

# Formalized approaches to Central European phytosociology



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# Formalized approaches to Central European phytosociology

- Standard methods of field sampling
- Introduction of Turboveg and JUICE software
- Introduction of Czech National Phytosociological Database

## Two concepts – European and North American

### European

- Braun-Blanquette
- estimation of species cover
- dominance of species expressed by their percentage cover
- includes herbs, mosses and lichens

### North American

- Wisconsin school
- measuring of basal area
- dominance of species expressed by Important Value Index
- usually includes only woody species

## Two concepts – European and North American

### European

- species cover is just subjectively estimated
- takes into account total cover of particular layers

### North American

- basal area could be accurately measured
- IVI doesn't take into account total cover – could be the same for densely and sparsely vegetated habitats

## Two concepts – European and North American

### European

- suitable approach for **vegetation mapping and classification** - field sampling is easier and faster, allows to sample more plots - the accuracy of estimated cover data is of low importance

### North American

- suitable rather for **vegetation monitoring** and **timber survey** – field sampling is more labour-intensive and the accuracy of the measuring allows for monitoring of changes – but is needed for vegetation classification

## Introduction to European / Braun-Blanquette approach

- based on estimation species cover – all determinable species have to be recorded

## Estimation of vegetation cover using Braun-Blanquet scale

### Combined scale of abundance and dominance

r	only one individual, negligible cover	}	abundance
+	more individuals, low cover		
1	cover lower than 5 %	}	dominance
2	cover 5–25 %		
3	cover 25–50 %		
4	cover 50–75 %		
5	cover 75–100 %		

### Westhoff & van der Maarel modification

2m	cover approx. 5 %, high abundance
2a	cover 5–15 %
2b	cover 15–25 %

## Introduction to European / Braun-Blanquette approach

- based on estimation species cover – all determinable species have to be recorded
- plot size issue – need for standardization of used plot sizes



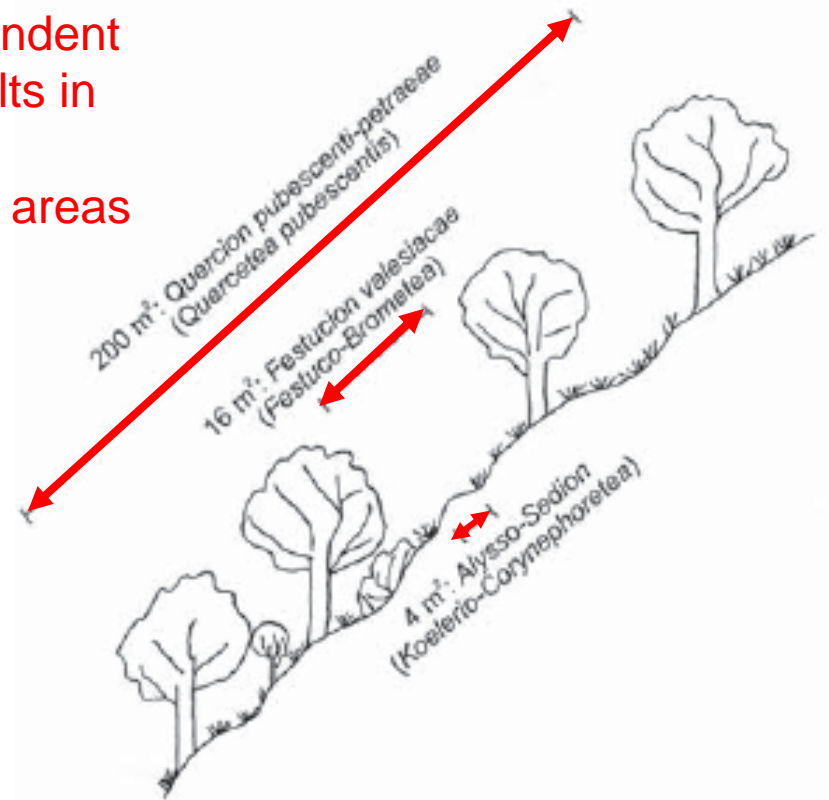
## Plot size issue

- vegetation attributes are scale-dependent
- differently sized sampling plots results in different classification
- need of standardization of used plot areas for particular vegetation types !

### Standard plot sizes proposed for European vegetation survey

(Chytrý & Otýpková 2003, *J. Veg. Sci.*)

- |                              |                    |
|------------------------------|--------------------|
| • woodlands                  | 200 m <sup>2</sup> |
| • shrub vegetation           | 50 m <sup>2</sup>  |
| • herbaceous veg.            | 16 m <sup>2</sup>  |
| • aquatic, trampled habitats | 4 m <sup>2</sup>   |

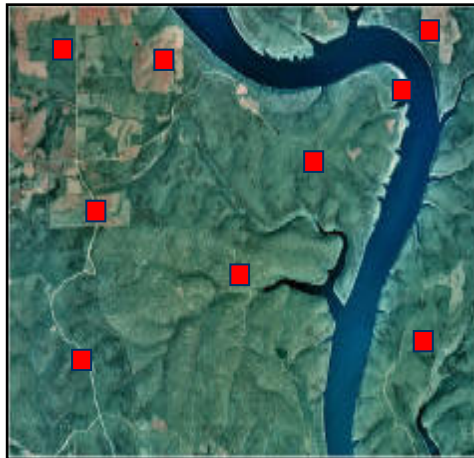


## Introduction to European / Braun-Blanquette approach

- based on estimation species cover – all determinable species have to be recorded
- plot size issue – need for standardization of used plot sizes
- arrangement of sampling plots in landscape

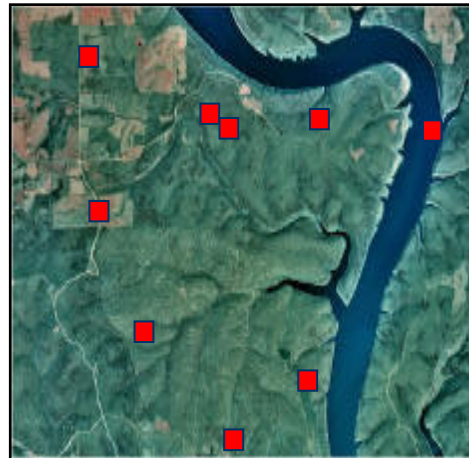
## Arrangement of plot sites in landscape

