

# The University of Western Australia

School of Environmental Systems Engineering

School of Plant Biology

The Graduate Research School

Pro Vice-Chancellor (Research and Research Training) Professor Robyn Owens

Pro Vice-Chancellor (Research Initiatives) Professor Alistar Robertson

## Present

### a Master Class in Recent Advances in Spatial Analysis of Multivariate Environmental Data: *Theory and Practice*

Gentilli Lecture Theatre (Geography and Geology, Room 131)

June 8-12, 2009

Professor Pierre Legendre

Vice-Chancellor's Visiting Professor

Département de sciences biologiques

Université de Montréal

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Webpage for free software: <http://www.bio.umontreal.ca/legendre/>

Webpages for this course : <http://biol09.biol.umontreal.ca/Perth09/>



**Professor Pierre Legendre** is a world authority in spatial ecology and environmental studies. Through his very productive career he has developed a number of tools which are widely used by ecologists and environmental scientists and engineers around the world. Professor Legendre received many national and international distinctions and awards throughout his career, such as Michel-Jurdant prize for Environment Sciences, Killam Research Fellow, Statistical Ecologist Award of the International Congress of Ecology (INTECOL) in 1994, and the Romanowski Medal (environmental science) of the Royal Society of Canada in 1995. Recipient of the Twentieth Century Distinguished Service Award "for outstanding contribution to the synergistic development and direction of statistics, ecology, environment and society" awarded in April 1999 by the Ninth Lukacs Symposium "Frontiers of Environmental and Ecological Statistics for the 21st Century". Recipient of the 2005 Prix Marie-Victorin, the annual prize of the Government of Québec for highest achievements in research in pure and applied sciences. Professor Legendre is a fellow of the national order of Quebec and the Royal Society of Canada and also an ISI Highly Cited Researcher in Ecology/Environment.

In 2008, Professor Legendre accepted the distinguished appointment by Professor Alan Robson as Vice-Chancellor Visiting Professor to The University of Western Australia.

**Intended audience:** researchers and graduate students who are interested in spatial analyses of environmental data as well as multi-species communities or other types of multivariate data. The course will present advanced statistical methods to approach these problems, including the study of multiscale spatial patterns displayed by natural or manthreatened communities or environments.

**Pre-requisites:** basic (bio-)statistics, including elementary notions about correlation, regression, and analysis of variance.

**Organisation of the course:** theory in the morning (3 hours), practicals using the R statistical language in the afternoon (3 hours). Additional time in the afternoon will be devoted to presentation of research questions by students and researchers. Students and researchers will use their own laptops for the practicals. Prior to the course, they will receive instructions about how to load the R language application in their computers, as well as the libraries of R functions that will be used during the practicals.

**Please see next page for details of course.**



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# The workshop will cover:

## Day 1

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0. Introduction to data analysis.
1. Ordination in reduced space: principal component analysis (PCA), principal coordinate analysis (PCoA), correspondence analysis (CA).
2. Transformation of species abundance data tables prior to linear analyses.

## Day 2

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3. Measures of similarity and distance, especially for community composition data.
4. Multiple regression. R-square and adjusted R-square. Partial regression.

## Day 3

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5. Statistical testing by permutation.
6. Canonical redundancy analysis (RDA) and canonical correspondence analysis (CCA). Multivariate analysis of variance by canonical analysis.

## Day 4

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7. Forward selection of environmental variables in RDA.
8. Spatial modelling: Origin of spatial structures. Multi-scale modelling of the spatial structure of ecological communities (PCNM). Extensions: MEM, AEM. Test of space-time interaction in repeated surveys.

## Day 5

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### morning

9. Spatial structure functions: correlograms, variograms. Control for spatial autocorrelation in tests of species-environment relationships.
10. Cartographic interpolation, kriging.
11. Spatial variation partitioning: canonical analysis or Mantel test?

### afternoon

12. Discussion of study cases presented by participants.

## Afternoons, days 1–4

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Practicals about these topics using the R language:

- Introduction to the R statistical language (file: Introduction\_to\_R.pdf)
- Practical in the R language: Basic matrix operations (file: Basic\_matrix\_operations.pdf)
- Practical using the R statistical language (file: Practicals\_in\_R.pdf)

## Registration:

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There is no charge for this course, but registration is essential. To register please contact:

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# Master Class

## Recent Advances in Spatial Analysis of Multivariate Environmental Data: Theory and Practice

### Registration Form

#### Participant Details

Last Name:

First name:

Position:  Researcher  Student  other  UWA Postgraduate Student

University/Organization:

School/ Department:

Phone:

Email:

#### Please send this form electronically to:

Anas Ghadouani

[Anas.Ghadouani@uwa.edu.au](mailto:Anas.Ghadouani@uwa.edu.au)

#### For information contact:

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For a map of where the Gentilli Lecture Theatre (Geography and Geology, Room 131) is located at UWA please go to: [http://www.uwa.edu.au/campus\\_map?id=1896](http://www.uwa.edu.au/campus_map?id=1896)



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