Osnovni principi analiziranja i mjerenja biološke i krajobrazne raznolikosti i zakonitosti

primjena specifičnih statističkih metoda i programskih paketa

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Planet zemlja kao savršena Božja kreacija

Ljepota stvaranja?

Ljepota stvorenog?

Vidjeti Boga i ljepotu stvorenog u prirodi?

Poštovanje Stvoritelja i Kreacije?

Dolina smrti (Foto. Daniel Bürgin), http://www.edenpics.com

Cilj predavanja

Utvrditi osnove mjerenja biološke i krajobrazne zakonitosti i raznolikosti putem odgovora na sljedeća pitanja:

- Zašto nam je važno utvrditi zakonitost i raznolikost?
- Koji su pokazatelji?
- Kako ih mjerimo?
- Koje alate možemo primijeniti?

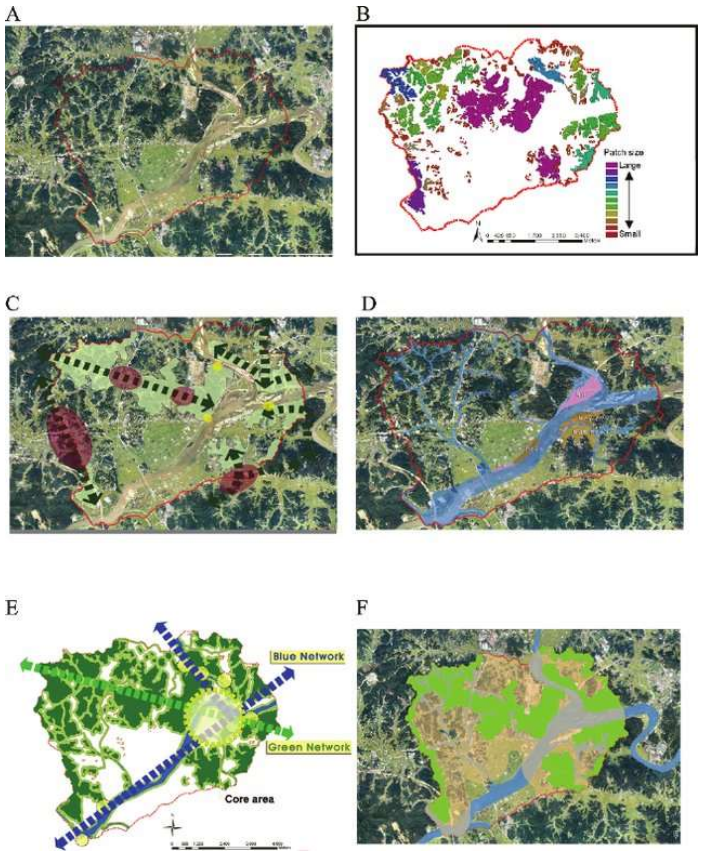
Svrha / ishod predavanja

- osigurati vještine mjerenja zakonitosti i raznolikosti
- pravilno odabrati odgovarajući indeks raznolikosti s obzirom na postavljena pitanja i/ili hipoteze
- uspješno uspoređivati zakonitost i raznolikost između „uzoraka”

BIOLOŠKA RAZNOLIKOST ili BIODIVERZITET

Što je raznolikost? Zašto je važna? Kako ju mjerimo?

- međuovisnost svih živih organizama i njihovo uravnoteženo zajedničko djelovanje, koje je ključ „zdravlja” Zemlje kao cjeline.
- Biološka raznolikost se pojavila kao ključni koncept u upravljanju i očuvanju različitih ekoloških sustava u okviru Krajobrazne ekologije i šire.
- Trenutno su ekološke studije sve više usmjerene na učinke agroekosustava na bioraznolikost unutar poljoprivrednih krajolika



Ro i Hong, 2008, dos Santos i sur., 2021

PETEROCARSTVENI SUSTAV

- **Whittaker-** 1969. razvrstao živa bića u 5 carstava i 2 nadcarstva

- **nadcarstvo**: **PROKARIOTI** (procaryota)
  carstvo: ***MONERI*** (monere)

- **nadcarstvo: EUKARIOTI** (eucaryota)
  carstvo: ***PROTISTI***
  GLJIVE
  BILJKE
  ŽIVOTINJE

OD DVOCARSTVENOG DO ŠESTEROCARSTVENOG SUSTAVA

<table>
<tr><th>Linnaeus
1735</th><th>Haeckel
1866</th><th>Chatton
1925</th><th>Copeland
1938</th><th>Whittaker
1969</th><th>Woese et al.
1977</th><th>Woese et al.
1990</th><th>Cavalier-Smith
2004</th></tr>
<tr><td>2</td><td>3</td><td>2</td><td>4</td><td>5</td><td>6</td><td>3</td><td>6</td></tr>
<tr><td rowspan="2">Nije uzeto u razmatranje</td><td rowspan="2">Protista</td><td rowspan="2">Procaryota</td><td rowspan="2">Monera</td><td rowspan="2">Monera</td><td>Eubacteria</td><td>Bacteria</td><td rowspan="2">Bacteria</td></tr>
<tr><td>Archaebacteria</td><td>Archaea</td></tr>
<tr><td rowspan="4">Vegetabilia</td><td rowspan="4">Plantae</td><td rowspan="5">Eucaryota</td><td rowspan="2">Protoctista</td><td rowspan="2">Protista</td><td rowspan="2">Protista</td><td rowspan="5">Eucaryota</td><td>Protozoa</td></tr>
<tr><td>Chromista</td></tr>
<tr><td>Plantae</td><td>Plantae</td><td>Plantae</td><td>Plantae</td></tr>
<tr><td>Protoctista</td><td>Fungi</td><td>Fungi</td><td>Fungi</td></tr>
<tr><td>Animalia</td><td>Animalia</td><td>Animalia</td><td>Animalia</td><td>Animalia</td><td>Animalia</td></tr>
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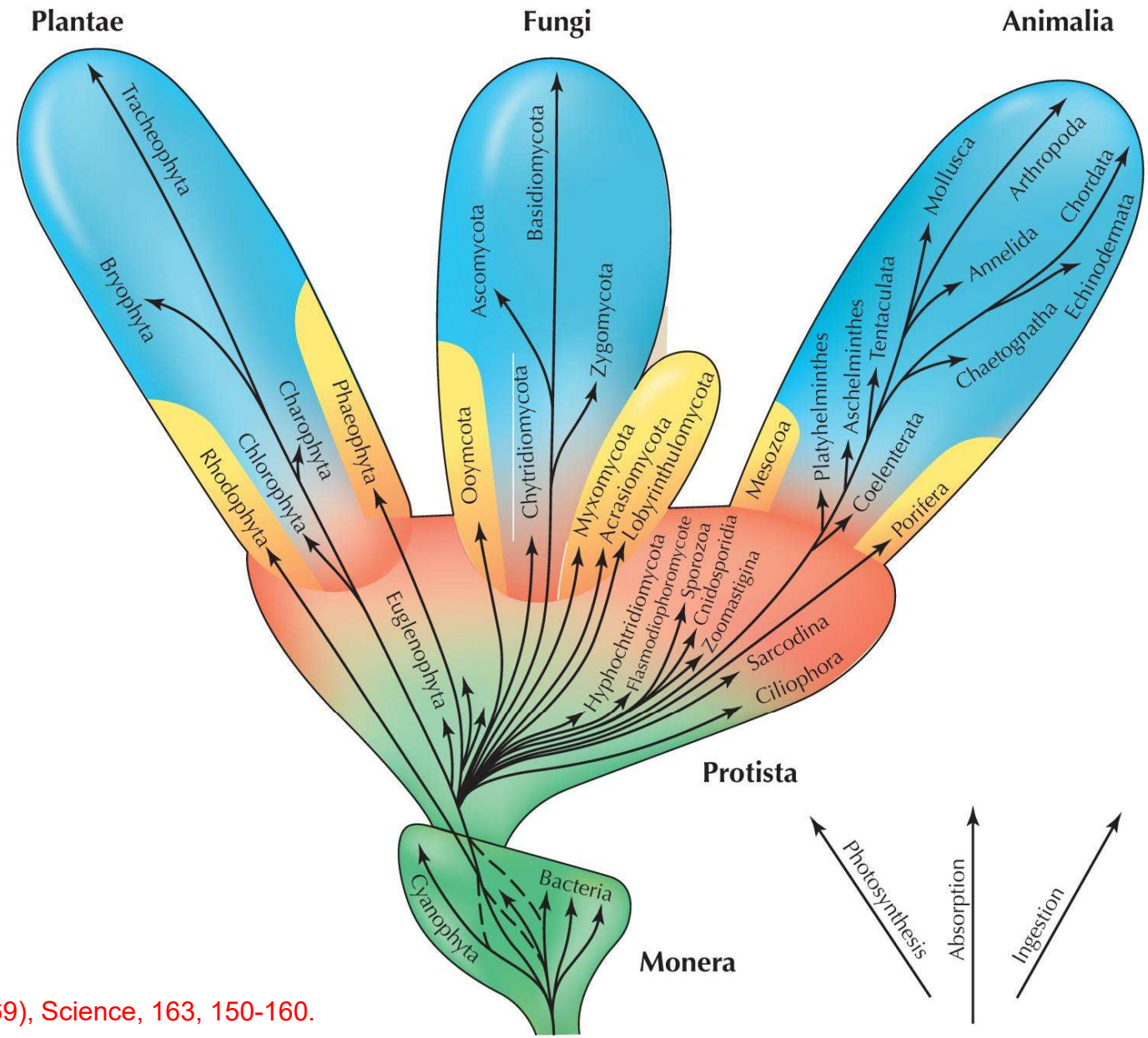
PETEROCARSTVENI SUSTAV prema Whittakeru (1969)



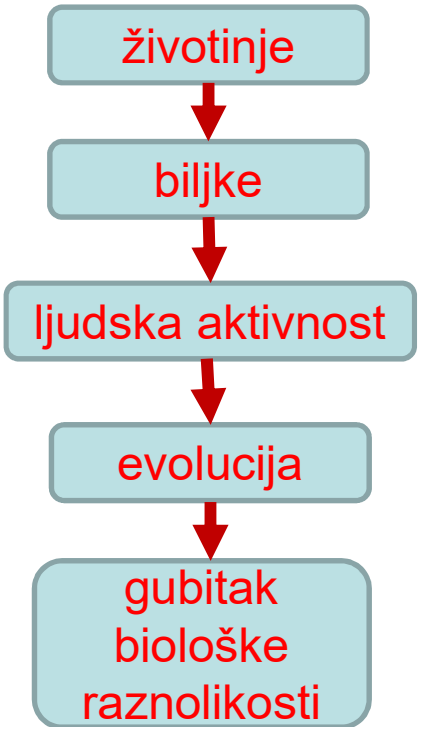
Whittakeru (1969), Science, 163, 150-160.

KONCEPT BIOLOŠKE RAZNOLIKOST

3 KONCEPTUALNI ILI VIŠE?

- **raznolikost vrsta**
- **genetska raznolikost**
- **strukturna (ekološka) raznolikost**

…



TAXON vs. SVOJTA

- **Taxon** /grč. *taksis* - red, (bojni) red ili (vojnička) vrsta, mjesto u bojnom redu, četa/.
- Hrvatski, već dosta ustaljen izraz **“svojta”** dodatno kao da hoće reći kako je svaka razina od vrste do carstva izraz descendencije ili zajedništva podrijetla, evolucijom.
- Dakle, takson ili svojta je taksonomski prepoznatljiva skupina bilo koje razine /ranga/ koju su taksonomi prepoznali dovoljno razlučenom od drugih, da je onda priključe upravo u tu određenu kategoriju.
- Na jednome te istom rangu (u istoj kategoriji) razne su svojte!

(Mayr i Ashlock, 1991)

SVOJTE vs. KATEGORIJE

- ***Vrsta dakle nije svojta nego kategorija*.**
- Isto tako: rod, porodica i red – su kategorije.
- Npr. *Gammarus fossarum* – to je svojta /taxon/.
- Pojam kategorija rabe biolozi u dvadesetak raznih značenja.
- Sve one, međutim, pripadaju trima skupinama:

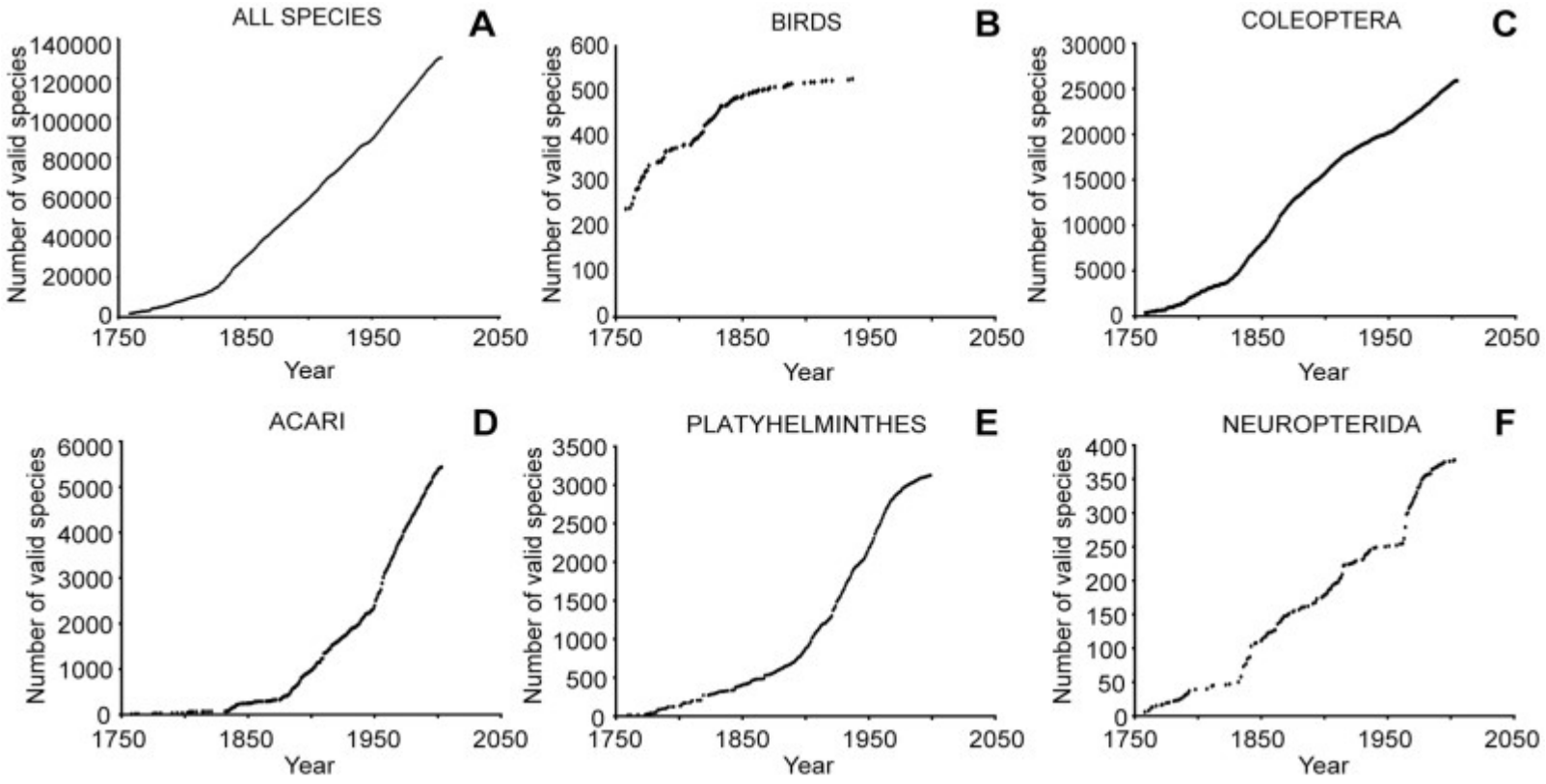
1. Vrstovna kategorija (species category)

2. Kategorije za raspoznavanje unutar populacija (infraspecific categories)

3. Kategorije za svojte iznad kategorije vrste (skupne kategorije su više kategorije)

(Mayr i Ashlock, 1991)

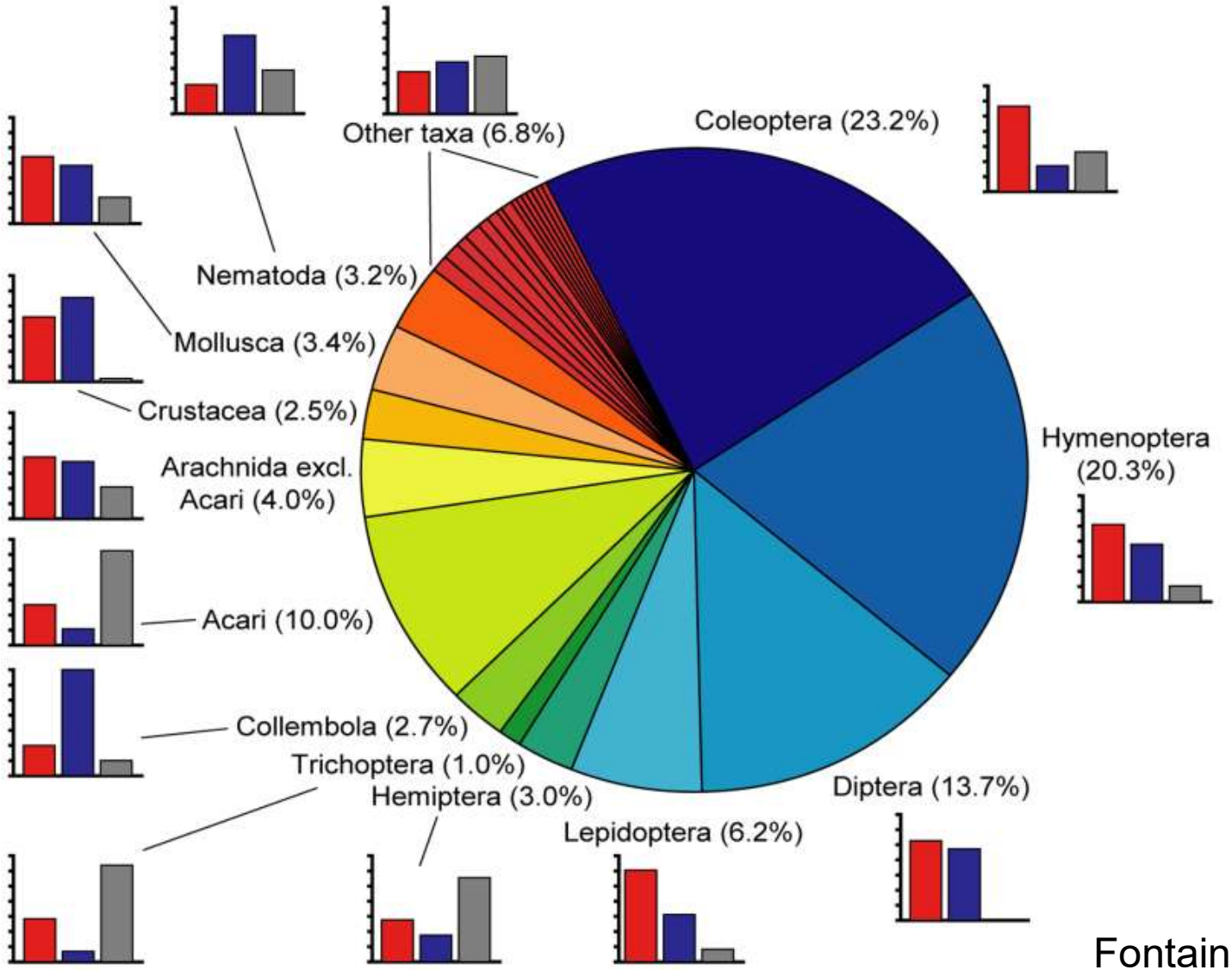
„Finding a new species could be easier than you think…”



Kumulativne krivulje validnog broja europskih vrsta životinja
(Preuzeto: Fontaine et al. 2012)

http://mappingignorance.org/2012/12/12/finding-a-new-species-could-be-easier-than-you-think/

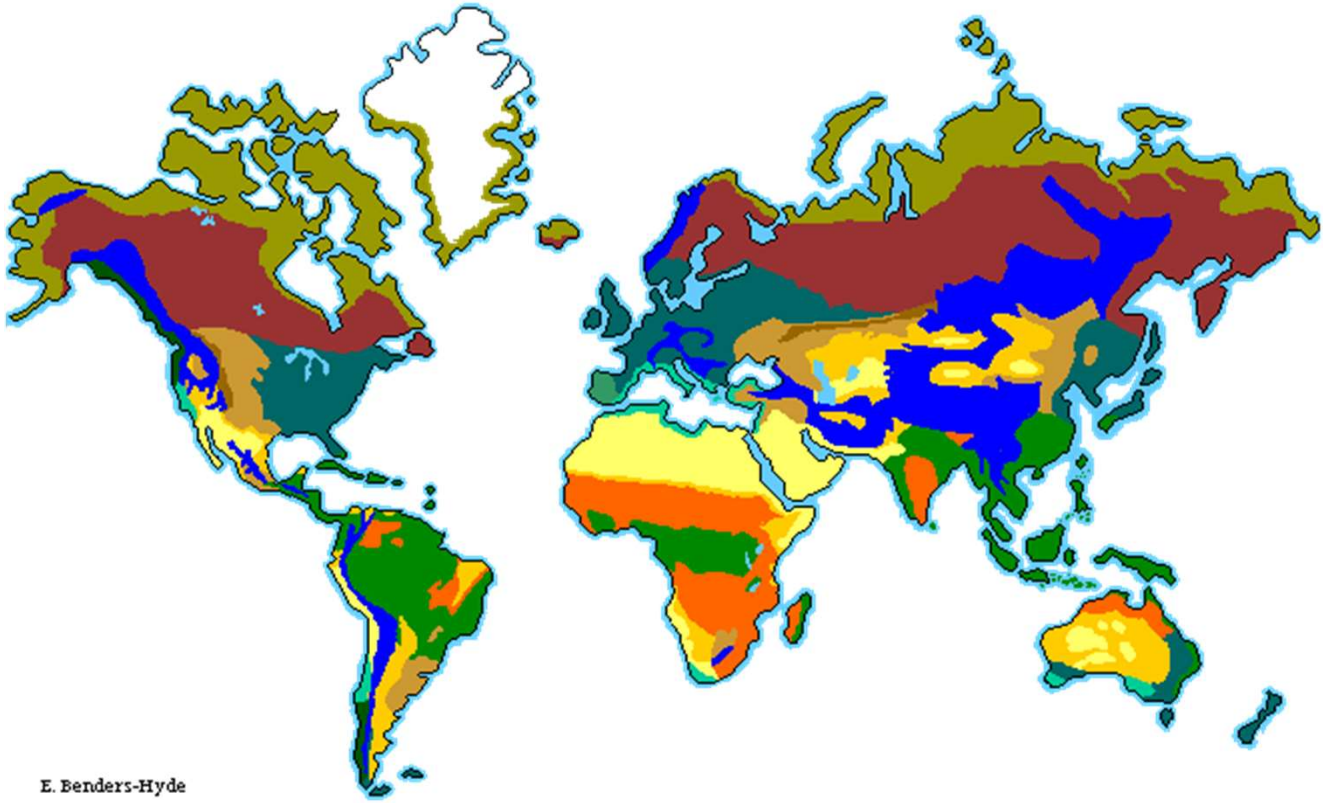
„Finding a new species could be easier than you think…"



Fontaine et al. 2012

http://mappingignorance.org/2012/12/12/finding-a-new-species-could-be-easier-than-you-think/

STRUKTURNA (EKOLOŠKA) RAZNOLIKOST



BIOMI

Da bi razumjeli biome svijeta potrebno je znati:

Obilježja klime pojedinih područja na Zemlji;

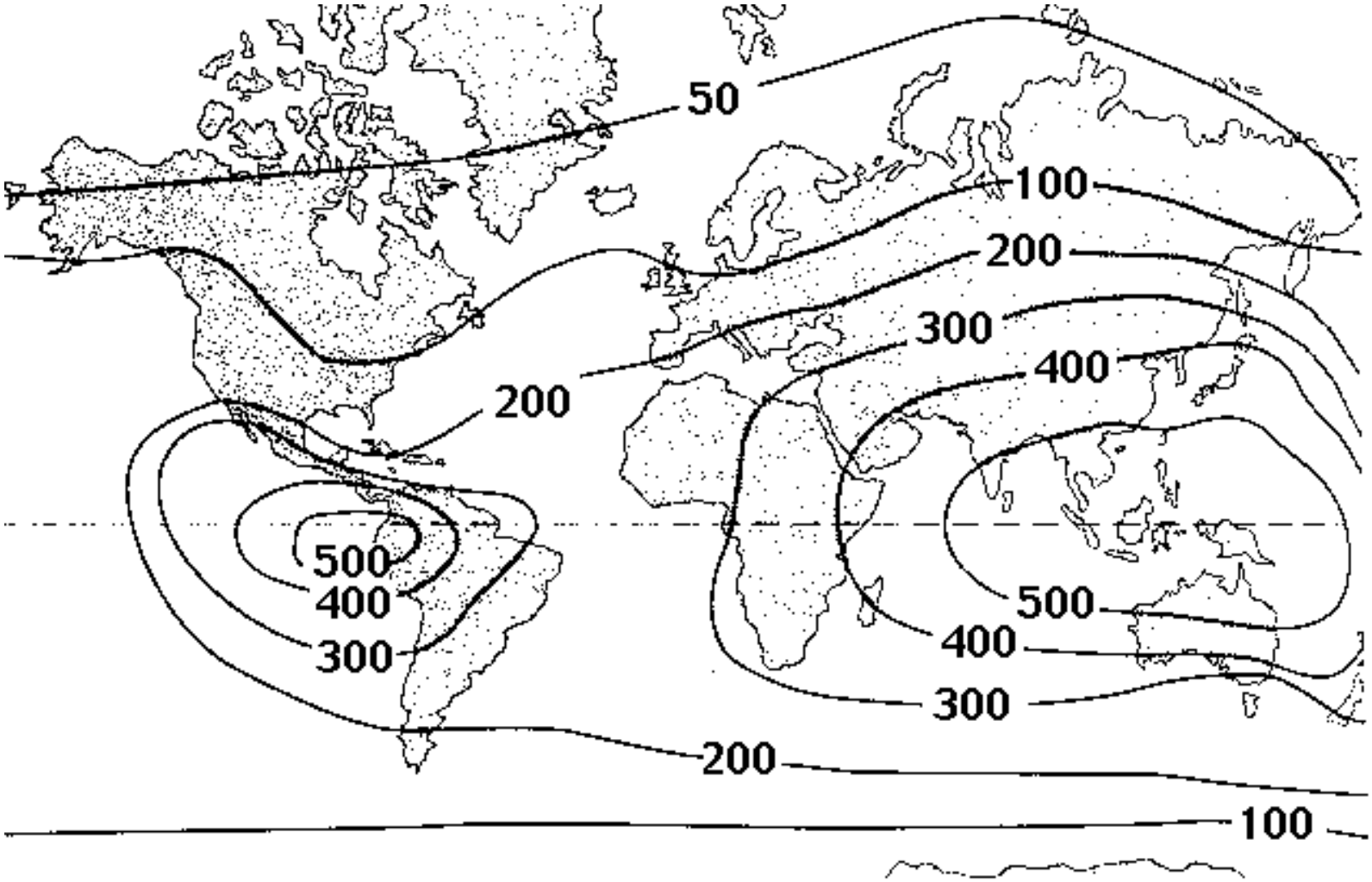
Gdje se koji biom nalazi i koja su geografska obilježja tog područja;

Koja je specifična prilagodba pojedinog tipa vegetacije;

Tipovi životinja koji žive u pojedinim biomima i njihovi oblici prilagodbi na uvjete okoliša.

