas managed for *ex situ* genetic conservation and seed production have been collected consistently since 1990.

#### Status

A total of 38 countries reported their 2015 data on this indicator (or part of it) to the EUFORGEN Secretariat at Bioversity International (see Table 32 Output Tables, data per country). Of these countries, 36 had also provided the data in 2010, while only 25 provided the data in 1990 and 2000. Most countries (34) used the EUFGIS Portal (<http://portaleufgis.org>) to report areas managed for genetic conservation. The EUFGIS database is populated by national data providers and contained data on 3,213 units in January 2015. The units harbour a total of 4,057 tree populations and most of them (92%) are managed for *in situ* genetic conservation. The data reported on the area managed

for *ex situ* genetic conservation include both dynamic and static *ex situ* genetic conservation units. Areas managed for seed production include seed orchards and seed stands. Seed sources identified for seed collection in the national registers of basic material are excluded as they are not actively managed for seed production.

The total areas managed for genetic conservation per country do not provide adequate information to enable the assessment of the status of the genetic conservation of various tree species at pan-European level as their distribution ranges and biological characteristics vary considerably. Hence the countries were also requested to report the areas per tree species. In Annex 8: Output Tables 32, 33, 34 and 35 show species-specific data for the trees listed under the Council Directive (1999/105/EC) on the marketing of forest reproductive material. As the EUFGIS database provides geo-referenced data on the conservation units, the geographical distribution of the units was compared with the distribution maps of selected tree species with a view to drawing some conclusions on the geographical representativeness of the genetic conservation efforts at pan-European level.

#### Area managed for genetic resources

A total of 501,567 ha were managed for the *in situ* genetic conservation of forest trees in 38 countries in 2015. The total area managed for *ex situ* conservation is 11,553 ha in 37 countries; for seed production it is 1,027,434 ha in 38 countries. A total of 145 tree species (including subspecies and hybrids) were reported for this indicator. However, these species are not managed equally for genetic conservation (*in situ* and *ex situ*) and seed production. A large proportion of the trees targeted for *in situ* genetic conservation are widely occurring stand-forming tree species, which are important for forestry. A group of five economically relevant tree species (*Abies alba*, *Fagus sylvatica*, *Picea abies*, *Pinus sylvestris* and *Pinus pinaster*) alone account for 55% of the total area managed for *in situ* genetic conservation, while in the case of many other economically important tree species, only small areas are managed for the same purpose.

Furthermore, very few genetic conservation areas are managed for scattered tree species (e.g. *Populus nigra*, *Sorbus domestica*, *Tilia platyphyllos* and *Ulmus laevis*), which are often considered of low importance. However, while these species may not be economically important, they have a high value in terms of maintaining forest biodiversity and ensuring ecosystem stability.

The assessment of the geographical representativeness of the *in situ* genetic conservation areas in Europe showed a clear need for the intensification of genetic conservation efforts. Significant gaps in genetic conservation exist, even in the case of common forestry species, for which large areas are managed for genetic conservation (see Figure 72 and 73). The geographical representativeness of the genetic conservation areas is considerably lower for most other tree species in Europe. These gaps mean that a large amount of valuable genetic resources are not managed for long-term genetic conservation.

Regarding *ex situ* genetic conservation, the collected data also reveal an imbalance in the efforts made for three species alone (*Pinus sylvestris*, *Picea abies* and *Quercus robur*), which account for 60% of the total *ex situ* genetic conservation areas in Europe. One exotic species, *Pseudotsuga menziesii*, is the fifth most important in terms of number of hectares, but accounts for just 3% of the area managed for *ex situ* genetic conservation in Europe.

Six stand-forming species (*Pinus sylvestris*, *Fagus sylvatica*, *Picea abies*, *Quercus petraea*, *Quercus robur*, and *Abies alba*) account for 60% of the total area managed for seed production. This indicates a strong emphasis on a very small number of economically important species in seed production.

### Trends

Following the adoption of the Pan-European minimum requirements, which have been implemented by most European countries since 2010, it is possible to consistently analyse the trend for *in situ* genetic conservation areas for all European countries since 2010. Trends in *ex situ* genetic conservation and seed production can be examined between 1990 and 2015.

For the 34 countries that provided data in both 2010 and 2015, *in situ* genetic conservation between 2010 and 2015 displays some progress towards the conservation of the genetic resources of more tree species. In 2010, 74 % of the area managed for genetic conservation was composed of five economically important tree

