

# Background and research activities

## **GIScience contribution to molecular ecology**

Dr Stéphane Joost – Oliver Selmoni (Msc)

Laboratory of Geographic Information Systems (LASIG)

Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland

# GIS Lab @ EPFL

- School of architecture, civil and environmental engineering (ENAC)
- Institute of Environmental engineering (IIE)
- Laboratory of Geographic Information Systems (LASIG)
- Research group
  - Landscape genetics and spatial epidemiology
  - Analysis of the relationship between living organisms and their environment.
  - Use of GIS and spatial statistics for the analysis and management of health data and genetic resources



# Who we are

- Stéphane Joost
  - Geology, geography and computer science at University of Lausanne (Switzerland)
  - University of Geneva, MicroGIS Inc., EPFL (PhD), UCSC Piacenza (Italy)
- Oliver Selmoni
  - MSc in Biology, University of Lausanne, Switzerland
  - PhD student at EPFL, seascape genomics

# Genetic information is GEO

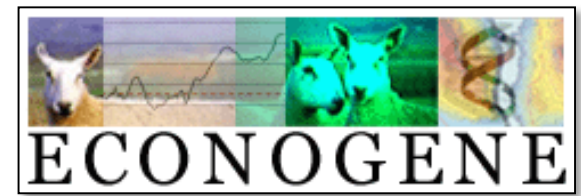
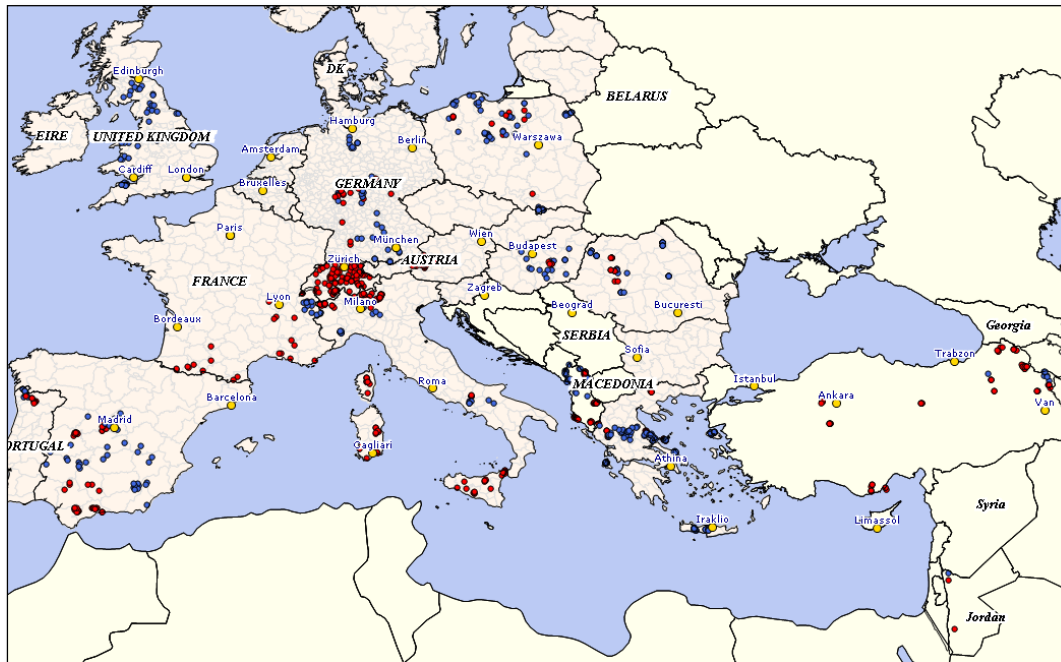
- In its natural framework, genetic information is embedded within a geographic context
- Plants, animals, humans are directly influenced by the characteristics of their surrounding environment
- thus the spatial dimension of genetic information has to be considered when trying to understand genetic resources
- We address this perspective from a GIScience angle

# Biology or geography ?



# GIS and biology at EPFL

- 2001, FP5 ECONOGENE project
- Conservation of small ruminant genetic resources in Europe