Globalna zakonitost biološke raznolikosti

BIVALVIA



Hipoteze koje objašnjavaju odnos između geografske širine i raznolikosti

POVIJESNE HIPOTEZE

Pretpostavka: **zajednice većih geografskih širina su mlađe zbog proteklih ledenih doba**

NEPOVIJESNE HIPOTEZE

Pretpostavka: **zajednice većih geografskih širina su manje produktivne**

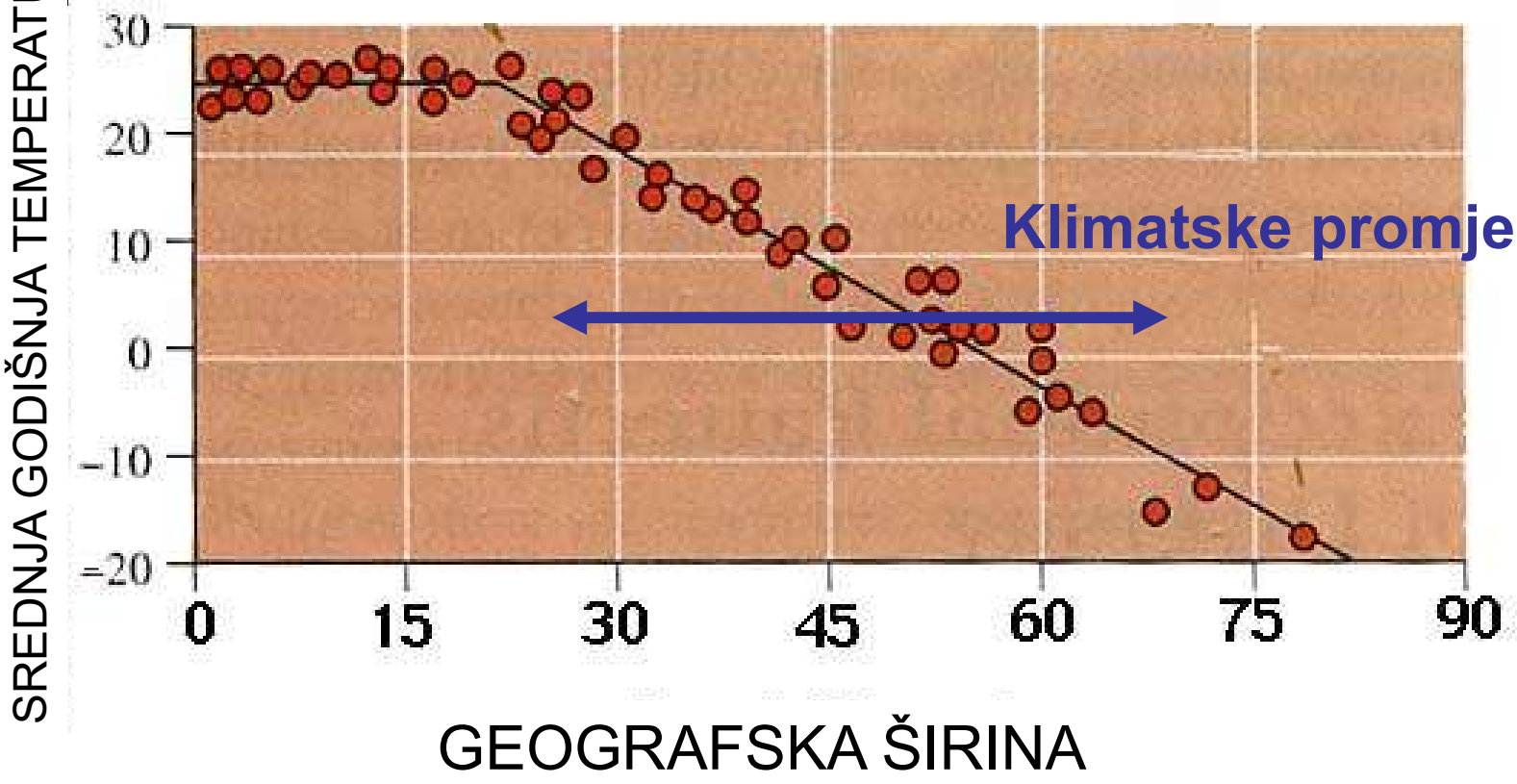
POVIJESNE HIPOTEZE

Evolucijska hipoteza: **starije zajednice imaju više vrsta koje su evoluirale**

Ekološka hipoteza: **starije zajednice imaju više vrsta koje su u njih migrirale**

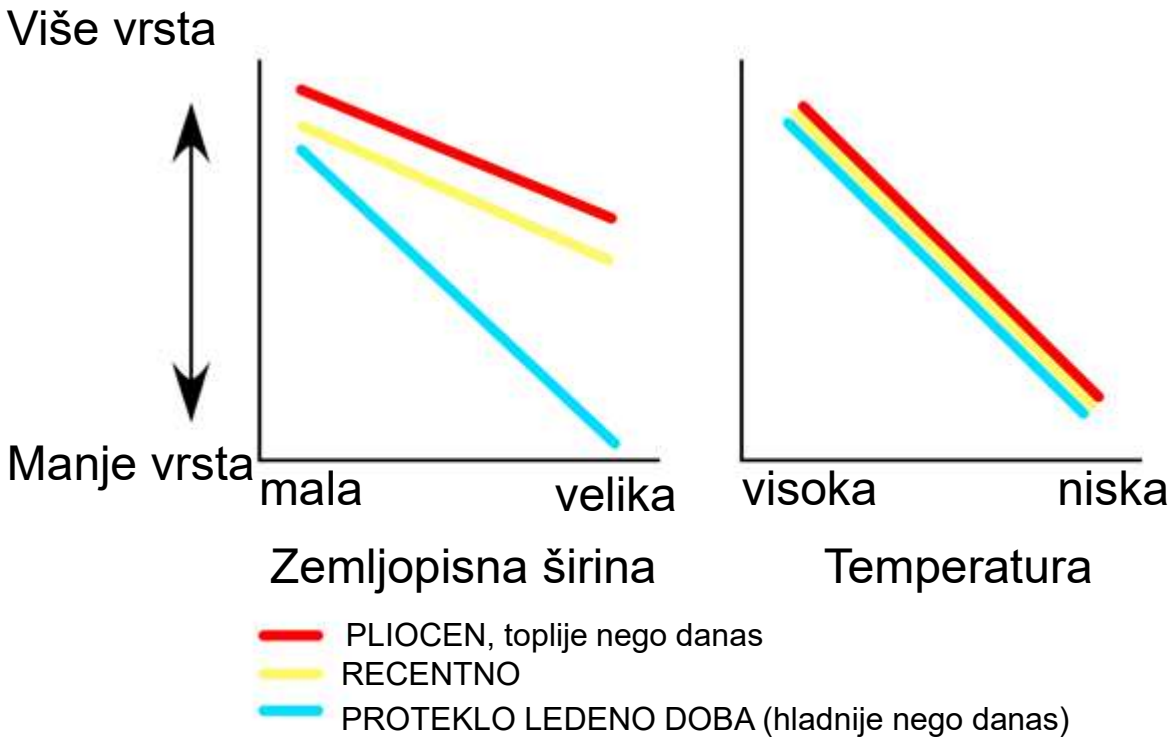
Klimatska hipoteza: **organizmima nisu potrebne posebne adaptacije da bi živjeli u stabilnoj klimi**

Klimatska hipoteza



Klimatske promjene?

Klimatska hipoteza

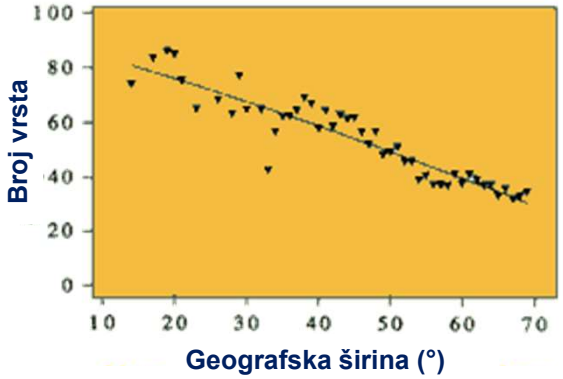


NEPOVIJESNE HIPOTEZE

HIPOTEZA PRODUKTIVNOSTI: **količina energije određuje broj vrsta koje nastanjuju neko područje**

HIPOTEZA KONTINENATA: **veći broj kontinenata je na nižim nego li na višim geografskim širinama**

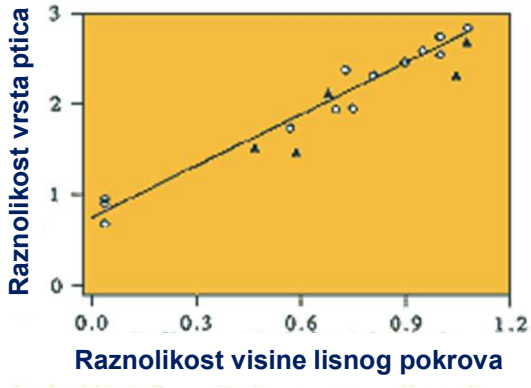
PROSTORNE ZAKONITOSTI RAZNOLIKOSTI



Raznolikost sisavaca se smanjuje s udaljenošću od ekvatora (Rosenzweig, 1996)

GEOGRAFSKA ŠIRINA KAO GRADIJENT:

Broj vrsta opada s udaljavanjem od ekvatora i sjeverno i južno.
Ta zakonitost je stara koliko i organizmi na Zemlji (od drvenastih biljaka do fosilnih krednjaka).



S povećanjem raznolikosti staništa povećava se i raznolikost ptica (Rosenzweig, 1996)

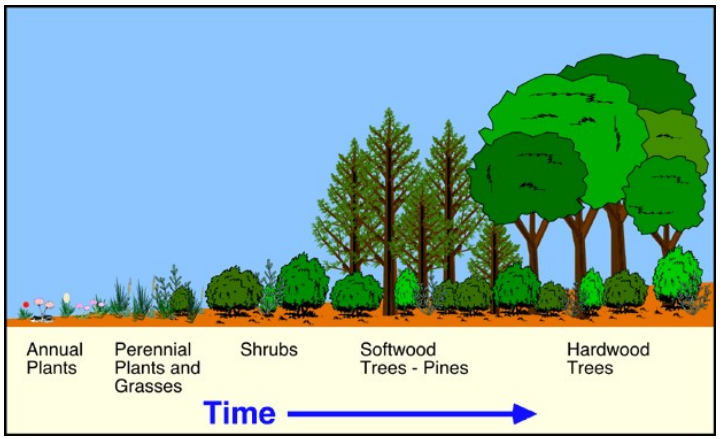
VARIJABILNOST STANIŠTA:

Veća varijabilnost staništa veća raznolikost vrsta unutar tog staništa.
Veći je broj vrsta na širem području (šire područje podrazumijeva veću varijabilnost staništa).

VREMENSKE ZAKONITOSTI RAZNOLIKOSTI

- **SEZONSKE ZAKONITOSTI**
- Raznolikost vrsta se može mijenjati sezonski.
- Dobar primjer za to su **ptice** i **kukci**.
- **Kukci** koji imaju značajne sezonske oscilacije u raznolikosti zbog različite strategije razvoja.
- Tako npr. neki kopneni kornjaši imaju ličinačku fazu razvoja u tlu a izlaze na površinu samo u odrasloj fazi. I kod procjene raznolikosti u tekućicama nailazimo na isti problem, budući da mnogi vodeni kukci u odrasloj fazi imaju tzv. emergenciju, kada izlijeću iz vode.
- Kod **ptica** je sezonska zakonitost povezana s migracijama

- **SUKCESIJSKE ZAKONITOSTI**
- Nakon uništenja nekog staništa zbog požara ili poljoprivredne proizvodnje, postoji prirodni slijed promjena obnove takvog staništa prema tzv. klimaksu ili klima-zonalnoj vegetaciji.



- **EVOLUCIJSKE ZAKONITOSTI**
- Tijekom evolucije je broj vrsta porastao u odnosu na razdoblje od prije 225 milijuna godina, no broj različitih koljena se nije značajno povećao, dok je broj razreda prestao rasti prije 65 milijuna godina.
- No u međuvremenu velik broj redova, porodica, rodova i vrsta je evoluirao.

BAZIČNE IZMJERE BIOLOŠKE RAZNOLIKOST

- **Što je zajednica?**
- Što je raznolikost i kako je utvrditi?
- Brojanje (cenzus) i procjene
- Replikativnost
- Upotreba metoda i tehnika

ŠTO JE ZAJEDNICA?

- Definirajte mi jednu zajednicu organizama!
- Definicije
  - Skupina populacija na jednom prostoru (Krebs 1985)
  - Skup populacija jedne vrste koja živi zajedno na nekom prostoru u isto vrijeme (Begon et al. 1986)
- Nadopune i modifikacije:
  - Grupa populacija u interakciji u isto vrijeme i na istom prostoru (James 2003)

BAZIČNE IZMJERE BIOLOŠKE RAZNOLIKOST

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ASPEKTI RAZNOLIKOSTI

- Što možemo mjeriti?
- Mogućnosti
  - Vrste (bogatstvo)
  - Gustoća populacija
  - Raznolikost
    - Odnos između bogatstva i gustoće
  - Trofička struktura
  - Evolucijska raznolikost
  - Raznolikost unutar vrsta (genetska, morfološka)
  - Druge?

BAZIČNE IZMJERE BIOLOŠKE RAZNOLIKOST

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SVOJSTVA POPULACIJE

- Populacija ima grupna, statistička svojstva koja nemaju pojedine jedinke:
  1. Gustoća populacije
  2. Natalitet, mortalitet, imigracija i emigracija
  3. Dobna i spolna struktura, genetički sastav i prostorni raspored

METODE ODREĐIVANJA GUSTOĆE POPULACIJE

- Raspon gustoća organizama u prirodi je vrlo velik (5 000 000/ m^2 - $2*10^{-6}$/ m^2)
- Koju ćemo tehniku upotrijebiti za određivanje gustoće ovisi o vrsti organizma, njegovoj veličini i pokretljivosti

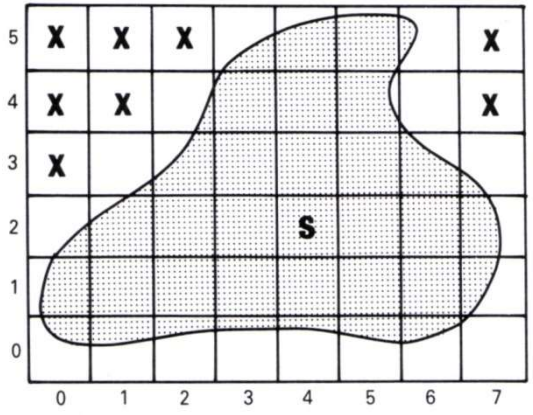
- APSOLUTNE METODE

- RELATIVNE METODE

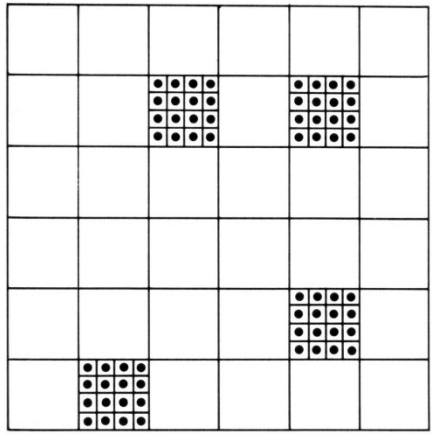
APSOLUTNE METODE:

1. Potpuno prebrojavanje-cenzus
2. Metoda probnih prostora (površina ili volumena)
3. Metode označi-ponovno ulovi (mark-recapture)
4. Metode uklanjanja jedinki
5. Daljinske metode (linijski i točkasti transekti)

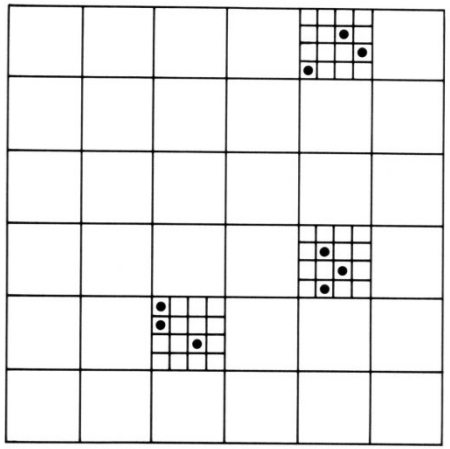
Slučajno odabiranje mjesta uzorkovanja



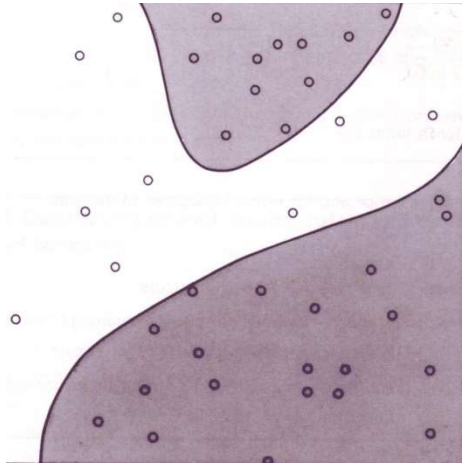
Klaster uzorkovanje



Višerazinsko uzorkovanje

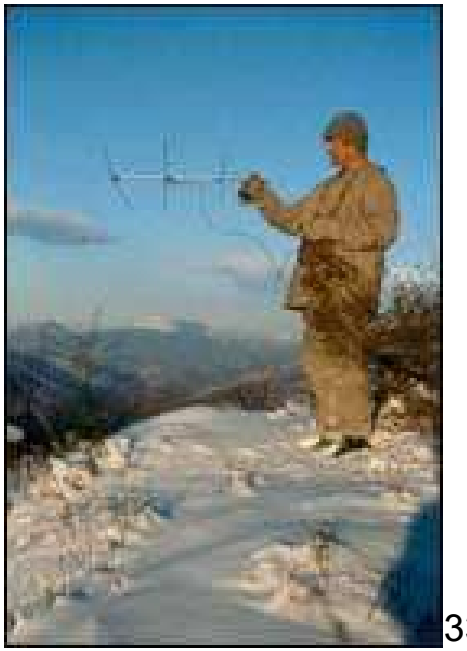


Stratificirano uzorkovanje

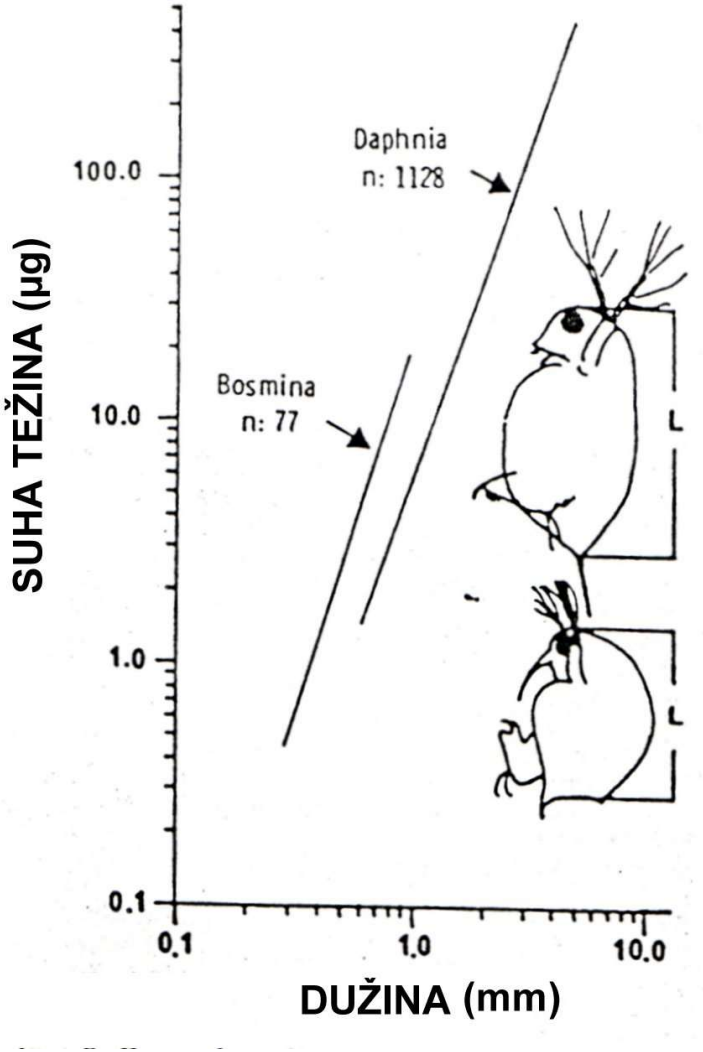


Prstenovanje ptica

Radio-telemetrija



ODREĐIVANJE BIOMASE PUTEM PRAVCA



ln W = ln a + b ln L

W = biomasa

a = nagib pravca

b = odsječak na osi y

koeficjenti u tablicama

L = srednja vrijednost dužine jedinki

Za svaki uzorak izmjeri se dužina od najmanje 20 jedinki!

BAZIČNE IZMJERE BIOLOŠKE RAZNOLIKOST

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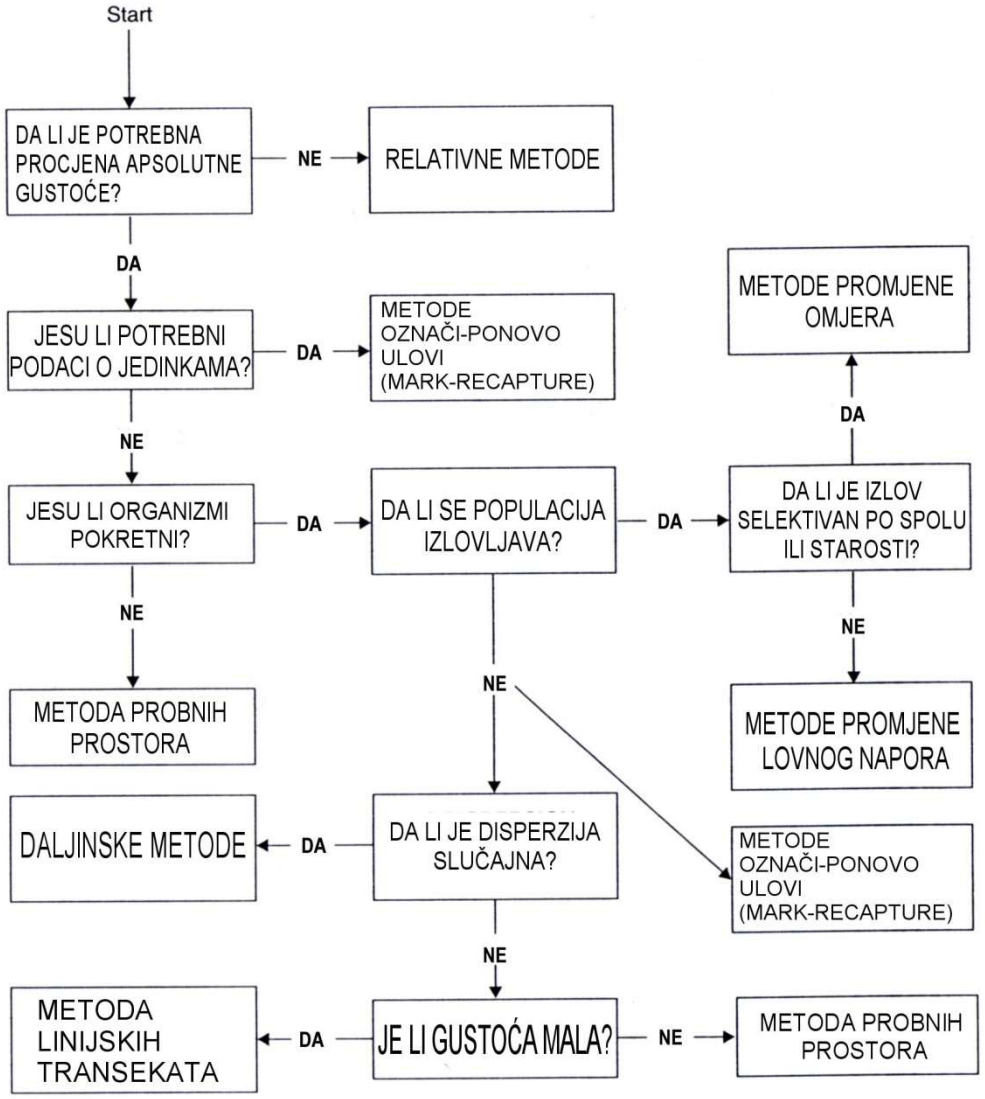
PROCJENA DIZAJNA ISTRAŽIVANJA

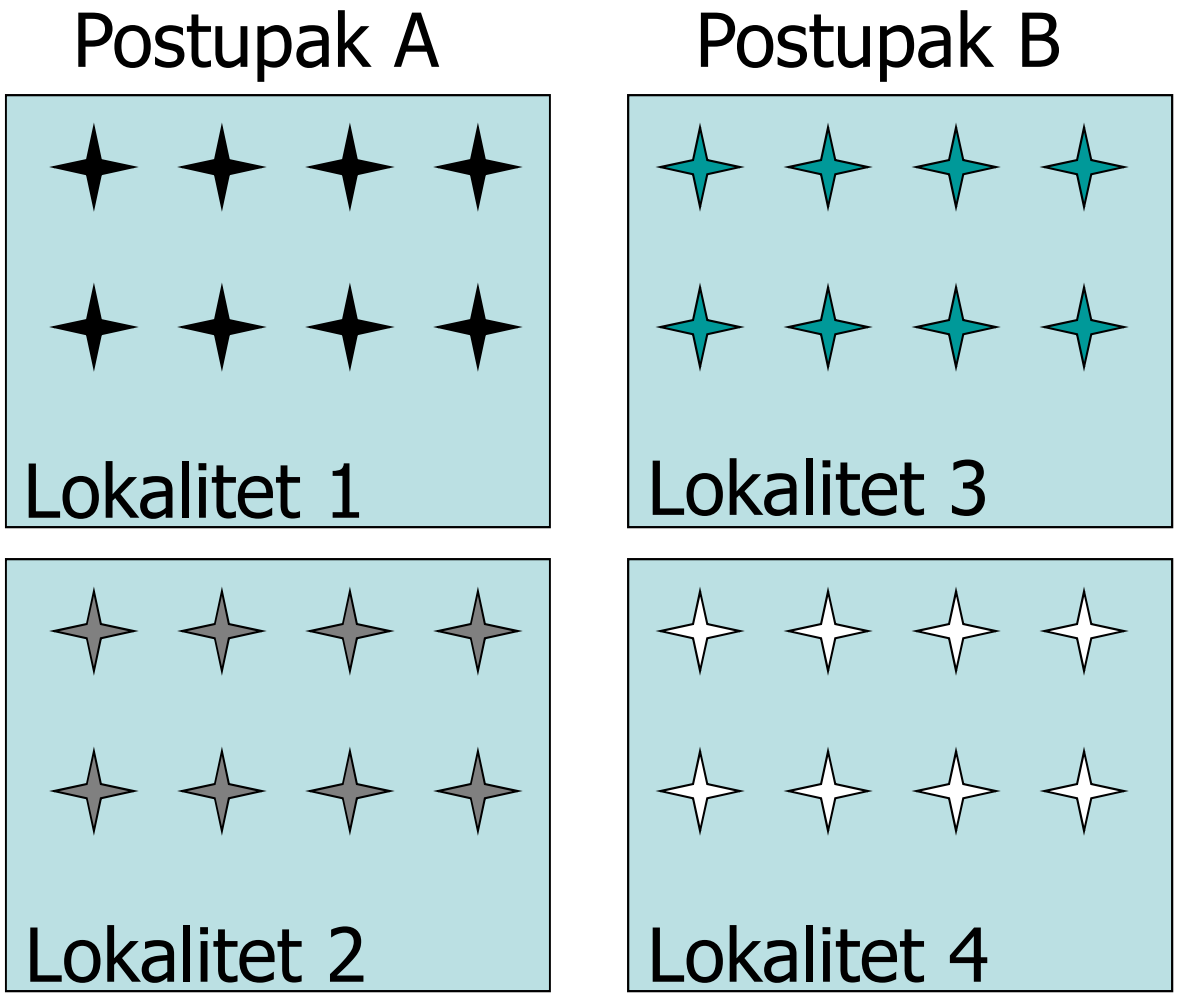
- Potreban je isti lovni napor / lov zajednice ili podkategorija
- Dosljednost
- Imati isti lovni napor u različitim područjima
  - vrijeme, područje, kvantitativno uzorkovanje
- Prikladno predstavlja područje istraživanja
  - Jednak uzorak različitih sastavnica područja
  - randomizirano vs. ciljano (umreženo, transekti)?

