SECTION 1

Course title

Multicriteria analysis for impact assessment: Theory and practice

Level
Intermediate

Prerequisites for participants
No prior experience with decision support systems or multicriteria analysis is required, but participants should be familiar with at least one impact assessment field (e.g., EIA, SEA, HIA, SIA, etc).

Language
English

Duration
2 days

Maximum number of participants
35

Participants are required to bring their own laptop for the hands-on sessions (laptops may be shared between two participants)

Trainer
Dr. Davide Geneletti (IAIA member in good standing)
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SECTION 2

a) **Summary of the course (300 words)**

Impact assessment processes aim to provide information for decision-making. Therefore, the identification and comparison of alternatives, and the justification of choices, represent essential elements of any impact assessment. Comparing alternatives against multiple objectives and criteria implies balancing different impact types, understanding the merits of each option, and eventually establishing a preference ranking. This calls for a framework to integrate factual information on effects and impacts, with values and preferences of decision-makers and stakeholders. Multicriteria analysis (MCA) offers such a framework.

This intermediate-level course aims at providing theoretical insights and hands-on experience on the application of MCA to impact assessment. More specifically, the course addresses the following topics:

- Basic concepts of decision theory (e.g., decision-making process, actors);
- Problem structuring;
- The philosophy of MCA;
- MCA methodological steps: value functions, weight assessment, aggregation techniques, sensitivity analysis, and results presentation;
- Working with Decision Support Systems (DSS);
- Using GIS and new digital technologies in MCA;
- MCA in the real world: examples in different impact assessment fields;

The teaching method is based on theoretical lectures, group discussions and hands-on exercises using DSS software (freely available). The target audience of this course is represented by practitioners, international agency personnel, public officers, research fellows, PhD and MSc students interested in the comparison of options in impact assessment. No prior experience with DSS or MCA is required, but participants should be familiar with at least one impact assessment field.

The expected learning outcomes include:
- Understanding advantages and limitations of MCA and its main techniques;
- Familiarizing with approaches for weight assessment and sensitivity analysis;
- Skills in using a DSS to conduct MCA
- Understanding the role played by different actors in MCA-based decision-making;
- Understanding the key principles of GIS-based MCA;
- Gaining first-hand experience by analyzing real-life case studies.

b) Course description and outline

DAY 1

Session title	Content	Session type
Introduction to environmental decision-making and MCA	- Characteristics of decision problems in impact assessment - Philosophy and general principles of MCA	Lecture
Methodological steps in MCA (I)	- Problem structuring and decision tree - Linking objectives, criteria, indicators	Lecture Short discussion
Coffee		
Structuring a decision problems	- Good and bad decision criteria and decision trees	Group work
Methodological steps in MCA (II)	- Value functions and normalization - Weight assessment	Lecture and discussion
Lunch		
Demo using a Decision Support System (DSS)	- Full demonstration of MCA steps - Brief overview of available software tools	Software demo
Practical exercise with a DSS (I)	- Construction of an evaluation matrix - Criteria normalisation	Hands-on
Coffee		
Practical exercise with a DSS (II) + Case study in impact assessment (I)	- Weight assessment - Case study: comparing the environmental effects of alternative project proposals	Hands-on + case study discussion
Conclusions	- What can and cannot be done through MCA	Discussion

DAY 2

Session title	Content	Session type
Methodological steps in MCA (III)	- Aggregation techniques - Sensitivity analysis -	Lecture
Case study in impact assessment (II)	- Case study: comparing the environmental effects of alternative policies	Lecture and discussion
Coffee		
Practical exercise with a DSS (III)	- Criteria aggregation	Hands-on
Practical exercise with a DSS (IV)	- Sensitivity analysis	Hands-on
Lunch		
Spatial information and new digital technologies to enhance MCA	- Key issues in applying MCA in a GIS environment - The potential of new digital technologies to support MCA-based decision-making processes	Lecture
Group exercise with a DSS (I)	- Full run of MCA for a case study in impact assessment	Group work
Coffee		
Group exercise with a DSS (II)	- Full run of MCA for a case study in impact assessment - GIS-based MCA: overview and software demo	Group work + software demo
Conclusions	- Adapting MCA to different decision contexts	Discussion

Outline of case study material:
Two case studies will be used during the training. The first will focus on the project level (comparing different locations for a transportation infrastructures), and the second on the planning/policy-making level (comparing alternative strategies for a land use policy). The participant will receive an abridged description of the case study (as well as links to background information) and the data-set that will be used during the practical sessions.

