

## *Spring School*

# **“Landscape genetics in transition to landscape genomics: challenges and opportunities to explore NGS data in a spatially explicit context”**

**SPRING SCHOOL VENUE:** The University Residential Centre of Bertinoro (Ce.U.B.), ITALY

**DATES:** 23 March - 29 March 2014

**Organised by Prof Ettore Randi (National Institute for Environmental Protection and Research, Italy) & Dr. Aritz Ruiz-Gonzalez (University of the Basque Country, Spain)**

Landscape genomics is an exciting and rapidly growing discipline that combines genome-wide patterns of genetic variation, large environmental data sets and spatial statistical methods, to improve our understanding of both species ecology and ecological adaptation. This spring school aims to provide an updated discussion of landscape genetics analysis in the new genomic era, guided by experts in genomics, spatial statistical analyses, and population genetics. It will include an assortment of conceptual, methodological and applied contributions, followed by hands-on training in order to provide an overview of novel approaches for analysing the environmental context of genomic variation.

### **Audience**

The Spring school is aimed at early-career researchers (PhD students, postdoctoral researchers, and faculty who wish to gain training in this area) who have some background knowledge in population genetics and landscape genetics but who have an interest in improving their skills with regards to the analysis of the environmental context of genome-wide genetic variation obtained from novel NGS data. The spring school will have a limited number of participants (30) and lectures (4).

### **Aim and Objectives**

This school aims to provide an updated discussion of landscape genetics analyses in the new genomic era, guided by experts in genomics, spatial statistical analyses, and population genetics. It will include an assortment of conceptual, methodological and applied contributions, followed by hands-on training in order to provide an overview of novel approaches for analysing the environmental context of genome-wide genetic variation.

The school will provide an excellent opportunity to introduce young scientists (PhD students and postdocs) to the complex field of landscape genomics and familiarise them with the application of novel analyses from different disciplines that merge within this novel field.

The specific objectives of this course are:

- 1) Promote better understanding links between the novel genomic information and spatially explicit analysis, in order to facilitate interdisciplinary communication and education in the new emerging field of landscape genomics
- 2) Provide an update of the current state of the landscape genetics field and the major challenges and opportunities by the incorporation NGS data.
- 3) Explore recent analytical advances in NGS of non-model species and gain experience about data collection, production and analysis strategies in population genomics.

- 4) Provide hands-on training for analysing the environmental context of genetic (neutral and adaptive) variation through spatial statistic and simulation modelling using the most recent methods on landscape genetics/genomics.
- 5) Address current research challenges and explore new opportunities to improve future landscape genomics applications, and positively contribute to the future growth of this promising field.

## SPRING SCHOOL VENUE

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The school will be held at The University Residential Centre of Bertinoro (Ce.U.B.), Italy. This centre is active since 1994 in the field of vocational training, conferences, congresses and lectures. Ce.U.B. is a professional training centre of the University of Bologna and it is located in the ancient town of Bertinoro (Forlì-Cesena). <http://www.ceub.it/>.



Lodging and meals (Breakfast, Lunch, Dinner and coffee breaks) during **the workshop are paid for by the ESF** and will be at the Ce.U.B guest house and canteen <http://www.ceub.it/default.asp?id=549> and at the Hotel Fontanelle <http://www.hotelfontanelle.it/hotel-1.html> .

## PROGRAM

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- **Sunday 23 March**

### ARRIVAL AND OPENING OF THE SCHOOL \*

**10:00- 20:00\*** Reception and registration of participants - Hotel Fontanelle (Via Loreta, 27, Fratta Terme)  
<http://www.hotelfontanelle.it/hotel-1.html>

**20:00- 20:30** Introductory talk about the aims and scope of the spring school on “**Landscape genetics in transition to landscape genomics: challenges and opportunities to explore NGS data in a spatially explicit context**”  
**Prof. Ettore Randi & Dr. Aritz Ruiz-Gonzalez**

**20:30 Welcome Buffet**

\* On Sunday 23 March (Late Morning & Afternoon) it will be available a Shuttle bus from Bologna airport to the School venue. The Reception and registration will be open until 22:00, but we encourage arriving before 20:00.

