ECOSCOPE
Networking biodiversity research observatories
/
Implications for GR monitoring

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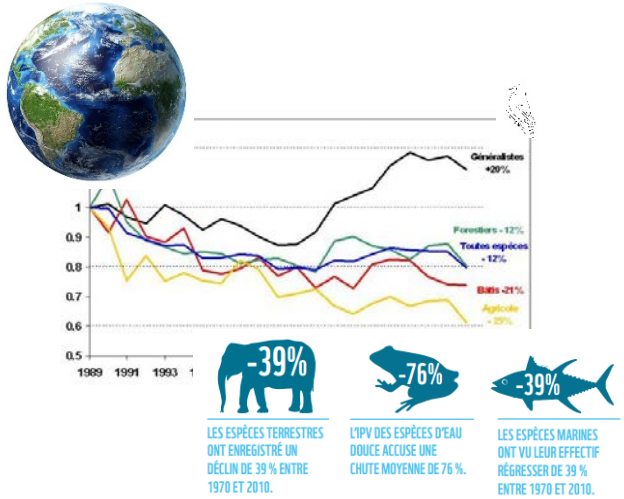
International workshop – Crop Agrobiodiversity Monitoring
25.03.2015, Agropolis

CONTEXT, ISSUES

- **CONTEXT**
  - Global trend : biodiversity loss

- **ISSUES**
  - Maintaining human well-being + ethical question
  - Limiting biodiversity decline by 2050
  - Preserving ecosystem services

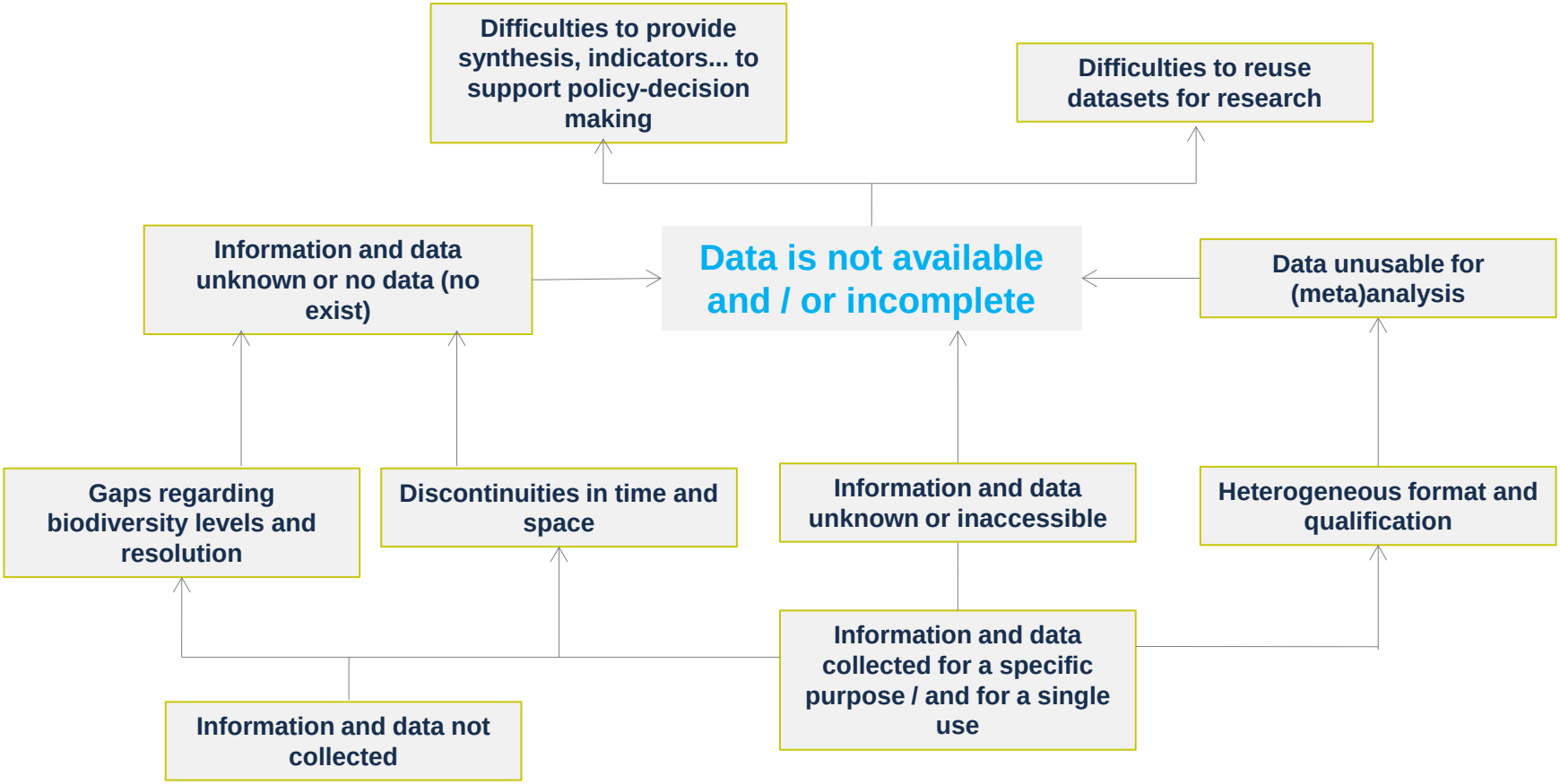
- **QUESTIONS**
  - How to measure the extent ?
  - How to decrease speed ?