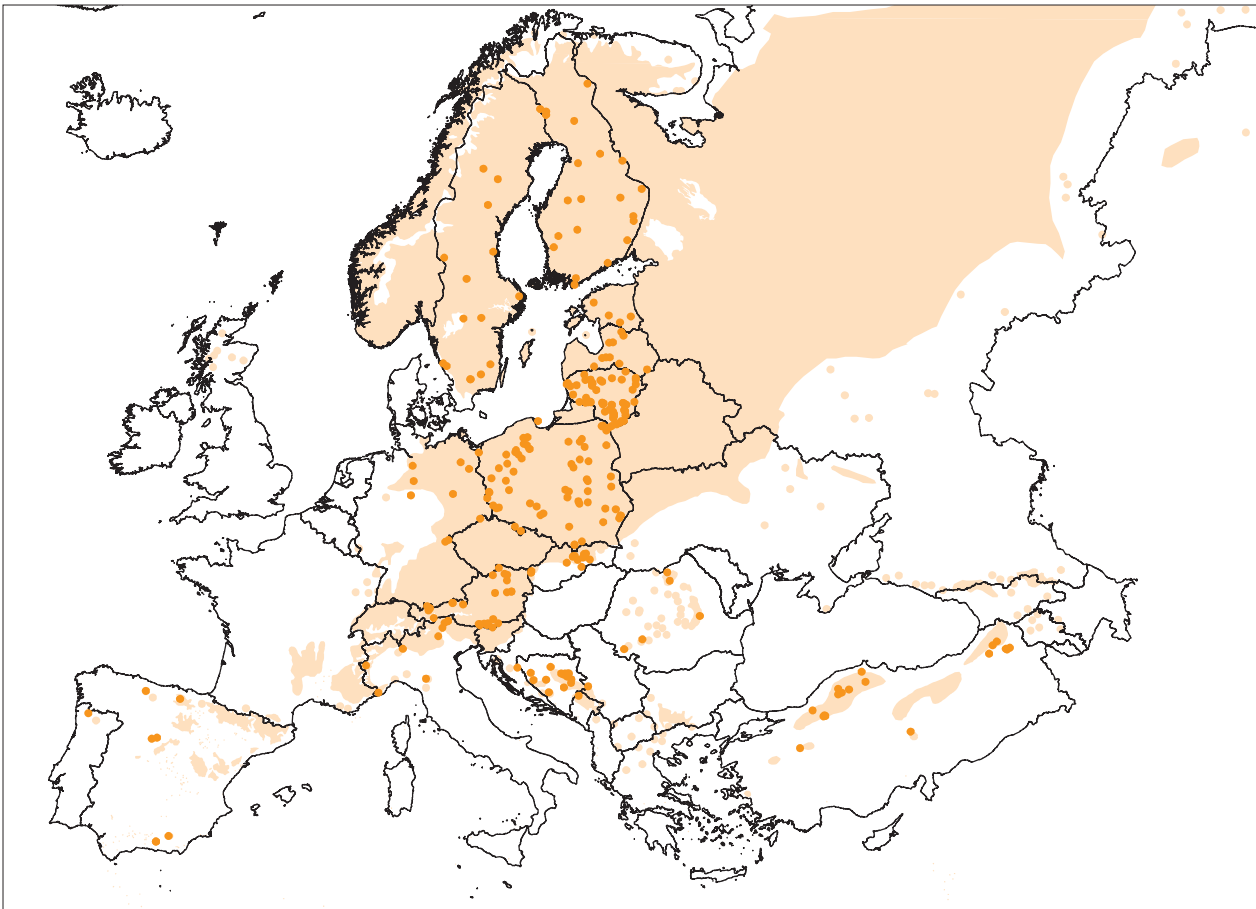


Figure 72. *Pinus sylvestris*: distribution range (shaded) and units managed for genetic conservation (dark dots). Data sources: EUFGIS Portal (<http://portale.eufgis.org>) and EUFORGEN ([www.euforgen.org](http://www.euforgen.org))

species, while in 2015 the same percentage included 12 species. In the case of many species, the *in situ* area declined in terms of hectares as a result of the harmonized definition. However, between 2010 and 2015, there was a considerable increase in the number of countries that have initiated conservation activities for new species and in the total number of genetic conservation units.

The areas managed for *in situ* conservation increased for 27 species (55%) and decreased for 19 species (39%). For 23 species, units were established in countries that did not conserve those species in 2010, representing a 50% increase in terms of the species.

The trend in areas managed for *ex situ* genetic conservation shows a continuous increase since 1990. The increase is more evident in Central-East Europe than the rest of Europe. While the total area managed for *ex situ* conservation tripled in the 28 countries that have reported data since 1990 (from 2,901 ha to 9,003 ha), it is possible to observe a general increase in the number of species conserved in each country. In the case of *ex situ*

conservation, 67% of the countries reported an increase in the number of species conserved.

Based on the 26 countries that consistently provided data on the areas managed for seed production, it is possible to observe an increase from 672,160 ha in 1990 to 983,759 in 2015. It is also possible to note a greater focus on this activity in Central-East Europe (in terms of number of hectares managed for seed production), which alone accounts for around half of the European conservation effort.

In terms of the area managed for seed production for different species between 2010 and 2015, despite a noticeable reduction in terms of total number of hectares, there was an increase in the number of countries that established new areas for species not considered previously: 85% percent of the countries reported an increase in the number of species managed for seed production and a reduction can only be observed for three exotic species.

