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ECOSYS, Functional Ecology and Ecotoxicology of Agroecosystems. A partner for your research in ecotoxicology

Christian Mougin

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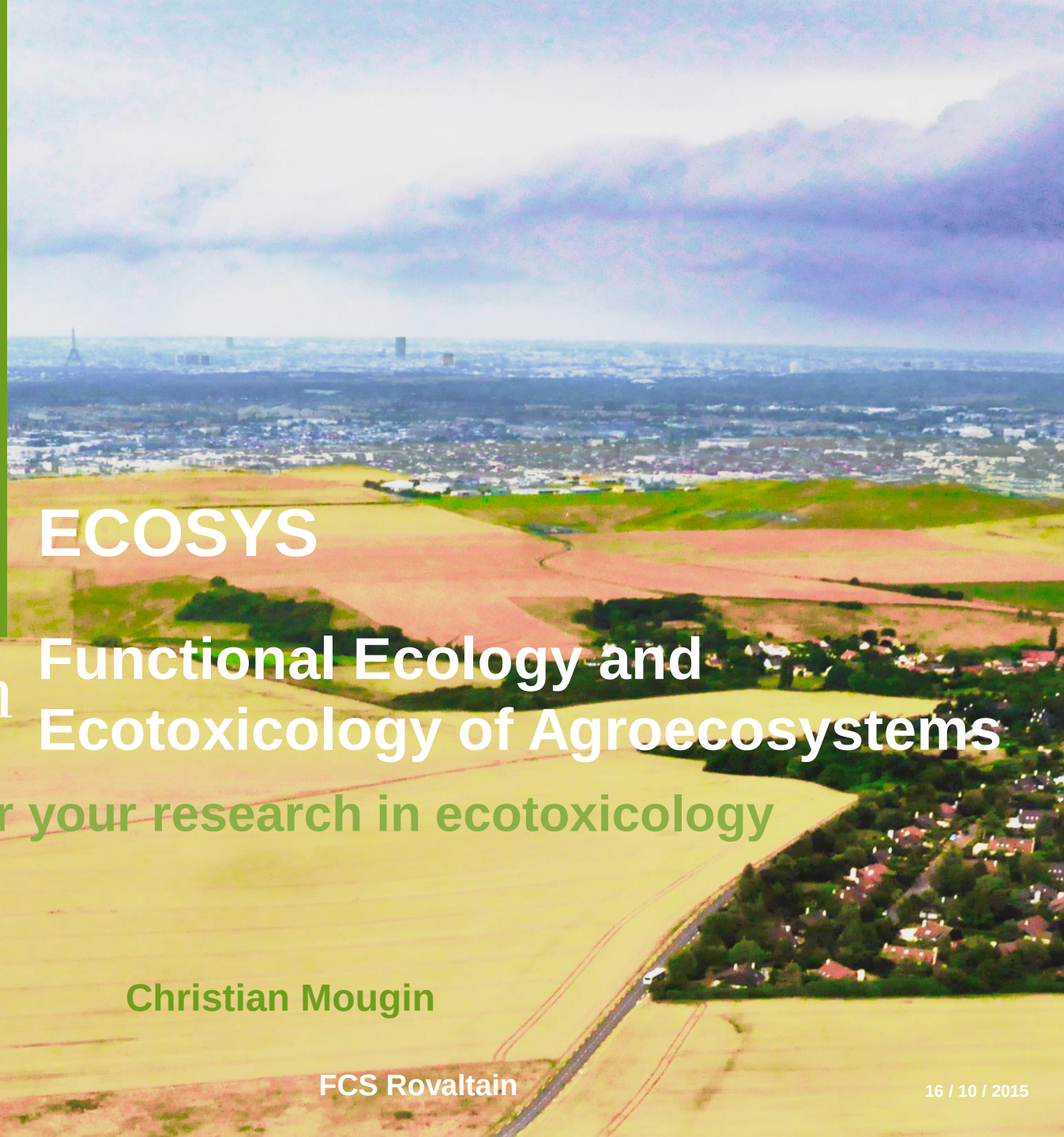