To understand status and anticipate changes in biodiversity and ecos. services
To inform policy & social decision
Can't be achieved by a single organisation
Requires a comprehensive approach from local to global level

MNHN, Bilan STOC, 2009
WWF, ZLS, Rapport Planète vivante, 2014

CONTEXT, ISSUES - DATA



CONTEXT, ISSUES - OBSERVATORIES

- **SCIENTIFIC COMMITTEE FRB 2009**

- **NEEDS**
  - To have and gather long time series of data
  - To cover all levels of biodiversity

- **OVERVIEW**
  - Many observatories (metropolitan and overseas)
  - Operational for years, data collection for a long time, lots of data
  - Address various aspects of biodiversity
  - Landscape : heterogeneous & data not sufficiently visible

➔ **improve coordination of research observatories**
➔ **harmonize methods & IS**
➔ **valuate data**

Lauching of ECOSCOPE in 2011 + start in 2012

ECOSCOPE

- **VISION & SCIENTIFIC CHALLENGE**
  - **Complementarities between observations + Link data producers - users**
- **MAIN OBJECTIVE**
  - **To coordinate observatories** (methods, information systems, measured variables) and to reinforce them in order to :
    - better organize data collection, management, diffusion and (re)use
    - enhance synergies and scientific cross-work
- **DELIVERABLES**
  - **An integrated national network of biodiversity research observatories fully accessible to stakeholders**
  - To have observation systems on all biodiversity organization levels

ECOSCOPE - NETWORK

- **RESEARCH OBSERVATORIES NETWORK (23)**

RGscope
10 OS dedicated to domesticated genetic ressources
-
Plants, Forests, Animals, MO

Citoscope
3 OS based on citizen sciences and framed by research organisms

Thematic
10 OS focusing on different ecosystems

+ others to be integrated

- Multi-scales approach / all levels of biodiversity organization / different types of data
- Several types of actors (researchers, stakeholders, citizens)
- **Integrates the emerging concept of Essential Biodiversity Variables (EBVs)**

ECOSCOPE - FRAMEWORK

- **INSTITUTIONAL SUPPORT AND RECOGNITION**

  - **Inter-organisms** (CNRS, Ifremer, INRA,Cirad, IRD, Irstea, MNHN)
  - Scientific coordination Denis Couvet (MNHN) – Operational coordination FRB
  - **SOERE** = Observation and Experimentation System for Environmental Research by the research organism's alliance (AllEnvi) (2011)
  - **National Research Infrastructure** (2012)

  +

  BON = National Biodiversity Observation Network by GEO BON (2012)
  Associated partner to EU BON (2014)

GEO GROUP ON EARTH OBSERVATIONS

GEO BON

EU BON

RGscope
RG aspect of ECOSCOPE

- **SCOPE**

  - Federating french genetic resources follow-up and characterization initiatives

  - AnGR, PGR, FGR, MGR

- **MAIN LINES**

  - Report : numerous existing networks ➔ need for empowering those networks and better coordination of their interactions with a special focus on data production harmonization and data sharing

  - High importance of metadata production and support research on domestic and wild relatives diversity

  - Promote the participation of RGscope in european and international initiatives dealing with major issues about GR research/management

