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Summary

On the basis of EU Community rules (Directives) regarding the marketing of forest reproductive material member states should create and apply delimitations of regions of provenance for those species and artificial hybrids that are mentioned in those Directives (the so called EU-species).
Most of the time artificial border lines like country borders are being used for the delimitation of those regions of provenance. This study describes an inventory of the present situation regarding the delimitations of regions of provenance in 5 Western European countries. An overview is given for the situation at the year 2000 regarding regions of provenance in The Netherlands, Germany, Belgium, Luxembourg and France. At the same time the used criteria are given that served as the basis for the delimitation of these regions of provenance. In all five countries the country borders serve as (outside) borderlines for the regions of provenance. In The Netherlands, Belgium and Luxembourg a relative small number of regions of provenance are delimitated for all EU-species. In case of the Netherlands the whole country is considered to be one region of provenance. The system that has been used for both Belgium and Luxembourg is similar. Both these two countries consist of two regions of provenance each. In these two countries administrative criteria as well as geographic and climatologic criteria have been used for the delimitation of these two regions of provenance. In this study the German system of delimitation of regions of provenance is extensively covered. The German system can be recognised by the very detailed way of classification of the country into regions of provenance. For all species covered by the German law separate regions of provenance are delimitated. In total Germany identified 178 regions of provenance. All of those regions of provenance are separated by one another on the basis of ecological criteria as well as on phenotypic and genetic characteristics of the species concerned. Another important factor is that in the German system the relevancy of the species for a certain area is also considered in this classification. Delimitation on the basis of ecological circumstances is carried out both horizontal as well as vertical. Basically 46 ecological base units have been used for the horizontal delimitation. These ecological base units are composed on forestry principles regarding growing areas and growing districts. By adjusting the horizontal delimitation with regard to altitude a vertical delimitation is created. Also in France the regions of provenance are delimitated by species. The French system however differs quite a lot compared to the zone concept that has been used in most other European countries. In France a region of provenance is considered to be the sum of all selected stands that are considered both morphological and ecological similar to be grouped within one and the same region of provenance. This means that in France a region of provenance can not be considered as stable in time or in space. The regions of provenance in France are delimitated on the basis of genetic or phenotypic characteristics and ecological criteria. In case there is limited or no information available regarding these criteria a number of other criteria are also considered (for instance climate, geology or administrative information). The present classification system in France however is under revision to become more corresponding to most of the other European countries.

1 Introduction

1.1 Delimitation of Regions of Provenance

For the use of forest reproductive material it is considered to be important to have knowledge about the suitability of this material for a certain planting area. Chances of adaptation and good performance are improving in case the more similar the ecological and climatologically circumstances are of the provenance of the reproductive material compared to the area to be planted. Because of the fact that in most cases the suitability of the reproductive material has not been tested for a certain area, for example in the case of material from the category 'selected' an estimation regarding this is needed. This is very difficult and quite often even impossible without the validated results derived from provenance trials. In order to cover this problem a system of regions of provenance has been developed and introduced into international directives and schemes and into national laws regarding forest reproductive material. The idea behind the delimitation of regions of provenance is based on the grouping of stands and areas with the same characteristics in order to use the reproductive material coming from these stands for the same type of forest establishments. Another reason the delimitation of regions of provenance is to create a system of certification on the marketing of forest reproductive material. A region of provenance has therefore in fact two important functions. On the one hand can the use of regions of provenance make the marketing of forest reproductive material easier by the certification of the area where the material comes from. On the other hand can recommendations regarding the use of forest reproductive material be made by means of regions of provenance (Muhs 1993). Because of the relative huge variation that can be found within and between provenances of species it is rather difficult to set up criteria on the basis of which regions of provenance are delimitated.
More than one option is possible. In most EU member states a technical approach is being used. Following the OECD Scheme for the control of forest reproductive material moving in international trade this means that regions of provenance are delimitated on the basis of administrative and/or geographic borders. Where relevant also altitude and other suitable border lines can be used. In practice most of the time this means that regions of provenance are delimitated on the basis of artificial borders that quite often can not be fully justified. The disadvantage of this approach is that administrative and geographic borders not always coincide with ecological borders. In all cases so far regions of provenance stop at country borders. Because trees and plants basically have nothing to do with administrative borders it seems much more logic to make use of more natural borders by the delimitation of regions of provenance regarding forest reproductive material. The idea is to make use of borders that are respected by trees and plants because of the different circumstances on both sides of these borders. Up to today however this system of technical approach is still in use, because it is relatively easy to create and to control. As long as there are not enough scientific arguments to make use of a more biological orientated approach this will probably stay the only way for the delimitation of regions of provenance.

1.2 Objectives of this study

On request of the "cultuurgroep van bos- en haagplantsoenkwekers" of the Dutch Tree Nurseries Society (NBvB) and "het Productschap Tuinbouw" a research was started by Alterra in order to make an overview of the different ways of interpretation carried out

by member states regarding the delimitation of regions of provenance. This inventory and the criteria that were used were carried out for five countries: The Netherlands, Germany, Belgium, Luxembourg and France and covered all broadleaved tree species that are included in the National Laws of these five countries.
Emphasis was put on broadleaves due to the greater relevancy of these species for the Dutch tree nursery sector compared to conifers. In this rapport the German system of delimitation of regions of provenance is extensively covered. This has several reasons. The German system can be recognised by the very detailed way of classification of the country into regions of provenance. At the same time Germany is an important market for the Dutch tree nursery sector.

In chapter 2 a brief outline is given of the EU Community rules (Directives) regarding the marketing of forest reproductive material. On the basis of these EU Community rules member states should create and apply delimitations of regions of provenance for those species and artificial hybrids that are mentioned in those Directives. In chapter 3 the regions of provenance per country will be discussed as well as the criteria used for the delimitations of these regions of provenance in each of the five countries. In chapter 4 a list of used references is given for further reading. Annex A describes a Survey of the use that has been made of growing areas and growing districts for the creation of ecological base units in Germany while annex B gives a description of the 46 ecological base units in Germany used for the delimitation of regions of provenance.

2 EU Community rules regarding the marketing of forest reproductive material

In the original chapter 2 of this report a brief outline is given of the EU Community rules (Directives) regarding the marketing of forest reproductive material. On the basis of these EU Community rules member states should create and apply delimitations of regions of provenance for those species and artificial hybrids that are mentioned in those Directives. Since the report was written in 1999 a reference was made to the Directives 66/404/EEC and 71/161/EEC being in operation at that particular moment compared to Directive 1999/105/EC starting to be in operation and implementation in the member states by the first of January 2003. It explains the increase of the number of categories ‘selected’ and ‘tested’ with two more: ‘source identified’ and ‘qualified’. This brings the EU system at the same principle as the OECD Scheme for the Control of Forest Reproductive Material Moving in International Trade.
It also gives information regarding the increase of the number of species concerned. The list of species covered by the EU Directive 1999/105/EC is given in Table 1.

Table 1. Species covered by EU-Directive 1999/105/EC

Species	*Present EU-species*	*EU-species by 1 January 2003*
Abies alba Mill.	X	X
Abies cephalonica Loud.		X
Abies grandis Lindl.		X
Abies pinsapo Boiss.		X
Acer pseudoplatanus L.		X
Alnus glutinosa Gaertn.		X
Alnus incana Moensch.		X
Betula pendula Roth.		X
Betula pubescens Ehrh.		X
Castanea sativa Mill.		X
Cedrus atlantica Carr.		X
Cedrus libani A. Richard		X
Eucalyptus globulus Labill.		X
Fagus sylvatica L.	X	X
Fraxinus angustifolia Vahl.		X
Fraxinus excelsior L.		X
Larix decidua Mill.	X	X
Larix kaempferi Carr.	X	X
Larix sibirica Ledeb.		X
Larix x eurolepis Henry.		X
Picea abies Karst.	X	X
Picea sitchensis Carr.	X	X
Pinus brutia		X
Pinus canariensis C. Smith.		X
Pinus cembra L.		X
Pinus contorta Loud.		X
Pinus halepensis Mill.		X
Pinus nigra Arnold	X	X
Pinus pinaster Ait.		X
Pinus pinea L.		X
Pinus radiata D. Don.		X
Pinus strobus L.	X	X
Pinus sylvestris L.	X	X
Populus spp.	X	X
Prunus avium		X
Pseudotsuga menziesii Franco	X	X
Quercus cerris L.		X
Quercus ilex L.		X
Quercus petraea Liebl.	X	X
Quercus pubescens Willd.		X
Quercus robur L.	X	X
Quercus rubra L.	X	X
Quercus suber L.		X
Robinia pseudoacacia L.		X
Tilia cordata Mill.		X

3 Criteria for Delimitation of Regions of Provenance per country

On the basis of EU Community rules (Directives) regarding the marketing of forest reproductive material member states should create and apply delimitations of regions of provenance for those species and artificial hybrids that are mentioned in those Directives. By definition of the EU Directive a region of provenance is: "for a species or sub-species, the region of provenance is the area or group of areas subject to sufficiently uniform ecological conditions in which stands or seed sources showing similar phenotypic or genetic characters are found, taking into account altitudinal boundaries where appropriate".
By the first of January 2003 these type of regions of provenance should be applied to basic material used for the production of reproductive material in the categories 'source identified' and 'selected', while formerly only in the case of the category 'selected'.
The regions of provenance of reproductive material produced in a seed orchard are that of the basic material used for the establishment of this seed orchard. The borders of the regions of provenance are to be indicated on maps that will be published by the member states.
The term 'sufficiently uniform' in the definition of a region of provenance is rather broad and gives room for the member states to interpret 'sufficiently uniform ecological conditions' to their own standards.
The same is the case for the term 'similar phenotypic or genetic characters' that leaves it up to the member states to make their own interpretation regarding the characters for certain species or region of provenance and to what account these should be similar. In the following chapters an overview is given of the way five countries implemented into their own legislation the definition of regions of provenance and on the basis of which criteria the regions of provenance in their territory were delimitated.