INRA SCIENCE & IMPACT

AgroParisTech

ECOSYS

Functional Ecology and Ecotoxicology of Agroecosystems

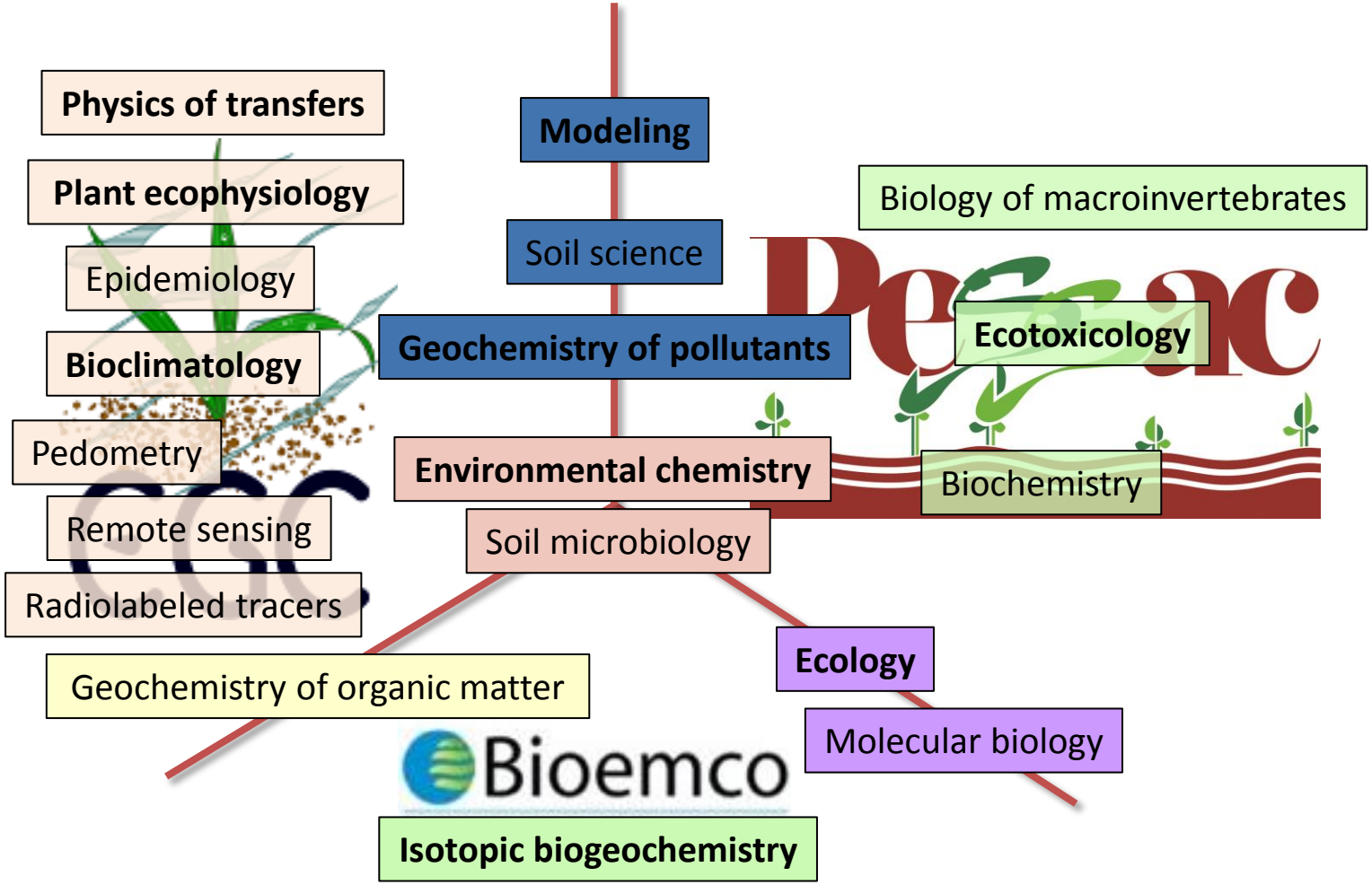
A partner for your research in ecotoxicology

Christian Mougin

FCS Rovaltain

16 / 10 / 2015

January 2015: a combination of scientific and technical skills



Organisation of the ECOSYS department

Management team | Management board | Advisory board | General meeting

Management, Common services, collective missions

- Financial management
- Human Ressources
- Mission mangement
- Communication
- Scientific information
- Computing
- Mechanical supply
- Laundry
- Logistics

