

# The use of bee (*Apis Mellifica*) for biomonitoring agricultural pollution.

## Study of a video-based bee counter for real-time monitoring of bee mortality

Benjamin POIROT, PhD

Benjamin Poirot<sup>a</sup>, Valérie Nevers<sup>a</sup>, Petra Kraemer<sup>b</sup>, Michel Ménard<sup>b</sup>, Didier Crauser<sup>c</sup>, Yves Le Conte<sup>c</sup>

<sup>a</sup>**APILAB**, Pôle technologique – 40 rue Chef de Baie 17 000 La Rochelle - FRANCE  
Tel: +33 (0) 5 46 34 10 71, Fax: +33 (0)5 35 54 01 98 [www.apilab.fr](http://www.apilab.fr), [contact@apilab.fr](mailto:contact@apilab.fr)

<sup>b</sup>**Laboratoire Informatique Image et Interaction (L3i)** – avenue Michel Crépeau 17 042  
La Rochelle – FRANCE Tel : +33 (0) 5 46 45 82 62, [petra.kraemer@univ-lr.fr](mailto:petra.kraemer@univ-lr.fr)

<sup>c</sup>**UMR « Abeilles et environnement » INRA –Université d'Avignon et des Pays de Vaucluse**  
INRA Domaine Saint-Paul - Site Agroparc 84 914 Avignon - FRANCE  
Tel : +33 (0) 4 32 72 26 01, [yves.leconte@avignon.inra.fr](mailto:yves.leconte@avignon.inra.fr)



# Biomonitoring Definition



**Biomonitoring** can give an idea of **pollutants impregnation in the environment** and **health risk**.

The **toxicological evaluation of environment** is performed through observation, sampling and behavior analysis.

This assessment provides an **environmental performance indicator**.



# Bioindicator species and biomonitoring

**A "good" bioindicator species must have different properties :**

- To be abundant and easy to sample
- To be resistant (Able to accumulate the pollutant without being killed)
- A size large enough to allow analysis
- A good longevity to have multiple age classes represented in the sample
- To be sedentary in order to better reflect local conditions
- To be representative of the concentration of pollutants in the studied environment