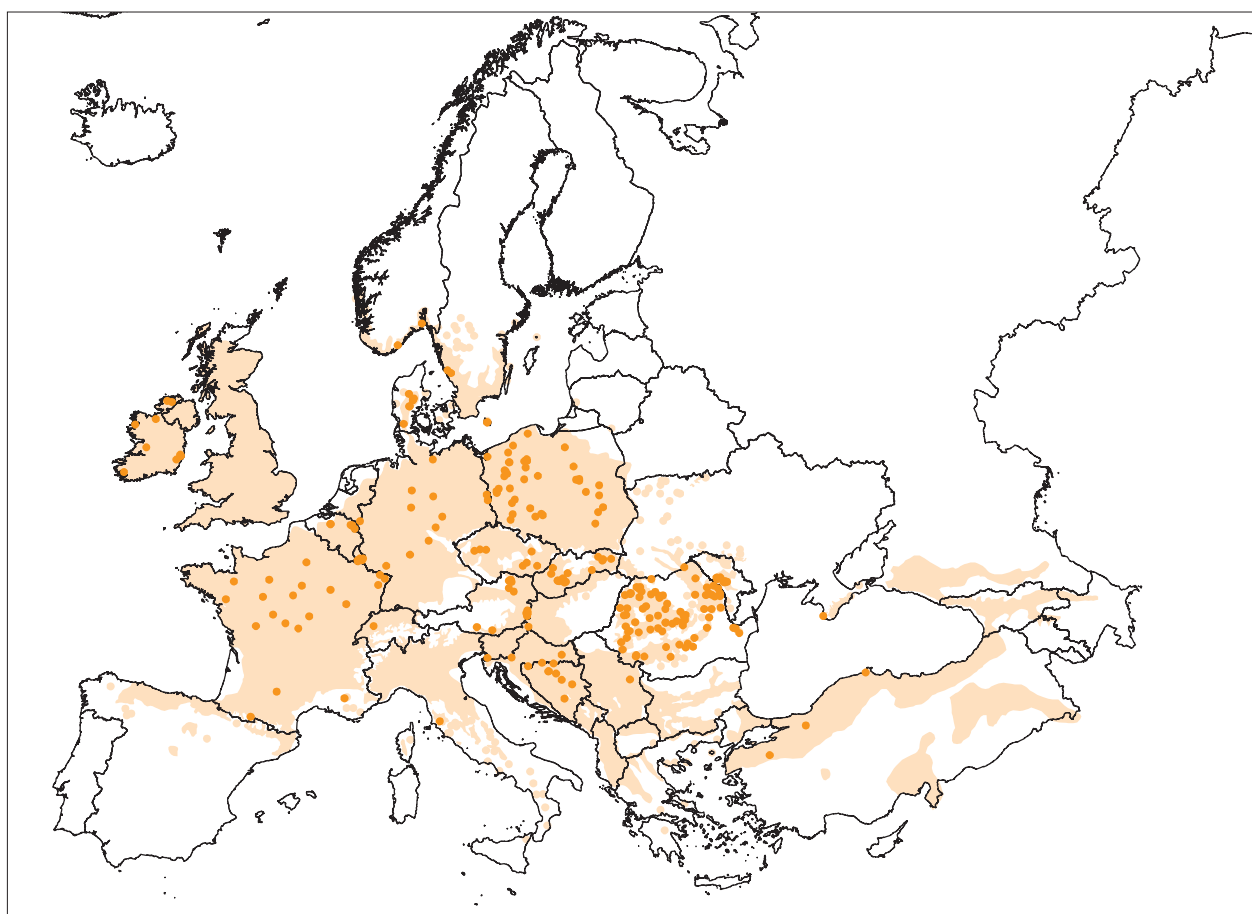


Figure 73. *Quercus petraea*: Distribution range (shaded) and units managed for genetic conservation (dark dots). (Data sources: EUFGIS Portal (<http://portal.eufgis.org>) and EUFORGEN ([www.euforgen.org](http://www.euforgen.org)))

**Table 32: Ind 4.6A Areas managed for conservation and utilisation of forest tree genetic resources (in situ and ex situ conservation) and areas managed for seed production by countries in 1990, 2000, 2005, 2010 and 2015**

