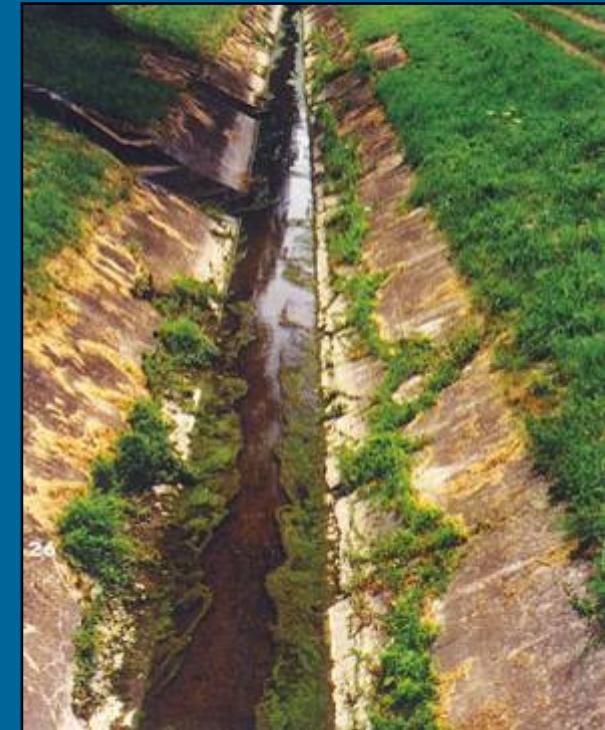


Building a Spatial Framework for the Analysis of Benthic Fauna Along the River Network of Switzerland



UNIVERSITÉ
DE GENÈVE

Lehmann¹ A., S., Stucki² P. and Gonseth³ Y.

¹University of Geneva, ²private consultancy, ³CSCF

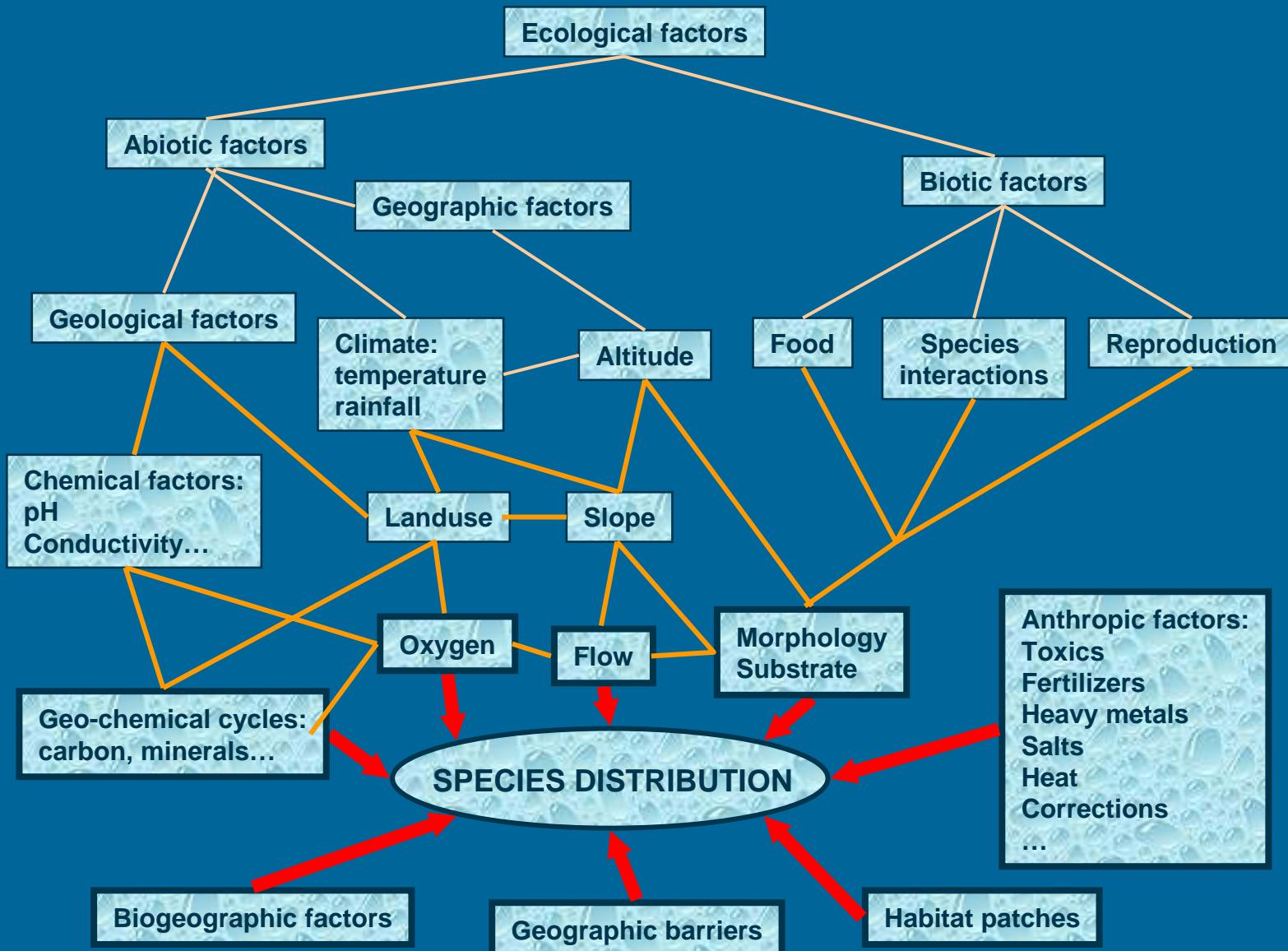
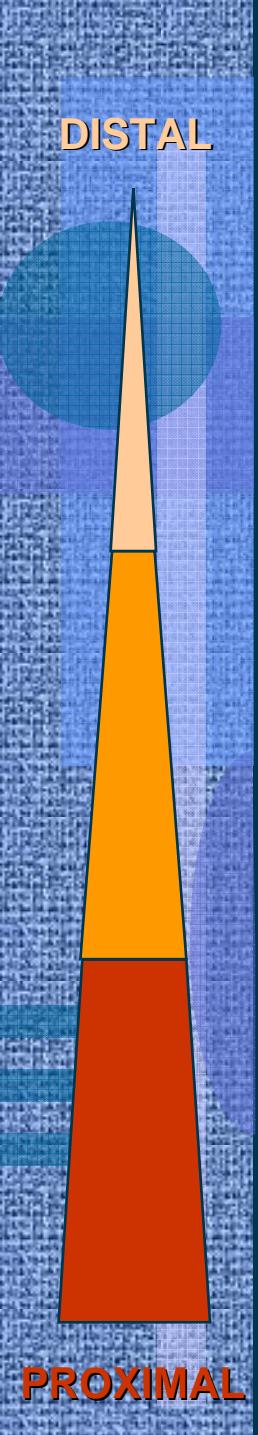


SWAT 2007 / June 5. 2007

- Introduction
- GIS spatial framework
- SWAT contribution
- Red lists of rare species
- Generalized Regression Analysis and Spatial Predictions
- Conclusions

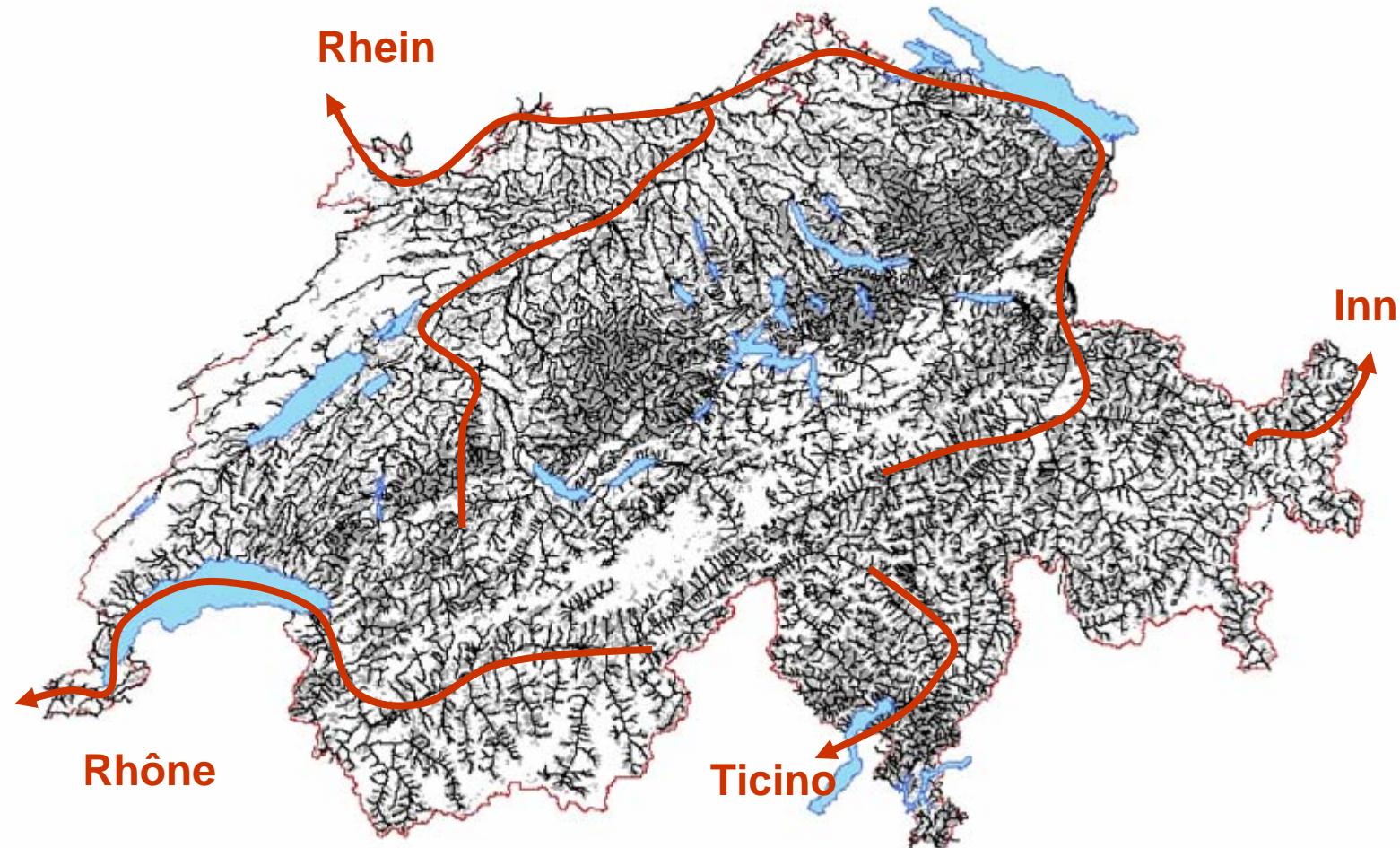


Introduction: conceptual model



Scale and Segmentation

Swiss rivers spatial framework



1:25'000: 186'000 segments, 64'000km 1:200'000: 60'000 segments, 23'000km

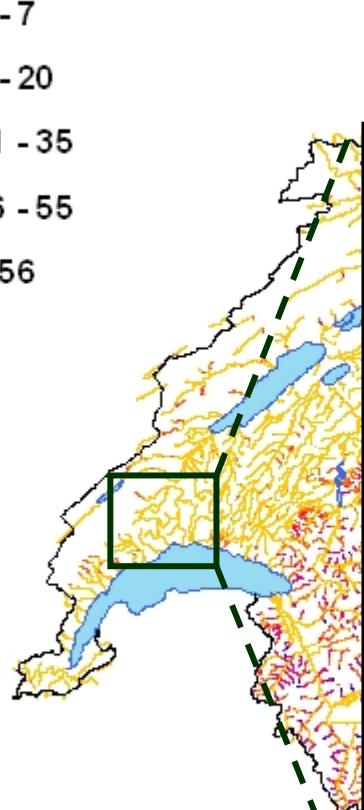
Switzerland: 41'285 km², alt. 193m-4634m, 4 main watersheds, pop. 7.5M, 178hab/km²