# Why using bees?

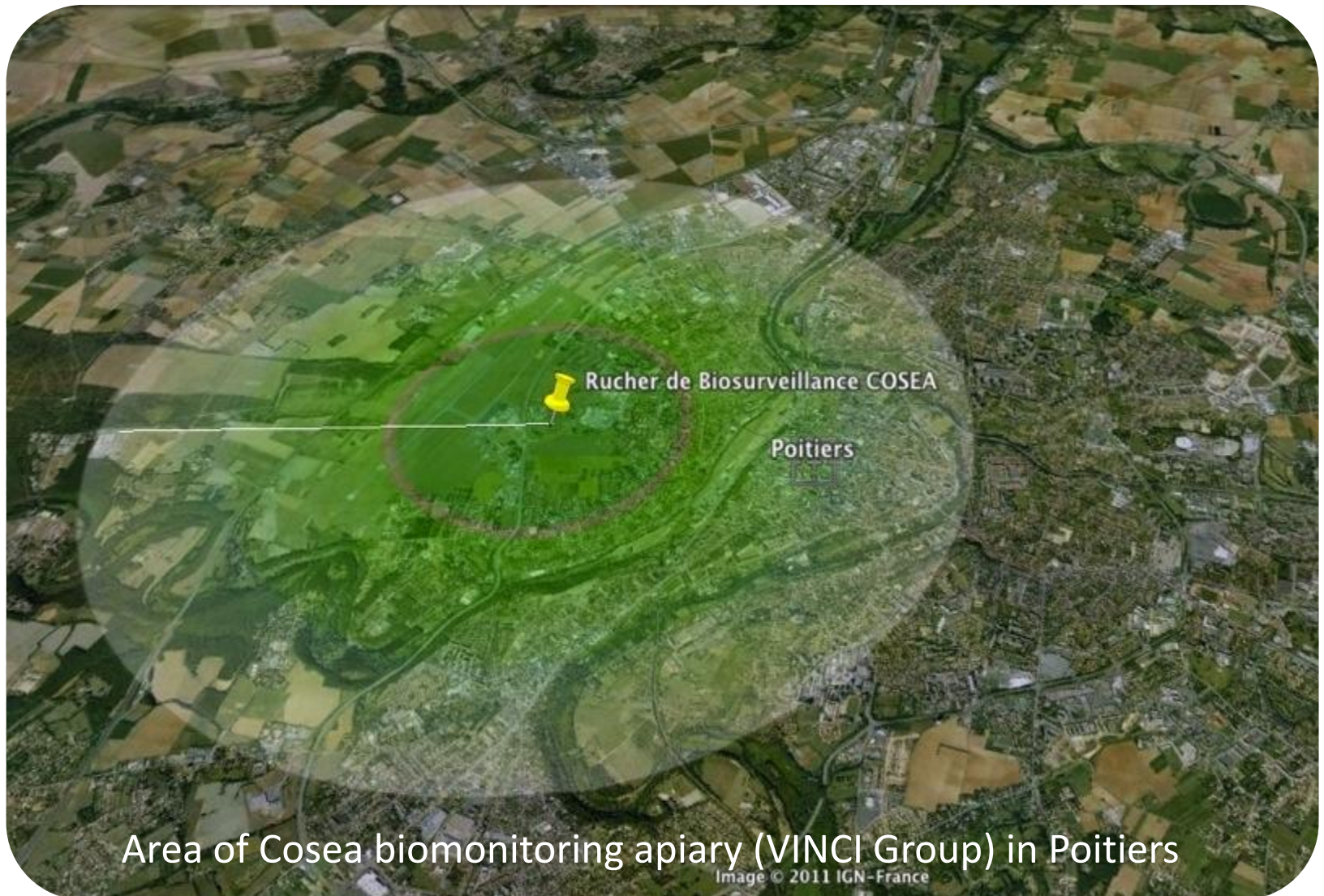
## 1. *Bees are exceptional samplers*

According to Claudio Porrini, "taking into account the fact that a hive contains about 40,000 bees, and a quarter of these are foragers who daily « visit » a thousand flowers each, it can be estimated that a bee colony is proceeding 10 million micro-samples every day. »

*Porrini C. Les origines de l'utilisation de l'abeille comme indicateur biologique. Bulletin Technique Apicole 35 (4), 2008, 162-164.*







Area of Cosea biomonitoring apiary (VINCI Group) in Poitiers

Image © 2011 IGN-France

Image © 2011 IGN-France

# Why using bees ?

## ***2. Bees have an important response to environmental stress***

They report very significantly the pollution of their environment through two ways:



**Biointegrators**



**Biomarkers  
Bioaccumulators**

*Claudianos C. A deficit of detoxification enzymes: pesticide sensitivity and environmental response in the honeybee. InsectMoleculaBiology 15 (5), 2006, 615-636.*



## Why using bees ?

**3. Bees can give good and regular indications of environmental conditions** because they are numerous and active (usually March to October).

**4. Bee presence is reassuring the public about the health status of the environment.**

➔ The use of bees for environmental monitoring has been practiced for over 20 years. Recent CNRS / INRA studies have shown that the bee is a suitable tool to perform environmental diagnostic.

*Claudianos C. A deficit of detoxification enzymes: pesticide sensitivity and environmental response in the honeybee. InsectMolecularBiology 15 (5), 2006, 615-636.*



## Example of the use of bee as a bioaccumulator

- Use of bees to characterize the level of environmental contamination by xenobiotics (ML, PAHs, dioxins, pesticides).

*Devillers J. Utilisation de l'abeille pour caractériser le niveau de contamination de l'environnement par les xénobiotiques. Bulletin Technique Apicole (35) 4, 2008, 179-180.*

- Use of bees to detect the presence of radioisotopes in the environment after Chernobyl disaster and other industrial accidents.

