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ANALYSIS OF MAIN STEPS FOR BROAD-SCALE ANALYSIS OF VEGETATION DATA

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- different species lists
- data standardization - header & species data, e.g. Euro+Med Plant Database
- definition of plot size range & excluding of releves without plot size
- geo referencing of vegetation plots
- selection procedures - excluding of some vegetation types (if you study grassland vegetation to exclude shrubland and woodland vegetation) & transitional releves
- stratification of vegetation data
- merging of species - agg & sensu lato
- excluding of lichen & bryophites & species determined to genera level
- merging of different layers of one and same species
- comment of local vs. regional classification

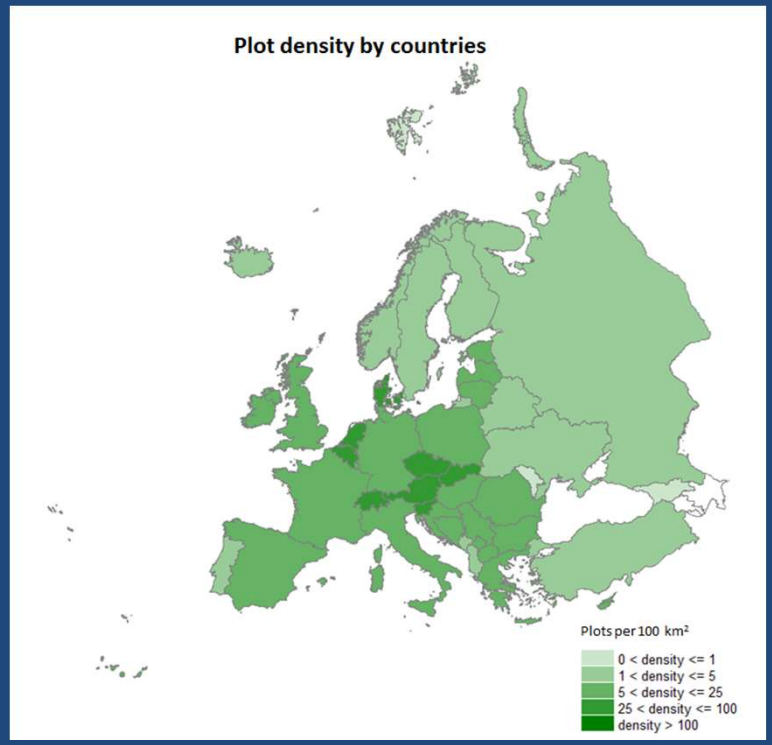
ANALYSIS OF MAIN STEPS FOR BROAD-SCALE ANALYSIS OF VEGETATION DATA

- 1 Vegetation research based on plot sampling has a long tradition in Europe, dating back to the late 19th and early 20th century.
- 2 Phytosociological studies resulted in local and regional overviews of vegetation types
- 3 For many years, vegetation-plot data had to be sorted and analyzed by hand.

	Successive number		1	2	3*	4	5	6	7	8	9		
	Altitude (m)		1300	1353	1115	1115	1118	1115	1295	1295	1110		
	Aspect		W		S	W	N	SE	E	NE	N		
	Inclination (°)		20		45	45	45	45	20	25	30		
	Relevé area (m²)		4	2	8	4	12	8	6	8	1		
	Stoniness (%)		20	10	20	10	20	15	50	10	40		
	Shrub layer (%)	B				5	5						
	Herb layer (%)	C	20	10	70	60	60	70	30	30	40		
	Moss layer (%)	D	60	80	10	30	20	15	20	60	20		
	Number of flowering plants/relevé		27	12	24	22	18	21	21	12	12	%	I_c
	Characteristic species of the association												
TR	*Heliosperma pusillum*	C	2.3	2.3	4.3	4.3	3.3	4.3	3.3	3.3	5.3	100	78
	Sanionia uncinata	D	2.3	2.3	3.3	4.3	3.3	3.3	2.3	+.3	2.3	100	62
	Campylium stellatum	D	+.3	+.3	+.3	1.3	+.3	.	+.3	.	+.3	78	18
	Carex capillaris	C	+.2	+	+	+	.	.	.	.	.	44	10
	Oncophorus virens	D	.	1.3	.	.	+.3	.	.	.	.	22	6
	Phytogeographical differential species												
AT	*Paederota lutea*	C	+	+	1.2	+	1.2	+.2	.	.	.	67	17
AT	*Valeriana saxatilis*	C	+	.	+.2	.	.	.	+	.	.	33	7
AT	*Phyteuma scheuchzeri* ssp. *columnae*	C	+	.	.	.	.	.	1.2	.	.	22	6
VP	*Saxifraga cuneifolia*	C	.	.	.	.	.	.	.	.	2.2	11	6
EP	*Rhodothamnus chamaecistus*	C	.	.	.	+.2	.	.	.	.	.	11	2
	Differential species for the subassociation												
TR	*Salix retusa*	C	+.2	+.2	3.3	1.3	1.2	+.2	.	.	.	67	23
ES	*Poa alpina*	C	.	.	3.2	1.1	1.2	2.2	.	.	1.2	56	26
TR	***Arabidetalia caeruleae* (incl. *Salicion retusae*) & *Thlaspietea rotundifolii***												
	Arabis alpina	C	.	.	+	.	.	1.2	.	+	.	33	9
	Trisetum argenteum	C	.	.	.	.	.	.	+	+	.	22	5
	Adenostyles glabra	C	.	.	.	+.2	.	.	.	.	.	11	2
	Cystopteris montana	C	.	.	.	.	.	.	+.2	.	.	11	2
AT	***Asplenietea trichomanis***												
	Cystopteris fragilis	C	.	.	+	.	+	+	+	.	.	44	10
	Carex brachystachys	C	.	.	.	+.2	.	.	+	.	.	22	5
	Cystopteris regia	C	+.2	.	.	.	.	.	1.2	.	.	22	6
	Primula carniolica	C	.	.	.	+.2	.	.	.	.	.	11	2
ES	***Elyno-Seslerietea***		.	.	.	.	.	.	.	.	.		
	Pinguicula alpina	C	+	.	.	.	.	.	+	.	.	22	5
	Aster bellidiastrum	C	+	.	.	.	.	.	.	.	.	11	2
	Tofieldia calyculata	C	+	.	.	.	.	.	.	.	.	11	2
AD	***Mulgedio-Aconitetea***												
	Viola biflora	C	1.1	1.1	4.2	3.2	2.2	2.2	3.2	2.2	+	100	55
	Chrysosplenium alternifolium	C	.	.	.	.	.	+.2	.	.	1.2	22	6
	Salix appendiculata	B	.	.	.	+	.	.	.	.	.	11	2
	Salix appendiculata	C	1.2	+	+	.	+.2	.	.	.	.	44	11
	Salix glabra	B	.	.	.	.	+	.	.	.	.	11	2
		C	.	.	.	.	+	.	.	.	.	11	2