Odabir metode za određivanje gustoće populacije

- Mnogi faktori-ekološki, ekonomski i statistički-utječu na odluku o tome kako odrediti veličinu populacije

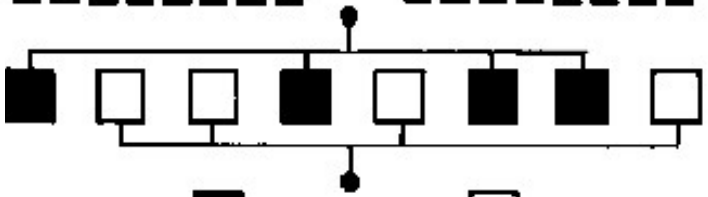


Pseudoreplikacija?!



- **Pitanje** – Što je posljedica postupka A i B?
- **Pseudoreplikacija** = tretiranje zvjezdica iste boje kao replikate
  Replikacija = uključivanje samo jedne zvjezdice iste boje ili njihove srednje vrijednosti

REPLIKACIJA

TIP DIZAJNA	SHEMA
A-1 POTPUNO RANDOMIZIRANO	
A-2 RANDOMIZIRANO U BLOKU	
A-3 SISTEMATIČNO	
B-1 JEDNOSTAVNO SEGREGIRANO	
B-2 GRUPIRANO SEGREGIRANO	
B-3 IZOLIRANO SEGREGIRANO	
B-4 RANDOMIZIRANO S UNUTAR OVISNIM REPLIKATIMA	
B-5 BEZ REPLIKATA	

BAZIČNE IZMJERE BIOLOŠKE RAZNOLIKOST

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BIOCENOLOŠKA ISTRAŽIVANJA

- nemoguće je upotrijebiti jednu metodu za uzorkovanje svih vrsta u zajednici s jednakom učinkovitošću
- istraživanja u biocenologiji zbog toga gotovo nikada ne obuhvaćaju sve vrste u zajednici na svim trofičkim razinama
- obično se analizira samo jedna grupa organizama na jednom ili nekoliko trofičkih razina

Što je biološka raznolikost / What is biodiversity?

Biodiversity is basically the variety within and among life forms on a site, ecosystem, or landscape. Biodiversity is defined and measured as an attribute that has two components — **richness** and **evenness**.

Bogatstvo vrsta = Richness = The number of groups of genetically or functionally related individuals. In most vegetation surveys, richness is expressed as the number of species and is usually called **species richness**.

Ujednačenost = Evenness = Proportions of species or functional groups present on a site. The more equal species are in proportion to each other the greater the evenness of the site. A site with low evenness indicates that a few species dominate the site.

Raznolikost = Diversity can be use to describe variation in several forms:

- Genetic (species, varieties, etc.)
- Life form (grasses, forb, trees, mosses, etc.)
- Functional group (deep rooted, nitrogen-fixing, soil crust, evergreen, etc.)

POKAZATELJI RAZNOLIKOSTI

1. BOGATSTVO VRSTA = **Richness**
2. UJEDNAČENOST = **Evenness**
3. RAZNOLIKOST vs. HETEROGEN

α, ß i γ raznolikost

α-lokalna raznolikost

ß-promjena lokalne raznolikosti

γ-kombinacija α i ß raznolikosti (γ = α×

“ALFA I OMEGA” ALATI

- INDEKSI RAZNOLIKOSTI
  - Alfa (α): raznolikost unutar staništa
  - Beta (β): raznolikost vrsta duž transekta ili gradijenta

    Visoka beta raznolikost upućuje na naglo povećanje broja vrsta dodatnim mjestima uzorkovanja duž gradijenta
  - Gamma (γ): raznolikost većih geografskih jedinica (otoci)
  - Epsilon (ε): regionalna raznolikost

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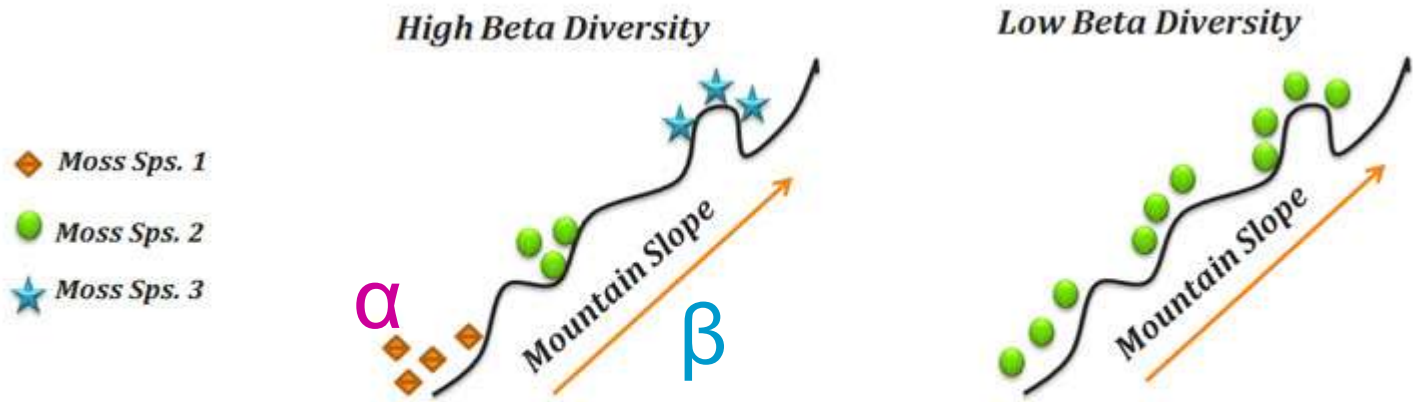
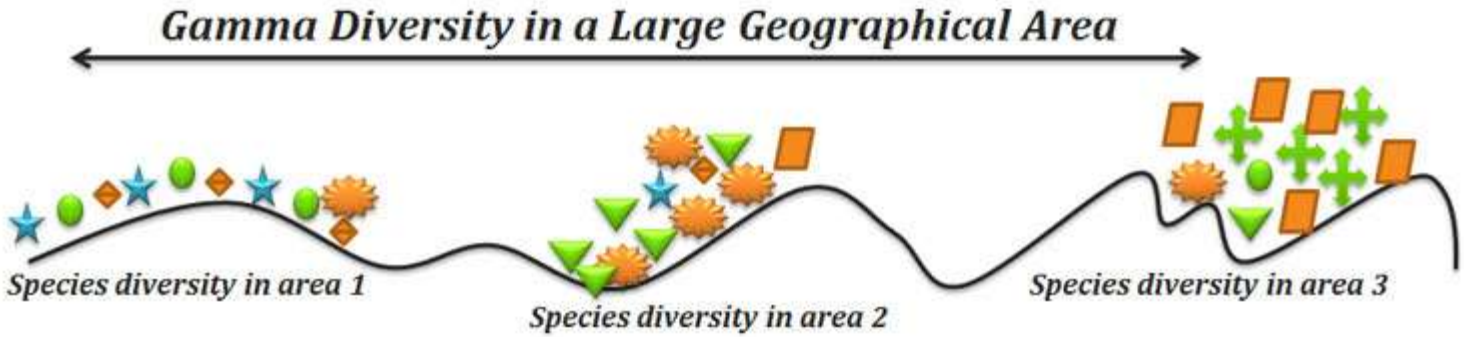
α & β & γ



Beta Diversity of Two Habitats (Mountain Slopes)



Gamma Diversity

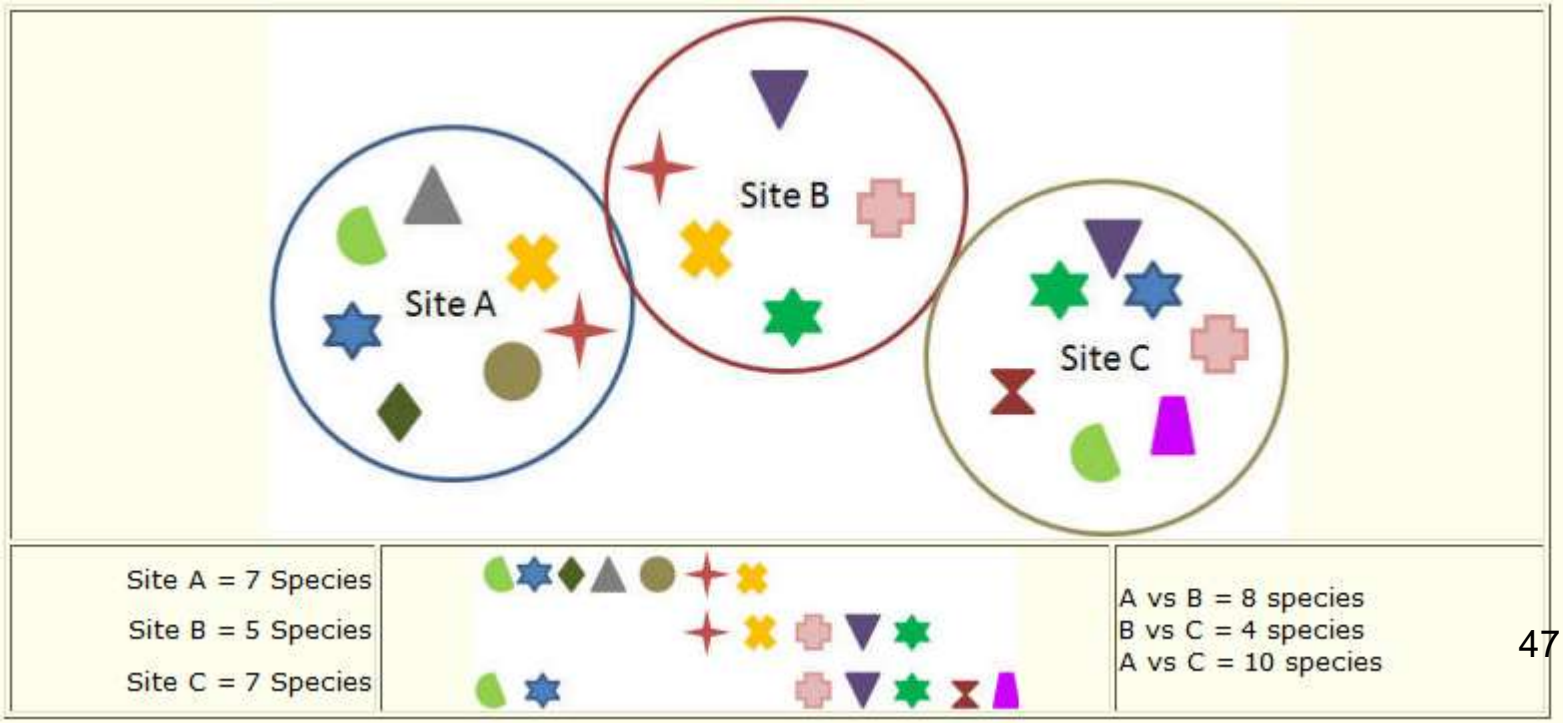
γ

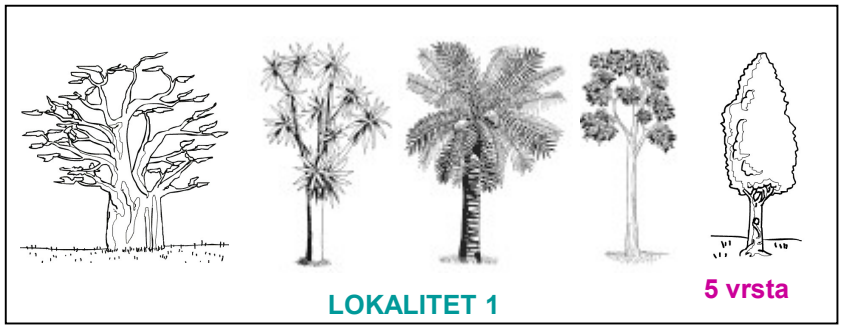
Biodiversity can be measured and monitored at several spatial scales:

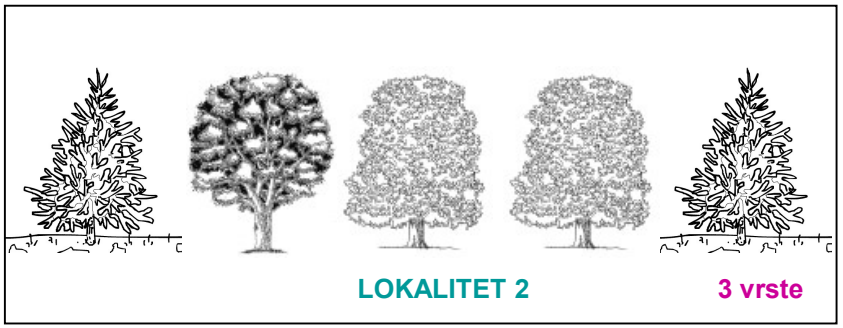
Alpha Diversity = richness and evenness of individuals within a habitat unit. For example in the figure below, **Alpha Diversity** of Site A = 7 species, Site B = 5 species, Site C = 7 species.

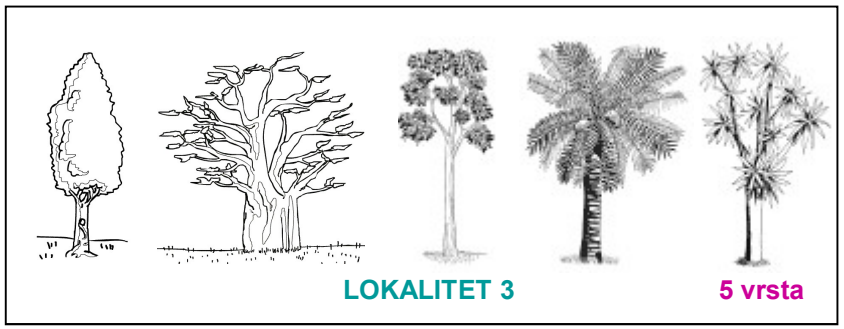
Beta Diversity = expression of diversity between habitats. In the example below, the greatest **Beta Diversity** is observed between Site A and C with 10 species that differ between them and only 2 species in common.

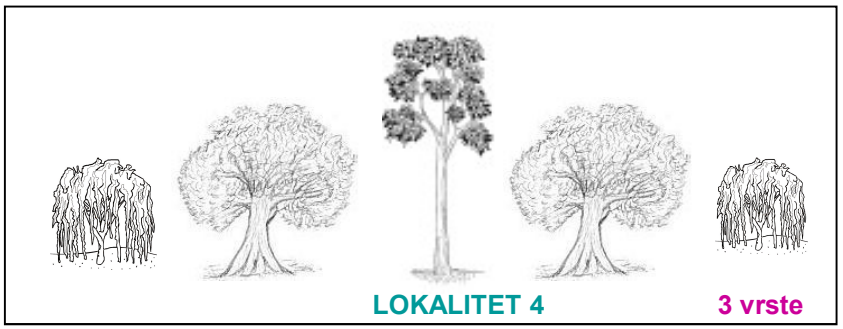
Gamma Diversity = landscape diversity or diversity of habitats within a landscape or region. In this example, the gamma diversity is 3 habitats with 12 species total diversity.











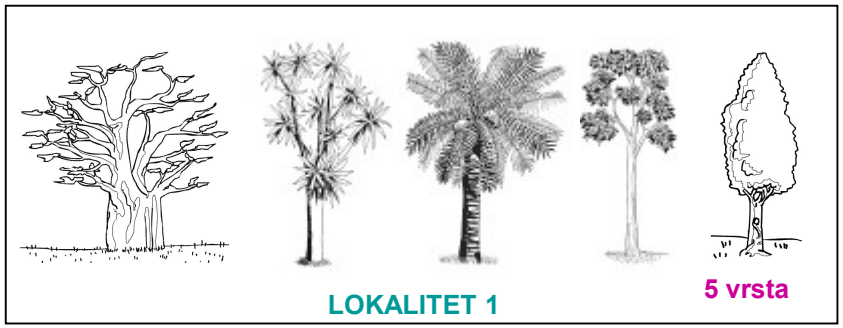
REGIJA X

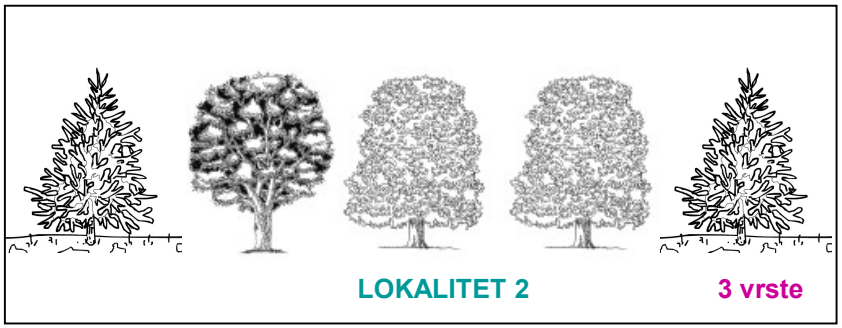
REGIJA Y

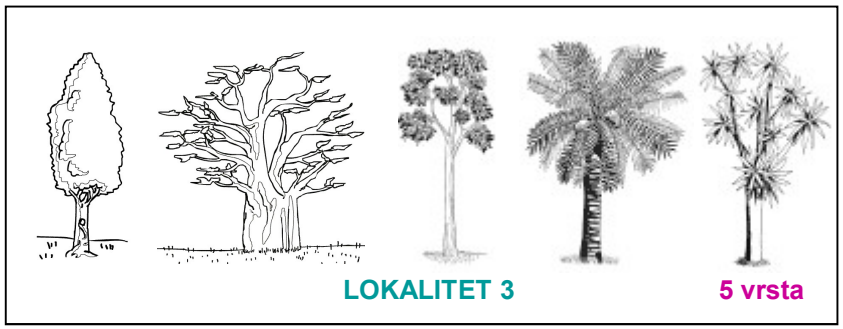
ALFA, BETA I GAMA RAZNOLIKOST

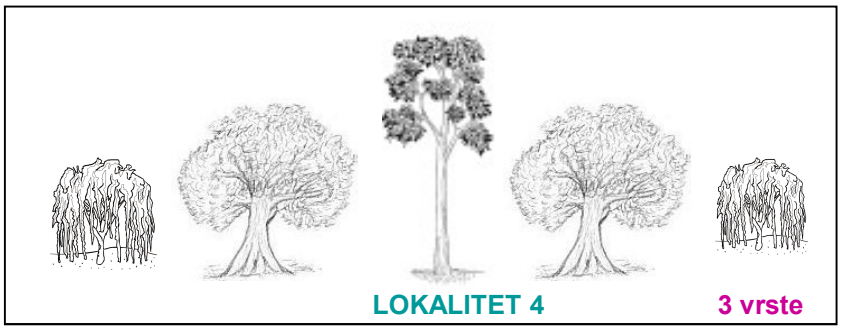
Što je gdje veće?

Idejno prema Perlman i Adelson (1997)









REGIJA X

REGIJA Y

- Alfa raznolikost je raznolikost unutar staništa.
- Promatrajući LOKALITETE 1 i 2, L1 ima veću alfa raznolikost nego L2, što u ovom slučaju predstavlja ujedno i različita staništa.
- Beta raznolikost utvrđuje razlike između dva lokaliteta ili duž nekog gradijenta, tj. u ovom slučaju između regija X i Y.
- To znači da REGIJA Y ima veću beta raznolikost nego REGIJA X te da je veći doprinos vrsta na lokalitetima regije Y. Velika beta bioraznolikost ukazuje na malu sličnost u sastavu vrsta između staništa.
- Gama raznolikost je jednaka alfa raznolikosti, samo mjerena na puno širem području. I alfa i beta raznolikost doprinose gama raznolikosti.
- Regija X ima visoku alfa raznolikost na svojim lokalitetima, no ona je u potpunosti jednaka, pa ta regija ima nisku beta raznolikost i tek umjerenu gama raznolikost. Regija Y ima nisku alfa raznolikost na svojim lokalitetima, no lokaliteti se međusobno razlikuju u sastavu vrsta, pa regija stoga ima visoku beta raznolikost i višu gama raznolikost nego regija X.

ASPEKTI RAZNOLIKOSTI U ŠUMSKIM EKOSUSTAVIMA

- STRUKTURNA RAZNOLIKOST

  (temeljna građa: listinac, prosjeka,…)

- RAZNOLIKOST SASTAVNICA (KOMPOZICIJSKA)

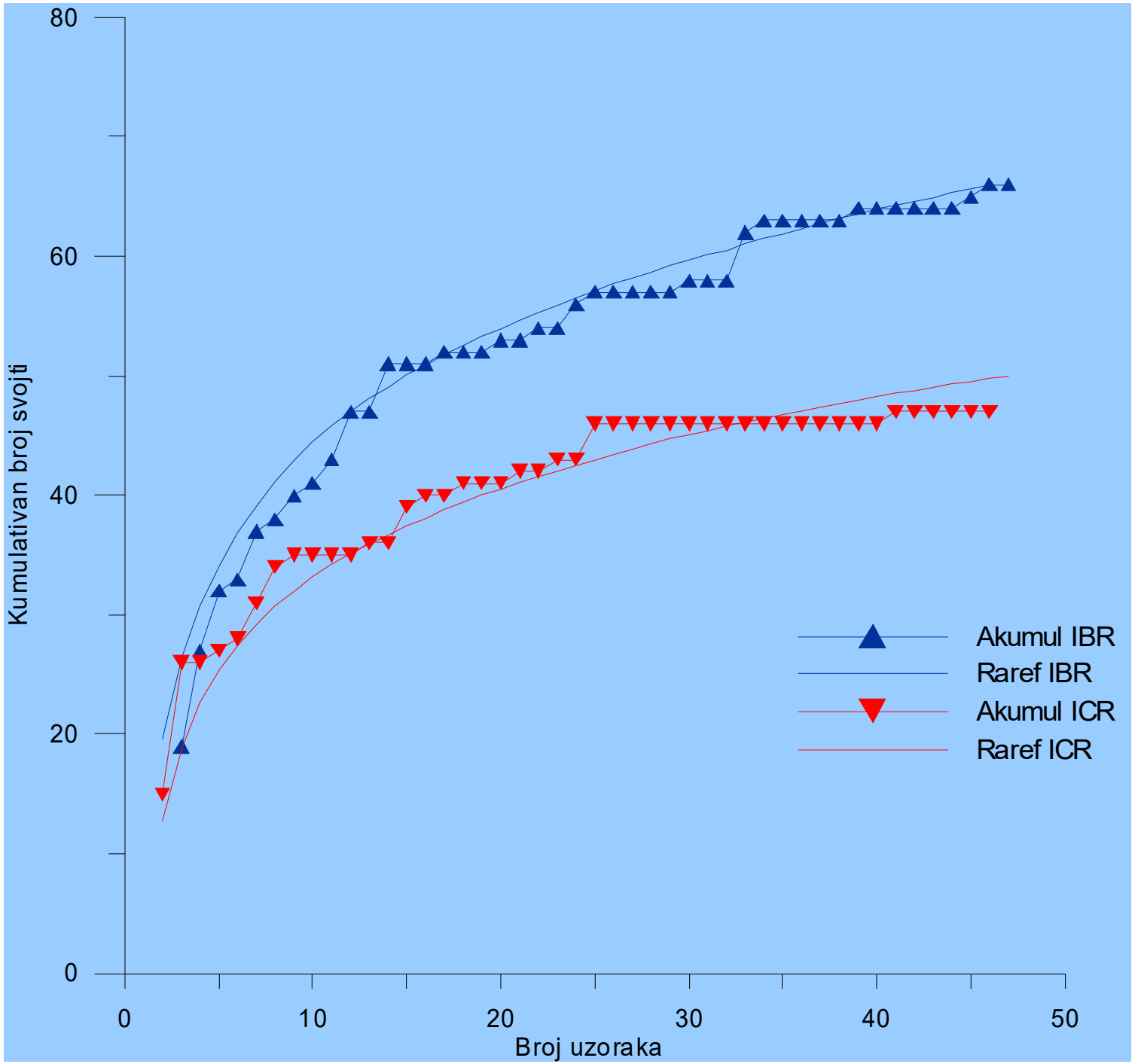
  (biološko ustrojstvo: vrste drveća, vrste prizemnih biljaka, kukci, ptice,…)

- FUNKCIONALNA RAZNOLIKOST

  (procesi u ekosustavu: kruženje hranjivih tvari, razgradnja, mikrobna petlja)

BOGATSTVO VRSTA

- najčešće je popis vrsta u zajednicama nepotpun (rijetke vrste)
- jako ovisi o uzorkovanju
- povećanje broja vrsta/svojti s uzorkovanjem =>akumulacijska i rarefakcijska krivulja


80
60
40
20
0
Kumulativan broj svojti
0
10
20
30
40
50
Broj uzoraka
Akumul IBR
Raref IBR
Akumul ICR
Raref ICR

MJERE RAZNOLIKOSTI/HETEROGENOSTI ZAJEDNICE =

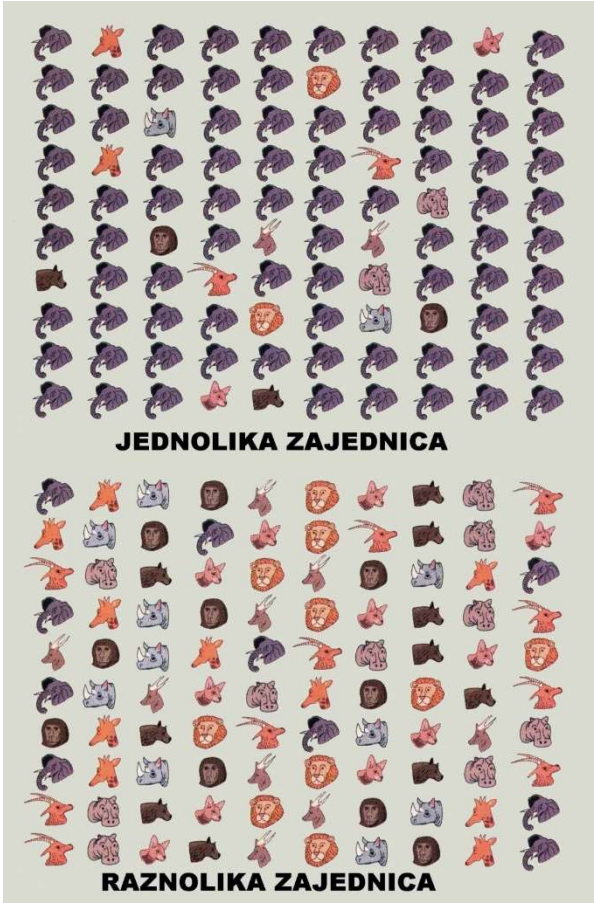
INDEKSI RAZNOLIKOSTI

1. Simpsonov indeks - predstavlja vjerojatnost da nasumično iz zajednice izvučemo dvije jedinke iste vrste

2. Shannon-Wienerov indeks

INDEKSI DOMINANTNOSTI

1. Berger-Parkerov indeks



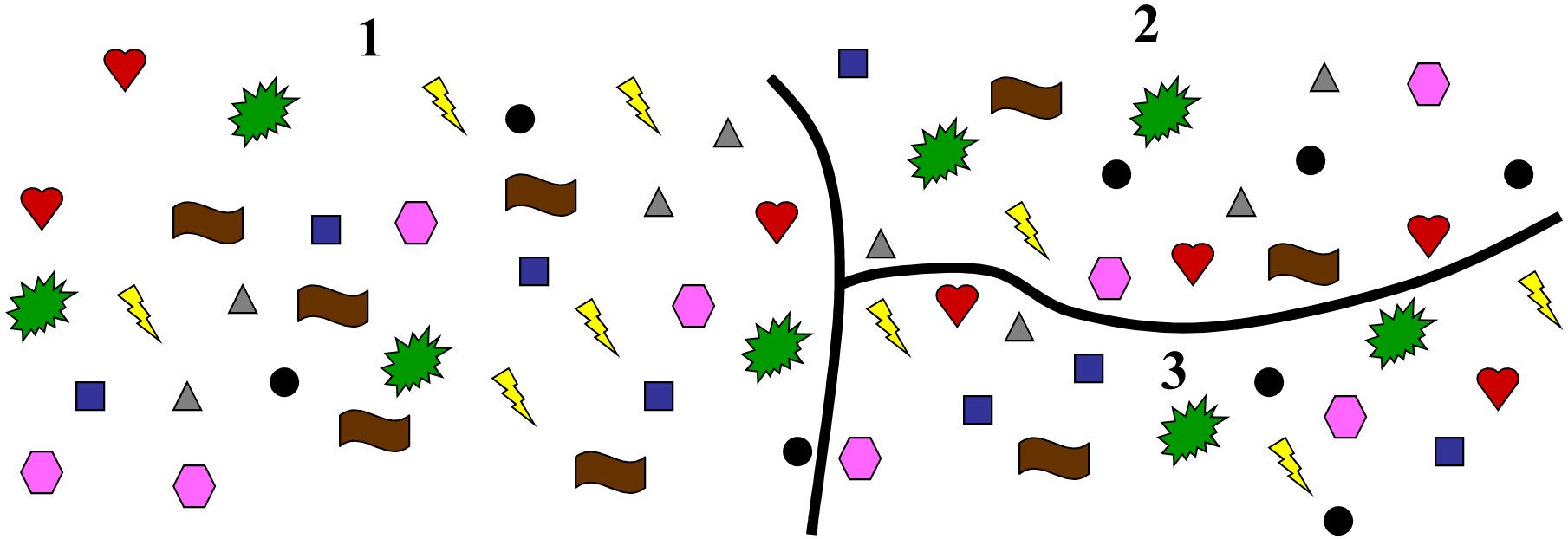
INDEKSI UJEDNAČENOSTI

1. na temelju Simpsonovog indeksa

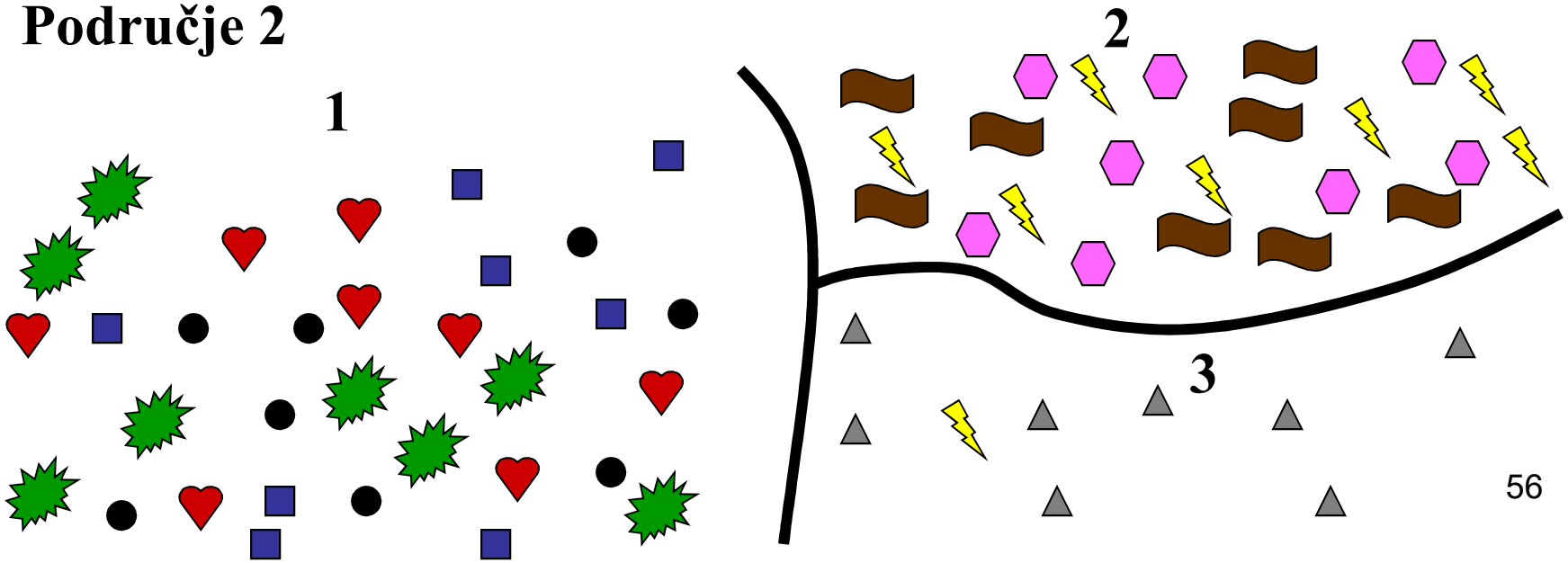
2. na temelju Shannonovog indeksa =Pielouov indeks

