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

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ECOSYS

**Functional Ecology and
Ecotoxicology of Agroecosystems**

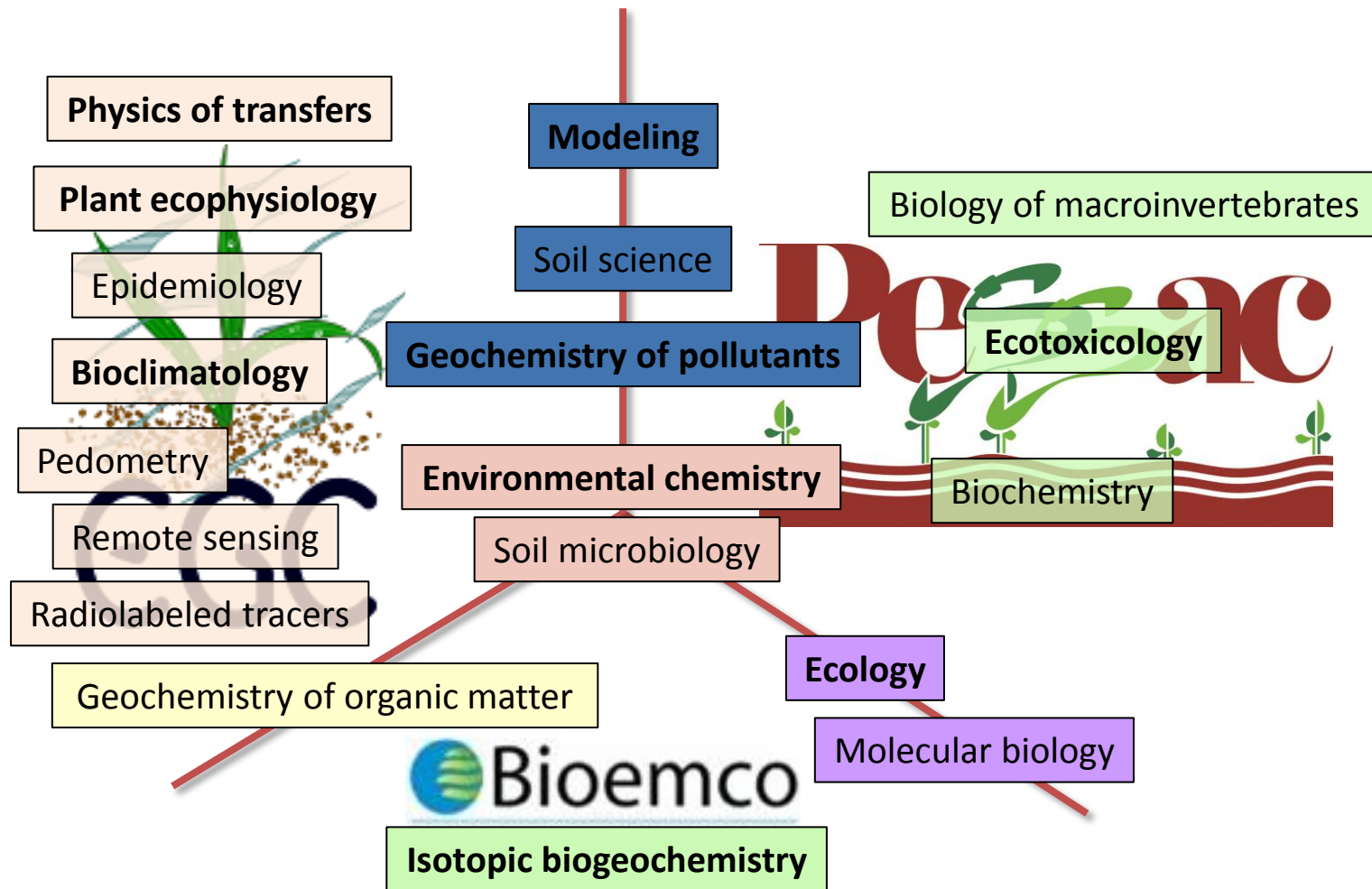
A partner for your research in ecotoxicology



Christian Mougin

FCS Rovaltain

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 

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 effects 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 research 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 pollutants 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, medicines, endocrine disruptors...)
- O₃, organic volatile compounds
- Biotoxines (cyanotoxines)
- Pathogens, pollens, spores...

❖ Non target organisms

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

≈ 25 peer-reviewed papers /year

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

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



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



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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 Capowicz

Toxicology Letters 235 (2015) 96–106



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}

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Chemosphere 128 (2015) 332–340



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,*}

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Applied Soil Ecology 88 (2015) 1–8



Earthworms in a 15 years agricultural trial



Céline Pelosi^{a,*}, Michel Bertrand^{b,c}, Jodie Thénard^a, Christian Mougin^a

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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. Ddarue^{1,2} · E. Ollivier^{1,2,3} · P. Awad^{1,4} · F. Fraillon¹ · 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 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



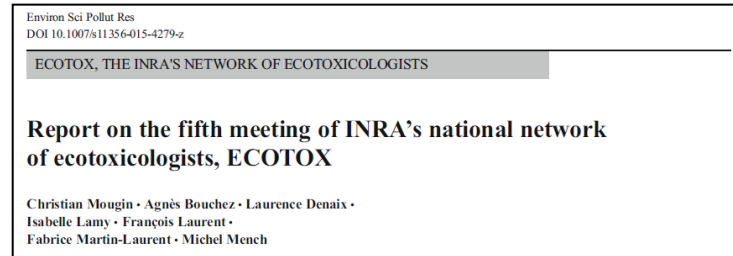
The INRA's network of ecotoxicologists,



❖ To promote the scientific discussion around ecotoxicology

> Meetings, workshops

> Projects of research



❖ To contribute to define the strategy of INRA

> Scientific watch

❖ To support operating means

> ISO standardization, expertise....

❖ To 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*

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



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Thank you for your attention !!