ANALYSIS OF MAIN STEPS FOR BROAD-SCALE ANALYSIS OF VEGETATION DATA

- There are more than 5,000,000 vegetation plots in Europe, half of which are already computerized. Of the computerized plots, about 75% are stored in central databases of the countries or regions concerned and 60% in TURBOVEG format.
- 1 Most of the records of vegetation plots are for countries in central and western Europe



ANALYSIS OF MAIN STEPS FOR BROAD-SCALE ANALYSIS OF VEGETATION DATA

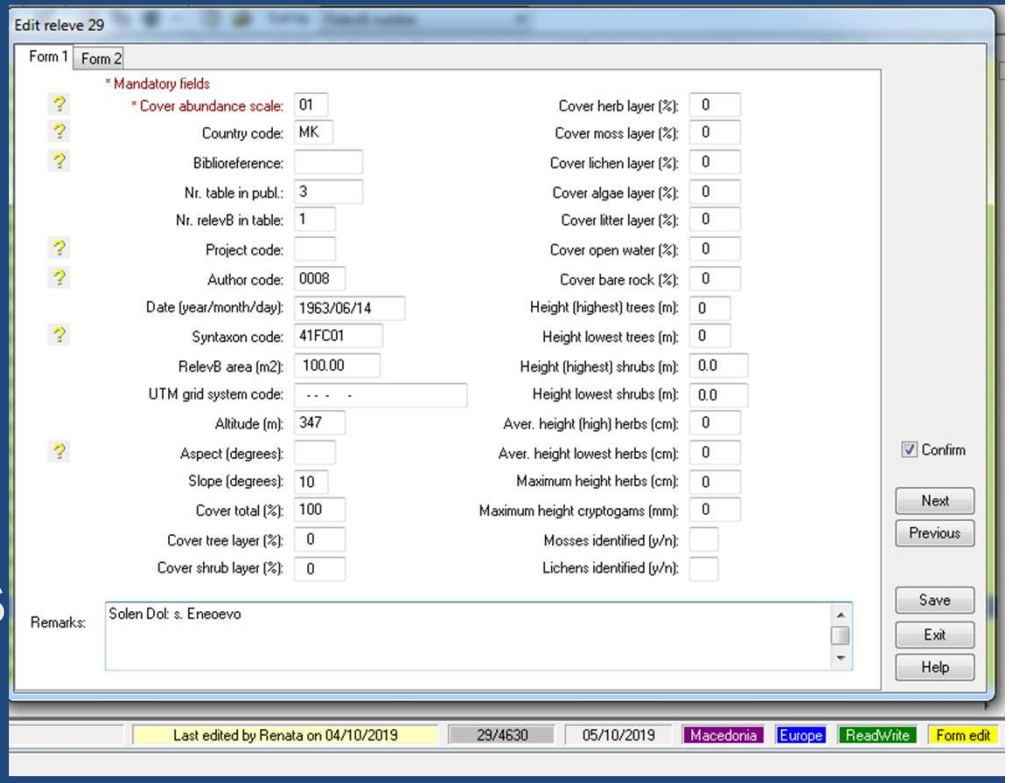
- 1 The data sets are managed separately in Turboveg 2
- 2 Databases provided by partners of the Braun-Blanquet project or the European Vegetation Archive are in most cases linked to one of the species lists available for Turboveg
- The TurboVeg 3 is in the process of being developed, which will enable the work of different vegetation sets without changing the species list.