3.1 The Netherlands

3.1.1 General

Legislation regarding forest reproductive material in The Netherlands is implemented in the 'Seed- and Plant Act of 6 October 1966'. This 'Seed- and Plant Act' can be considered as a frame-law that not only covers the position of newly bred material produced by plant breeders, but also the marketing of plant reproductive material. Legislation regarding the marketing of plant reproductive material is mainly based on all the EU Directives regarding the marketing of basically all agricultural-, vegetable- and forest reproductive material. This means that among others Directive 66/404/EEC regarding the marketing of forest reproductive material is part of the 'Seed- and Plant Act'. Regarding the forest reproductive material the 'Seed- and Plant Act' covers the same species as mentioned in the Directive 66/404/EEC.

In the 'Seed- and Plant Act' is also stated that a list of recommended varieties and provenances of trees is created. This so called 'Rassenlijst' should be issued every other five years and contains only varieties and provenances of species and genera that can be recommended, which means that only part of all the material in trade in The Netherlands is covered by this list (Table 2). As a rule, provenances that are not listed

are not certified by the Dutch Designated Authority (Naktuinbouw) and can therefore not be marketed.

3.1.2 Delimitation of Regions of Provenance

The whole country of The Netherlands is considered to be one region of provenance for all species mentioned in the EU Directive, indicated with code NL (Figure 1). No possible existing differences in ecological circumstances have been taken into account. This one region of provenance is divided into 8 sub regions that are numbered 1 to 8 and also have been named. The sub regions are subsequently divided into districts (1, 2, etc.) (Anonymous 1996).

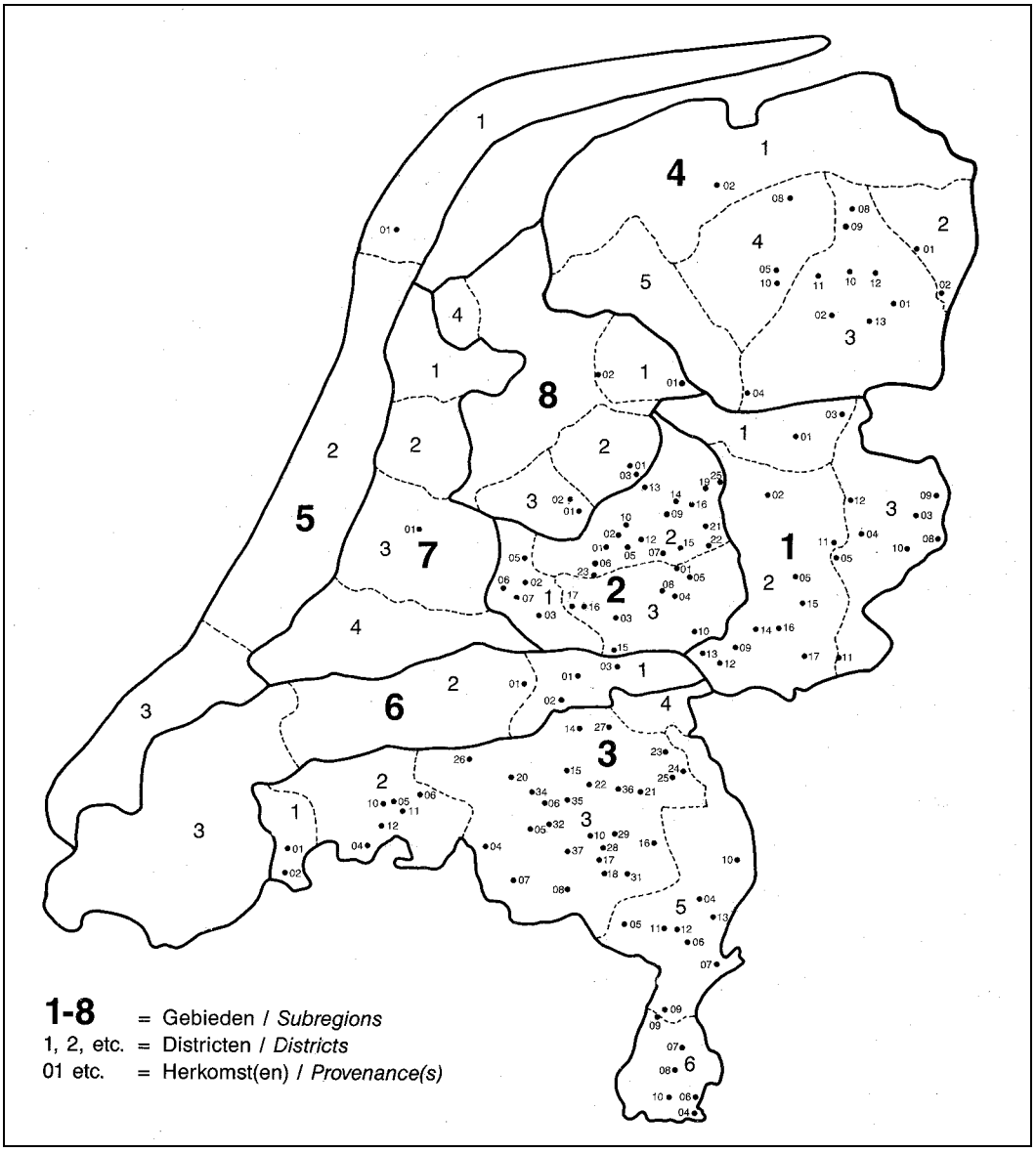

Figure 1. Delimitations of regions of provenance in The Netherlands with subdivision into sub regions and districts (Source: Zesde Rassenlijst van bomen 1996).

Table 2. List of species mentioned in the Dutch list of varieties (de Rassenlijst van Bomen).

Species
Abies alba Mill.
Abies grandis Ldl.
Acer pseudoplatanus L.
Alnus L.
Betula L.
Fagus sylvatica L.
Fraxinus excelsior L.
Larix L.
Picea abies L.
Picea sitchensis Carr.
Pinus contorta Dgl.
Pinus nigra L.
Pinus strobus L.
Pinus sylvestris L.
Populus L.
Prunus avium L.
Pseudotsuga menziesii
Quercus petraea L.
Quercus robur L.
Quercus rubra L.
Robinia L.
Salix alba L.
Thuja plicata D. Don.
Tilia europaea L.
Tsuga heterophylla
Ulmus glabra Huds.
Ulmus hybriden

3.2 Germany

3.2.1 General

The marketing of forest basic- and reproductive material in Germany is regulated by the 'Gesetz über forstliches Saat- und Pflanzgut ('FsaatG') i.d.F. vom 26. Juli 1979 (BGB1. IS. 1242 ff), zuletzt geändert durch Artikel 22 des Gesetzes vom 2. August 1994 (BGB1. IS. 2018)'. This legislation is based on the EU-Directives 66/404/EEC and 71/161/EEC. The 'Bundesministerium für Ernährung, Landwirtschaft und Forsten' has the responsibility for this legislation. The implementation of this legislation into the law is passed on to the separate states by a special law.
Germany has added 5 species to the de 'FSaatG' on top of the species mentioned in the EU Directive. These species are *Abies grandis*, *Alnus glutinosa*, *Fraxinus excelsior*, *Tilia cordata* en *Acer pseudoplatanus*. In total 18 species and one genera (*Populus*) are covered by the 'FSaatG'.
In accordance with the 'FSaatG' a register of approved seed stands and seed orchards ('Erntezulassungsregister') and of approved clones and clonal mixtures ('Baumzuchtregister') is kept by the designated authorities in each of the states.
A summary of all these registrations is kept and published by the 'Bundesanstalt für Landwirtschaft und Ernährung' in order of the Federal Ministry for Food, Agriculture and Forestry. The designated authorities of the states are responsible for the approval of the basic material within those states.

Germany does not know a federal list of recommended varieties and provenances. Some of the states however issue a list of recommended varieties and provenances. In these lists is stated which provenances are recommended for certain planting areas

within the same state. The planting areas for these recommendations of provenances are based on forestry growing areas and growing districts (see also next paragraph).

3.2.2 Delimitation of Regions of Provenance

The delimitation of regions of provenance in Germany is carried out separately for all species concerned. The new classification in regions of provenance after the unification of former East- and West Germany is layed down in the 'Forstsaat-Herkunfsgebietsverordnung vom 7. Oktober 1994', that turned into force on the first of January 1995. The regions of provenance mentioned in this regulation are crossing the borders of the states within the Federal Republic and make the proper use as well as the control possible of selected material through the definitions in the 'FsaatG'. The collection and use of selected basic material with the assistance of actual knowledge and experience of these newly delimitated regions of provenance makes improvement of stability and production of forests possible. Through this regulation the protection of forests and the improvement of forestry are served.

Reasons for subdividing of Regions of provenance

For the subdivision of regions of provenance in Germany the following arguments are given:

The ecological conditions are determining for the distribution as well as the planting possibilities of the different tree species concerned and are herewith the most important selection criteria. The system of natural selection does not only work for autochthonous populations, but is also a key factor for artificial established stands of both indigenous as well as exotic tree species. Populations show within certain areas as a reaction to the prevailing circumstances generally the same characters as populations that grow somewhere else under circumstance that can be compared. The most important characters for tree species are adaptation and adaptability.
Climatologically circumstances are most important for large scale diversity. Besides the large scale diversity of the tree species there is a smaller adaptability process to local circumstances of the planting area. The 'FSaatG' does however not demand separation of selected basic material of stands within one region of provenance. Stands from areas with comparable circumstances are therefore combined within one region of provenance. On top of this are phenotypic and genetic characters included in the delimitation of regions of provenance when similarities or differences have been detected in trials. In this way it is possible to continuously make use of material form each of the regions of provenance and to combine basic material in such a way that the best adaptation is guaranteed for the ecological circumstances in that particular region of provenance. This would not be possible if regions of provenance are not separated. The forest owner receives information about the ecological conditions that should meet the requirements of the basic material through this system of appointment of regions of provenance. In this way he is able to make the right choice of basic material and thus avoids risks establishing plantations (Anonymous 1994).