*Porrini, C. Les abeilles utilisées pour détecter la présence de radio-isotopes dans l'environnement. Bulletin Technique Apicole (35) 4, 2008, 168-178.*

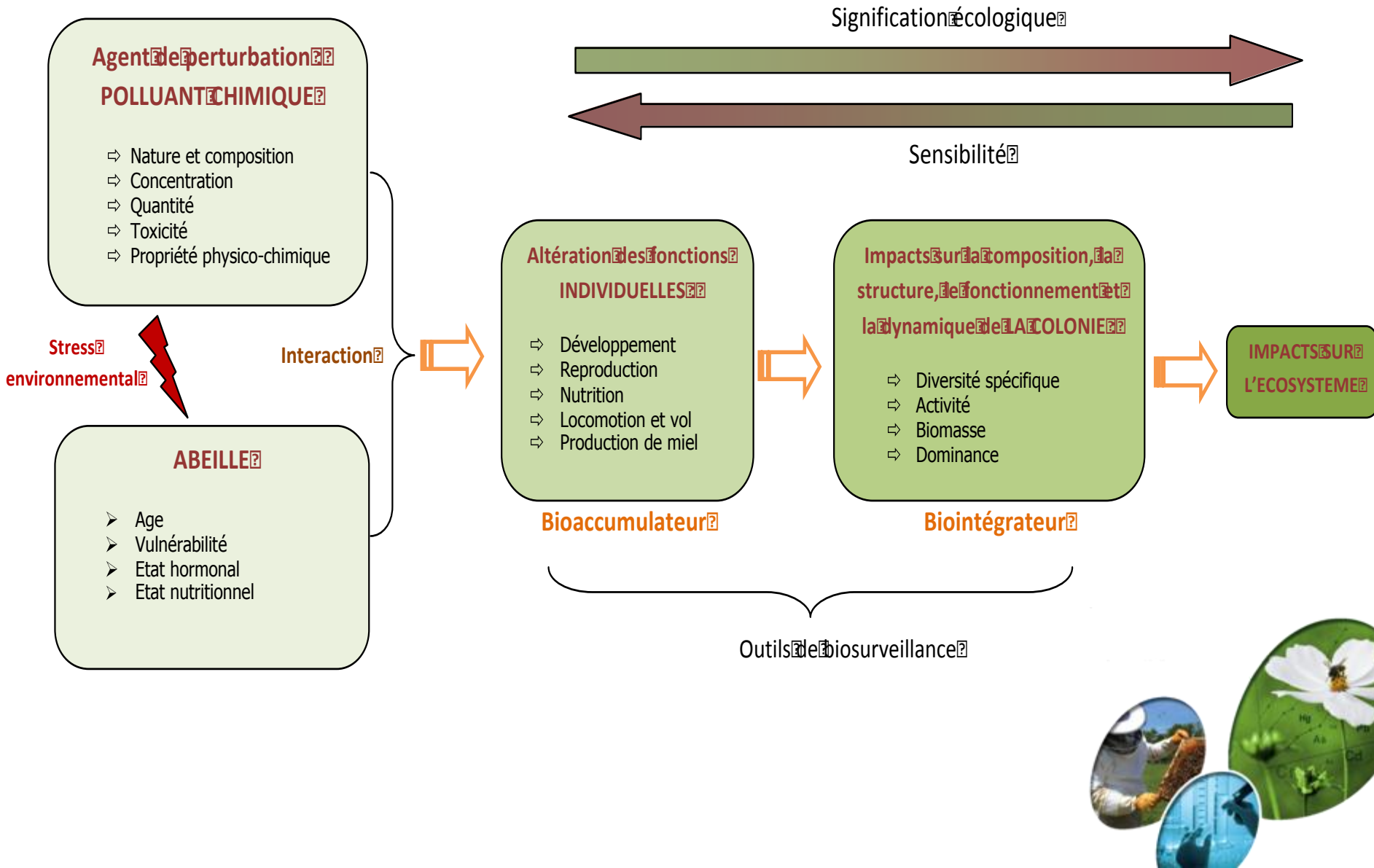
➔ In 2008, use of bee as a bioindicator by the Conseil Général of the french region of Isère

*Leoncini, I. L'observatoire en Isère: la colonie d'abeilles, témoin de la qualité environnementale. Bulletin Technique Apicole (35) 4, 2008, 165-167*