Zajednica	1	2	3	4
sp 1	10	20	33	91
sp 2	10	20	22	1
sp 3	10	20	15	1
sp 4	10	20	10	1
sp 5	10	20	6	1
sp 6	10	0	4	1
sp 7	10	0	3	1
sp 8	10	0	2	1
sp 9	10	0	2	1
sp 10	10	0	1	1
H :	1.0	0.70	0.81	0.21

Področje 1



Področje 2



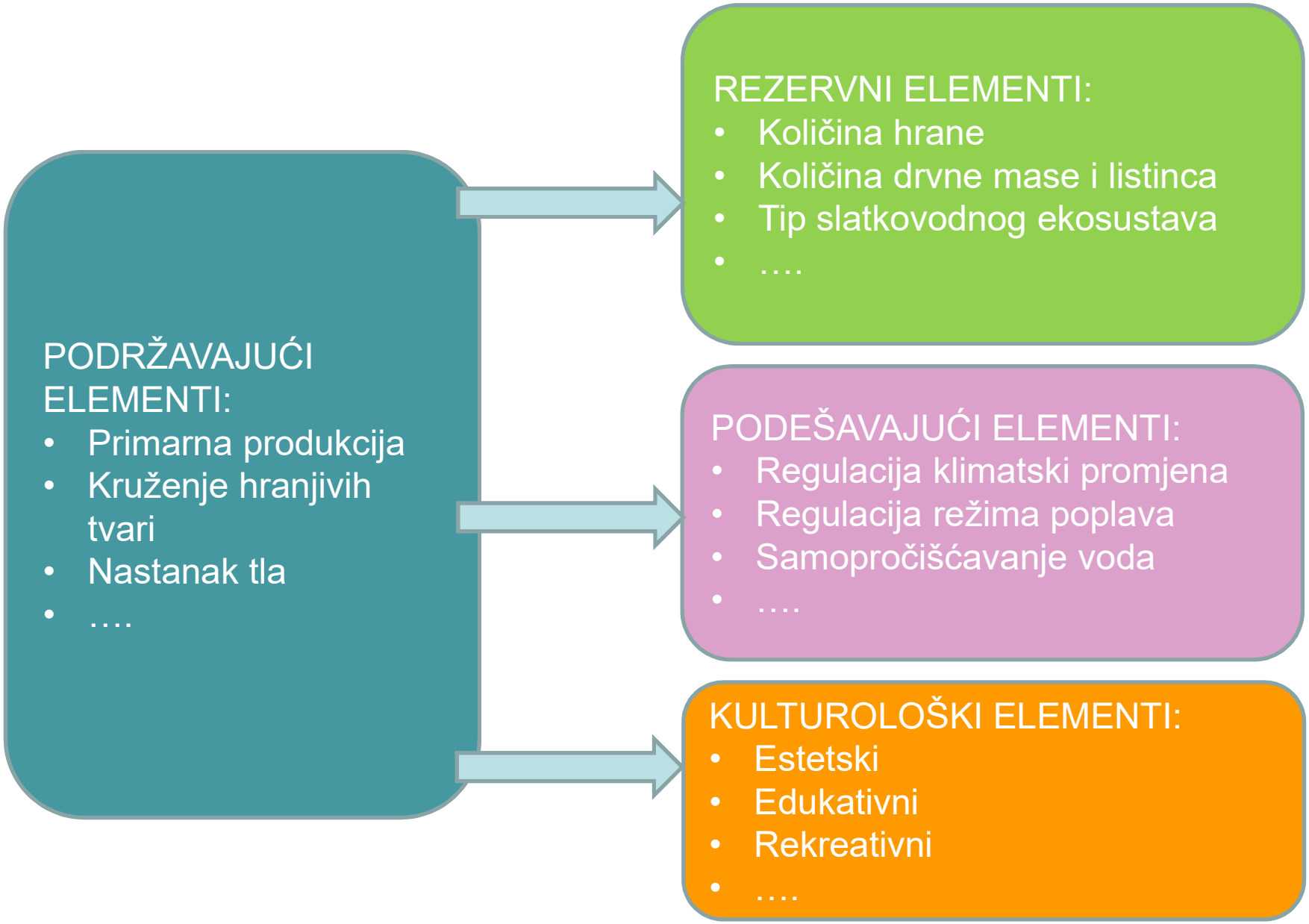
Uloga bazičnih ekoloških istraživanja u zaštiti prirode

- Ekologija je znanstvena disciplina za proučavanje interakcija živih organizama s okolišem;

- Glavne pod-discipline:
  - Fiziološka ekologija
  - Ekologija populacija
  - Ekologija zajednica
  - Ekologija ekosustava…

- Glavna ekološka problematika / pitanja
  - Biološka raznolikost
  - Status ekosustava

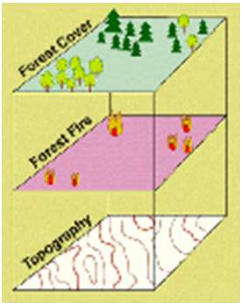
PROCJENA STATUSA EKOSUSTAVA



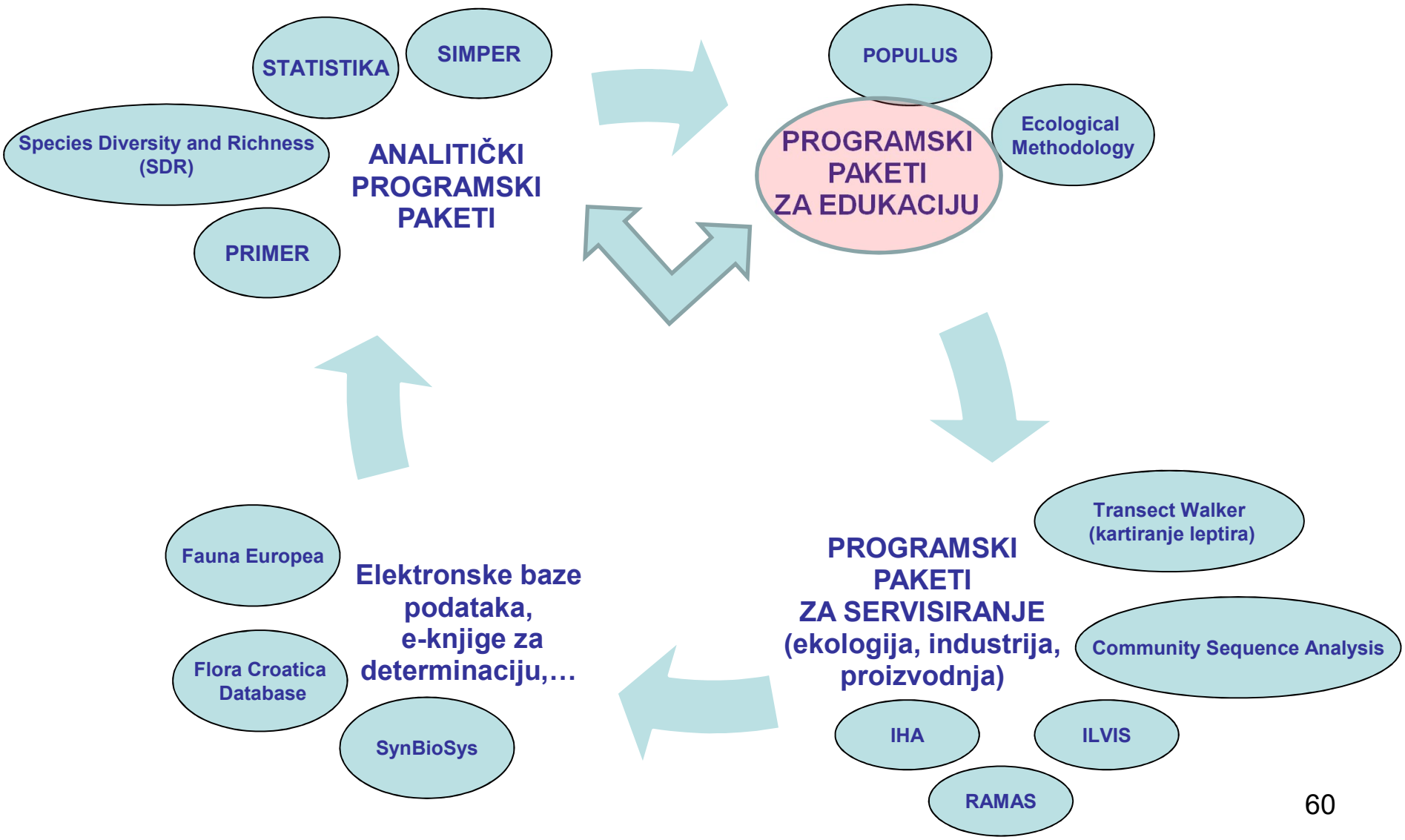
UPRAVLJANJE PRIRODOM

je osigurano putem holističkog pristupa u praćenju statusa zaštite zaštićenih područja, prirodnih rezervata, nacionalnih parkova i sl. te održivom korištenju ekoloških sustava i biološke raznolikosti, a obuhvaća:

- **Korištenje opsežnih baza podataka** putem interneta, koje obuhvaćaju pohranjivanje informacija o ekološkim podacima i podacima o upravljanju zaštićenim područjima, prirodnim rezervatima, nacionalnim parkovima te prirodnim i polu-prirodnim ekološkim sustavima, primjenljivim u bilo kojoj klimatskoj zoni i za vodeni i za kopneni okoliš;
- **Praćenje stanja** putem tabličnih prikaza, indikatora, ugroženih vrsta te vrsta od posebnog interesa, sastava vode, podataka o kvaliteti, strukturi, broju posjeta i sl.
- **Izrada uputa, tehničkih rješenja i postupaka za ekološko praćenje stanja**, s obzirom na različite potrebe i pristup;
- **Izrada terenskih obrazaca i upitnika** za prikupljanje podataka na temelju upita lokalnog stanovništva, udruga i sl.
- **Korištenje programskih paketa**, integrirajući i preklapajući različite tipove podataka (ILVIS, IHA, RAMAS,…).



Korištenje programskih paketa



PROGRAMSKI PAKETI ZA EDUKACIJU

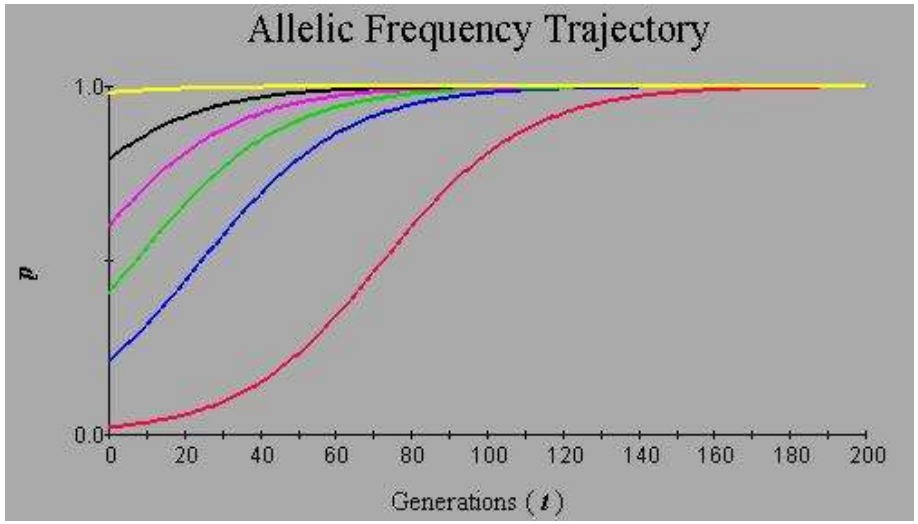
POPULUS (Alstad 2001) – edukacijski softverski paket za simulaciju populacijske biologije i evolucije (npr. simulacija genetičkog drifta).

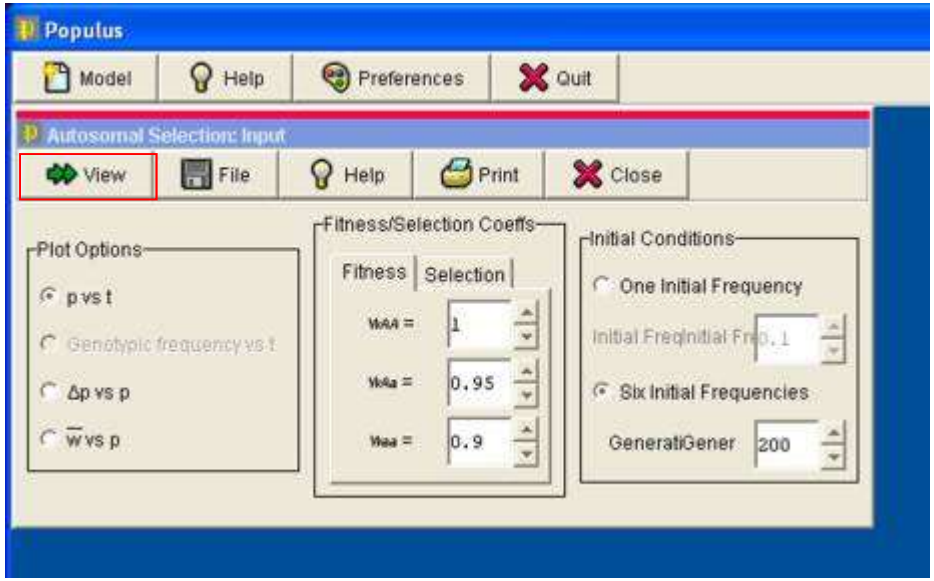
RAST POPULACIJE

INTERAKCIJE MEĐU VRSTAMA

BAZIČNI POPULACIJSKI MODELI

…



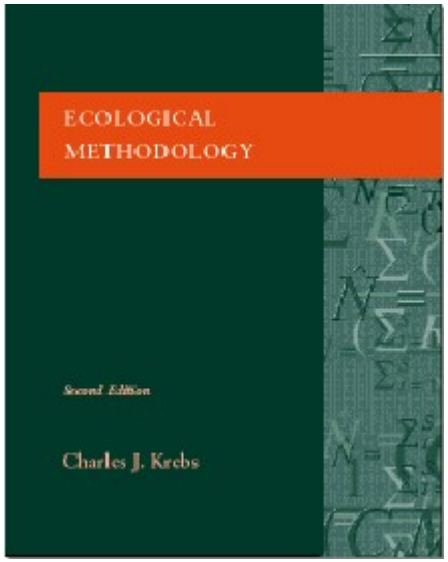


Npr. FREKVENCIJA ALELA U 200 GENERACIJA

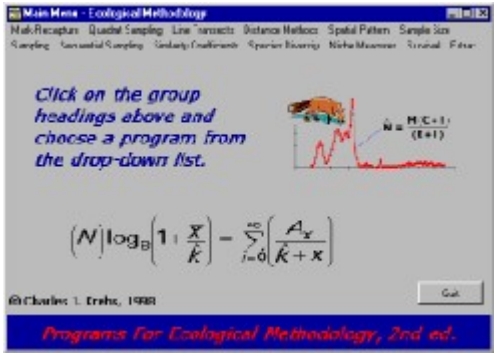
http://www.ent.orst.edu/insect_ecology/Web%20pages/using.htm

PROGRAMSKI PAKETI ZA EDUKACIJU

Krebs, C.J. 2014. Ecological Methodology, 3rd ed. (in prep)



Chapter 1 - Ecological Data for Field Studies
Chapter 2 - Estimating Abundance and Density: Mark-Recapture Techniques
Chapter 3 - Estimating Abundance and Density: Additional Methods
Chapter 4 - Estimating Abundance: Quadrat Counts
Chapter 5 - Estimating Abundance: Line Transects and Distance Methods
Chapter 6 - Spatial Pattern and Indices of Dispersion
Chapter 7 - Sample Size Determination and Statistical Power
Chapter 8 - Sampling Designs - Random Sampling, Adaptive and Systematic Sampling
Chapter 9 - Sequential Sampling
Chapter 10 - Experimental Designs
Chapter 11 - Quasi-experimental Designs
Chapter 12 - Similarity Coefficients and Cluster Analysis
Chapter 13 - Species Diversity Measures
Chapter 14 - Niche Measures and Resource Preferences
Chapter 15 - Estimation of Survival Rates
Chapter 16 - The Garbage Can



Programski paket **Ecological Methodology** raspoloživ je na stranici **Exeter Software**. Verzija 7 (trenutno 7.2) pokreće se iz sučelja Windows 95/98/NT/2000/XP i Windows 7.

http://www.zoology.ubc.ca/~krebs/books.html

http://www.exetersoftware.com/cat/ecometh/ecomethodology_whatsnew70.html

Ecological Methodology

- **MARK-RECAPTURE**. This group contains 9 programs as follows:

Petersen Method
Schnabel-Schumacher Method
Resight Estimation (Radio-telemetry)
Jolly-Seber Full Model
Zero-truncated Poisson Test of Equal Catchability
Leslie, Chitty and Chitty Test for Marked Animals Equal Catchability
Caughley Closed Population Estimators
Catch-Effort Models for Exploited Populations
Change-in-Ratio Estimators for Exploited Populations

- **QUADRAT SAMPLING**. This group contains 7 programs from Chapter 4 as follows:

Optimal Quadrat Size and Shape
Poisson Distribution
Negative Binomial Distribution
Goodness-of-fit to a Negative Binomial Distribution
Calculating a Theoretical Negative Binomial Distribution
Aerial Survey Methods
Line Intercept Sampling

- **LINE TRANSECTS**. This group contains two programs to compute line transect estimators.

Hayne Estimator
Shape-restricted Line Transect Estimator

- **DISTANCE METHODS**. This group contains 5 programs from Chapter 5 for plotless sampling.

Byth and Ripley
T-square
Ordered Distance
Variable Area Transect
Point Quarter

- **SPATIAL PATTERN**. This group contains four programs from Chapter 6 to test for random spatial patterns as follows:

Clark and Evans Test
Campbell and Clarke Test
Contiguous Quadrats (TTLQV)
Indices of Dispersion (Quadrat Counts)

- **SAMPLE SIZE**. This group contains 6 programs from Chapter 7 to estimate sample sizes needed as follows:

Continuous Variables - Means
Continuous Variables - Variances
Discrete Variables - Proportions
Discrete Variables - Poisson Counts
Discrete Variables - Negative Binomial Counts
Specialized Ecological Variables

- **SAMPLING**. This group contains 6 programs from Chapter 8 on sampling designs as follows:

Means of Ratios
Stratified Sampling
Construction of Strata
Adaptive Sampling
Multistage Sampling
Ranked Set Sampling

- **SEQUENTIAL SAMPLING**. This group contains 8 programs from Chapter 9 to estimate sequential designs as follows:

Means - Normal Distributions
Variances - Normal Distributions
Proportions - Binomial Distributions
Counts - Negative Binomial Distribution
Stopping Rules – Green's and Kuno's
Sequential Schnabel Population Estimates
Iwao's Method for Quadrat Counts

Ecological Methodology

- **SIMILARITY COEFFICIENTS**. This group contains 7 programs from Chapter 11 to estimate similarity as follows:

Binary Coefficients
Euclidean Distance Coefficient
Bray-Curtis Metric
Canberra Metric
Percentage Similarity
Morisita's Index of Similarity
Horn's Index

- **SPECIES DIVERSITY**. This group contains 6 programs to calculate the measures described in Chapter 12 to estimate species diversity:

Species Richness - Rarefaction Method
Species Richness - Jackknife Method for Quadrat Counts
Logarithmic Series
Lognormal Distribution
Simpson's Index of Diversity
Shannon-Wiener Measure
Brillouin's Index of Diversity
Evenness Measures
Bootstrapped confidence limits for species diversity estimators

- **NICHE MEASURES AND DIET PREFERENCE**. This group contains 5 programs from Chapter 15 as follows:

Niche Breadth
Niche Overlap
Habitat and Dietary Preferences
Resource Selection Indices
Rodgers' Index for Cafeteria Food Preferences

- **SURIVAL**. This group contains 7 programs from Chapter 14 as follows:

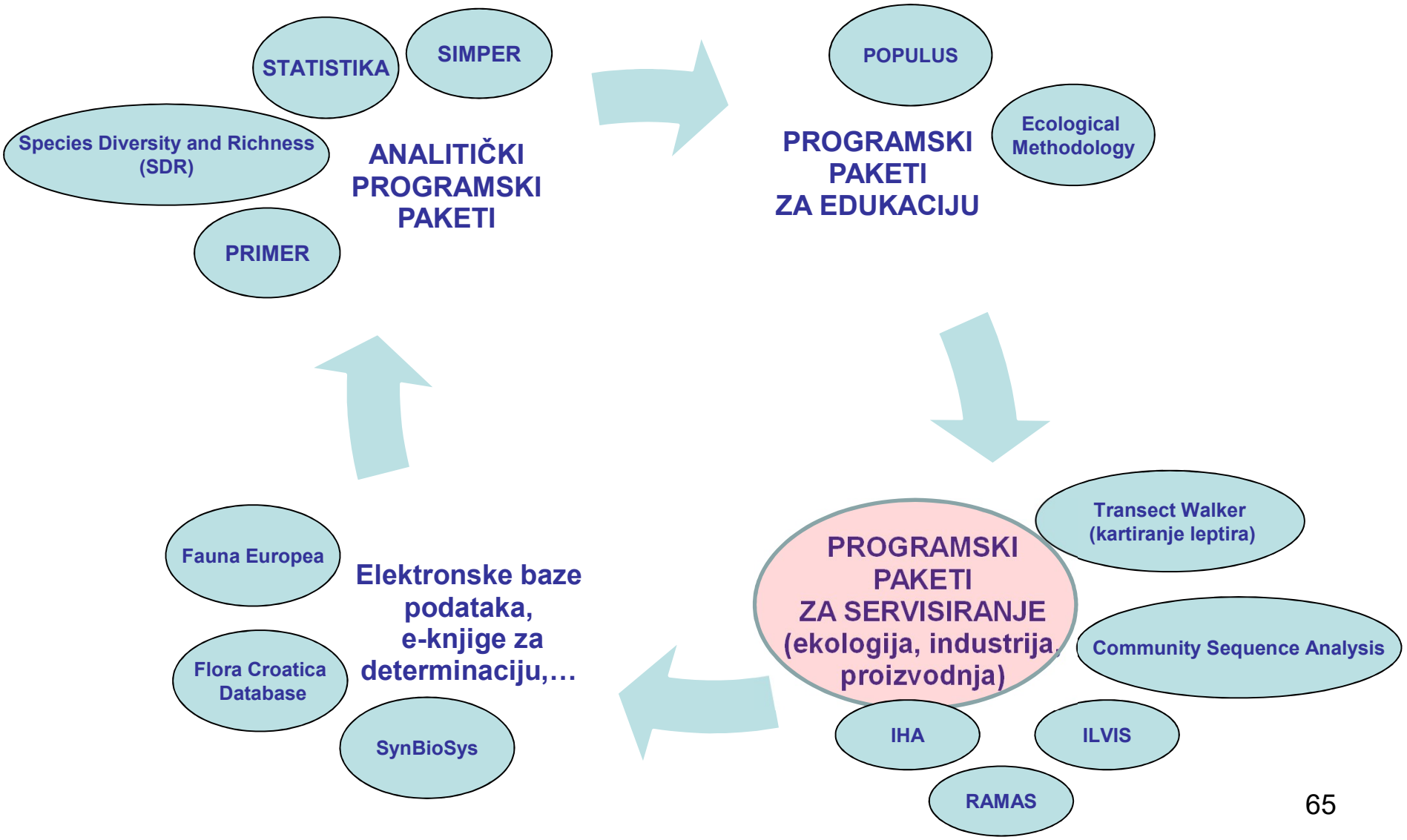
Conversion of Survival Rates
Life Tables
Expectation of Life
Radio-telemetry Survival Rates
Kaplan-Meier Method
Log Rank Test
Likelihood Ratio Test

- **EXTRAS**. This group contains 13 miscellaneous programs from Chapter 13 and other chapters, as follows:

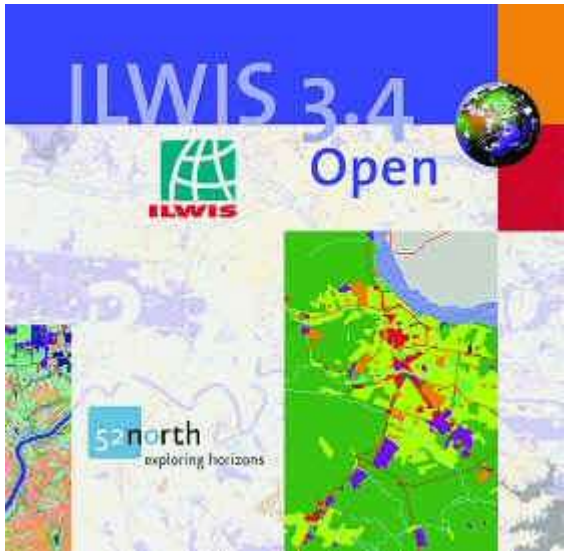
Significant Digits for Recording Data (Chapter 1)
Binomial Confidence Limits (Chapter 2)
Multinomial Confidence Limits (Chapter 13)
Poisson Confidence Limits (Chapters 2 and 4)
Means and confidence limits from a frequency distribution
Bootstrapped means and confidence limits for ratio or interval data
Logarithmic Transformation Constant in log (X + c)
Transformations
Correction for Means from Logarithmic Transformations
Box-Cox Transformation
Repeatability of Measurements
Geometric Mean Regression
Means from Frequency Distributions
Uniform random number generator with constraints

http://www.exetersoftware.com/cat/ecometh/ecomethodology_whatsnew70.html

Korištenje programskih paketa



PROGRAMSKI PAKETI ZA SERVISIRANJE



ILVIS

Potpuno integriranje GDALa - (Geospatial Data Abstraction Library) – koji predstavlja bazu podataka za čitanje i pisanje rasteriranih formata geoprostornih podataka koji se stavljaju pod licencu X/MIT tip otvorenog izvora putem Open Source Geospatial Foundation.