| Reference year         | Area managed for in situ genetic conservation [ha] |         |         |         |        | Area managed for ex situ genetic conservation [ha] |       |       |       |       | Area managed for seed production [ha] |         |         |         |         |
|------------------------|--|---------|---------|---------|--------|--|-------|-------|-------|-------|---------------------------------------|---------|---------|---------|---------|
|                        | 1990   | 2000    | 2005    | 2010    | 2015   | 1990   | 2000  | 2005  | 2010  | 2015  | 1990                                  | 2000    | 2005    | 2010    | 2015    |
| Albania                | N.A.   | N.A.    | N.A.    | N.A.    | N.A.   | N.A.   | N.A.  | N.A.  | N.A.  | N.A.  | N.A.                                  | N.A.    | N.A.    | N.A.    | N.A.    |
| Andorra                | N.A.   | N.A.    | N.A.    | N.A.    | N.A.   | N.A.   | N.A.  | N.A.  | N.A.  | N.A.  | N.A.                                  | N.A.    | N.A.    | N.A.    | N.A.    |
| Austria                | 1,693  | 1       | 14,416  | 9,178   | 9,178  | 16   | 93    | 95    | 96    | 78    | N.A.                                  | N.A.    | 7,175   | 26,020  | 27,960  |
| Belarus                | 5,248  | 5,248   | 6,086   | 6,223   | 6,242  | 1,021  | 1,823 | 1,796 | 1,797 | 1,798 | 1,434                                 | 2,301   | 2,101   | 2,112   | 2,109   |
| Belgium                | 1,003  | 1,448   | 1,700   | 1,695   | 1,566  | 65   | 88    | 119   | 181   | 219   | 1,407                                 | 3,579   | 3,876   | 3,937   | 2,379   |
| Bosnia and Herzegovina | 3,559  | N.A.    | 4,942   | 2,905   | 3,277  | 11   | N.A.  | 11    | 67    | 72    | 1,766                                 | N.A.    | 3,233   | 2,972   | 3,349   |
| Bulgaria               | N.A.   | 131,744 | 145,105 | 60,051  | 90,791 | 161  | 514   | 540   | 856   | 352   | 50,035                                | 52,840  | 51,267  | 52,081  | 34,037  |
| Croatia                | 5,162  | 5,274   | 4,977   | 1,216   | 4,120  | 75   | 80    | 80    | 48    | 114   | 22                                    | 27      | 74      | 5,059   | 71,444  |
| Cyprus                 | 250  | 5,445   | 5,445   | N.A.    | 4,065  | N.A.   | N.A.  | 3     | 3     | 4     | 19                                    | 19      | 19      | 3       | 4,069   |
| Czech Republic         | 106,001  | 106,001 | 106,001 | 111,794 | 34,804 | 338  | 357   | 357   | 290   | 301   | 149,000                               | 137,361 | 111,794 | 217,357 | 141,950 |
| Denmark                | N.A.   | N.A.    | 4,650   | 2,880   | 2,880  | N.A.   | N.A.  | N.A.  | 40    | 76    | N.A.                                  | N.A.    | 1,632   | 1,550   | 1,388   |
| Estonia                | 3,551  | 3,224   | 3,195   | 2,878   | 2,878  | 222  | 256   | 227   | 230   | 254   | N.A.                                  | N.A.    | 2,546   | 2,429   | 2,398   |
| Finland                | 0  | 7,030   | 6,941   | 7,599   | 7,218  | 0  | 6     | 7     | 8     | 8     | 3,041                                 | 2,830   | 2,824   | 2,935   | 2,405   |
| France                 | N.A.   | 9,762   | 10,228  | 11,451  | 12,728 | N.A.   | 28    | 32    | 32    | 491   | 75,408                                | 66,254  | 60,695  | 63,566  | 61,858  |
| Georgia                | N.A.   | N.A.    | N.A.    | 809     | 809    | N.A.   | N.A.  | N.A.  | N.A.  | N.A.  | N.A.                                  | N.A.    | N.A.    | 1,120   | 1,032   |
| Germany                | 1,891  | 11,093  | 12,618  | 32,366  | 33,437 | 268  | 1,112 | 1,123 | 1,181 | 1,193 | 102                                   | 801     | 625     | 193,974 | 169,964 |
| Greece                 | 30,797   | 30,797  | 30,797  | 30,797  | 30,797 | 2  | 3     | 6     | 6     | 6     | N.A.                                  | N.A.    | 7,532   | 7,532   | 7,532   |
| Holy See               | N.A.   | N.A.    | N.A.    | N.A.    | N.A.   | N.A.   | N.A.  | N.A.  | N.A.  | N.A.  | N.A.                                  | N.A.    | N.A.    | N.A.    | N.A.    |
| Hungary                | N.A.   | N.A.    | 2,289   | 0       | 425    | 27   | 57    | 91    | 32    | 33    | 3,773                                 | 4,400   | 4,359   | 3,889   | 4,247   |
| Iceland                | 0  | 0       | 0       | 292     | 292    | 0  | 14    | 14    | 55    | 55    | 0                                     | 9       | 10      | 10      | 12      |
| Ireland                | N.A.   | N.A.    | N.A.    | 633     | 705    | 25   | 29    | 29    | 82    | 29    | 2,282                                 | N.A.    | 3,828   | 4,343   | 4,502   |