RGscope
RG national inventories and monitoring contributions in France

➔ Ministry of agriculture is in charge

- AnGR

  FRB is involved in european EFABIS (ERFP) and DAD.IS (FAO) databases updating

  Population data and stats for a set of races of several species

- PGR

  In 2015 : meetings with ministry of agriculture to set up FRB involvement in articulation with futur national GR conservation coordinator (to be nominated)

  One objective is to restart EURISCO (ECPGR) updating procedure for French accessions

  FRB participates in discussions on GR conservation recognition by public authorities – this may lead to monetary support for conservation and ITPGRFA Article 17 implementation

RGscope
RG national inventories and monitoring contributions

- **FGR**

  Ministry of agriculture created National Commission for Forest Genetic Resources in charge of updating EUFORGEN IS with in situ and ex situ conservation national inventories

- **National Biodiversity Observatory**

  Launched by Ministry of ecology

  Produce and gather a set of indicators to follow societal issues concerning biodiversity

  RGscope involved to provide scientific expertise and sollicitate stakeholders for GR indicators identification

ECOSCOPE METADATA PORTAL

To be launched in 2015

- **Main features**
  - **Referencing observatories and their databases, publishing metadata and faciltating metadata sharing with other metadata initiatives**
  - **Browsing metadata, accessing to contact**
  - **Better understanding of observatories landscape by metadata analysis**

ECOSCOPE METADATA PROFILE

- **Provides information on :**

  - **By whom, what for, where and when observations are produced, data and samples access** = discovery level
  - **How, why, what / data** = exploration level

- **Integrates :**

  - INSPIRE Directive conformity
  - Ecological Metadata Language standard (GBIF, DataOne, LTER...)
  - Link with SINP (French IS on operational observatories) through a common subset of metadata
  - Essential Biodiversity Variables
  - Observation, collection and experimentation descriptors typology
  - Focus on scientific objectives linked to data, thematic approaches and methodologies
  - Georeferenced study sites
  - Collection informations, GR access module

ECOSCOPE DESCRIPTORS TYPOLOGY

Biological entity observed	**Biological identification**	Taxonomy
		Genealogy
	Occurrence, abundance or origin	Inventory/field observation
		Collection or acquisition (specimen/collection)
	Genetics and genomics	DNA/RNA sequencies
		Gene annotations/gene fimilies
		Polymorphism markers
		Genetic maps
		Genome expression
		Cell components
		Epigenetics
	Phenotype	Morphology
		Metabolism
		Physiology
		Ethology
	Conservation and management	Protection measures
		Management mode
Environment observed	**Ecological environment**	Habitat
		Ecosystem
		Landscape
	Physical environment	Climate
		Other physical metrics
	Chemical environment	Environment chemistry
	Biotic environment	Direct environment assessment
		Biodiviersity local indices
	Socio-economic environment	Site protection measures
		Production system
		Agricultural practices and management
Multimedia	**Other data supports**	Pictures
		Maps
		Videos
		Sounds

+ Link to methodology or data standards

COLLECTION METADATA

Collection :

Collection name :

Parent collection identifier :

Collection identifier :

Collection formation period :

Collection living time period :

Dominant preservation methode

select one item

Specimen preservation methods :

No selected

Curatorial units :

+ Add curatorial unit

RG COLLECTION METADATA

Informations regarding access and benefit sharing rules for genetic resources :

Type of ABS measures	Response	Comment
From other collections for which ABS rules or voluntary approaches were applied	I don't know / No / Yes	
Sampling following applicable ABS rules	I don't know / No / Yes	
Sampling following best practices or sectorial guidelines	I don't know / No / Yes	
Sampling whitout applicable ABS rules but following voluntary approach to apply the Nagoya protocol	I don't know / No / Yes	

+ Availability of additional information associated with the accessions

ESSENTIAL BIODIVERSITY VARIABLES

- ✓ Conceived by GEO BON collaborators (Pereira et al. (2013) « Essential Biodiversity Variables », Science, Vol. 339, 18 Jan. 2013)