Pristup Postgres/gis bazama podataka za izvorne podatke i karte

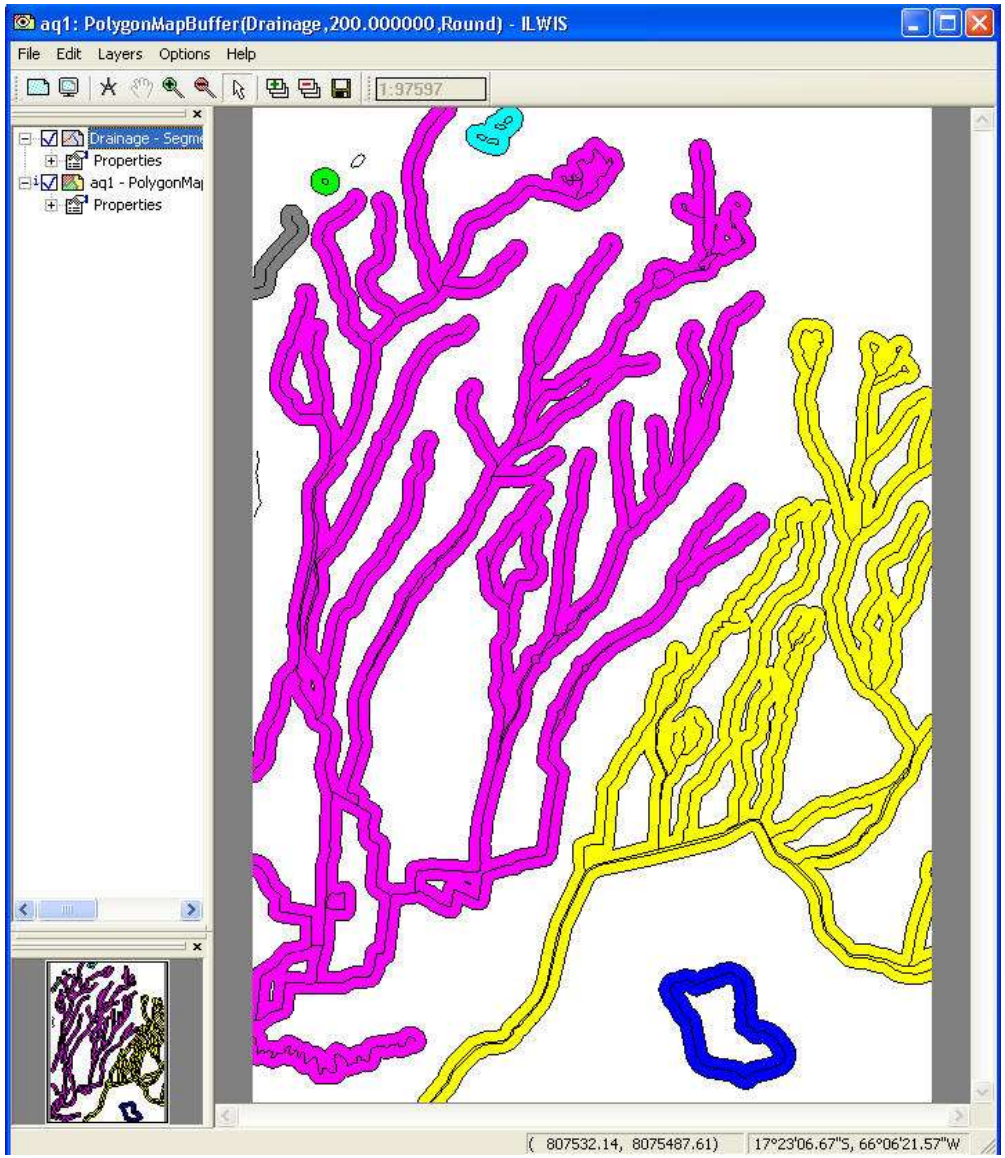
Proširenje i unapređenje funkcionalnosti SEBa (Surface Energy Balance) - Definiranje radnog područja i osjetljivosti (frekvencija, kalibracija i geolociranje satelita)

Inicijativa za razvoj ovog programskog paketa potječe od 1984. god. od strane Ministarstva razvoja iz Nizozemske za potrebe planiranja korištenja zemljišta i upravljanje slivnim područjima.

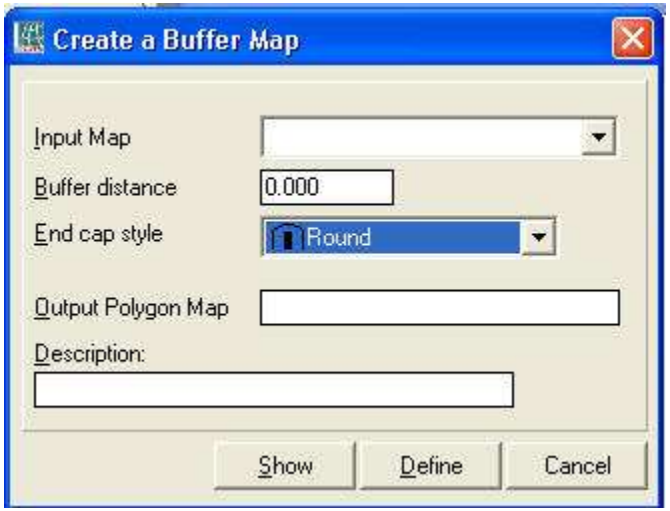
http://www.ilwis.org/

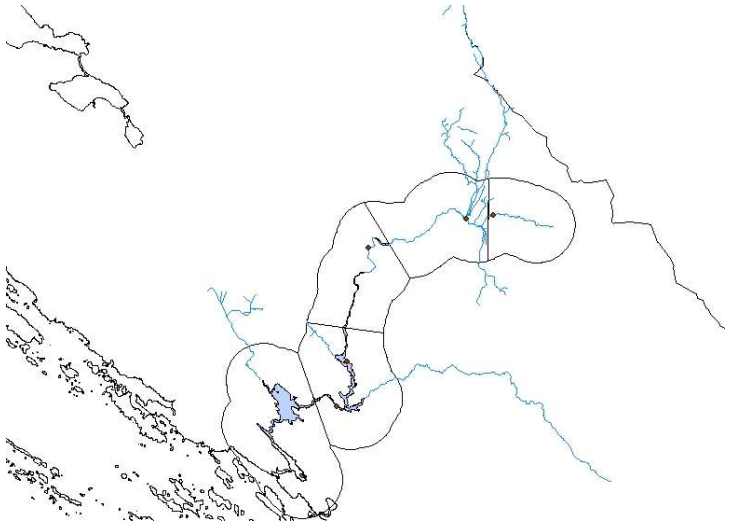
ILVIS 3.7

Korištenje programskog paketa ILVIS za kartiranje slivova i manjih vodotoka



kartiranje poligoskih bafera (Poligon Map Buffer)

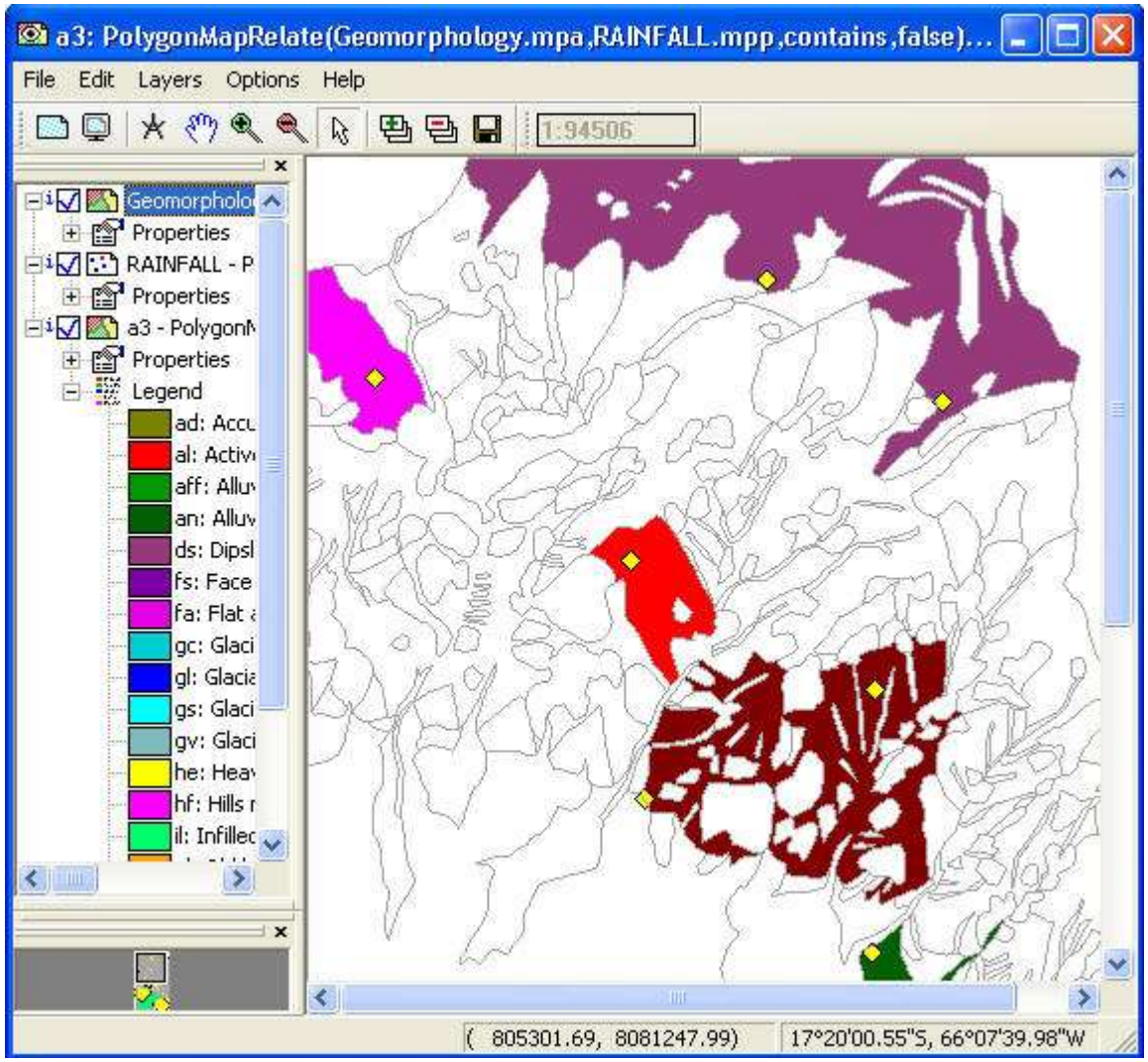




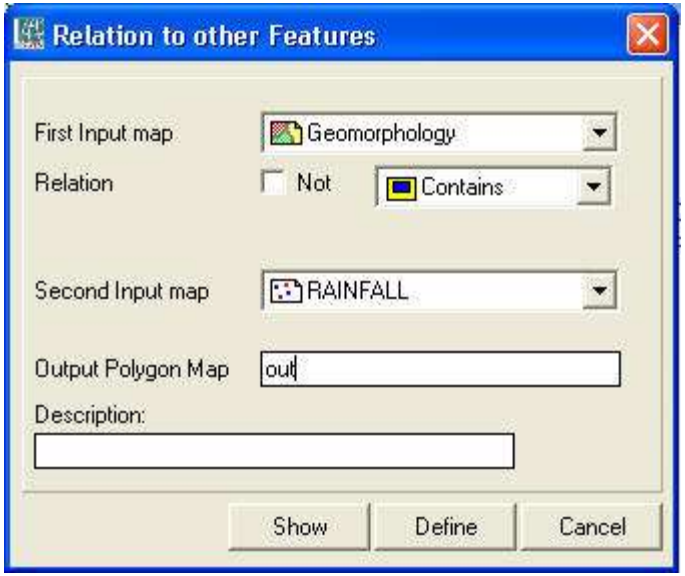
Rijeka Krka s bafer zonama (Gottstein i sur. 2009)

ILVIS 3.7

Korištenje programskog paketa ILVIS za relacijsko kartiranje poligona



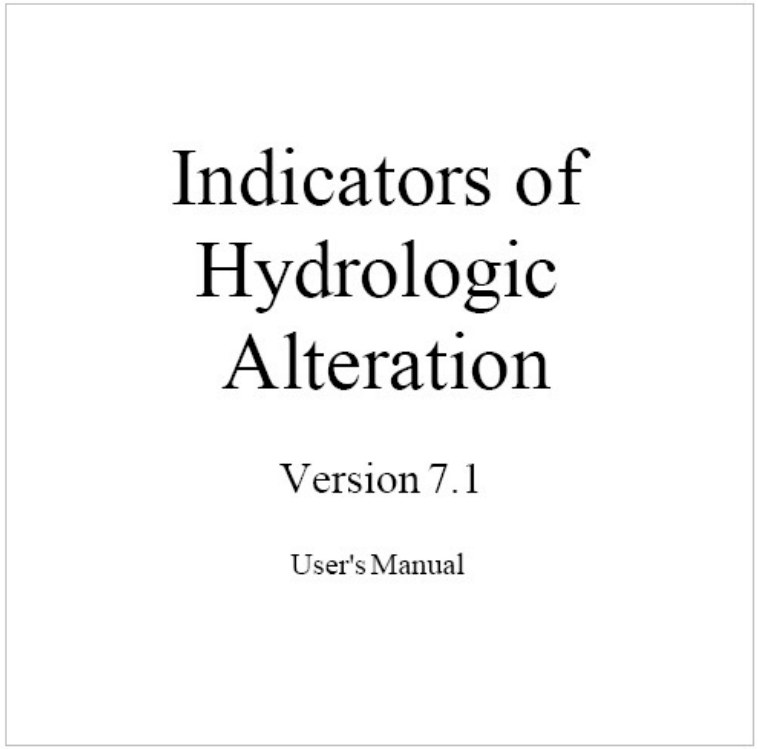
Količina oborina vs. geomorfologija područja



Relacijsko kartiranje poligona (Poligon Map Relate)

IHA 7.1

PROGRAMSKI PAKETI ZA SERVISIRANJE



- Programski paket koji je razvijen od strane TNCa (The Nature Conservancy)
- Vrlo lak za korištenje, uspoređujući podatke o prirodnim i hidrološkim izmijenjenim vodotocima.
- Koristi različite tipove hidroloških podataka, kao što je protok, status tekućica, razina podzemnih voda i dr.
- Važnost IHA programskog paketa jest u tome što može koristiti dnevne hidrološke podatke kroz dugo vremensko razdoblje u serijama koje se mogu definirati ovisno o ekološki relevantnim hidrološkim parametrima.

IHA 7.1

SAŽETAK IHA PARAMETARA I NJIHOV UTJECAJ NA EKOLOŠKI SUSTAV

IHA Parameter Group	Hydrologic Parameters	Ecosystem Influences
1. Magnitude of monthly water conditions	Mean or median value for each calendar month *Subtotal 12 parameters*	• Habitat availability for aquatic organisms • Soil moisture availability for plants • Availability of water for terrestrial animals • Availability of food/cover for fur-bearing mammals • Reliability of water supplies for terrestrial animals • Access by predators to nesting sites • Influences water temperature, oxygen levels, photosynthesis in water column
2. Magnitude and duration of annual extreme water conditions	Annual minima, 1-day mean Annual minima, 3-day means Annual minima, 7-day means Annual minima, 30-day means Annual minima, 90-day means Annual maxima, 1-day mean Annual maxima, 3-day means Annual maxima, 7-day means Annual maxima, 30-day means Annual maxima, 90-day means Number of zero-flow days Base flow index: 7-day minimum flow/mean flow for year *Subtotal 12 parameters*	• Balance of competitive, ruderal, and stress- tolerant organisms • Creation of sites for plant colonization • Structuring of aquatic ecosystems by abiotic vs. biotic factors • Structuring of river channel morphology and physical habitat conditions • Soil moisture stress in plants • Dehydration in animals • Anaerobic stress in plants • Volume of nutrient exchanges between rivers and floodplains • Duration of stressful conditions such as low oxygen and concentrated chemicals in aquatic environments • Distribution of plant communities in lakes, ponds, floodplains • Duration of high flows for waste disposal, aeration of spawning beds in channel sediments

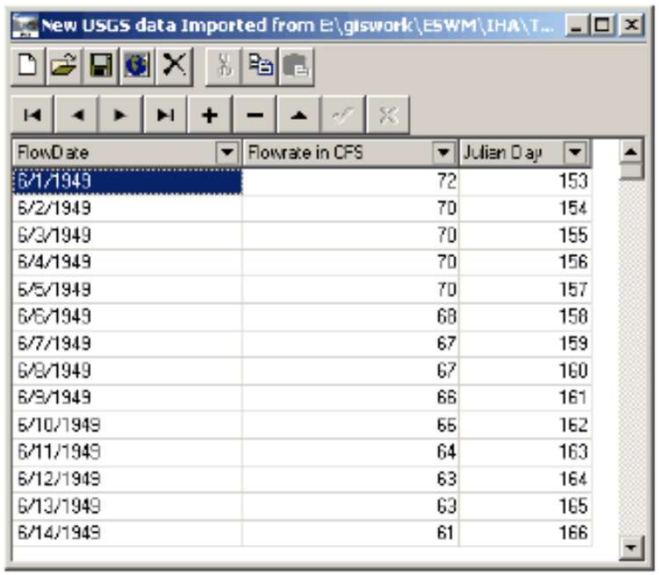
IHA 7.1

NASTAVAK TABLICE

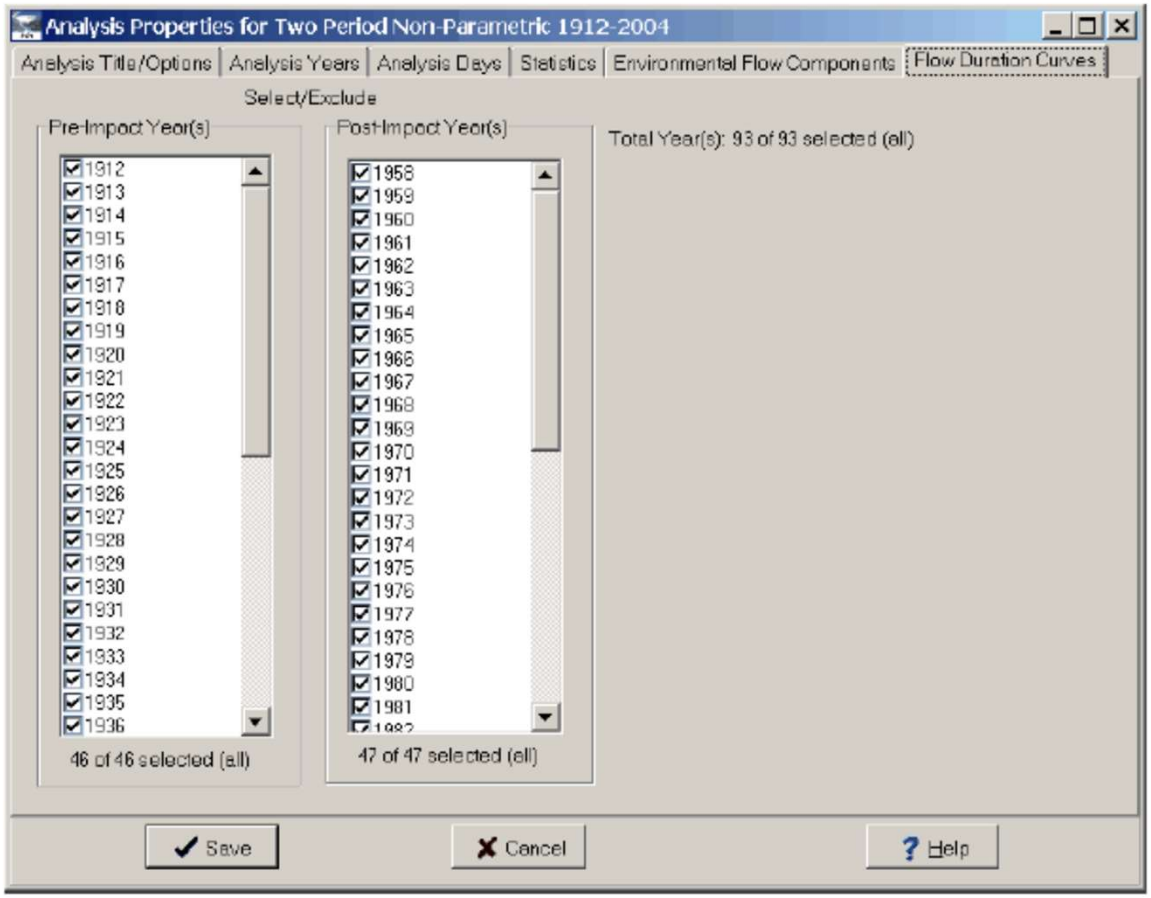
3. Timing of annual extreme water conditions	Julian date of each annual 1-day maximum Julian date of each annual 1-day minimum *Subtotal 2 parameters*	• Compatibility with life cycles of organisms • Predictability/avoidability of stress for organisms • Access to special habitats during reproduction or to avoid predation • Spawning cues for migratory fish • Evolution of life history strategies, behavioral mechanisms
4. Frequency and duration of high and low pulses	Number of low pulses within each water year Mean or median duration of low pulses (days) Number of high pulses within each water year Mean or median duration of high pulses (days) *Subtotal 4 parameters*	• Frequency and magnitude of soil moisture stress for plants • Frequency and duration of anaerobic stress for plants • Availability of floodplain habitats for aquatic organisms • Nutrient and organic matter exchanges between river and floodplain • Soil mineral availability • Access for waterbirds to feeding, resting, reproduction sites • Influences bedload transport, channel sediment textures, and duration of substrate disturbance (high pulses)
5. Rate and frequency of water condition changes	Rise rates: Mean or median of all positive differences between consecutive daily values Fall rates: Mean or median of all negative differences between consecutive daily values Number of hydrologic reversals *Subtotal 3 parameters* **Grand total 33 parameters**	• Drought stress on plants (falling levels) • Entrapment of organisms on islands, floodplains (rising levels) • Desiccation stress on low-mobility streamedge (varial zone) organisms