# Interdisciplinary project

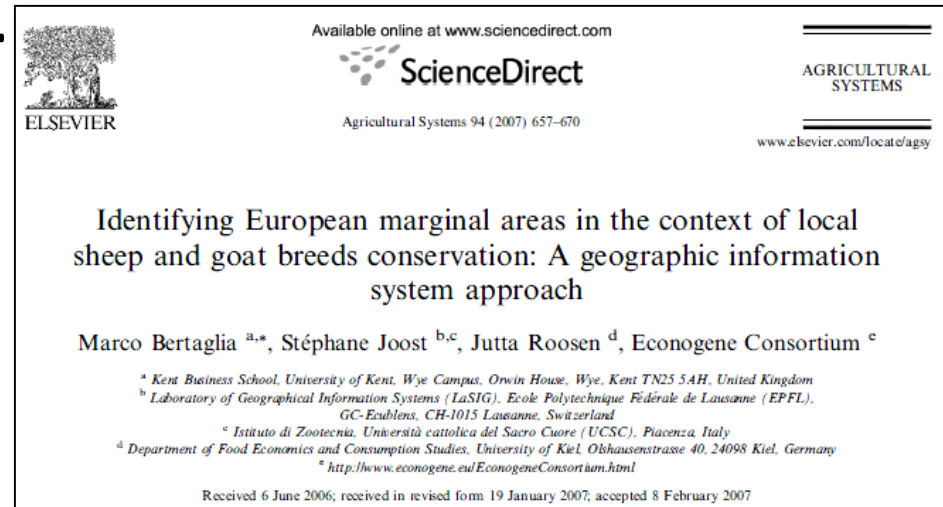
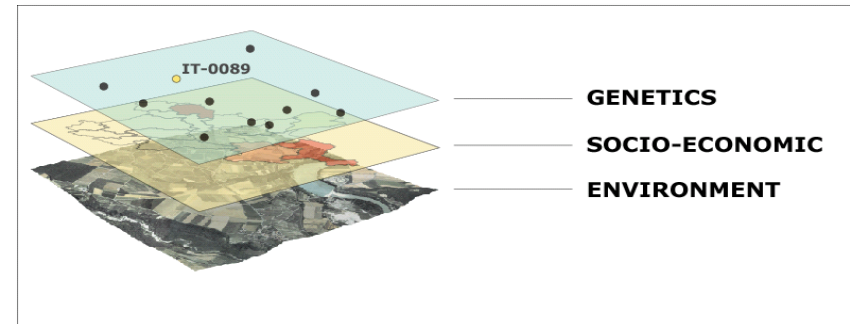
- Interdisciplinary approach with biologists, veterinarians, economists, GIScientists, sociologists
- Brought together by Régis Caloz, Godfrey Hewitt and Pierre Taberlet, Mike Bruford
- Project chaired by Paolo Ajmone-Marsan
- Alessio Valentini



**Two roles for GIS...**

# 1. Data integration

- **Integration** of different types of information produced by a variety of disciplines
- Multicriteria **decision-making** support for the definition of conservation priorities between endangered breeds



## 2. Spatial analysis of genetic data

- Test and assess the potential contribution of spatial analysis to extract information and new knowledge in molecular ecology
- Support basic research on natural selection and adaptation processes, and on evolution in general

# Main current projects

- [EU H2020 IMAGE](#): Innovative Management of Animal Genetic Resources (improve genomic methodologies, biotechnologies, and bioinformatics)
- SNSF GENESCALE: at which scale does natural selection operate? multiscale landscape genomic (*Arabis alpina*)
- [EU FP7 NEXTGEN](#): adaptation in sheep, goats, cattle, whole genome data, Iran, Morocco, Uganda
- ADCORE: seascape genomics
- [URBANGENE](#): multispecies investigation of the impact of the urbanization process on genetic diversity in the Geneva cross-border area

# Original contribution of GIScience

- URBANGENE (<http://urbangene.epfl.ch>)