Criteria for delimitation

The delimitation of regions of provenance in Germany is executed on the basis of the following criteria (Anonymous 1994):

- Delimitation following ecological circumstances
  - Horizontal delimitation
    The delimitation of regions of provenance is based on forestry growing areas and growing districts. Through this system it can be guaranteed that regions of provenance meet the legal requirements from the 'FSaatG'. Knowledge about forestry habitats defines growing areas as large scale landscapes that are discriminated from by geomorphology, climate, natural forest communities and landscape history. These large scale landscapes generally correspond with those of geographical experts and plant sociologists. The growing districts are smaller, regional units with a preferentially physiological character. The borders of growing districts are mainly determined by forest ecological criteria. The forestry growing areas in the range of the former border between East- and West Germany are combined.
  - Vertical delimitation
    At the delimitation of regions of provenance the horizontal delimitation in strongly accidental areas is adjusted according to the altitude. Through this system it can be guaranteed that those regions of provenance that do not meet the horizontal requirements for delimitation still meet the ecological requirements of the legal definition of a region of provenance. Knowledge about forestry habitats distinguishes altitudinal steps based on geography, climate and natural forest communities. The location of comparable altitudinal steps shifts with the climate, decreasing latitude and longitude and with the rising of the landmass in general.

- Delimitation following phenotypic or genetic characters
  Following the legal definition a regions of provenance is also based on phenotypic or genetic characters of the tree species. Analyses derived from experience and provenance research are included in the delimitation of regions of provenance. In general more information is gathered for conifers than there is for broadleaves.

- Relevancy
  At the differentiation of the delimitation of regions of provenance of the tree species the relevancy of the species concerned regarding German forestry in different areas of Germany is also taken into account.

Basically 46 ecological base units have been used for the horizontal delimitation of the Federal Republic of Germany. These ecological base units are composed on forestry principles regarding growing areas and growing districts (see Annex 1). An ecological base unit is the smallest component used for the delimitation of regions of provenance. The growing areas and growing districts in Germany have been reported about in several publications (Anonymous 1985, 1993, Kopp & Schwanecke 1991).
In Annex B a description is given of these ecological base units that have been used for the determination of the forestry growing areas. Every ecological base unit has a number. Border lines of these ecological base units are described and delimitated in the 'FSaatG' following geographic and business technical borders based on fixed infrastructural lines (streets, railroads, rivers/canals, state- and country borders). For reasons of simplification smaller deflections are accepted. Figure 2 shows a map indicating the ecological base units for the determination of the forestry growing areas.

Figure 2. Map of ecological base units (Source: AID).

Description of the regions of provenance

For all species covered by the German law separate regions of provenance are delimitated. In total Germany identified 178 regions of provenance. These vary from 7 to 30 for indigenous species, from 2 to 6 for exotic species and 1 for the genus *Populus*. Regarding 3 broadleaved species (*Fraxinus excelsior*, *Alnus glutinosa* en *Tilia cordata*) and 6 exotic species similar regions of provenance have been delimitated. Table 3 gives information on the amount of regions of provenance per 'FSaatG' species.

Table 3. Overview of the 'FSaatG' species and the number of regions of provenance per species.

Species	*Number of regions of provenance*	*Different levels of altitude*
Abies alba Mill.	12	Yes
Abies grandis (Dougl.) Lindl.	2	No
Larix kaempferi (Lamb.) Carr.	2	No
Picea sitchensis (Bong.) Carr.	2	No

Species	*Number of regions of provenance*	*Different levels of altitude*
Pinus nigra Arnold	2	No
Pinus strobus L.	2	No
Quercus rubra L.	2	No
Acer pseudoplatanus L.	11	Yes
Alnus glutinosa (L.) Gaertn.	8	No
Fraxinus excelsior L.	8	No
Tilia cordata Mill.	8	No
Fagus sylvatica L.	26	Yes
Larix decidua Mill.	7	Yes
Picea abies (L.) Karst.	30	Yes
Pinus sylvestris L.	23	Yes
Populus spp.	1	No
Pseudotsuga menziesii (Mirb) Franco	6	Yes
Quercus petraea (Mattuschka) Liebl.	13	No
Quercus robur L.	9	No

The regions of provenance carry characteristically German names that are kept in German language (for instance: Erzgebirge mit Vorland), for several tree species also including specifications regarding altitude (for example: montane Stufe). The reference number of the region of provenance exists of a 3-digit tree species number (for example: beech 810) and a 2-digit area number of the species. For example the regions of provenance 'Erzgebirge mit Vorland, montane Stufe' for beech is indicated with code 810 14 (Table 4).

Table 4. Overview of the regions of provenance per species with exception of conifers.

Species	*Region of provenance*	*Reference number*	*Number of the ecological base unit*
Populus ssp.	Bundesgebiet	900 01	1-46
Alnus glutinosa	Nordwestdeutsches Tiefland	802 01	3,4
	Nordostdeutsches Tiefland	802 02	1,2,5
	Mittel- und Ostdeutsches Tief- und Hügelland	802 03	6, 9,11,14,16
	Westdeutsches Bergland	802 04	7,8,12,20-22,29,31
	Oberrheingraben	802 05	30
	Südostdeutsches Hügel- und Bergland	802 06	13,15,17-19,25-28,36,37
	Süddeutsches Hügel- und Bergland	802 07	23,24,32-35,38-43
	Alpen und Alpenvorland	802 08	44-46
Fraxinus excelsior	Nordwestdeutsches Tiefland	811 01	3,4
	Nordostdeutsches Tiefland	811 02	1,2,5
	Mittel- und Ostdeutsches Tief- und Hügelland	811 03	6,9-11,14,16
	Westdeutsches Bergland	811 04	7,8,12,20-22,29,31
	Oberrheingraben	811 05	30
	Südostdeutsches Hügel- und Bergland	811 06	13,15,17-19,25-28, 36,37
	Süddeutsches Hügel- und Bergland	811 07	23,24,32-35,38-43
	Alpen und Alpenvorland	811 08	44-46
Tilia cordata	Nordwestdeutsches Tiefland	823 01	3,4
	Nordostdeutsches Tiefland	823 02	1,2,5
	Mittel- und Ostdeutsches Tief- und Hügelland	823 03	6,9-11,14,16
	Westdeutsches Bergland	823 04	7,8,12,20-22,29,31
	Oberrheingraben	823 05	30
	Südostdeutsches Hügel- und Bergland	823 06	13,15,17-19,25-28, 36,37
	Süddeutsches Hügel- und Bergland	823 07	23,24,32-35,38-43
	Alpen und Alpenvorland	823 08	44-46
Acer pseudoplatanus	Norddeutsches Tiefland	801 01	1-5
	Mittel- und Ostdeutsches Tief- und Hügelland	801 02	6,9-11,14,16
	Westdeutsches Bergland, kolline Stufe	801 03	7,8,12,20,29 tot 400m,

Species	*Region of provenance*	*Reference number*	*Number of the ecological base unit*
			21,22,31 tot 500m
	Westdeutsches Bergland, montane Stufe	801 04	7,8,12,20,29 vanaf 400m, 21,22,31 vanaf 500m
	Oberrheingraben	801 05	30
	Südostdeutsches Hügel- und Bergland, kolline Stufe	801 06	13,15,17-19,25,27 tot 600m, 26,28,36,37 tot 800m
	Südostdeutsches Hügel- und Bergland, montane Stufe	801 07	13,15,17-19,25,27 vanaf 600m, 26,28,36,37 vanaf 800m
	Süddeutsches Hügel- und Bergland, kolline Stufe	801 08	23, 24, 31 – 35, 38 – 43 tot 600m
	Süddeutsches Hügel- und Bergland, montane Stufe	801 09	23,24,31-35,38-43 vanaf 600m
	Alpen und Alpenvorland, submontane Stufe	801 10	44-46 tot 900m
	Alpen und Alpenvorland, hochmontane Stufe	801 11	44-46 vanaf 900m
Quercus robur	Niedersächsischer und Rheinisch-Westfälische Bucht	817 01	3
	Ostsee-Küstenraum	817 02	1,2
	Heide und Altmark	817 03	4,5
	Ostdeutsches Tiefland	817 04	6,10,11
	Mitteldeutsches Tief- und Hügelland	817 05	9,14,16
	Westdeutsches Bergland	817 06	7,8,12,20-22,29,31
	Oberrheingraben	817 07	30
	Südostdeutsches Hügel- und Bergland	817 08	13,15,17-19,25-28,36,37
	Süddeutsches Hügel- und Bergland sowie Alpen	817 09	23,24,32-35,38-46
Quercus rubra	Norddeutsches Tiefland	816 01	1-5
	Übriges Bundesgebiet	816 02	6-46
Quercus petraea	Niedersächsischer Küstenraum und Rheinisch-Westfälische Bucht	818 01	3
	Ostsee-Küstenraum	818 02	1,2
	Heide und Altmark	818 03	4,5
	Ostdeutsches Tiefland	818 04	6,10,11
	Mitteldeutsches Tief- und Hügelland	818 05	9,14,16
	Rheinisches und Saarbergland	818 06	12,20
	Harz, Weser- und Hessisches Bergland außer Spessart	818 07	7,8,21,31
	Pfälzerwald	818 08	29
	Oberrheingraben	818 09	30
	Spessart	818 10	22
	Fränkisches Hügelland	818 11	23,24
	Südostdeutsches Hügel- und Bergland	818 12	13,15,17-19,25-28,36,37
	Süddeutsches Mittelgebirgsland sowie Alpen	818 13	32-35,38-46
Fagus sylvatica	Niedersächsischer Küstenraum und Rheinisch-Westfälische Bucht	810 01	3
	Ostsee-Küstenraum	810 02	1,2
	Heide und Altmark	810 03	4,5
	Nordostbrandenburgisches Tiefland	810 04	6
	Märkisch-Lausitzer Tiefland	810 05	10,11
	Mitteldeutsches Tief- und Hügelland	810 06	9,14,16
	Rheinisches und Saarpfälzer Bergland, kolline Stufe	810 07	12 tot 400m 20,29 tot 500m
	Rheinisches und Saarpfälzer Bergland, montane Stufe	810 08	12 vanaf 400m 20,29 vanaf 500m
	Harz, Weser- und Hessisches Bergland, kolline Stufe	810 09	7,8 tot 400m 21,22,31 tot 500m
	Harz, Weser- und Hessisches Bergland, montane Stufe	810 10	7,8 vanaf 400m 21,22,31 vanaf 500m
	Thüringer Wald, Fiechtelgebirge und Vogtland, kolline Stufe	810 11	15,25 tot 600m 13,26,27 tot 700m
	Thüringer Wald, Fiechtelgebirge und	810 12	15,25 vanaf 600m