**Preferential**

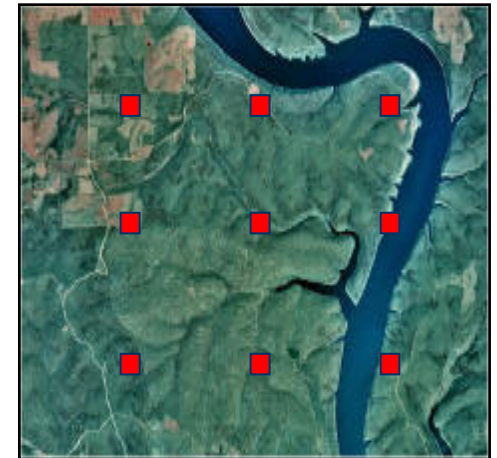


Placed subjectively  
according to presumed  
knowledge of vegetation  
types

**Random**



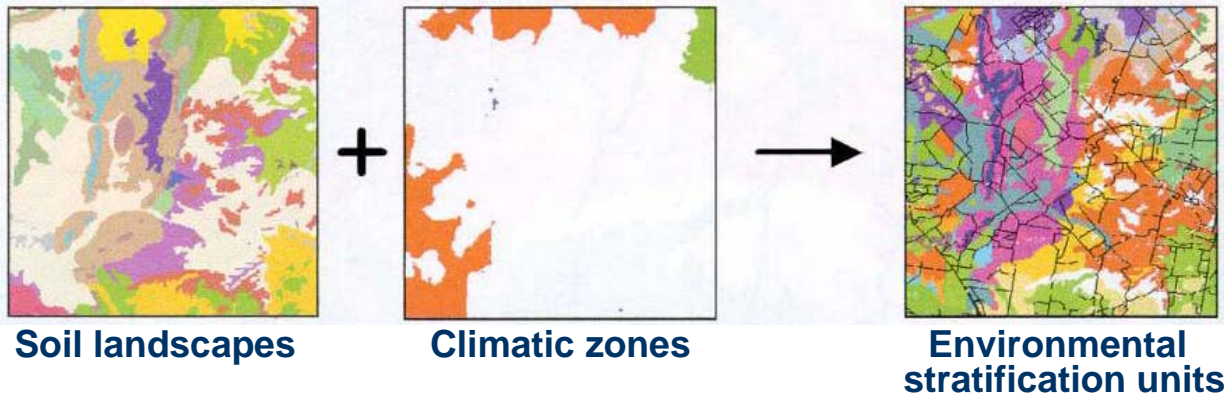
**Systematic**



Objectively placed plots –  
risk that rare habitats won't  
be sampled

## Arrangement of plot sites in landscape

### GIS-based environmentally stratified sampling



Austin et al.  
(2000)

**Advantage:** Maximum variation is sampled, including rare habitats

**Choice 1:** Which environmental layers should be chosen?

**Choice 2:** Equal number of plots in each stratum or proportionally to the total area of the strata?



26-8-2005

78/05 TBV No: 555542

oak-hornbeam forest on diluvium  
Vltava river valley, Čertův

GPS: N 48°53'36.7" E 14°21'54.1"

ALT: 415 m a.s.l. GPS-BIAS: ±1m

AREA: 10x15 m = 150 m<sup>2</sup>

ASPECT: 160°, SLOPE: 5°

E<sub>3</sub> 90%, E<sub>2</sub> 2%, E<sub>1</sub> 70%, E<sub>0</sub> 2%

E<sub>3</sub> Tili cord 5

trees

E<sub>2</sub> Abies alba 1

Tili cord +

shrubs

E<sub>1</sub> Hep nobi 2m

Asar europ 2m

Alli pet +

Maia bif 1

Poa nemo 2a

Fest hete 2b

Stell holo 2m

Solid virg r

Luz Luz 2a

Pulm Obse 1

Viol rivu 1

Hier muror +

Plat sp. r

Aego poda 1

Aera spon r

Ct eligit 2m

Anem nemo r

Camp pers +

Aven fleu +

herbs

juveniles:

Acer osppl 1

Ceras avi +

juveniles

Q petrea r

Ac platan +

E<sub>0</sub> Plag aff +

Plag und r

Poly form +

Thuid tam r

Hypn eubr +

Afri undu r

mosses

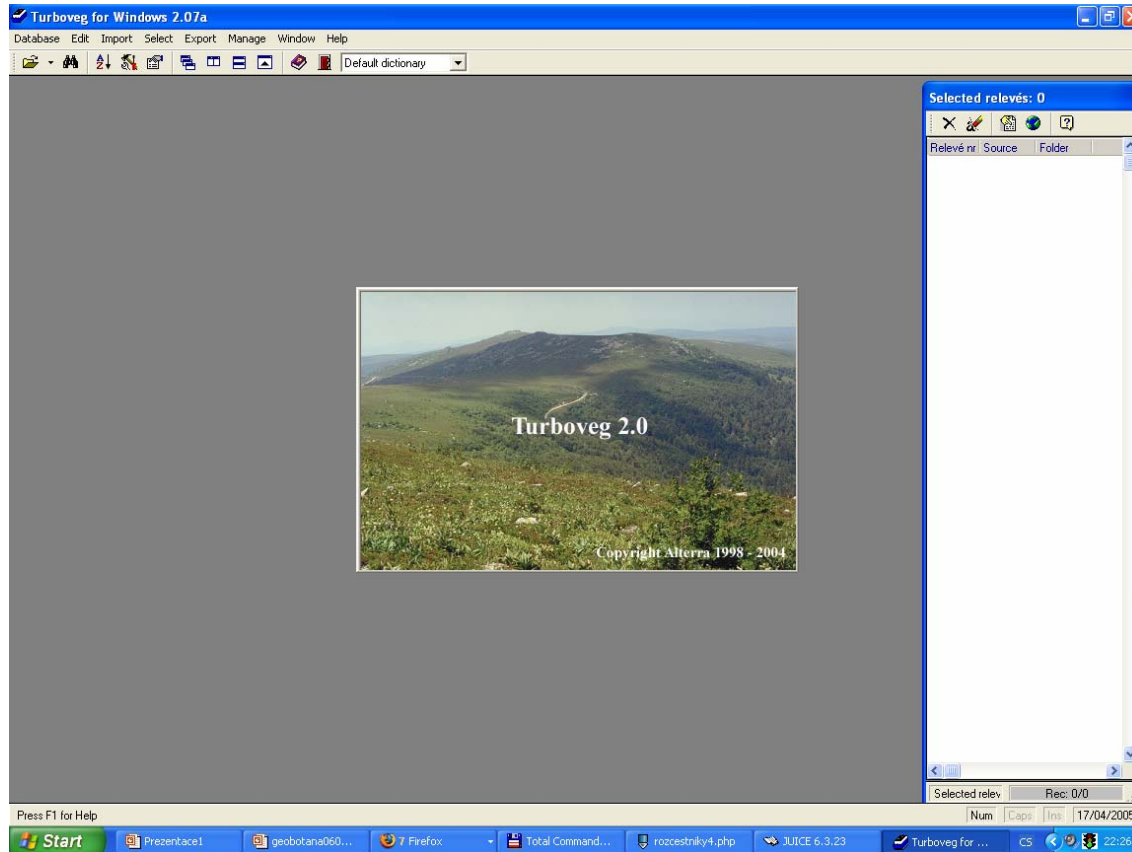
Notes: photo 3090, 3091

soil sample 78/05

soil type: kambisol (155) notes

Temperate oak-hornbeam forest on diluvium

**Turboveg** – database program for entering, storage and export of vegetation data



Information -

[http://www.sci.muni.cz/botany/dbase\\_cz.htm#Turboveg](http://www.sci.muni.cz/botany/dbase_cz.htm#Turboveg)



Turboveg for Windows 2.07a

Database Edit Import Select Export Manage Window Help

Database: Zeleny04

Relevé number

Relevé number	Cover abundance scale	Country code	Biblioreference	No. table in publ.	No. relevé in table	Project code	Author code	Date (year/month/day)	Sr
1	02	CZ					0669	2004/04/23	3
2	02	CZ					0669	2004/04/23	0
3	02	CZ					0669	2004/04/24	3
4	02	CZ					0669	2004/04/28	2
5	02	CZ					0669	2004/04/28	2
6	02	CZ					0669	2004/04/28	2
7	02	CZ					0669	2004/04/28	2
8	02	CZ					0669	2004/05/12	2
9	02	CZ					0669	2004/05/12	2
10	02	CZ					0669	2004/05/17	2
11	02	CZ					0669	2004/05/17	2
12	02	CZ					0669	2004/05/17	2
13	02	CZ					0669	2004/05/21	2
14	02	CZ					0669	2004/05/21	2
15	02	CZ					0669	2004/06/13	2
16	02	CZ					0669	2004/05/17	2
17	02	CZ					0669	2004/06/10	
18	02	CZ					0669	2004/06/09	2
19	02	CZ					0669	2004/06/09	2
20	02	CZ					0669	2004/06/10	2
21	02	CZ					0669	2004/06/10	2
22	02	CZ					0669	2004/06/12	2
23	02	CZ					0669	2004/06/13	2
24	02	CZ					0669	2004/06/13	2
25	02	CZ					0669	2004/05/14	3
26	02	CZ					0669	2004/05/14	3
27	02	CZ					0669	2004/06/27	

