UNIVERSITY OF LJUBLJANA
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COMPARISON OF FLORA AND VEGETATION OF CHOSEN COMMON BEECH-SILVER FIR FOREST IN SPAIN AND SLOVENIA

B. Sc. Thesis
Academic Study Programmes

Ljubljana, 2012

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BIOTEHNIŠKA FAKULTETA
ODDELEK ZA GOZDARSTVO IN OBNOVLJIVE GOZDNE VIRE

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Jesús MATEOS RONCERO

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AI V delu je predstavljena fitocenološka, floristična in vegetacijska primerjava bukovo-jelovih gozdov v Sloveniji in Španiji glede na najvažnejše okoljske dejavnike. Glede na literaturne vire ti gozdovi v Sloveniji pripadajo sintaksonom *Omphalodo-Fagetum* in *Galio-Abietetum,* v Španiji *pa Luzulo-Fagetum, Lysimanchio-Fagetum, Scillo-Fagetum, Festuco-Abietetum, Goodyero-Abietetum, Helleboro-Fagetum, Buxo-Fagetum* in *Coronillo-Fagetum*.

Ti gozdovi se v Sloveniji nahajajo predvsem na visokem dinarskem krasu (Trnovski Gozd, območje Kočevske in Snežnika) in na Pohorju, medtem ko so v Španiji razširjeni v Pirinejih in njihovi okolici. Primerjava je bila narejena na osnovi objavljenih popisov, ki so zbrani v združeno tabelo za nadaljnje floristične in vegetacijske analize. Na koncu so predstavljene in opisane diferencialne rastlinske vrste za izbrane bukovo-jelove gozdove v obeh državah.

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AB A phytosociological, floristic and climatic comparison of common beech (*Fagus sylvatica*)-silver fir (*Abies alba*) forest is presented. According to the syntaxonomy, chosen forest belongs to associations *Omphalodo-Fagetum* and *Galio-Abietetum* in Slovenia; and to associations *Luzulo-Fagetum, Lysimanchio-Fagetum, Scillo-Fagetum, Festuco-Abietetum, Goodyero-Abietetum, Helleboro-Fagetum,Buxo-Fagetum* and *Coronillo-Fagetum* in the case of Spain.

In Slovenia chosen forest are mainly found in Trnovski gozd, Kočevska region, Snežnik and Pohorje, while in Spain they are distributed only around Pyrenees. This comparison is made according to gathered samples integrated into a synthetic table for the purpose of vegetation and floristic analysis. Finally, differential species of chosen forest in both countries are described.

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ABBREVATIONS AND SYMBOLS

°C	Celsius grade
mm	milimeter
m a.s.l	meter above sea level
subass.	subassociation
var.geogr.	geographical variant
subvar.geogr.	geographical sub-variant
Br.-Bl.	Braun Blanquet

1 INTRODUCTION

Silver fir-common beech forest is one of the most appreciated forest ecosystems all around the world. It is mostly represented in Europe, from West to East and through its Central part. The value of this mixed wood resides on the landscape value, due to the combination of coniferous and deciduous species, which insures leaves cover during winter time because of silver fir, and exuberant sprouting at the beginning of spring by beech. Also, it presents a powerful contrast between light green and dark green leaves, breaking the huge beech dominance which fills almost all Europe. Furthermore they are abundant in undergrowth species, some of them with colorful flowering.

Another interesting point is the fauna that resides in this kind of woodland which is very rich in different animal species. Everything together means huge biodiversity, characteristic of this concrete type of forest. Moreover the wood value of these stands has to be remarked, in good quality and large diameters.

Silver fir (*Abies alba* Mill.) and Common beech (*Fagus sylvatica* L.) have quite similar ecological behavior. Both are shade and hygrophilous species and neither needs specific soil pH properties. This means that they can grow either on silicates or limestone. Silver fir has stronger and deeper root system than common beech, which is shallower, so fir is able to absorb deeper water during drought periods and requires deeper soil as well.

Slovenia and Spain are quite different countries regarding climatic factors, nevertheless silver fir-beech forest are found in both. However in Spain this type of forest can only be found around the Pyrenees or pre-Pyrenees. This means that only some parts of the Spanish woods are silver fir-beech forest while in Slovenia this type of forest represents one of the most numerous stands.

1.1 ECOLOGICAL CHARACTERISTICS OF SILVER FIR AND COMMON BEECH

First, in broad sense ecological characteristics of silver fir and common beech in both countries are explained below (Serrada R. 2008 in the case of Spain, and Brus R. 2005 in the case of Slovenia).

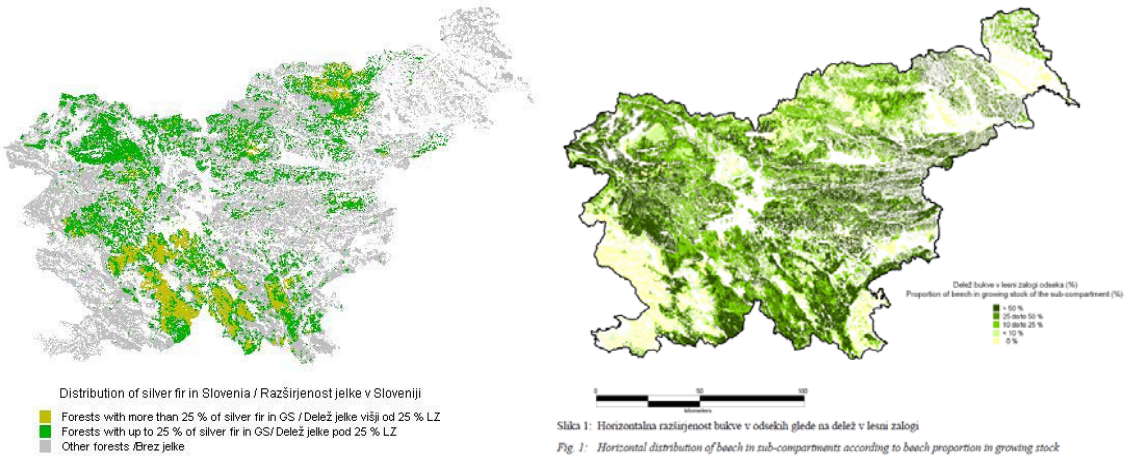
- ✓ **Silver fir ecological characteristics**
  - Altitude:
    - Spain:(700)1200-1800(2000) m a.s.l
    - Slovenia: (300)800-1200 m a.s.l
  - Rainfall patterns:
    - Spain:
      - Annual precipitation average: more than 650 mm
      - Summer precipitation average: more than 250 mm
    - Slovenia:
      - Annual precipitation average:1000-2500 mm
  - Temperature patterns:
    - Spain:
      - Annual temperature average: 6-11 ºC
      - Warmest month temperature average: 15-18 ºC
      - Coldest month temperature average: from -3º to 0ºC
    - Slovenia:
      - Annual temperature average: 5-8 ºC
- ✓ **Common beech ecological characteristics**
  - Altitude:
    - Spain: (0) 900-1600 (2000) m a.s.l
    - Slovenia: (200)500-1600 (1800) m a.s.l
  - Rainfall patterns:
    - Spain:
      - Annual precipitation average: 600-900 mm
      - Summer precipitation average: 150-200 mm
    - Slovenia:
      - Annual precipitation average: more than 600 mm

- Temperature patterns:
  - Spain:
    - Annual temperature average: 7-10 ºC
    - Warmest month temperature average: 18 ºC
    - Coldest month temperature average: 0 ºC
  - Slovenia:
    - Annual temperature average: 10.2 ºC
    - Warmest month temperature average: 20.4 ºC
    - Coldest month temperature average: -0.5 ºC

1.2 GENERAL DISTRIBUTION OF SILVER FIR AND COMMON BEECH

General distribution maps of both species in each country are presented below, where a huge difference in terms of stand surface between the two countries can be observed.

✓ **Slovenian distribution maps**



1) **2)**

Figure 1: Distribution of *Abies alba* Mill. in Slovenia. Areas where share of silver fir in total growing stock is higher than 25 % are coloured yellow; green are areas with silver fir share up to 25 % (The Vegetation Map …, 2012)

Figure 2: Distribution of *Fagus sylvatica* L. in Slovenia (The Vegetation Map …, 2012)

✓ **Spanish distribution maps**

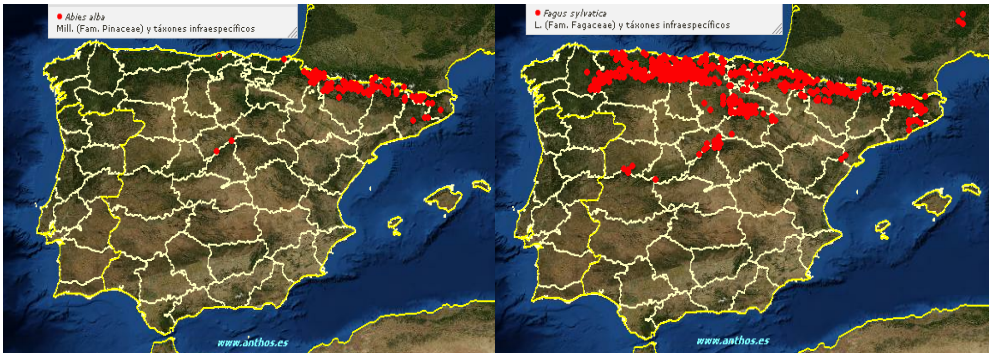


Figure 3: *Abies alba* Mill.distribution in Spain (SIVIM) **Figure 4**: *Fagus sylvatica* L.distribution in Spain(SIVIM)

Silver fir only appears in Pyrenees while common beech has wider North distribution.

1.3 GENERAL SYNTAXONOMY VIEW

Silver fir-common beech forest belongs to class *Querco-Fagetea* Br.Bl. et Vlieg. 1937 and to order *Fagetalia sylvaticae* Pawlowski 1928. However silver fir should belong to class *Vaccinio-Piceetea* Br.-Bl 1939 emend. Zupancic 1976, since coniferous forest is found in this class. This issue has raised a great deal of debate among authors.

In Slovenia, silver fir-common beech forest is represented in two alliances, one *Aremonio-Fagion* that contains the association *Omphalodo-Fagetum*. The other is alliance *Fagion sylvaticae* which incorporates the association *Galio-Abietetum*. On the other hand, in Spain, the type of forest in analysis belongs to alliance *Fagion sylvaticae*. This alliance is divided into two suballiances, each with several associations:

- First, suballiance *Fagion sylvaticae* with *Luzulo-Fagetum*; *Lysimachio-Fagetum*; *Scillo-Fagetum; Festuco-Abietetum; Goodyero-Abietetum;* and *Helleboro-Fagetum*.
- Second, suballiance *Epipactido-Fagetum* with *Coronillo-Abietetum*; and *Buxo-Fagetum*.

1.4 MAIN PURPOSE OF THE RESEARCH

The main purpose of this research is to compare the silver fir-common beech forest both in Slovenia and Spain. To reach our goal we will compare them taking into account physical factors like altitude, slope and orientation, also vegetation communities and floristic analyses are compared, trying to find consequential conclusions.

2 OVERVIEW OF PUBLICATIONS

Throughout the years research has been made regarding the silver fir-common beech forest. We have selected an overview of publications about this topic, the most important of which are described below.

2.1 SPANISH SYNTAXONOMY

Spanish silver fir-common beech mixed forest belongs to order *Fagetalia sylvaticae* Pawlowski 1928, to alliance *Fagion sylvaticae* (*Scillo-Fagion* Oberdorfer 1957), which is constituted of the following two suballiances in which corresponding associations of the chosen forest appears (Rivas-Martinez 1991).