- *Quality assurance*
- *Metrology*
- *Hygiene and health*
- *Sustainable develop.*
- *Training course*
- …

Technical poles

- Environmental biophysics
- Environmental chemistry (isotopic)
- Biology and biochemistry
- Plateforme Biochem ENV
- Observatories
- Greenhouses
- Modeling and calculation

Scientific disciplinary poles

- **Plant ecophysiology** — Epidemiology and nitrogen nutrition
- **Ecotoxicology** — Fate and impact of contaminants on terrestrial organisms
- **Soil science** — Biogeochemistry or organic matter and pollutants
- **Bioclimatology** — $N_{reactive}$ transfer and pollutant gases

Transversal thematic axes

Integration of the processes to evaluate the effects of agricultural practices on agroecosystems

- **Biomass production** for feed and food and renewable carbon
- **Waste valorisation** : recycling of organic residual by-products
- **Biodiversity pool :** dynamics and effects of living organisms in agroecosystems
- **Climate regulation and C-N** storage
- Regulation of the **quality of environmental compartments**

The pole « ecotoxicology »

- **Dynamics of micropollutants/organisms interactions in soils**
  - How can the main mechanisms involved in the transformation and speciation of micropollutants govern their availability in ecosystems?
  - What are the main ways of organisms exposure to micropollutants and their resulting biological effects?
  - How can biological and/or geochemical feed-back loops modify the fate and effets of contaminants?

- **Contribution of ecotoxicology to the multi-criteria evaluation of soils from agroecosystems and ecosystem services**
  - What are the impacts of cropping systems on the fate and impact of micropollutants?
  - What are the impacts of cropping systems on the biodiversity in agroecosystems?

> 8 researchers, 2 teaching researchers, 10 engineers, 10 technicians for resaerch in soil ecotoxicology

The axe « Regulation of the quality of environmental compartments »

- **How can agroecosystems and their mode of management impact**
  - the soil, air and water quality?
  - the fate and impact of contaminants?

- **What are the determinants of the fate of contaminants?**

- **How are linked exposure to polluants and their impacts on organisms and activity?**

- **Ways for future research:**
  - effects of cocktails of pollutants at low doses
  - long term assessment of impacts
  - landscape ecotoxicology

Exemples of research projects

- **Remediation of contaminated arable land: impact of energy crops growth on trace element bio-availability and on the response of soil biota**
- **Biological and Ecological functional Traits of Soil Invertebrates (BETSI) to link species assemblages to environment factors**
- **Chronic exposure to antibiotics and metals in soil: impact on microbial processes including antibiotic resistance dynamics**
- **Resistance of agricultural landscapes to pesticide transfers in soils and living organisms**
- **Submitted: Eutrophic surface waters and cyanobacteria toxic effects on irrigated crops**
- **…**

Our experimental models

- **Pollutants**
  - Metals
  - Organics (pesticides, medecines, endocrine disruptors…)
  - O_3, organic volatile compounds
  - Biotoxines (cyanotoxines)
  - Pathogens, pollens, spores…

- **Non target organisms**
  - Micro-organisms
  - Filamentous fungi
  - Earthworms, enchytreids
  - Soil invertebrates
  - Higher plants

≈ 25 peer-rewiewed papers /year

http://www6.versailles-grignon.inra.fr/ecosys/

Science of the Total Environment 520 (2015) 136–145

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Subcellular partitioning of metals in *Aporrectodea caliginosa* along a gradient of metal exposure in 31 field-contaminated soils

Léa Beaumelle [a], Frédéric Gimbert [b], Mickaël Hedde [a], Annie Guérin [c], Isabelle Lamy [a,*]

[a] INRA, UR 251 PESSAC, 78026 Versailles Cedex, France
[b] Laboratoire Chrono-Environnement, UMR 6249 University of Franche-Comté/CNRS Usc INRA, 16 route de Gray, 25030 Besançon Cedex, France
[c] INRA, US 0010 LAS Laboratoire d'analyses des sols, 273 rue de Cambrai, 62000 Arras, France

Ecotoxicology (2015) 24:616–625
DOI 10.1007/s10646-014-1409-1

The impact of management strategies in apple orchards on the structural and functional diversity of epigeal spiders

