From farm, landscape and territory analysis to scenario exercise: an educational programme on participatory integrated analysis

Olivier Therond[a], Denis Paillard[b], Jacques-Eric Bergez[a], Magali Willaume[b], Annie Ouin[c], Delphine Leenhardt[a], Philippe Grieu[b] and Caroline Auricoste[a]

[a]*INRA, UMR 1248 AGIR, F-31326 Castanet Tolosan, France, Olivier.Therond@toulouse.inra.fr*
[b]*INP-ENSAT, UMR 1248 AGIR, F-31326 Castanet Tolosan, France*
[c]*INP-ENSAT, UMR DYNAFOR, F-31326 Castanet Tolosan, France*

Abstract: *Tools and methodologies have been developed to enable integrated analysis (IA) of complex issues like agro-ecosystems and natural resources management. They are based on interdisciplinary and often on participatory approaches combining, interpreting and communicating knowledge from diverse scientific disciplines and from stakeholders. In this paper we present the original educational programme built to enable students in agronomy to implement participatory IA methods in order to deal with sustainability issues in rural territory. In this educational programme students take a professional project management situation on a given case study. One of the originality of the course programme lies in its twofold objectives: building student capacities for carrying out integrated multi-scale analysis of complex systems and providing researchers with an operational research device which facilitates the integrated analysis of new study territories. The educational programme articulates trips in the case study region and formation modules on project management, farming systems sustainability assessment, landscape multifunctionality analysis, stakeholder analysis and interviews, territorial diagnosis and narrative scenario construction. The main objectives and methods used in these modules are presented and discussed in the light of the outcomes of the implementation of this educational programme. Discussion is focused on the main educational and research issues of this programme.*

Keywords: *landscape analysis, farming system assessment, stakeholder analysis, multi-scale integrated analysis, scenario.*

Introduction

Nowadays, agricultural projects have to be integrated in larger territorial development issues concerning multiple actors with diverse and contrasting interests and management objectives. Dealing with the sustainability of such projects requires to integrate in the reasoning and building project process a complex set of issues juggling with environmental, social and economic trade-offs acting at many scales. Tools and methodologies have been developed to enable integrated analysis (IA) of complex issues like agro-ecosystem and natural resource management. They are based on interdisciplinary and often on participatory approaches combining, interpreting and communicating knowledge from diverse scientific disciplines and from stakeholders. They allow a better understanding of complex system functioning and responses to changes and the sound design of sustainable management and development strategies. These methods allow incorporating stakeholders in the analysis, assessment and decision making processes. With such IA methods, analysing and solving complex problems is an ongoing learning and negotiation process often called "social learning" (Pahl-Wostl and Hare, 2004). In such process, emphasizing learning as well as participation, the main challenge is on communication issues, mutual and common understanding, problem and perspectives sharing and development of new social practices.

In this paper we present the educational programme that researchers from INRA AGIR research unit and University of Toulouse, Faculty of Agronomy (ENSAT - France) built to enable students in agronomy to implement participatory IA methods in order to deal with sustainability issues in rural territory. The main objective of the programme is to provide students with competences (knowledge, skills and experience) for leading a multi-scale integrated analysis on a territory. In this

educational programme we put students in a professional project management situation on a given case study. The latter is chosen to allow the valorisation and the articulation of the different disciplinary or multi-disciplinary series courses. The paper presents first the general description of the educational programme then the main outcomes of the 2009 programme. It concludes with a short discussion on the main educational and research issues of the programme.

Description of the educational programme

Objectives and outline of the combined course programme and research device

One of the originality of the course programme lies in its twofold objectives. The first and classical one is building student capacities for carrying out integrated multi-scale analysis of complex systems like rural territories. The second and more original one is to provide researchers with an operational research device which facilitates the investigation of new study territories. Researchers can then get useful information on issues at stake and on the points of view of stakeholders for a given research question. The second objective of the course programme makes it project management-oriented. It is foreseen that each year the case study region and the question investigated by students will be determined by a research unit according to its research objectives and projects.

The course programme is embedded into a specialized master which ends student's studies in agronomy and provides them with a French degree of "Agronomic engineer". When starting this master students have basic knowledge in: plant and animal biology, cropping and farming systems, rural economy, sociology and development, geographic information systems, statistics, etc and skills in qualitative inquiries and farming system analysis.