Selected relevés: 0

Relevé: 7

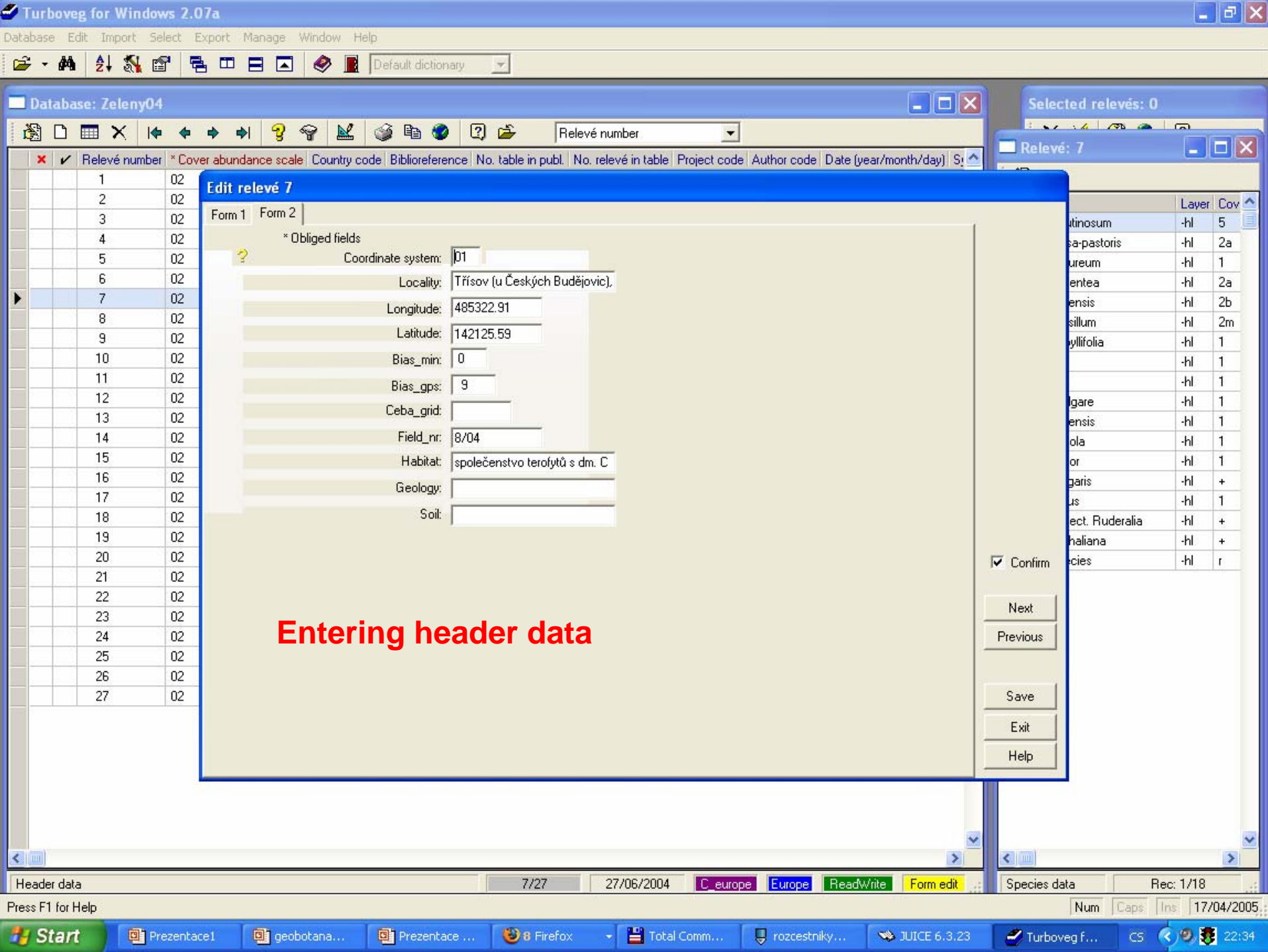
Species	Layer	Cov
Cerastium glutinosum	-hl	5
Capsella bursa-pastoris	-hl	2a
Lamium purpureum	-hl	1
Potentilla argentea	-hl	2a
Veronica arvensis	-hl	2b
Geranium pusillum	-hl	2m
Arenaria serpyllifolia	-hl	1
Urtica dioica	-hl	1
Poa species	-hl	1
Origanum vulgare	-hl	1
Ajuga genevensis	-hl	1
Lactuca serriola	-hl	1
Plantago major	-hl	1
Artemisia vulgaris	-hl	+
Holcus lanatus	-hl	1
Taraxacum sect. Ruderalia	-hl	+
Arabidopsis thaliana	-hl	+
Veronica species	-hl	r

Header data7/2727/06/2004C europeEuropeReadWriteForm editSpecies dataRec: 1/18

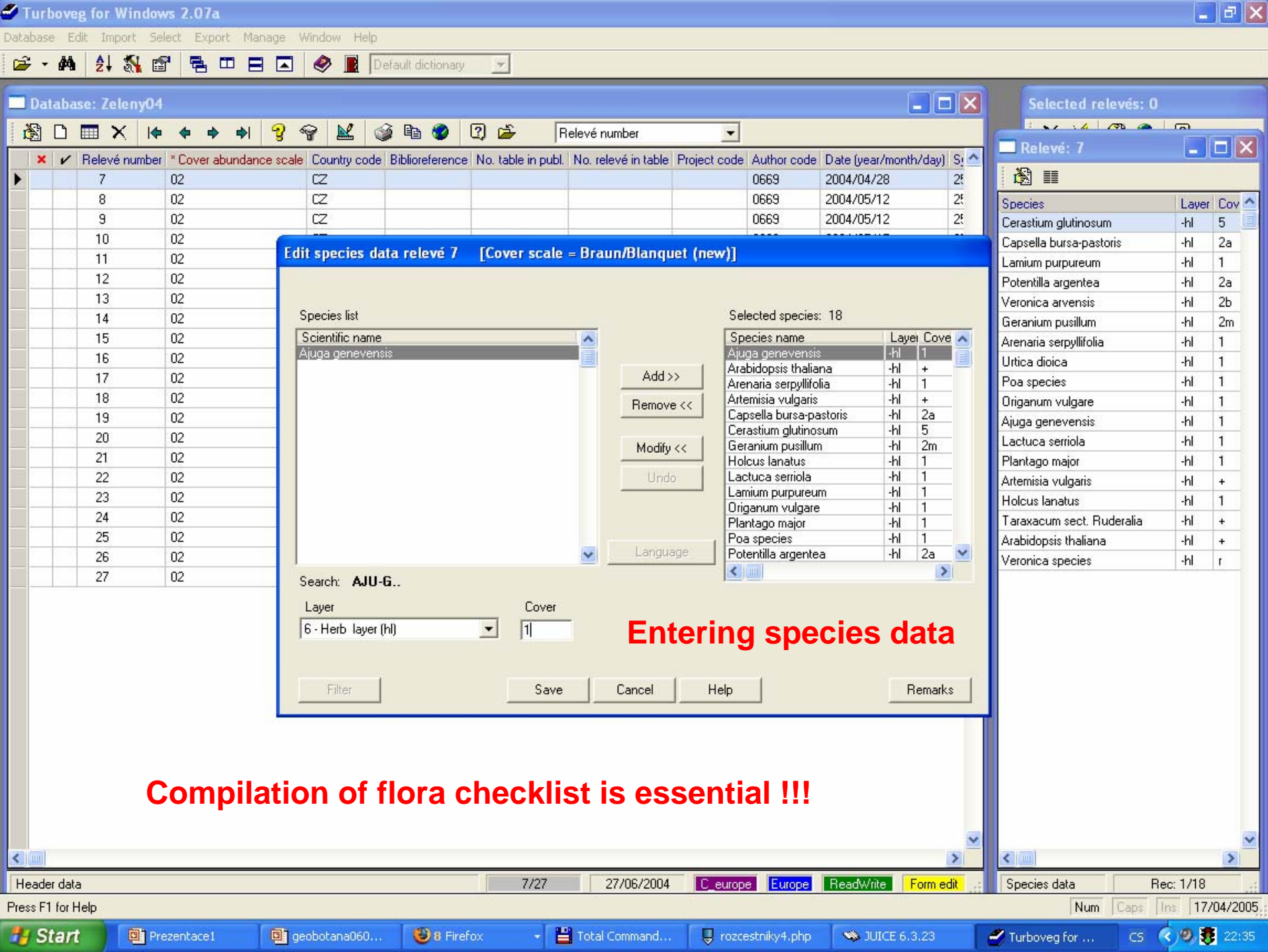
Press F1 for HelpNumCapsIns17/04/2005

StartPrezentace1geobotana060...8 FirefoxTotal Command...rozcestniky4.phpJUICE 6.3.23Turboveg for ...CS22:33

