Pôle hydroécologie
cours d'eau

ONEMA
Office national de l'eau et des milieux aquatiques

Cemagref
Sciences, eaux & territoires

Riparian corridors and stream ecological status: relationships and methodologies.

Villeneuve B. , Tormos T., Mengin N., Chandesris A.,

Souchon Y. (speaker)

yves.souchon@cemagref.fr

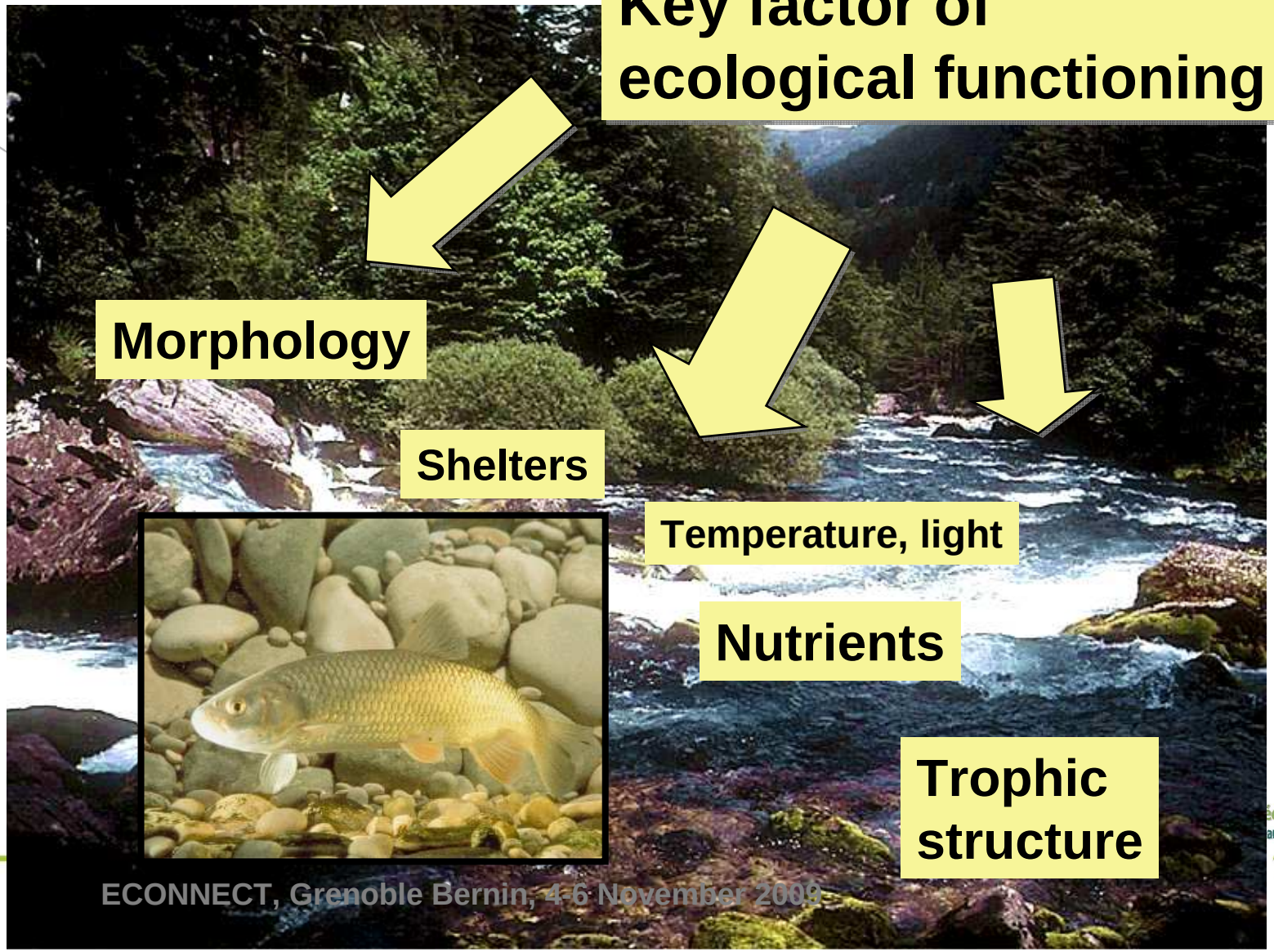
ECONNECT, Grenoble/Bernin 4-6 november 2009

In memory of J.G. Wasson

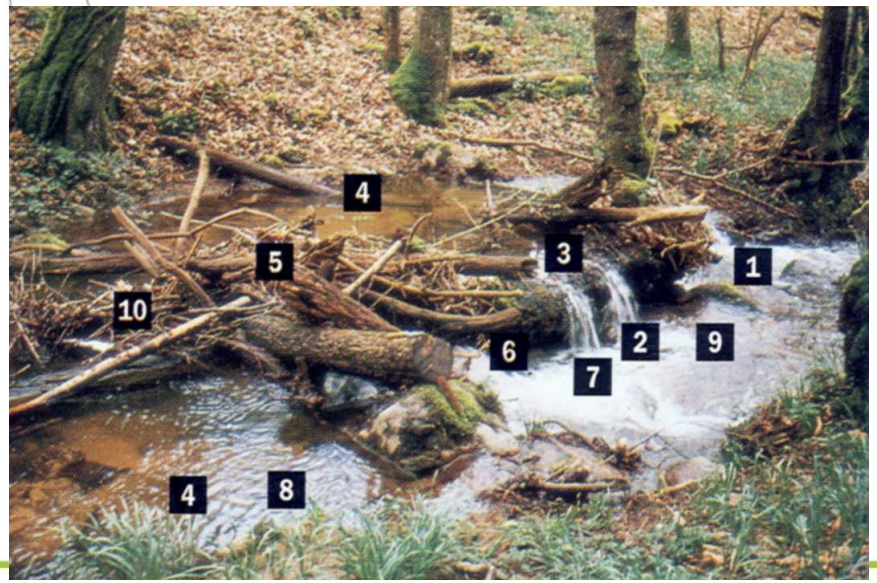
- 1. Riparian areas and stream ecological functioning
- 2. Large scale analysis of ecological status (sensu WFD) to land cover in stream corridor
- 3. Future analysis and tools

The Riparian corridor

Key factor of ecological functioning



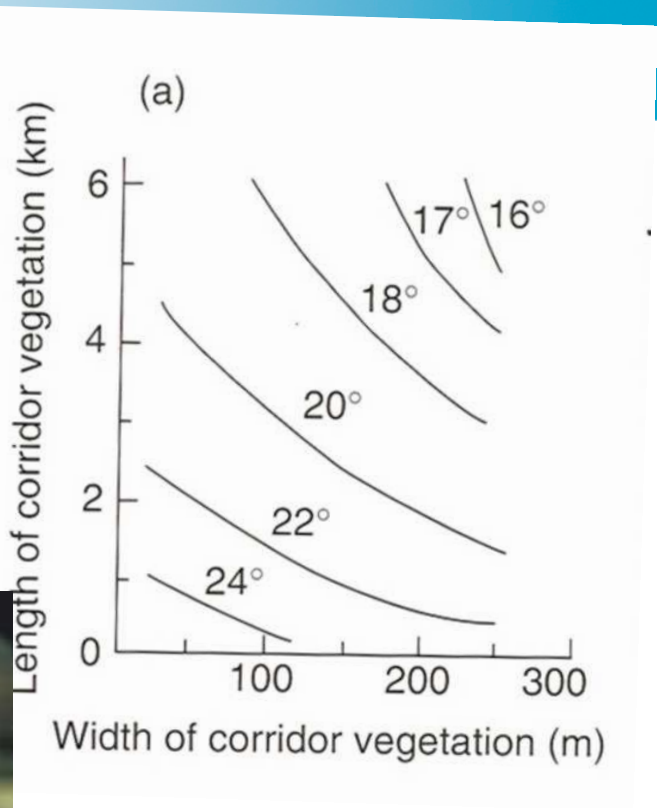
Aquatic habitat Diversification



Fish in trees…

Pôle hydroécologie cours d'eau
ONEMA Office national de l'eau et des milieux aquatiques
Cemagref Sciences, eaux & territoires