Generally post-graduate students get jobs as project managers in agricultural and rural development, land and territory planning, natural resources management, sustainable development (i.e. Agenda 21). They work in local or regional agricultural advisory services, local or regional governments, national ministries, regional or national natural parks and specialised agencies.

Few theoretical lectures are provided to students during this programme course. They are limited to the essential ones (e.g. on scenario methods). The objective is to put students into a "learning by doing" situation while ensuring they are closely supervised all along the project to avoid students loose too much time on minor problems and/or are stopped on a given step of the project. In most courses students work in groups of 3-5 students and are asked to present and argue their results in front of the full student group.

The educational programme is organised as follows: (i) a 4-day trip in the case study region to meet the main stakeholders and discover issues at stake and the main agro-ecosystems; (ii) a general course on project management; (iii) a module on methods to assess sustainability of farming systems; (iv) a module on landscape multifunctionality and methods of landscape diagnosis; (v) a module on "territorial development". This last module is composed of four main sub-modules (i) a question-oriented stakeholder analysis; (ii) a 3-day trip in the case study region to interview selected stakeholders; (iii) the construction of a territory diagnosis, a conceptual model of the functioning of the territory and contrasted narrative scenarios based on information collected during interviews. The course programme ends with a presentation to stakeholders of the main outcomes of students' projects. Each of these course modules and sub-modules are presented in detail in the following sections.

Territory discovering and project management theory

The first 4-day trip initiates the educational programme and enables students to discover the investigated territory. During this trip students meet key stakeholders of the territory who present them the main characteristics and the key agricultural and environmental issues of the territory.

Before starting the effective project-oriented course series a presentation of the main objectives, concepts, methods and tools of project management is performed. Beyond work organisation and scheduling objectives, these methods and tools help students to well specify the objectives of their work by answering to the main following questions: What are the objectives of the work for researchers who bring the question and for stakeholders who will be interviewed? What are the objectives of the participatory exercises (interviews and work restitution)? How should deliverables be shaped to be best adapted to researchers and to stakeholders (e.g. scientific report, short stakeholder oriented document, oral presentation)?

Sustainability assessment at farming system level (8 days)

Since concern for farming system sustainability has emerged, methods and tools have been developed to assess the sustainability of these systems (Sadok et al., 2009; van der Werf and Petit, 2002). Many questions have arisen for scientists on the characterisation of the functioning and the validation of these methods, but also on the identification of conflicting durability objectives and the choice of indicators best suited to quantify them.

The first objective of the Farm Sustainability Assessment module is to discover and analyse diverse farming systems representative of the study region. It focuses on farm level and on interactions with farmers considered as key stakeholders in rural territories. The methodological objectives of the module are: (i) to consider through cases studies benefits and limits of pre-existing assessment methods and necessary adaptations to specific farming systems and (ii) to identify questions to be asked and traps to avoid for assessing sustainability.

The first part of the module is dedicated to theoretical learning, including global concepts and analyses of various farm durability assessment methods. The second part is focused on the implementation of a selection of assessment methods on pre-selected farms representative of the case region farming systems. It ends by a presentation of the assessment outcomes to concerned farmers.

Landscape diagnosis (8 days)

Because landscapes are at the interface between ecological and socio-economic processes, their analysis needs a multi-disciplinary approach. Landscapes are often described as an “open book” of the relationship between natural and socio-technical systems. The aim of the module called “Landscape Multifunctionality” is to offer numerous disciplinary views on landscape (anthropology, geography, architecture and urbanism) with a particular focus on landscape ecology to provide lecture keys of the “landscape book”. Additionally, technical tools are provided to describe and analyse landscapes (point of view, transect, annotated diagram in 2 or 3 dimensions).

The last day of the first 4-day trip is dedicated to the landscape analysis. Student conducted two walked transects of several kilometres crossing two valleys where they described what they see (architectural and “natural” infrastructures, crop mosaic, see De Ravignan, and Lizet, 1987 for the description of the transect method). Additionally, at high altitude points (about 10 for each transect), they use drawing, and landscape reading framework to analyse the landscape (composition, structure, texture, stability, coherence…). Students are encouraged to talk with people encountered “by chance” during their walk and ask them about past, present and future landscapes. During all the “landscape days”, they are asked to take photographs of whole landscapes as well as remarkable elements. These photographs are presented to the stakeholders, interviewed during the second trips, about three questions: Which picture represents the best what you are proud of in your territory? Which picture represents the best what you dislike in your territory? Which picture represents the best the future of your territory? This use of photographs for eliciting stakeholder’s values representations is described in detail in Lelli and Paradis (2010).