Christophe Mazzia · Alain Pasquet · Gaël Caro · Jodie Thénard · Jean-François Cornic · Mickaël Hedde · Yvan Capowiez

Toxicology Letters 235 (2015) 96–106

Contents lists available at ScienceDirect

Toxicology Letters

journal homepage: www.elsevier.com/locate/toxlet

BK/TD models for analyzing *in vitro* impedance data on cytotoxicity

S. Teng [a], S. Barcellini-Couget [b], R. Beaudouin [a], C. Brochot [a,*], G. Desousa [c], R. Rahmani [c], A.R.R. Pery [a,d]

[a] INERIS (METO), Verneuil-en-Halatte 60550, France
[b] ODESIA Neosciences, Sophia Antipolis F- 31076, France
[c] INRA Toxalim, Sophia Antipolis F- 31076, France
[d] AgroParisTech, UMR 1402 INRA-AgroParisTech EcoSys, Thiverval-Grignon F- 78850, France

Chemosphere 128 (2015) 332–340

Contents lists available at ScienceDirect

Chemosphere

journal homepage: www.elsevier.com/locate/chemosphere

Evaluation of phytotoxicity and ecotoxicity potentials of a cyanobacterial extract containing microcystins under realistic environmental concentrations and in a soil–plant system

Sylvain Corbel [a,d], Christian Mougin [a,b], Fabrice Martin-Laurent [c], Olivier Crouzet [a,b], David Bru [c], Sylvie Nélieu [a,b], Noureddine Bouaïcha [d,*]

[a] INRA, UMR1402 ECOSYS, F-78026 Versailles, France
[b] AgroParisTech, UMR1402 ECOSYS, F-78026 Versailles cedex, France
[c] INRA, UMR1347 Agroécologie, F-21000 Dijon, France
[d] Laboratoire Ecologie, Systématique et Evolution, UMR8079, Univ. Paris-Sud/CNRS/AgroParisTech, Université Paris-Sud, F-91405 Orsay, France

Applied Soil Ecology 88 (2015) 1–8

Contents lists available at ScienceDirect

Applied Soil Ecology

journal homepage: www.elsevier.com/locate/apsoil

Earthworms in a 15 years agricultural trial

Céline Pelosi [a,*], Michel Bertrand [b,c], Jodie Thénard [a], Christian Mougin [a]

[a] INRA, UR251 PESSAC, F-78026 Versailles cedex, France
[b] INRA, UMR211 Agronomie INRA AgroParisTech, F-78850 Thiverval-Grignon, France
[c] AgroParisTech, UMR211 Agronomie INRA AgroParisTech, F-78850 Thiverval-Grignon, France

Environ Sci Pollut Res
DOI 10.1007/s11356-015-5270-4

ECOTOX, THE INRA'S NETWORK OF ECOTOXICOLOGISTS

Evaluation of epoxiconazole bioavailability in soil to the earthworm *Aporrectodea icterica*

S. Nélieu [1,2] · G. Delarue [1,2] · E. Ollivier [1,2,3] · P. Awad [1,4] · F. Fraillon [1] · C. Pelosi [1,2]

Many interesting tools!

- **For analysis**
  -Environmental chemistry (metals, organics, stable and radioactive isotopes…)
  -Environmental biochemistry (Biochem-Env)
  -Greenhouse gases
  -…

- **For long-term field observation and experimentation**
  -Bare fallow
  -ICOS/AnaEE-F
  -SOERE PRO
  -…

- **Conservatories and collections**
  -Soil samples (85 years)
  -Soil invertebrates
  -The BETSI database

The Biochem-Env platform

The environmental biochemistry for Research

http://www.biochemenv.fr

- **Developped since 2013**

- **Two facilities:**
  - A technical platform for the development and the technological watch of methods measuring enzymatic activities and microbiological descriptors in soils and sediment, the biochemical biomarkers in terrestrial and aquatic macrofauna, as well as lipidic biomarkers (PLFAs)
  - An information system for managing the traceability of samples and data (LIMS shared with the INRA platforms GenoSol and ChemEnvi).