DIFFERENT SPECIES LISTS

- As it stands, a single TurboVeg base can be linked to only one species list
- If we have few species lists, then the taxa from database should be linked to one of the existing species lists
- One of the most important steps in using vegetation data (from different sources) for statistical analysis is to take care about the taxonomic content of the names existing in the database. That is, to make sure, that exactly one (correct and valid) name defines one biological entity
- Besides it is necessary to unify the species lists also is necessary header data to unify

DATA STANDARTISATION - HEADER & SPECIES DATA

- In the field research we record besides the data of the floristic composition, also the data on the ecology
- releve area
- altitude
- aspect
- slope
- cover total
- cover of differen layers
- latitude longitude



DATA STANDARTISATION - HEADER & SPECIES DATA

- In addition to the database we also include data about
- author
- date
- country code,
- geological substrate
- syntaxonomic code
- remarks
- and depending on needs and other data such as soil composition

DATA STANDARTISATION - HEADER & SPECIES DATA

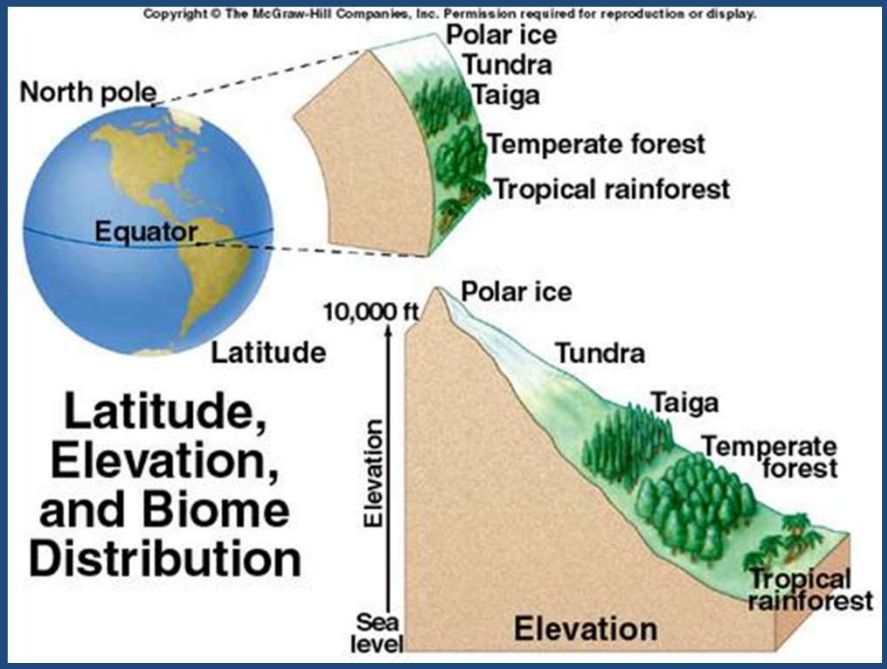
- but often in the past, much of this data is not recorded and they are missing
- For analysis of large data base relevés with missing values must be deleted

GEOREFERENCING OF RELEVES

- As older relevé material is not georeferenced, we should retrospective georeferencing of relevés that will allow stratified resampling to avoid oversampled areas.
- This is very laborious and time consuming but it will increase the value of gathered data. And it is only possible if we have enough data on the site where the research was done

GEOREFERENCING OF RELEVES

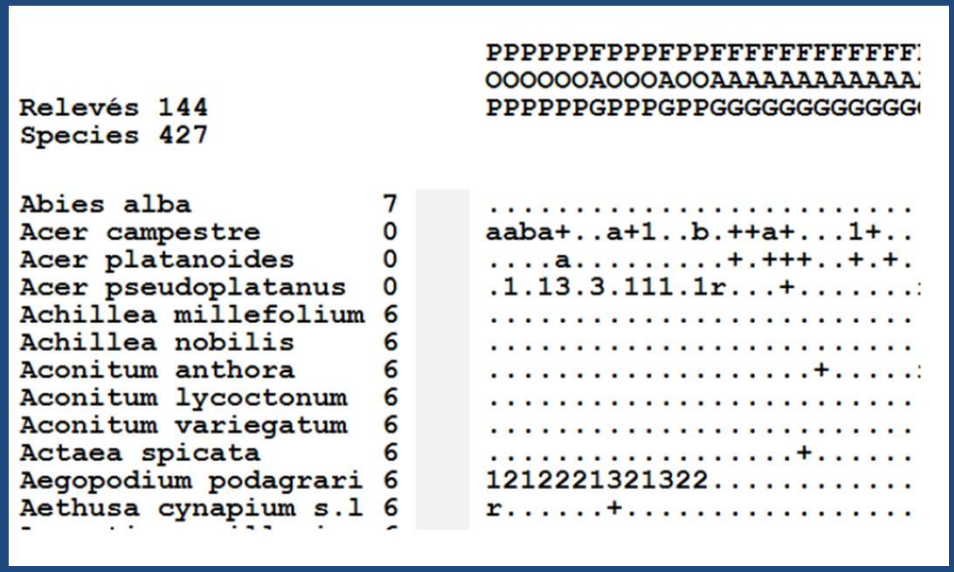
- Why do we need latitude and longitude in vegetation research?
- Thanks to the interaction of altitude and latitude primarily biomes are determined



SELECTION PROCEDURES - EXCLUDING OF SOME VEGETATION TYPES

- EuroVegChecklist Expert System
- JUICE related to the paper of Mucina et al. 2016
- All plots are related to some vegetation unit with the highest number (cover) of target species.

As a result, we will obtain an identification of relevés to vegetation classes (saved in Short Headers), as it is shown :