Turboveg software interface







**JUICE** – software for editing, classification and analysis of large vegetation datasets



Program could be downloaded free at –  
<http://www.sci.muni.cz/botany/juice.htm>





Releve No. 3
Turboveg No.: 555403

Edit header

No. of species: 26 (29 records)  
Shannon-Wiener Index: 2.16  
Equitability: 0.64

☒ Layer
☐ Cover
☐ Aph.
☐ Seq.

4	<i>Fagus sylvatica</i>	[1]
3	<i>Fagus sylvatica</i>	[4]
1	<i>Sambucus nigra</i>	[4]
r	<i>Sorbus aucuparia</i>	[4]
2	<i>Dentaria enneaphyllos</i>	[6]
2	<i>Mercurialis perennis</i>	[6]
+	<i>Galeobdolon montanum</i>	[6]
+	<i>Oxalis acetosella</i>	[6]
+	<i>Galium odoratum</i>	[6]
+	<i>Dentaria bulbifera</i>	[6]
+	<i>Polystichum aculeatum</i>	[6]
+	<i>Asplenium trichomanes</i>	[6]
+	<i>Dryopteris filix-mas</i>	[6]
r	<i>Meracleum sphondylium</i>	[6]
r	<i>Epilobium species</i>	[6]
r	<i>Polypodium vulgare</i>	[6]
r	<i>Actaea spicata</i>	[6]
r	<i>Senecio ovatus</i>	[6]
r	<i>Petasites albus</i>	[6]
r	<i>Melica nutans</i>	[6]
r	<i>Asplenium viride</i>	[6]
r	<i>Carex digitata</i>	[6]
r	<i>Viola reichenbachiana</i>	[6]
+	<i>Fagus sylvatica</i>	[7]
+	<i>Sambucus nigra</i>	[7]
+	<i>Acer pseudoplatanus</i>	[7]
r	<i>Picea abies</i>	[7]
2	<i>Porella platyphylla</i>	[9]
1	<i>Ctenidium molluscum</i>	[9]

Table number: 3  
Collector number: 555403



- expert system for relevant classification



JUICE 6.3.41

FileEditSpeciesRelevésHeadSortingSeparatorsSynoptic TableIndicator ValuesAnalysisTable SimulationHelp

Releve

yellow

Species

black

Separator hierarchy

2

Statistics:

Phi coeff.

Total time: 0 days 0 h 2 min 17 sec

TWINSPAN category:

Relevés 144

Species 651

Stellaria pallida

Lamium purpureum

Artemisia vulgaris

Capsella bursa-pasto

Campanula trachelium

Veronica arvensis

Lactuca serriola

Cerastium glutinosum

Potentilla argentea

Geranium pusillum

Origanum vulgare

Plantago major

Holcus lanatus

Arabidopsis thaliana

Veronica species

Myosotis ramosissima

Veronica persica

Erophila verna

Viola tricolor

Holosteum umbellatum

Anchusa arvensis

Poa pratensis

Festuca ovina aqq.

Alopecurus pratensis

Poa angustifolia

Holcus mollis

Achillea millefolium

Trifolium arvense

Erodium cicutarium

Thlaspi arvense

Vicia hirsuta

Rosa species

Potentilla tabernaem

Taraxacum sect. Eryt

Lychnis viscaria

Cerastium arvense

Veronica prostrata

Campanula rotundifol

Centaurea stoebe s.l

Verbascum chaixii ss

...

sorting of relevés according to the results of chosen

classification analysis

Frequency:

1 Rel. No.: 127

555527 Turboveg No.:

Row: 88

Column: 69

Start

2 Microso...

PCD (Čes-...

Total Com...

Turboveg f...

JUICE 6.3.41

CS

100%

1:59



JUICE 6.3.41

File Edit Species Relevés Head Sorting Separators Synoptic Table Indicator Values Analysis Table Simulation Help

Statistics: Phi coeff.

Species black

Separator hierarchy 2

Total time: 0 days 0 h 5 min 27 sec

Percentage synop

Analysis Of Synoptic Table

Number of releve  
releves 144  
Species 651

Fidelity threshold: 50

Frequency threshold (1-100 %): 30

Cover threshold (1-100 %): 30

Diagnostic species

Constant species 16

Dominant species 38

75.9 Dryopteris filix-mas [6]  
61.0 Impatiens parviflora [6]  
59.2 Tilia cordata [1]  
59.2 Oxalis acetosella [6]  
59.2 Galeobdolon montanum [6]  
56.7 Geranium robertianum [6]  
56.3 Hepatica nobilis [6]  
52.4 Asarum europaeum [6]  
51.6 Urtica dioica [6]

65 Hypnum cupressiforme [9]  
59 Poa nemoralis [6]  
52 Corylus avellana [4]  
43 Stellaria holostea [6]  
43 Acer platanoides [7]  
41 Tilia cordata [4]  
41 Polytrichum formosum [9]  
41 Polypodium vulgare [6]  
39 Acer pseudoplatanus [7]  
37 Luzula luzuloides [6]  
35 Pulmonaria obscura [6]  
33 Melica nutans [6]  
31 Solidago virgaurea [6]  
31 Sambucus nigra [4]  
31 Atrichum undulatum [9]  
31 Alliaria petiolata [6]