EBV Class	EBV	Measurement and scalability	Temporal sensitivity	Feasibility	Relevance and related CBD 2020 targets
Genetic composition	Co-ancestry	Pairwise relatedness among individuals or inbreeding coefficient of selected species, within and among populations of each species.	Generation time	Available for many species but few populations, and little systematic sampling over time.	This variable provides a good measure of the genetic independence of allele frequencies among individuals and their susceptibility to lowered fitness. Targets: 12.
	Allelic diversity	Allelic richness from genotypes of selected species (e.g. endangered species and domesticated species) at multiple locations (statistically representative of the species distribution).	Generation time	Data available for several species and for several locations, but little global systematic sampling.	It is one the most used variables to measure genetic diversity, and can support the estimation of indicators such as "Trends in genetic diversity of selected species" and the "Red List Index". Targets: 12, 13.
	Population genetic differentiation	Gene frequency differentiation (Fst and other measures) among populations or of a subpopulation compared to the metapopulation of selected species.	Generation time	Data available for many species but often for a limited number of populations. Easy to augment datasets.	Beta diversity analogue; this variable captures the variation among populations. This variable can also help to identify local genetically-based adaptation and help provide a 'population adaptive index'. Targets: 12, 13, 15.
	Breed and variety diversity	Number of animals of each livestock breed and proportion of farmed area under each local crop variety, at multiple locations.	5 to 10 years	Large datasets have been compiled by national organizations and FAO for livestock breeds, but there is insufficient systematic sampling for coverage of local crop varieties.	It is an essential variable to estimate the indicator "Trends in genetic diversity of domesticated animals and cultivated plants". Target: 13.

6 EBVs classes

- ➢ Genetic composition
- ➢ Species populations
- ➢ Species traits
- ➢ Community composition
- ➢ Ecosystem function
- ➢ Ecosystem structure

measurments, observations, and protocols

- ✓ Provide a framework to establish a Global Observation System
- ✓ Endorsed by the CBD & in line with the 2020 Aichi targets C

Assessement of wheat genetic diversity in French landscape during XXst century

Mozilla Firefox

Fichier Édition Affichage Historique Marque-pages Outils ?