## PPGIS 4 bufo bufo in URBANGENE

Stéphane Joost, Ivo Widmer, Estelle Rochat

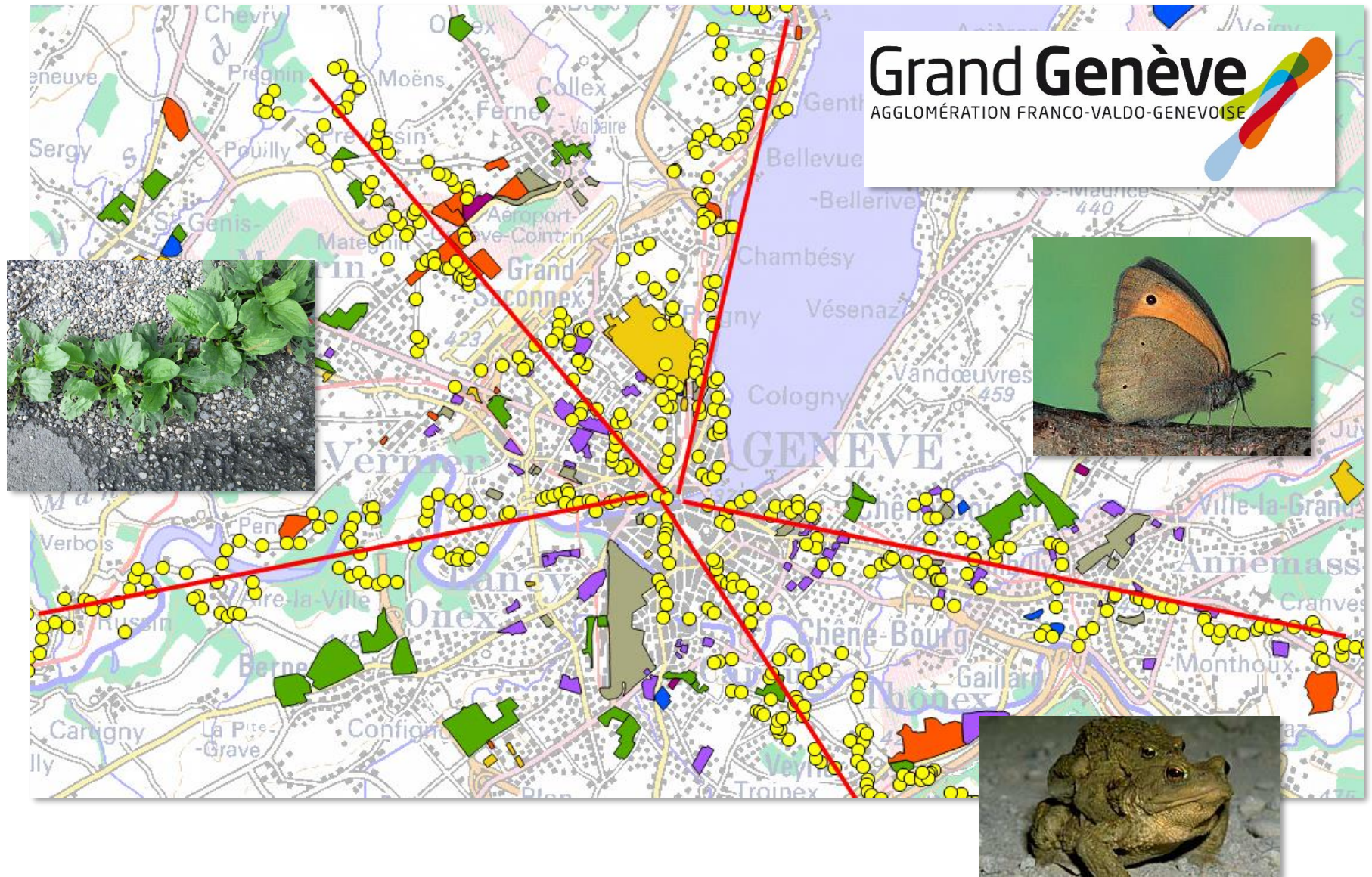
Laboratoire de Systèmes d'Information Géographique (LASIG), EPFL

Daniel Rappo, Olivier Ertz, Raphaël Baumann,  
Sandrine Divorne, Jérôme Freyre, Jens Ingensand