Note: The main differences with the respect to editions of this course offered at previous IAIA conferences are:
- This edition will address impact assessment more in general, rather than being focused on EIA/SEA, as in previous years;

- A specific session on "MCA in the real world" has been added, where the entry points of MCA in actual decision making are described and illustrated through examples;
- More group work on "problem structuring", where participants will interact in small groups
- More time devoted to GIS-based MCA and the use of digital technologies to support MCA-based decision-making processes (e.g., GeoSocial Networking), consistently with the conference theme;
- New case studies will be presented, in order to suit the theme of this year's conference. At least one of the case studies that will be presented will involve the use of new digital technologies and collaborative decision support systems.

Material
Participants will receive a course handout including:
- All presentations shown during the course;
-A database containing the case study material that will be used during the hands-on sessions.
- Relevant papers authored by the trainer describing MCA applications in a variety of fields;
- A comprehensive reference and resource list, including links to relevant case study materials;

Equipment
Participants should plan to provide their own laptop (or to share it with fellow participants) for the hands-on activities. Hands-on sessions will use a DSS software package freely available on the internet (DEFINITE 3.1, demo version).

Communication
The course handout will be sent (electronically) to course participants about two weeks before the beginning of the training, together with the instructions to download and install the software package that will be used. The trainer will be available through e-mail to sort out any difficulties related to software installations. Sending the material beforehand has been highly appreciated by previous editions' participants.
The trainer will attend the full duration of the IAIA conference and will be available to provide support through email communication after the event.

SECTION 3. Qualification of the trainer

Davide Geneletti is a tenured researcher and lecturer at the Department of Civil, Environmental and Mechanical Engineering of the University of Trento, Italy. During the summer of 2014 he was a Visiting Scholar at Stanford University, and in 2010-2011 he was Mid-career Research Fellow at Harvard University. He has worked in applied research projects in over 15 different countries in Europe, Asia and Latin America.

He has consulted on impact assessment-related topics and performed project review and monitoring for international bodies, including UN-Habitat, UNEP, the European Commission, the Government of Chile, the UK Nuclear Decommissioning Authority, the National Research Council of the Romanian Government, as well as for National Park Authorities and local and regional governments in Italy.

He has been the recipient of several research grants by national and international institutions, including the European Commission and the Chilean Agency for Economic Development. Additionally, he has been funded by the 'High-level lectures grant' programme of the Secretariat of Foreign Affairs of the Mexican Government to provide post-graduate trainings on multicriteria analysis and Decision Support Systems in three different years.

He has published widely in field of environmental assessment, multicriteria analysis and GIS with over 100 among scientific papers (58 of which are listed by the Scopus database; *h index*: 17), book chapters and books. In 2009, he co-edited a book on "Spatial decision support for urban and environmental planning". He serves on the editorial board of "Environmental Impact Assessment Review", "Journal of Environmental Assessment, Policy and Management", "Impact Assessment and Project Appraisal", "Landscape and Urban Planning", and "Planning Malaysia". He is an associate editor for the international journal "Change and Adaptation in Socio-ecological Systems".

He is regularly invited to provide guest lectures and short courses on environmental assessment and planning, spatial decision support systems and multicriteria analysis. This is a list of the recipients of such activities (internationally and last few years only): University of Trento (2013, 2012); SETAC Summer school (Italy, 2012); IAIA Annual Meeting (2011, 2012 and 2013); Universidad Catolica de Temuco (Temuco, Chile, 2010); Pontificia Universidad Catolica de Chile (2010); Centro Andaluz de Medio Ambiente (Granada, Spain, 2009); Royal Institute of Technology (Stockholm, Sweden, 2009); International Association for Landscape Ecology (IALE) World Congress (Wageningen, The Netherlands, 2007),Universidad de Alcalá (Spain, 2007), Universidad Politécnica de Catalunya (Barcelona, Spain, 2007).

Full CV, list of trainings and list of publications available at: http://www.ing.unitn.it/~genelett

Selection of relevant publications
Geneletti, D. (2014). Integration of impact assessment types improves consideration of alternatives. Impact Assessment and Project Appraisal 32(1).
Uribe, D., Geneletti, D., del Castillo, R., Orsi, F. (2014) , Integrating Stakeholder Preferences and GIS-Based Multicriteria Analysis to Identify Forest Landscape Restoration Priorities. Sustainability 6(2), 935 - 951.
Bagli, S, Geneletti, D, Orsi, F. Routeing of power lines through least-cost path analysis and multicriteria evaluation to minimise environmental impacts, Environmental Impact Assessment Review. 31 (2011): 234-239.
Geneletti, D. Combining stakeholder analysis and spatial multicriteria evaluation to select and rank inert landfill sites, Waste Management. (2010) 328-337.
Geneletti, D. Duren, I. Protected area zoning for conservation and use: a GIS-based integration of multicriteria and multiobjective analysis, Landscape and Urban Planning. 85 (2008) 97-110.
Geneletti, D. An approach based on spatial multicriteria analysis to map the nature-conservation value of agricultural land, Journal of Environmental Management. 83 (2007) 98-105.