Temperature regulation



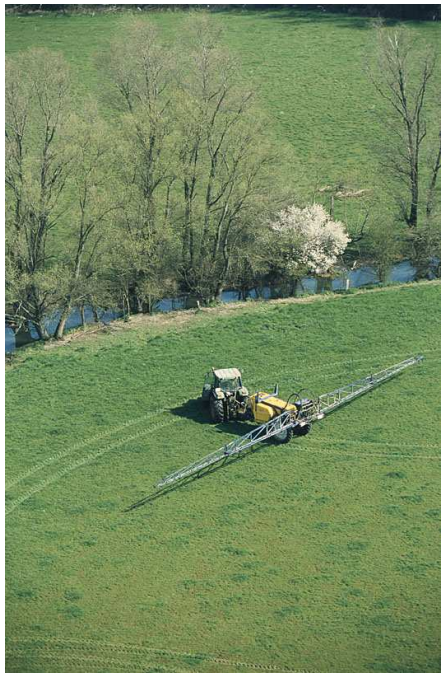
Pôle hydroécologie cours d'eau
ONEMA Office national de l'eau et des milieux aquatiques
Cemagref Sciences, eaux & territoires

Water Quality Regulation

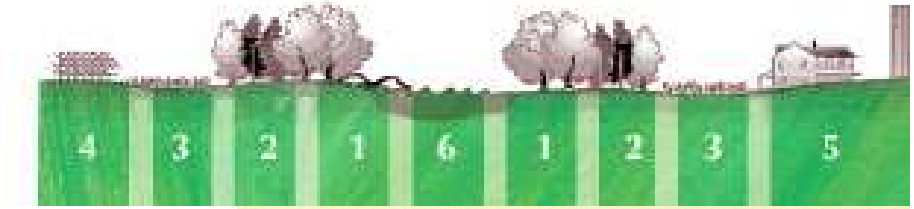
- Biochemical processes

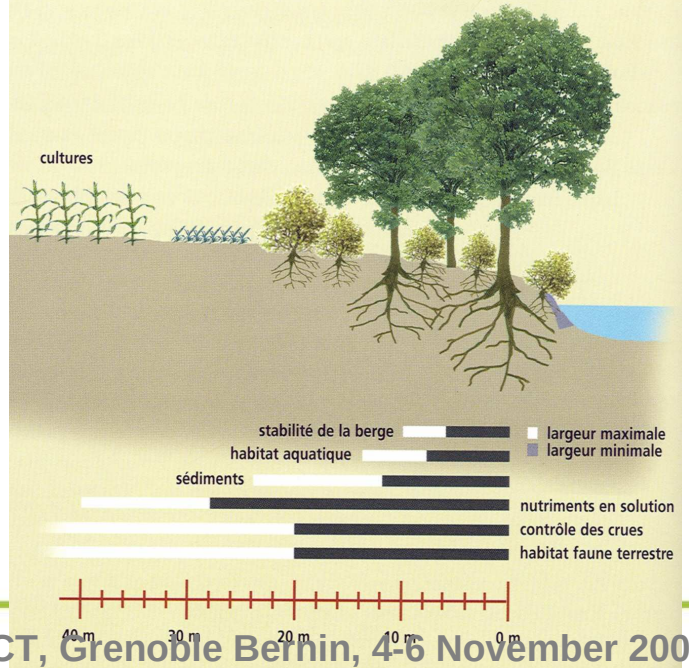
Pollutants interception, recycling

  - Protecting buffer zones :
    - **Nitrates**, phosphorus, sediments, **pesticides**
    - ***Good agricultural practices already needed!***
  - Purification functions