http://proteus.moulon.inra.fr/bd_diversite/departement_repartition_form.pl

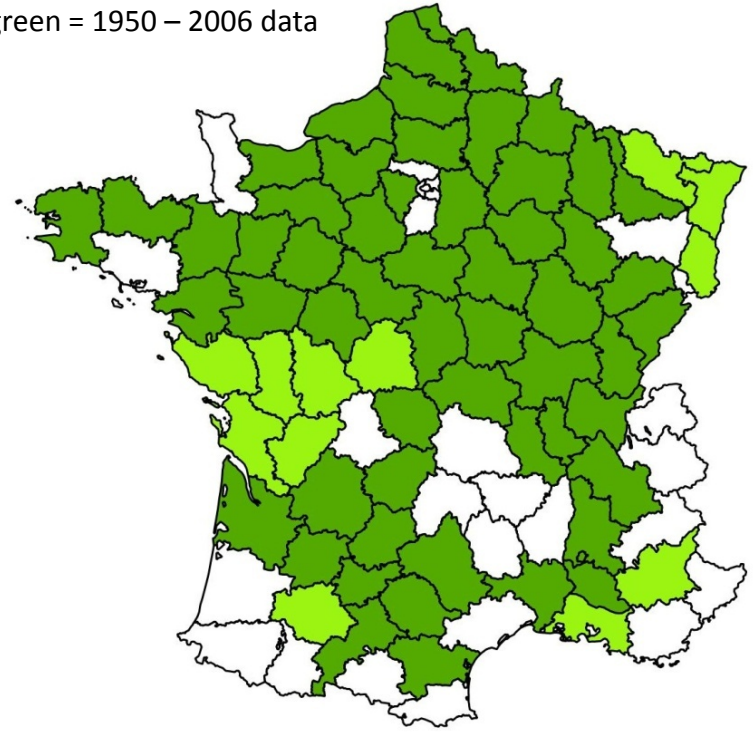
Les plus visités À la une

http://proteus....tition_form.pl

department repartition
set Ht parameters
indicator compute
indicator comparator

WHEAT BIODIVERSITY

Dark green = 1912 – 2006 data
Light green = 1950 – 2006 data



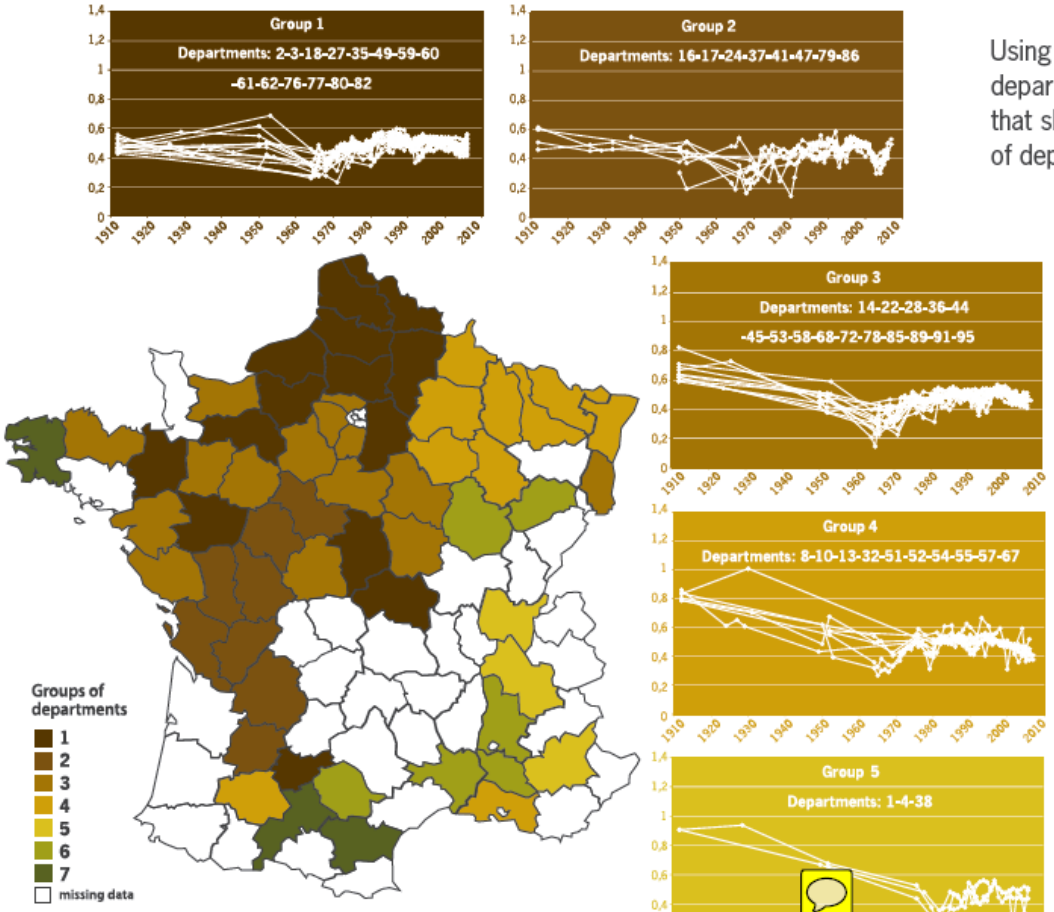
Personnaliser...

Genetic diversity dashboard

A DASHBOARD BASED ON 7 INDICATORS TO ASSESS THE STATE OF GENETIC DIVERSITY OF CULTIVATED PLANTS

INDICATORS	INDEXES	DIVERSITY MEASURES	INCORPORATED INFORMATION			
			Number of varieties	Acreage	Between varieties genetic data	Within varieties genetic data
Varietal richness	Number of varieties	Number of varieties	✓			
Spatial diversity of the varieties	SW (Shannon)	Acreage heterogeneity of varieties	✓	✓		
	Es (Simpson)	Acreage dominance of varieties	✓	✓		
	J (Piélou)	Acreage equitability of varieties	✓	✓		
Between varieties genetic diversity	H (Nei)	Allelic frequencies in the pool of varieties	✓		✓	
Between varieties spatial genetic diversity	H*	Allelic frequencies in cultivated surfaces	✓	✓	✓	
Between and within varieties spatial diversity	Ht*	Genetic diversity between and within varieties in cultivated acreage	✓	✓	✓	✓