History of the course

- **At IAIA Conferences**

A 2-day version of the course was offered at IAIA 2013. The course had 22 paid participants. The evaluations of the 2013 edition were very positive (**average rating: 8.9**). Out of the 16 filled evaluation sheets:
- 6 rated the course with 10/10
- 5 rated the course with 9/10
- 2 rated the course with 8/10
- 2 rated the course with 6/10
- 1 did not provide numerical rating, but assessed all aspects as "excellent" or "very good"

A 2-day version of the course was offered at IAIA 2012. The course had 20 paid participants and one free (student) participant. The evaluations of the 2012 edition were also very positive (**average rating: 8.4**). Out of the 14 filled evaluation sheets:
- 3 rated the course with 10/10
- 3 rated the course with 9/10
- 5 rated the course with 8/10
- 3 rated the course with 7/10

A 1-day version of the course was offered at IAIA 2011. It was attended by 24 people and the evaluations were very positive (**average rating: 8.8**). Out of the 20 filled evaluation sheets:
- 5 rated the course with 10/10
- 8 rated the course with 9/10
- 4 rated the course with 8/10
- 1 rated the course with 7/10
- 1 rated the course with 6/10
- 1 did not provide numerical rating, but assessed all aspects of the course as "good".

In the evaluation sheets, many participants suggested the course to be extended to 2 days, so as to include hands-on computer exercises.

- **Others**

Davide Geneletti has been regularly offering MCA courses similar in content to the one proposed here (in different formats, ranging from one to five days) since 2001 in European, Latin American and Asian institutions.

In Europe and Latin America:
- Short Course on Spatial Multicriteria Analysis for Environmental Decision Making (Trento; 2012 and 2013). The average rating for both editions was **between 8.5 and 9** (on a scale of 10). Course Secretariat to which rating sheets can be requested: Claudia.Fraizingher@unitn.it
- Centro Andaluz de Medio Ambiente (Granada, 2009). The average rating was **8.06** (evaluation sheets are attached). Course organizer: Dr. Luis Cayuela, lcayuela@ugr.es
- IALE (International Association for Landscape Ecology) World Congress (Wageningen, 2007). 1-day Pre-conference training course.
- Universidad Nacional Autónoma de México (Mexico City, 2006. Course organizer: Dr. Luis Chias, Instituto de Geografia, lchias@yahoo.com).
- Universidad Autónoma de Morelos (Cuernavaca, 2004 and 2005. Course organizer: Dr. Valentino Sorani, vsorani@yahoo.com.mx)
- Universidad Autónoma de Queretaro (Queretaro, 2003. Course organizer: Dr. Raul Pineda, rfpineda@uaq.mx)
- Universidad de Autónoma de Guerrero (Acapulco, 2001)

In all these courses, attendance has been very high (between 20 and 40 people).
Course evaluations for which the numerical rating is not available have always been **very positive**.
The course organizer might be able to provide the evaluation sheets or at least an overview of the evaluation outcome.

Additionally, the course has been offered (in a 20-h format) on a yearly basis from 2002 till 2010 at the Ph.D. School in Environmental Engineering of the University of Trento. Evaluations have always been very positive also for this course (Contact: Secretariat of the School, Ms Laura Martuscelli, martusce@ing.unitn.it).

In Asia:
The course has been given 3 times in Kuala Lumpur (Malaysia) between 2005 and 2007, as a 2 and 3-day stand-alone course organized by the International Islamic University of Malaysia. The course has been offered also in Manila (The Philippines), as part of a longer course in decision support systems. Even in these cases evaluation were very positive. For the course in Malaysia evaluations can be requested by contacting the course organizer, Prof. Alias Abdullah (International Islamic University of Malaysia, profdralias@gmail.com).

Finally, the course (1 to 2 day version) has been offered in Italy a number of times in the framework of EIA and environmental management specialization courses, directed at practitioners, researchers and public administration officers.

SECTION 4

a) I offered over 30 short courses and training events (+ around 25 semester-long courses in MSc and BSc programmes). Course offering has never been cancelled.

b) None of the training course offering has been cancelled or amended in its structure or trainer.

c) I do not see any specific reason for cancelling the course, as I intend to participate to IAIA 2014.

d) Back-up strategy: In case of unexpected withdrawn, a colleague in my Department, Dr. Francesco Orsi (who is based in Trento, a few-hour train trip from Florence) will be asked to replace me. He is fully qualified to give the training, and very familiar with the course structure and objectives, given that he took one of the earliest editions of the course, and helped with hands-on sessions during some of the subsequent editions.

e) I agree to provide free place to students based on formula described in the "IAIA 2015 Call for Training Course Proposals".