39 Tilia cordata [1]  
15 Hypnum cupressiforme [9]  
11 Fagus sylvatica [1]  
9 Corylus avellana [4]  
7 Acer platanoides [1]  
6 Poa nemoralis [6]  
4 Tilia platyphyllos [1]  
4 Quercus robur [1]  
4 Picea abies [1]  
4 Isoetecium alopecuroides [9]  
4 Impatiens parviflora [6]  
4 Impatiens noli-tangere [6]  
4 Fraxinus excelsior [1]  
4 Alnus glutinosa [1]  
2 Urtica dioica [6]  
2 Tilia cordata [4]  
2 Stellaria pallida [6]  
2 Rosa pendulina [4]  
2 Ranunculus ficaria ssp. bulbifer [6]  
2 Prunus padus [1]  
2 Polypodium vulgare [6]  
2 Plagiomnium species [9]  
2 Milium effusum [6]

☐ Include diagnostic species  
☐ Show references

Minimum freq. (1-100 %): 0

Mark in the table black

Mark in the table black

Mark in the table black

No. of relevés: 54  
Aver. species No.: 35.1  
Aver. positive fidelity: 15.2  
Sharpness: 15.2

Export Cancel Refresh

numerical determination of diagnostic, constant and dominant species for recognized groups of relevés

77. Stellaria pallida

Frequency: 1 Rel. No.: 127 Row:  
Turboveg No.: 555527 Column:

Start

2 Microso...

PCD (Čes-...

Total Com...

Turboveg f...

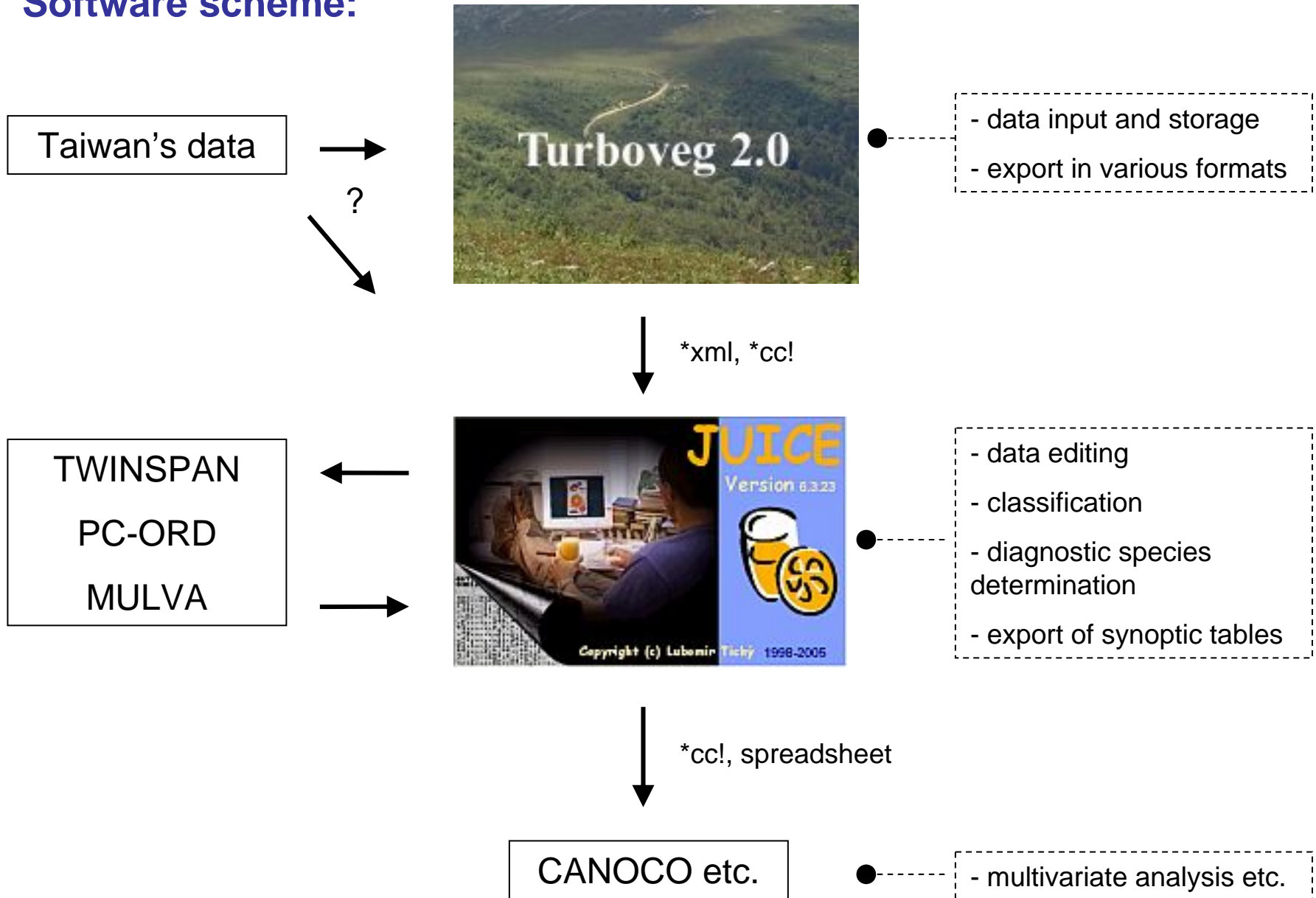
JUICE 6.3.41

EN

100%

2:02

## Software scheme:

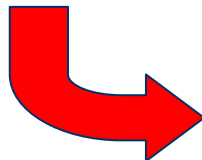




## Vegetation plot databases: Europe

### Largest databases

- the Netherlands (Wageningen)  
ca. 400,000 plots
- France (Marseille)  
> 130,000 plots
- Czech Republic (Brno)  
ca. 72,000 plots
- Mecklenburg-Vorpommern  
ca. 52,000 plots