| Italy                  | 92,914   | 92,914  | 92,914  | 59,787  | 62,660 | 49   | 34    | 34    | 184   | 204   | 13                                    | 13      | 13      | 286     | 37,455  |
| Latvia                 | 4,950  | 5,565   | 4,883   | 4,888   | 4,888  | 238  | 328   | 438   | 539   | 607   | 7,583                                 | 7,452   | 7,067   | 1,445   | 705     |
| Liechtenstein          | N.A.   | N.A.    | 1,278   | 1,278   | 1,274  | N.A.   | N.A.  | N.A.  | N.A.  | 0     | N.A.                                  | 51      | 51      | 51      | 434     |
| Lithuania              | 3,081  | 3,144   | 4,650   | 3,626   | 3,621  | 25   | 35    | 35    | 90    | 1,071 | 1,310                                 | 1,450   | 1,992   | 2,547   | 2,385   |
| Luxembourg             | 0  | 0       | 0       | 995     | 1,434  | 0  | 0     | 6     | 17    | 47    | 106                                   | N.A.    | 144     | 144     | 185     |
| Malta                  | N.A.   | N.A.    | N.A.    | N.A.    | 555    | N.A.   | N.A.  | N.A.  | N.A.  | 0     | N.A.                                  | N.A.    | N.A.    | N.A.    | 0       |
| Moldova                | N.A.   | 1,991   | 1,991   | 2,171   | N.A.   | N.A.   | 25    | 25    | 63    | N.A.  | N.A.                                  | 31      | 31      | 67      | N.A.    |
| Monaco                 | N.A.   | N.A.    | N.A.    | N.A.    | N.A.   | N.A.   | N.A.  | N.A.  | N.A.  | N.A.  | N.A.                                  | N.A.    | N.A.    | N.A.    | N.A.    |
| Montenegro             | N.A.   | N.A.    | N.A.    | N.A.    | N.A.   | N.A.   | N.A.  | N.A.  | N.A.  | N.A.  | N.A.                                  | N.A.    | N.A.    | N.A.    | N.A.    |
| Netherlands            | 0  | 0       | 0       | 330     | 330    | 0  | 5     | 12    | 6     | 6     | 28                                    | 47      | 47      | 62      | 62      |
| Norway                 | 20   | 48      | 48      | 13,763  | 13,764 | N.A.   | 78    | 78    | 78    | 69    | 207                                   | 217     | 217     | 217     | 211     |
| Poland                 | 0  | 4,737   | 5,258   | 6,070   | 6,242  | 0  | 45    | 584   | 865   | 1,285 | 223,331                               | 226,068 | 222,086 | 211,516 | 196,208 |
| Portugal               | 0  | 0       | 0       | 42      | 142    | 0  | 91    | 104   | 50    | 50    | N.A.                                  | 23,855  | 25,294  | 26,349  | 26,349  |
| Romania                | 0  | 10,702  | 12,150  | 11,008  | 10,559 | 114  | 129   | 135   | 385   | 683   | 59,058                                | 59,058  | 59,775  | 59,775  | 40,209  |
| Russian Federation *   | 26,621   | 25,927  | 91,623  | N.A.    | N.A.   | 1  | 17    | 241   | N.A.  | N.A.  | 153                                   | 1,970   | 1,201   | N.A.    | N.A.    |
| Serbia                 | N.A.   | N.A.    | 78,419  | 337     | 337    | 13   | 16    | 16    | 18    | 20    | N.A.                                  | 2,060   | 1,902   | 1,628   | 1,625   |
| Slovakia               | N.A.   | 9,631   | 21,540  | 33,139  | 33,429 | 232  | 381   | 373   | 810   | 352   | 51,860                                | 59,072  | 60,388  | 68,400  | 68,930  |
| Slovenia               | 0  | 0       | 0       | 1,135   | 1,101  | 0  | 0     | 0     | 6     | 3     | 2,399                                 | 2,295   | 3,567   | 4,081   | 4,280   |
| Spain                  | 0  | 0       | 320     | 4,820   | 50,513 | 0  | 10    | 52    | 71    | 74    | 0                                     | 33,560  | 29,642  | 17,869  | 19,108  |
| Sweden                 | 520  | 520     | 520     | 520     | 559    | 0  | 26    | 26    | 21    | 12    | 0                                     | 4,054   | 4,054   | 4,081   | 2,735   |
| Switzerland            | N.A.   | N.A.    | 1,464   | 952     | 1,426  | N.A.   | N.A.  | N.A.  | 0     | 4     | N.A.                                  | 2,270   | 2,680   | 3,622   | 3,682   |
| FYROM                  | N.A.   | N.A.    | N.A.    | 967     | N.A.   | N.A.   | N.A.  | N.A.  | 117   | N.A.  | N.A.                                  | N.A.    | N.A.    | 306     | N.A.    |
| Turkey                 | N.A.   | 20,387  | 27,477  | 34,615  | 37,326 | 24   | 27    | 38    | 118   | 125   | 35,916                                | 45,377  | 46,219  | 43,773  | 47,436  |
| Ukraine                | 29,075   | 30,363  | 26,566  | 25,812  | 25,715 | 121  | 397   | 397   | N.A.  | 1,827 | 1,445                                 | 1,490   | 1,490   | 16,091  | 18,919  |
| United Kingdom         | N.A.   | 17,882  | 17,882  | 0       | 0      | 177  | 249   | 256   | 18    | 18    | 2,372                                 | 2,621   | 2,245   | 13,867  | 13,867  |