Stakeholder analysis and interviews (8 days)

In complex decision making situations with different conflicting interests the problem may be addressed taking into account the points of view and values of the different stakeholders (Pahl-Wostl and Hare, 2004; Grimble and Wellard, 1997). Multi-stakeholders approach allows identifying the key stakeholders and assessing their respective interests in given issues. Here the term stakeholder means any individual and organised or unorganised group of people who have an interest or stake in a particular issue or system (Grimble and Wellard, 1997).

The module on stakeholder analysis (SA) is organised to enable students through a structured approach to identify and classify stakeholders and then to investigate stakeholder characteristics, interests and point of views. In the SA procedure students apply the most fundamental classification of stakeholders distinguishing the stakeholders who affect the resource and the resource management (have a direct impact on the resource) and the stakeholders affected by the resource management problem or evolution. Then students apply a hierarchical approach defining the relative importance and influence of the different stakeholders for the addressed question. This hierarchy allows determining stakeholders who will be interviewed in priority given the time dedicated to interviews.

To design the stakeholder survey guideline students have to define how to articulate three pre-defined methods for information collection: a semi-directive interview, a participatory map of the resource issues and the use of landscape photographs (made during the landscape module). The student's work on the interview guideline is guided by addressing the following questions: What is the information to collect? Which type of survey to carry out? What is the conceptual framework analysis to design the survey?

Finally students have to contact each stakeholder and to organise the interviews during the second 3-day trip into the studied territory. About 45-50 interviews are carried out by 4-5 groups of 4-5 students.

Territory diagnosis (4 days)

To analyse information collected during the interviews students build three types of territory diagnosis: a participatory resource map, a SWOT (Strengths, Weaknesses, Opportunities, Threats) matrix and a conceptual model of the territory functioning.

The *participatory resource map* is built by and with stakeholders. It allows them to highlights the importance of different resources and related-problems while visualizing spatial relationships with the different elements of the territory and landscape. During interviews students ask each stakeholder to shape their spatial perception of the territory on an individual map representing the very main geographical entities of the investigated territory. Once the interviews are completed, students build the spatial map of issues at stake by combining and synthesising the different maps produced by each stakeholder.

The *SWOT analysis* provides an efficient way to determine and structure the range of factors that influence the sustainable development of the investigated territory. Strengths are attributes to the territory that are helpful to the social and economic development and to the conservation or restoration of the quality of environment. In opposition weaknesses are those attributes of the territory that are counterproductive for the achievement of these objectives. Opportunities are external conditions that are helpful to achieve these objectives. They are outside conditions or circumstances that the stakeholders of the territory could turn to the territory advantages. Threats are external conditions that are harmful to achieving these objectives. They are current or future conditions in the outside environment that may harm the territory development. In the course module the SWOT matrix is built through an iterative and reflexive process. Each group of students builds a SWOT matrix according to the information they collected. Then the four or five matrixes are presented to the whole group, discussed and argued and a new synthetic SWOT matrix is rebuilt according to the conclusion of the discussions between student groups.

The *ARDI* (Actors, Resources, Dynamics and Interactions) *method* (Etienne et al, 2008) is based on the use of a precise methodological framework to build a conceptual model of the functioning of the territory given a studied issue with respect to natural resource management. The construction of the collective representation is done by means of a series of collective workshops during which Actors, Resources, Dynamics and Interactions (ARDI), are identified and clarified by stakeholders and researchers (part of each type of participants depends on the case study and the objectives of the study). The original character of the method into the course programme is that students play the role of stakeholders. The oriented-formation objective is to show to students that such methodology allows formalising and sharing a common representations starting from potentially divergent points of view. Applying the method students have to answer to the following questions: Who are the main stakeholders involved directly or indirectly in the management of (natural and agricultural) resources of the territory? What are the principal resources of the territory and what is the key information to guarantee a sustainable use of these resources? What are the main processes that drive strong changes in resource dynamics? The last phase of the ARDI method consists of synthesizing answers to the three preceding questions by formalising the interaction between users and resources. It is the core step of the exercise since it leads to the conceptual model representing all interactions related to the studied question. For this they have to respond to the question: How does each stakeholder use the resources and modify the processes?