500m segments

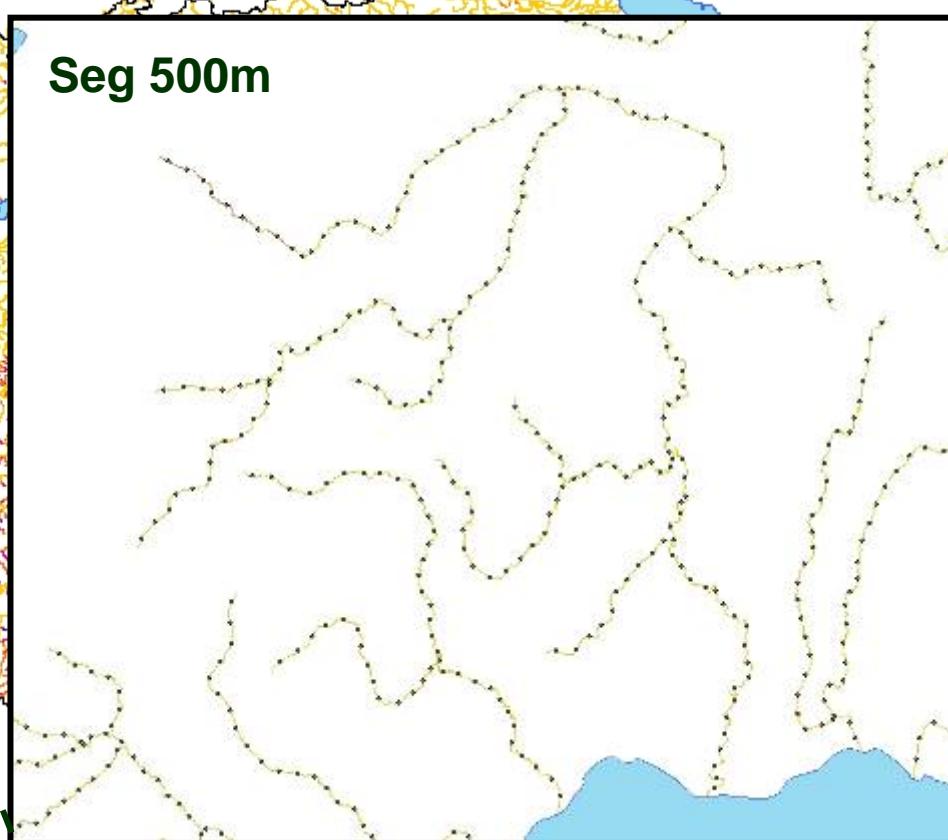
Scale and Segmentation

Slope

- 0 - 7
- 8 - 20
- 21 - 35
- 36 - 55
- > 56



Seg 500m



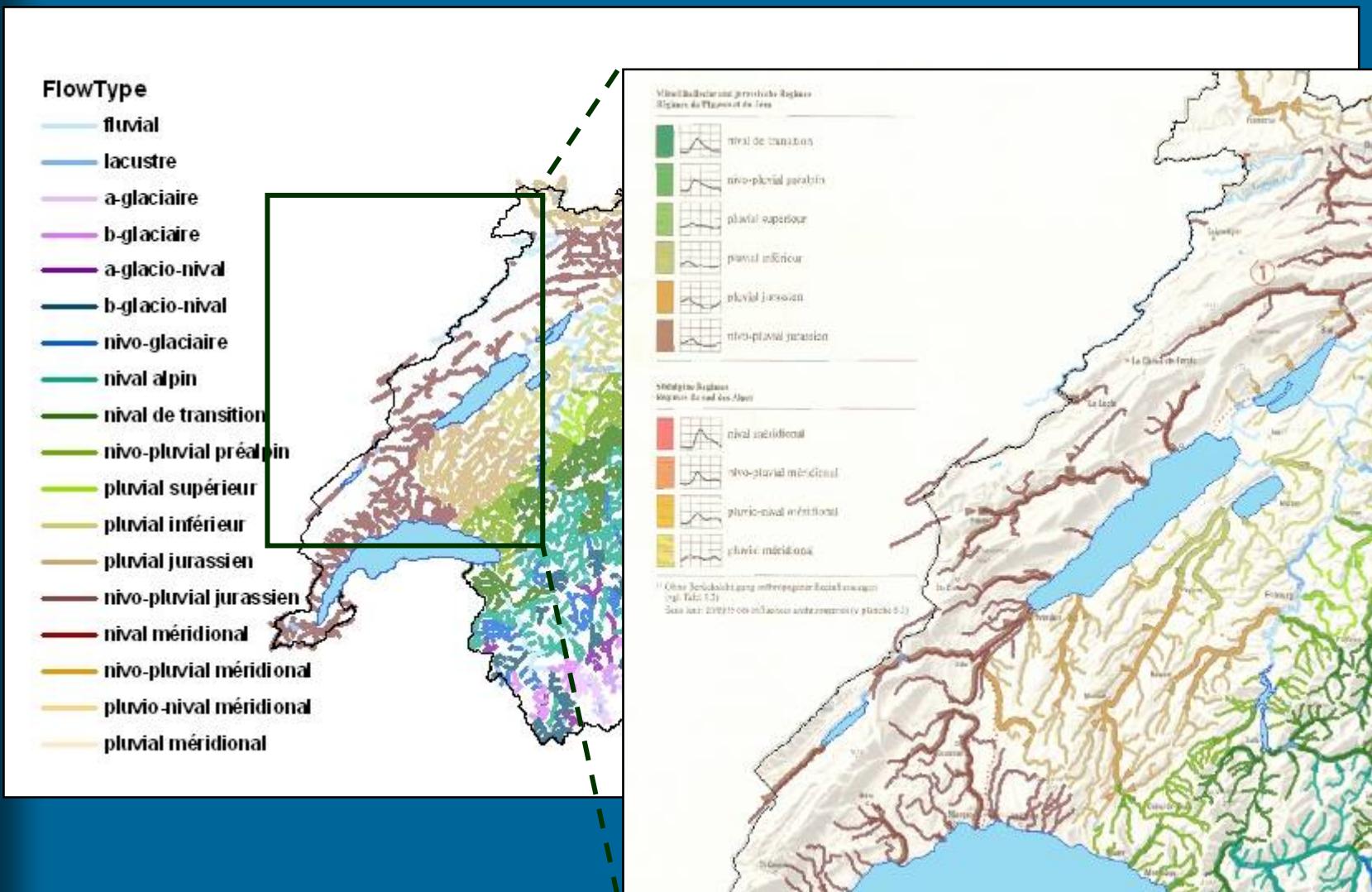
1/ dissolve with Gewiss ID

2/ split every 500m

3/ sample grids

Scale and Segmentation

Hydrological Atlas

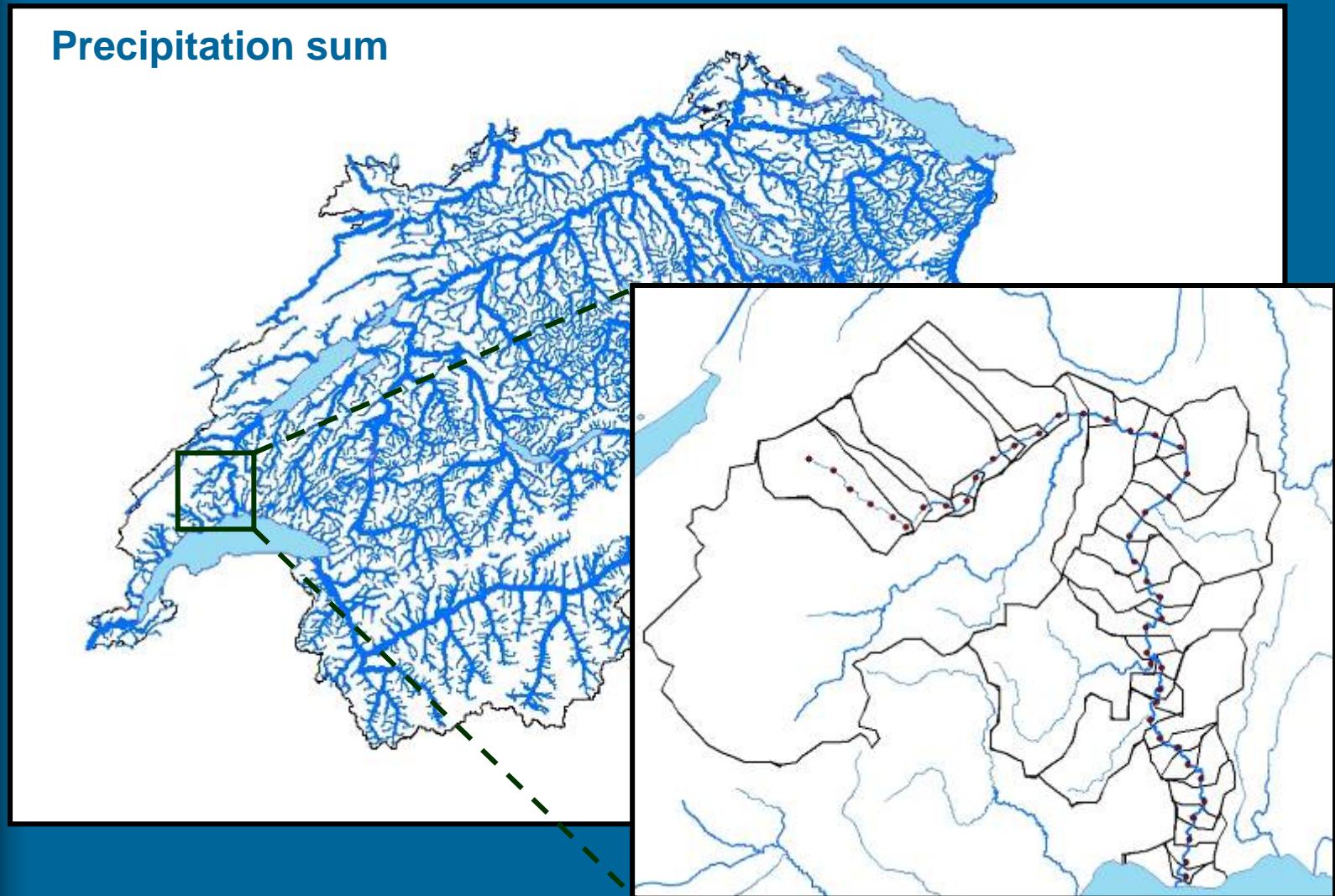


On screen digitalisation

1000m Watersheds

Scale and Segmentation

Precipitation sum

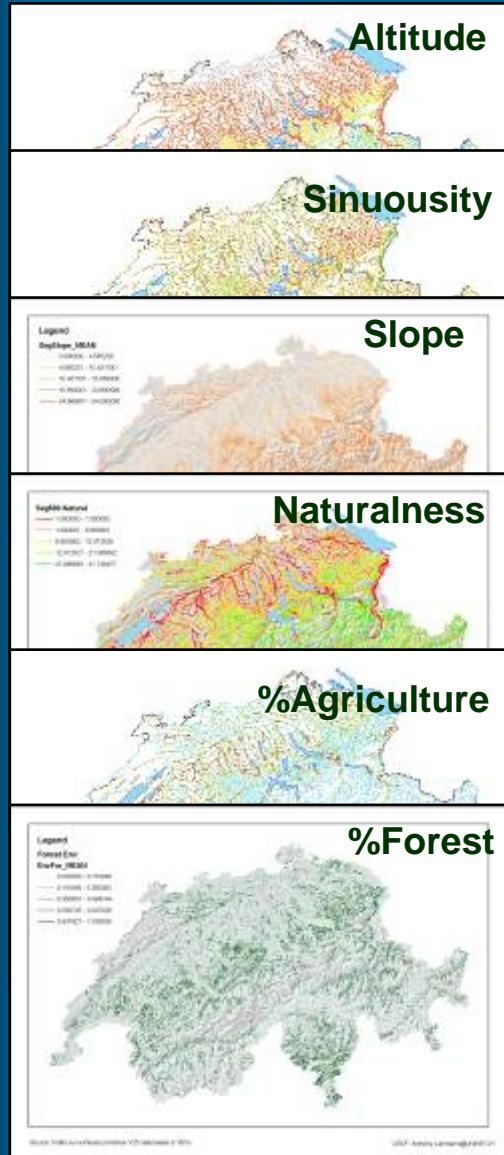


- 1/ script to delineate watersheds
- 2/ script to sample grid layers

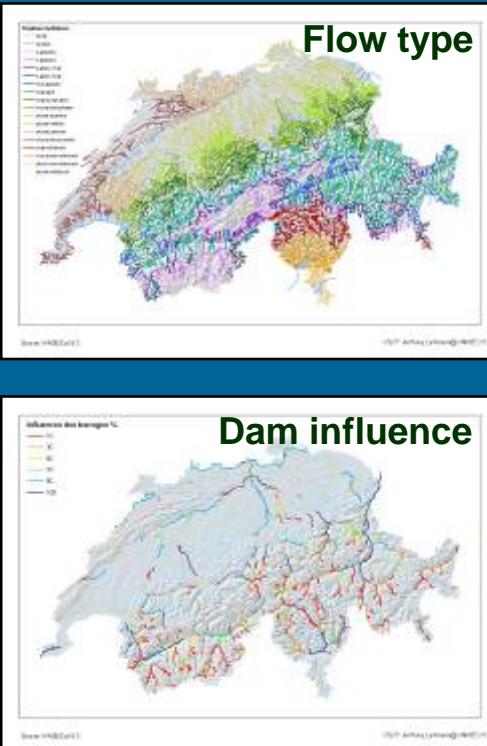
Available Predictors

Geodatabase

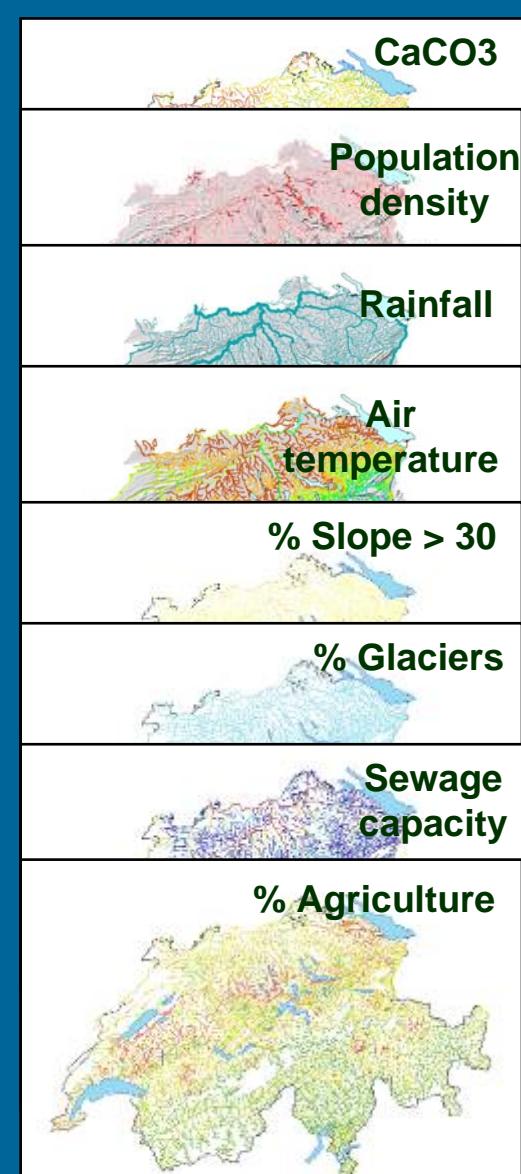
500m segments



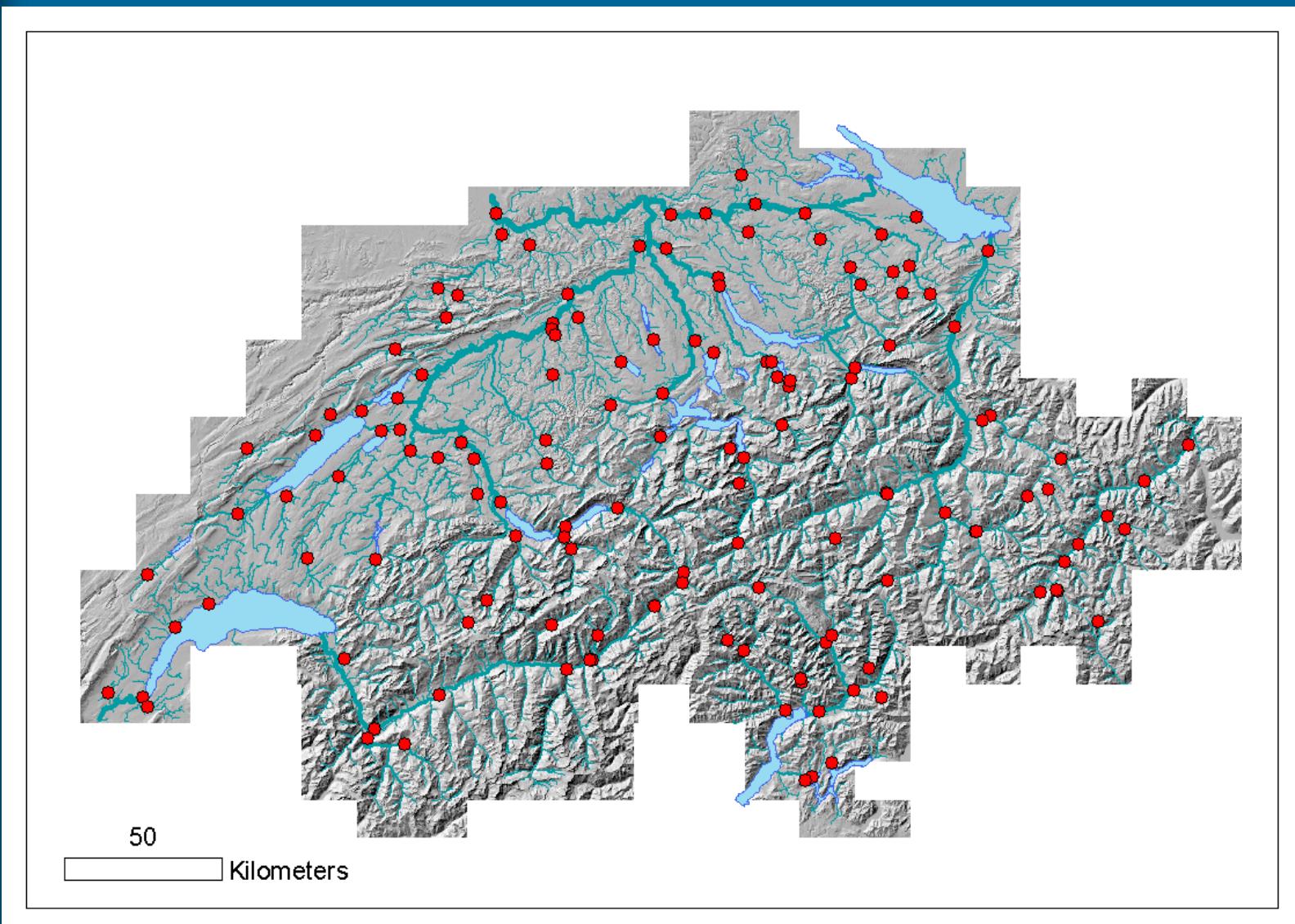
Hydrologic atlas



Watersheds (1000m)