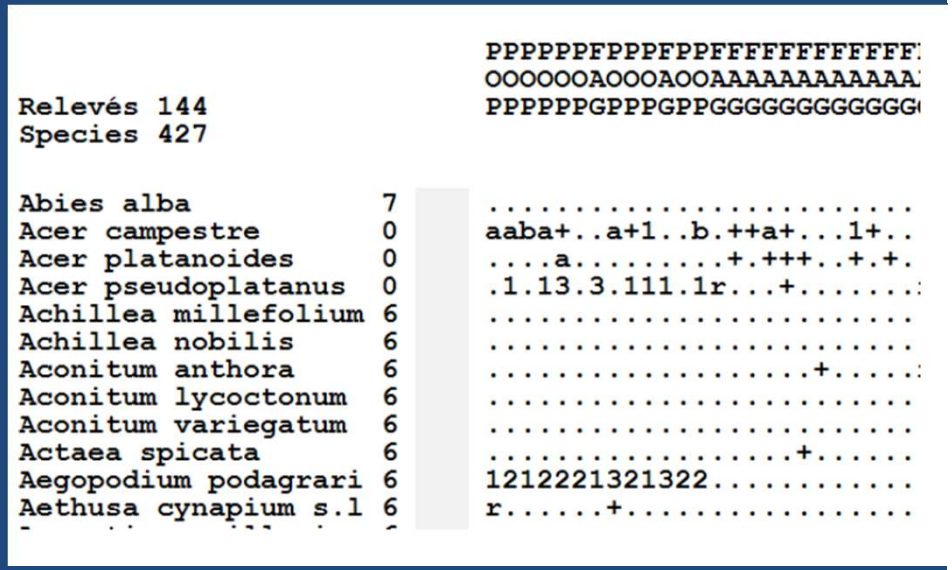
```
                                  PPPPPPPFPPPFPPFFFFFFFFFFFF
                                  OOOOOOAOOOAOOAAAAAAAAAAAA
Relevés 144                       PPPPPPGPPPGPPGGGGGGGGGGGG
Species 427

Abies alba                 7      ..........................
Acer campestre             0      aaba+..a+1..b.++a+...1+..
Acer platanoides           0      ....a.........+.+++..+.+.
Acer pseudoplatanus        0      .1.13.3.111.1r...+.......
Achillea millefolium       6      ..........................
Achillea nobilis           6      ..........................
Aconitum anthora           6      ....................+.....
Aconitum lycoctonum        6      ..........................
Aconitum variegatum        6      ..........................
Actaea spicata             6      ....................+.....
Aegopodium podagrari       6      1212221321322.............
Aethusa cynapium s.l       6      r......+..................
```

SELECTION PROCEDURES - EXCLUDING OF SOME VEGETATION TYPES

- POP Alno glutinosae-Populetea albae P. Fukarek et Fabijanic 1968
- FAG Carpino-Fagetea sylvaticae Jakucs ex Passarge 1968

Such data may be exported and can be used for relevé sorting and definition of broad vegetation groups useful for the next analyses.



```
                                  PPPPPPPFPPPFPPFFFFFFFFFFFF
                                  OOOOOOAOOOAOOAAAAAAAAAAAA
Relevés 144                       PPPPPPGPPPGPPGGGGGGGGGGGG
Species 427

Abies alba                7
Acer campestre            0       aaba+..a+1..b.++a+...1+..
Acer platanoides          0       ....a.........+.+++..+.+.
Acer pseudoplatanus       0       .1.13.3.111.1r...+.......
Achillea millefolium      6       ..........................
Achillea nobilis          6       ..........................
Aconitum anthora          6       ..................+.....
Aconitum lycoctonum       6       ..........................
Aconitum variegatum       6       ..........................
Actaea spicata            6       ..................+.......
Aegopodium podagrari      6       1212221321322.............
Aethusa cynapium s.l      6       r......+..................
```

FILES WITH TARGET SPECIES AND CLASS NAMES

- To use EuroVegChecklist Expert System
- are need two text files with a correct structure for the proper identification of vegetation units

*.TXT file with two columns –
(1) abbreviation of the vegetation unit and
(2) species name. These fields are divided by tabs.

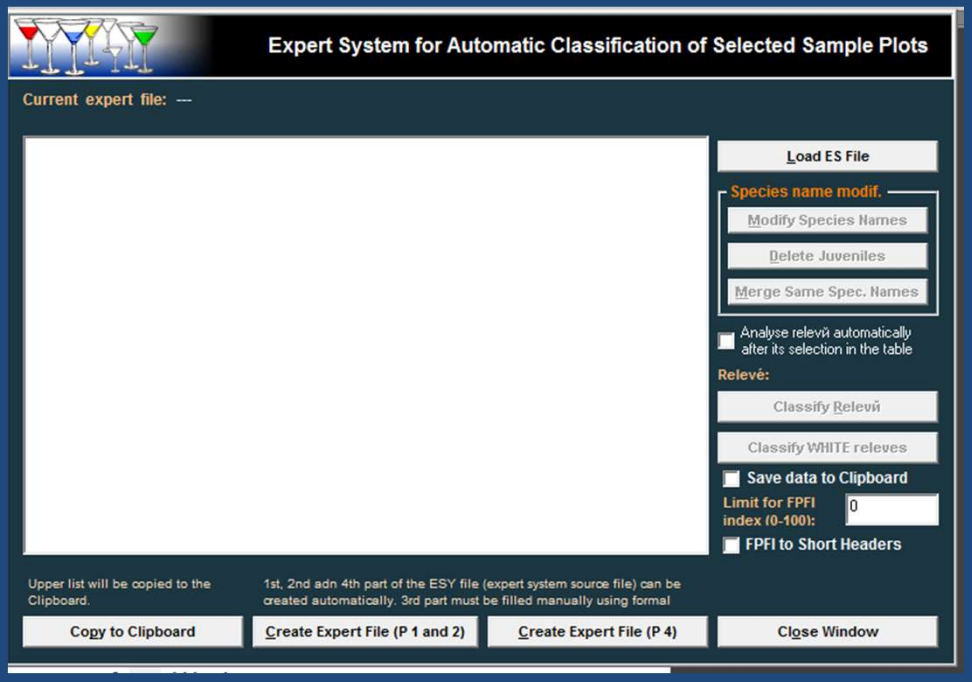
FES	Acinos alpinus subsp. pyrenaeus
RUM	Acinos alpinus var. nebrodensis
DAP	Acinos alpinus var. nebrodensis
RUM	Acinos granatensis subsp. aetnensis
DAP	Acinos granatensis subsp. aetnensis
STE	Acinos rotundifolius
FAG	Aconitum altissimum
MUL	Aconitum altissimum
MUL	Aconitum napellus subsp. hians
MUL	Aconitum napellus subsp. splendens
MUL	Aconitum napellus subsp. tauricum
PUR	Aconitum neomontanum
MUL	Aconitum neomontanum