Through the implementation of these three territory diagnosis methods students make an integrated analysis of the studied complex system. This problem specification is a key step that highlights and challenges stereotypes distorting the perception of issues and problems. This avoids badly specified or even false problems. Such approaches allow crystallising different types of knowledge that are often spread out in the territory and between stakeholders. Finally they allow clarifying the components (actors, resources, processes) of the complex investigated system, its boundaries, what is endogenous and exogenous and the main past and present change trends affecting the system evolution. These approaches allow building a sound description of the current situation that is the necessary starting point for scenario development.

Scenario exercise (4 days)

In a policy or management decision context, scenarios enable stakeholders to anticipate and to explore possible futures and to assess potential consequences of different policy or management strategies. It is often emphasized that scenarios are not predictions or forecasts but perceived pictures of possible futures (Therond et al., 2009). Scenarios identify the key future drivers (or driving forces) and their trends. These drivers usually correspond to any natural or human induced factors that may cause a change in investigated systems. Participatory scenario exercise using simple and structured methods has proved to be a suitable and powerful approach for initiating and supporting discussions about the future of the territory (Godet, 2002). Thinking about scenarios of the future of a territory provides stakeholders with a unique opportunity to go beyond short-term constraints and conflicts and make stakeholders aware of the need to face potential exogenous and endogenous changes.

In the programme course students have to build narrative (vs. quantitative) scenario using information, collected through the interviews, on the visions of stakeholders about the possible future(s) of the investigated territory. These qualitative scenarios provide qualitative description of possible pathways of the future development. They allow incorporating the views of different stakeholders and describing a complex system in well-written storylines that are easily understandable for stakeholders (Alcamo, 2008). To develop the narrative scenarios student groups use an adapted version of the approaches described by Godet (2006) and Therond et al (2009). The main steps of this approach are (i) identification of the key change factors that can affect the future of the territory (ii) characterisation of change factors by determining whether they are endogenous or exogenous, whether there is a high or low level of uncertainty on their trend/shape and whether they have a strong or a small impact on the territory evolution (iii) selection of 3 to 5 key driving forces with a critical level of uncertainty and a strong impact on the territory evolution (iv) definition

of 2 to 4 modalities for each selected driving force and (v) construction of different images of the future (scenario) as combinations of driving forces modalities. During the last step the focus is on the consistency of the link established between modalities of driving factors. After scenarios building each group presents and argues their scenarios specifying their consistency. Given the conclusion of these presentations the whole student class rebuilds 3 to 5 final scenarios combining the key outcomes of each student group. Finally students develop narrative story lines describing each of the final scenarios.

Presentation of the work to stakeholders (2 days)

The formation-oriented objective of this presentation is to put students in a real situation in front of stakeholders. They have to present and to argue their work and animate the debates about the diagnosis and scenarios they built. During the debates, students may also experience a social learning process i.e. process of learning and change of individual point of views.

The stakeholders-oriented objective is fourfold (i) to share and discuss the different representations of the territory built by the students (ii) to assist stakeholders in building a shared vision of their territory (iii) to enable stakeholders to anticipate and to explore possible future scenarios and to assess potential consequences of different driving forces changes and management strategies and (iv) to highlight that development of any region stems from its historical dynamic and depends not only to the exogenous changes but also and often mainly to the endogenous choices (Godet, 2002).

Application in 2009 - The Neste system territory

Case study project

The INRA research team called “MAGE” (Modelling applied to environmental resource management) develops modelling tools for water management from local (irrigation block and farm) to territory level, the Neste system being its main study territory. MAGE was greatly interested in using the research device provided by the educational programme on the Neste system territory. Accordingly the students of the 2009 programme course had to use IA methodologies to investigate the following question: “What are the current issues at stake in the Neste system territory and what are its possible future scenarios regarding natural and agricultural resource management?”.

MAGE activities and objectives were first presented to the students. Then they had to write a mission letter presenting and (re)formulating MAGE objectives, the objectives of the participatory exercises, human and time constraints, the work schedule (GANTT), the work organisation by task and expected outcomes of the project. A first challenge for students was to define an auto-organisation. They experienced the efficiency of management project tools. They had also to distinguish and specify expected outputs for the different “customers” of the project (researchers and stakeholders). They also had to consider how compensating stakeholders for their time and their knowledge. Based on management project theory students proposed to announce to stakeholders, during interviews, their engagement in presenting the work at the end of the programme.