- ✓ Suballiance *Scillo-Fagenion* Oberdorfer ex. Rivas-Martinez 1973.
  - *Luzulo-Fagetum*. (*Luzulo niveae-Fagetum sylvaticae* (Suspl. 1942) Br.-Bl. 1952)
  - *Lysimachio-Fagetum*. (*Lysimachio nemorum-Fagetum sylvaticae* Gruber 1973 em. Rivas Mart., Báscones, T. E. Díaz, F. Fernández-González et Loidi 1991)
  - *Scillo-Fagetum*. (*Scillo lilio-hyacinthi-Fagetum sylvaticae* Br.-Bl. ex O. Bolòs 1957) Association divided into 5 subassociations which contain chosen wood:
    - subass. *saxifragetosum hirsutae* Vanden Berghen 1968
    - subass. *abietetosum* (Grüber 1978) J. Vigo 1979
    - subass. *luzuletosum sylvaticae* O. Bolos 1957
    - subass. *buxetosum sempervirentis* subass. nova
    - subass. *prenanthetosum purpureae* O. Bolos 1957
  - *Festuco-Abietetum*. (*Festuco altissimae-Abietetum albae* Rivas Mart. 1968)
  - *Goodyero-Abietetum*. (*Goodyero-Abietetum* (Br.-Bl.) O. Bolòs 1957 em. nom. Rivas Mart. 1968)
  - *Helleboro-Fagetum*. (*Helleboro-Fagetum* O. Bolòs (1948) 1957)

- ✓ Suballiance *Epipactido helleborines-Fagenion sylvaticae* Rivas-Martfnez, T.E. Díaz, F. Prieto, Loidi &Penas suball. Nova
  - *Coronillo-Abietetum*. (*Coronillo emerici-Abietetum albae* Rivas Mart., Báscones, T. E. Díaz, F. Fernández-González et Loidi 1991)

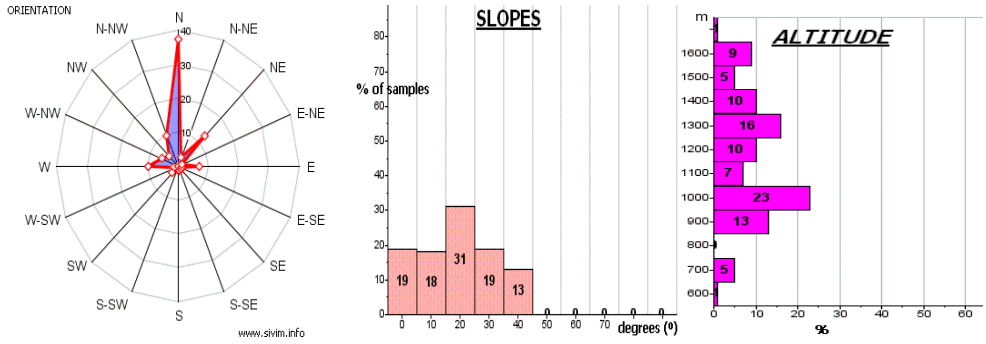
- *Buxo-Fagetum*. (*Buxo sempervirentis-Fagetum sylvaticae* Br.-Bl. et Suspl. 1937 em. Br.-Bl. 1952).

Most of the associations are distributed around Pyrenees or Pre-pyrenees.

These associations are described below. The analyzed factors are both geographical and ecological found in samples which have been obtained from Sistemas de Información de la Vegetación Ibérica y Macaronésica (SIVIM) database.

2.1.1 Association Luzulo *niveae-Fagetum sylvaticae*

The soil mostly present sandstones, this association are distributed around moist areas. (Rivas-Martínez 1991)



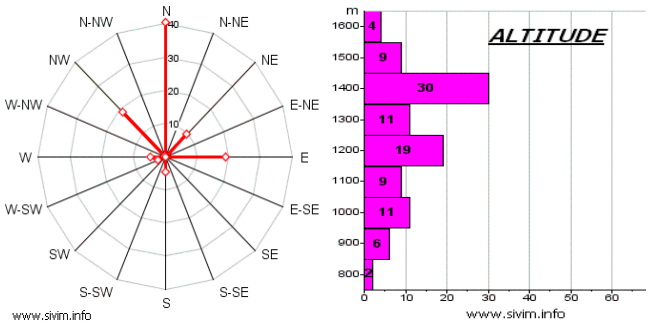
a) b) c)

Figure 5: *Luzulo-Fagetum* ecology (SIVIM): a) Orientation.; b) Inclination.; c) Altitude.

Figure 6: samples distribution map of association *Luzulo-Fagetum*(SIVIM)

2.1.2 Association *Lysimachio nemorum-Fagetum sylvaticae*

Acidophilic syntaxon distributed around high and medium Pyrenees on wet places. (Rivas-Martínez 1991)



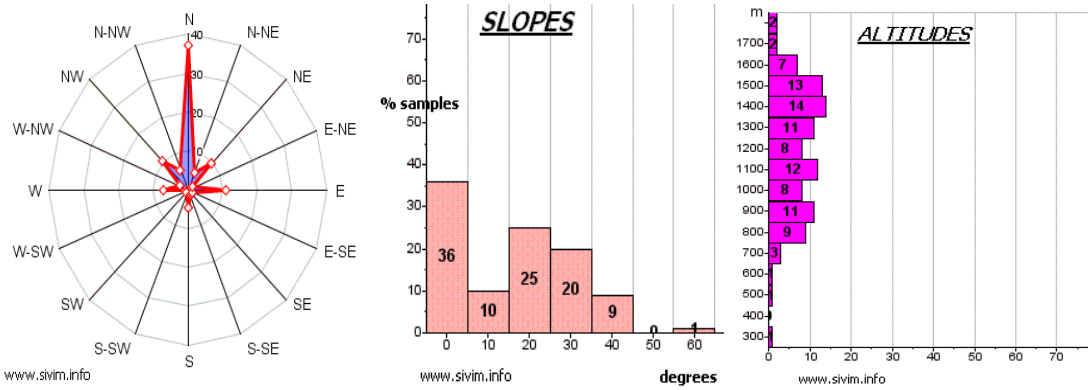
a) b)

Figure 7: *Lysimachio–Fagetum* ecology(SIVIM): a) Orientation.; b) Altitudes

Figure 8: *Lysimachio-Fagetum* samples distribution map (SIVIM)

2.1.3 Association *Scillo lilio-hyacinthi-Fagetum sylvaticae*

This syntaxon belongs to montane belt, ombrophilous, mesophytic, neutrophilic and basophilic (Rivas-Martínez 1991).



a) b) c)

Figure 9: *Scillo-Fagetum* ecology (SIVIM): a) Orientation.; b) Inclination; c) Altitudes

Figure 10: *Scillo-Fagetum* samples distribution map (SIVIM)

Main subassociations of this syntaxon that contain silver fir-beech forest are explained below.

2.1.3.1 Subassociation *saxifragetosum hirsutae*

It is mostly distributed around occidental Pyrenees, this association requires deep and decarbonated soils (Rivas-Martínez 1991).

Figure 11: Subassociation *saxifragetosum* samples distribution map(SIVIM)

2.1.3.2 Subassociation *abietetosum*

It is distributed around Jaca (Huesca) in Aragón province, Pre-Pyrenees area.

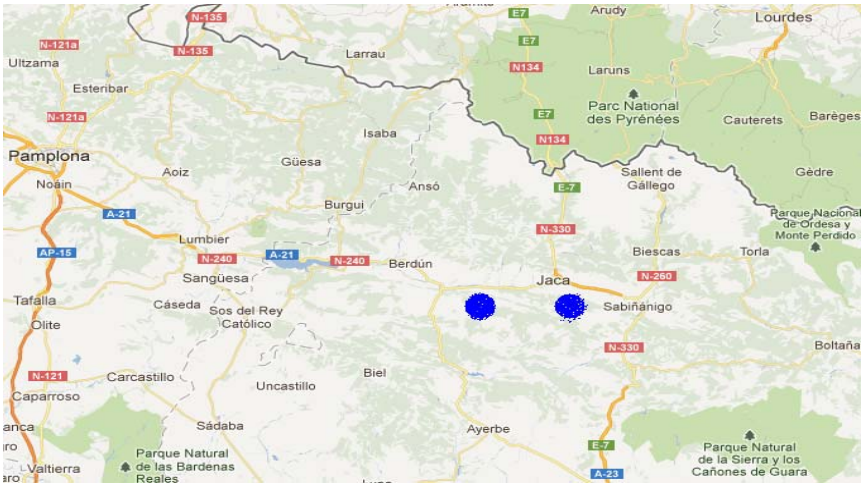


Figure 12: Subassociation *abietetosum* samples distribution map(SIVIM)

2.1.3.3 Subassociation *luzuletosum sylvaticae*

Samples distributed around National Park Ordesa y Monte Perdido (Huesca), high Pyrenees. Typical association found in high Pyrenees areas with slight acidophilic soil and important shade (Rivas-Martínez 1991).

Figure 13: Subassociation *luzuletosum* samples distribution map (SIVIM)

2.1.3.4 Subassociation *buxetosum sempervirens*

Basophilous association and slightly xerophytic, it is found in soils that are easily dried up (Rivas-Martínez 1991).

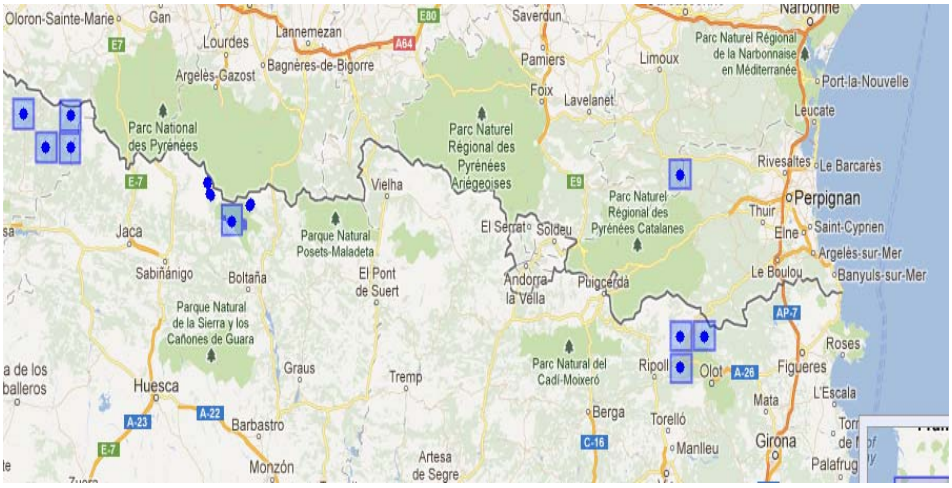


Figure 14: Subassociation *buxetosum* samples distribution map(SIVIM)

2.1.3.5 Subassociation *prenanthetosum purpureae*

Syntaxon found close to Natural Park Posets-Maladeta in the high Pyrenees. It is typical of high mountains with superficial horizon slightly acid (Rivas-Martínez 1991).

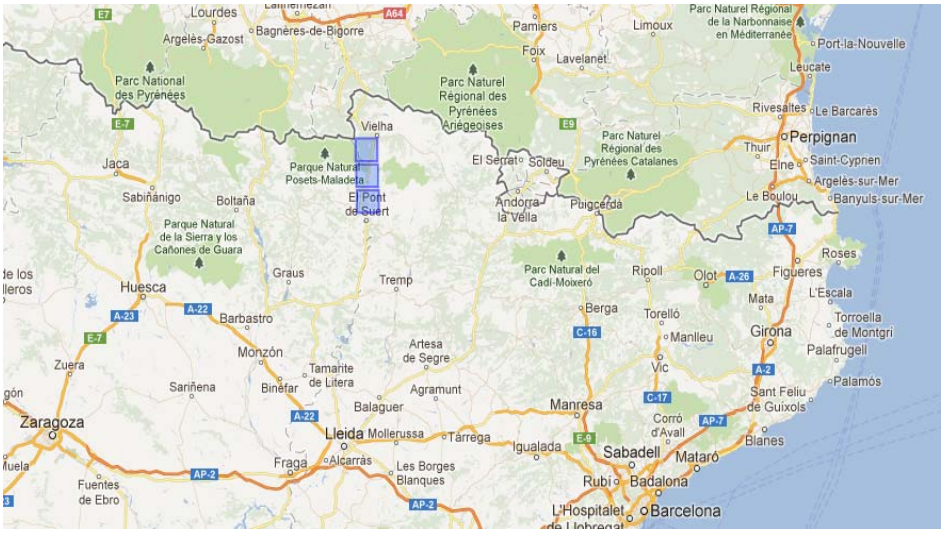


Figure 15: Subassociation *prenanthetosum* samples distribution map (SIVIM)

2.1.4 Association *Festuco altissimae-Abietetum albae*

Montane belt, mesophytic, ombrophilous, neutro-basophilous however sometimes appears in an organic surface horizon (moder) quite acid (Rivas-Martínez 1991).