The *.HEA file with a similar structure contains the column with
(1) abbreviation of vegetation unit and
(2) the full vegetation unit name:

BID	Bidentetea
BRA	Brachypodio pinnati-Betuletea pendulae
BUL	Poetea bulbosae
CAK	Cakiletea maritimae
CAN	Cytiso-Pinetea canariensis
CFR	Charetea
COR	Koelerio-Corynephoretea
CRI	Crithmo-Staticetea
CRY	Crypsidetea aculeatae
CYT	Cytisetea scopario-striati
DAP	Daphno-Festucetea
DRY	Drypetea spinosae

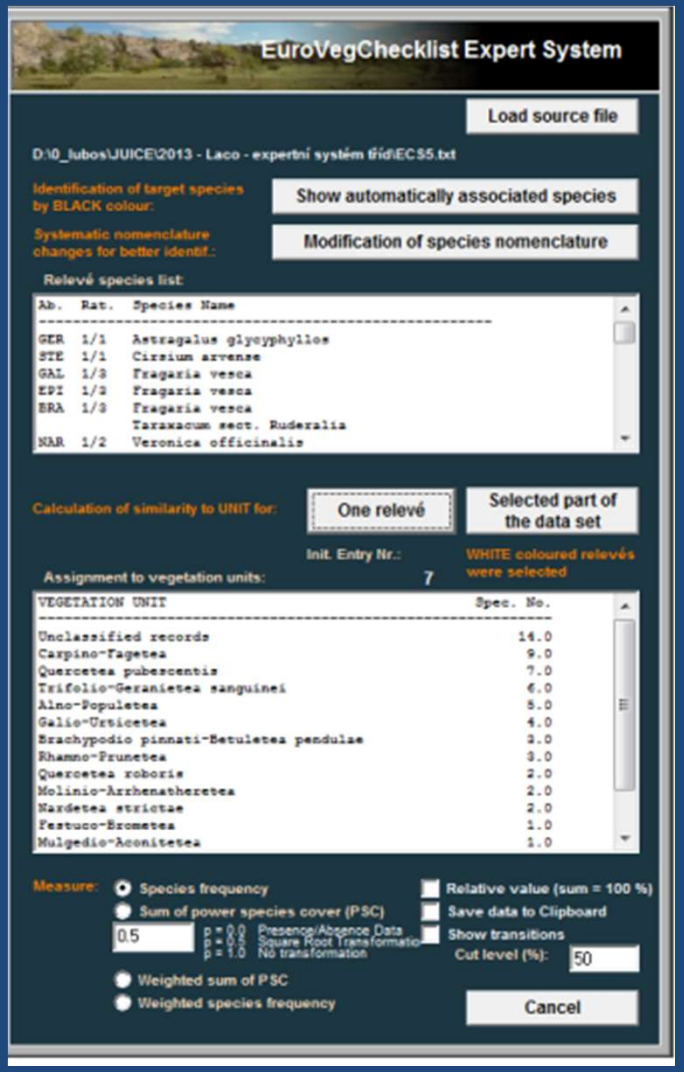
INITIATION OF THE FUNCTION EXPERT SYSTEM

- The function can be called from the main JUICE menu ‘Analysis’ and ‘EuroVegChecklist
- Expert System’. The following window will ask for the previously mentioned ECS5.TXT file and displays an expert system classification tool.



CLASS IDENTIFICATION FOR A SINGLE RELEVÉ

- We can select any relevé by selecting the button ‘One relevé’. A list of species, which were determined within selected relevé, will appear in an upper list.
- It will contain an information about
- (1) related class abbreviation,
- (2) some ratio of species importance (calculated as an
- inversed number of classes determined by the same species) and
- (3) species name
- Bottom list shows the number (cover etc.) of species, which indicate the same vegetation class.