The specification of the work was quite difficult to obtain, due to the inexperience of the students to question a request and a need, and to implement project management tools. Furthermore, they experienced the limits of their usual technical approaches to structure their tasks and to understand and describe a complex human-technology-environment problem.

Case study region

The study area is the Neste System. This 800 000 ha area gathers the catchment areas of 14 gascony rivers artificially supplied in water by the Neste canal. The land is mainly dedicated to agriculture: 500 000 ha are cultivated from which 50 000 ha are irrigated. The main irrigated crop is maize.

Thanks to the canal and European common agricultural policy, irrigated area has been multiplied by around three since the 70's. As a consequence, two years out of ten, the system faces a lack of water that threats the environmental equilibrium of the rivers and the satisfaction of agricultural needs in water. On the side of the regional water management, the Neste system is operated by the public-private company "Compagnie d'Aménagement des Coteaux de Gasgogne" (CACG) that optimises water releases in different rivers according to local demands (mainly irrigation and ecological needs).

Assessment of farming system Sustainability

In 2009 two contrasted methods for the sustainability assessment of farming systems were implemented by the students. The French IDEA method (Indicateurs de Durabilité des Exploitations Agricoles) of farm sustainability indicators accounts for different dimensions of sustainability: economic viability, social liveability and agroecological and environmental reproducibility (Zahm et al., 2006). The French PLANETE GES method focuses on assessment of energetic and and greenhouse gases emissions and consumption at farm level (Bochu, 2002). Four farmers with contrasted representative production systems (mixed crop-livestock farming, rainfed mixcrop, irrigated mixcrop, and irrigated maize) were inquired during 3 or 4 hours. Calculation, analysis and diagnosis were produced afterwards by students alone.

Both methods were in purpose simple and pedagogic, favouring large discussions with farmers. They not only allowed assessing different dimensions of farm durability, but also gave rise during the inquiries to questions and rich debates on sustainability concepts (mainly IDEA method) and on possible improvement means. This sharing would be greatly improved by incorporating farmers in analysis and results interpretation steps.

Despite the diversity of production systems, a general trend appeared: for the four investigated systems the economical dimension seemed more controlled and had generally better results than others sustainability dimensions. Farmer's results were often penalised by a poor production diversity or by strong farm constraints (equipments for on-farm maize drying, distances between field plots). An important shortcoming of the IDEA methods also appeared: by construction it greatly favours mixed crop-livestock systems, making comparisons and links between farming systems difficult. Improvement propositions made by students were therefore limited.

Landscape diagnosis

During and after the landscape diagnosis students produced a synthetic diagram of landscape physiognomy (see Fig. 1). This diagram helped them to realise the strong structuring effect of hills and rivers.