Species	*Region of provenance*	*Reference number*	*Number of the ecological base unit*
	Vogtland, montane Stufe		13,26,27 vanaf 700m
	Erzgebirge mit Vorland, kolline Stufe	810 13	17-19 tot 500m
	Erzgebirge mit Vorland, montane Stufe	810 14	17-19 500m tot 700m
	Erzgebirge mit Vorland, hochmontane Stufe	810 15	17-19 vanaf 700m
	Oberrheingraben	810 16	30
	Württembergisch-Fränkisches Hügelland	810 17	23,24,32-34,39
	Fränkische Alb	810 18	35
	Bayerischer und Oberpfälzer Wald, submontane Stufe	810 19	28,36,37 tot 800m
	Bayerischer und Oberpfälzer Wald, montane Stufe	810 20	28,36,37 vanaf 800m
	Schwarzwald, submontane Stufe	810 21	38 tot 900m
	Schwarzwald, hochmontane Stufe	810 22	38 vanaf 900m
	Schwäbische Alb	810 23	40,41
	Alpenvorland	810 24	42-45
	Alpen, submontane Stufe	810 25	46 tot 900m
	Alpen, hochmontane Stufe	810 26	46 vanaf 900m

In the following part of this chapter a description is given of all regions of provenance per 'FSaatG' species, with exception of conifers. Based on a detailed description of the forestry backgrounds a motivation in German is given for the delimitation of regions of provenance regarding the different species.
Since this information is translated from the original German text this is not translated into English. Further information can best be obtained form the original German text. There are in total seven groups of regions of provenance for the 'FSaatG' species that all have a separate map:

1. *Populus* spp.

Basic material of the genus *Populus* is without exception marketed as tested basic material. Suitability to site is in all cases of forest establishment with poplars preferred above the use of regions of provenance. Because of this reason it is decided to create for the genus *Populus* just one region of provenance that covers the whole country of Germany.

2. *Alnus glutinosa*, *Fraxinus excelsior* en *Tilia cordata*

01 *Nordwestdeutsches Tiefland*
02 *Nordostdeutsches Tiefland*
03 *Mittel- und Ostdeutsches Tief- und Hügelland*
04 *Westdeutsches Bergland*
05 *Oberrheingraben*
06 *Südostdeutsches Hügel- und Bergland*
07 *Süddeutsches Hügel- und Bergland*
08 *Alpen und Alpenvorland*

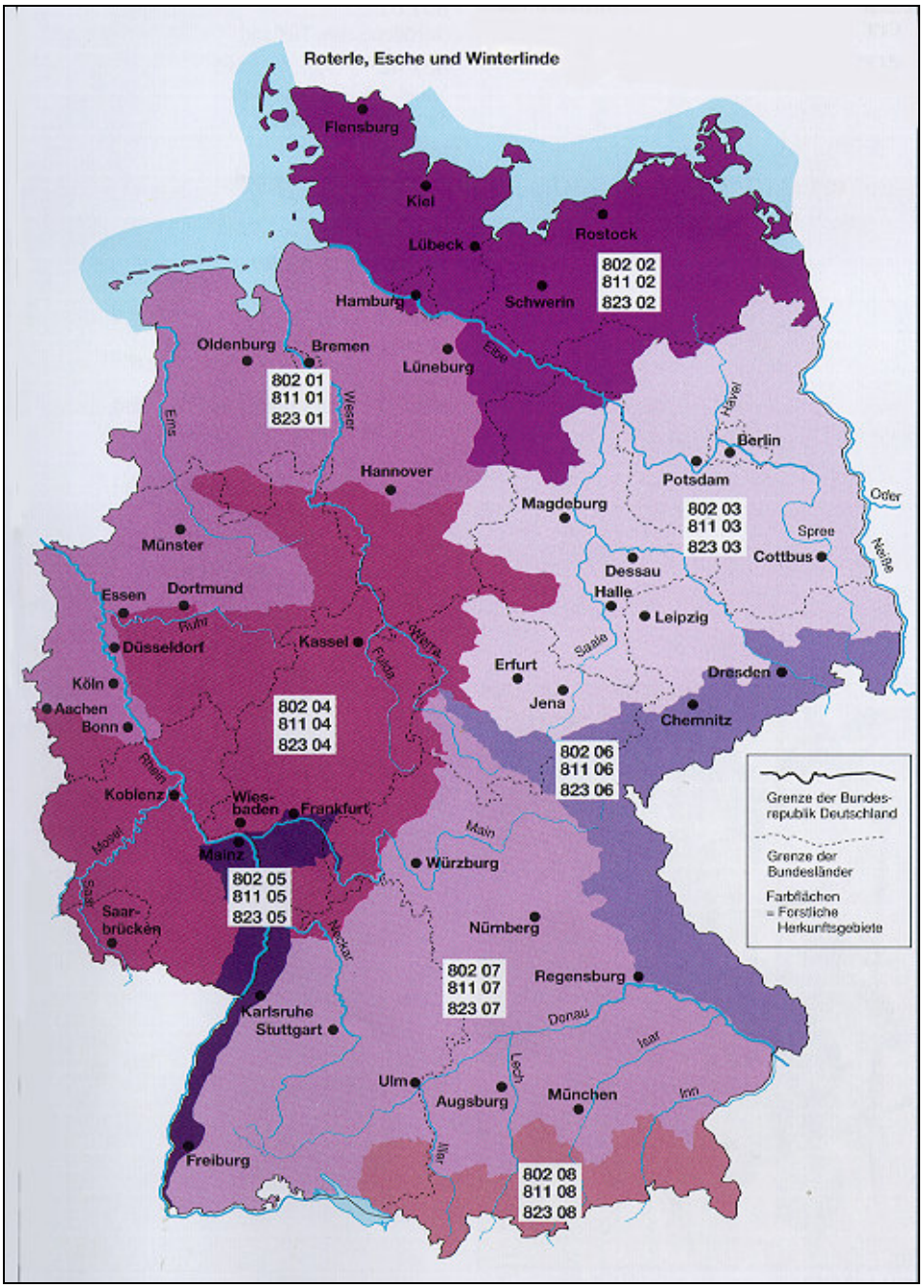

Figure 3. **Delimitation of Regions of Provenance for *Alnus glutinosa*, *Fraxinus excelsior* en *Tilia cordata* (Source: AID).**

3. *Acer pseudoplatanus*
01 *Norddeutsches Tiefland*
02 *Mittel- und Ostdeutsches Tief- und Hügelland*
03/04 *Westdeutsches Bergland*
05 *Oberrheingraben*
06/07 *Südostdeutsches Hügel- und Bergland*
08/09 *Süddeutsches Hügel- und Bergland*
10/11 *Alpen und Alpenvorland*

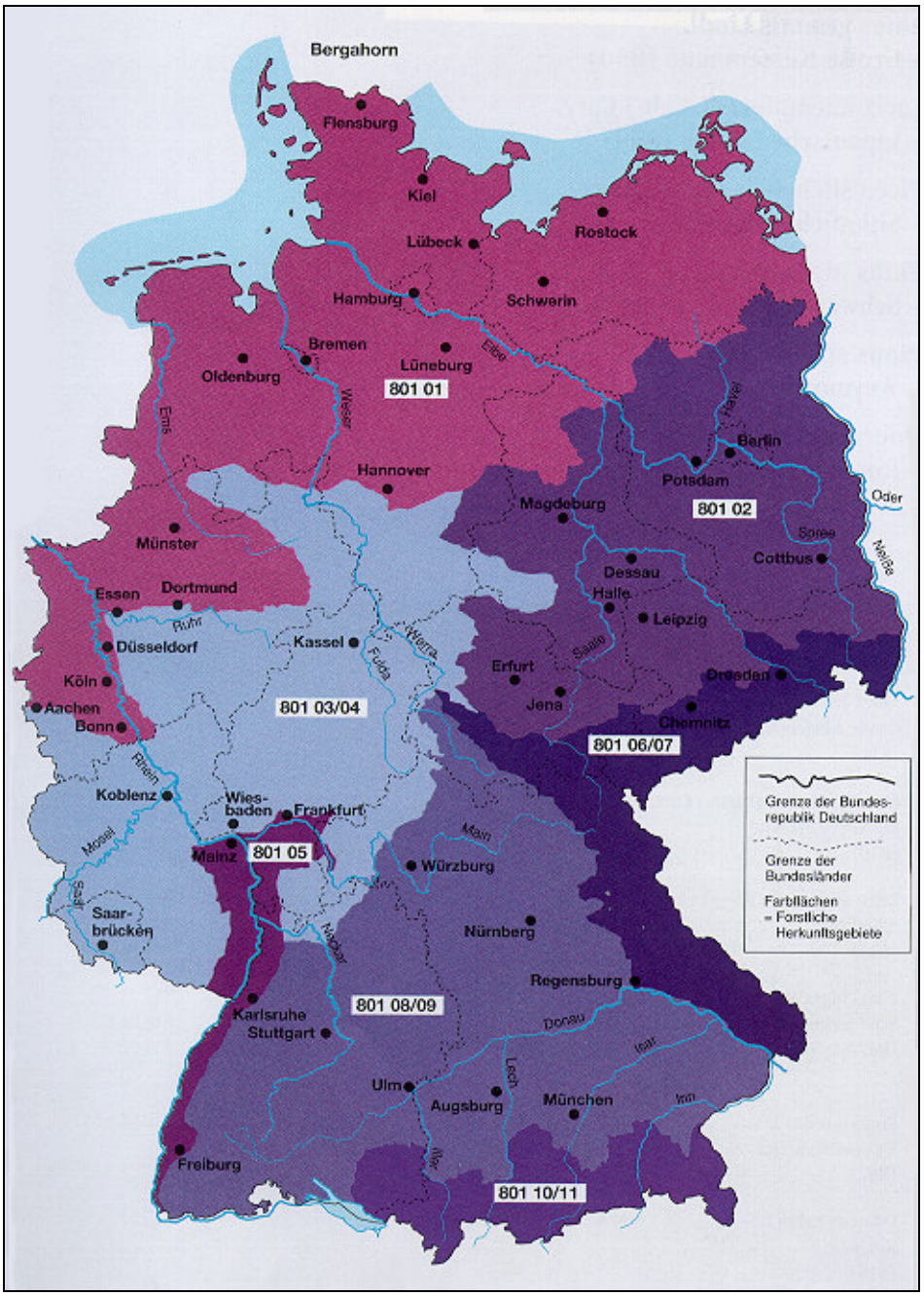

Figure 4. Delimitation of Regions of Provenance for *Acer pseudoplatanus* (Source: AID).