- **Monday 24 March**

### FROM LANDSCAPE GENETICS TO LANDSCAPE GENOMICS

**Dr. Stephane Joost**

**Session 1** - Ten years of landscape genetics: where are we now?

**Session 2** – Landscape genomics: a brief perspective

### DETECTION OF GENOMIC REGIONS UNDER SELECTION IN LANDSCAPE GENOMICS

**Dr. Stephane Joost**

**Sesion 3** - Designing a landscape genomic approach

**Sesion 4**- Landscape genomics for detection of candidate loci under selection: promises and pitfalls

**Sesion 5**- SamBada integrated software for landscape genomic analysis of large datasets (*Hands-on training*)

- **Tuesday 25 March**

### SPATIALLY EXPLICIT MODELS FOR LANDSCAPE GENETICS AND GENOMICS (1)

**Dr. Samuel Cushman**

**Session 1** - Analysis of empirical landscape genetic data

**Session 2** - Analysis of empirical landscape genetic data and landscape genetic modeling with R (*Hands-on training*)

**Session 3**- Analysis of spatial heterogeneity of genetic diversity with sGD (*Hands-on training*)

- **Wednesday 26 March**

### SPATIALLY EXPLICIT MODELS FOR LANDSCAPE GENETICS AND GENOMICS (2)

**Dr. Samuel Cushman**

**Session 1** - Simulation of gene flow with CDPOP software (*Hands-on training*)

**Session 2** - Modelling population connectivity with UNICOR (*Hands-on training*)

- **Thursday 27 March**

**PRODUCING AND ANALYSING NGS DATA OF NON-MODEL SPECIES**

*Dr. Robert Ekblom*

**Session 1** – NGS genome analysis in non-model species: a general overview -Genome sequencing-

**Session 2** - NGS transcriptome analysis in non-model species: a general overview –Transcriptome sequencing-

**Session 3** - Microsatellite identification of assembled transcriptome data (*Hands-on training*)

**Session 4** - Identifying differentially expressed genes in RNA-Seq data (*Hands-on training*)

**Session 5** - Illumina read mapping and SNP calling on genome sequencing data (*Hands-on training*)

**Session 6** Population genetic analyses of SNP data (*Hands-on training*)

- **Friday 28 March**

**LANDSCAPE GENETICS IN TRANSITION TO LANDSCAPE GENOMICS: CHALLENGES AND OPPORTUNITIES IN A CONSERVATION CONTEXT**

*Dr. Gernot Segelbacher*

**Session 1** - Landscape genetics in transition to landscape genomics: challenges and opportunities in a conservation context (*Introductory talk*)

**Session 2** - Brief presentations (<5min) of school participant's research projects. *Open discussion.*

**Session 3** - Round table: Exchange of ideas and suggestions about research challenges and new opportunities to improve future landscape genomics applications. This session will be guided by Dr. Gernot Segelbacher and with the participation of Dr. Samuel Cushman, Dr. Robert Ekblom and Dr. Ettore Randi and all the school students.

**20:00 Workshop Closing dinner**

- **Saturday 29 March**

**DEPARTURE\***

*\* On Saturday 29 (Morning) it will be available a Shuttle bus from the School venue to Bologna airport.*

**SCHOOL LECTURES**

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- **Dr. Samuel Cushman**-USDA Forest Service, Rocky Mountain Research Station. USA

Website: <http://www.fs.fed.us/rmrs/people/scushman/>

- **Dr. Stephane Joost** -Laboratory of Geographic Information Systems (LASIG), School of Architecture Civil and Environmental Engineering (ENAC). SWITZERLAND

Website: <http://people.epfl.ch/cgi-bin/people?id=149002&lang=en&cvlang=en>

- **Dr. Robert Ekblom** - Department of Evolutionary Biology. Evolutionary Biology Centre, EBC . Uppsala University. SWEDEN

Website: [http://www.ebc.uu.se/Research/IEG/evbiol/people/pages/Ekblom\\_Robert/?languageId=1](http://www.ebc.uu.se/Research/IEG/evbiol/people/pages/Ekblom_Robert/?languageId=1)

- **Dr. Gernot Segelbacher** - Wildlife Ecology and Management, University of Freiburg, GERMANY

Website: <http://www.wildlife.uni-freiburg.de/Staff/segelbacher>

## REGISTRATION

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**\*\*\*CLOSED\*\*\***

The workshop is supported by the European Science Foundation (ESF). Registration is free and accommodation and meals during the workshop are paid for by the ESF. Travel costs will be reimbursed up to a maximum of €100 for Italian participants and up to a maximum of €200 for non-Italian participants. Travel costs will be reimbursed after the Spring school by the Ce.U.B. Secretary. The reimbursement of travel costs (train, bus, and plane) is subject to receipt of the original travel tickets (or electronic tickets with indication of price).