Process optimization





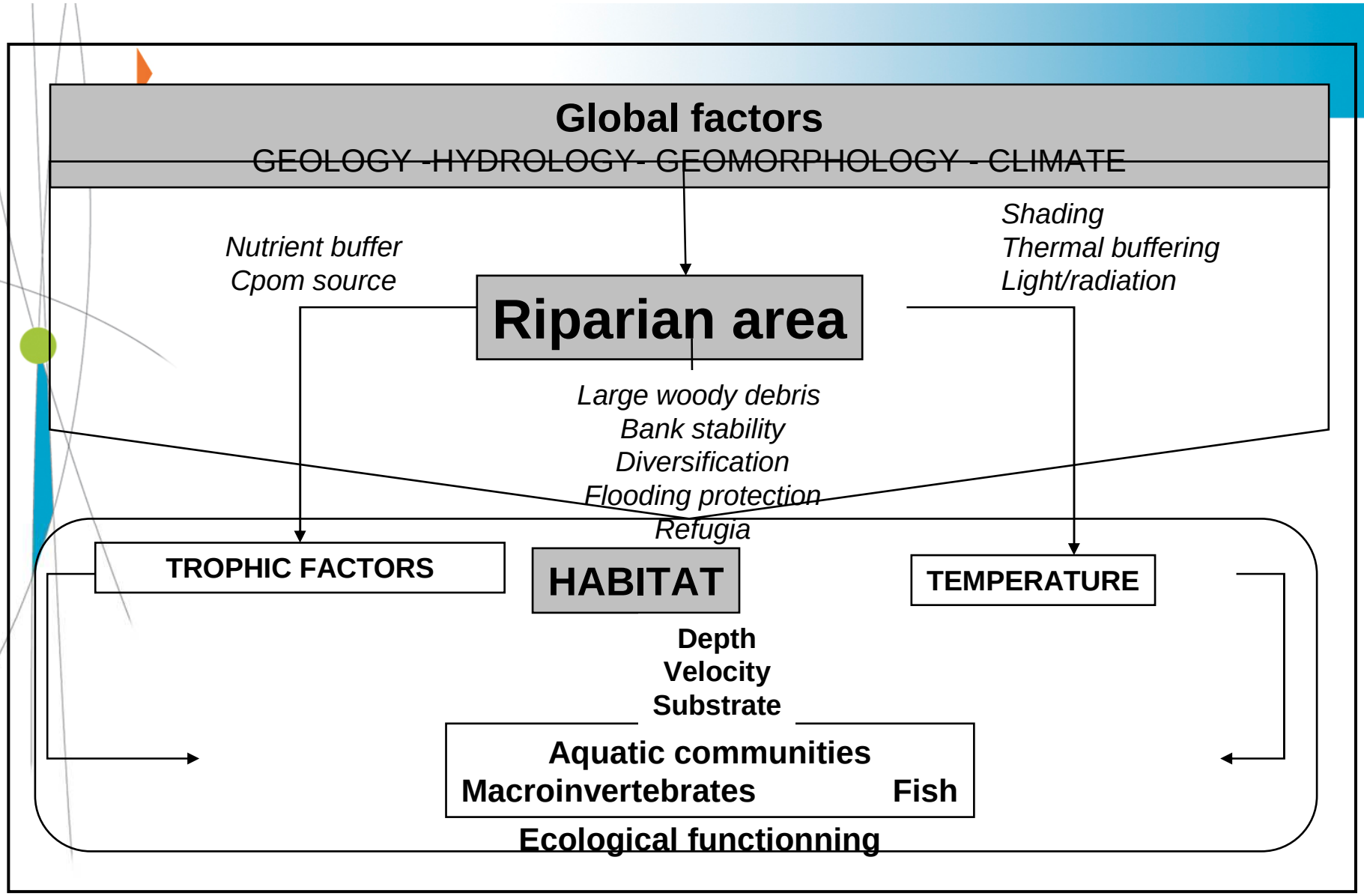
Corridors with 2 to 3 bands

Grass
+
(exploited wood)
+
Natural riparia

Small brooks make large rivers…

Protect headwaters

Pôle hydroécologie cours d'eau
ONEMA
Cemagref

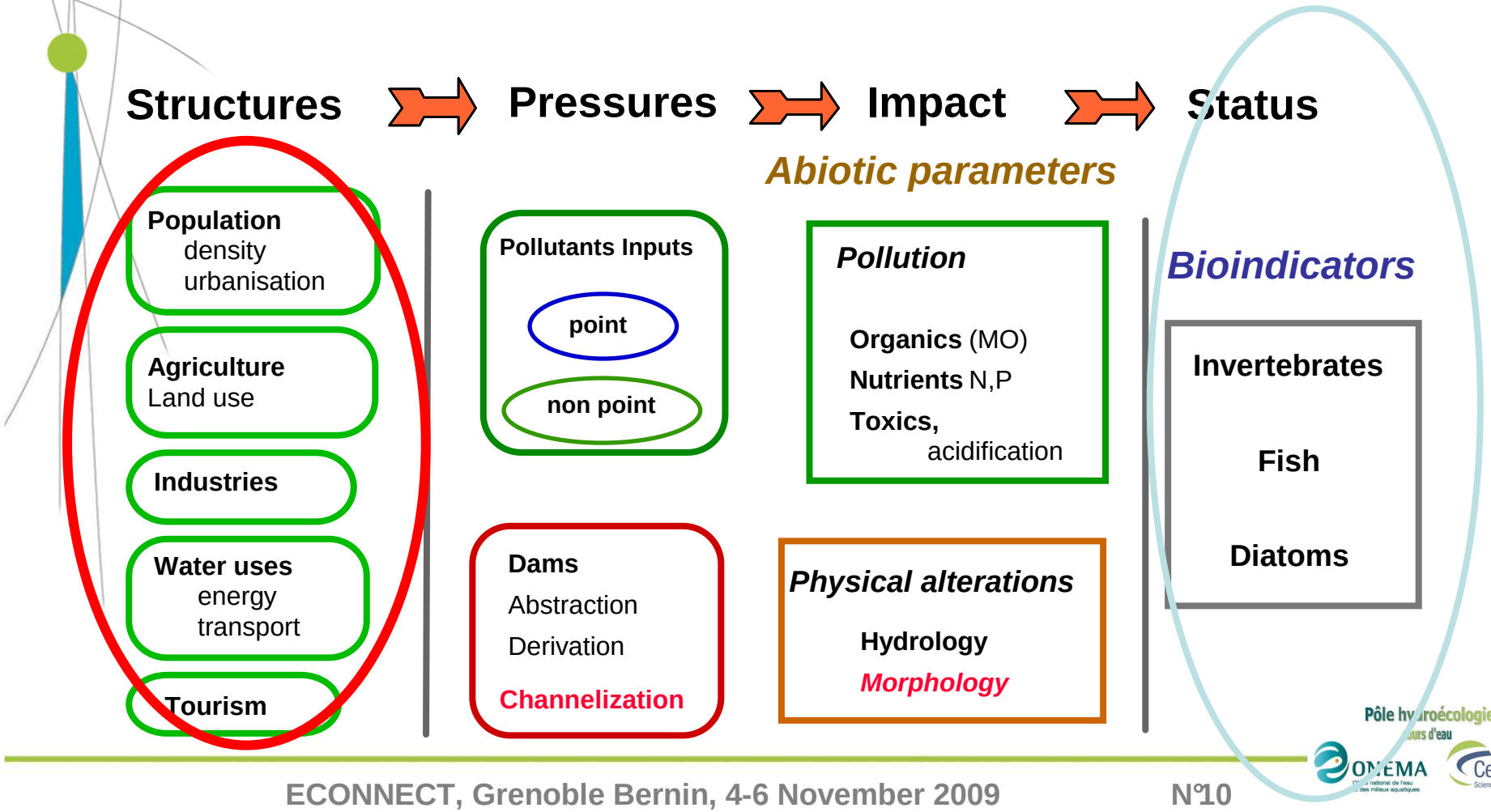


Riparian influence on running freshwater ecological functionnig (modified from Maridet, 1995).

In memory of J.G. Wasson

- 1. Riparian areas and stream ecological functioning
- 2. Large scale analysis of ecological status (sensu WFD) to land cover in stream corridor
- 3. Future analysis and tools

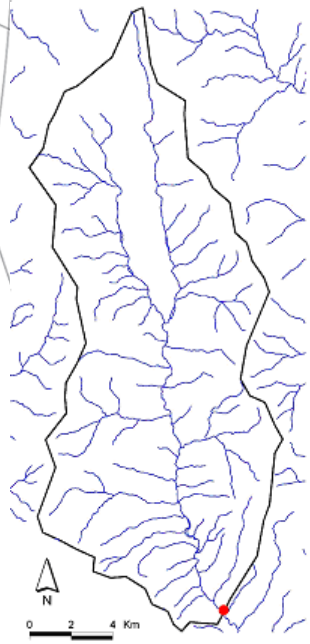
Selection of pressure parameters
Driving forces as proxies

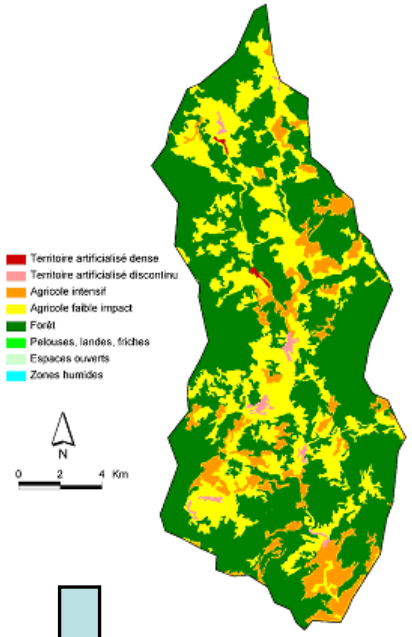


"Pressure" data : Land cover

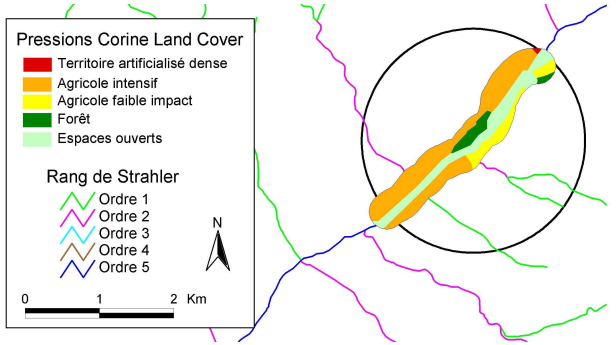
Calculation of the catchment area

For each biological site (e.g. IBGN)