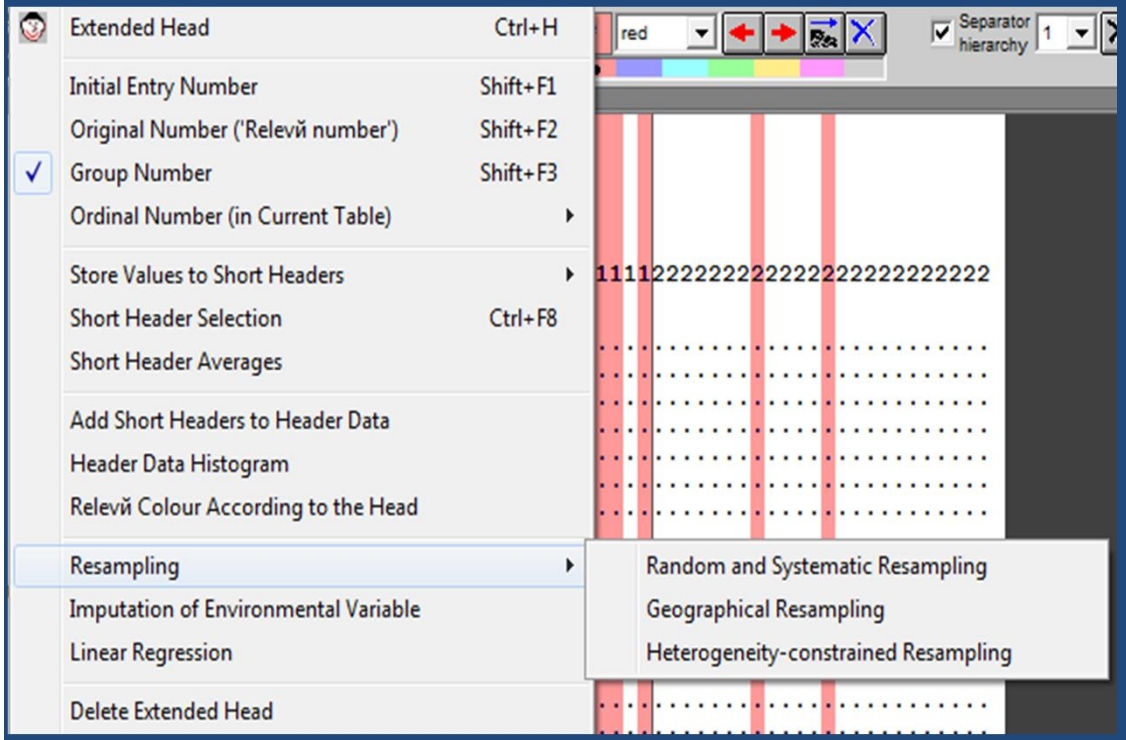


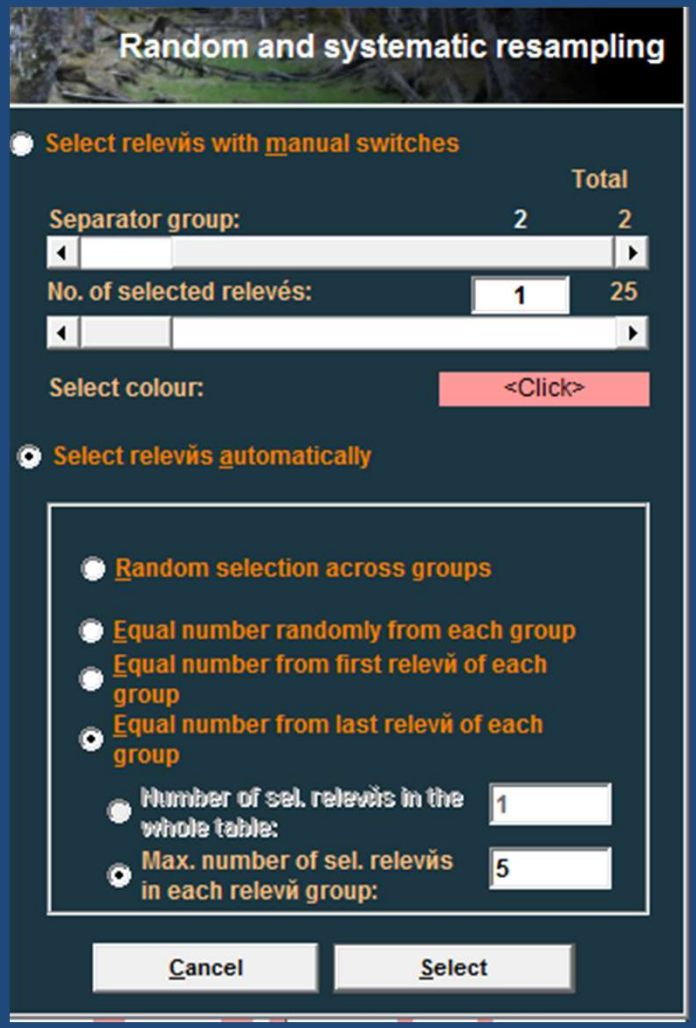
STRATIFIED RESAMPLING

- The heterogeneous origin of the data in large phytosociological databases may seriously influence the results of their analysis. Therefore are proposed some strategies for stratified resampling of such databases, which may improve the representativeness of the data.