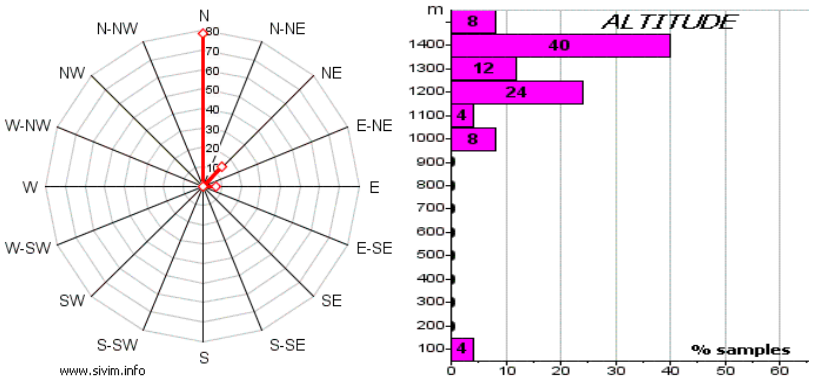


Figure 16: *Festuco-Abietetum* ecology (SIVIM): a) Orientation; b) Altitude

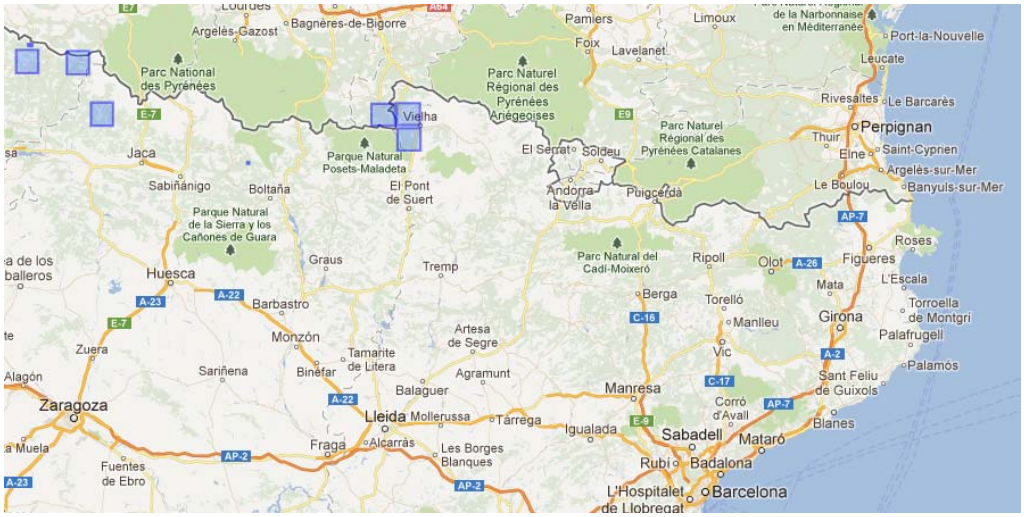
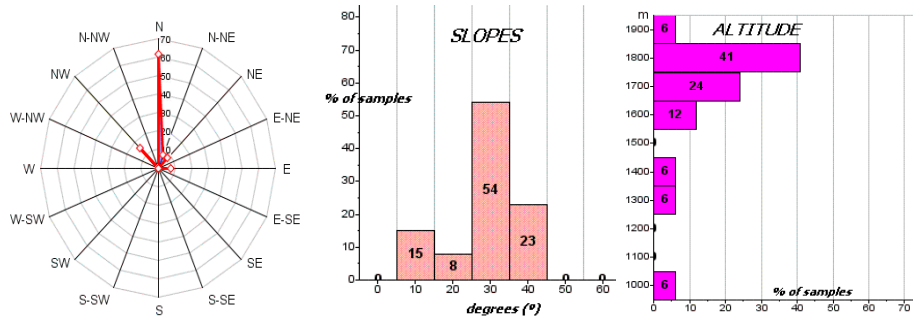


Figure 17: *Festuco-Abietetum* samples distribution map (SIVIM)

2.1.5 Association *Goodyero-Abietetum albae*

Syntaxon acidophilus, ombrophilus, characteristic of montane belt (high Pyrenees) (Rivas-Martínez 1991).



a) b) c)

Figure 18: *Goodyero-Abietetum* ecology (SIVIM): a) Orientation; b) Inclination; c) Altitude

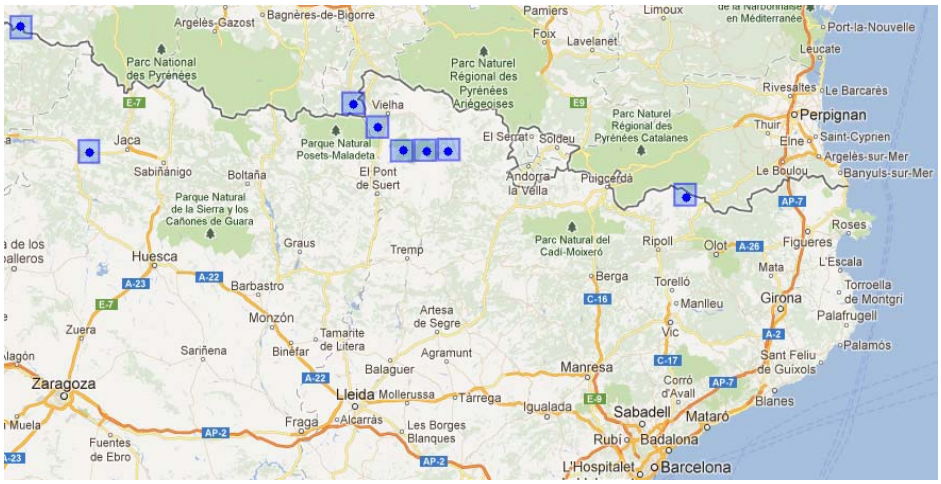
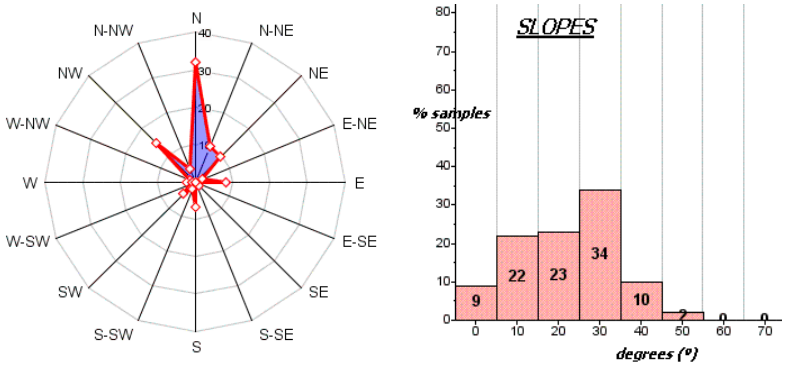


Figure 19: *Goodyero-Abietetum* samples distribution map (SIVIM)

2.1.6 Association *Helleboro-Fagetum*

The classification of this group is quite difficult according to different authors, nevertheless it is included in silver fir-beech forest samples, but chosen woodland does not always appears in all of them.



a) **b)**

Figure 20: *Helleboro-Fagetum* ecology (SIVIM): a) Orientation; b) Inclination

The huge south distribution out of Pyrenees or pre-Pyrenees is remarked, in places where silver fir is not able to survive (Figure 21).

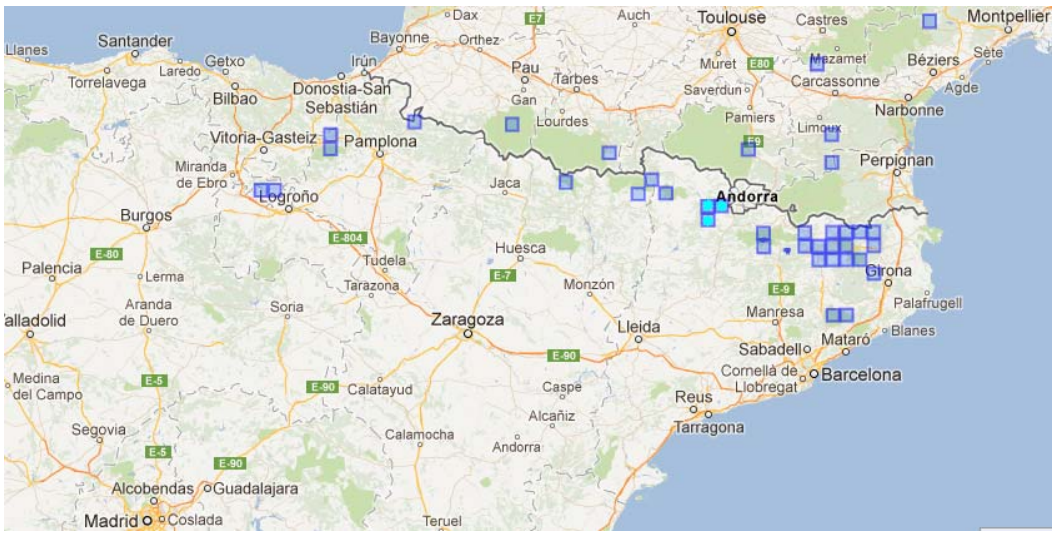


Figure 21: *Helleboro-Fagetum* samples distribution map (SIVIM)

2.1.7 Association *Coronillo emerici-Abietetum albae*

Xerophytic, neutrophilous or basophilous, ombrophilus, characteristic of places with deep soil, mainly in the foothills of Pyrenees) (Rivas-Martínez 1991).

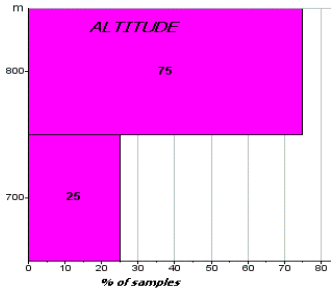
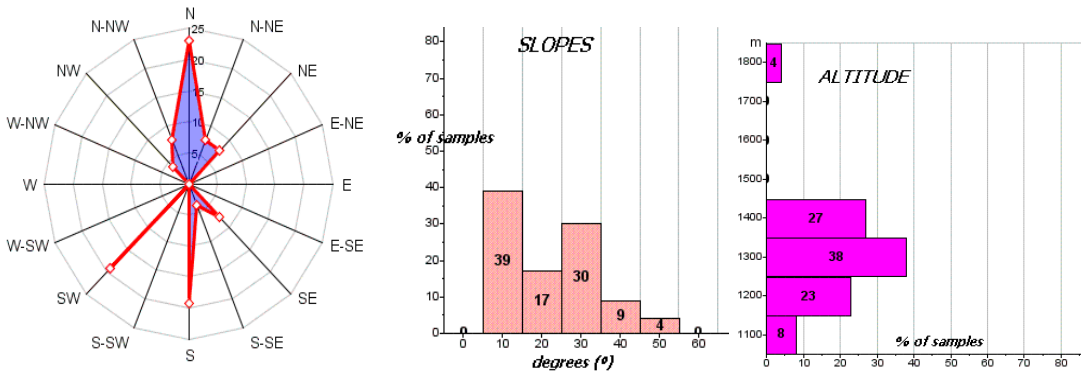


Figure 22: *Coronillo-Abietetum* samples altitude(SIVIM)

Figure 23: *Coronillo-Abietetum* samples distribution map (SIVIM)

2.1.8 Association *Buxo sempervirentis-Fagetum sylvaticae*

Syntaxon xerophytic, termophilous and neutro-basophilous (Rivas-Martínez 1991).



a) b) c)

Figure 24: *Buxo-Fagetum* ecology (SIVIM): a) Orientation; b) Inclination; c) Altitude

There is an important south distribution of this association outside of the Pyrenees because it is found in places with more dry characteristics.