Delimitation of a « riparian buffer"



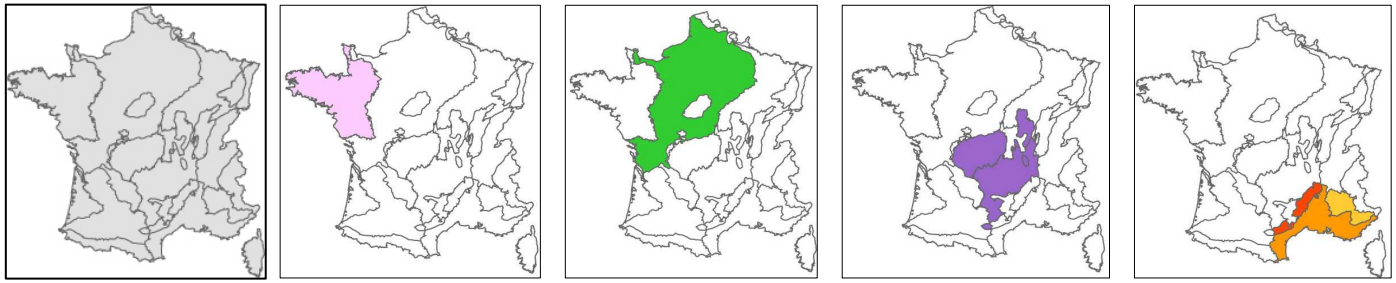
Evaluation of land cover pressure according to CORINE Land Cover

(44 categories

Summarized in 4 principal)

Pôle hydroécologie cours d'eau
ONEMA Office national de l'eau et des milieux aquatiques
Cemagref Sciences, eaux & territoires

PLS models: France (IBGN)



France	France - all		*Armorican*		*Calcareous*		*Central massif*		*Mediterranean*	
PLS model R^2	R^2 = 18 %		R^2 = 20%		R^2 = 15 %		R^2 = 31 %		R^2 = 38 %	
CORINE Land cover	*basin*	*riparian*	*basin*	*riparian*	*basin*	*riparian*	*basin*	*riparian*	*basin*	*riparian*
Continuous urban fabric	**-0.09**		**-0.07**		**-0.07**		**-0.13**		**-0.12**	**-0.05**
Discontinuous urban fabric	**-0.16**	**-0.08**	**-0.19**	**-0.09**	**-0.18**	**-0.09**	**-0.18**	**-0.12**	**-0.21**	**-0.07**
Industrial-commercial units	**-0.10**	**-0.09**	**-0.12**		**-0.10**		**-0.16**	**-0.15**	**-0.16**	
Dump sites	**-0.04**									
Construction sites	**-0.04**									
Non irrigated arable land	**-0.07**	**-0.05**	**-0.09**							
Vineyards	**-0.06**		**-0.07**				**-0.09**	**-0.08**		
Fruit trees	**-0.04**		**-0.04**	**-0.03**					**-0.11**	
Pastures					**0.06**	**0.10**			**0.10**	**0.06**
Broad-leaved forest	**0.05**	**0.05**	**0.11**	**0.11**					**0.12**	
Coniferous forest	**0.07**						**0.10**	**0.08**		
Mixed forest	**0.05**								**0.08**	
Moors and heathland									**0.07**	
Sparsely vegetated areas	**0.04**									

PLS models: Slovakia (Saprobic Index)



Slovakia	Slovakia - all		*Carpathians*		*Pannonians*	
PLS model R^2	R^2 = 44 %		R^2 = 38 %		R^2 = 29 %	
CORINE Land cover	***basin***	***riparian***	***basin***	***riparian***	***basin***	***riparian***
Artificial surfaces	**-0.17**		**-0.15**		**-0.24**	
Agricultural areas	**-0.17**		**-0.16**		**-0.14**	
Forests and semi-natural	**0.18**		**0.17**		**0.17**	
Industrial-commercial units		**-0.07**		**-0.09**		
Non irrigated arable land		**-0.11**		**-0.09**		
Broad-leaved forest		**0.08**		**0.07**		**0.14**
Coniferous forest		**0.12**		**0.13**		
Mixed forest		**0.06**		**0.07**		

Wasson, Villeneuve et al., Freshwater Biology, accepted

Pôle hydroécologie cours d'eau ONEMA Cemagref

Riparian corridor

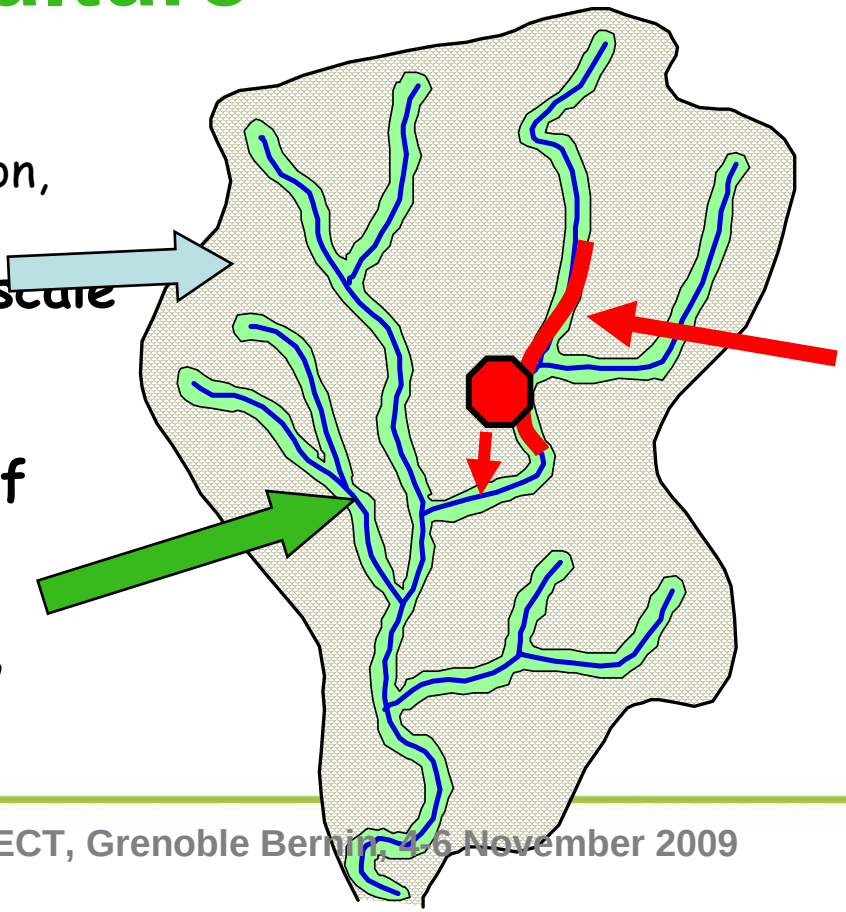
- Clear and general impact of artificial land cover
  - in all models
  - Due to Hydro-morphological alterations (not pollution)
- Negative effect of arable land, vineyards
  - **But variable according to the regions**
- "Buffering" effect of riparian land cover
  - **Clearly positive and significant for forests**
  - Even with urban pressures
  - **Pastures** : according to the cattle rearing…
  - **Regional variability**