\* Data received only for the Komi, Arkhangelsk, Karelia and Vologda Regions

Source: European Forest Genetic Resources Programme, Bioversity International

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**Table 33: Ind 4.6B Areas managed for in situ conservation of forest tree genetic resources by selected tree species in 1990, 2000, 2005, 2010 and 2015**

| Species                      | 1990    |                  | 2000    |                  | 2005    |                  | 2010    |                  | 2015   |                  |
|------------------------------|---------|------------------|---------|------------------|---------|------------------|---------|------------------|--------|------------------|
|                              | ha      | number countries | ha      | number countries | ha      | number countries | ha      | number countries | ha     | number countries |
| <i>Abies alba</i>            | 33,860  | 9                | 48,545  | 13               | 52,729  | 15               | 36,315  | 15               | 36,060 | 16               |
| <i>Abies cephalonica</i>     | -       | -                | -       | -                | -       | -                | -       | -                | -      | -                |
| <i>Abies grandis</i>         | -       | -                | 3       | 1                | 20      | 3                | 18      | 2                | 45     | 2                |
| <i>Abies pinsapo</i>         | -       | -                | -       | -                | 100     | 1                | 100     | 1                | 361    | 2                |
| <i>Acer platanoides</i>      | 235     | 2                | 249     | 4                | 544     | 7                | 1,025   | 10               | 951    | 9                |
| <i>Acer pseudoplatanus</i>   | 22,558  | 4                | 22,856  | 9                | 23,211  | 11               | 4,886   | 10               | 4,821  | 11               |
| <i>Alnus glutinosa</i>       | 734     | 8                | 1,232   | 14               | 1,616   | 16               | 1,440   | 13               | 1,631  | 19               |
| <i>Alnus incana</i>          | 10      | 1                | 115     | 2                | 132     | 4                | 83      | 6                | 686    | 5                |
| <i>Betula pendula</i>        | 4,970   | 5                | 6,452   | 10               | 6,556   | 11               | 2,042   | 13               | 2,963  | 13               |
| <i>Betula pubescens</i>      | 73      | 2                | 743     | 5                | 863     | 6                | 1,422   | 6                | 1,861  | 6                |
| <i>Carpinus betulus</i>      | 4,808   | 6                | 6,481   | 10               | 7,146   | 12               | 3,045   | 15               | 4,016  | 16               |
| <i>Castanea sativa</i>       | 25      | 2                | 902     | 3                | 934     | 7                | 1,023   | 6                | 1,508  | 8                |
| <i>Cedrus atlantica</i>      | -       | -                | -       | -                | -       | -                | -       | -                | 43     | 2                |
| <i>Cedrus libani</i>         | -       | -                | -       | -                | -       | -                | 2,735   | 1                | 2,555  | 2                |
| <i>Fagus sylvatica</i>       | 105,105 | 8                | 149,784 | 13               | 166,509 | 17               | 77,990  | 20               | 76,131 | 22               |
| <i>Fraxinus angustifolia</i> | 351     | 2                | 746     | 4                | 835     | 3                | 947     | 7                | 6,872  | 9                |
| <i>Fraxinus excelsior</i>    | 8,064   | 6                | 10,373  | 12               | 11,497  | 17               | 5,444   | 19               | 5,428  | 20               |
| <i>Larix decidua</i>         | 28,478  | 8                | 29,902  | 11               | 30,495  | 12               | 13,052  | 10               | 9,918  | 11               |
| <i>Larix x eurolepis</i>     | 19      | 2                | 29      | 2                | 32      | 3                | 5       | 2                | 5      | 1                |
| <i>Larix kaempferi</i>       | 15      | 2                | 11      | 1                | 42      | 2                | 71      | 2                | 16     | 1                |
| <i>Larix sibirica</i>        | 1,924   | 1                | 1,924   | 1                | 3,989   | 1                | 0       | 1                | 0      | 1                |
| <i>Picea abies</i>           | 85,482  | 14               | 126,804 | 18               | 156,284 | 21               | 127,698 | 22               | 76,847 | 23               |
| <i>Picea sitchensis</i>      | -       | -                | 2       | 1                | 4       | 2                | 6       | 1                | -      | -                |
| <i>Pinus brutia</i>          | 26      | 1                | 7,862   | 2                | 8,820   | 2                | 8,696   | 2                | 8,325  | 3                |
| <i>Pinus canariensis</i>     | -       | -                | -       | -                | -       | -                | -       | -                | 2,426  | 1                |
| <i>Pinus cembra</i>          | 1,206   | 3                | 2,105   | 6                | 2,106   | 6                | 3,299   | 5                | 3,938  | 7                |
| <i>Pinus contorta</i>        | -       | -                | -       | -                | 1       | 1                | -       | -                | -      | -                |
| <i>Pinus halepensis</i>      | 1,982   | 2                | 1,898   | 2                | 1,858   | 3                | 4,660   | 3                | 6,957  | 3                |
| <i>Pinus leucodermis</i>     | 3,160   | 2                | 3,354   | 2                | 4,381   | 3                | 2,333   | 3                | 1,146  | 2                |
| <i>Pinus nigra</i>           | 636     | 4                | 13,463  | 8                | 15,992  | 10               | 11,293  | 13               | 24,022 | 11               |
| <i>Pinus pinaster</i>        | 2,923   | 2                | 2,922   | 2                | 2,905   | 3                | 5,826   | 5                | 43,758 | 5                |
| <i>Pinus pinea</i>           | 589     | 2                | 904     | 3                | 893     | 3                | 4,254   | 1                | 4,538  | 2                |
| <i>Pinus radiata</i>         | -       | -                | -       | -                | -       | -                | -       | -                | -      | -                |
| <i>Pinus sylvestris</i>      | 27,826  | 13               | 77,990  | 19               | 120,858 | 22               | 42,758  | 20               | 45,041 | 20               |
| <i>Populus alba</i>          | -       | -                | 43      | 2                | 64      | 2                | 155     | 5                | 115    | 5                |
| <i>Populus nigra</i>         | 637     | 1                | 683     | 4                | 725     | 4                | 1,135   | 6                | 2,677  | 8                |
| <i>Populus tremula</i>       | 297     | 3                | 1,010   | 7                | 1,495   | 8                | 1,329   | 9                | 1,624  | 9                |
| <i>Prunus avium</i>          | 2,328   | 4                | 2,395   | 6                | 2,618   | 8                | 1,222   | 11               | 1,129  | 13               |
| <i>Pseudotsuga menziesii</i> | 248     | 4                | 707     | 5                | 874     | 7                | 538     | 3                | 1,513  | 5                |
| <i>Quercus cerris</i>        | 2,391   | 2                | 4,958   | 5                | 4,868   | 6                | 1,810   | 8                | 4,389  | 7                |
| <i>Quercus ilex</i>          | 2,542   | 1                | 2,608   | 2                | 2,567   | 2                | 748     | 2                | 1,772  | 4                |
| <i>Quercus petraea</i>       | 15,177  | 8                | 32,207  | 14               | 32,839  | 19               | 14,286  | 23               | 22,315 | 23               |
| <i>Quercus pubescens</i>     | 2,993   | 2                | 3,332   | 5                | 3,377   | 7                | 959     | 7                | 985    | 7                |
| <i>Quercus robur</i>         | 20,471  | 10               | 23,939  | 14               | 25,195  | 19               | 13,747  | 21               | 19,416 | 24               |
| <i>Quercus rubra</i>         | 28      | 3                | 48      | 3                | 152     | 4                | 341     | 5                | 290    | 2                |
| <i>Quercus suber</i>         | -       | -                | -       | -                | -       | -                | 101     | 2                | 85     | 2                |
| <i>Robinia pseudoacacia</i>  | 14      | 2                | 193     | 3                | 314     | 6                | 195     | 3                | 191    | 2                |
| <i>Tilia cordata</i>         | 6,215   | 6                | 6,533   | 11               | 7,003   | 13               | 1,391   | 14               | 1,029  | 15               |
| <i>Tilia platyphyllos</i>    | 233     | 2                | 906     | 4                | 1,113   | 6                | 270     | 6                | 393    | 6                |