4. *Quercus robur*
01 *Niedersächsischer und Rheinisch-Westfälische Bucht*
02 *Ostsee-Küstenraum*
03 *Heide und Altmark*
04 *Ostdeutsches Tiefland*
05 *Mitteldeutsches Tief- und Hügelland*
06 *Westdeutsches Bergland*
07 *Oberrheingraben*
08 *Südostdeutsches Hügel- und Bergland*
09 *Süddeutsches Hügel- und Bergland sowie Alpen*

Figure 5. Delimitation of Regions of Provenance for Q*uercus robur* (Source: AID).

5. *Quercus rubra*
01 *Norddeutsches Tiefland*
02 *Übriges Bundesgebiet*

Figure 6. Delimitation of Regions of Provenance for Q*uercus rubra* (Source: AID).

6. *Quercus petraea*

01 *Niedersächsischer Küstenraum und Rheinisch-Westfälische Bucht*
02 *Ostsee-Küstenraum*
03 *Heide und Altmark*
04 *Ostdeutsches Tiefland*
05 *Mitteldeutsches Tief- und Hügelland*
06 *Rheinisches und Saarbergland*
07 *Harz, Weser- und Hessisches Bergland außer Spessart*
08 *Pfälzerwald*
09 *Oberrheingraben*
10 *Spessart*
11 *Fränkisches Hügelland*
12 *Südostdeutsches Hügel- und Bergland*
13 *Süddeutsches Mittelgebirgsland sowie Alpen*

Figure 7. Delimitation of Regions of Provenance for Q*uercus petraea* (Source: AID).

7. Fagus sylvatica

01 *Niedersächsischer Küstenraum und Rheinisch-Westfälische Bucht*
02 *Ostsee-Küstenraum*
03 *Heide und Altmark*
04 *Nordostbrandenburgisches Tiefland*
05 *Märkisch-Lausitzer Tiefland*
06 *Mitteldeutsches Tief- und Hügelland*
07/08 *Rheinisches und Saarpfälzer Bergland*
09/10 *Harz, Weser- und Hessisches Bergland*
11/12 *Thüringer Wald, Fiechtelgebirge und Vogtland*
13/14/15 *Erzgebirge mit Vorland*
16 *Oberrheingraben*
17 *Württembergisch-Fränkisches Hügelland*
18 *Fränkische Alb*
19/20 *Bayerischer und Oberpfälzer Wald*
21/22 *Schwarzwald*
23 *Schwäbische Alb*
24 *Alpenvorland*
25/26 *Alpen*

Figure 8. Delimitation of Regions of Provenance for *Fagus sylvatica* (Source: AID).

3.3 Belgium

3.3.1 General

The Belgian regulations regarding forest reproductive material (Koninklijk Besluit van 17 mei 1968 gewijzigd door het K.B. van 12 januari 1970 houdende de inrichting van de keuring van uitgangsmateriaal en teeltmateriaal van bosbouwsoorten) is based on EU Directives 66/404/EEC and 71/161/EEC. The present Belgian law is strongly out of date, partly because it does not coincide with most of the recently revised Directives in international regulations and furthermore because it does no longer unite with the changed institutional structure of Belgium and the competence of federal and regional services. Because of this the Belgian law is presently under revision. Both the control of reproductive material as well as the responsibility for a National List of basic material is a federal matter and is carried out by the Service for Reproductive material (Dienst Teeltmateriaal) that comes under the competency of the Ministry for Trade and Agriculture. The admission of the basic material for the production of reproductive material on the other hand is a regional (Gewestelijke diensten) matter. The Belgian law covers the same EU species as mentioned in Directive 66/404/EEC (Van Langenhove *et al* 1997). In correspondence with the Dutch National Catalogue in the Walloon region (Wallonië) a list of recommended provenances is issued: 'Dictionnaire des provenances recommandables' (Anonymous 1997). For the time being such a list is not issued for the Flanders region (Vlaanderen).

3.3.2 Delimitation of Regions of Provenance

Belgium is divided into two regions of provenance: I. North of the rivers Samber en Maas and II. South of the rivers Samber en Maas (Figure 9). These areas are the same for all tree species. Both these regions of provenance could be subdivided into three zones:

I.1. Kempen
I.2. Vlaanderen
I.3. Brabant en Haspengouwen
II.1. Laag Maasplateau
II.2. Ardennen
II.3. Lotharingen

Delimitation of these areas is based on administrative and plant pathological-geographical criteria and in some cases also on altitude.

In Table 5 en 6 the regions of provenance are described regarding to altitude, soil type and climatologically conditions (Anonymous 1999b).

Table 5. Altitude and soil type of regions of provenance in Belgium.

Region of Provenance	*Zone*	*Altitude (m)*	*Soil type*
I	1	0 – 100	Vooral zeer arme zandige podzolgronden, varierend van goede vochtvoorziening tot droog
I	2	0 – 50	Zandige tot verbeterde zandleembodem, dikwijls goede vochtvoorziening
I	3	10 – 220	Vooral rijke leembodem (löss, A/B/C profiel)
II	1	60 – 400	Wisselvallig maar tamelijk rijk; lemig met keien, zware klei, bruine kalkgronden
II	2	100 – 700	Zure bruine gronden A/C tamelijk arm; plateaus (> 500m) met turfgronden met witte kleiaarde
II	3	200 – 450	Wisselvallig maar dikwijls rijk, zandig (macigno); mergel en bruine kalkgronden

Table 6. Average climate in regions of provenance (1901 – 1930).

Region of Provenance	*Zone*	*Average Temp. (°C)*	*Days with frost*	*Precipitation (mm)*	*Growing season (days)*	*Winter days*	*Days with snow*	*Lowest Temp. (°C)*	*Highest Temp.(°C)*
I	1	9.3	80.8	867	172	8.4	18.5	– 22.9	+ 38.7
I	2	10.2	58.4	820	178	6.0	9.0	– 19	+ 35
I	3	9.4	58.7	835	172	7.1	15.4	– 17.7	+ 36.5
II	1	8.6	79.5	856	162	10.6	18.5	– 19.8	+ 37
II	2	7.1	115.5	1010	139	14.8	36.5	– 24	+ 34.3
II	3	7.1	118.4	1106	150	12.9	26.6	– 24.6	+ 36.2

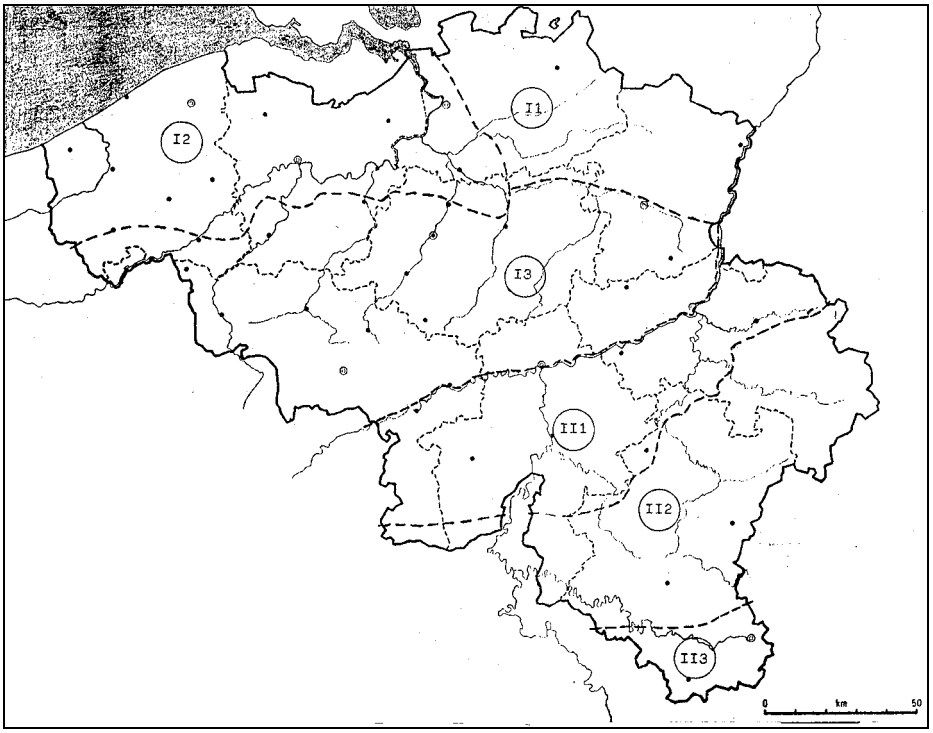

Figure 9. Regions of Provenance in Belgium (Source: Catalogus van het Belgisch Uitgangsmateriaal voor Bosboomsoorten 1999b).

3.4 Luxembourg

3.4.1 General

The regulations regarding forest reproductive material in Luxembourg (Loi du 18 février 1971 concernant la commercialisation des matériels forestiers de reproduction) correspond with the EU Directives 66/404/EEC and 71/161/EEC as well as the OECD Scheme for the Control of Forest Reproductive Material Moving in International Trade. The law in Luxembourg covers the same EU species as mentioned in Directive 66/404/EEC. Luxembourg issues a modest list of recommended varieties and provenances of trees and hardly carries out any research regarding the content of this list and of the selection of seed stands. Most of the reproductive material originates from Belgium.