Spatially distinct causes of impact

Agriculture

Pollution
nutrients, erosion, pesticides
At the basin scale

General Degradation of riparian Corridors
Channelization



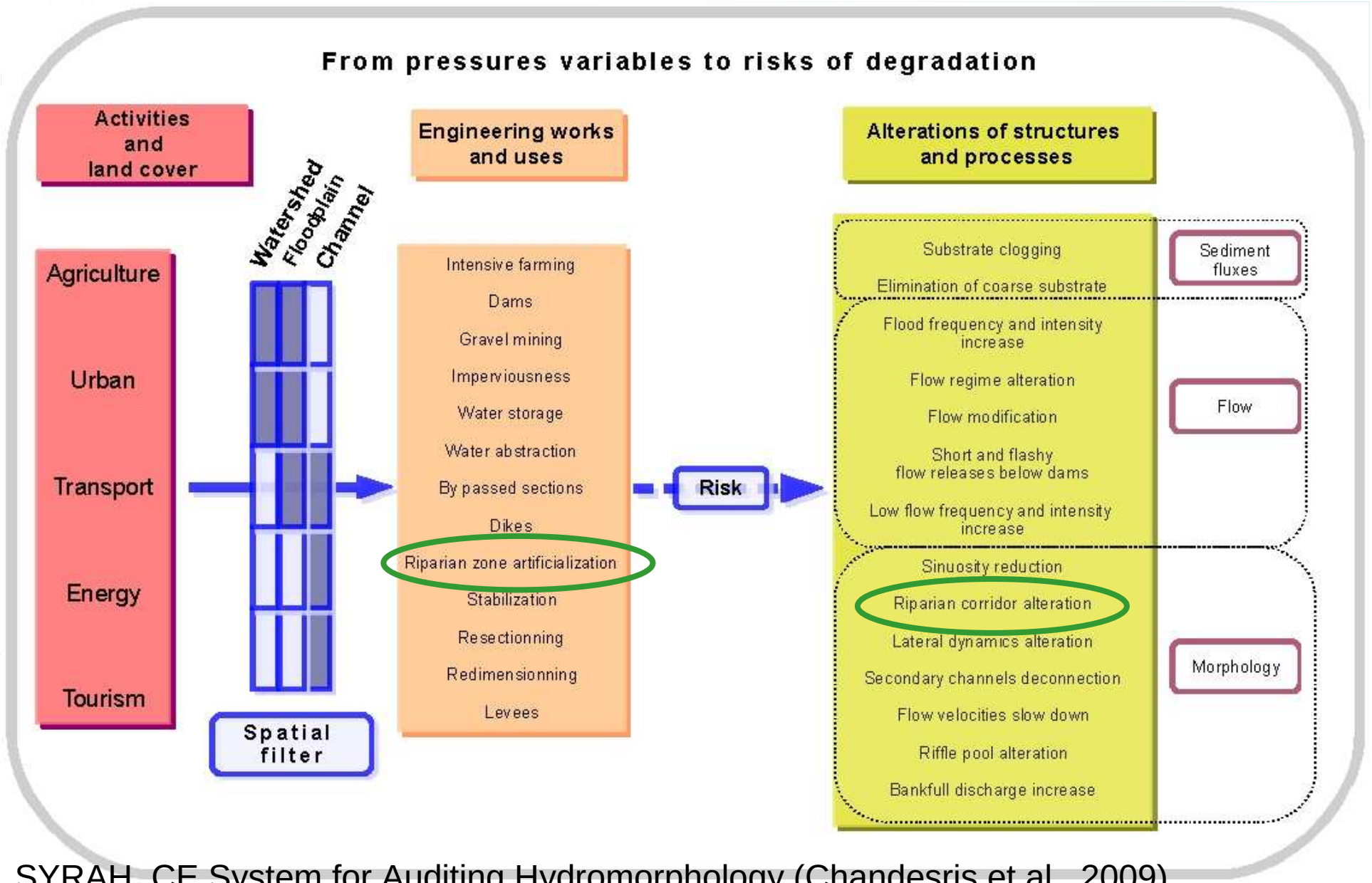
Urban

Direct pollution
inputs in the river

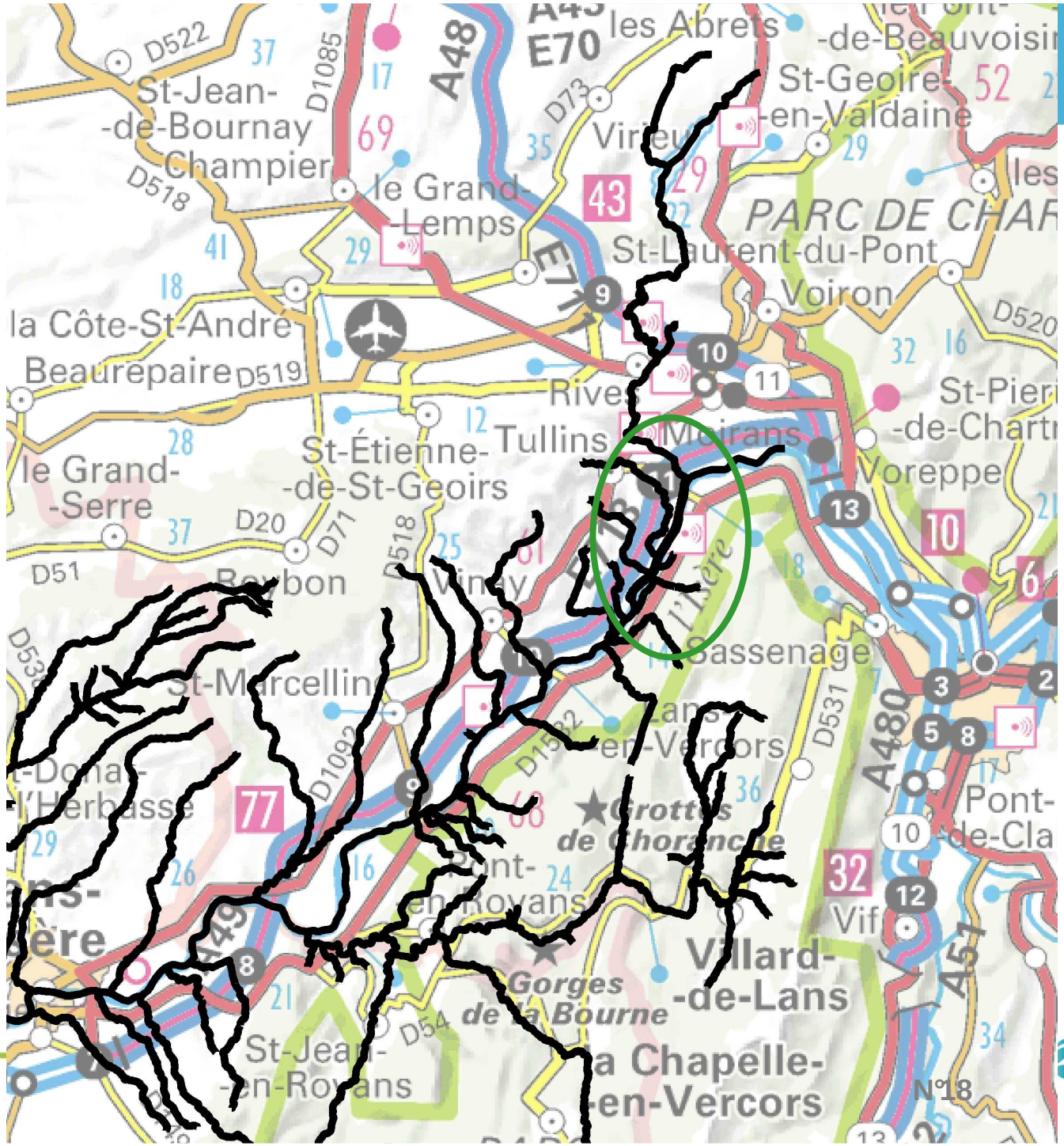
Extended impacts on Corridors and river beds
Flood defence
Stabilization