CLASS IDENTIFICATION FOR A SINGLE RELEVÉ

- The function can be called from the main JUICE menu ‘Home’ and ‘Resampling





CLASS IDENTIFICATION FOR A SINGLE RELEVÉ

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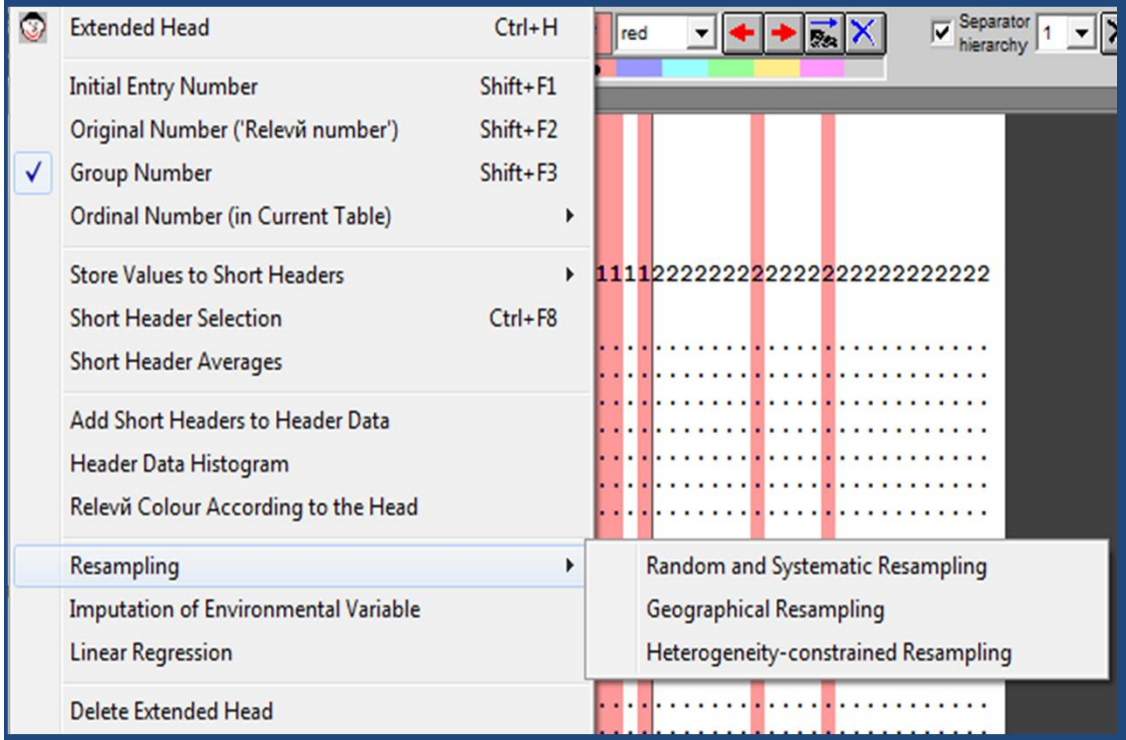
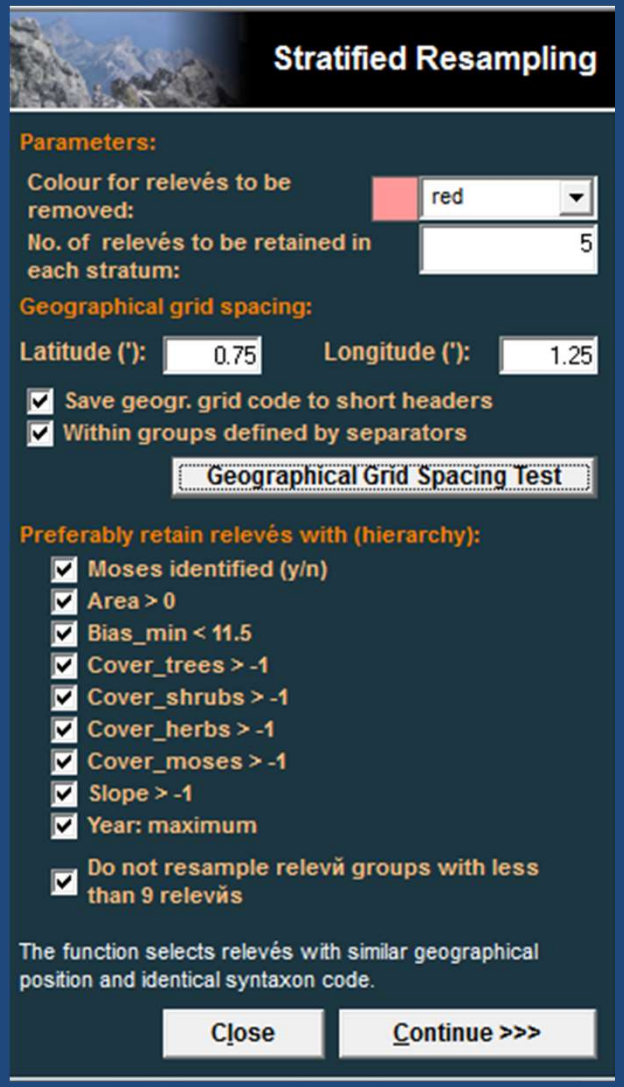




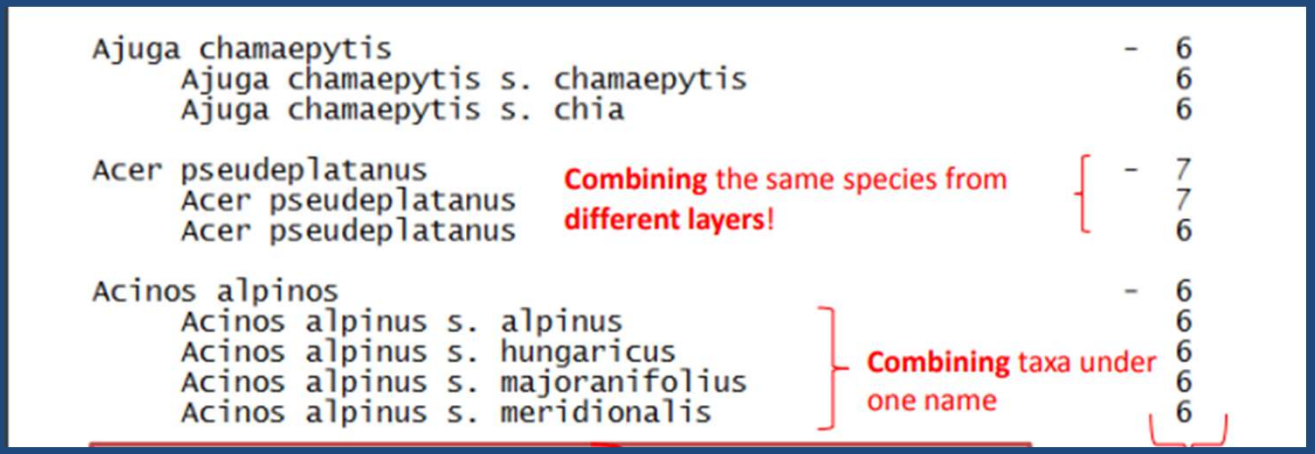
NOMENCLATURE - MERGING OF SPECIES - AGG & SENSU LATO

- Nomenclature is a basic problem of larger phytosociological tables with relevés from several authors.
- Unification of nomenclature is often necessary due to differences in species delimitation (e.g. records of species both sensu lato and sensu stricto contained in a single table). JUICE has some tools for
- - species aggregation and manipulation with species names,
- - species covers in relevés and
- - header data.