IHA 7.1

Unos podataka

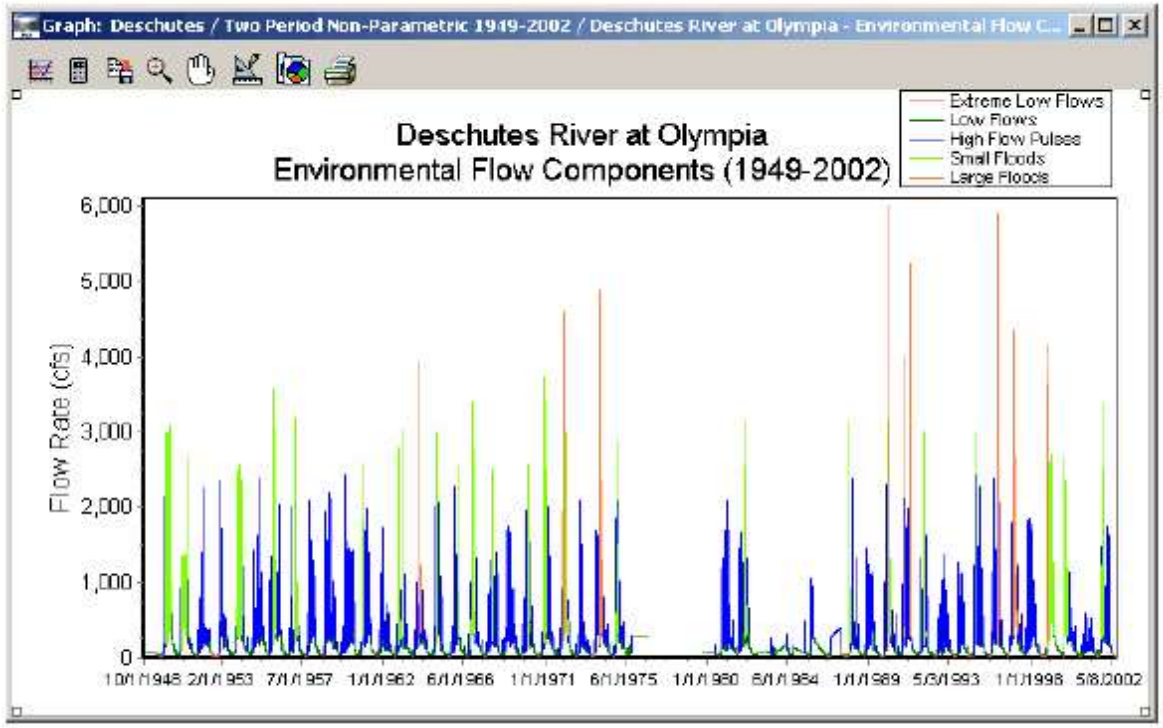


Flow Duration Curves Tab

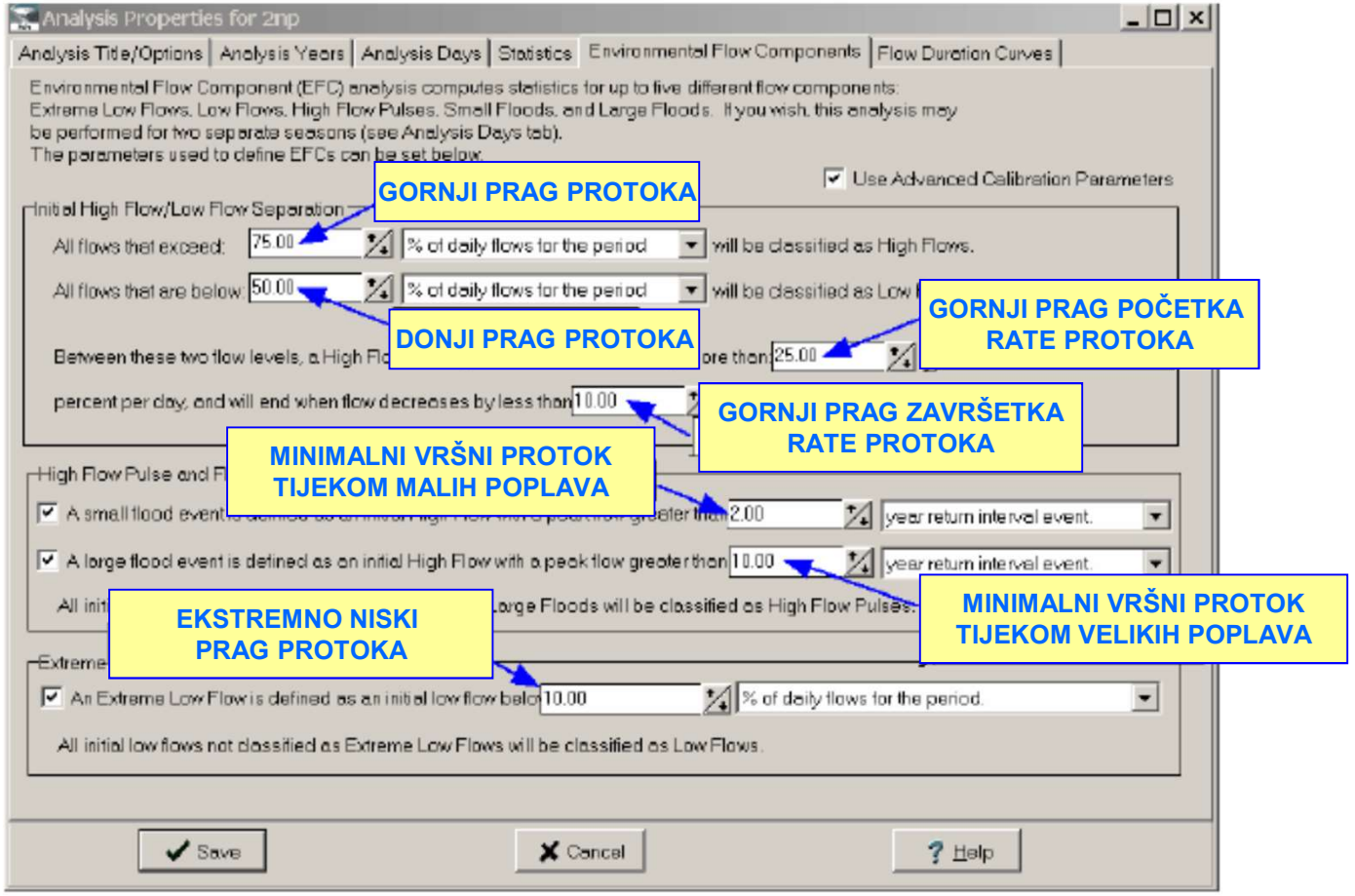


IHA 7.1

Testiranje režima poplava



IHA 7.1 Testiranje režima poplava

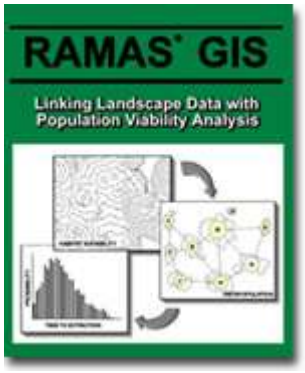


PROGRAMSKI PAKETI ZA SERVISIRANJE

RAMAS

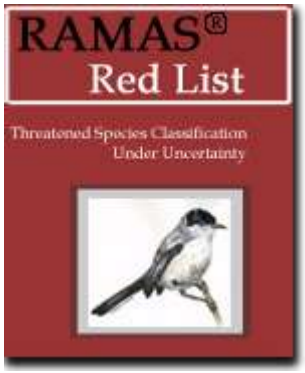
Ecology and Conservation

RAMAS Metapop 6.0
RAMAS GIS 6.0
RAMAS Landscape
RAMAS Multispecies Assessment



Threatened Species

RAMAS Rapid List
RAMAS Red List 3.0
RAMAS Red List Professional



Ecotoxicology

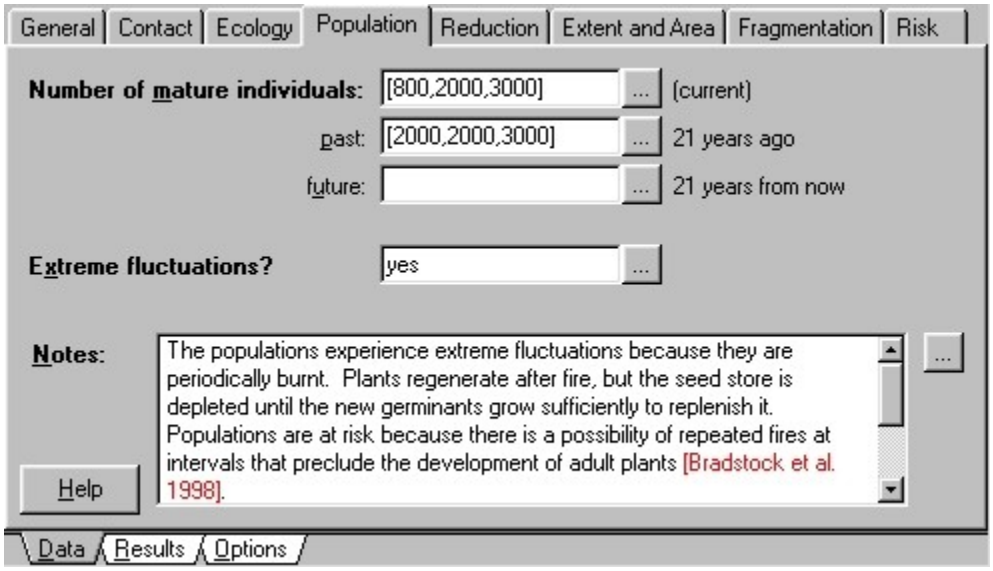
RAMAS Ecotoxicology
RAMAS Ecosystem

http://www.ramas.com/indexEnv.htm

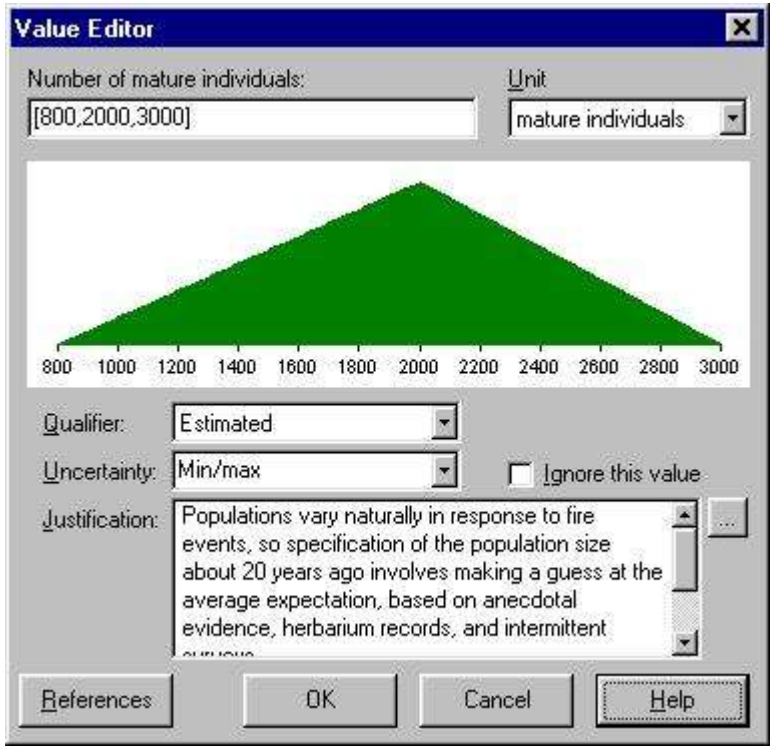
RAMAS Red List 3.0 (IUCN)

(Akçakaya & Ferson 2001)

Za populaciju 4 tipa unosa podataka:

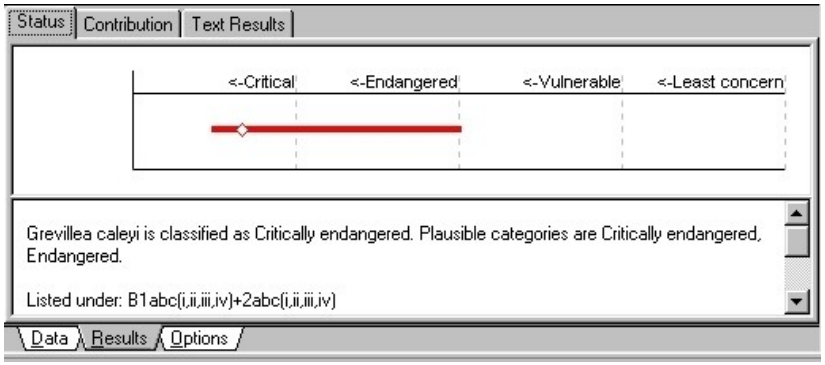


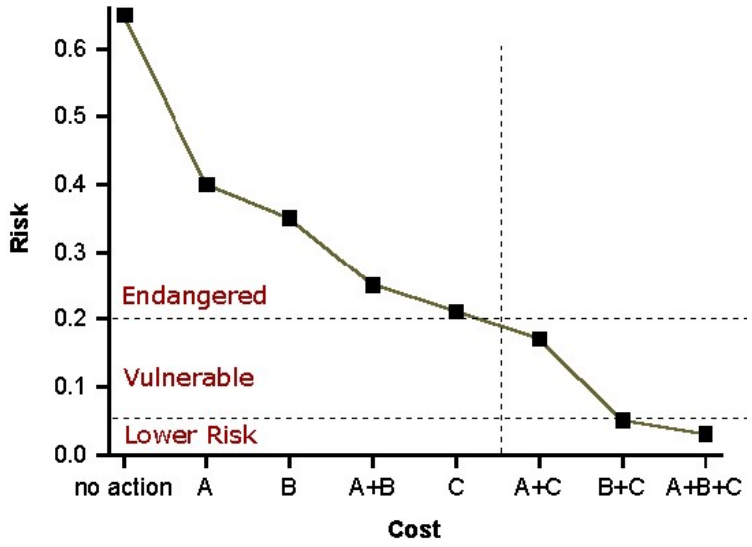
Unošenje podataka u RAMAS Red List 3.0
(Akçakaya & Ferson 2001)



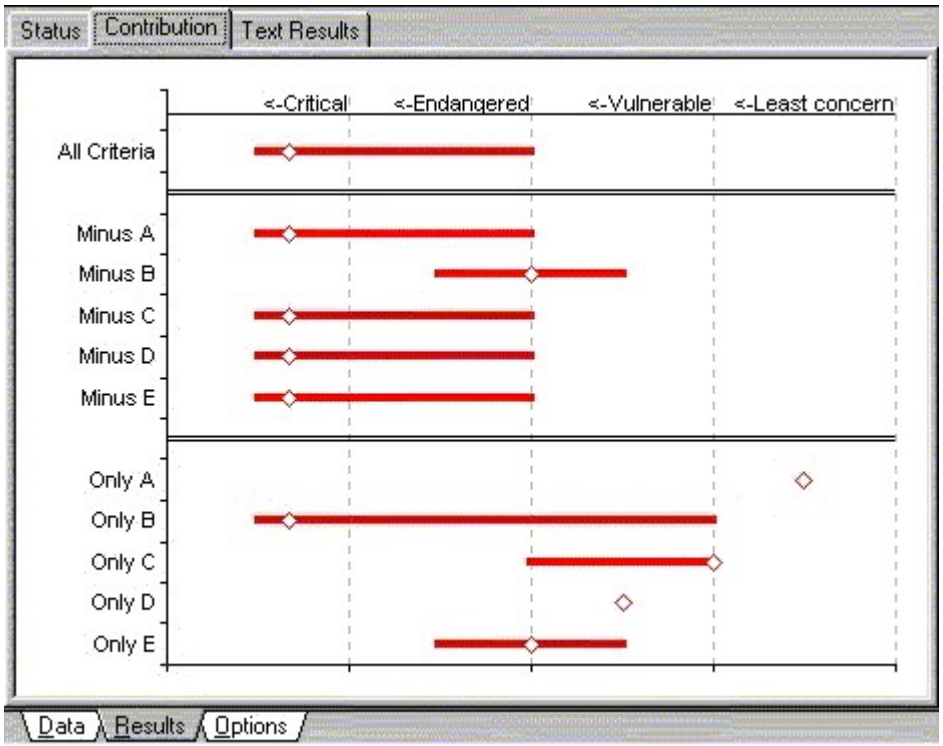
Interpretacija rezultata RAMAS Red List 3.0
(Akçakaya & Ferson 2001)

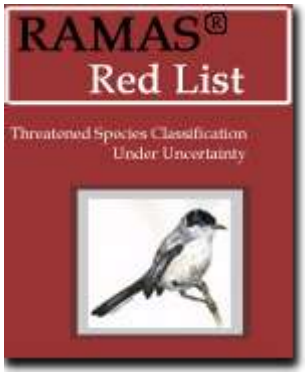
Sažetak rezultata za status svojte:





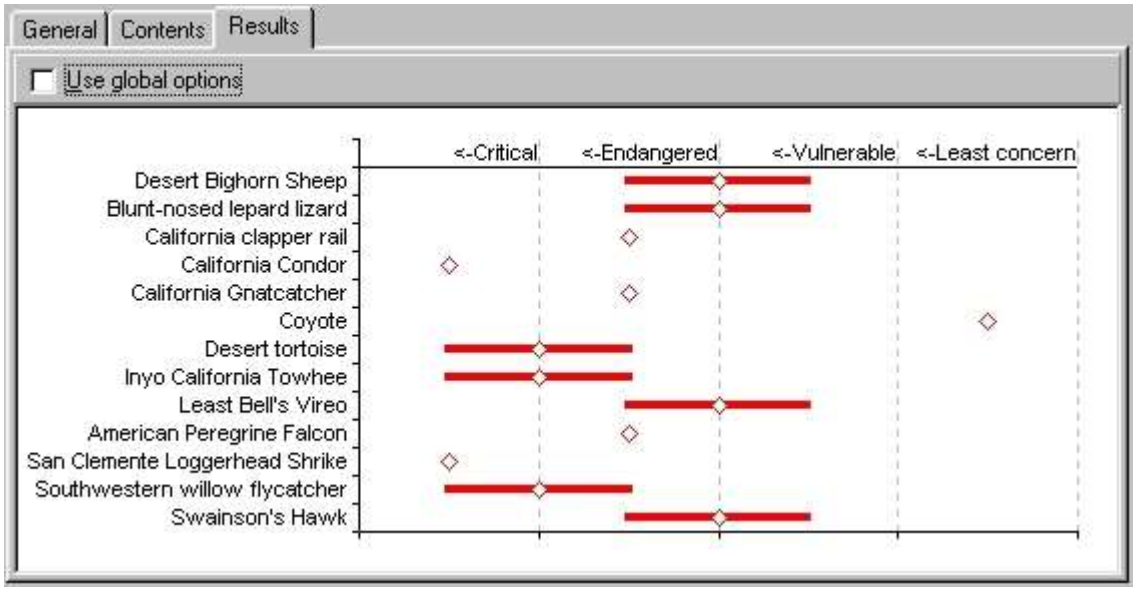
Sažetak rezultata za status svojte po kriterijima:

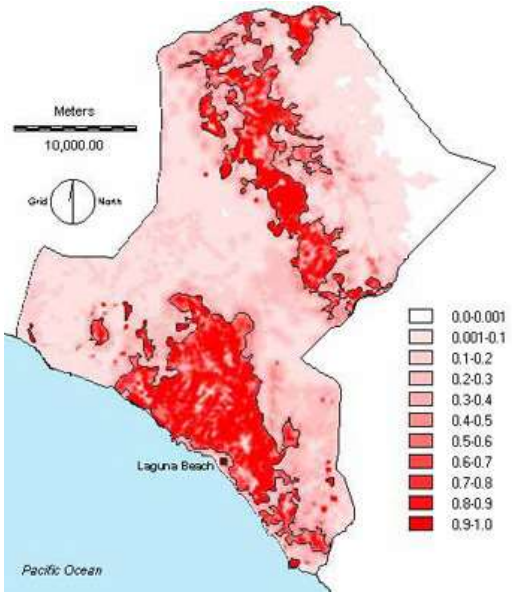




Interpretacija rezultata RAMAS Red List 3.0 (Akçakaya & Ferson 2001)

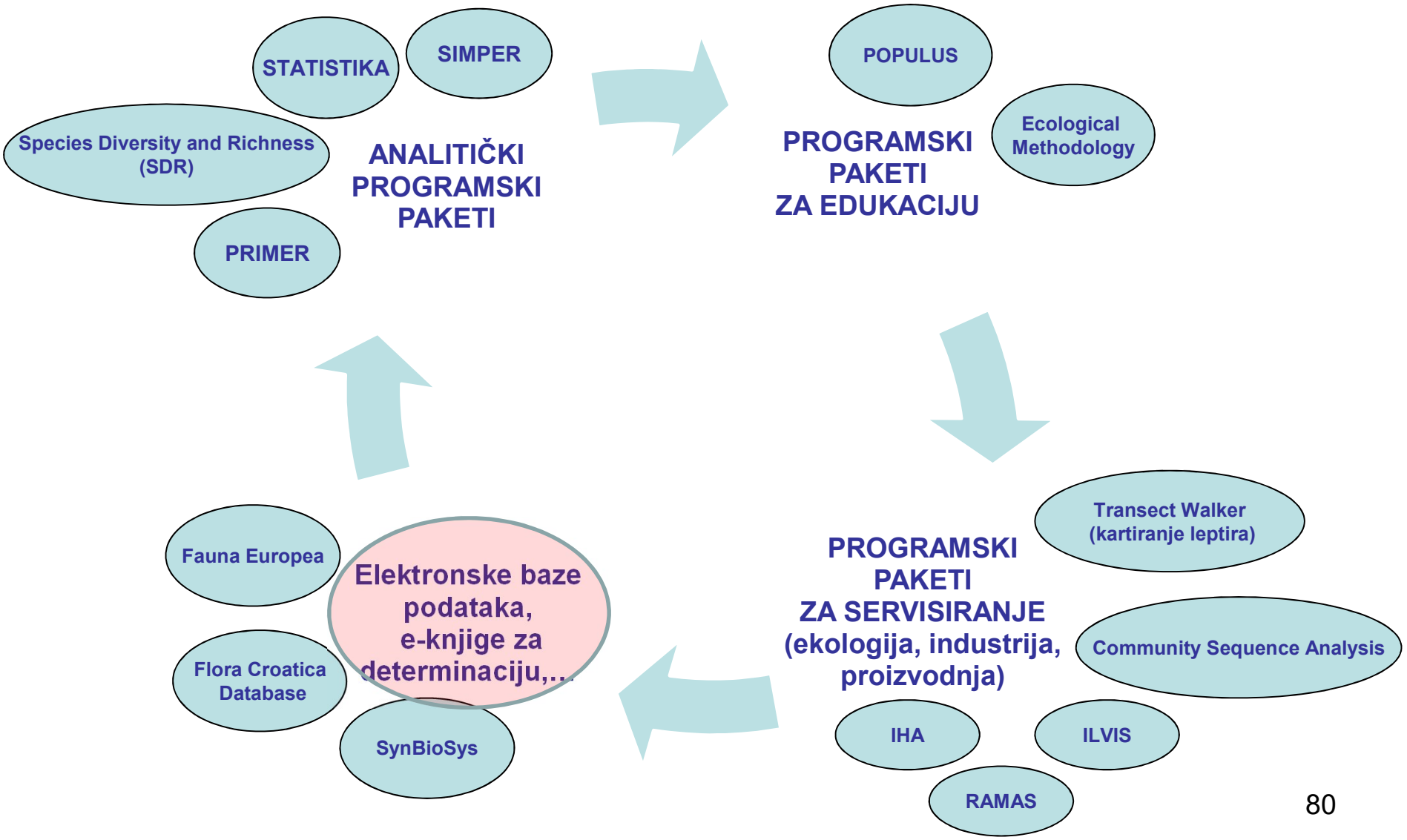
Sažetak rezultata za uspoređivanje statusa svih svojti:





Prikaz karte staništa vrste „California Gnatcatcher" u državi Orange, CA. Tamnija crvena polja označavaju više prikladna staništa, a bijela označavaju nepogodna staništa. Crne linije pokazuju granice izoliranih staništa identificirane RAMAS GIS programom. Za detalje, pogledajte Akçakaya i Atwood (1997; Conservation Biology 11: 422-434).

Korištenje programskih paketa



- '**BioScore plant database**' – bazira se na:

  - SynBioSys Europe bazi podataka
  - Target species (ciljane vrste) bazi podataka
  - Dodatnim bazama podataka s ekološkim informacijama

http://web.woodyplants-database.org/plant/search
http://hort.uconn.edu/search.php

SynBioSys - Europe 0.9

Clear | Show information | Help | Close programme

Plant species

- Psilotaceae
- Lycopodiaceae
- Selaginellaceae
- Isoetaceae
- Equisetaceae
- Ophioglossaceae
- Osmundaceae
- Parkeriaceae
- Adiantaceae
- Pteridaceae
- Hymenophyllaceae
- Polypodiaceae
- Grammitidaceae
- Dicksoniaceae
- Hypolepidaceae
- Thelypteriadaceae
- Aspleniaceae
- Athyriaceae
- Aspidiaceae
- Elaphoglossaceae
- Davalliaceae
- Blechnaceae
- Marsileaceae
- Salviniaceae
- Azollaceae
- Pinaceae
- Taxodiaceae
- Cupressaceae

Plant species

Vegetation

Landscape

Extra

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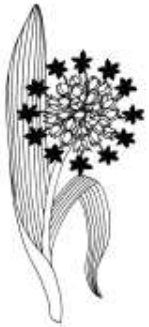
Welcome page

Parameters



SynBioSys Europe, an initiative of the **European Vegetation Survey**, is an information system for the evaluation and management of biodiversity among plant species, vegetation types and landscapes. The project is coordinated from Alterra at Wageningen, in The Netherlands, and will function as a network of distributed databases related through a web-server. It incorporates a GIS platform for the visualisation of layers of information on plant species, vegetation and landscape data, and offers the possibility to identify vegetation types and to analyse the patterns and processes which relate them to plant species, and landscape types. The expert system will enhance the capacity of European nature and environment agencies to participate in the management and interpretation of information on species, vegetation and landscape both at a national and at a European scale.

Species

SynBioSys Europe is developing a synonymised species list for the European vascular and cryptogam flora (including bryophytes, lichens and stoneworts). This list will be compiled by bringing together and analysing national floras, used by the software package TURBOVEG. For each plant species, author citations, synonyms and country-based distribution patterns will be presented. To help implement European policies for nature conservation and biodiversisty, links to the Habitat Directive, the Bern Convention and Red Lists will be indicated. At present, the available list of Flora Europaea is incomplete, outdated, and moreover is lacking the necessary links with biological floras. Computerised links between the SynBioSys Species Checklist, national floras and vegetation tables will enable standard query routines to highlight environmental conditions necessary for sustaining plant communities and habitats.

Vegetation

On the vegetation level, SynBioSys Europe uses the newly completed conspectus of European vegetation types. This hierarchic overview comprises 15 formations, 80 vegetation classes, 233 orders and 933 alliances. Information will be presented for each vegetation unit, including general descriptions, species composition (listing diagnostic, frequent and dominant species), structure and dynamics, ecology, geographic distribution, nature conservation and bibliography. On the lowest level, the alliance, lists of associations will be presented and key associations considered in more detail. Two types of vegetation tables will be presented: based on synoptic tables and based on individual relevés. The latter will be extracted from national databases, using the TURBOVEG software package, which is already in use in more than 25 countries throughout Europe. A cross-walk to the EUNIS Habitat Classification is designed to help implement the Natura 2000 and Emerald networks.

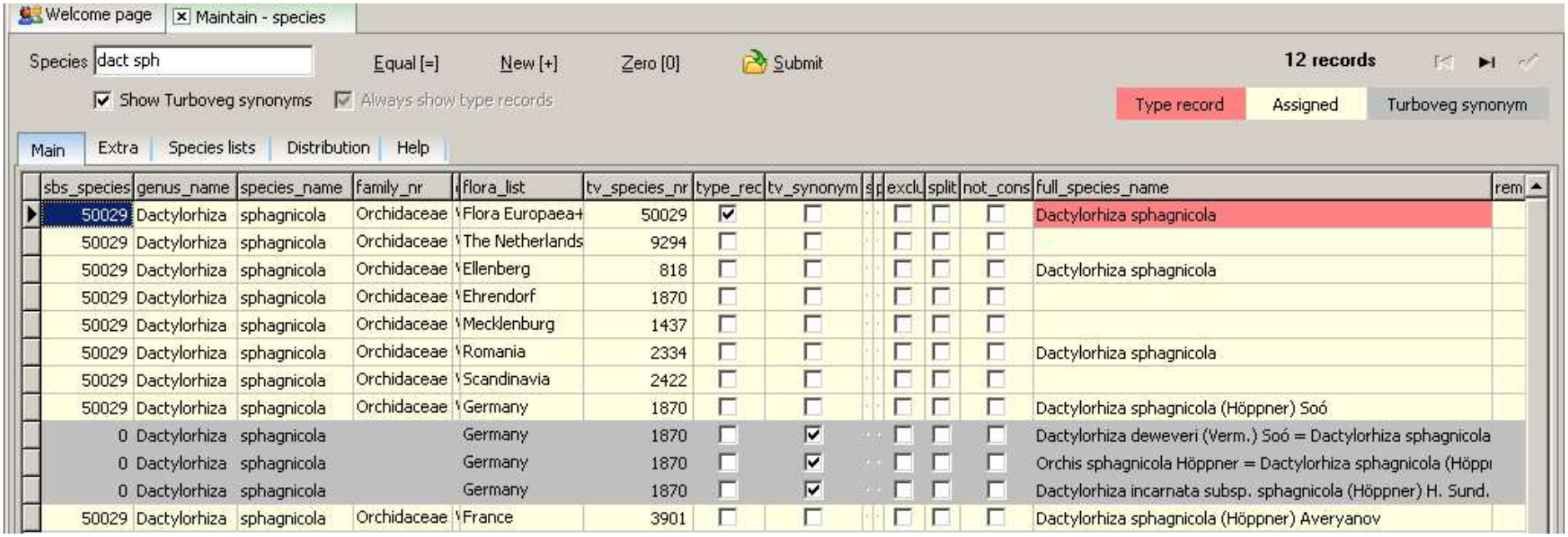
Landscape

For the categorisation of landscape types in SynBioSys Europe, the recently published Map of the Natural Vegetation of Europe (by the Bundesamt für Naturschutz, Bonn, Germany) will be used as a basis. More than 100 geobotanists from 31 European countries cooperated on this map, its legend and the explanatory text. The map has been printed in 9 sheets at a scale of 1:2.5 million. The legend is built-up of different hierarchical levels. It comprises 19 major formations and 700 mapping units. Each mapping unit, representing specific landscape types, will be documented by a general description and information on composition and structure of the main natural vegetation types, on distribution, ecology, land use, landscape pattern, actual plant communities, and nature conservation. One of the main goals within SynBioSys is to link the landscape units with actual vegetation types and relevés on the basis of so-called vegetation complexes.

http://www.synbiosys.alterra.nl

User 'ozing001' on computer 'ALTERRA2042'