3.4.2 Delimitation of Regions of Provenance

Luxemburg is divided into two regions of provenance: 'Ösling' and 'Gutland', that all together covers the whole country. These areas are the same for all tree species covered by the law in Luxembourg. The delimitation of these areas is mainly based on differences in climate and geological criteria and circumstances. In 1995 a survey was carried out in order of the Forestry Administration regarding the delimitation of the natural vegetation in Luxembourg (Anonymous 1995). In this particular survey an ecological subdivision was made into growing areas that in their turn could be subdivided into growing districts. Based on this study four regions of provenance could in fact be distinguished: the two growing areas 'Ösling' and 'Gutland' together with two smaller areas 'Moselle' and 'Minette'. The latter two areas are located at the border with Germany. However for the time being it was decided to stick to the two main areas 'Ösling' and 'Gutland' because the other two were regarded to be too small. The growing areas 'Moselle' and 'Minette' cover respectively 1 and 5% of the total surface of Luxembourg. The region of provenance 'Ösling' coincides with the growing area 'Moselle'. The region of provenance 'Gutland' covers the growing areas 'Gutland', 'Moselle' and 'Minette' (Table 7, Figure 10).

Table 7. Delimitation of regions of provenance into growing areas and growing districts in Luxembourg.

Herkomstgebied	*Groeigebied*	*Groeidistrict*
Ösling	Ösling	Nördliches Hochösling
		Südliches Hochösling
		Obersauer-, Wiltz-, Clierf- und Bleestal
		Ourtal
Gutland	Gutland	Ösling-Vorland
		Arttert-Gutland
		Stegener Gutland
		Alzette-, Attert- und Mittelsauertal
		Untersauertal
		Eisch-Mamer-Gutland
		Schooffielser und Müllerthaler Gutland
		Südliches Gutland
		Rebierger Gutland
		Pafebierger Gutland
		Mosel-Vorland und Syretal
	Moselle	Moseltal
	Minette	Minette-Vorland
		Minette

Delimitation of the growing areas

The distinguishing of the growing areas Ösling and Gutland is based on geological, pedological and geomorphologic criteria. The growing area Ösling differs quite a lot from the other areas seen from a topographical point of view. Based on geology a borderline could be drawn between Trias and Devon. Ösling originates completely from Devon (schist and quartzite). Based on pedology the brown woodland soil on the Devon schist could be separated from the brown woodland soil on the rock formations of Trias.
The growing areas Gutland and Minette are separated from each other by a line crossing the real Minette, the Dogge lowlands and enclosing the Minette-Vorland. Climatologic, but also culture-historical and regional criteria do play a role in this delimitation.
The growing areas Gutland and Minette are delimitated based on climatologic criteria. The growing area Moselle distinguishes itself from the other growing areas most of all by a warmer and dryer climate (lowest average annual precipitation together with the highest average annual temperature). Besides this it also has an extremely long vegetation period (Anonymous 1995).

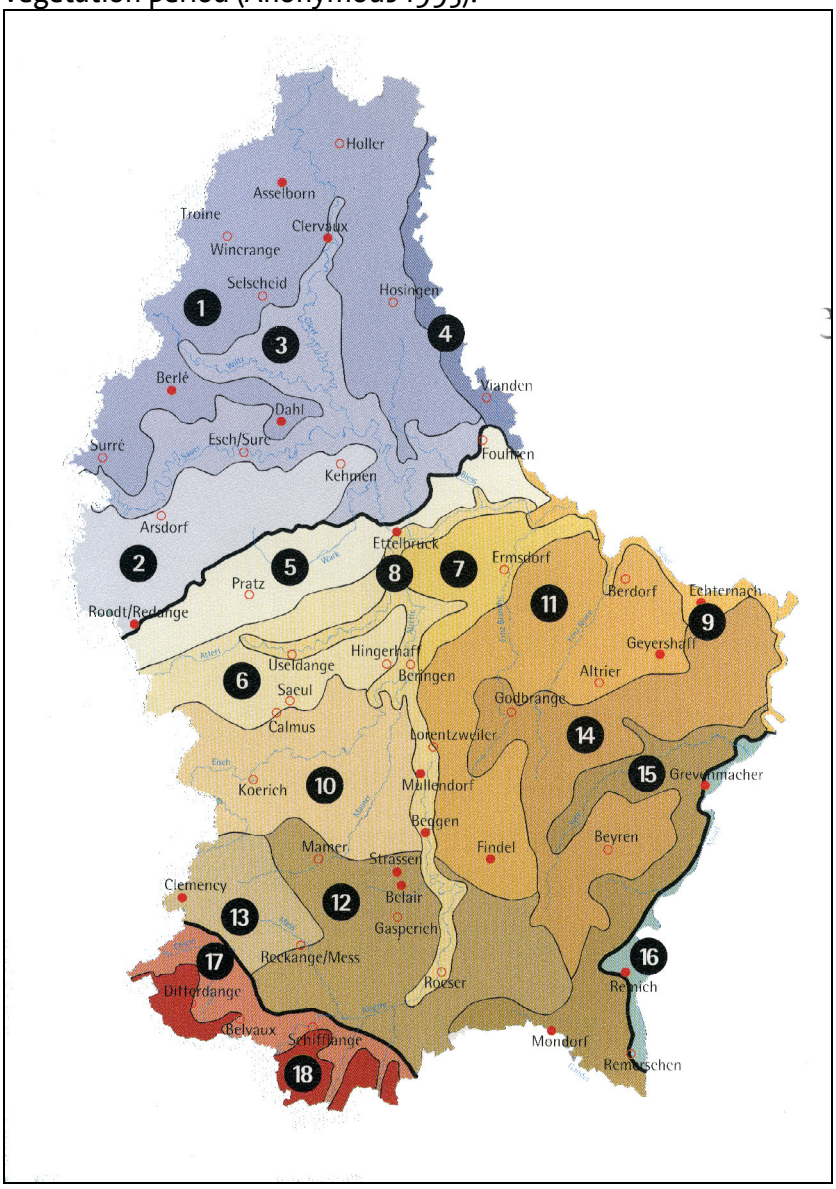

Figure 10. 1 – 4: Region of provenance Ösling, 5 – 18: Region of provenance Gutland (Source: EFOR).

3.5 France

3.5.1 General

The 'Code forestier', livre V, titre V, regarding selection and breeding of forest tree species regulates the marketing of forest reproductive material in France. This regulation is in principle based on the EU Directives 66/404/EEC and 71/161/EEC. Species covered by the 'Code forestier' and to which the EU Directives apply are all the EU-species together with *Prunus avium*, *Cedrus atlantica* Manetti, *Cedrus libani* (G. Don) Loudon, *Pinus pinea*, *Pinus pinaster* Ait. en *Pinus halepensis* Mill.
The 'Centre National du Machinisme Agricole, du Génie Rural, des Eaux et des Foréts' (CEMAGREF) is responsible for the selection of seed stands and the maintenance of a national register of forest basic material (Répertoire national des matériels de base français des essensces forestières). This register is issued every year.

3.5.2 Delimitation of Regions of Provenance

France uses a completely different approach compared to the other member states regarding the delimitation of regions of provenance. A region of provenance in France is defined as the sum of all selected stands that are morphologically and ecologically seen similar enough to be grouped within one and the same unit. This definition is completely in accordance with both the OECD and the EU regulations. This associational concept however differs strongly from the concept that is used by most European member states and that is based on zones (the surface is delimitated in geographically fixed areas).
A region of provenance is therefore not stable in time or in space according to this associational concept. Regions of provenance could for instance disappear in case all the stands within a certain marginal area disappear or they can vary in space according to the number of stands that is selected. A region of provenance could therefore only be identified as a cloud of spots representing stands.
This system is in operation in France since 1973 and since then in total about 73.000 hectares of selected stands is distinguished for 21 forest tree species. The regions of provenance are delimitated for all species separately. A total of 158 regions of provenance are identified. Compared to the introduced species a higher number of regions of provenance is usually identified for the indigenous species (Fernandez 1992).

Criteria for delimitation
The regions of provenance are delimitated according to the following criteria (Fernandez 1992):

- Genotype
  In case the knowledge is available genetically characteristics are used to delimitate the regions of provenance. An example of this is the delimitation of geographic races of *Pinus pinaster* Ait. into regions of provenance, that can be verified with the use of terpenes.
- Phenotype
  Some ecotypes could be distinguished based on phenotype. In mountainous regions the relief could lead to the creation of small homogeneous populations as for example is the case with Scots pine in the Vosges and the Central Massif.
- Ecological criteria
  The delimitation of regions of provenance could also be based on pH or the texture of the soil as is for example the case with Wild cherry and Beech.

– Other criteria
  In most cases there is no knowledge available to create units in an objective way. For this reason geographic units are often delimitated based on climatologic or geologic criteria. Sometimes new regions of provenance are being added or removed because of practical reasons.

Description of the regions of provenance
In this paragraph the delimitation of regions of provenance with accompanying maps is given for the 'Code forestier' species with the exception of the conifers.

1. *Populus* ssp.

Reproductive material of the genus *Populus* is without exception marketed as tested reproductive material. With the use of Poplars the choice of clones for a certain location is of more importance than the region of provenance.

2. *Fagus sylvatica*

For Beech 20 regions of provenance are distinguished (Table 8, Figure 11). With the delimitation of regions of provenance the acidity of the soil in the north east part of the country (04-Nord-Est calcaire en 05-Nord-Est acide) is taken into account because it is assumed that this species is very sensitive for this factor.

Figure 11. Regions of provenance for *Fagus sylvatica* in France (Source: CEMAGREF).

Table 8. Information regarding regions of provenance for *Fagus sylvatica* in France (Source: CEMAGREF).

Region of Provenance	*Altitude (m)*	*Climate*	*Precipitation*	*Stands*	*Surface (ha)*
		Temperature (°C)		*number*	
01-Perche	150 – 280	10.3	728	4	348
02-Bordure Manche	40 – 220	9.9	729	11	2192
03-Picardie	40 – 220	10.6	624	4	1373
04-Nord-Est calcaire	200 – 470	8.9	881	45	3436
05-Nord-Est acide	200 – 600	8.9	806	8	136
06-Nord-Est Massif Central	520 – 600	9.1	1264	2	288
07-Sud Massif Central moyenne altitude	500 – 920	9.0	1312	17	349
08-Bretagne	110 – 180	10.3	881	2	87
09-Bassin superieur de la Saone	300 – 500	9.3	958	23	1033
10-Charentes-Poitou	90 – 130	11.6	966	2	147
11-Plateaux du Jura	420 – 900	7.3	1387	18	474
12-Auvergne altitude	700 – 1250	8.4	1375	13	347
13-Pyrenees centrales	700 – 1400	10.8	1426	13	521
14-Argonne	190 – 280	8.5	861	4	62
15-Quest Massif Central	725	8.4	1375	1	2
16-Prealpes	1100 – 1350	7.7	2020	2	19
17-Est Massif Central moyenne altitude	720 – 780	10.2	724	2	5
18-Alsace-sundgau	280 – 590	9.9	705	8	208
19-Pyrenees orientales	630 – 1100	8.3	1065	2	149
20-Pyrenees occidentales basse altitude	210 – 900	11.0	1657	4	232

3. *Quercus robur*

For Pedunculate oak 10 regions of provenance are distinguished (Table 9, Figure 12). With the delimitation of regions of provenance ecological and morphological criteria were taken into account.