In memory of J.G. Wasson

- 1. Riparian areas and stream ecological functioning
- 2. Large scale analysis of ecological status (sensu WFD) to land cover in stream corridor
- 3. Future analysis and tools



SYRAH_CE System for Auditing Hydromorphology (Chandesris et al., 2009)

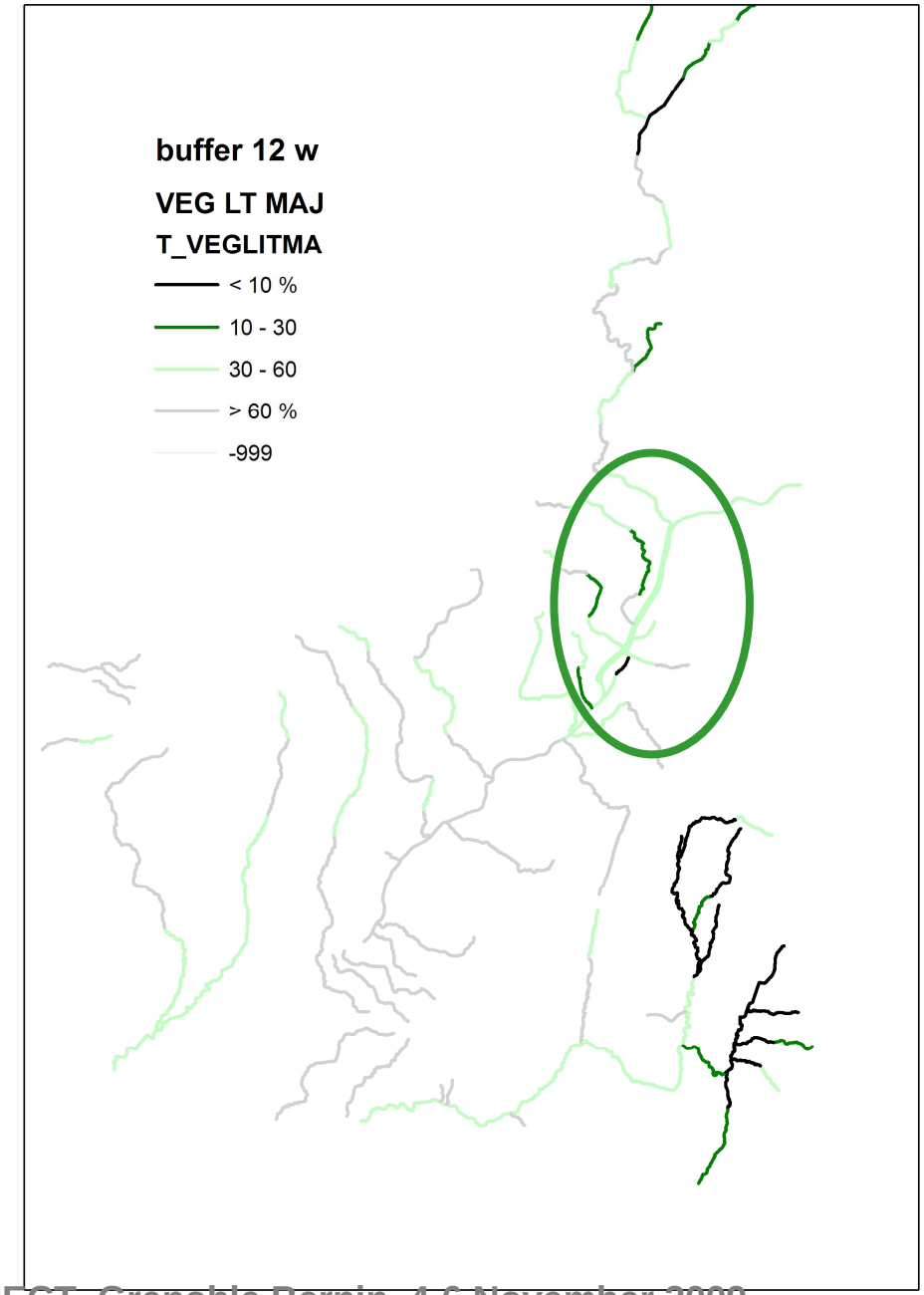