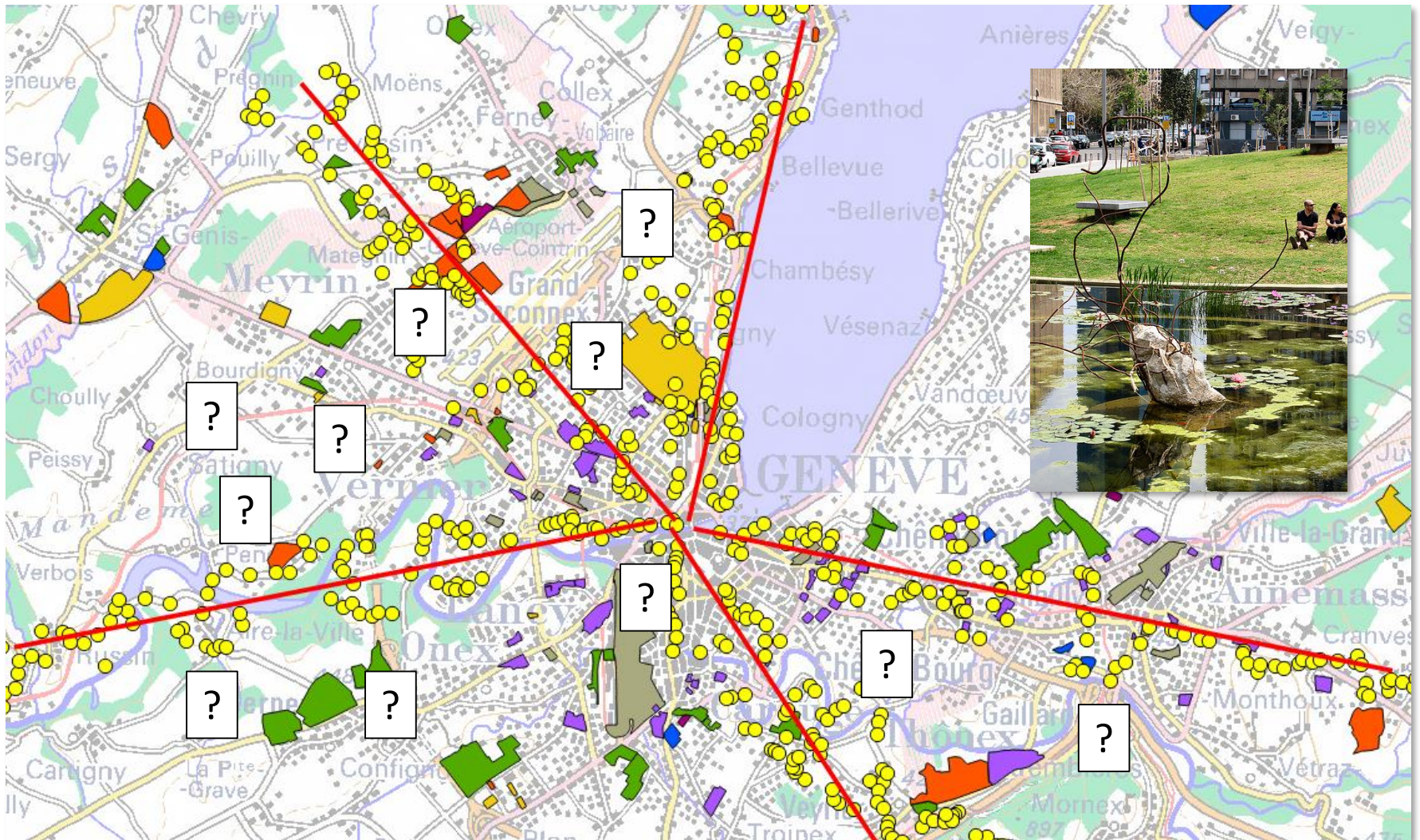
Département COMEM+ & Institut G2C, HEIG-VD



# Effects of urbanization on genetic diversity



# But where are the ponds ?



# Urbangene.heig-vd.ch

Google Agenda x L'endroit où vous vivez p... x Urbangene EPFL x URBANGENE

urbangene.heig-vd.ch

Apps myAgenda SEARCH CONFERENCES DISCIPLINES EPFL FUNDING GENETICS GIS HOBBIES IT METHODS MFSA PRESSE PRIVATE PROJECTS PUBLICATIONS SCIENTISTS SOFTWARE Teaching

EPFL  
ÉCOLE POLYTECHNIQUE  
FÉDÉRALE DE LAUSANNE

URBANGENE

heig-vd  
Haute École d'Ingénierie et de Gestion  
du Canton de Vaud

Le projet URBANGENE est conduit par l'EPFL et le Grand Genève. Son but est d'estimer les effets de l'urbanisation sur la biodiversité dans l'agglomération genevoise.

Des informations complémentaires sur le projet peuvent être trouvées sur [le site du projet URBANGENE de l'EPFL](#).