Source: European Forest Genetic Resources Programme, Biodiversity International

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**Table 34: Ind 4.6C Areas managed for ex situ conservation of forest tree genetic resources by selected tree species in 1990, 2000, 2005, 2010 and 2015**

| Species                      | 1990    |                  | 2000    |                  | 2005    |                  | 2010    |                  | 2015    |                  |
|------------------------------|---------|------------------|---------|------------------|---------|------------------|---------|------------------|---------|------------------|
|                              | ha      | number countries | ha      | number countries | ha      | number countries | ha      | number countries | ha      | number countries |
| <i>Abies alba</i>            | 30.8    | 8                | 124.8   | 12               | 183.8   | 12               | 307.3   | 12               | 309.7   | 14               |
| <i>Abies cephalonica</i>     | 0.5     | 1                | 0.5     | 1                | 0.5     | 1                | 6       | 1                | 18.5    | 2                |
| <i>Abies grandis</i>         | 7.9     | 3                | 8.5     | 4                | 12.3    | 4                | 23.1    | 7                | 19.9    | 7                |
| <i>Abies pinsapo</i>         | -       | 0                | -       | 0                | -       | 0                | -       | 0                | 3.3     | 1                |
| <i>Acer platanoides</i>      | -       | 0                | 1.2     | 1                | 1.9     | 2                | 11.7    | 5                | 5.2     | 4                |
| <i>Acer pseudoplatanus</i>   | 23.1    | 3                | 35.8    | 7                | 90      | 7                | 32.1    | 6                | 32.2    | 8                |
| <i>Alnus glutinosa</i>       | 5.8     | 5                | 19.6    | 7                | 55.4    | 9                | 37.9    | 6                | 92.6    | 11               |
| <i>Alnus incana</i>          | 3.2     | 2                | 2.2     | 2                | 2.2     | 2                | 1.6     | 1                | 3.6     | 2                |
| <i>Betula pendula</i>        | 7.8     | 2                | 94.7    | 3                | 127.3   | 5                | 169.3   | 9                | 200.9   | 10               |
| <i>Betula pubescens</i>      | 1       | 1                | 4.9     | 2                | 6.9     | 3                | 10.1    | 2                | 14.1    | 3                |
| <i>Carpinus betulus</i>      | -       | 0                | 8.4     | 2                | 10.5    | 3                | 6.3     | 3                | 3.9     | 2                |
| <i>Castanea sativa</i>       | -       | 0                | 10      | 1                | 11.6    | 1                | 18.6    | 3                | 32.5    | 4                |
| <i>Cedrus atlantica</i>      | 4.5     | 1                | 4.5     | 1                | 4.5     | 1                | 7.1     | 3                | 10.5    | 5                |
| <i>Cedrus libani</i>         | 3.3     | 1                | 3.3     | 1                | 3.3     | 1                | 5.5     | 3                | 16.7    | 3                |
| <i>Fagus sylvatica</i>       | 75.3    | 2                | 232.7   | 6                | 267.7   | 6                | 300.3   | 13               | 113.7   | 13               |
| <i>Fraxinus angustifolia</i> | -       | 0                | 0.2     | 1                | 0.7     | 1                | 0.5     | 1                | 14.7    | 4                |
| <i>Fraxinus excelsior</i>    | 5.5     | 1                | 26.7    | 11               | 51.3    | 12               | 64.8    | 12               | 109.4   | 13               |
| <i>Larix decidua</i>         | 247.4   | 12               | 302.8   | 12               | 328.4   | 14               | 275.4   | 14               | 339.1   | 14               |
| <i>Larix x eurolepis</i>     | 5.1     | 2                | 14.8    | 3                | 18.8    | 4                | 43.7    | 3                | 41.2    | 3                |
| <i>Larix kaempferi</i>       | 1.6     | 2                | 2.8     | 2                | 9.8     | 3                | 2.3     | 2                | 5.1     | 4                |
| <i>Larix sibirica</i>        | -       | 0                | 4       | 1                | 10.3    | 2                | 5       | 1                | 6.2     | 2                |
| <i>Picea abies</i>           | 618.6   | 14               | 956.5   | 18               | 1,284.8 | 20               | 1,338.1 | 18               | 1,506   | 22               |
| <i>Picea sitchensis</i>      | 84.9    | 5                | 131.6   | 7                | 131.6   | 7                | 47.1    | 6                | 54.9    | 8                |
| <i>Pinus brutia</i>          | 10.1    | 2                | 10.1    | 2                | 20      | 2                | 102.5   | 2                | 135.7   | 2                |
| <i>Pinus canariensis</i>     | -       | 0                | -       | 0                | -       | 0                | -       | 0                | 270.3   | 2                |
| <i>Pinus cembra</i>          | 21.8    | 4                | 33      | 4                | 34      | 4                | 17.5    | 2                | 2.4     | 1                |
| <i>Pinus contorta</i>        | 38      | 3                | 39.4    | 4                | 40.5    | 5                | 27.2    | 4                | 48.9    | 9                |
| <i>Pinus halepensis</i>      | 22.6    | 2                | 17      | 2                | 17      | 2                | 10      | 1                | 12      | 2                |
| <i>Pinus leucodermis</i>     | -       | 0                | -       | 0                | -       | 0                | 2       | 1                | -       | 0                |
| <i>Pinus nigra</i>           | 55.6    | 8                | 78.9    | 8                | 151.7   | 9                | 291.1   | 8                | 298.1   | 12               |
| <i>Pinus pinaster</i>        | 5.6     | 1                | 58.4    | 2                | 58.4    | 2                | 25.6    | 3                | 23.9    | 4                |
| <i>Pinus pinea</i>           | 9.1     | 1                | 9.1     | 1                | 9.1     | 1                | 2       | 1                | 36.1    | 4                |
| <i>Pinus radiata</i>         | 8.8     | 2                | 8.8     | 2                | 8.8     | 2                | 10      | 1                | 7.4     | 3                |
| <i>Pinus sylvestris</i>      | 1,608.1 | 17               | 2,443.4 | 18               | 2,673.5 | 20               | 2,580   | 21               | 4,294.8 | 23               |
| <i>Populus alba</i>          | 2.3     | 1                | 2.1     | 1                | 12.1    | 2                | 13.4    | 6                | 17.8    | 6                |
| <i>Populus nigra</i>         | 3.1     | 2                | 115.3   | 6                | 117.6   | 9                | 44.4    | 8                | 69.5    | 11               |
| <i>Populus tremula</i>       | 3.2     | 2                | 4.5     | 4                | 31.2    | 5                | 53.3    | 5                | 22.4    | 5                |
| <i>Prunus avium</i>          | 2.8     | 2                | 25.4    | 7                | 65.1    | 9                | 67.6    | 11               | 67.9    | 14               |
| <i>Pseudotsuga menziesii</i> | 108.9   | 9                | 663.9   | 9                | 258     | 10               | 318.1   | 14               | 325.6   | 16               |
| <i>Quercus cerris</i>        | -       | 0                | -       | 0                | -       | 0                | 6       | 1                | 3       | 1                |
| <i>Quercus ilex</i>          | -       | 0                | -       | 0                | -       | 0                | 2       | 1                | 292.8   | 2                |
| <i>Quercus petraea</i>       | 50      | 5                | 42.7    | 9                | 70.6    | 11               | 140.7   | 11               | 258     | 14               |
| <i>Quercus pubescens</i>     | 3.6     | 1                | 4.7     | 3                | 1.1     | 2                | 1       | 1                | -       | 0                |
| <i>Quercus robur</i>         | 90.2    | 9                | 480.5   | 16               | 792.5   | 17               | 481.2   | 17               | 1,184.2 | 18               |
| <i>Quercus rubra</i>         | -       | 0                | 8.4     | 3                | 8.4     | 3                | 82.2    | 5                | 70.1    | 6                |
| <i>Quercus suber</i>         | -       | 0                | 48.8    | 2                | 48.8    | 2                | 37.6    | 3                | 17.5    | 3                |
| <i>Robinia pseudoacacia</i>  | -       | 0                | 76.1    | 2                | 65.8    | 2                | 186.3   | 7                | 216.3   | 7                |
| <i>Tilia cordata</i>         | 1.7     | 1                | 13      | 4                | 28.3    | 7                | 20.2    | 6                | 48.5    | 10               |
| <i>Tilia platyphyllos</i>    | -       | 0                | 2.4     | 1                | 1.3     | 2                | -       | 0                | 17.3    | 2                |

Source: European Forest Genetic Resources Programme, Bioversity International

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Table 35: Ind 4.6D Areas managed for seed production by selected tree species in 1990, 2000, 2005, 2010 and 2015