- **Actually, the platform develops high-throughput tools. It is involved in ISO standardisation of protocols. It benefits of the French agreement "quarantine materials" and develops ISO 9001 labeling.**

A significant contribution to federatives structures

- **ECOSYS contributes to the main research structures in Paris area**

  -***Fédération Île de France de Recherche en Environnement***
  http://www.fire.upmc.fr/

  -***Laboratoire d'excellence BASC***
  Biodiversity, Agroecosystems, Society, Climate
  http://www6.inra.fr/basc

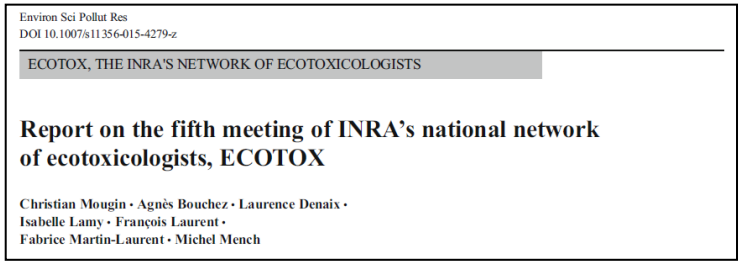
> To access to complementary skills : agriculture, climate, surface waters, social sciences, economy… and experimental sites

The INRA's network of ecotoxicologists, ECOTOX

- **To promote the scientific discussion around ecotoxicology**

  > Meetings, workshops

  > Projects of research


Environ Sci Pollut Res
DOI 10.1007/s11356-015-4279-z

ECOTOX, THE INRA'S NETWORK OF ECOTOXICOLOGISTS

Report on the fifth meeting of INRA's national network of ecotoxicologists, ECOTOX

Christian Mougin · Agnès Bouchez · Laurence Denaix · Isabelle Lamy · François Laurent · Fabrice Martin-Laurent · Michel Mench

- **To contribute to define the strategy of INRA**

  > Scientific watch

Bulletin de veille du Réseau des Ecotoxicologues de l'INRA

ECOTOX N°16, aout 2015

Edito

- **To support operating means**

  > ISO standardization, expertise….

- **The promote the scientific production**

  > Special Issue ESPR, books ISTE

Somes figures

- **Contact : christian.mougin@versailles.inra.fr**

- **Mailing list: ecotox@listes.inra.fr**

- **Website: http://www6.inra.fr/ecotox**

- **120 members**
  - Within 23 research, experimental or service departments from INRA
  - 40 from other institutes (Irstea, Irsn) or Universities…
  - 10 young scientists (Ph.D)

- **4 main areas of research**
  - Ecodynamics and bioavailability of contaminants, exposure
  - Physiological and behavioral changes
  - Changes of population and community dynamics
    > Modeling

Networking and main partners in the field of ecotoxicology

- Partnership with the RTP EcotoxicoMic
- Interrelationships with the FCS Rovaltain
- Interrelationships with Antiopes
- Interrelationships with the GIS Medicaments
- Standardisation (ISO)
- …

Previous partnership

- **Barrande project**

Folia Microbiol. 53 (4), 289–294 (2008) http://www.biomed.cas.cz/mbu/folia/

Degradation of PAHs by Ligninolytic Enzymes of *Irpex lacteus*

T. CAJTHAML[a], P. ERBANOVÁ[a], A. KOLLMANN[b], Č. NOVOTNÝ[a], V. ŠAŠEK[a], C. MOUGIN[b]

[a]*Department of Ecology, Institute of Microbiology, Academy of Sciences of the Czech Republic, 142 20 Prague, Czechia*

e-mail cajthaml@biomed.cas.cz

[b]*INRA, UR251 Physicochimie et Ecotoxicologie des Sols d'Agrosystèmes Contaminés, Versailles, 78026, France*

Received 21 August 2007
Revised version 10 December 2007

Actual partnership

- **ISO standardisation : international ring-test ISO 20130**

Soil quality — Measurement of enzyme activity patterns in soil samples using colorimetric substrates in micro-well plates

- **Leader**
  Nathalie Cheviron, ECOSYS INRA, Biochem-Env platform

- **Project participant**
  Mgr. Stanislav Malý, Ph.D.
  Central Institute for Supervising and Testing in Agriculture
  Oddělení mikrobiologie a biochemie (Brno)
  (Department of Microbiology and Biochemistry)

Concluding remarks

- **ECOSYS pole Ecotoxicology : a partner for your research**
- **ECOSYS infrastructures: a lot of tools you can use**
- **ECOTOX network: fit international collaboration**

Thank you for your attention !!