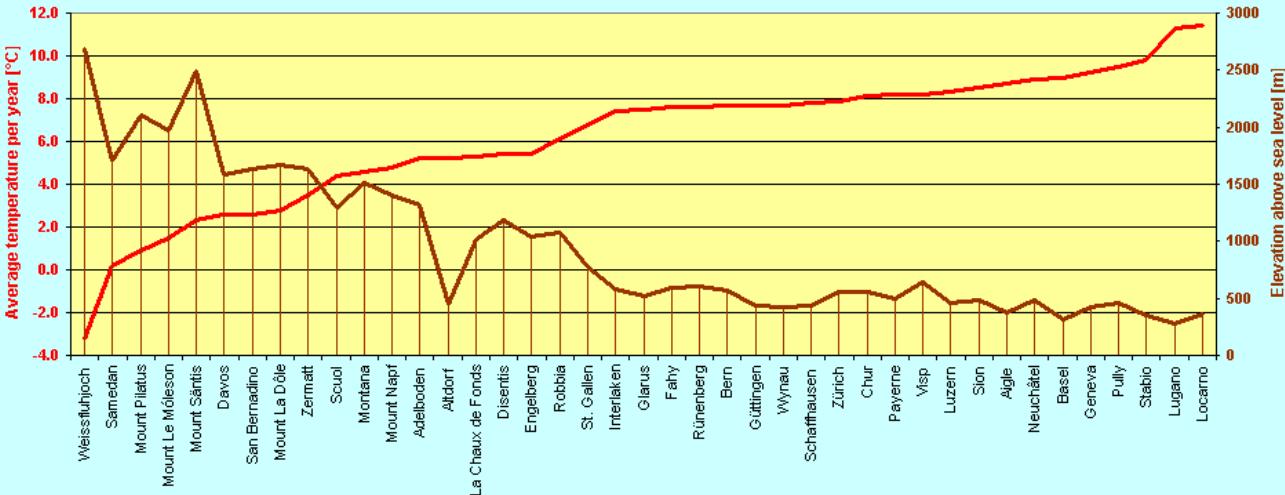
SWAT contribution



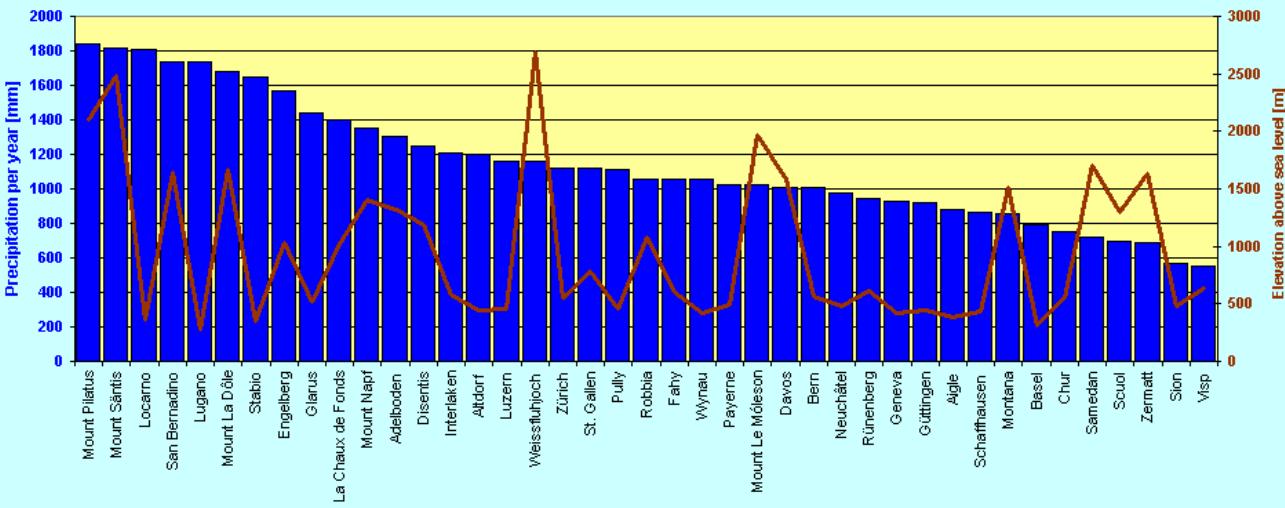
Swiss climate

Climate in Switzerland

Temperature in Switzerland



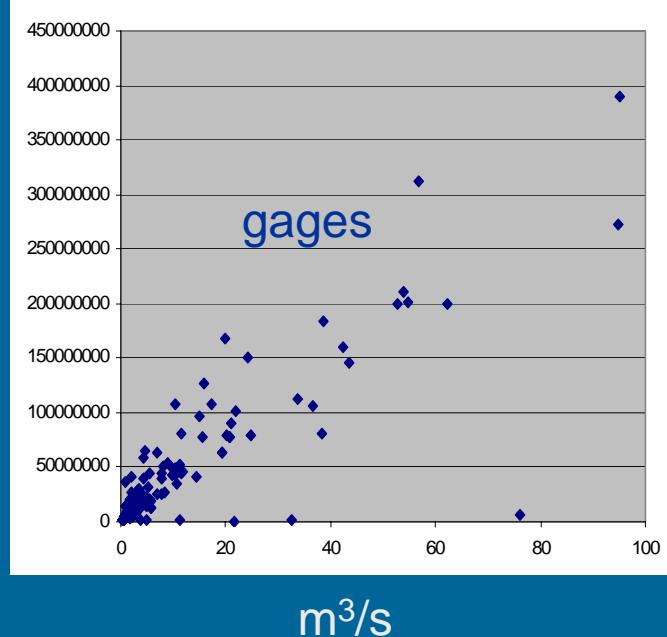
Precipitation in Switzerland



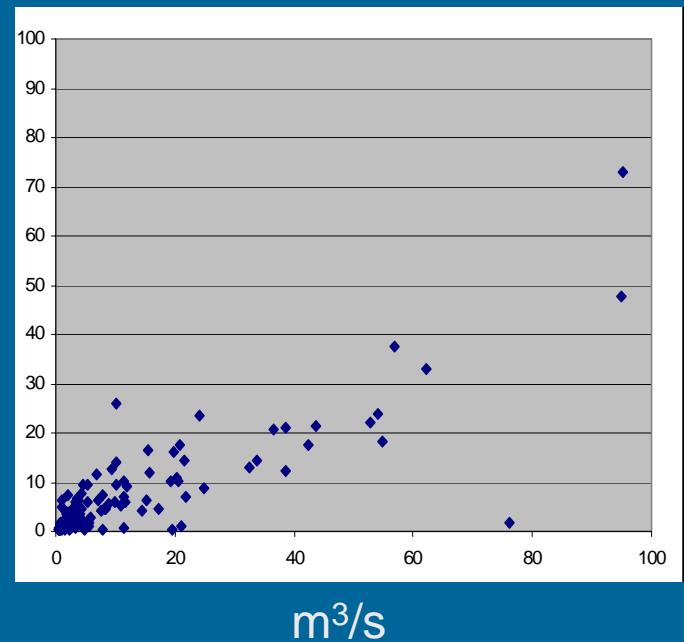
Comparing methods on annual flow

Relative scale

SUM of PRECIPITATION



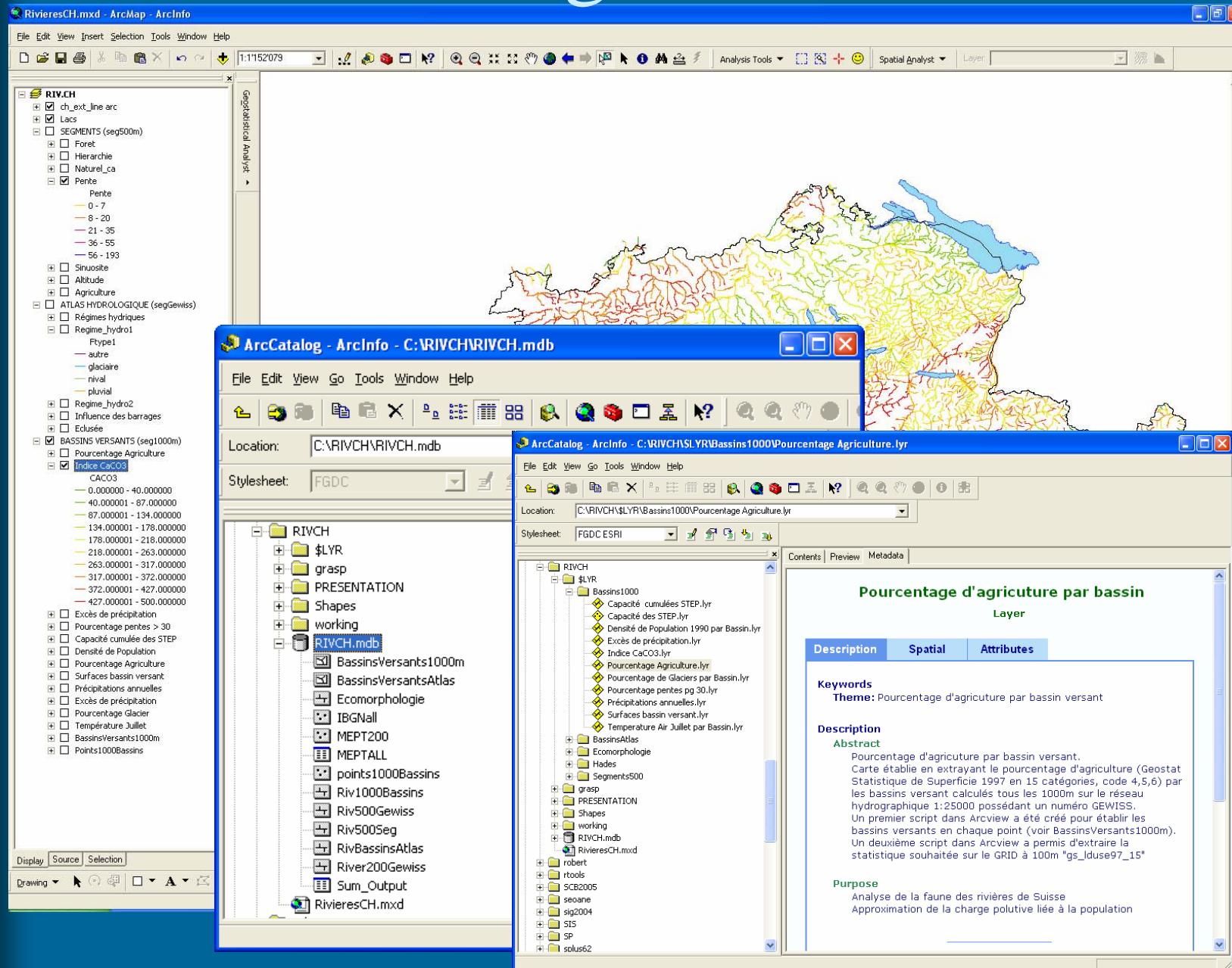
SWAT



SWAT

A proper calibration is under way !

ArcGIS geodatabase



Red list for MEPT species

Molluscs

Ephemeropters

Plecopters

Tricopters

- New red list status
- Length of suitable rivers
- Several hundred species

IUCN Red List of Threatened Species - Microsoft Internet Explorer

Sicher Editer Speicher Regeln Quitt Z

IUCN **SSC**  Resources Review Committee

Alcohol IUCN | Our work | Committees | Members | Regions | Stay informed | Get involved

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2006 IUCN Red List of Threatened Species

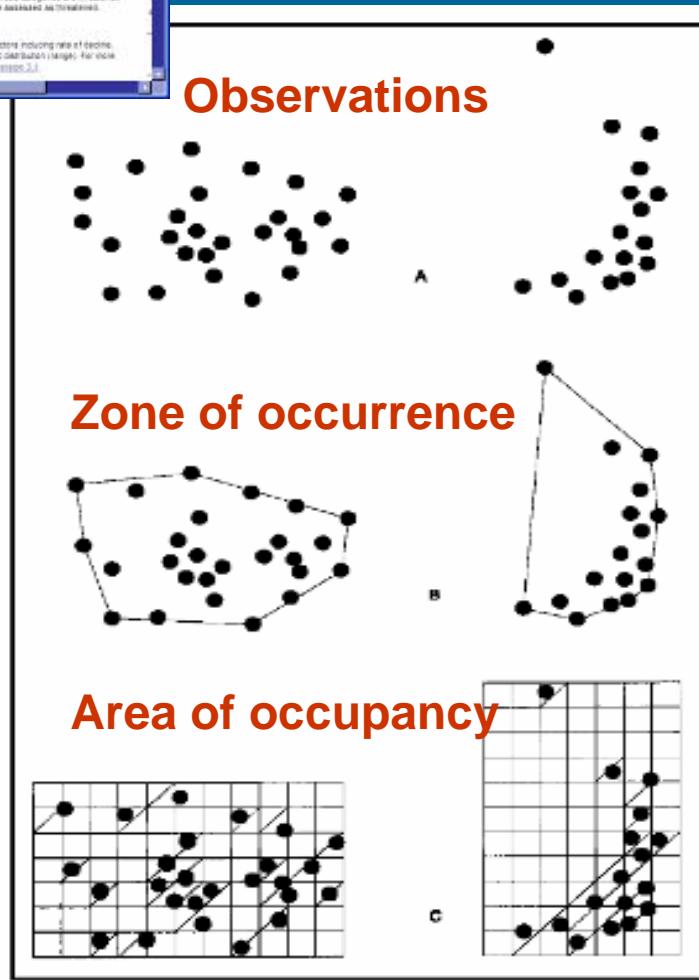
How do species enter the Red List and who decides? Approved experts assess species based on five qualitative criteria and then classify the species into one of 9 categories in the IUCN Red List.