Vous pouvez contribuer à notre inventaire !

Poursuivez en indiquant sur la carte (en Suisse ou en France) les emplacements où vous avez vu une mare...

C'est parti ! 



Grand Genève  
AGGLOMÉRATION FRANCO-VALDO-GÉNEVOISE

Leaflet | © OpenStreetMap contributors

FR 10:40 20.03.2014

# L'EPFL dresse un diagnostic de la biodiversité

**RECHERCHE** — Des chercheurs de l'EPFL lancent une vaste étude pour évaluer l'impact de l'urbanisation sur la biodiversité en utilisant l'information génétique. Le public est invité à repérer et à signaler les mares à crapauds.

Mis à jour à 12h37 [1 Commentaire](#)



[www.bauernzeitung.ch](http://www.bauernzeitung.ch) / ETH Lausanne will genetische Vielfalt von Kröten in Genf erforschen

Schweiz-International

Publiziert: 20.03.2014 / 14:49



## ETH Lausanne will genetische Vielfalt von Kröten in Genf erforschen

Forscher der ETH Lausanne (EPFL) lancieren eine grossangelegte Genomstudie, um den Einfluss der Stadtentwicklung auf die Artenvielfalt zu untersuchen. Sie bitten deshalb die Genfer Bevölkerung um Hilfe, ihnen möglichst viele Lebensräume von Erdkröten mitzuteilen.



# Add a pond...

Google Agenda x L'endroit où vous vivez pr x Urbangene EPFL x URBANGENE x

urbangene.heig-vd.ch

Apps myAgenda SEARCH CONFERENCES DISCIPLINES EPFL FUNDING GENETICS GIS HOBBIES IT METHODS MFSA PRESSE PRIVATE PROJECTS PUBLICATIONS SCIENTISTS SOFTWARE Teaching »

Recherche lieu, adresse, commune, ...