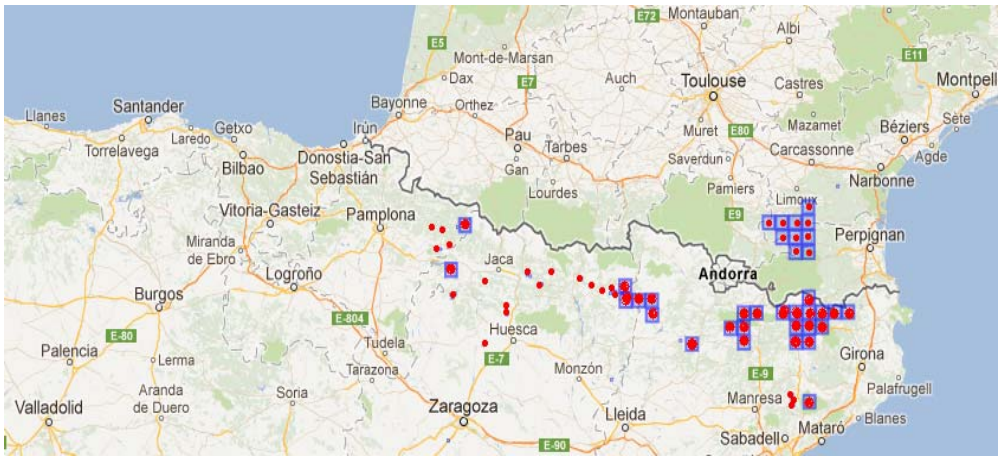


Figure 25: *Buxo-Fagetum* samples distribution map (SIVIM)

It is important to take into consideration that some of the included figures are not completely reliable, because sometimes parameters like orientation and inclination were not registered (no data). This happens when orientations with no data are incorrectly considered orientation north, and when inclinations with no data are improperly recognized as inclination 0º.

In any case these figures have been included in consideration that they at least give some ecological information. Mostly, due to incorrectly considered data, the orientation north is always dominant, although it should not be. Despite that a general approximation could be done. Still, some illustrations of the syntax have not been included due to their huge data lag.

2.2 SLOVENIAN SYNTAXONOMY

First, an important remark has to be made, Slovenian silver fir-common beech stands also appear in association *Homogyno sylvestris-Fagetum* (Marincek 1993) - but this pre-alpine syntaxon is not object of this research.

Second, the chosen forest appears in the associations *Omphalodo Fagetum* and *Galio-Abietetum*. Below, the distribution of both Slovenian associations can be observed (Figure 26).

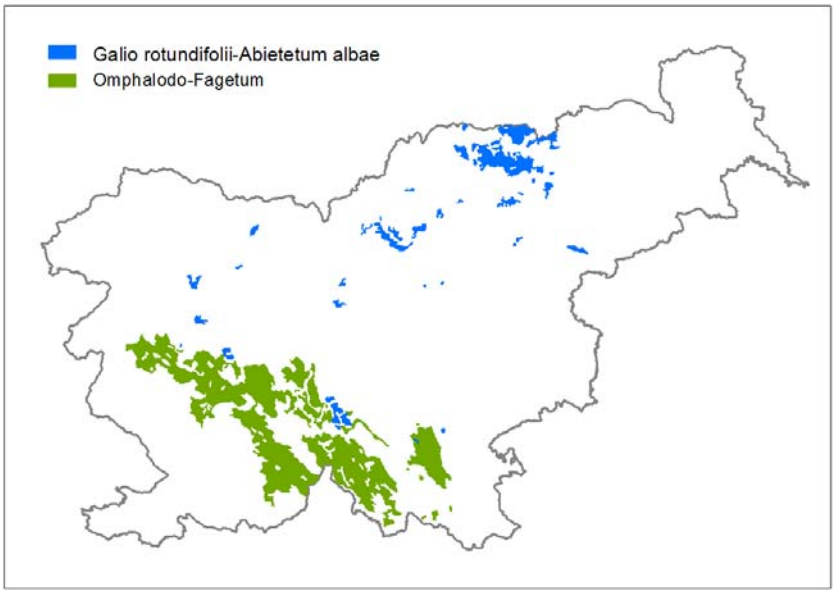


Figure 26: *Galio-Abietetum* and *Omphalodo-Fagetum* distribution in Slovenia (The Vegetation Map …, 2012)

2.2.1 Association *Omphalodo Fagetum*

The chosen forest is studied into association *Omphalodo-Fagetum* (Tregubov 1957 corrected Puncer 1980), that belongs to Illyrian alliance *Aremonio-Fagion* (Horvat 1938), in contrast to the Central European beech communities. This typical association from west-Dinaric fir-beech forest is divided into two geographical variants, *Omphalodo-Fagetum* var. geogr. *Saxifraga cuneifolia*, further divided into two geographical sub-variants, subvar.geogr. *Anemonia trifolia* (western part) and subvar.geogr. *Omphalodes verna* (central-eastern part).

Other geographical variant is *Omphalodo-Fagetum* var.geogr. *Calamintha grandifolia*, also further divided into two geographical sub-variants, subvar.geogr. *Dentaria pentaphyllos* and sub.var.geogr. *Dentaria polyphylla* (Surina 2002).

Explained association is sketched below:

- Alliance *Aremonio-Fagion* Horvat 1938
  - ❖ Association *Omphalodo-Fagetum* (Tregubov.1957 corr.Puncer 1980)
    - ➢ *Omphalodo-Fagetum* var. geogr. *Saxifraga cuneifolia*
      - o subvar.geogr. *Anemone trifolia*
      - o subvar.geogr. *Omphalodes verna*

- *Omphalodo-Fagetum* var. geogr. *Calamintha grandifolia*
  - subvar.geogr. *Dentaria pentaphyllos*
  - subvar.geogr. *Dentaria polyphylla*

Syntaxon *Omphalodo-Fagetum* is mostly found in carbonated soils.

The mentioned association is optimally developed between Sneznik plateau and the Kocevje region in Slovenia. Floristic and phytogeografical differences occurring throughout its distribution area, which spreads from the Trnovski Gozd plateau in the northwest to Velebit (Croatia) in the southeast, indicate that the association is not homogeneous. The reason for this is in the lower proportion of Southeast - European-Illyrian (Illyricoid) species towards the north-west, while influence of Alpine species is greater towards north-west direction because of the close proximity of the Alps. (M. Wraber 1953, 1959, Puncer 1979, Dakskobler 2000, Surina 2001)

2.2.1.1 *Omphalodo-Fagetum* var. geogr. *Saxifraga cuneifolia*

Stands of this new syntaxon are transitional to stands of pre-Alpine fir-silver forest of the association *Homogyno sylvestris-Fagetum* var.geogr. *Sesleria autumnalis*. This association and both sub-variants geographically mostly reside in Trnovski Gozd, which is the unique place of *Omphalodo-Fagetum* where *Saxifraga cuneifolia* grows. Despite that subvar.geogr. *Anemone trifolia* is found in the western part of the forest, and subvar.geogr.*Omphalodes verna* is distributed around center-eastern part of Trnovski gozd. The reason of this sub-variant differentiation lies in the distribution of *Omphalodes verna*, main differential specie of the association *Omphalodo-Fagetum*, which does not exist in Western part of Trnovski gozd. In fact, there exists a huge proportion of *Anemone trifolia* (62% of cover), specie that gives the name at this sub-variant.
Nevertheless this geographical sub-variant, *Omphalodo-Fagetum* var.geogr. *Saxifraga cuneifolia*, is not included in the synthetic table, only *Omphalodo-Fagetum* var. geogr. *Calamintha grandiflora* is into the research.

2.2.1.2 *Omphalodo-Fagetum* var. geogr. *Calamintha grandiflora*

Syntaxon with a high proportion and cover value of *Aremonio-Fagi*on alliance, typical composition located in Sneznik and Kocevsko region, more specıfically in Rog. Syntaxon subdivided into 14 subassociations (Dakskobler 2011): 1. *asaretosum;* 2. *aegopodietosum podagraria;* 3. *equisetosum telmateiae;* 4. *galietosum odorati;* 5. *festucetosum drymejae;* 6. *mercurialietosum perennis;* 7. *caricetosum albae;* 8. *aceretosum;* 9. *thelypteretosum limbospermae;* 10. *festucetosum altissimae;* 11. *neckeretosum crispae;* 12. *adenostyletosum glabrae;* 13. *homogynetosum sylvestris* and 14. *lycopodietosum annotini.*

However, in the case of this research, the following subassociations of *Omphalodo-Fagetum* were found in the gathered samples, and consequently appear in the synthetic table:

- subass. *asaretosum* Puncer 1980.

It is found in low-middle mountain region from 500 to 700 m a.s.l with limestone soil.

- subass. *neckeretosum crispae* Puncer 1980.

It is found on very rocky and sometimes on very steep slopes even on the mountain ridges.

- subass. *adenostyletosum glabrae* Puncer 1980.

Syntaxon found in the highest parts of Kocevsko region between 1100 and 1200m a.s.l, most commonly on rocky and shade parts.

- subass. *mercurialetosum perennis* Tregubov 1957.

It is found on sunny sides and in some parts quite steep slopes always on limestone.

- subass. *festucetosum drymejae* Accetto 1998.

Syntaxon distributed around Kocevski Rog on gradual slopes with brown carbonated soil.

- subass. *aceretosum* (=*phyllitidetosum* Puncer, Wojterski, Zupančič 1974)

It grows in sinkholes, as well as on wet and partly rocky soils.

- subass. *galietosum odorati (=typicum)* Puncer 1980.

Main syntaxon of Slovenian silver fir-common beech forest, found in realignments between sinkholes on gradual slopes and in shallow and wide limestone valleys.

- subass. *caricetosum albae* Marinček 2009.

Syntaxon found in the virgin forest Strmec na Kocevskem, it grows on steep and sunny calcareous slopes with shallow soils.

An interesting remark is the importance of silver fir-common beech wood in Kocevsko region, where the Virgin forest Pečka can be found. The virgin forest expands over 60.2 ha at the altitude of 795 to 910 metres above sea level. It is dominated by Dinaric fir-beech forests, namely by the geographical variant of the association *Omphalodo-Fagetum* (Tregubov 1957) Marinček et al. 1993 var. geogr. *Calamintha grandiflora* Surina 2002 with four subassociations: (Marincek 2004)

1. *typicum* (M. Wraber 1955) Puncer 1980.
2. *galietosum odorati*(Tregubov 1957) Puncer 1980
3. *festucetosum altissimae* Puncer, Wojterski, Zupančič 1974
4. *phyllitidetosum*(Puncer, Wojterski, Zupančič 1974) subass. Nova

2.2.2 Association *Galio-Abietetum*

Galio rotundifolii Abietetum Wraber 1959, however is found on non-carbonate soils and belongs to a different alliance than *Omphalodo-Fagetum*. This alliance is *Fagion sylvaticae* Luquet 1926. Which is located in potential beech forest but suballiance *Galio-Abietenion* Oberdorfer 1962 also contains silver fir. Nevertheless, silver fir could be characteristic specie of Central Europe broadleaved forest and not perhaps of the coniferous forest. Silver fir is found on Pohorje and it is probably prevailing there due to many anthropogenic disturbances in the past (Belec 2009).

For this reason it is consequently enlisted to beech forest alliance *Fagion sylvaticae* and not into coniferous forest alliance *Vaccinio- Piceion* Br.-Bl. 1939. Silver fir was, in the case of Pohorje, always present as a beech forest characteristic species and not a coniferous one, so we can consider silver fir as a beech companion (Belec 2009).

This syntaxon is located in acid substrate with round-leaved bedstraw (*Galium rotundifolium* L.), and could not be valuated as natural climax or pedoclimax phytocenosis but only as an artificially cultivated Norway spruce-silver fir forest on sites of potential beech forest due to economic benefits of farmers (Belec 2009).
The huge cover of Norway spruce is consequence of plantation, made in the past because of the great profits given in that time. Its timber became valuable before the middle of the 19th

century, when demand for it increased in the lands of Hungarian crown, where numerous ships were made with Norway spruce timber on river Drava (Belec 2009).