What do the categories mean? Categories are considered to be "Conservation status" (Critically Endangered, Endangered and Vulnerable). Species in these categories are threatened with greater extinction and survival risk. 16,779 species are assessed as threatened.

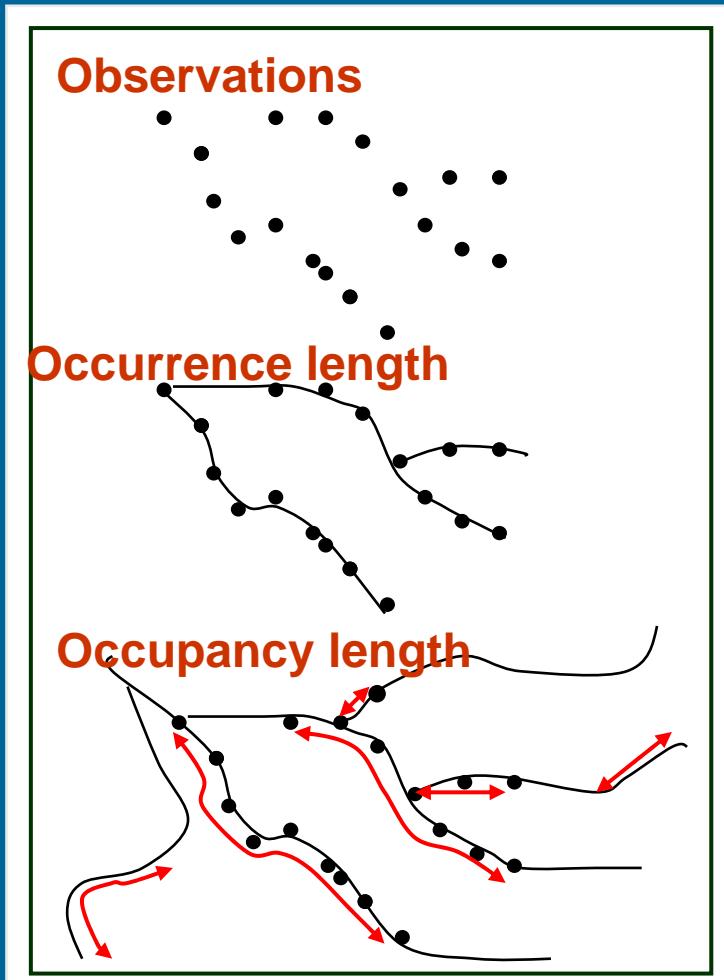
What are the decisions based upon? The criteria are based on a combination of biological factors including rate of decline, population size, area of occupancy and area of potential distribution range. For more detail see the [Red List Criteria and Criteria Toolkit version 3.1](#).

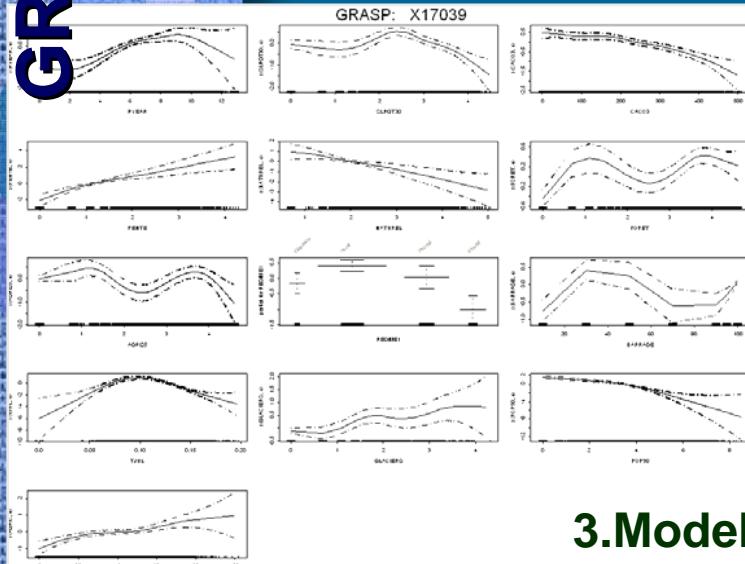
IUCN Red lists criteria: Extent of occurrence

Land

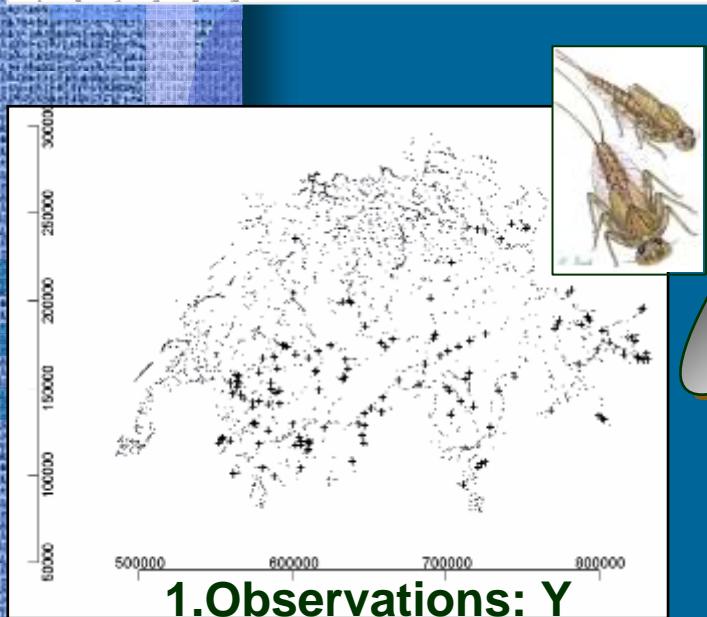


Rivers

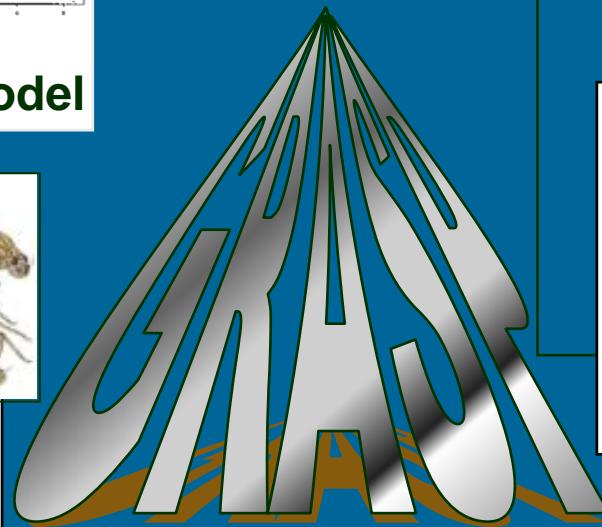




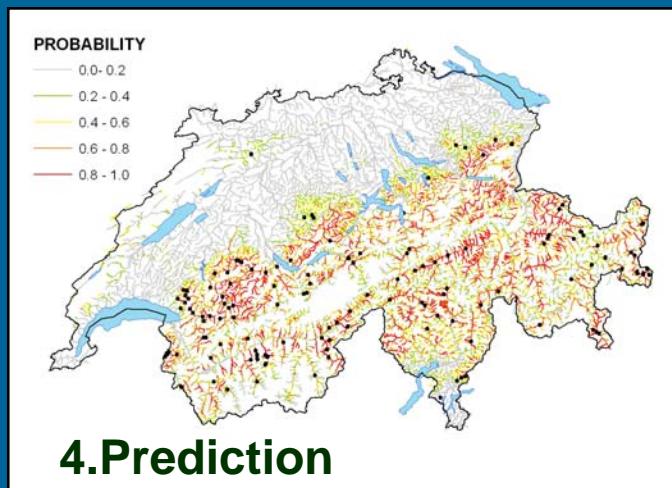
1.Observations: Y



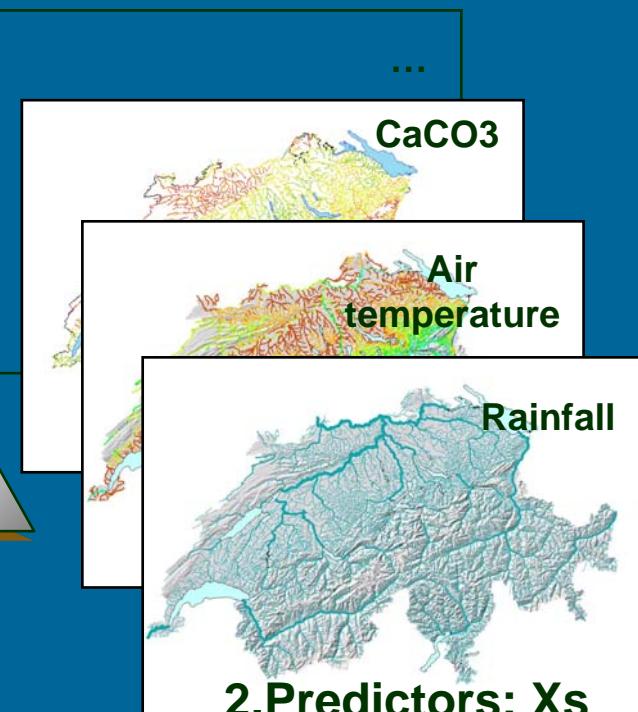
3.Model



Lehmann et al., Ecol. Mod. 2002



2.Predictors: Xs



Type of responses

Data

Presence only:

Distribution

pseudo 0
> binomiale

Distributions



**Presence
absence:**

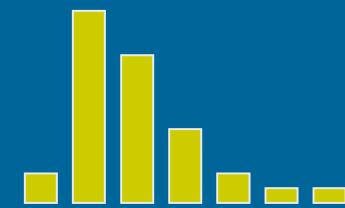
binomiale



**Abundance:
Richness:**

Poisson

Poisson



Cover :

binomiale

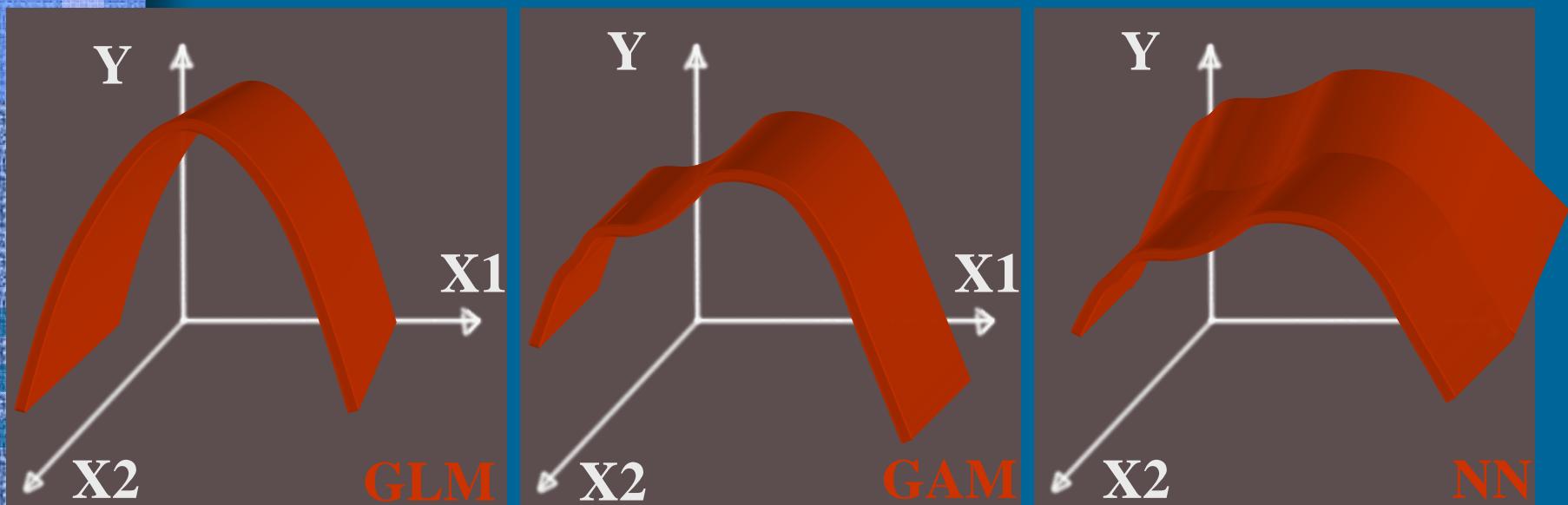


Biomass :

normale



Statistical Models

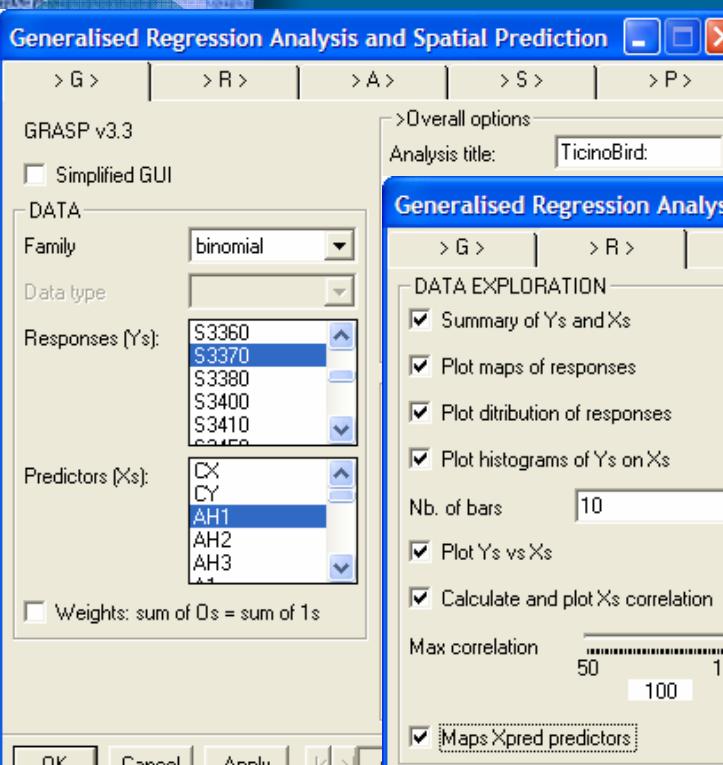


Inference

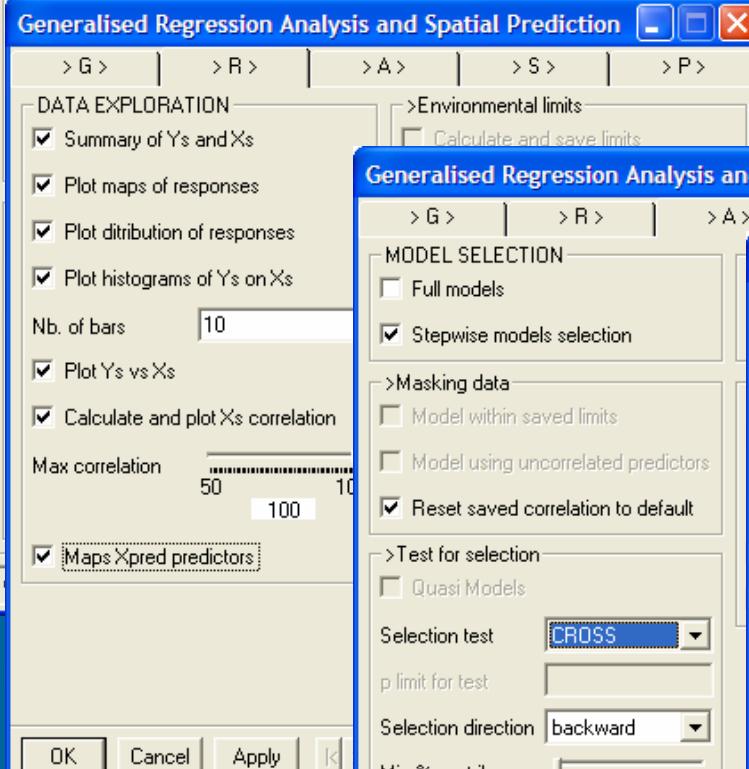
Prediction

Running GRASP from Splus GUI

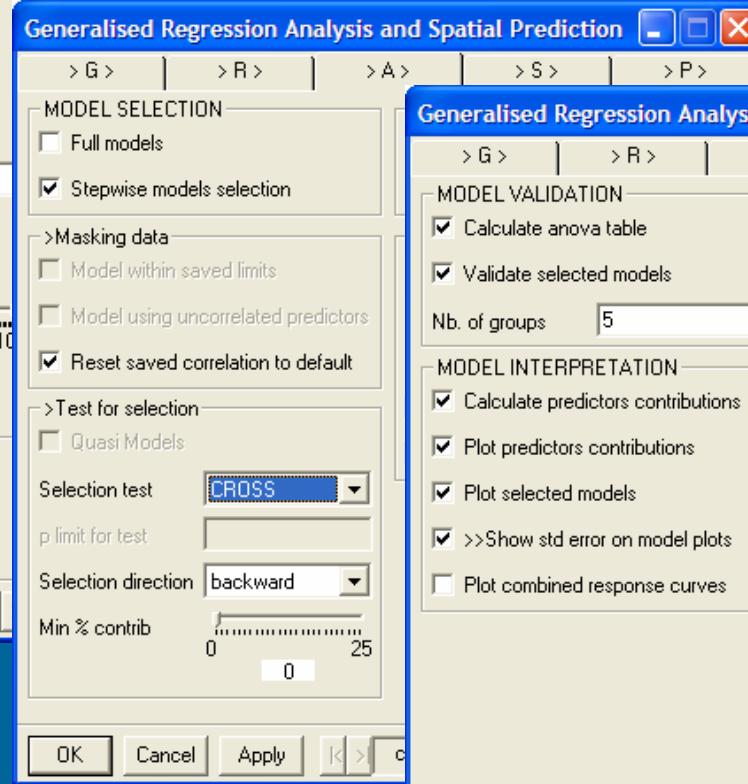
Choice of Ys and Xs



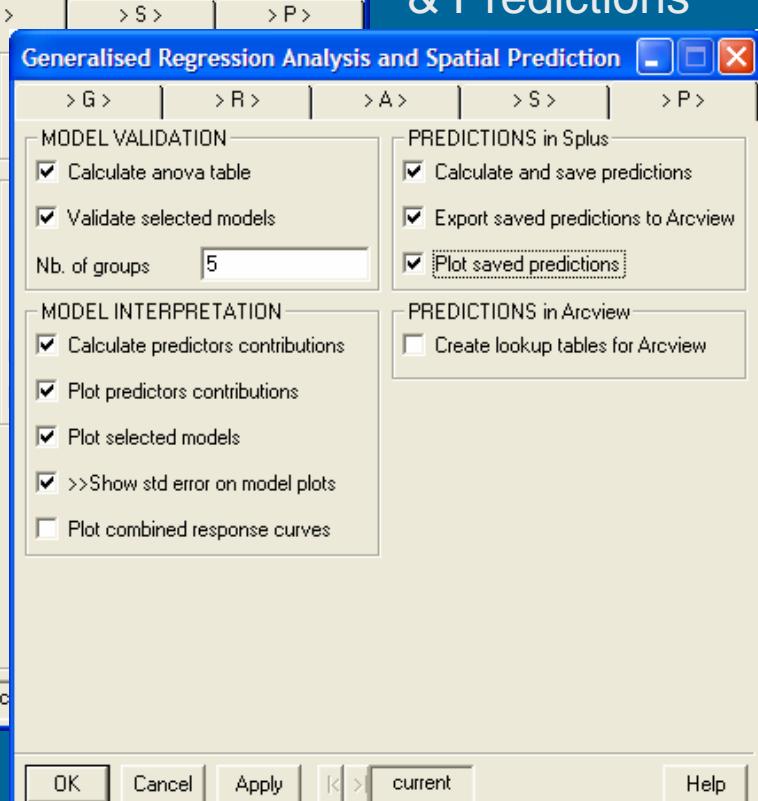
Data exploration



Selection methods



Interpretation & Predictions



Website

Welcome to GRASP - Microsoft Internet Explorer

Fichier Edition Affichage Favoris Outils ?
Précédente ▶ Rechercher Favoris H Historique Imprimer Nouveau F12 Aide
Adresse : http://www.unige.ch/ia/climate/grasp/ OK Liens >

USER GROUP


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UNIVERSITÉ DE GENÈVE

Generalized Regression Analysis and Spatial Prediction

GRASP DOWNLOADS:

***** GRASP- R v.2.5 *****

GRASP-R v.2.5: this R version is available through CRAN server under the name "grasp".
<http://www.r-project.org/>