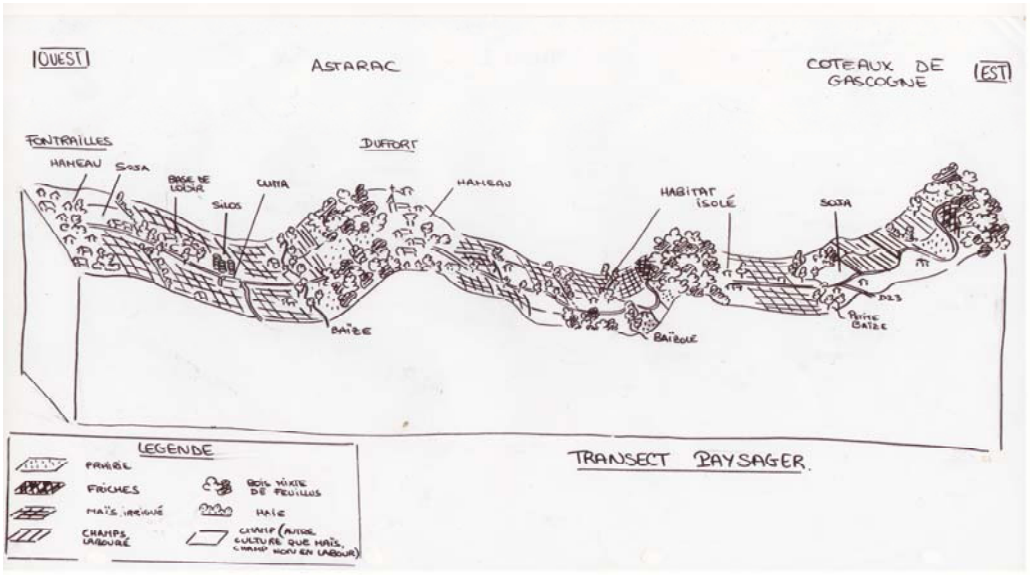

Figure 1. Bloc diagram made by students representing a transect of the Neste System territory Landscape.

The second part of the work using photographs to respond to question about landscapes showed that stakeholders with different "a priori" opinion could choose the same photograph but not for the same reasons (farmers and environmental associations chose the same photograph for the "future" landscape: landscape with large, eroded and uncovered fields). This "photograph selection exercise" was pointed out by the students as fruitful because response of the people may be, at that time (the end of the interview) more driven by their own thinking rather than their position as a representative of a given organisation. The use of photographs was then identified as an efficient way to capture sensitive visions and values of stakeholders.

Stakeholder analysis and interviews

Thanks to a 1-day brainstorming session students identified an important list of stakeholders. During this brainstorming session each stakeholder proposal was debated and had to be argued as important with respect to the investigated issue. Finally, students made a hierarchical classification using the pre-cooked stakeholder classifications presented above. Given the time and organisation constraints of the second 3 day trip this classification helped them to identify the 45 to 50 stakeholders that should be met.

Even if students first thought that a questionnaire should be built to interview stakeholders, they realised that a guideline for a semi-directive and goal oriented discussion was better adapted. They understood that such interview shape allows capturing representations that are deeply ingrained in the stakeholder' minds while it is not possible via a questionnaire. They also discussed about the fact that individual interviews would be much more efficient for getting individual perception and capturing the diversity of points of view than a collective discussion. Finally they debated on and defined the best way to articulate the different tools to collect information: the ZADA was used along the interview and the photographs presented and discussed at the end of the interview.

To answer to the investigated question students organised the interview grid in order to answer to the main following questions: How stakeholder perceives the situation (strengths and weaknesses)? What are his actions influencing the management situation? What are his relations with the other stakeholders? How do they perceive the future of the management situation? What are opportunities and threats of the management situation? What would be the desired situation? What would be the changes to reach this desired situation?

The interview grid was operational and allowed to collect the main needed information. However students discovered that mapping stakeholder interactions was difficult and not really fruitful. They

also noticed that some stakeholders were not used to draw resources on the map. After the interview students had the feeling that mapping issues was not really fruitful. However when they combined all stakeholder maps they discovered that the final map was a rich and useful representation of the agricultural and natural resource issues of the territory. After discussions students discovered that each group used the interview grid in different ways and realised that they should had more discussed about the use of the interview grid before leading the interviews. Accordingly it was suggested organising, before interviews, a collective role playing game of an interview to enable students sharing and clearly defining a common use of the grid.

Territory diagnosis

The various groups presented and discussed their SWOT matrices of the Neste system territory and rebuilt a final and synthetic one. The iterative SWOT matrix construction exercise revealed to be an efficient way to structure information collected trough the numerous interviews and to highlight the key characteristics of the territory.

The ARDI method has been first implemented by each student group separately. Then each group presented and argued its interaction diagram and the full student group collectively rebuilt a common diagram. This diagram of the territory functioning was the critical output of the ARDI process as it is the graphical formalisation of how students, through stakeholder interviews, perceived the system functioning. During the construction of the collective interactions diagram, students discussed about (i) which actors and resources representing given the investigated issue and (ii) how representing their interactions. Most students were surprised by the complexity of the represented system and the power of the ARDI method to formalise the functioning of such complex system.