SynBioSys – popis vrsta



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50029	Dactylorhiza	sphagnicola	Orchidaceae	The Netherlands	9294	☐	☐	☐	☐	☐		
50029	Dactylorhiza	sphagnicola	Orchidaceae	Ellenberg	818	☐	☐	☐	☐	☐	Dactylorhiza sphagnicola	
50029	Dactylorhiza	sphagnicola	Orchidaceae	Ehrendorf	1870	☐	☐	☐	☐	☐		
50029	Dactylorhiza	sphagnicola	Orchidaceae	Mecklenburg	1437	☐	☐	☐	☐	☐		
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50029	Dactylorhiza	sphagnicola	Orchidaceae	Germany	1870	☐	☐	☐	☐	☐	Dactylorhiza sphagnicola (Höppner) Soó	
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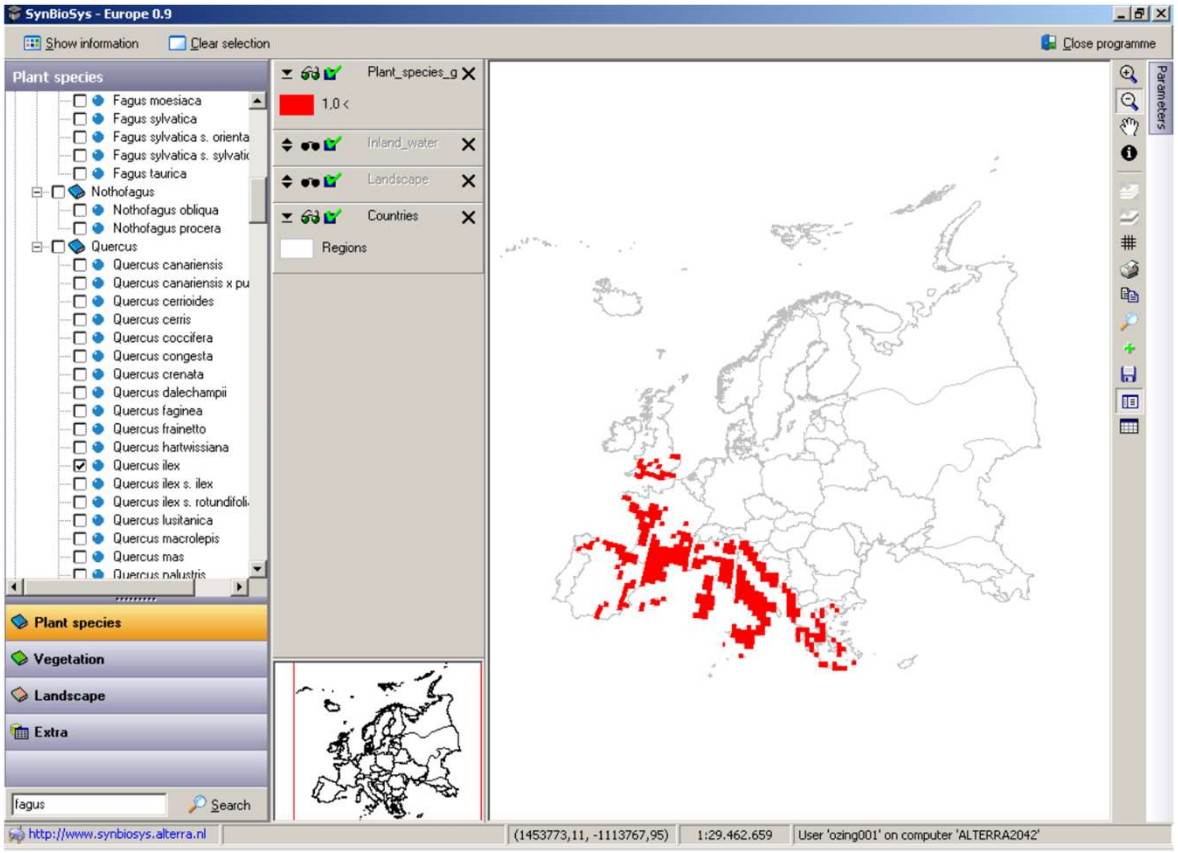
0	Dactylorhiza	sphagnicola		Germany	1870	☐	☑	☐	☐	☐	Orchis sphagnicola Höppner = Dactylorhiza sphagnicola (Höppı	
0	Dactylorhiza	sphagnicola		Germany	1870	☐	☑	☐	☐	☐	Dactylorhiza incarnata subsp. sphagnicola (Höppner) H. Sund.	
50029	Dactylorhiza	sphagnicola	Orchidaceae	France	3901	☐	☐	☐	☐	☐	Dactylorhiza sphagnicola (Höppner) Averyanov	

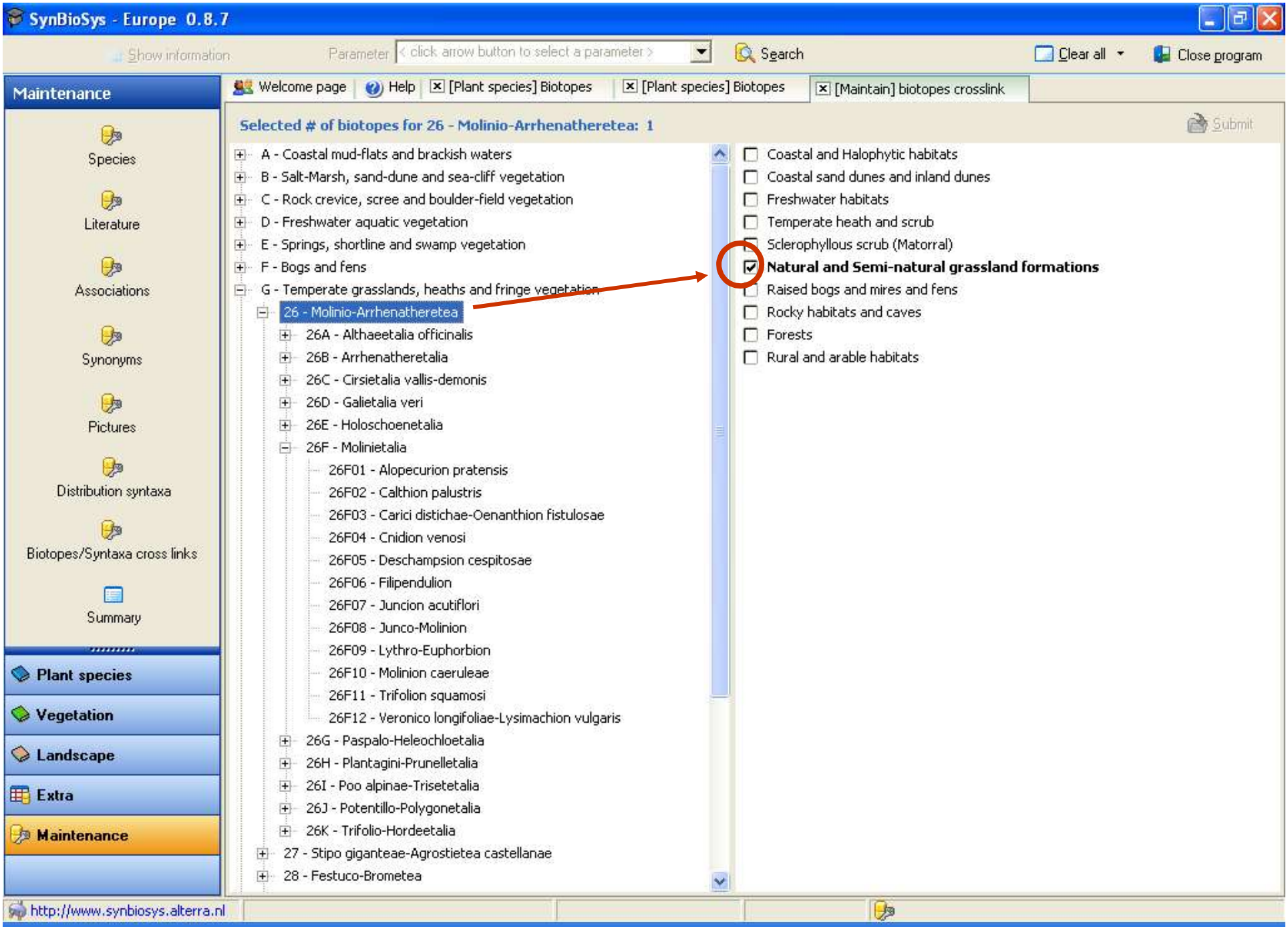
BioScore

SynBioSys – podaci o rasprostranjenosti vrsta

- Koordinatna mreža (Atlas Flora Europaea: ca. 1700 vrsta)



BioScore


SynBioSys - Europe 0.8.7
Show information
Parameter
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Search
Clear all
Close program
Maintenance
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Literature
Associations
Synonyms
Pictures
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Summary
Plant species
Vegetation
Landscape
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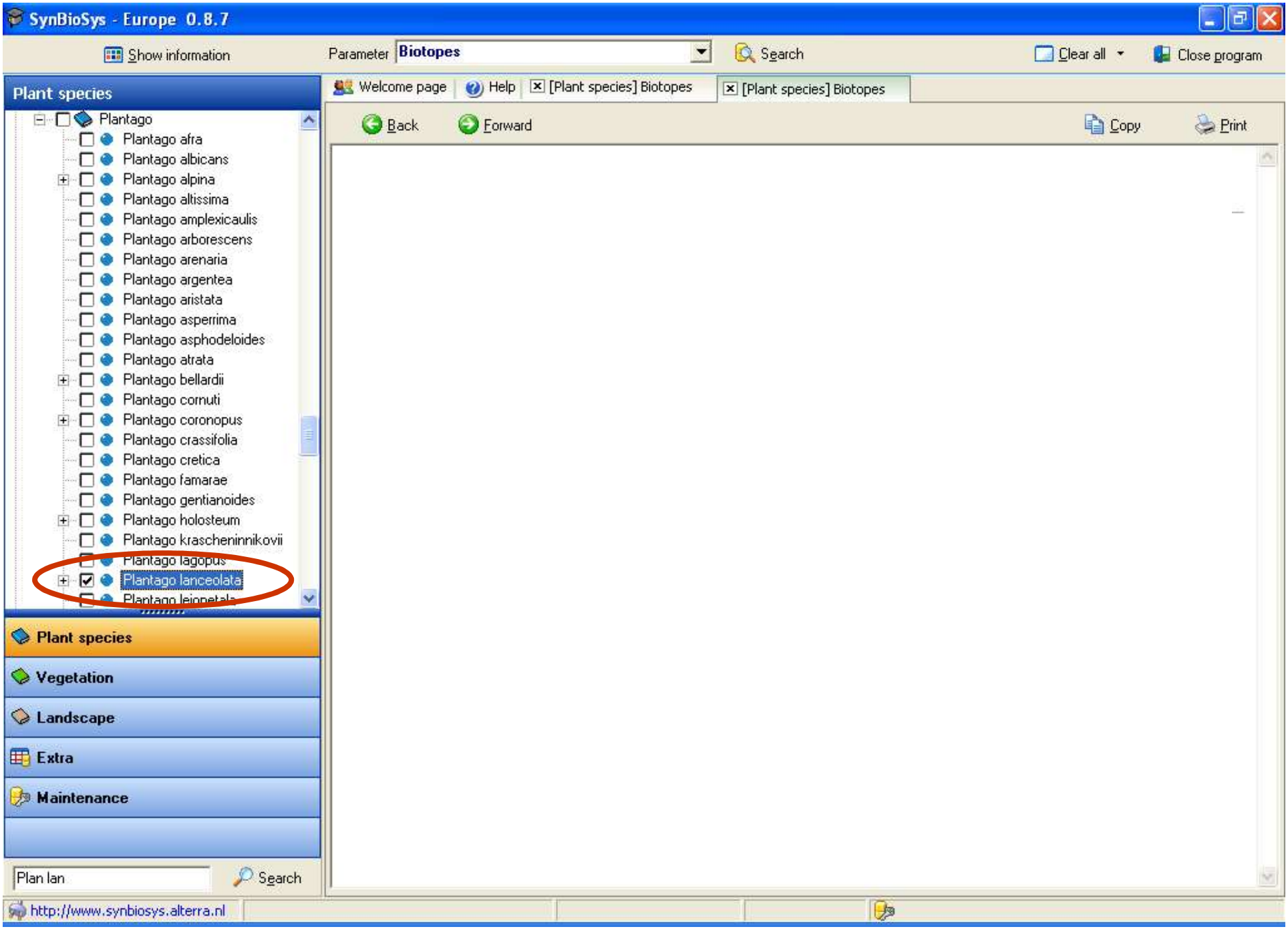
Maintenance
Welcome page
Help
[Plant species] Biotopes
[Plant species] Biotopes
[Maintain] biotopes crosslink
Selected # of biotopes for 26 - Molinio-Arrhenatheretea: 1
Submit
A - Coastal mud-flats and brackish waters
B - Salt-Marsh, sand-dune and sea-cliff vegetation
C - Rock crevice, scree and boulder-field vegetation
D - Freshwater aquatic vegetation
E - Springs, shortline and swamp vegetation
F - Bogs and fens
G - Temperate grasslands, heaths and fringe vegetation
26 - Molinio-Arrhenatheretea
26A - Althaeetalia officinalis
26B - Arrhenatheretalia
26C - Cirsietalia vallis-demonis
26D - Galietalia veri
26E - Holoschoenetalia
26F - Molinietalia
26F01 - Alopecurion pratensis
26F02 - Calthion palustris
26F03 - Carici distichae-Oenanthion fistulosae
26F04 - Cnidion venosi
26F05 - Deschampsion cespitosae
26F06 - Filipendulion
26F07 - Juncion acutiflori
26F08 - Junco-Molinion
26F09 - Lythro-Euphorbion
26F10 - Molinion caeruleae
26F11 - Trifolion squamosi
26F12 - Veronico longifoliae-Lysimachion vulgaris
26G - Paspalo-Heleochloetalia
26H - Plantagini-Prunelletalia
26I - Poo alpinae-Trisetetalia
26J - Potentillo-Polygonetalia
26K - Trifolio-Hordeetalia
27 - Stipo giganteae-Agrostietea castellanae
28 - Festuco-Brometea
Coastal and Halophytic habitats
Coastal sand dunes and inland dunes
Freshwater habitats
Temperate heath and scrub
Sclerophyllous scrub (Matorral)
Natural and Semi-natural grassland formations
Raised bogs and mires and fens
Rocky habitats and caves
Forests
Rural and arable habitats
http://www.synbiosys.alterra.nl


SynBioSys - Europe 0.8.7
Show information
Parameter
Biotopes
Search
Clear all
Close program
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Plantago afra
Plantago albicans
Plantago alpina
Plantago altissima
Plantago amplexicaulis
Plantago arborescens
Plantago arenaria
Plantago argentea
Plantago aristata
Plantago asperrima
Plantago asphodeloides
Plantago atrata
Plantago bellardii
Plantago cornuti
Plantago coronopus
Plantago crassifolia
Plantago cretica
Plantago famarae
Plantago gentianoides
Plantago holosteum
Plantago krascheninnikovii
Plantago lagopus
Plantago lanceolata
Plantago leiopetala
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Vegetation
Landscape
Extra
Maintenance
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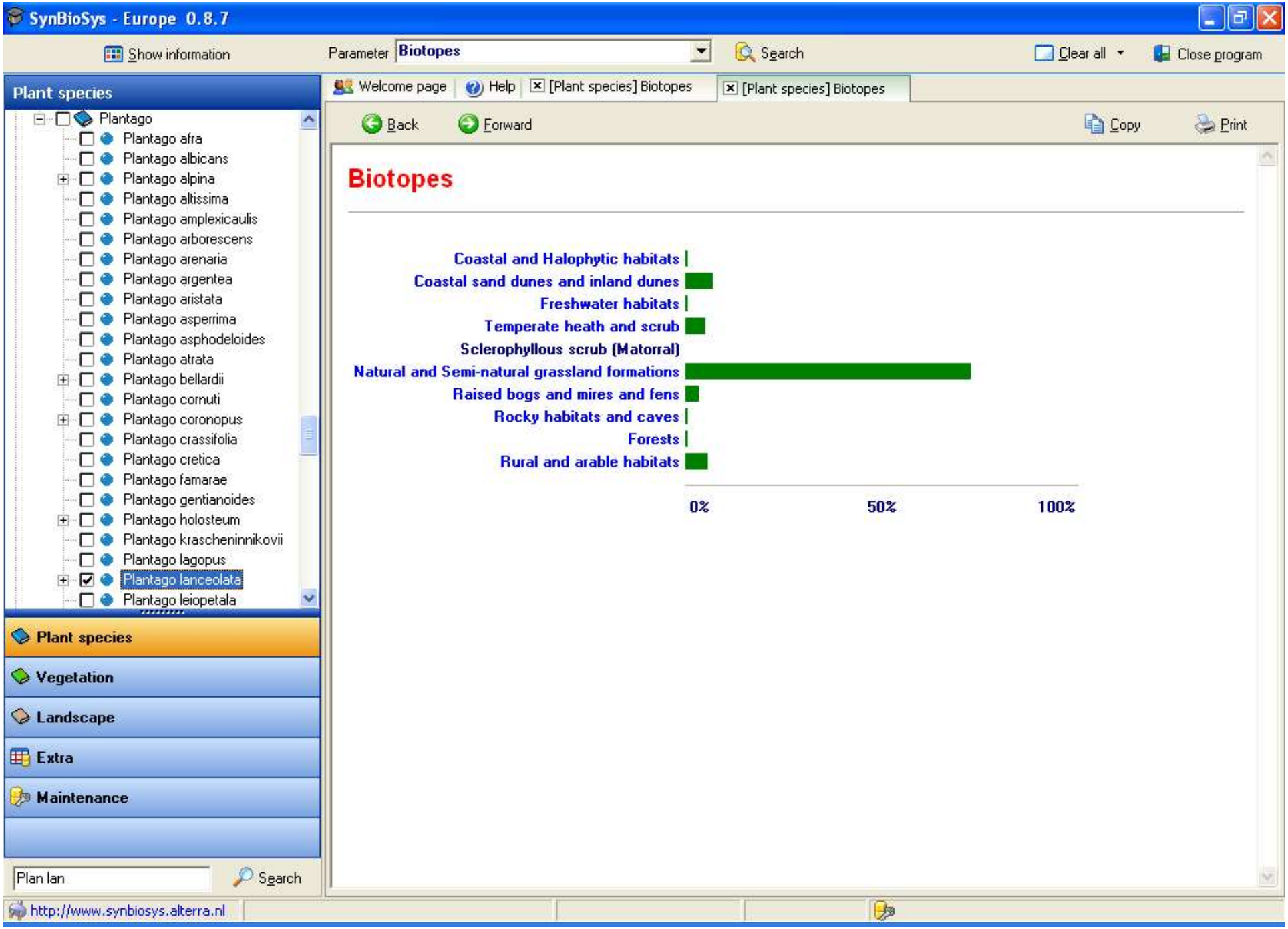
Search
http://www.synbiosys.alterra.nl


SynBioSys - Europe 0.8.7
Show information
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Biotopes
Search
Clear all
Close program
Plant species
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Plantago asperrima
Plantago asphodeloides
Plantago atrata
Plantago bellardii
Plantago cornuti
Plantago coronopus
Plantago crassifolia
Plantago cretica
Plantago famarae
Plantago gentianoides
Plantago holosteum
Plantago krascheninnikovii
Plantago lagopus
Plantago lanceolata
Plantago leiopetala
Plant species
Vegetation
Landscape
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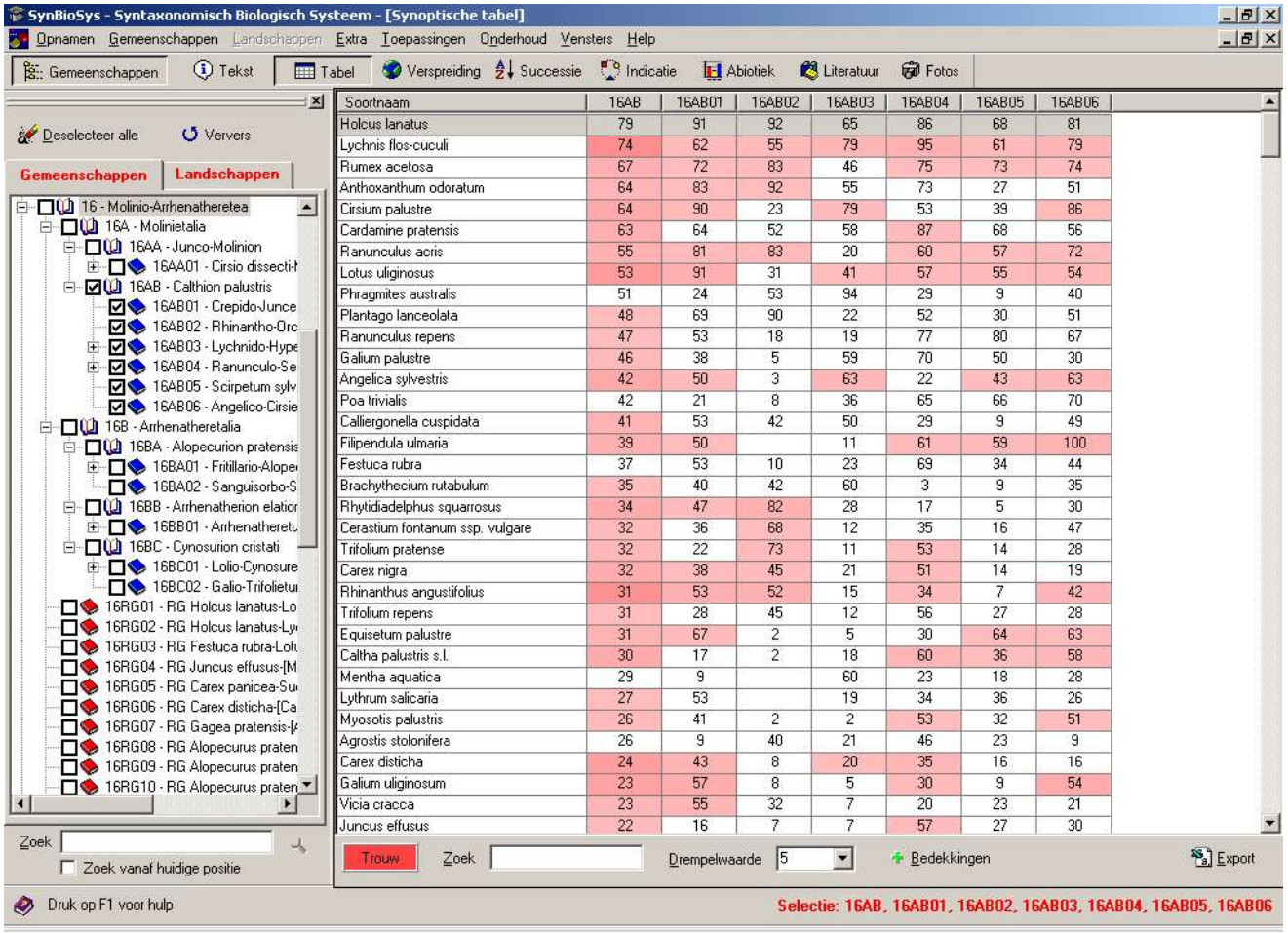
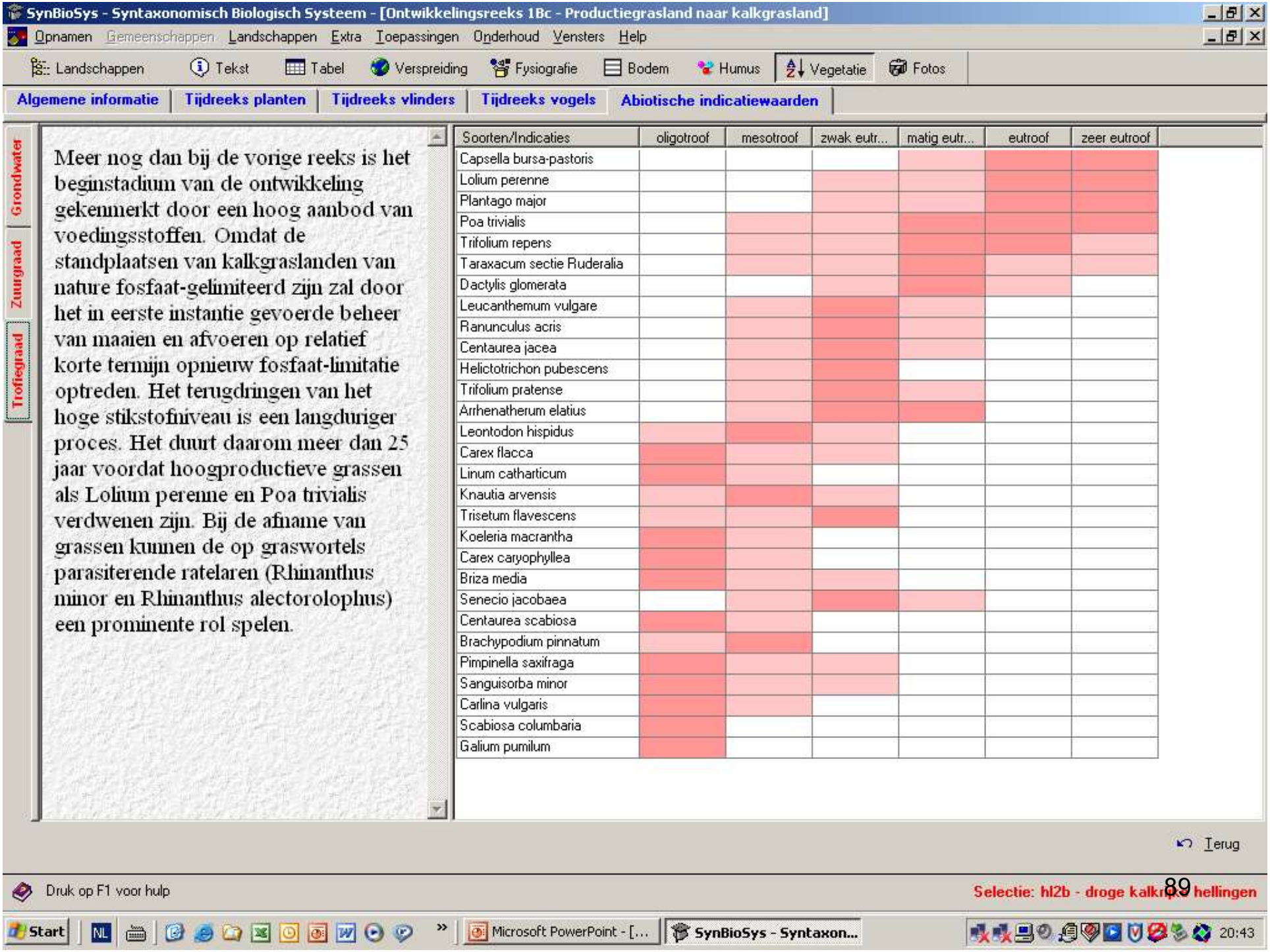
Maintenance
Plan lan
Search
http://www.synbiosys.alterra.nl
Welcome page
Help
[Plant species] Biotopes
[Plant species] Biotopes
Back
Forward
Copy
Print
Biotopes
Coastal and Halophytic habitats
Coastal sand dunes and inland dunes
Freshwater habitats
Temperate heath and scrub
Sclerophyllous scrub (Matorral)
Natural and Semi-natural grassland formations
Raised bogs and mires and fens
Rocky habitats and caves
Forests
Rural and arable habitats
0%
50%
100%

SynBioSys

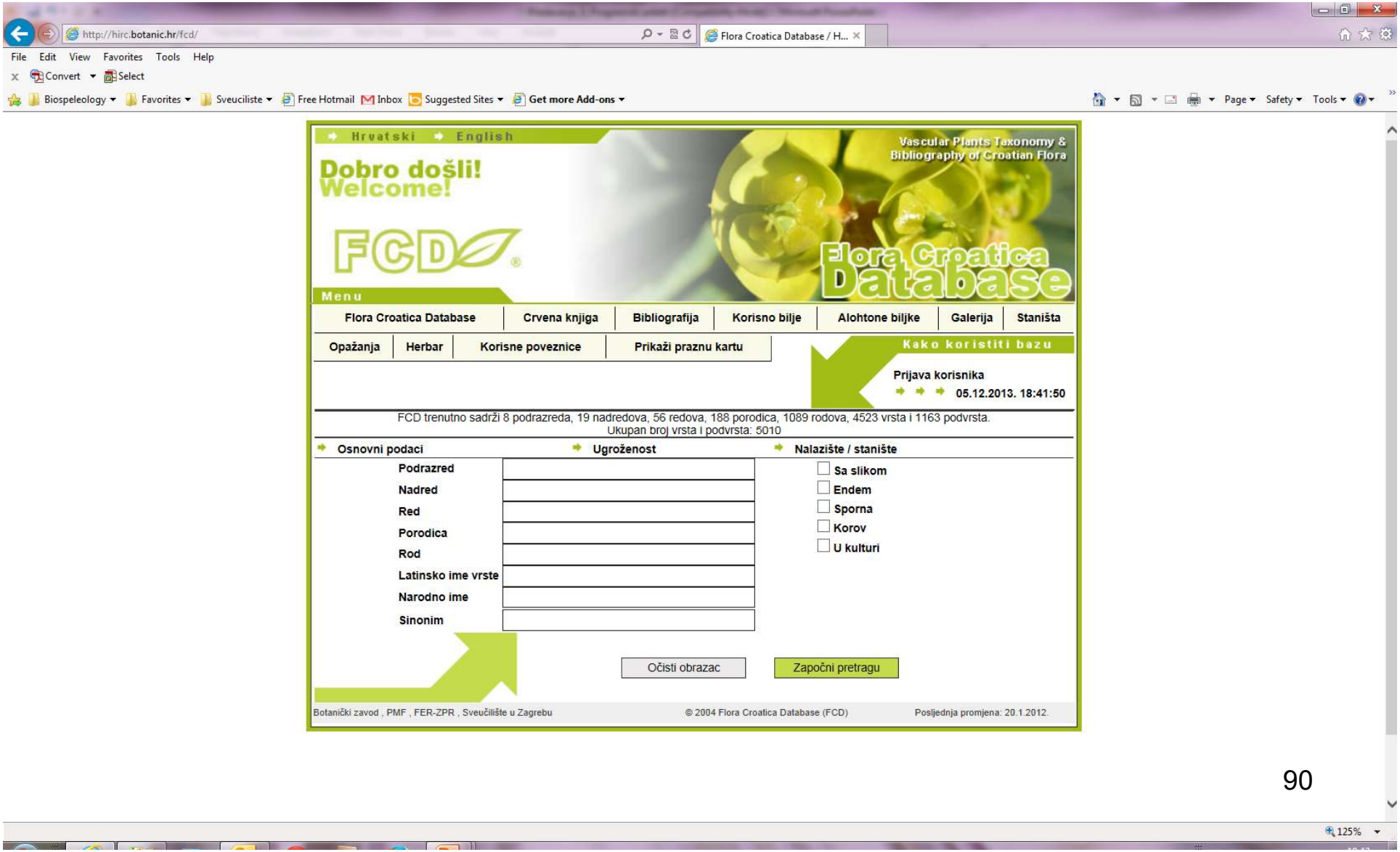


Soortnaam	16AB	16AB01	16AB02	16AB03	16AB04	16AB05	16AB06
Holcus lanatus	79	91	92	65	86	68	81
Lychnis flos-cuculi	74	62	55	79	95	61	79
Rumex acetosa	67	72	83	46	75	73	74
Anthoxanthum odoratum	64	83	92	55	73	27	51
Cirsium palustre	64	90	23	79	53	39	86
Cardamine pratensis	63	64	52	58	87	68	56
Ranunculus acris	55	81	83	20	60	57	72
Lotus uliginosus	53	91	31	41	57	55	54
Phragmites australis	51	24	53	94	29	9	40
Plantago lanceolata	48	69	90	22	52	30	51
Ranunculus repens	47	53	18	19	77	80	67
Galium palustre	46	38	5	59	70	50	30
Angelica sylvestris	42	50	3	63	22	43	63
Poa trivialis	42	21	8	36	65	66	70
Calliergonella cuspidata	41	53	42	50	29	9	49
Filipendula ulmaria	39	50		11	61	59	100
Festuca rubra	37	53	10	23	69	34	44
Brachythecium rutabulum	35	40	42	60	3	9	35
Rhytidiadelphus squarrosus	34	47	82	28	17	5	30
Cerastium fontanum ssp. vulgare	32	36	68	12	35	16	47
Trifolium pratense	32	22	73	11	53	14	28
Carex nigra	32	38	45	21	51	14	19
Rhinanthus angustifolius	31	53	52	15	34	7	42
Trifolium repens	31	28	45	12	56	27	28
Equisetum palustre	31	67	2	5	30	64	63
Caltha palustris s.l.	30	17	2	18	60	36	58
Mentha aquatica	29	9		60	23	18	28
Lythrum salicaria	27	53		19	34	36	26
Myosotis palustris	26	41	2	2	53	32	51
Agrostis stolonifera	26	9	40	21	46	23	9
Carex disticha	24	43	8	20	35	16	16
Galium uliginosum	23	57	8	5	30	9	54
Vicia cracca	23	55	32	7	20	23	21
Juncus effusus	22	16	7	7	57	27	30