***** GRASP- S v.3.3 *****

SPLUS SCRIPT : [graspdump v3.3.ssc](#) (tested for Splus6.x and Splus 2000)

TRIAL DATASETS: [trialdata_v3.zip](#) (some fake data from Switzerland to get started)
(Splus *.sdd format to be opened from the OPEN item in the FILE menu)

MDA LIBRARY: [mixture discriminant analysis \(and BRUTO and MARS\)](#), (Trevor Hastie, Rob Tibshirani)

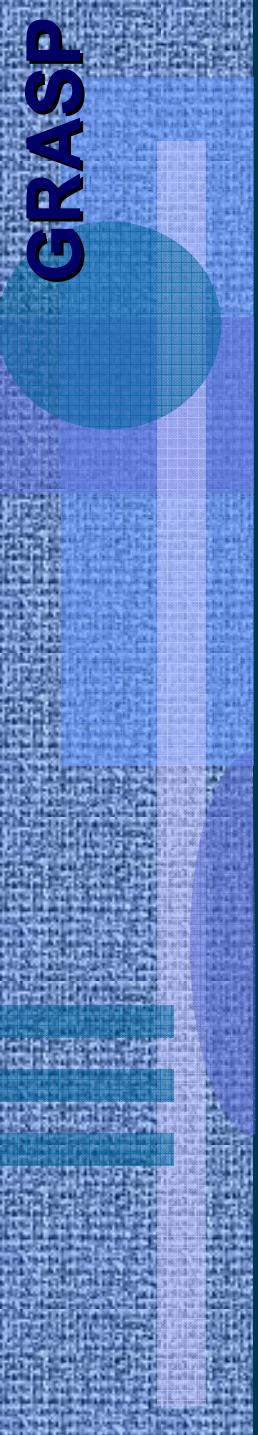
USER MANUAL: [GRASP_ME v3.2.pdf](#)