Table 9. Information regarding regions of provenance for *Quercus robur* in France (Source: CEMAGREF).

Region of Provenance	*Altitude (m)*	*Climate*	*Precipitation*	*Stands*	*Surface (ha)*
		Temperature (°C)		*number*	
01-Bourgogne	180 – 260	10.6	719	23	1188
02-Plateaux du Nord-Est	120 – 250	9.8	725	20	930
03-Nord	60 – 120	10.5	632	3	249
04-Vallee du Rhin	130 – 430	10.0	587	6	85
05-Sud-Quest vallées	10 – 350	12.4	1126	35	527
06-Loire Moyenne	100 – 250	10.3	802	9	84
07-Quest	60 – 240	11.3	597	12	143
08-Bassin superieur de la Saone	200 – 500	9.3	958	29	608
09-Sud-Quest hors vallées	280 – 330	11.6	1101	2	16
10-Quest Massif Central	400 – 600	8.4	1375	3	10

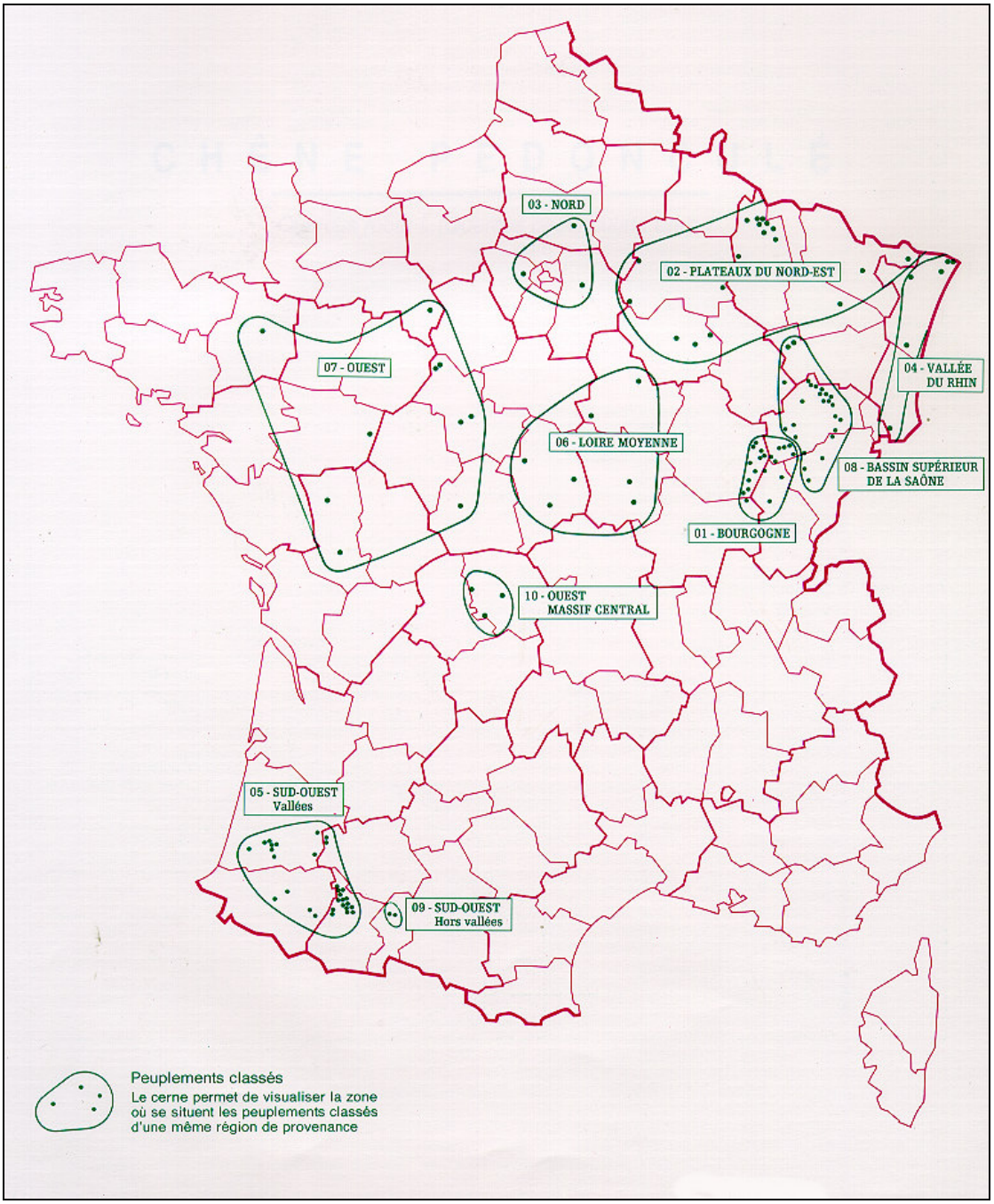

Figure 12. Regions of provenance for *Quercus robur* in France (Source: CEMAGREF).

4. *Quercus rubra*

For Northern red oak 3 regions of provenance are distinguished (Table 10, Figure 13).

Table 10. Information regarding regions of provenance for *Quercus rubra* in France (Source: CEMAGREF).

Region of Provenance	*Altitude (m)*	*Climate* *Temperature (°C)*	*Precipitation*	*Stands* *number*	*Surface (ha)*
01-Nord-Est	120 – 600	10.1	1068	98	248
02-Centre et Nord-Est	20 – 420	10.5	624	27	95

Region of Provenance	*Altitude (m)*	*Climate*	*Precipitation*	*Stands*	*Surface (ha)*
04-Sud-Quest	30 – 600	12.4	1126	31	157

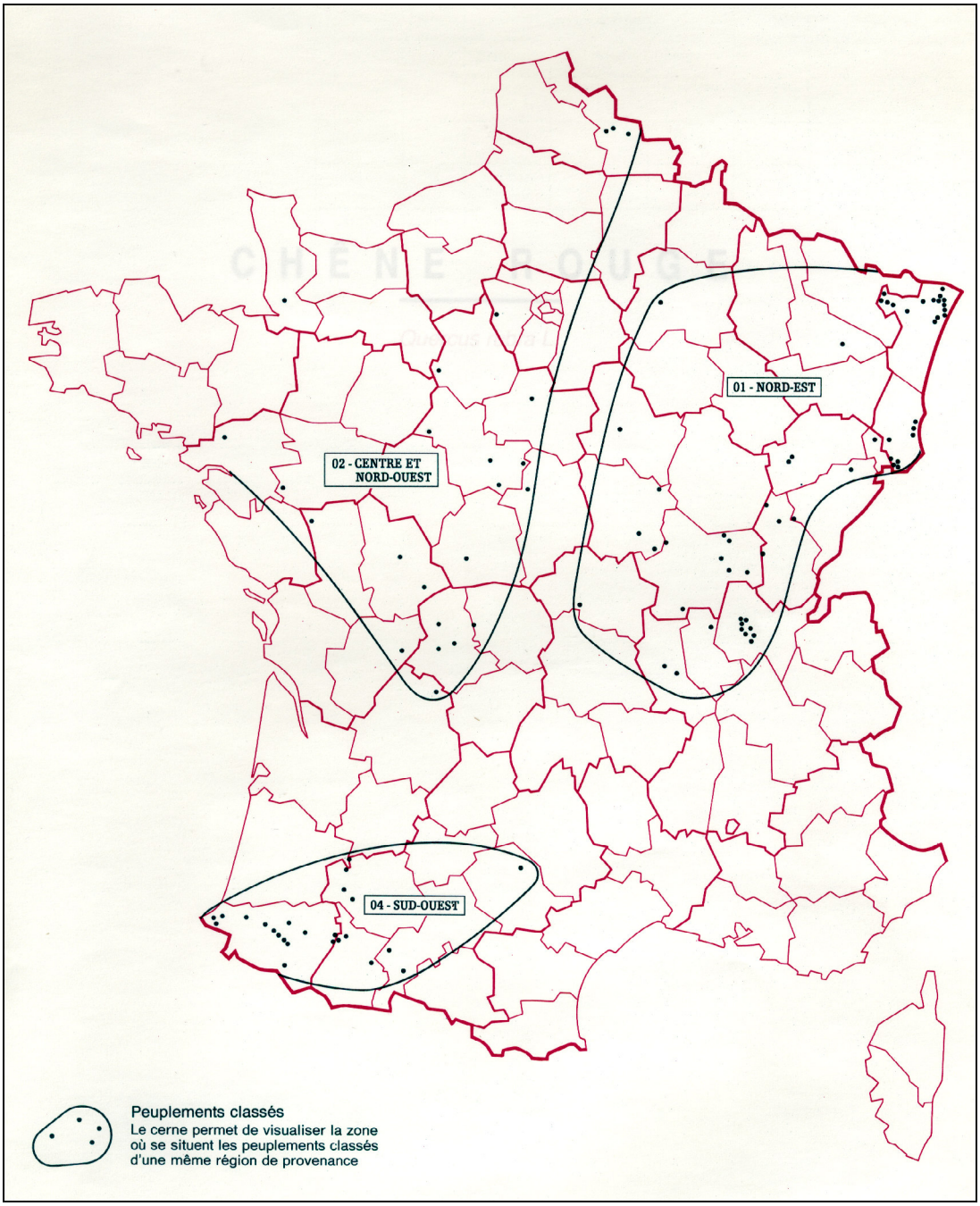

Figure 13. Regions of provenance for *Quercus rubra* in France (Source: CEMAGREF).

5. *Quercus petraea*

For Sessile oak 15 regions of provenance are distinguished (Table 11, Figure 14).