French departments trends



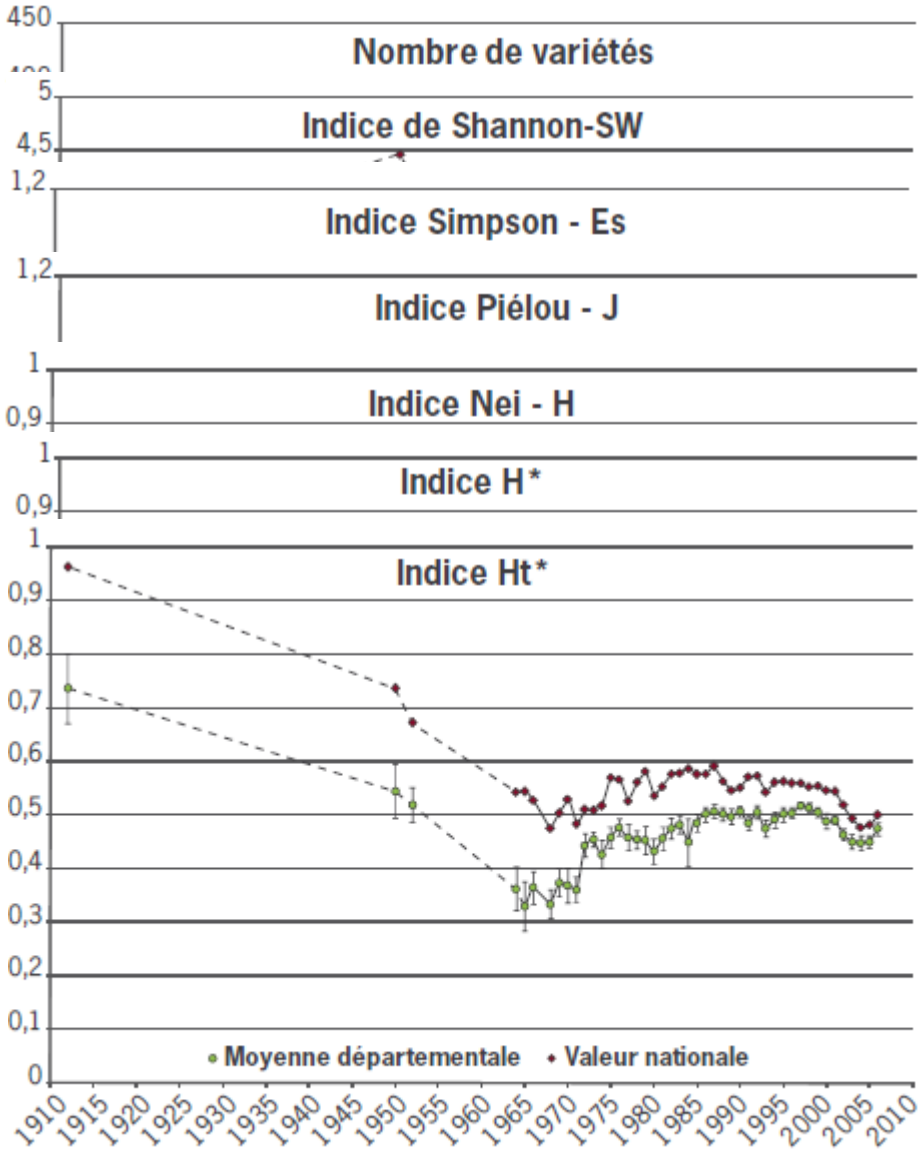
The colored gradient corresponds to the speed of agriculture modernization indicated by Ht* values : from the earliest in brown to the latest in green

Using a multivariate method on Ht* values, departments (French administrative territories) that show similar tendencies are pooled. 7 groups of departments are identified.

- The map shows that agricultural modernization, involving landraces replacement by breeders' varieties, didn't operate simultaneously across the whole French territory. In 1912, North, Center, West and around Paris (groups 1, 2 and 3), which were large cereal production regions, excepting the South-West, presented a smaller diversity compared to other departments.

- The regions where diversity was still high in 1912 cultivated a relatively high number of landraces on the majority of their territory. For the South-West and at the periphery of large wheat production regions, 85% of the wheat acreage was cultivated with numerous landraces at this time (groups 4, 5, 6 and 7). In these departments, agricultural modernization occurred later and ended in the early 60's with the complete replacement of landraces and «old lines» by «modern pure lines.»

Global trends



➔Strong varietal creation effort

➔ Numerous varieties appearance on small agreages since 1980

➔No particular variations in dominance of major varieties

➔Increasing gap between rare and major varieties

➔No intervarietal genetic diversity increase intervariétale however number of varieties increases

➔Genetic homogenization trend between dominant varieties (>1 % of national wheat acreage)

➔ Strong intravarietal homogenization during first half of XXst century

FRB report (French) : http://www.fondationbiodiversite.fr/les-programmes-frb/synthese-sur-les-indicateurs-de-biodiversite-cultivee
2 peer-reviewed articles : Bonneuil et al. 2012 doi:10.1016/j.ecolind.2012.04.002, Bonnin et al. 2014 doi:10.1016/j.agee.2014.06.003

THANK YOU

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