Regression of silver fir distribution in Europe began centuries ago (Horndasch, 1993), whereas in Slovenia the die-back process raised concern in the 1960s and 1970s (Batič, 1997). The first interpretations of silver fir decline causes were based on the hypothesis that fir dies particularly on the periphery of its natural range (Rubner 1953; Dannecker 1955), Later on, the explanations for silver fir decline (Brinar, 1964, 1974) were based on changes in climate extremes, or saw fir decline as a result of incorrect silvicultural treatments in the past or unsuitable sites (Mlinšek, 1964). Increment analysis for silver fir in the Dinaric phytogeographic region from the 1960-1995 period showed that increment depression was reached between 1976 and 1986. After that year diameter and height increment increased (Levanič, 1997), as well as vitality (Prelc et al.1993). Changes of share of silver fir are also influenced by diameter distribution of forests and difficulties in regeneration in the Dinaric phytogeographic region (Bončina, 1996; Jarni et al. 2004) whereas silver fir regenerates successfully out of Dinaric silver fir-beech forests and silver fir forests (Bončina et al. 2003a; Kunstek, 2004).

This association is mostly found in cold and wet areas of hillside or foothill; it is distributed from 350 to 1000 m a.s.l., with deep and washed soil that contains magmatic and metamorphic bedrock. (M.Waber 1959).

In obtained samples about this syntaxon, only one subassociation is found, subass. *epimedietosum*, however is distributed in lower altitude around Dolenjska region than the rest of the association, mainly distributed around Pohorje.

- Alliance Fagion sylvaticae Luquet 1926
  - ✓ Galio-Abietetum Wraber 1959.

2.3 DIFFERENTIAL SPECIES OF EACH SYNTAXON

Below, a classification according to differential species for each country and association is explained.

2.3.1 Spanish syntaxa

Differential species are explained according to each syntaxon (Rivas Martínez 1991)

2.3.1.1 Differential species of alliance *Fagion sylvaticae*:

Crepis lampsanoides, Euphorbia hyberna, Helleborus occidentalis, Lathyrus laevigatus subsp. *grandiflorus, Saxifraga hirsuta* subsp. *hirsuta, Saxifraga x geum, Saxifraga umbrosa, Scilla lilio-hyacinthus, Scrophularia alpestris.*

2.3.1.2 Differential species between both suballiances: *Scillo-Fagenion* and *Epipactido-Fagenion*

- Suballiance *Scillo-Fagenion*:

Betula pendula, Cardamine heptaphylla, Crataegus laevigata, Goodyero repens, Isopyrum thalictroides, Luzula nivea, Luzula pilosa, Lysimachia nemorum, Maianthemum bifolium, Pulmonaria affinis, Sambucus racemosa, Saxifraga umbrosa

- Suballiance *Epipactido-Fagenion*:

Acer opalus, Cephalanthera longifolia, Cephalantera rubra, Coronilla emerus, Epipactis helleborine, Lathyrus niger, Primula veris, Quercus humilis, Sorbus aria, Viburnum lantana.

2.3.1.3 Differential species of each association:

- Association *Lysimachio nemorum-Fagetum sylvaticae:*

Digitalis purpurea, Aruncus dioicus, Geranium nodosum, Betula pendula

- Association *Scillo lilio-hyacinthi-Fagetum sylvaticae:*

Meconopsis cámbrica, Ulmus scabra, Saxifraga hirsuta, Isopyrum thalictroides, Euphorbia dulcis, Rosa arvensis, Symphytum tuberosum, Phyllitis scolopendrium, Lathyrus laevigatus subsp. *grandiflorus, Saxifraga umbrosa, Festuca gigantea.*

- Association *Festuco altissimae-Abietetum albae:*

Orthilia secunda, Pyrola chlorantha, Vaccinium myrtillus, Luzula nivea

This are acidophilous species because of the organic layer formation.

- Association *Goodyero-Abietetum albae:*

Brachipodium rupestre, Erica vagans, Hypericum pulchrum, Teucrium scorodina

- Association *Coronillo emerici-Abietetum albae* (Suballiance *Epipactido-Fagenion*)

Contains some *Quercetalia pubescentis* elements, which means more termophilous species and consequently lower altitude.

Primula veris subsp.*columnae, Coronilla emerus, Quercus humilis, Acer opalus, Cephalanthera rubra.*

- Association *Buxo sempervirentis-Fagetum sylvaticae* (Suballiance *Epipactido-Fagenion)*

Also with differential species from *Quercetalia pubescentis* like *Quercus humilis* and *Coronilla emerus.*

Buxus sempervirens, Geranium nodosum, Pulmonaria affinis and *Melittis melissophylum* as well.

2.3.2 Slovenian syntaxa

Differential species of each syntaxon are explained bellow.

2.3.2.1 Differential species of alliance *Aremonio Fagion*:

Omphalodes verna, Aremonia agrimonoides, Dentaria enneaphyllos, Lamium orvala, Cardamine waldsteinii, Calamintha grandiflora, Daphne laureola, Cyclamen purpurascens, Scopolia carniolica, Hacquetia epipactis, Dentaria trifolia, Rhamnus fallax, Helleborus niger, Geranium nodosum and *Isopyrum thalictroides.* (Surina, 2002)

2.3.2.2 Differential species of association *Omphalodo-Fagetum*:

Abies alba, Omphalodes verna, Aremonia agrimonoides, Cardamine trifolia, Rhamnus fallax, and *Calamintha grandiflora* (Surina, 2002)

2.3.2.2.1 Differential species of *Omphalodo-Fagetum* subassociations

Differential species of *Omphalodo-Fagetum* subassociations are explained (Dakskobler, 2011)

- Subassociation *asaretosum* Puncer 1980

Asarum europaeum; Carex digitata; Luzula pilosa and *Primula vulgaris*.

- Subassociation *neckeretosum crispae* Puncer 1980

Neckera crispa, Goodyera repens, Rhytidiadelphus loreus,Lycopodium annotinum and *Vaccinium myrtilus.*

- Subassociation *galietosum odorati* Puncer 1980

Galium odoratum and *Sanicula europaea*

- Subassociation *adenostyletosum glabrae* Puncer 1980

Adenostyles glabra, Polystichum lonchitis, Polygonatum verticilatum and *Picea abies.*

- Subassociation *mercurialetosum perennis* Tregubov 1957

Mercurialis perennis, Cyclamen purpurascens and *Euonymus verrucosa.*

- Subassociation *festucetosum drymejae* Accetto 1998

Festuca drymeia, Arum maculatum and *Ilex aquifolium.*

- Subassociation *aceretosum* Puncer, Wojterski, Zupancic 1974

Scopolia carniolica, Stellaria Montana, Chrysosplenium alternifolium, Circaea lutetiana, Adoxa moschatellina,Phyllitis scolopendrium and *Polystichum braunii.*

- Subassociation *caricetosum albae* Marincek 2009

Carex alba, Fraxinus ornus, Cephalanthera rubra and *Ostrya carpinifolia.*

2.3.2.3 Differential species of association *Galio-Abietetum*:

Abies alba, Galium rotundifolium, Rubus hirtus, Maianthemum bifolium and *Thelypteris limbosperma.*

3 MATERIALS AND METHODS

The synthetic table, on which this comparison is based, is made from 664 relevés, 395 of them are from Spain while 269 are from Slovenia. Spanish samples contain 8 associations and 5 subassociations, while Slovenian relevés contain 2 associations and 9 subassociations. It is explained in table below (Table 1).

Table 1: Number of gathered relevés in Slovenia and Spain

SPANISH associations		Number of relevés	Number of tables
Luzulo-Fagetum		38	5
Lysimachio-Fagetum		41	2
Scillo-Fagetum	*saxifragetosum*	15	3
	abietetosum	9	3
	luzuletosum	12	1
	buxetosum	87	5
	prenanthetosum	22	2
Festuco-Abietetum		22	2
Goodyero-Abietetum		89	6
Helleboro-Fagetum		17	2
Coronillo-Abietetum		3	1
Buxo-Fagetum		40	2
		395	**34**
SLOVENIAN associations			
Omphalodo-Fagetum	*asaretosum*	16	1
	neckeretosum	16	2
	adenostyletosum	10	1
	mercurialetosum	13	1
	festucetosum	22	3
	aceretosum	22	2
	galietosum	44	3
	caricetosum	6	1
Galio-Abietetum		98	5
Galio-Abietetum	*epimedietosum*	22	1
		269	**20**

Relevés are obtained from Slovenian and Spanish published data base of chosen stand. Floristic composition of Silver fir-common beech forest is found in several publications around Europe, but in this research only the ones which concern Spain and Slovenia and have acceptable values of the chosen woodland are considered, just in case that data file were

found, like the geographical sub-variant, *Omphalodo-Fagetum* var.geogr. *Saxifraga cuneifolia,* which is not included in the synthetic table, because data files were not found.

The comparison is made following Ellenberg indicator values (EIV), that represents a set of seven numbers expressing the average realized niches of species along seven fundamental ecological gradients (light, temperature, continentality, nutrients, soil moisture, pH and salinity), it is the base to compare the reliability, distribution, and abundance. Salinity factor is not included in this research because does not make any sense in the chosen forest.

The reliability of each Ellenberg value is made following p-value calculations, then values under 0.05 p-value are rejected, like in the case of temperature. After that, each couple of Ellenberg value is represented in a boxplot. Floristic and vegetation comparison of each syntaxon is made according to the synthetic table, mostly common species of both countries are described, characteristic and differential species as well. Moreover species of both countries are classified into Raunkiaer system, for compare differences in Raunkiaer life form categories between Spain and Slovenia.

4 RESULTS

The comparison between Spain and Slovenia is made according to Ellenberg indicator values, which are explained below.

Spanish associations are represented with black circles, while Slovenian associations are symbolized with grey circles (Figure 27,28,29,30,31,32 y 33).

4.1 ELLENBERG INDICATOR VALUES

✓ Temperature:

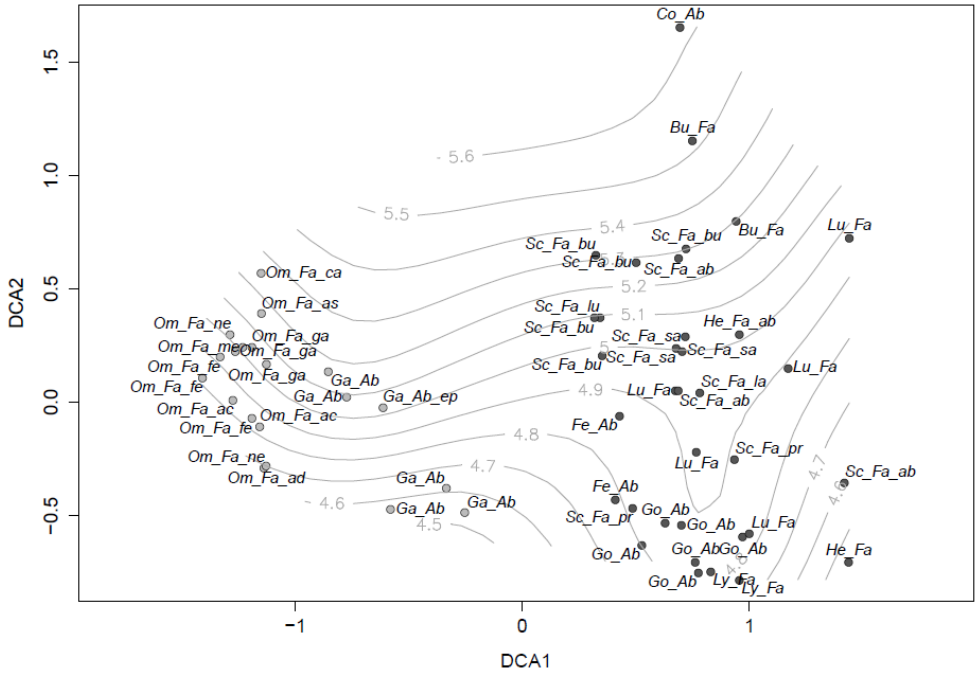


Figure 27: Temperature Ellenberg indicator value

Note: Slovenian associations are represented in grey color, while Spanish are in black.