| Species                      | 1990    |                  | 2000    |                  | 2005    |                  | 2010    |                  | 2015    |                  |
|------------------------------|---------|------------------|---------|------------------|---------|------------------|---------|------------------|---------|------------------|
|                              | ha      | number countries | ha      | number countries | ha      | number countries | ha      | number countries | ha      | number countries |
| <i>Abies alba</i>            | 33,017  | 12               | 27,741  | 14               | 27,258  | 18               | 64,291  | 20               | 50,529  | 23               |
| <i>Abies cephalonica</i>     | 0       | 1                | 2       | 1                | 1,568   | 2                | 1,568   | 2                | 1,568   | 2                |
| <i>Abies grandis</i>         | 9       | 3                | 13      | 4                | 23      | 7                | 79      | 7                | 192     | 8                |
| <i>Abies pinsapo</i>         | 0       | 1                | -       | 0                | -       | 0                | 0       | 1                | 3       | 2                |
| <i>Acer platanoides</i>      | 46      | 5                | 78      | 9                | 99      | 11               | 400     | 12               | 209     | 16               |
| <i>Acer pseudoplatanus</i>   | 345     | 9                | 657     | 14               | 1,644   | 19               | 25,665  | 18               | 4,655   | 23               |
| <i>Alnus glutinosa</i>       | 1,448   | 10               | 1,957   | 15               | 2,198   | 18               | 3,727   | 20               | 12,585  | 22               |
| <i>Alnus incana</i>          | 0       | 1                | 6       | 3                | 14      | 6                | 59      | 8                | 1,470   | 10               |
| <i>Betula pendula</i>        | 1,025   | 9                | 1,485   | 16               | 1,397   | 17               | 1,345   | 19               | 10,104  | 20               |
| <i>Betula pubescens</i>      | 1       | 3                | 135     | 8                | 174     | 9                | 137     | 8                | 230     | 9                |
| <i>Carpinus betulus</i>      | 557     | 3                | 789     | 8                | 750     | 11               | 5,586   | 14               | 5,035   | 15               |
| <i>Castanea sativa</i>       | 537     | 4                | 547     | 6                | 991     | 10               | 1,284   | 14               | 1,864   | 19               |
| <i>Cedrus atlantica</i>      | 1,441   | 2                | 807     | 4                | 721     | 3                | 762     | 3                | 803     | 4                |
| <i>Cedrus libani</i>         | 2,861   | 1                | 3,643   | 1                | 3,592   | 1                | 3,651   | 2                | 3,697   | 3                |
| <i>Fagus sylvatica</i>       | 68,893  | 14               | 80,057  | 17               | 79,988  | 23               | 208,857 | 23               | 134,988 | 24               |
| <i>Fraxinus angustifolia</i> | 101     | 3                | 626     | 7                | 750     | 8                | 493     | 7                | 36,912  | 12               |
| <i>Fraxinus excelsior</i>    | 2,628   | 12               | 3,213   | 20               | 4,175   | 24               | 14,901  | 23               | 6,404   | 25               |
| <i>Larix decidua</i>         | 6,873   | 14               | 7,061   | 18               | 8,485   | 22               | 17,210  | 21               | 11,814  | 23               |
| <i>Larix x eurolepis</i>     | 111     | 5                | 124     | 7                | 150     | 9                | 155     | 9                | 140     | 10               |
| <i>Larix kaempferi</i>       | 201     | 7                | 172     | 7                | 167     | 8                | 838     | 7                | 200     | 8                |
| <i>Larix sibirica</i>        | 49      | 2                | 183     | 3                | 84      | 3                | 139     | 3                | 62      | 2                |
| <i>Picea abies</i>           | 163,798 | 22               | 153,202 | 21               | 129,816 | 26               | 151,074 | 26               | 116,407 | 29               |
| <i>Picea sitchensis</i>      | 1,030   | 6                | 403     | 8                | 1,041   | 10               | 1,133   | 10               | 1,149   | 8                |
| <i>Pinus brutia</i>          | 8,038   | 2                | 12,091  | 2                | 12,714  | 3                | 13,166  | 4                | 13,242  | 5                |
| <i>Pinus canariensis</i>     | -       | 0                | -       | 0                | 108     | 1                | 146     | 1                | 24,895  | 3                |
| <i>Pinus cembra</i>          | 13      | 3                | 202     | 6                | 1,729   | 7                | 2,187   | 7                | 3,874   | 9                |
| <i>Pinus contorta</i>        | 191     | 2                | 950     | 3                | 965     | 5                | 2,048   | 5                | 1,061   | 5                |
| <i>Pinus halepensis</i>      | 331     | 4                | 477     | 4                | 2,176   | 8                | 2,176   | 7                | 6,738   | 8                |
| <i>Pinus leucodermis</i>     | 61      | 1                | 77      | 2                | 307     | 3                | 273     | 3                | 265     | 3                |
| <i>Pinus nigra</i>           | 20,373  | 15               | 38,592  | 18               | 38,611  | 23               | 27,709  | 21               | 30,320  | 22               |
| <i>Pinus pinaster</i>        | 1,506   | 3                | 5,730   | 4                | 7,198   | 6                | 15,075  | 6                | 17,520  | 8                |
| <i>Pinus pinea</i>           | 1,496   | 2                | 4,214   | 3                | 5,841   | 5                | 5,641   | 5                | 9,142   | 5                |
| <i>Pinus radiata</i>         | 40      | 3                | 5       | 2                | 155     | 5                | 231     | 3                | 223     | 4                |
| <i>Pinus sylvestris</i>      | 63,132  | 23               | 77,189  | 25               | 69,536  | 32               | 81,029  | 31               | 170,404 | 33               |
| <i>Populus alba</i>          | 33      | 4                | 32      | 4                | 58      | 5                | 154     | 4                | 145     | 6                |
| <i>Populus nigra</i>         | 5       | 1                | 105     | 4                | 88      | 5                | 7       | 2                | 15,173  | 10               |
| <i>Populus tremula</i>       | 220     | 4                | 183     | 7                | 164     | 6                | 378     | 6                | 782     | 7                |
| <i>Prunus avium</i>          | 315     | 7                | 643     | 11               | 830     | 16               | 3,884   | 21               | 1,570   | 21               |
| <i>Pseudotsuga menziesii</i> | 1,835   | 15               | 2,139   | 19               | 2,079   | 24               | 5,673   | 27               | 2,510   | 26               |
| <i>Quercus cerris</i>        | 2,451   | 3                | 3,143   | 7                | 3,072   | 9                | 5,191   | 9                | 5,011   | 11               |
| <i>Quercus ilex</i>          | -       | 0                | 1,855   | 1                | 3,437   | 3                | 3,157   | 4                | 7,676   | 6                |
| <i>Quercus petraea</i>       | 40,609  | 15               | 41,450  | 17               | 46,982  | 22               | 93,945  | 23               | 68,579  | 24               |
| <i>Quercus pubescens</i>     | 41      | 2                | 57      | 4                | 43      | 5                | 241     | 6                | 380     | 7                |
| <i>Quercus robur</i>         | 18,049  | 18               | 19,186  | 23               | 19,944  | 28               | 32,499  | 26               | 65,254  | 27               |
| <i>Quercus rubra</i>         | 1,020   | 8                | 1,516   | 17               | 1,630   | 18               | 2,389   | 16               | 1,945   | 18               |
| <i>Quercus suber</i>         | 10      | 1                | 16,480  | 2                | 19,656  | 3                | 19,819  | 3                | 21,119  | 5                |
| <i>Robinia pseudoacacia</i>  | 1,425   | 5                | 1,714   | 7                | 1,916   | 10               | 1,917   | 11               | 3,462   | 12               |
| <i>Tilia cordata</i>         | 743     | 6                | 1,047   | 15               | 1,605   | 17               | 8,585   | 15               | 4,113   | 17               |
| <i>Tilia platyphyllos</i>    | 154     | 3                | 737     | 6                | 608     | 7                | 731     | 9                | 257     | 10               |

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