Nearly one million plots already computerized

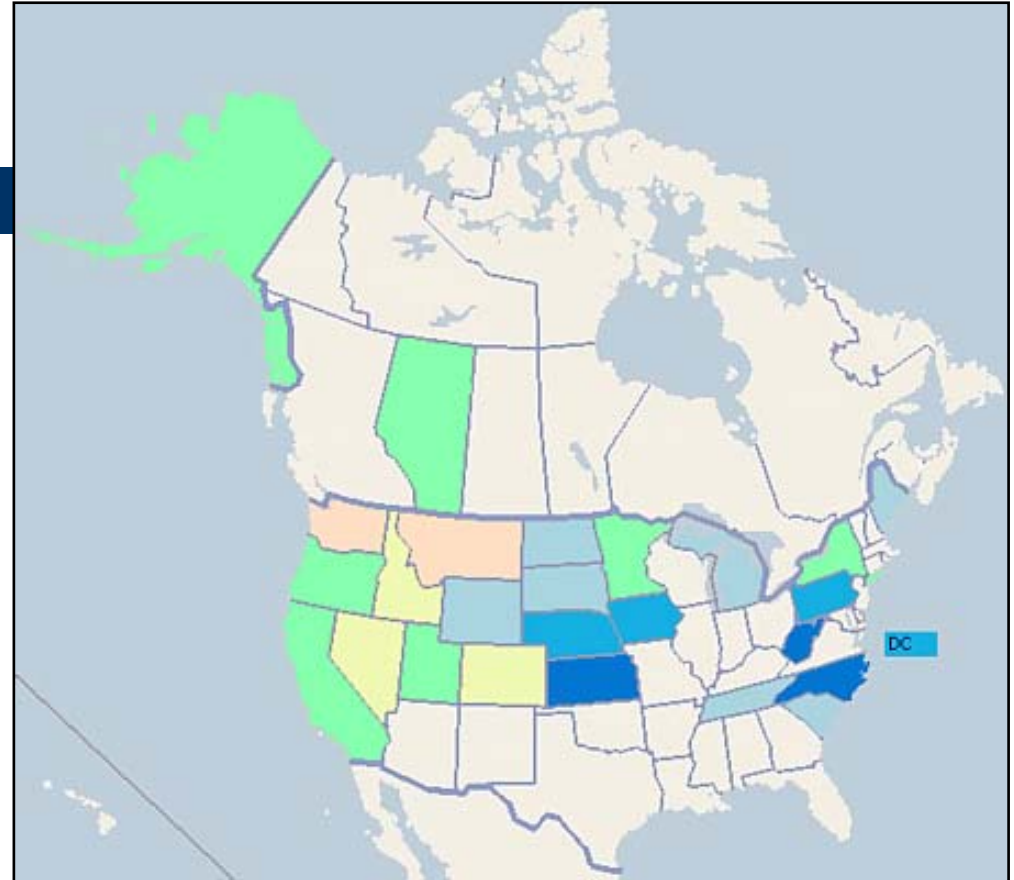
## Vegetation plot databases: North America

VegBank

[www.vegbank.org](http://www.vegbank.org)