Temperature value is almost totally similar in both countries.

✓ Reaction (Ph):

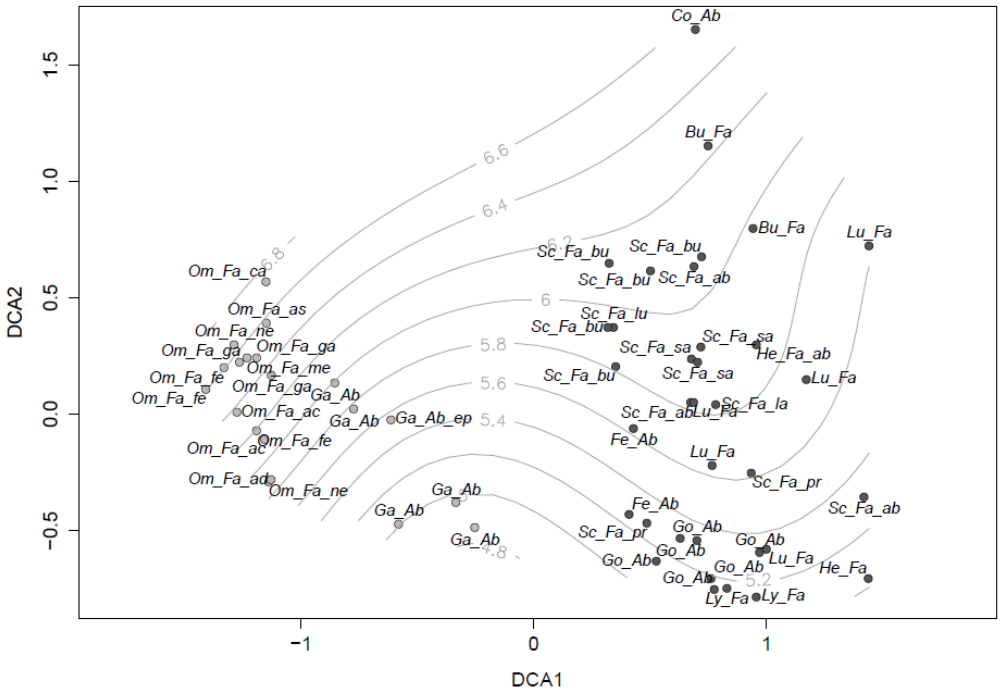


Figure 28: Reaction Ellenberg indicator value

Reaction indicator (pH) is higher in Slovenian forest which is due to prevalent carbonate bedrock (Figure 28)

✓ Moisture:

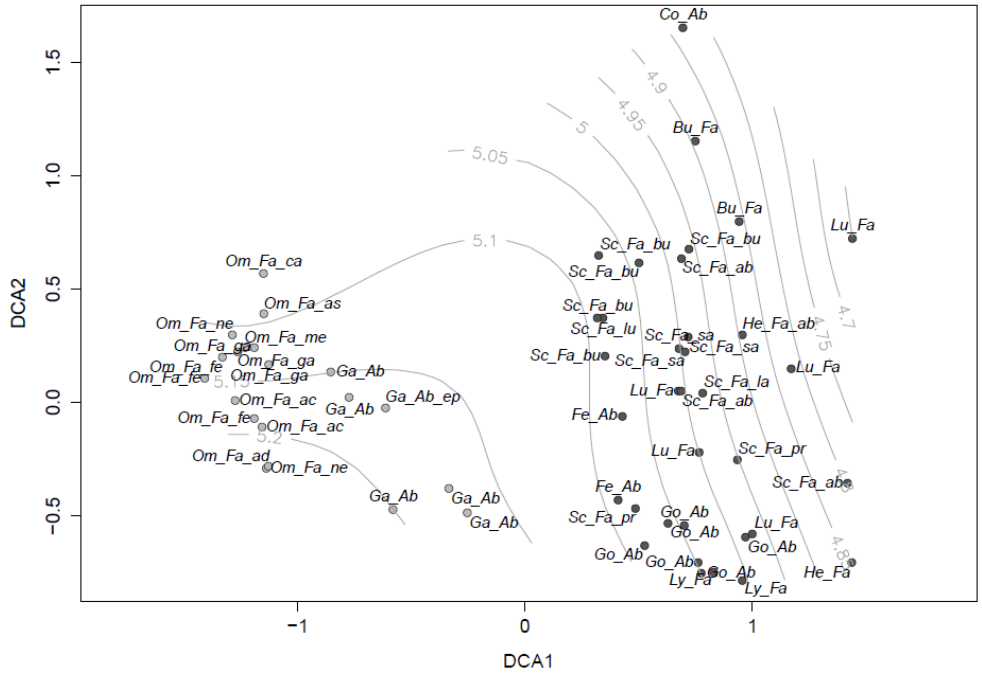


Figure 29: Moisture Ellenberg indicator value

Moisture value is consequently a bit higher in Slovenian silver fir-common beech forest.

✓ Continentality:

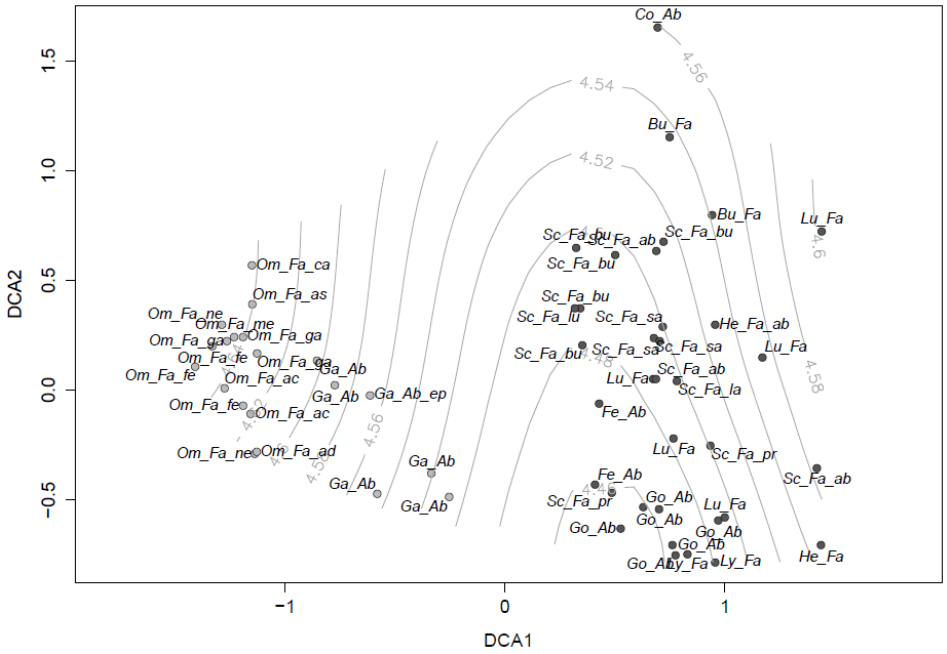


Figure 30: Continentality Ellenberg indicator value

Slovenian fir-beech forest has more continentality.

✓ Light:

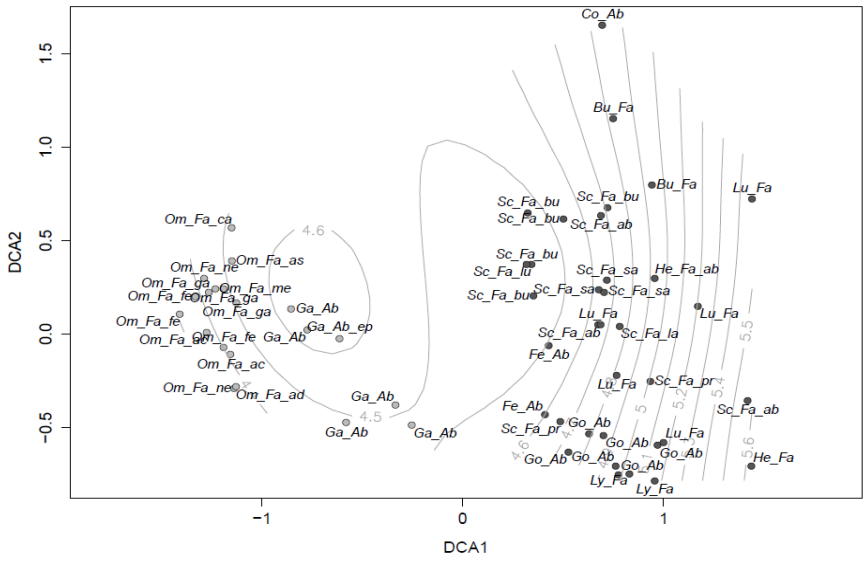


Figure 31: Light Ellenberg indicator value

Spain is pretty much insolated country following light indicator.

✓Nitrogen:

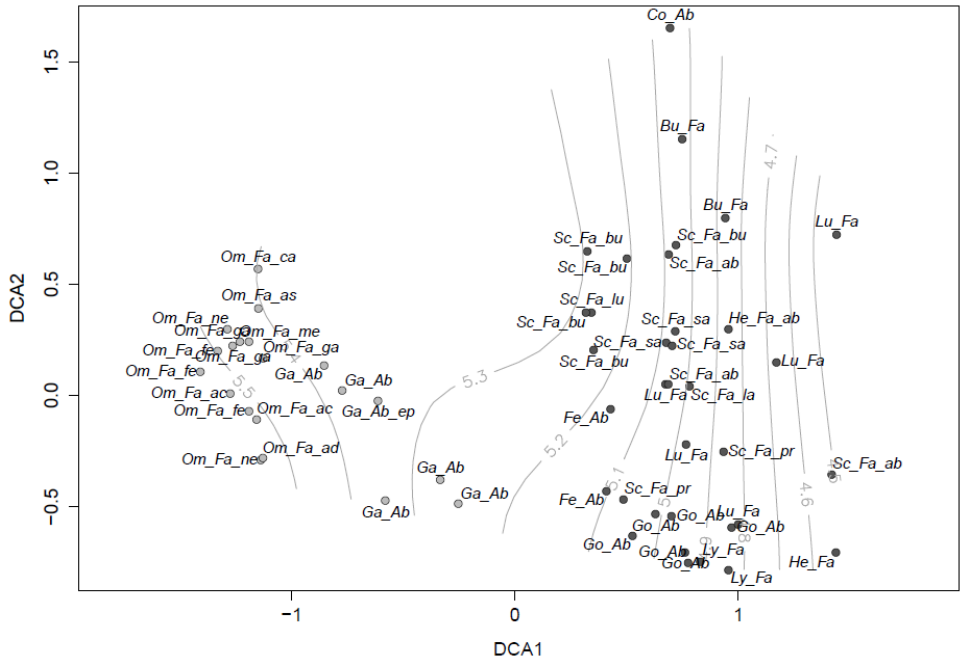


Figure 32: Nitrogen Ellenberg indicator value

Nitrogen value is also a bit higher in Slovenia than in Spain.

✓ Altitude:

Altitude is not an Ellenberg value, but this graphic is made following samples altitude date.