Scenario exercise

As for most other formation modules, students worked first by group to build scenarios. In these groups they were confronted to the difficulty to specify the change forces and to classify them according the pre-defined criteria presented above. The other challenge for students was to determine if correlations existed between driving forces and then if some driving forces could be aggregated in more generic ones. Once driving forces classified, aggregated and selected, students well understood how determining driving force modalities and building 3 to 5 scenarios by linking a modality of each selected driving force. The presentation by each group of its scenarios led to interesting and stimulating discussions between students that ended by the construction of a final common set of scenarios. To build these final scenarios students had to explain what they wanted to show and highlight to stakeholders through a selection of 4 scenarios. They collectively decided to emphasize the different possible dynamics of agriculture (extensification vs. intensification vs. diversification), the non linear relations between water management and agriculture (e.g. the past choice of building a new dam could increase the water cost while water needs for agriculture could significantly decrease) and the relations between agriculture and the other activities (e.g. tourism and tertiary sector).

Presentation of the work to stakeholders

Presentation of the study outcomes was done by students in front of about 20 stakeholders. Debates with and between stakeholders were active and mainly oriented on the environmental issues. The under representation of farmers (only one) in the assistance explains this orientation of debates. During the debates most stakeholders reacted to students' presentations. They expressed their points of view on the system and explained what they knew about the system functioning and their vision on possible futures of the system. By doing this, stakeholders initiated a social learning process

where sharing of knowledge and argumentation of points of view were the most observable phenomenon.

Discussion and Conclusions

Currently the educational programme is improved year after year. Researchers and teachers are presently dealing with the key question of the programme evaluation. They are assessing how effective this programme is to provide students with competences and capacities and they are improving and developing the integration of different disciplinary series courses.

Through this structured approach for participatory integrated analysis students discover how bringing the gap between science and stakeholder knowledge and that “formulating the problem is the problem” when addressing problems of social and natural systems.

In this educational course students are typically quite often between “hard and soft science” with an active participation of stakeholders in the problem framing, the conceptual modelling and the scenario construction. They use different tools enabling them to implement a complete system approach taking into account explicitly the different aspects of the investigated complex system and structuring multi-level analysis from field-farm to territory level and from short term to long term temporal scales (including historical points of view).

The role playing game allows students experiencing different resource management objectives and points of view. The scenario construction method allows them structuring approach of the possible future pathways of a territory.

In accordance with the main experiences of active (or participative) pedagogies the full availability of teachers and researchers to discuss and adapt methods and to organise the reflexive processes as well as the theory consolidation is a key success factor of this educational programme. As researchers place an explicit order to students they participate actively to the course programme. They count on study outcomes for the contextualisation of their research activities and the identification of societal questions at stake. The study provides them with methodological experiences helping building effective participatory research.

The difficulties come from the non-conventional course methods and positions. They push teachers and researchers to mix and balance theoretical approaches and practice, to initiate students self-finding, to give more importance to the learning process than the results, and last but not least to negotiate more time and monetary resources.

References

Alcamo, J. (2008) The SAS approach: combining qualitative and quantitative knowledge in environmental scenarios. In : A.J. Jakeman (ed.) *Environmental futures. The practice of environmental scenario analysis*. Elsevier, pp. 123-150.

Bochu, J.L. (2002) Planète: Méthode pour l’analyse énergétique de l’exploitation agricole et l’évaluation des émissions de gaz à effet de serre. Solagro, 10 p. http://www.solagro.org/site/im_user/286014planeteooct02.pdf

De Ravignan, F. and B. Lizet (1987) Comprendre un paysage, INRA, 1987.

Etienne, M., Du Toit, D., Pollard, S. (2008) ARDI: a co-construction method for participatory modelling *in natural resources management*. Presentation held at the iEMSs Fourth Biennial Meeting in Barcelona, Spain, 7-10 July 2008. http://www.iemss.org/iemss2008/uploads/Main/Vol2-iEMSs2008-Proceedings.pdf

Grimble, R. and K. Wellard (1997) Stakeholder Methodologies in Natural Resource Management: a Review of Principles, Contexts, Experiences and Opportunities. *Agricultural Systems*, 55(2): 173-193.

Pahl-Wostl, C. and M. Hare (2004) Processes of Social Learning in Integrated resources Management, *Journal of Community & Applied Social Psychology*, 14: 193-206.

Godet, M. (2002) Foresight and territorial dynamics, *Foresight* 4,5 :9-14.

Godet, M. (2006) Creating Futures Scenario Planning as a Strategic Management Tool. Paris: Economica, 2006, pp. 47-82.

Lelli, L. and S. Paradis (2010) Entre reconnaissance et renaissance territoriale : de l'usage du paysage dans la concertation locale, *DD&T*, 18 p. in press.

http://developpementdurable.revues.org