Table 11. Information regarding regions of provenance for *Quercus petraea* in France (Source: CEMAGREF).

Region of Provenance	*Altitude (m)*	*Climate* *Temperature (°C)*	*Precipitation*	*Stands* *number*	*Surface (ha)*
01-Secteur Ligerien	90 – 160	11.0	679	9	3089
02-Charentes-Poitou	110 – 160	11.2	697	8	659
03-Picardie	50 – 150	9.8	652	3	218

Region of Provenance	*Altitude (m)*	*Climate* *Temperature (°C)*	*Precipitation*	*Stands* *number*	*Surface (ha)*
04-Sud Bassin Parisien	60 – 180	10.6	632	8	956
05-Centre-Sud	160 – 320	10.9	718	7	1112
06-Allier	180 – 530	10.9	659	11	1072
07-Nord-Est gréseux	180 – 600	8.9	806	17	531
08-Vallee de la Saone	200 – 270	10.6	719	4	82
09-Erst Bassin Parisien	120 – 280	10.4	746	11	600
10-Morvan-Nivernais	230 – 550	10.3	802	6	432
11-Nord-Est limons et argiles	190 – 450	9.2	747	28	814
12-Bretagne	65 – 90	11.2	632	2	38
13-Sud du Massif Central	230 – 570	12.5	747	6	108
14-Quest Bassin Parisien	150 – 280	10.3	728	6	1521
15-Gascogne	110 – 450	11.6	1101	3	35

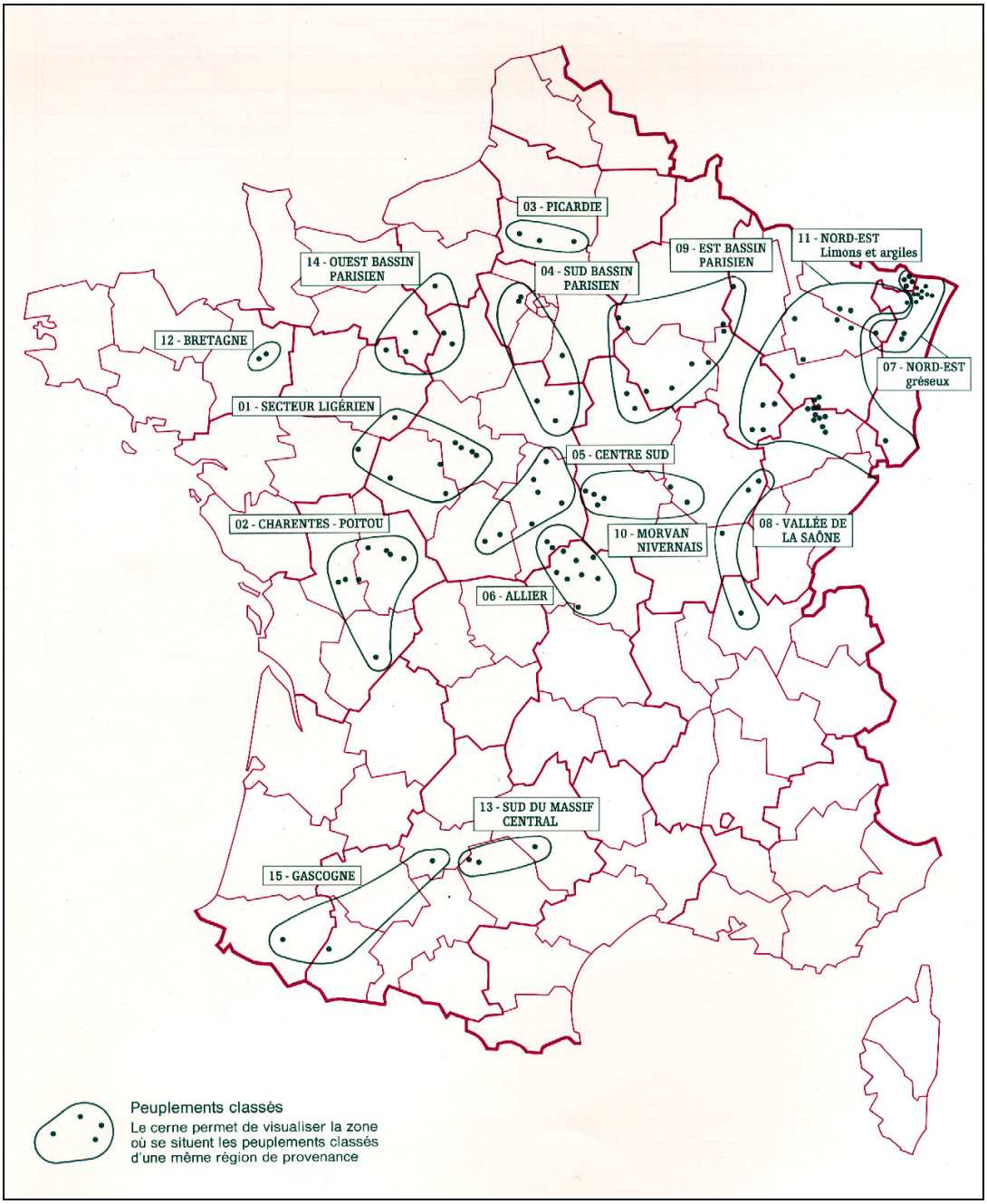

Figure 14. Regions of provenance for *Quercus petraea* in France (Source: CEMAGREF).

6. *Prunus avium*

For European cherry 2 regions of provenance are distinguished (Table 12, Figure 15). With the delimitation of regions of provenance acidity of the soil was taken into account.

Table 12. Information regarding regions of provenance for *Prunus avium* in France (Source: CEMAGREF).

Region of Provenance	*Altitude (m)*	*Climate* *Temperature (°C)*	*Precipitation*	*Stands* *number*	*Surface (ha)*
01-France neutrophile	35 – 700	10.6	719	26	60
02-France acidiphile	65 – 800	10.0	576	76	351

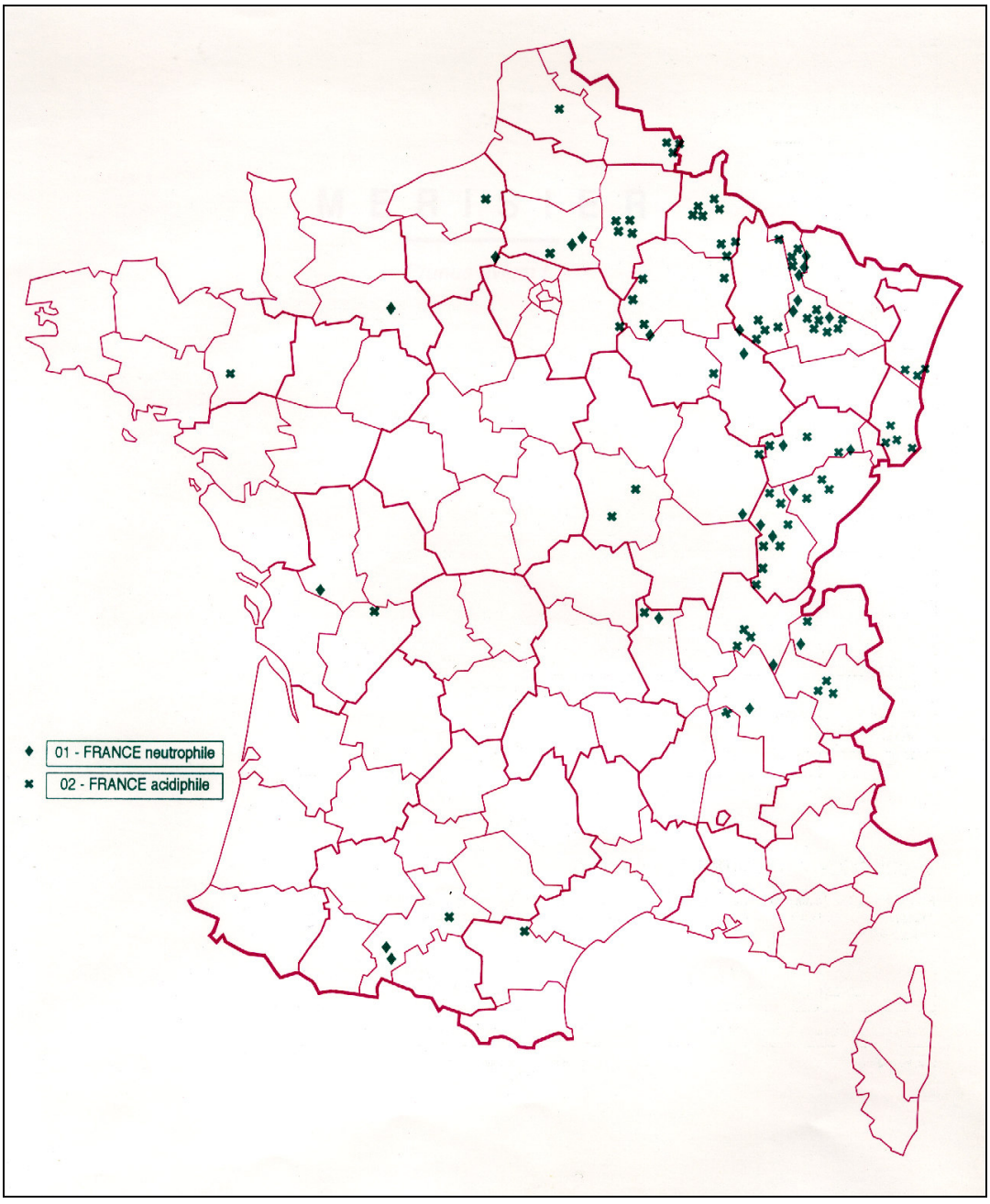

Figure 15. Regions of provenance for *Prunus avium* in France (Source: CEMAGREF).

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ANNEX A

SURVEY OF THE USE THAT HAS BEEN MADE OF GROWING AREAS AND GROWING DISTRICTS FOR THE CREATION OF ECOLOGICAL BASE UNITS IN GERMANY

ANNEX B

DESCRIPTION OF THE 46 ECOLOGICAL BASE UNITS IN GERMANY USED FOR THE DELIMITATION OF REGIONS OF PROVENANCE