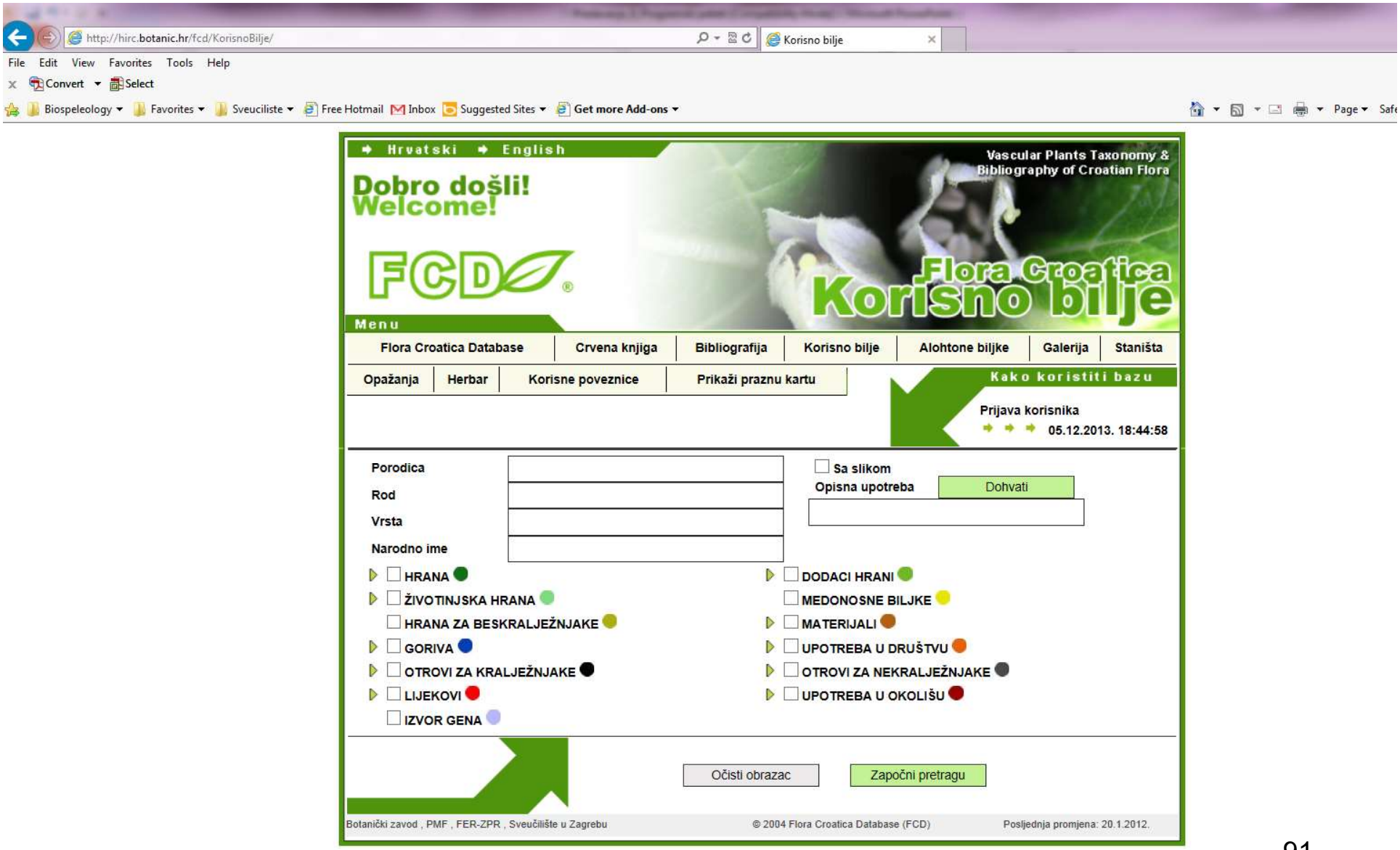


Soorten/Indicaties	oligotroof	mesotroof	zwak eutr...	matig eutr...	eutroof	zeer eutroof
Capsella bursa-pastoris						
Lolium perenne						
Plantago major						
Poa trivialis						
Trifolium repens						
Taraxacum sectie Ruderalia						
Dactylis glomerata						
Leucanthemum vulgare						
Ranunculus acris						
Centaurea jacea						
Helictotrichon pubescens						
Trifolium pratense						
Arrhenatherum elatius						
Leontodon hispidus						
Carex flacca						
Linum catharticum						
Knautia arvensis						
Trisetum flavescens						
Koeleria macrantha						
Carex caryophyllea						
Briza media						
Senecio jacobaea						
Centaurea scabiosa						
Brachypodium pinnatum						
Pimpinella saxifraga						
Sanguisorba minor						
Carlina vulgaris						
Scabiosa columbaria						
Galium pumilum						

ELEKTRONSKE BAZE PODATAKA – FLORA HRVATSKE

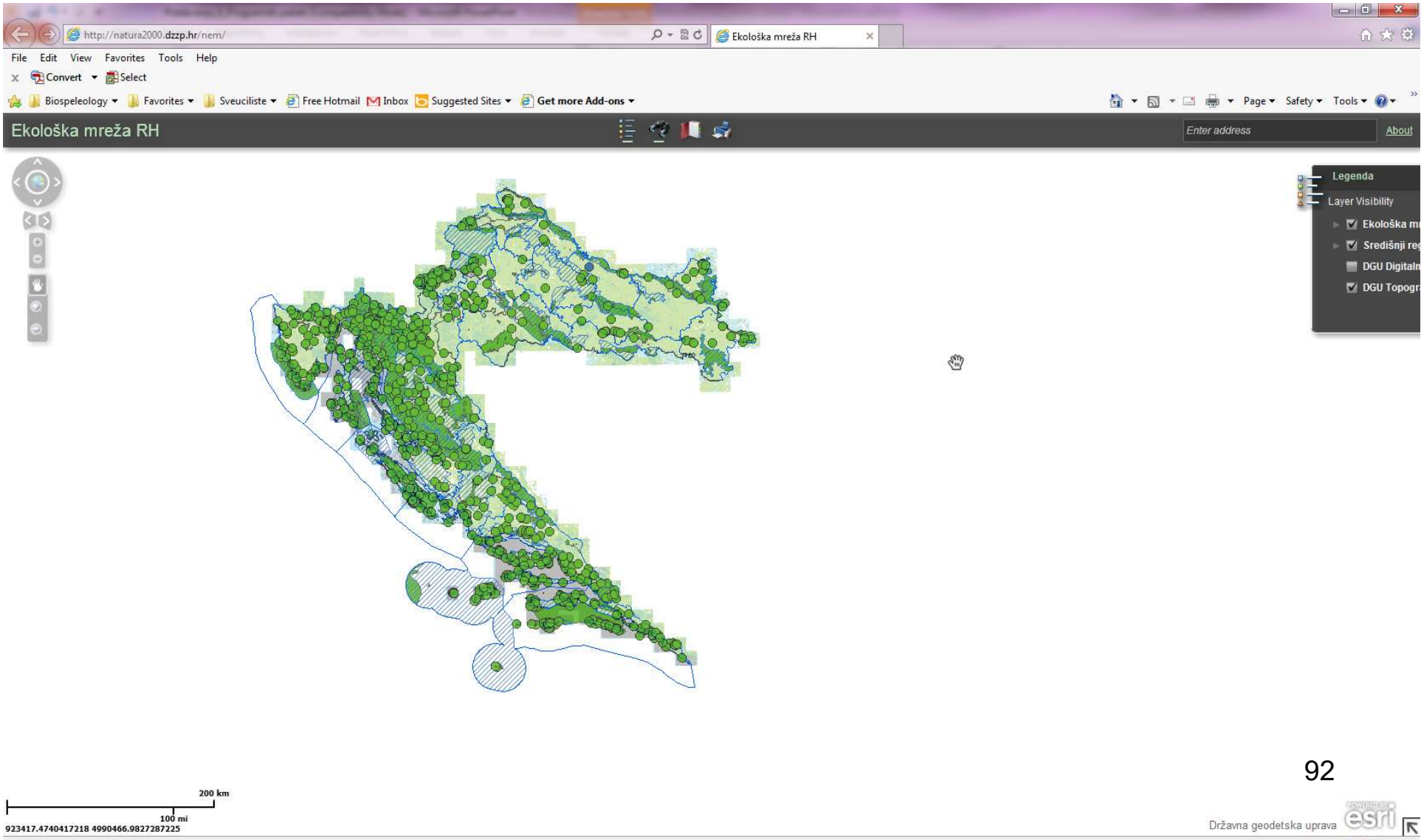


ELEKTRONSKE BAZE PODATAKA – FLORA HRVATSKE

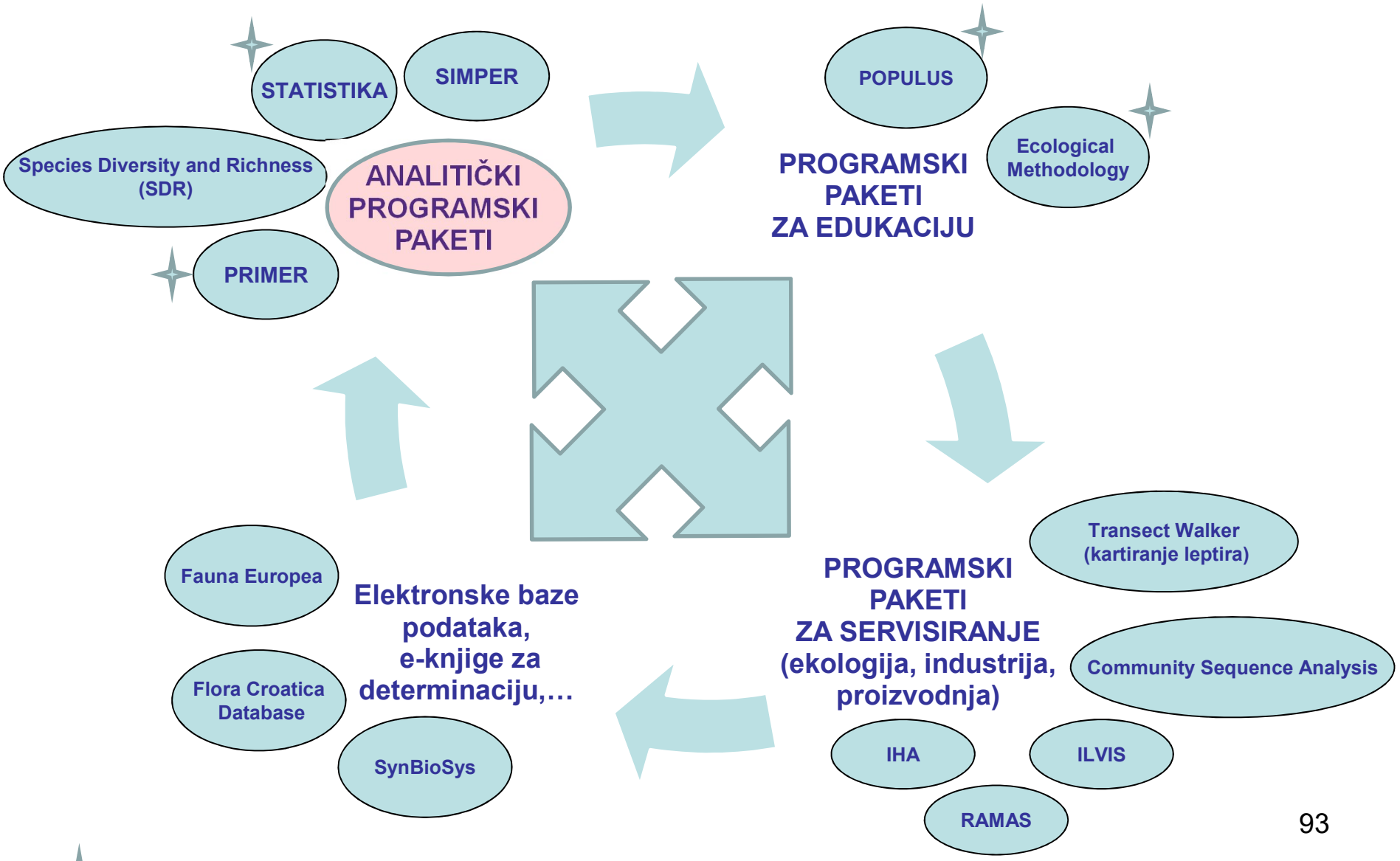


ELEKTRONSKE BAZE PODATAKA – HRVATSKA – NATURA 2000

http://natura2000.eea.europa.eu/#



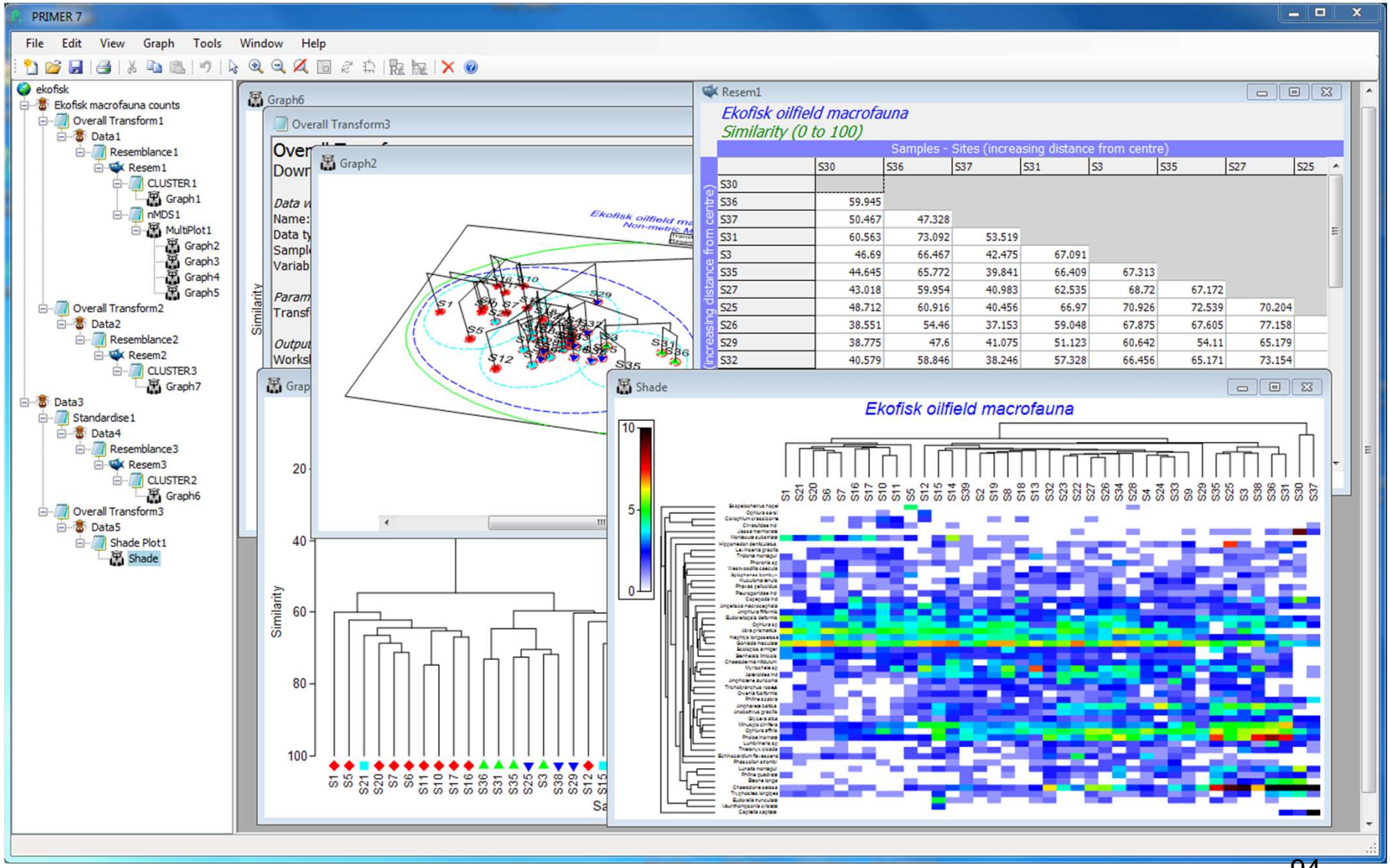
Korištenje programskih paketa



Bit će korišteni u okviru vježbi iz ovog kolegija!

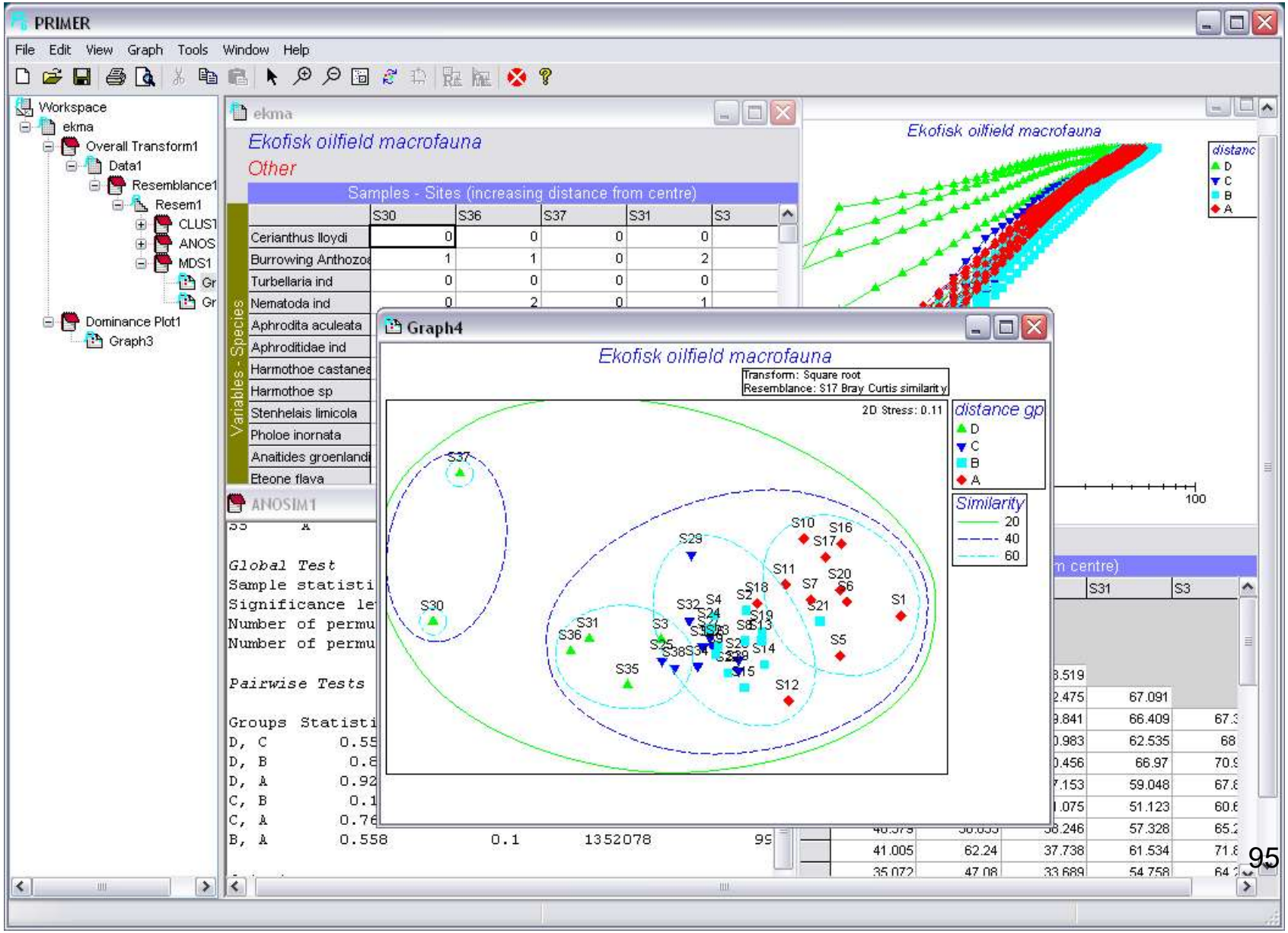
ANALITIČKI PROGRAMSKI PAKETI

PRIMER 7.1



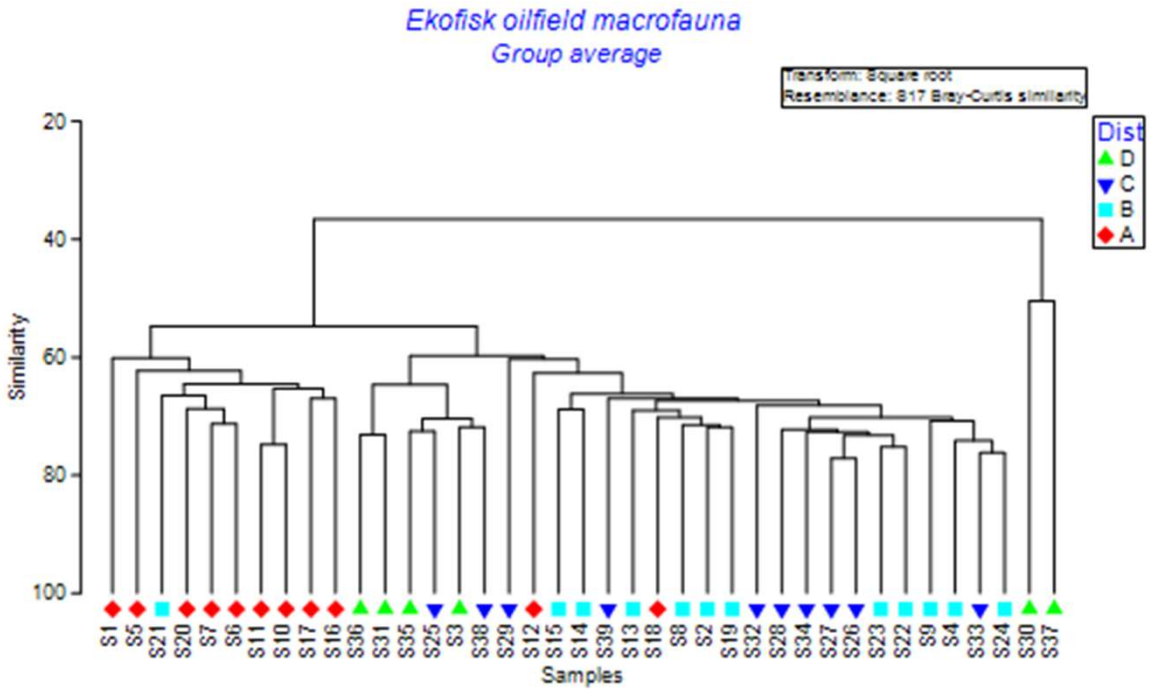
ANALITIČKI PROGRAMSKI PAKETI

PRIMER 7.1

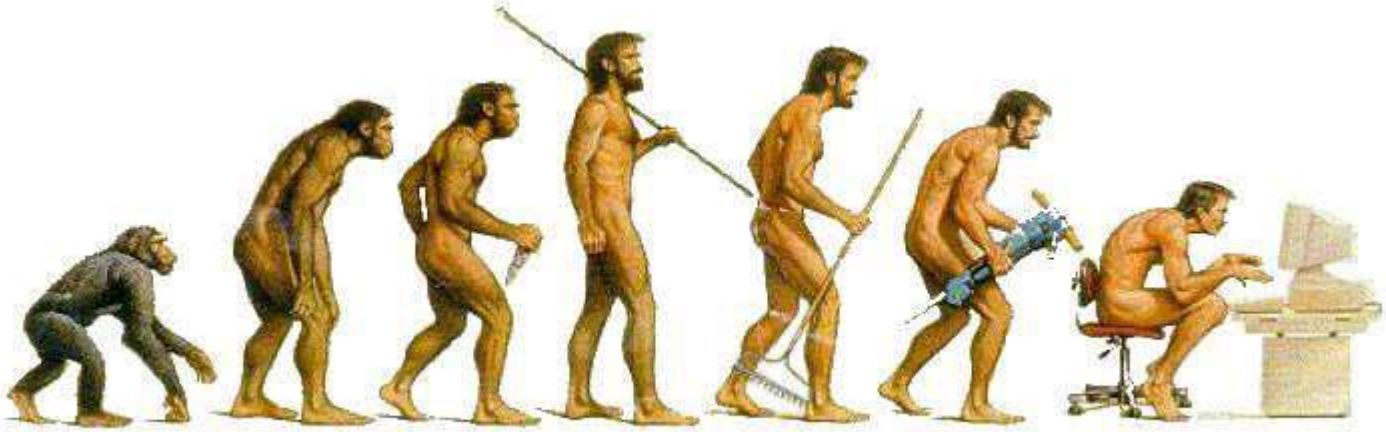


ANALITIČKI PROGRAMSKI PAKETI

PRIMER 7.1



http://primer-demo.software.informer.com/




CODE GREEN
¡e!
The Secretary of the Interior noted that American children spend a daily average of only four minutes outside.
Outside what?
©2009 Stephanie McMillan
¡e!

LITERATURA

dos Santos, J.S., Dodonov, P., Oshima, J.E.F., Martello, F., de Jesus, A.S., Ferreira, M.E., Silva-Neto, C.M., Ribeiro, M.C. and Collevatti, R.G., 2021. Landscape ecology in the Anthropocene: an overview for integrating agroecosystems and biodiversity conservation. *Perspectives in Ecology and Conservation*, *19*(1), 21-32.

Ro, T.H. and Hong, S.K., 2008. Landscape ecology for biodiversity. U: Hong, S.K., Nakagoshi, N., Fu, B.J. i Morimoto, Y. (ed.) *Landscape Ecological Applications in Man-Influenced Areas,* Springer, Dordrecht, str. 149-161.