Numbers of plots – July 2005

> 3,000	1,000-3,000	250-999
100-249	50-99	1-29

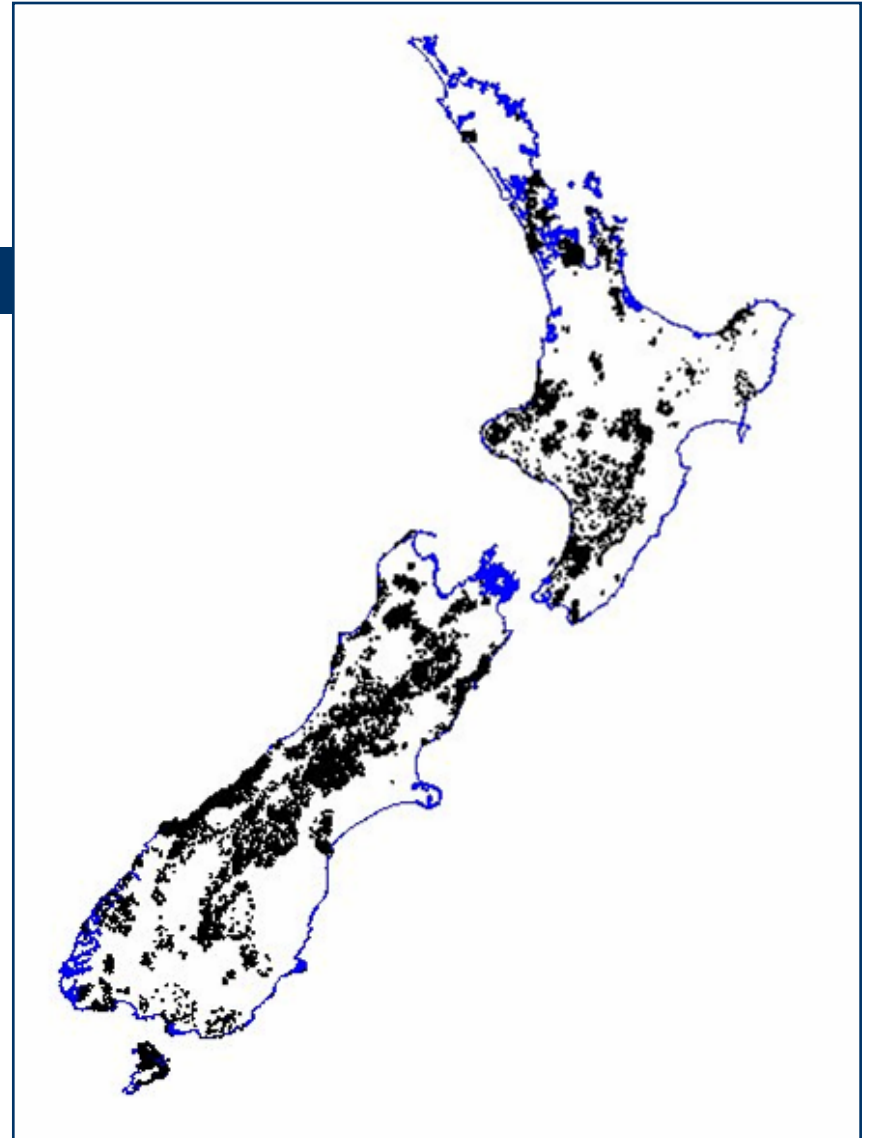


Vegetation plot  
databases:  
New Zealand

NZ National Vegetation  
Survey Databank

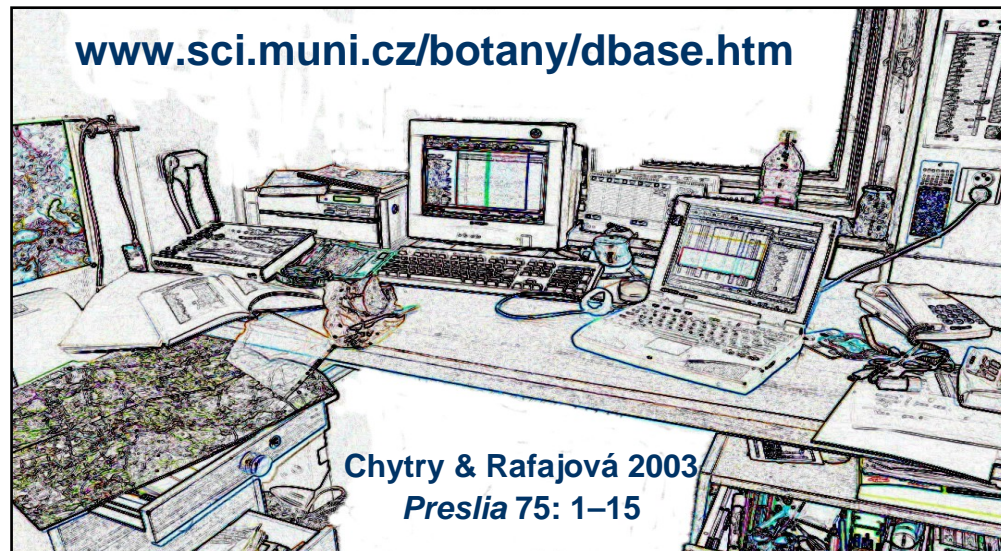
> 45 000 plots  
(~ 10 000 RECCE plots)

[nvs.landcareresearch.co.nz](http://nvs.landcareresearch.co.nz)

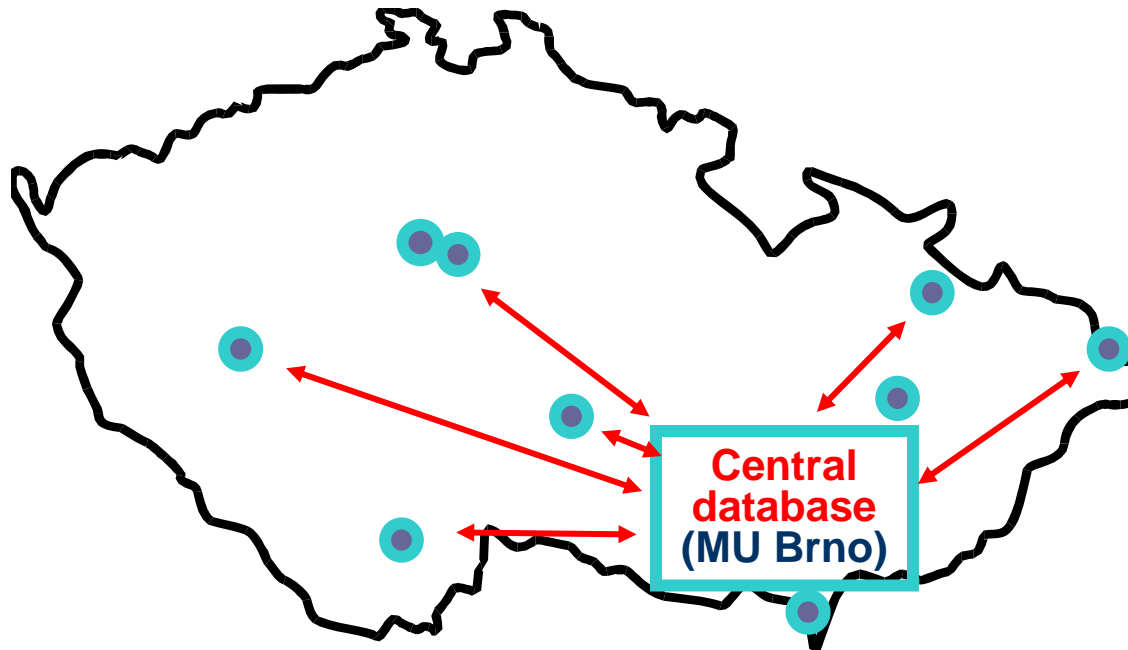


# Czech National Phytosociological Database

- built in 1996–2005
- in 2005 contains more than 72 000 relevés
- contains relevés sampled in 1922–2005
- operated by Turboveg software



# Czech National Phytosociological Database



- one central and several local databases (managed by local coordinators)
- data exchange and free providing for non-commercial use

## ... few recommendations at the conclusion

- set up plot sampling standards, uniform and obligatory for all working groups => sampling method, plot size, arrangement of sampling sites, recommended time of sampling, compatible software for data entering, storage and processing
- compile complete checklist of vascular plant species (essential for Turboveg or other central database software)
- if you will adopt Braun-Blanquette approach – is it possible to merge old and new data? (not quite sure)

Thanks are due to **Milan Chytrý** who kindly provided part of this presentation materials (contribution on IBC Vienna 2005 and teaching materials - available online at <https://www.sci.muni.cz/botany/chytry>)

... and thank you for your attention!