SYRAH_CE

230 000 km
in 2010

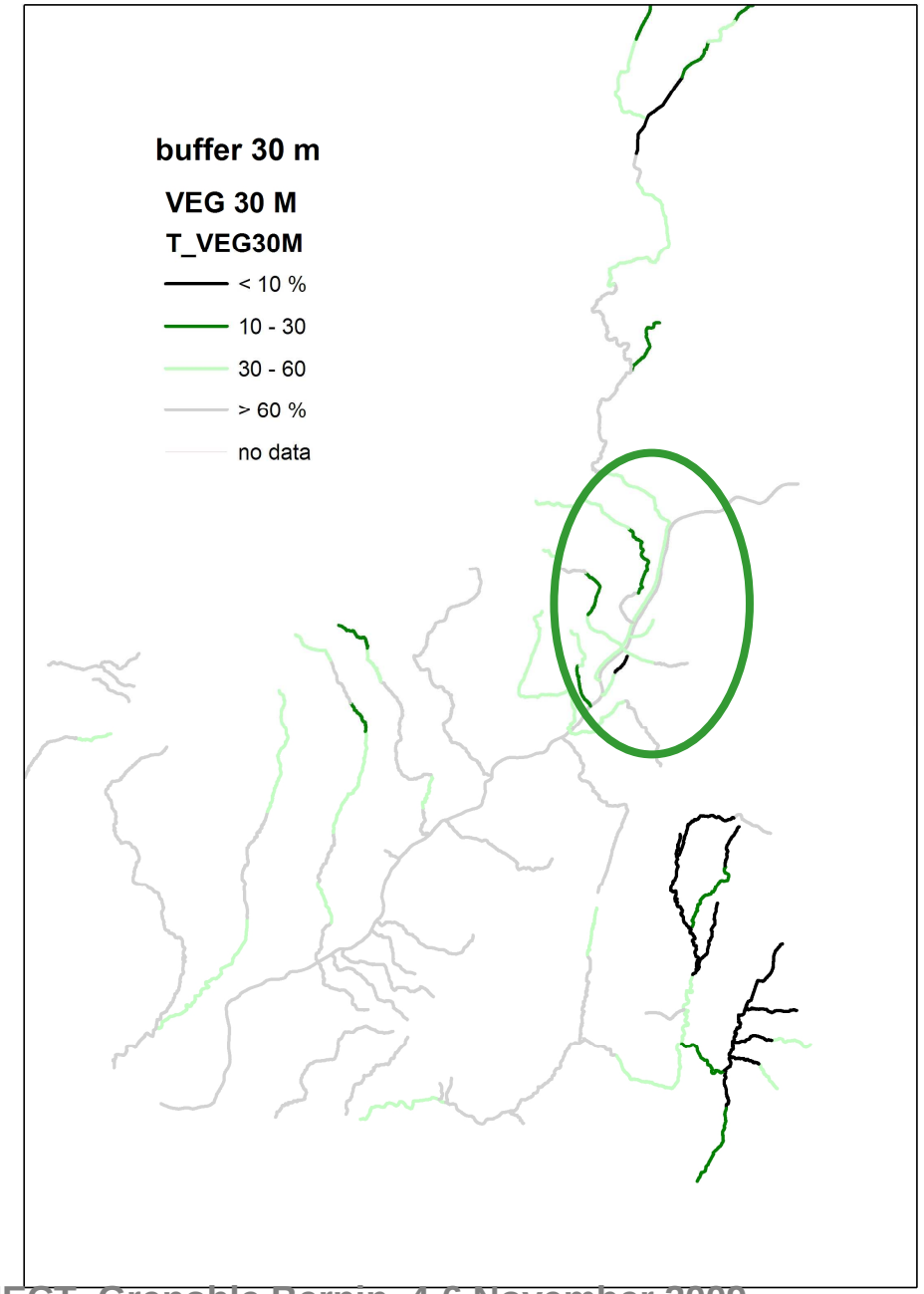
Pôle hydroécologie
cours d'eau
ONEMA
Cemagref

SYRAH_CE



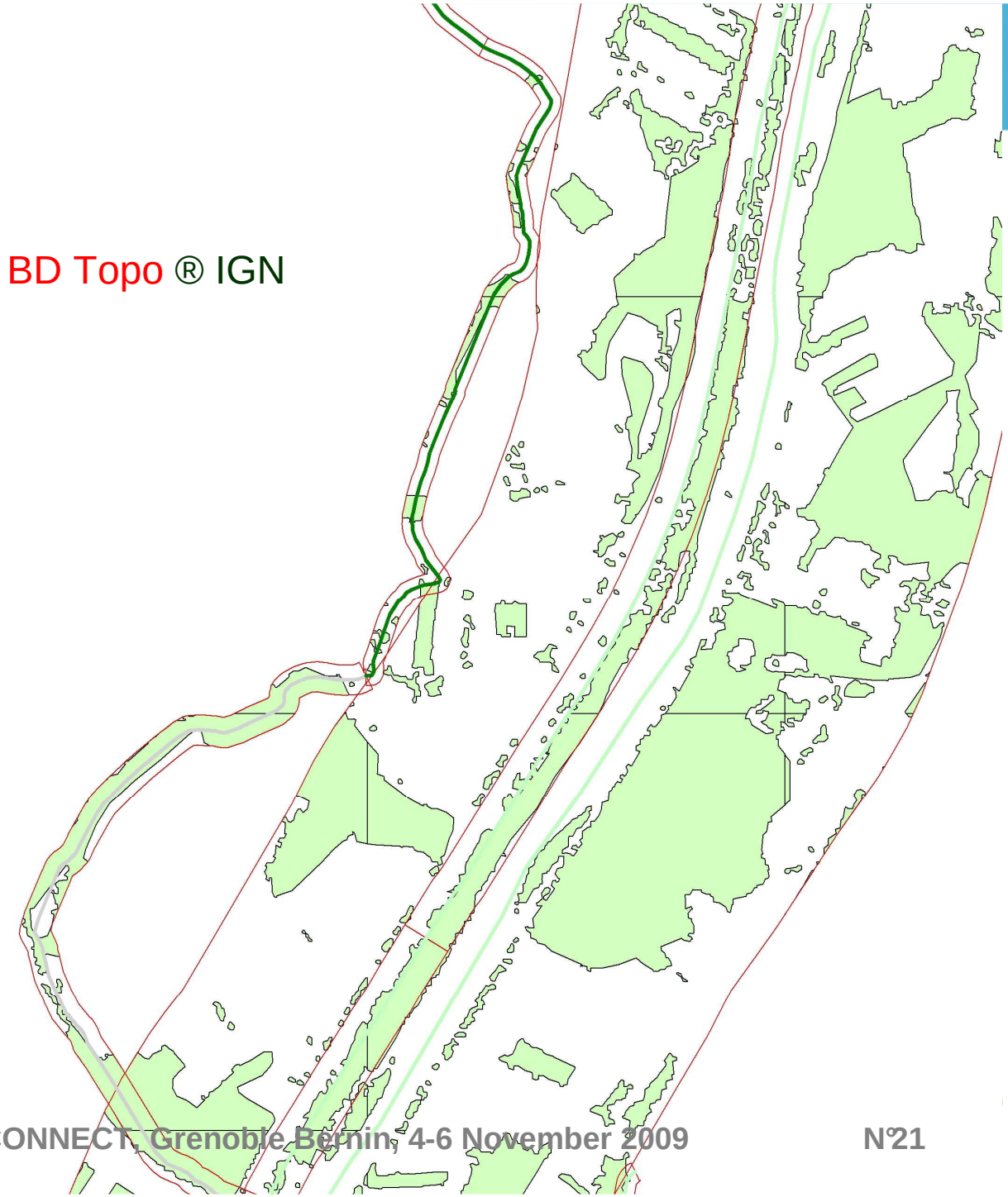
Pôle hydroécologie cours d'eau
ONEMA Office national de l'eau et des milieux aquatiques
Cemagref Sciences, eaux & territoires