DE CARTOGRAPHIE DE LA FAUNE CENTRE SUISSE CSCF/SZKF

Manaki Whenua Landcare Research

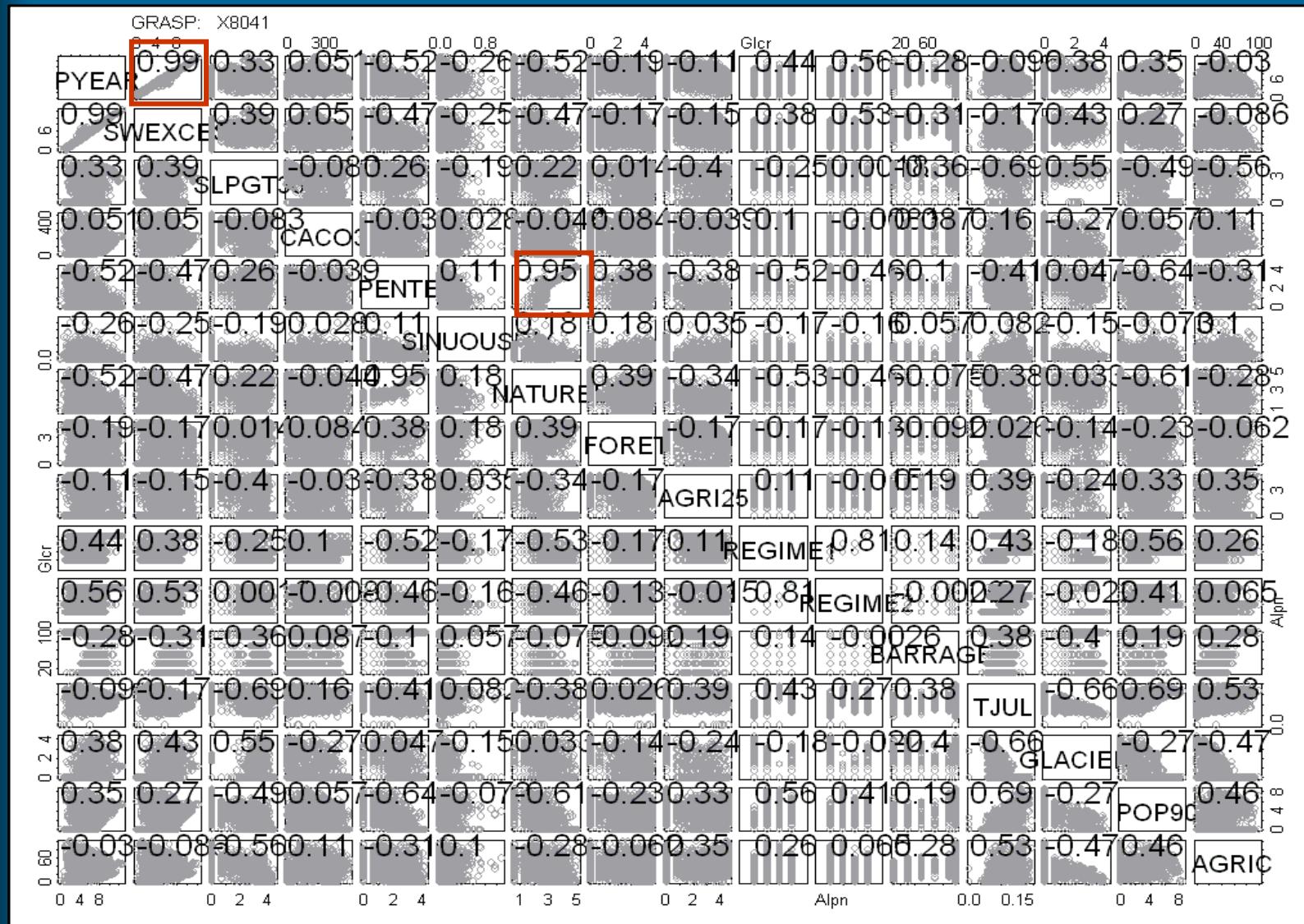
R version

Splus version

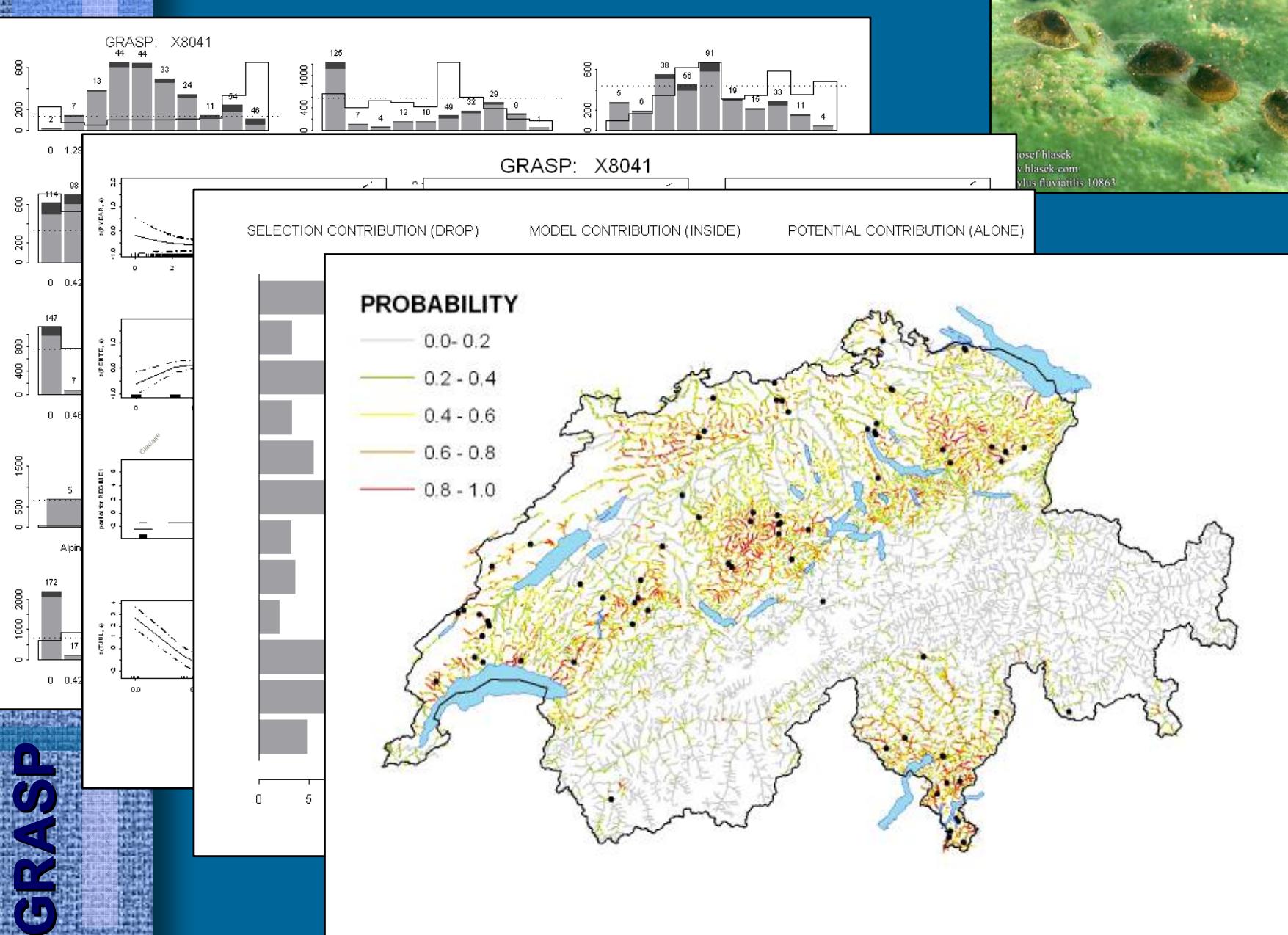


<http://www.unige.ch/ia/climate/grasp>

Correlation between predictors

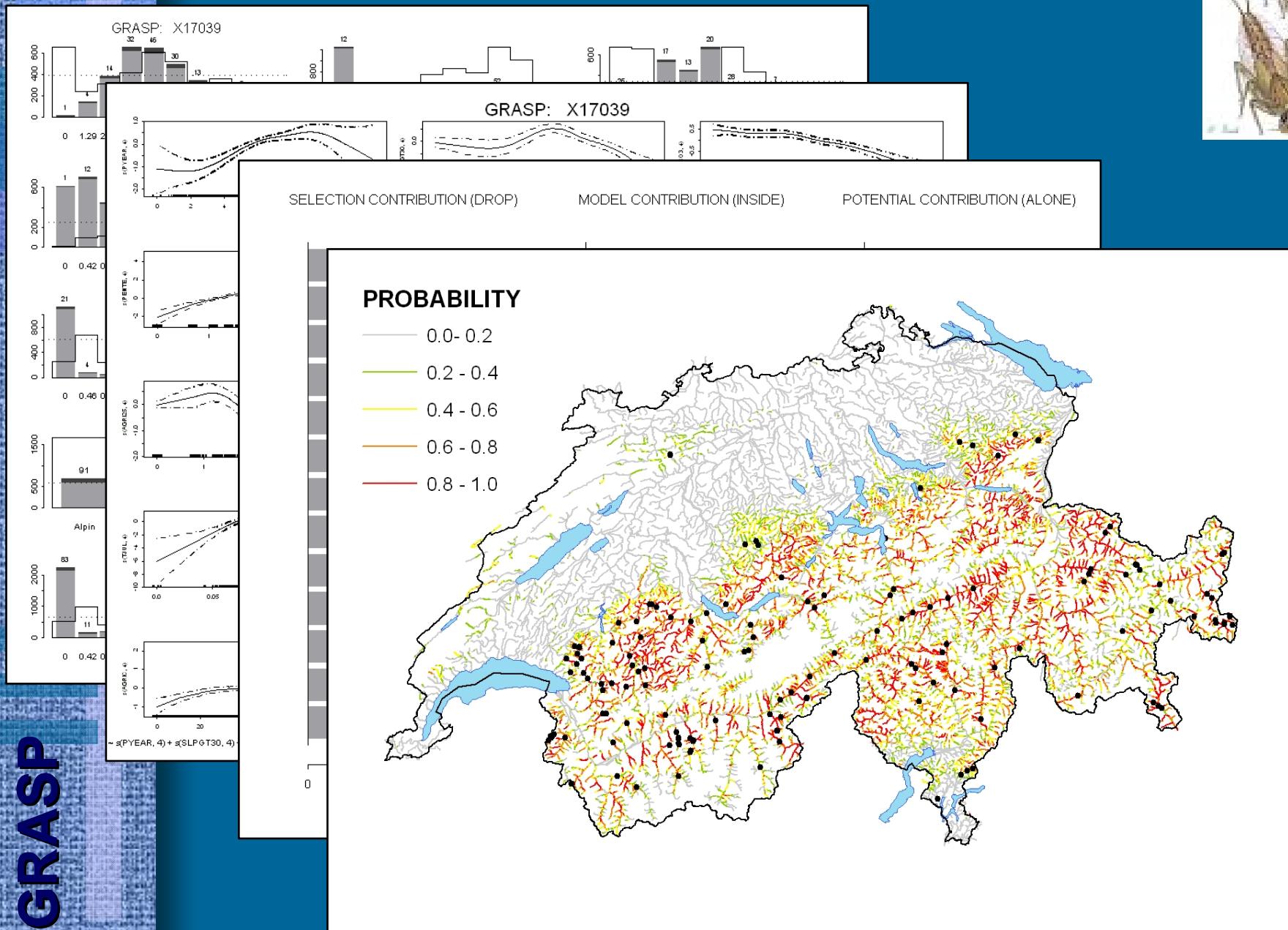


Ancylus fluviatilis



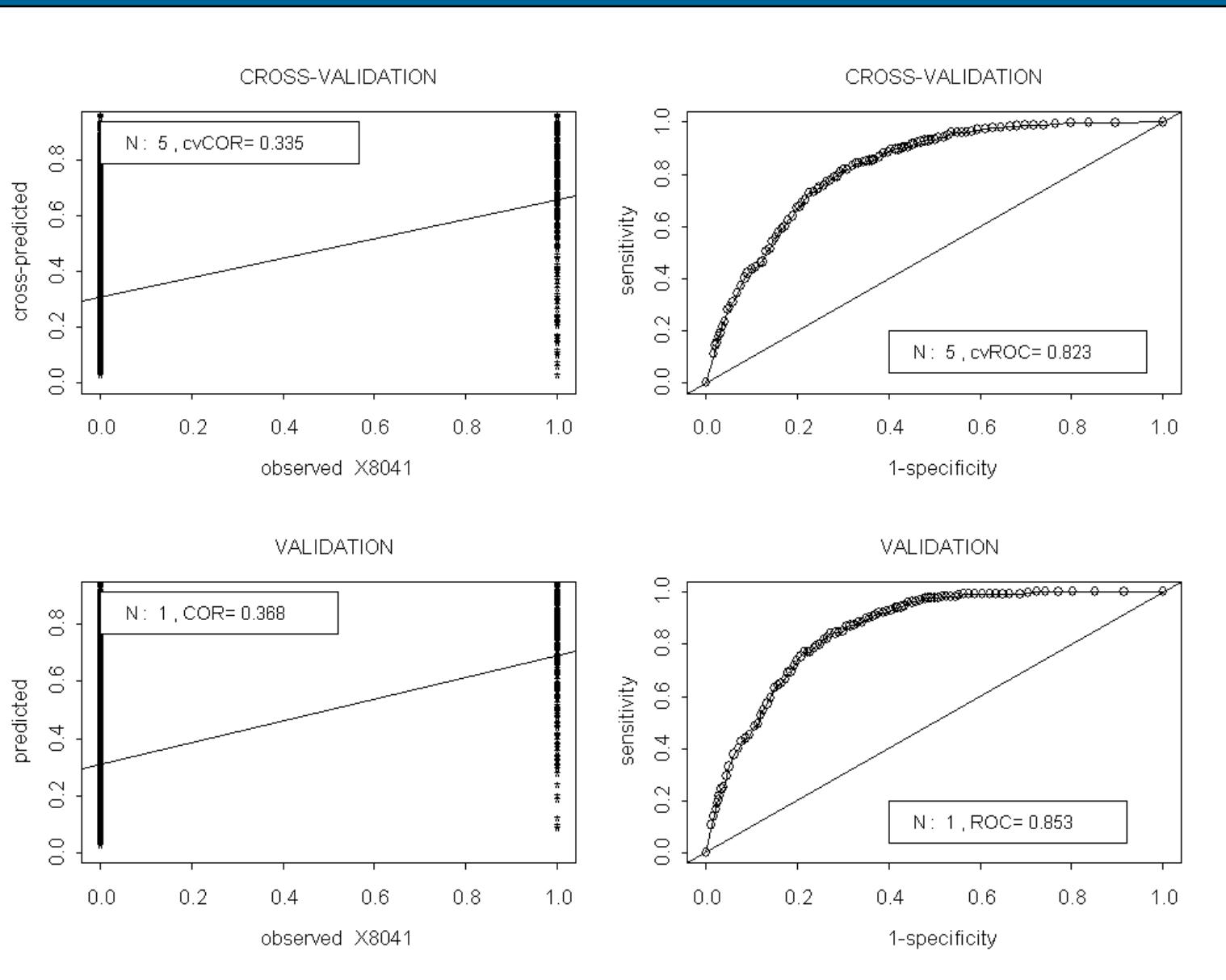
GRASP

Epeorus alpicola

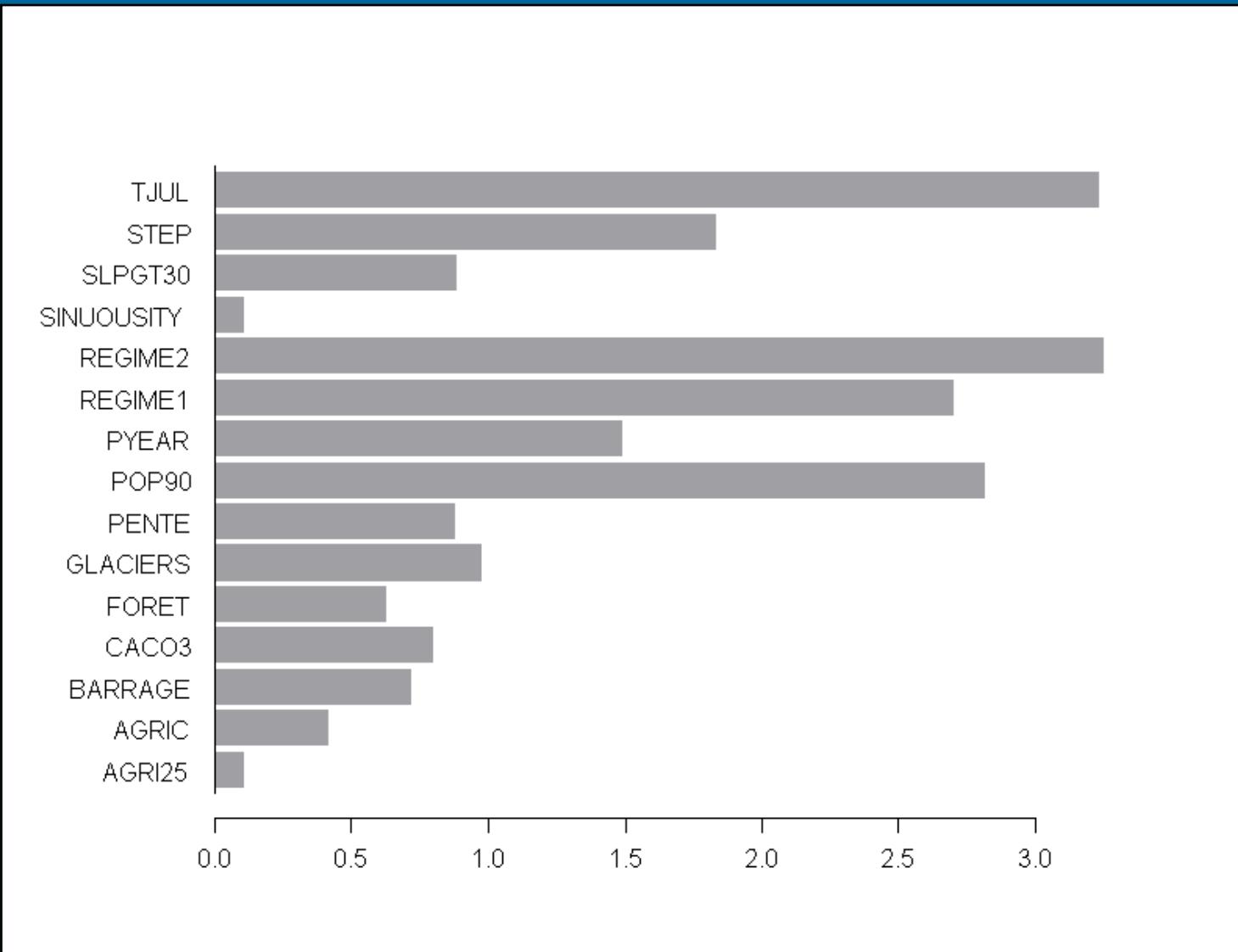


Statistical validation

GRASP



Mean contribution on 326 species



Next tasks

- Improve soil database
- Run SWAT on separate the watersheds to increase resolution
- Proper calibration, sensitivity analysis
- Extract water temperature data for every reach
- Re-run GRASP species models
- Evaluate species length of occupation

Conclusions

- SWAT could greatly contribute to the study and modeling of river invertebrates' distribution.
- The combination with true climatic data will allow taking into account river floods and droughts, as well as simulating the impact of future climatic changes.
- GRASP is an interesting companion to SWAT in order to extrapolate point measurements such as species observations to an entire river network.
- SWAT+GRASP should allow defining species red lists criteria in terms of length of available river for every species

Thanks

Acknowledgements:

Dr. F. Cordillot (OFEV),

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Dr. J. Leathwick (NIWA),

Dr. R. Caloz (EPFL),

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Numerous and indispensable species data providers