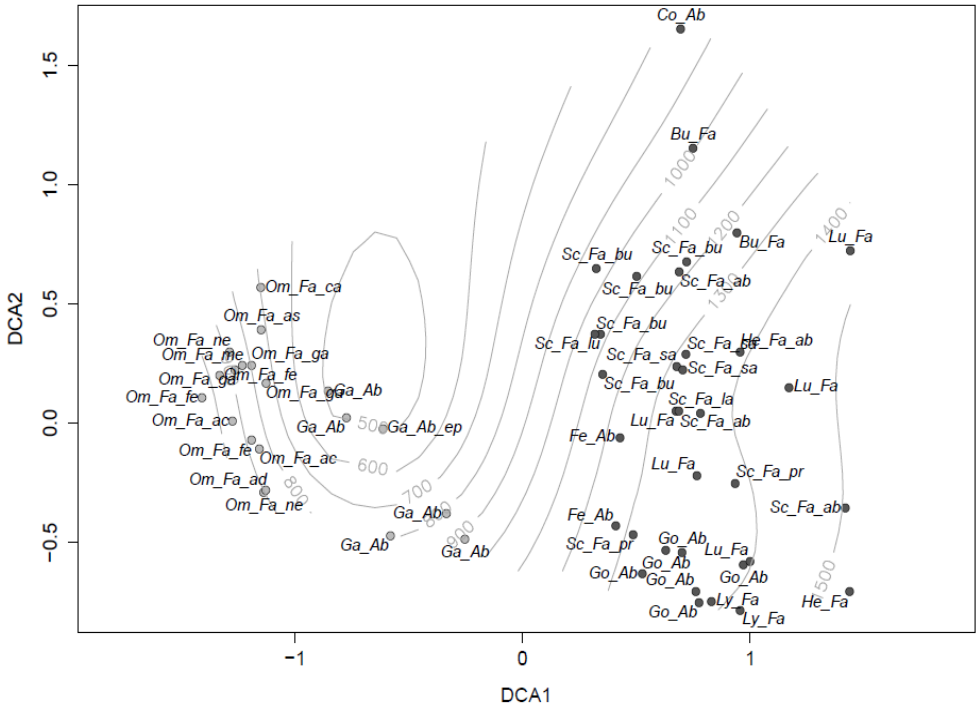


Figure 33: Altitude Ellenberg indicator value

Altitudes are considerably higher in the case of Spain, from 800 m a.s.l to 1775 m a.s.l , while in the case of Slovenia the span is from 577 m a.s.l to 1136 m a.s.l. Also, altitude has bigger range (amplitude) in Spain.

4.2 RAUNKIAER CLASSIFICATION

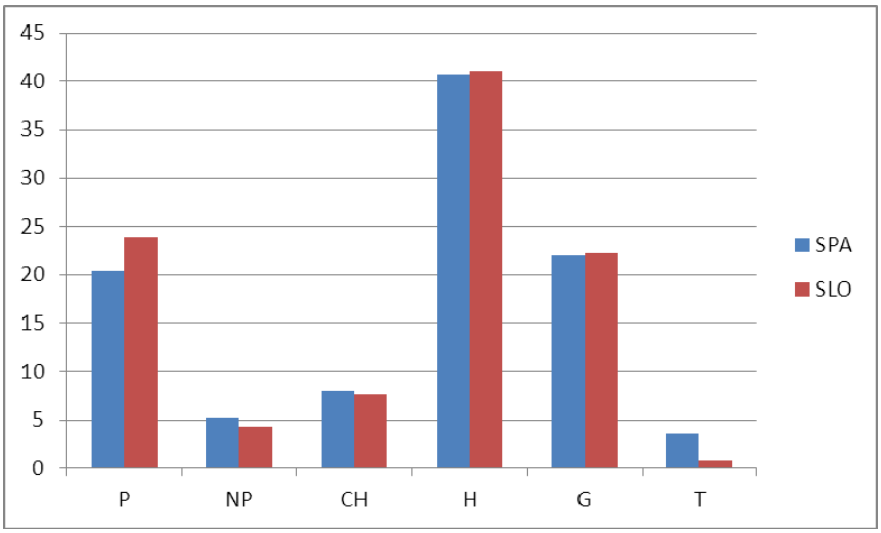


Figure 34: Raunkiær classification of all Slovenian and Spanish species

P: Phanerophyte; NP: Nanophanerophyte; CH: Chamaephytes; H: Hemicryptophytes; G: Geophytes; T: Therophytes

It is observed that there are almost the same values of each Raunkiaer life form.

Synthetic table made with all syntaxonomical tables of every relevés from each association is included in the appendix A of this research.

5 DISCUSSION AND CONCLUSIONS

To find exact conclusion is quite difficult due to the relevant differences between both countries, mostly climatic conditions. Anyway could be object of discussion some parameters and species.

The chosen forest grows in much more insolated places in Spain, due to climatic characteristic of that country (Figure 31 and 35). Also is remarkable the huge difference on altitude distribution of silver fir-common beech forest (Figure 33 and 36), higher in Spain, also it could be explained due to climatic characteristics. Because the chosen forest needs wet and cold places. Spain is dryer and warmer than Slovenia, so the vegetation needs higher places for get the required temperature and moisture.

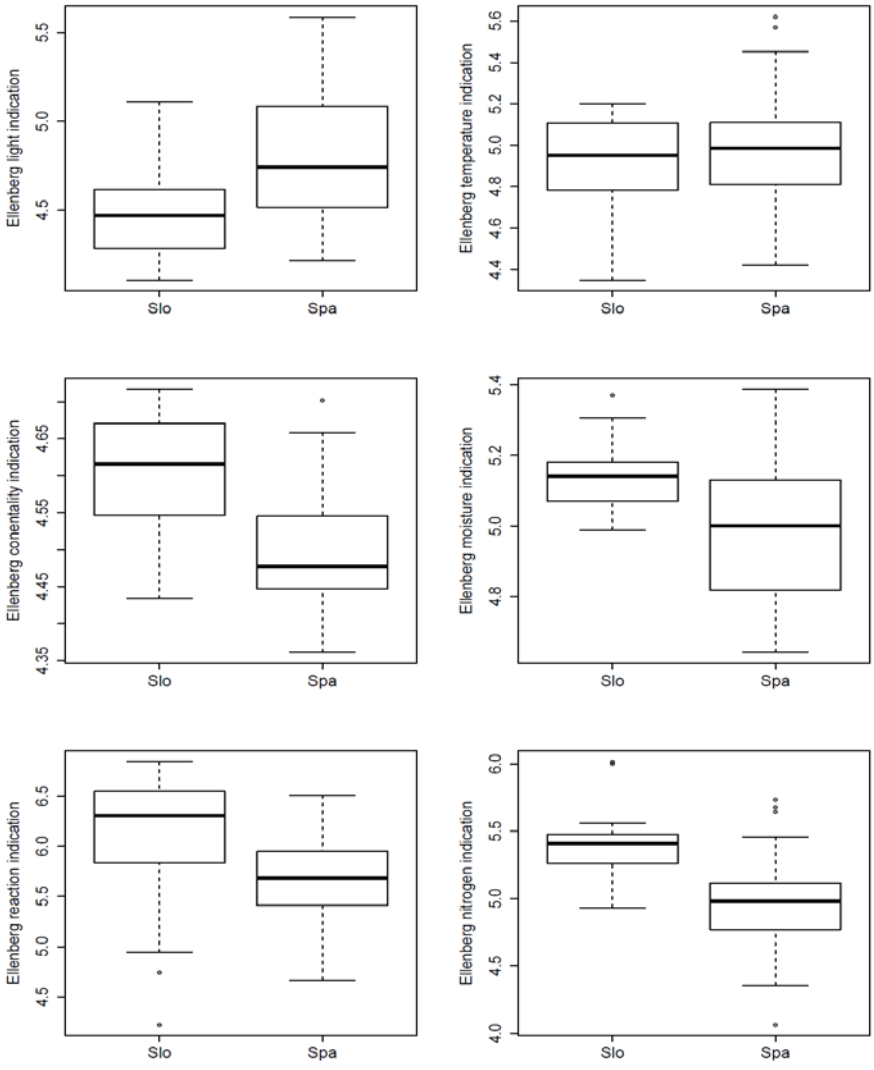


Figure 35: Synthetic comparison of Ellenberg indicator values

However reaction indicator (pH) is higher in Slovenia, which means that the chosen forest grows on more calcareous bedrock. (Figure 28 and 35)

Stand structure, like cover of tree layer and shrubs are bigger in the case of Spain. The slope of the terrain is also stepper in Spain (Figure 35), because Spanish silver fir-common beech forest is found in higher mountains and consequently higher slopes.

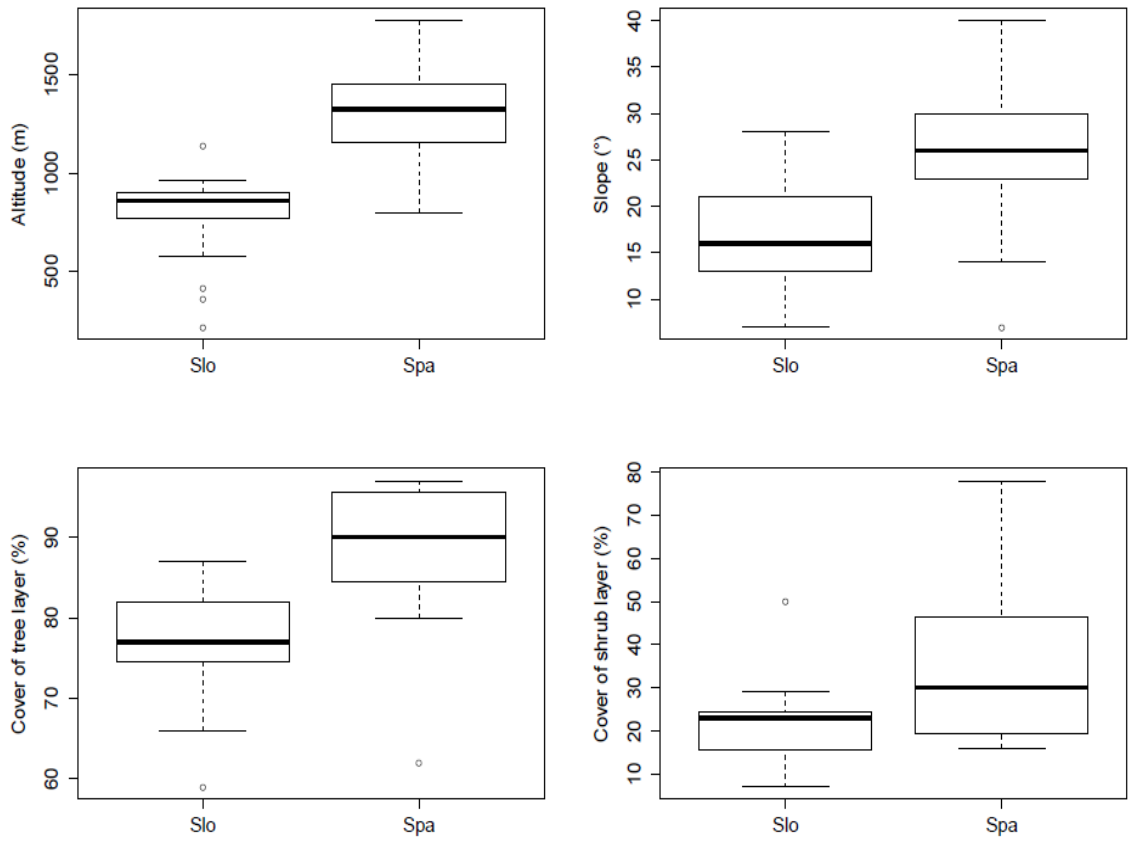


Figure 36: Synthetic comparison of altitude, slope, cover of tree and shrub layer

The numbers of species that are found in Spanish relevés are 508 while is Slovenia are 315 species. This means more diversity in Spanish silver fir-common beech forest. Then, according to obtained samples, common species in both countries in almost all associations (more than 50%) are described in table 2.

***Table 2**: Common species in silver fir-common beech forest in Spain and Slovenia.*

Abies alba	*Hieracium murorum*
Ajuga reptans	*Luzula sylvatica*
Anemone nemorosa	*Mercurialis perennis*
Brachypodium sylvaticum	*Mycelis muralis*
Carex digitata	*Oxalis acetosella*
Carex sylvatica	*Paris quadrifolia*
Daphne laureola	*Polystichum aculeatum*
Dryopteris dilatata	*Prenanthes purpurea*
Dryopteris filix-mas	*Rosa pendulina*
Epilobium montanum	*Rubus idaeus*
Euphorbia amygdaloides	*Sambucus racemosa*
Fagus sylvatica	*Sanicula europaea*
Fragaria vesca	*Sorbus aucuparia*
Galium odoratum	*Ulmus glabra*
Geranium robertianum	*Vaccinium myrtillus*
Hedera helix	*Viola reichenbachiana*

Species that appear in almost all Slovenian associations (more than 50% of association), while are not found in Spanish samples of silver fir-common beech forest, are cited in table 3.