SYRAH_CE



SYRAH_CE

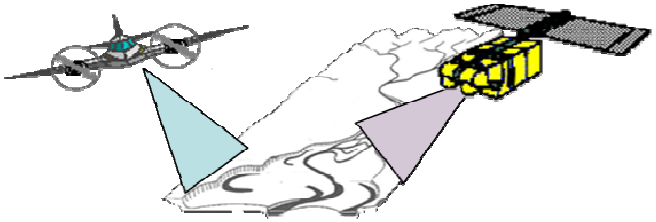
BD Topo ® IGN



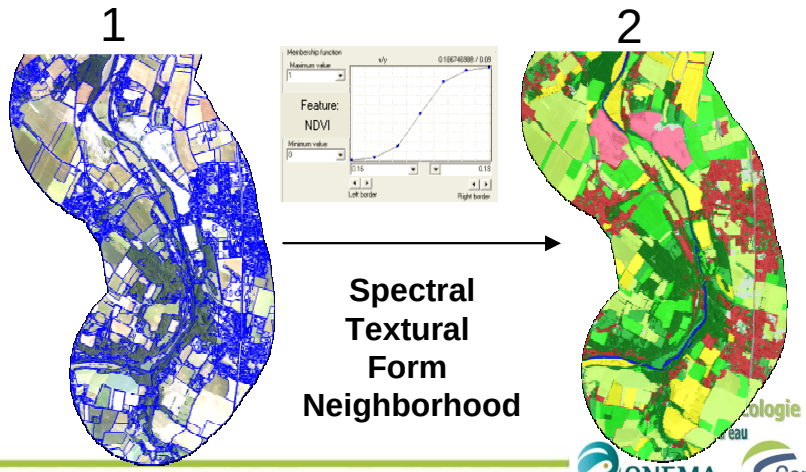
Pôle hydroécologie cours d'eau
ONEMA Office national de l'eau et des milieux aquatiques
Cemagref Sciences, eaux & territoires

Other tools (to be vectorized)

- **Data selection:**
  - ❑ BD Ortho ® IGN
    (0.5 m, B,V,R)
  - ❑ SPOT 5 XS
    (10 m, MIR, PIR, R, V)
  - ❑ Other data
    (RPG, CLC, BDR, …)



- **Classification methodology:**
  - ❑ Object oriented approach:
    1- Segmentation
    2- Classification



Tormos thesis, 2009

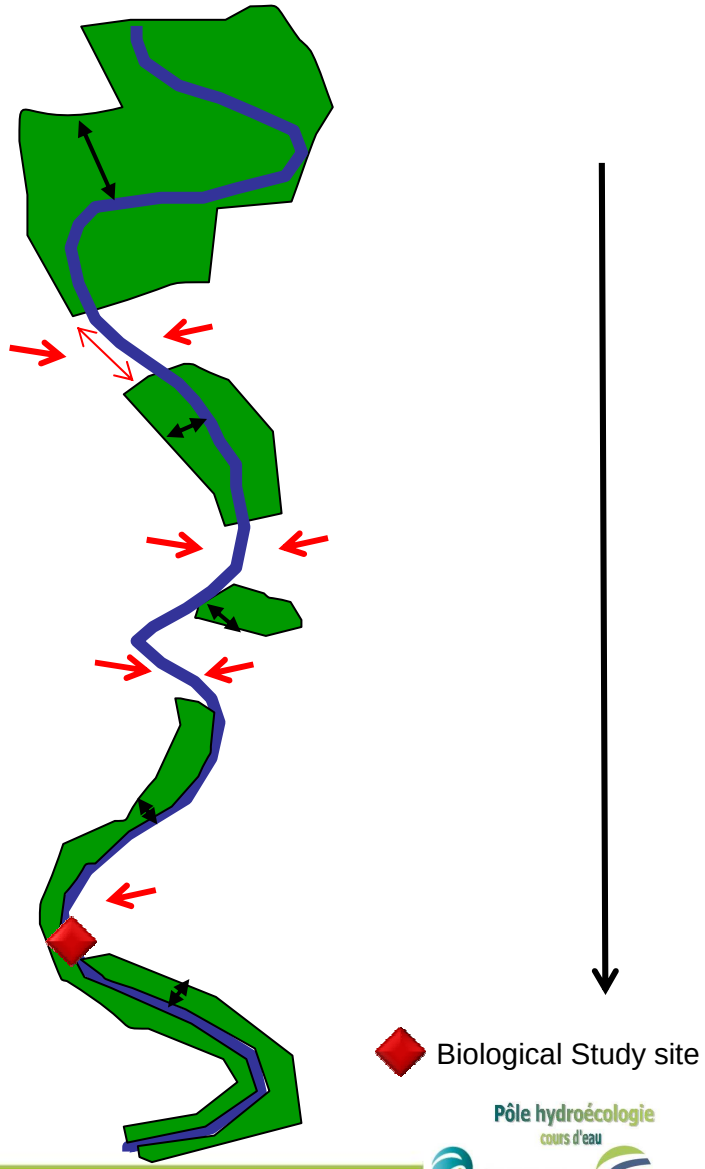
Indicators

- Objectives :

❑ Define riparian indicators

Riparian area buffer

- Structure :
  - Average width
  - Width variability
- Connectivity (continuity) :
  - Number of breaks
  - Length of breaks



Biological Study site

Tormos thesis, 2009

Conclusion (1/2)

- **Yes we can… act immediately with sufficient knowledge to improve ecological status**
- **One of the powerful control lever is potentially the restoration of the riparian areas**
- **Due to ecoregional differences in combined pressures, differenciated territory politics of restoration are needed**

Conclusion (2/2)

- **To support research and to define appropriate regional politics it is necessary to build a better spatial framework of natural and disturbance situations (in p. T°C, chemical and hydromorphological elements including riparian areas)**
- **A new era of bioindication has to progress toward better discrimination between sources of impairment**
- **Future Pressure/biological responses models would beneficiate of the two previous advances**
- **Future restoration measures are experimental opportunities to inscrease knowledge; pre and post data have to be carefully designed**

« L'arbre, la rivière et l'homme »

Medad MEEDDM/D4E, 2008, 64 p.

Thank you for attention

Pôle hydroécologie cours d'eau
ONEMA Office national de l'eau et des milieux aquatiques
Cemagref Sciences, eaux & territoires

- **References**

Chandesris A., Malavoi J.R., Souchon Y., Wasson J.G., Mengin N. (2007). Le système relationnel d'audit de l'hydromorphologie des cours d'eau (SYRAH CE) : un outil multi-échelles d'aide à la décision pour la gestion des cours d'eau. Ingénieries - Eau Agriculture & Territoires, **50**, 77-80.

Chandesris, A., Mengin, N., Malavoi, J., Souchon , Y., Pella, H., Wasson, J.G. (2008). SYstème Relationnel d'Audit de l'Hydromorphologie des cours d'eau : principes et méthodes. MEDAD, 64 p.

Chandesris A., Malavoi J.R., Mengin N., Wasson J.G.**,** Souchon Y. (2009). Hydromorphology auditing: A generalized framework at a nation scale to view streams and rivers in their landscape context. Communication au congrès : The 7th International Symposium on Ecohydraulics, 15 jan 2009 – Concepcion - Chile. Communication orale Souchon.

Maridet, L. (1995). Rôle des formations végétales riveraines. Recommandations pour une gestion régionalisée. Rapport final, Cemagref BEA/LHQ, Ministère de l'Environnement, Direction de l'Eau, SDMAP PARIS, 69 p.

Wasson, J.G., Villeneuve, B., Lital, A., Dobiasova, M., Bacikova, S., Pella, H., Mengin, N., Murray-Bligh, J., Timm, H., Chandesris, A. (Accepted). Large scale relationships between basin and riparian land cover and ecological status of European rivers: examples with invertebrate indices from France, Estonia, Slovakia and United Kingdom. Freshwater Biology.