# Bee biomonitoring



# Use of bee as biointegrator

## Biomonitoring tools for pesticides control

**1 apiary with 3 hives equipped with multiple sensors:**

- Bee counter (INRA exclusive license)
  - Mortality rate
  - Daily activity
- Behavior (in development)
- Weight
- Local weather data (temperature, humidity, rainfall)



# Use of bee as biointegrator

## Biomonitoring tools for pesticides control

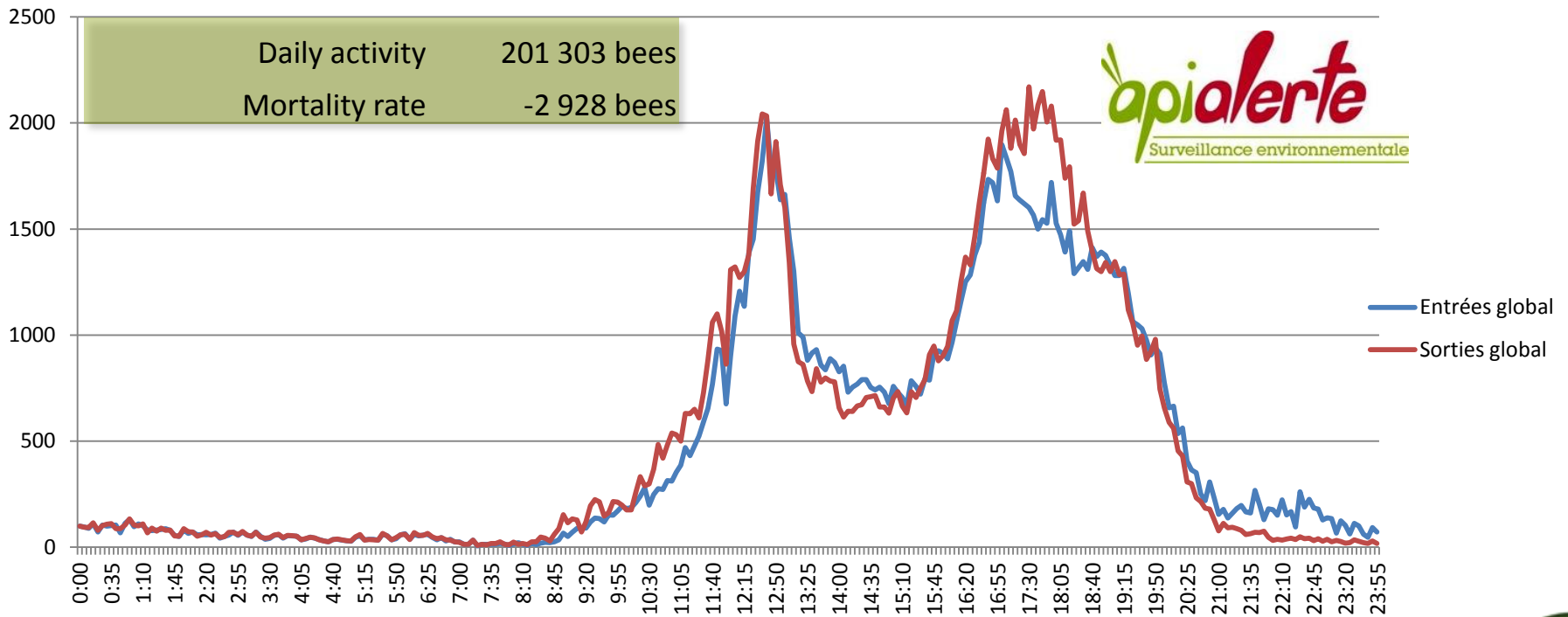
An on-board computer for signal acquisition, processing and sending data on a server in real time *via*:

- GSM
- WIFI
- Ethernet
- Satellite



# Use of bee as biointegrator

## Example of daily activity report



# Use of bee as biointegrator

## Examples of biomonitoring applications for agricultural pollution:

- Poitiers city in partnership with ATMO to monitor pesticides pollution in the air
- Beekeepers & farmers to control bee populations during flowering periods and pesticide treatments
- Veolia pumping station of drinking water (protection of catchment area of 3 km)







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