Table 3: Slovenian characteristic species of silver fir-beech forest

Acer pseudoplatanus	*Gentiana asclepiadea*		
Aremonia agrimonoides	*Lamiastrum galeobdolon*		
Asplenium trichomanes	*Lamium orvala*		
Calamintha grandiflora	*Omphalodes verna*		
Cardamine bulbifera	*Picea abies*		
Cardamine enneaphyllos	*Polygonatum multiflorum*		
Cardamine trifolia	*Salvia glutinosa*		
Cyclamen purpurascens	*Senecio ovatus*		

Species that according to obtained relevés are found in almost all Spanish association (more than 50% of all associations), while in Slovenia does not appear in the chosen forest are listed on table 4.

Table 4: Spanish characteristic species of silver fir-common beech forest

Buxus sempervirens	*Poa nemoralis*		
Cardamine heptaphylla	*Polypodium australe*		
Euphorbia hyberna	*Pulmonaria affinis*		
Helleborus viridis	*Ranunculus nemorosus*		
Luzula nivea	*Scilla lilio-hyacinthus*		
Melica uniflora	*Vicia sepium*		

Some of this species could be also found in Slovenia, like *Luzula nivea* that grows in altimontane beech forest. *Poa nemoralis* and *Melica uniflora* are termophilic species found in lower elevation than the samples; *Polypodium australe* also grows in Slovenia however not in silver fir-beech forest, *Vicia sepium* grows out of the forest, for this reason is not found in the relevés; *Ranunculus nemorosus* could be found in Slovenia as well.

About this, illogical nonappearance of some species could be due to the absence of some associations in the research, or as well, because of subjective sampling method.

According to explained characteristic species and mostly distribution of each one of them, a differential species table of chosen forest is presented (Table 5), in this case, with species that are able to grow just in one country and it is found in numerous associations.

Table 5: Differential species of silver fir-beech forest in Slovenia and Spain

SLOVENIA	**SPAIN**
Calamintha grandiflora	*Buxus sempervirens*
Aremonia agrimonoides	*Cardamine heptaphylla*
Omphalodes verna	*Pulmonaria affinis*
Picea abies	*Scilla lilio hyacinthus*
Lamium orvala	*Meconopsis cambric*
Salvia glutinosa	*Helleboro viridis*
Cardamine enneaphyllos	*Helleboro foetidus*
Cardamine trifolia	
Cardamine bulbifera	

It is interesting to remark that the huge cover of *Picea abies* in Slovenia is due to the plantations made in the past for economic benefits. While in Spain is not a native species but is also cultivated, however in lower proportion.
Another comment about *Calamintha grandifolia, Aremonia agromonoides, Omphalodes verna* and *Lamium orvala* which are typical Eastern Europe species on silver fir-common beech forest, as well *Salvia glutinosa* however it has wider distribution.

Some species from the genus *Cardamine* should be commented, *Cardamine enneaphyllos,, Cardamine bulbifera* which are also typical Illyrian species, as well *Cardamine waldsteinii* and *Cardamine pentaphyllus* nevertheless they do not appear in the majority of the Slovenian associations. *Cardamine polyphylla* should also appear in our samples because is Illyrian specie however it is not found in any one. The reason is probably sampling method or uncompleted database of releves While *Cardamine heptaphylla* is just typical for Western Europe.

Some interesting remarks about Spanish differential species should be also explained. *Helleborus foetidus* is included because it is unique for Western Europe (*Helleborus viridis*, as well) however it is not represented in huge proportion of the relevés. While *Helleborus viridis* appears considerably so it could be a vicaristic species for *Helleborus odorus* in Slovenia.

In addition, the Spanish differential specie *Buxus sempervirens* is not native in Slovenia due to climatic characteristics, because Slovenia is too wet and cold country for it.

Coronilla emerus which is differential specie of Spanish association *Coronillo-Abietetum* is found in Slovenia as well, nevertheless only in oak forest because is a typical submediterranean element.

An important observation about genus *Acer* should be also explained. *Acer obtusatum* is typical for Dinaric submediterranean region in quite high altitudes, however it just appears in less than 50% of the Slovenian associations, and while obviously does not exist in Spain. In the other hand, *Acer opalus* is found only in Spain, this two species could be vicaristic, what means that they thrive in similar but geographicaly different regions.

6 SUMMARY

A phytosociological, floristic, climatological and geographical comparison of common beech-silver fir forest between Spain and Slovenia is presented. Following literature of chosen forest, it is explained that in Slovenia two alliances are found. The first one *Aremonio-Fagion* with association *Omphalodo-Fagetum,* that grows on carbonate soil and is subdivided into two geographical sub-variants. One is found in Trnovski Gozd, var.geogr. *Saxifraga cuneifolia,* while the other is distributed around Sneznik and Kocevsko region,var.geogr. *Calamintha grandifolia* which is included on the synthetic table. This geographical variant is subdivided into eight subassociations: *asaretosum, neckeretosum, adenostyletosum, mercurialetosum, festucetosum, aceretosum, galietosum* and *caricetosum.*

Second Slovenian alliance is *Fagion-sylvaticae* which contains association *Galio-Abietetum,* distributed at Pohorje on non carbonate soil.

On the other country, Spain, silver fir-common beech belongs also to alliance *Fagion-Sylvaticae*, subdivided into two suballiances. First, *Scillo-Fagenion* is divided in *Luzulo niveae-Fagetum* (acidophilic), *Lysimanchio nemorum-Fagetum* (acidophilic), *Scillo lilio-hyacinthi-Fagetum* (neutro-basophilic), *Festuco altissimae-Abietetum* (neutro-basophilic), *Goodyero-Abietetum* (acidophilic), and *Helleborus viridis-Fagetum*; second the xerofitic suballiance *Epipactido-Fagenion* is subdivided into *Buxo sempervirens-Fagetum* and *Coronillo emeri-Fagetum*.

This comparison is made according to gathered samples which are compiled into a synthetic table. The synthetic table is the base of floristic and climatological analysis; Ellenberg indicator values for phytosociological units were also calculated. Species composition were analysed for Raunkiaer life forms as well.

Finally differential species of the chosen forest in both countries are described.

7 POVZETEK

V nalogi je predstavljena fitocenološka, floristična, klimatološka in geografska primerjava izbranih bukovo-jelovih gozdov v Sloveniji in Španiji. Na osnovi literaturnih virov smo ugotovili, da omenjeni gozdovi v Sloveniji pripadajo dvem zvezam, Prva zveza je Aremonio-Fagion z asociacijo Omphalodo-Fagetum, ki uspeva na karbonatnih tleh in se deli na dve geografski subvarianti. Prvo najdemo v Trnovskem gozdu, var.geogr. Saxifraga cuneifolia, druga je razširjena na območju Snežnika in Kočevske,var.geogr. Calamintha grandifolia .Slednja je vključena v sintetično tabelo. Ta geografska varianta je členjena na osem subasociacij: asaretosum, neckeretosum, adenostyletosum, mercurialetosum, festucetosum, aceretosum, galietosum and caricetosum.

Druga zveza v Sloveniji je Fagion-sylvaticae, ki vsebuje asociacijo Galio-Abietetum, razširjeno na Pohorju na nekarbonatnih tleh.

V Španiji bukovo-jelovi gozdovi pripadajo zvezi Fagion-Sylvaticae, ki se deli na dve podzvezi. Prva, Scillo-Fagenion se deli na Luzulo niveae-Fagetum (acidofilna), Lysimanchio nemorum-Fagetum (acidofilna), Scillo lilio-hyacinthi-Fagetum (neutro-bazofilna), Festuco altissimae-Abietetum (neutro-bazofilna), Goodyero-Abietetum (acidofilna), in Helleborus viridis-Fagetum. Druga, kserofitna podzveza Epipactido-Fagenion se deli na Buxo sempervirens-Fagetum in Coronillo emeri-Fagetum.

Primerjava sintaksonov v obeh državah je bila narejena na osnovi izbranih popisov, združenih v sintetsko tabelo, ki je bila osnova za nadaljne floristične in klimatološke analize. Na osnovi popisov rastlin so bili izračunani Ellenbergovi indeksi in analiza vegetacije glede na Raunkiaerjeve življenske oblike. Na koncu so predstavljene še diferencialne rastlinske vrste za obravnavane gozdove v obeh državah.

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APPENDIX B: Legend for synthetic table

Number	SYNTAXON	ABBREVIATION
1	Buxo-Fagetum	Bu_Fa
2	Buxo-Fagetum	Bu_Fa
3	Galio-Abietetum	Ga_Ab
4	Galio-Abietetum	Ga_Ab
5	Galio-Abietetum	Ga_Ab
6	Galio-Abietetum	Ga_Ab
7	Helleboro-Fagetum	He_Fa
8	Helleboro-Fagetum abietetosum	He_Fa_ab
9	Lysimachio -Fagetum	Ly_Fa
10	Lysimachio -Fagetum	Ly_Fa
11	Coronillo -Abietetum	Co_Ab
12	Festuco-Abietetum	Fe_Ab
13	Festuco-Abietetum	Fe_Ab
14	Goodyero-Abietetum	Go_Ab
15	Goodyero-Abietetum	Go_Ab
16	Luzulo -Fagetum	Lu_Fa
17	Luzulo -Fagetum	Lu_Fa
18	Luzulo -Fagetum	Lu_Fa
19	Luzulo -Fagetum	Lu_Fa
20	Luzulo -Fagetum	Lu_Fa
21	Luzulo -Fagetum abietetosum	Lu_Fa_ab
22	Scillo-Fagetum saxifragetosum	Sc_Fa_sa
23	Scillo-Fagetum saxifragetosum	Sc_Fa_sa
24	Scillo-Fagetum saxifragetosum	Sc_Fa_sa
25	Scillo-Fagetum abietetosum	Sc_Fa_ab
26	Scillo-Fagetum abietetosum	Sc_Fa_ab
27	Scillo-Fagetum abietetosum	Sc_Fa_ab
28	Scillo -Fagetum luzuletosum	Sc_Fa_lu
29	Scillo-Fagetum buxetosum	Sc_Fa_bu
30	Scillo-Fagetum buxetosum	Sc_Fa_bu
31	Scillo-Fagetum buxetosum	Sc_Fa_bu
32	Scillo-Fagetum buxetosum	Sc_Fa_bu
33	Scillo-Fagetum buxetosum	Sc_Fa_bu
35	Scillo-Fagetum prenanthetosum	Sc_Fa_pr
36	Scillo-Fagetum prenanthetosum	Sc_Fa_pr
37	Scillo-Fagetum prenanthetosum	Sc_Fa_pr
38	Omphalodo-Fagetum asaretosum	Om_Fa_as
39	Omphalodo-Fagetum neckeretosum	Om_Fa_ne
40	Omphalodo-Fagetum neckeretosum	Om_Fa_ne
41	Omphalodo-Fagetum adenostyletosum	Om_Fa_ad
42	Omphalodo-Fagetum mercurialetosum	Om_Fa_me
43	Omphalodo-Fagetum festucetosum	Om_Fa_fe
44	Omphalodo-Fagetum festucetosum	Om_Fa_fe
45	Omphalodo-Fagetum festucetosum	Om_Fa_fe
46	Omphalodo-Fagetum aceretosum	Om_Fa_ac

47	Omphalodo-Fagetum aceretosum	Om_Fa_ac
48	Omphalodo-Fagetum galietosum	Om_Fa_ga
49	Omphalodo-Fagetum galietosum	Om_Fa_ga
50	Omphalodo-Fagetum galietosum	Om_Fa_ga
51	Omphalodo-Fagetum caricetosum	Om_Fa_ca
52	Galio-Abietetum epimedietosum	Ga_Ab_ep
53	Galio-Abietetum	Ga_Ab
54	Galio-Abietetum	Ga_Ab
55	Galio-Abietetum	Ga_Ab
56	Galio-Abietetum	Ga_Ab
57	Galio-Abietetum	Ga_Ab