Zoomer, puis déplacer l'icône pour affiner sa position

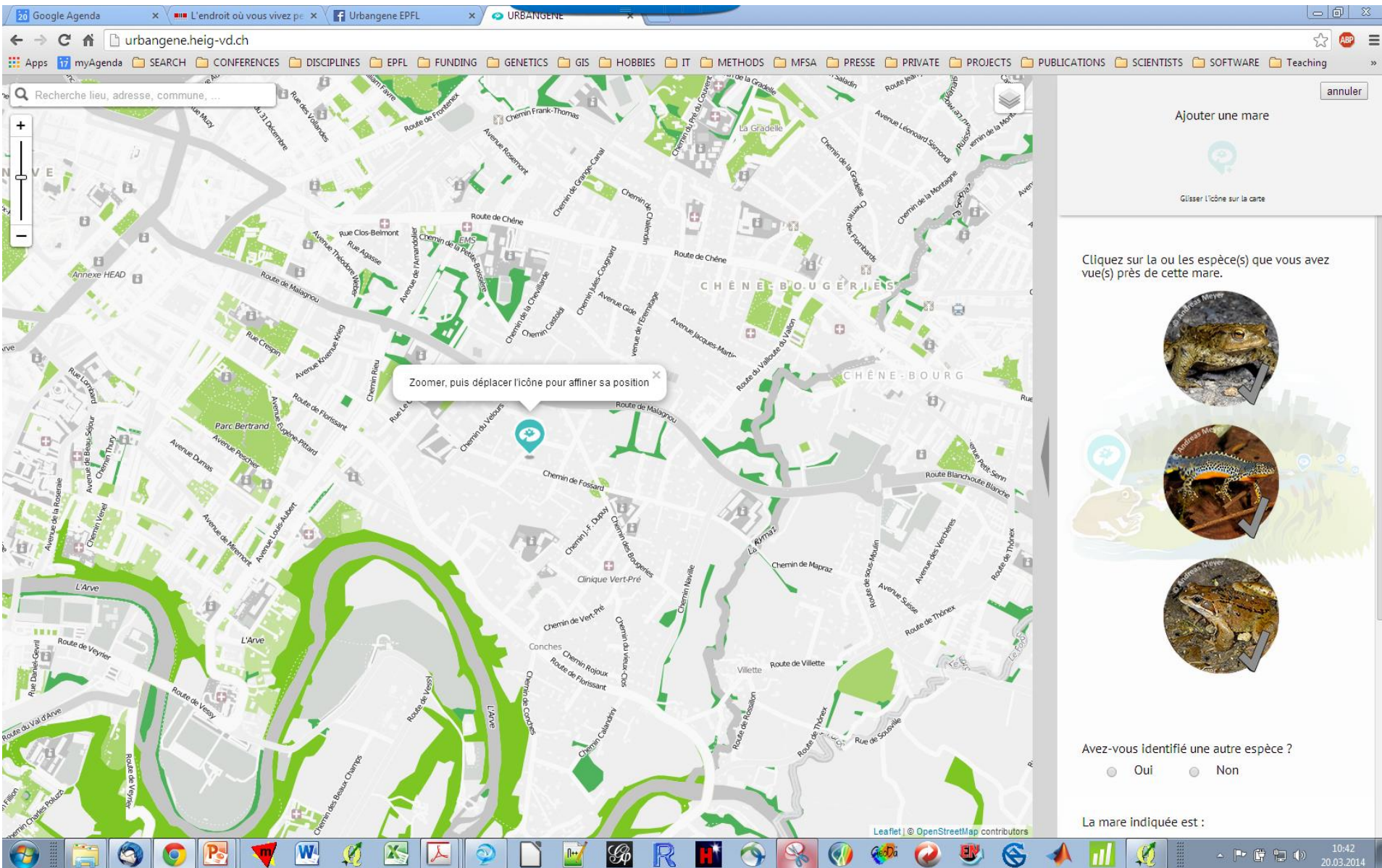
Ajouter une mare

Glisser l'icône sur la carte

Cliquez sur la ou les espèce(s) que vous avez vue(s) près de cette mare.

Avez-vous identifié une autre espèce ?  
☐ Oui ☐ Non

La mare indiquée est :



The screenshot shows a web browser window with the URL 'urbangene.heig-vd.ch'. The browser's address bar and tabs are visible at the top. Below the browser window, a map of a residential area is displayed. A blue location pin is placed on the map, and a tooltip bubble says 'Zoomer, puis déplacer l'icône pour affiner sa position'. To the right of the map is a sidebar titled 'Ajouter une mare' (Add a pond). It contains a map icon and the instruction 'Glisser l'icône sur la carte' (Drag the icon onto the map). Below this is a section titled 'Cliquez sur la ou les espèce(s) que vous avez vue(s) près de cette mare.' (Click on the one or more species you have seen near this pond). It features three circular images of amphibians: a frog, a salamander, and a toad. At the bottom of the sidebar, there is a question 'Avez-vous identifié une autre espèce ?' (Have you identified another species?) with radio buttons for 'Oui' (Yes) and 'Non' (No). Below that, it says 'La mare indiquée est :'. The bottom of the browser window shows a Windows taskbar with various application icons and the system clock showing 10:42 on 20.03.2014.

## Identifying super corals through DNA analysis



Le doctorant pratiquera la plongée pour récolter ses échantillons. © Jamani Caillet/EPFL 2018

**20.02.18** - A PhD student from EPFL will spend three months in New Caledonia for a research project supported by the International Coral Reef Initiative. He will share his experience on the EPFL Out There blog.

Oliver Selmoni, a second-year PhD student at EPFL, will have three months to collect 400 coral reef samples in New Caledonia. This French archipelago lies directly east of Australia and is surrounded by the second largest coral reef in the world after the Great Barrier Reef. Like so many other coral reefs, this precious ecosystem – which is a UNESCO World Heritage site – is under threat. On 20 February, Selmoni will join a research initiative launched by EPFL into how corals adapt to global warming, pollution and the anthropization of coastal areas. The project is being carried out in conjunction with the French National Research Institute for Sustainable Development (IRD – UMR ENTROPIE). He will post updates, photos and videos to the EPFL Out There blog and Instagram up until the end of May.

### LINKS

# [French National Research Institute for Sustainable Development \(IRD\)](#)

[International Coral Reef Initiative \(ICRI\)](#)

[LASIG](#)

### RELATED ARTICLES

**07.02.2018**

[Confirming the risks of pesticide use in Burkina Faso](#)

**31.01.2018**

[Two months in Pyeongchang to study Korean snowfalls](#)

[▶ \*All Geographic Information Systems Laboratory news\*](#)

[▶ \*Architecture, Civil and Environmental Engineering | ENAC news\*](#)

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