SPECIES AGGREGATION

- Species aggregation should be realized immediately after table import from TURBOVEG
- Sort the species list in alphabetical order.

- Mark all similar species, which should be aggregated into one



- select menu SPECIES and MERGE <selected> SPECIES.

COMBINATION OF SPECIES COVER VALUES FROM DIFFERENT VEGETATION LAYERS 1

- Phytosociological releves consist of lists of species occurring on certain plots and their cover values in different vegetation layers.
- When combining the cover values of two layers into a unique value, the overlap between the layers must be
- taken into account.
- With two layers this can easily done by subtracting the product of the cover values from their sum.
- For large databases where rich data sets have to be compiled that were originally recorded from different numbers of vegetation layers

SPECIES AGGREGATION

- Confirm name and layer of the new aggregated species. All the species contained in the resulting aggregated species are automatically deleted from the data set.
- Example: Species 1 - cover 50 %, Species 2 - cover 30 %, Species 3 - cover 20 %
- MERGE SPECIES function will calculate combined cover of these three species as:
- (1.00 - 0.00) * 0.50 + (1.00 - 0.50) * 0.30 + (1.00 - 0.65) * 0.20 = 0.72 = 72 %

BRYOPHYTES AND LICHENS

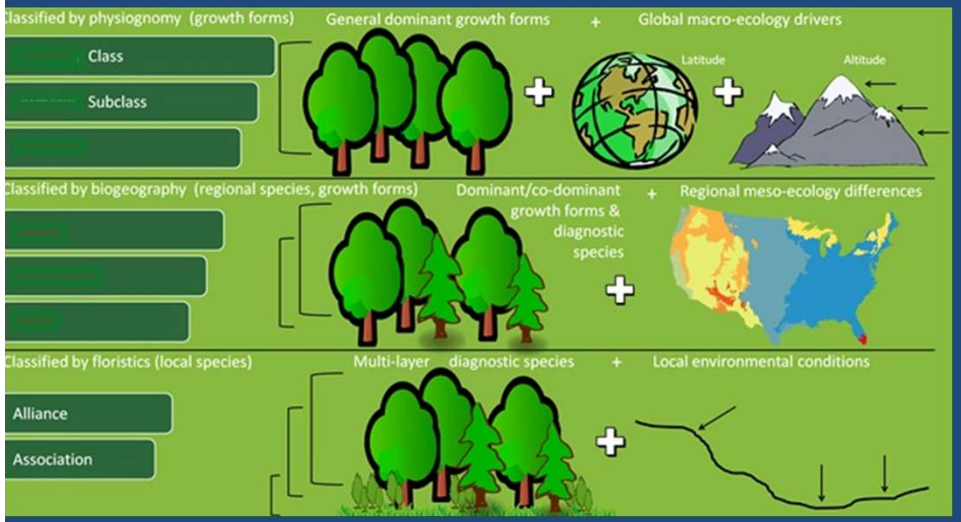
- Bryophytes and lichens present different ecological requirements
- Very often the mosses or lichens are not collected, or are determined to the level of genus
- Therefore, if we have a complete list of mosses and lichens present in the vegetation, we would be difficult to compare the vegetation, since mosses and lichens are missing in the literature

LOCAL VS. REGIONAL CLASSIFICATION

The lower levels (alliance and association) are based on diagnostic and/or dominant species and compositional similarity reflecting local to regional environmental factors.

Association

Topo-edaphic climate, substrates, hydrology, and disturbance regimes



The upper levels of the hierarchy are based on dominant and diagnostic growth forms that reflect environment at global to continental scales

Class or order

Global macroclimatic factors driven primarily by latitude and continental position, altitude, seasonality of precipitation, substrates, and hydrologic conditions.

PLOT SIZE OF MINIMUM AREA PER SQUARE METER FOR DIFFERENT COMMUNITIES

Size of the plot “minimal area”.
For adequate sampling, a plot must be large enough to cover the pattern or community to be investigated, and must, therefore, be at least the size of the “ minimal area”. On the other hand, in studying vegetation it is important, from the economic point of view, that no effort is wasted in collecting maximum information. Therefore, the ideal plot size will be the one nearest to the “minimal area”, giving the most favorable balance between information obtained and effort expended

Epiphytic communities	0,1-0,4
Terrestrial mosses communities	1-4
Hygrophilous Pioneering Communities (Isoeto-Nanojuncetea)	1-4
Lawn dunes (Koelerio-Corynephoretea)	1-10
Salty marshes (Asteretea tripolii)	2-10
Mobile coastal dune communities (Ammophiletea)	10-20
Alpine grasslands and dwarf shrubs (Elyno-Seslerietea)	10-50
Limestone pastures (Festuco-Brometea)	10-50
Weed communities (Secalietea)	25-100
Rough communities (Rhamno-Prunetea)	25-100
Steppe communities	50-100
Moderate deciduous forests (Carpino-Fagetea sylvaticae)	100-500
Mixed deciduous forests (S. America)	200-800
Tropical secondary rainforests	200-1000
Tropical floodplains	2000-4000