From Action Research to Action Learning – Ecosystem services assessment as a learning platform for students, local land users and researchers

Moonen, A.C.[1], Lardon, S.[2], Marraccini[3], E., Pinto-Correia[4], T. and D. Rizzo[1]

[1] *Institute of Life Sciences, Scuola Superiore Sant'Anna, Italy, moonen@sssup.it*

[2] *INRA & AgroParisTech, UMR Métafort, Clermont-Ferrand, France*

3 Institut Polytechnique LaSalle Beauvais-Esitpa, France

4 University of Évora, Portugal

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Abstract: The Spring School in Landscape and Territory Agronomy has been organized by an international team of teachers since 2007. The target of landscape agronomy is to address the spatially explicit interactions between farming practices and natural resources at territorial level. It requires an action research approach that we have conducted on different topics all applied to the same region in Pisa (Italy).The case-study based Spring School is a good platform for action learning. So far, we focused on environmental and water management (2007, 2009), peri-urban agriculture (2013) and the ecosystem services provided by agricultural and semi-natural habitat management (2015). These case studies enabled to elicit the relationship between stakes that are often treated separately. The course was designed for PhD students of various disciplinary backgrounds but all interested in action research related to agricultural land management. In this learning platform, local stakeholders are involved through round table discussions, interviews and the territory game, a participatory territorial foresight. Students can experience the effectiveness of action research by interacting with local stakeholders and they become aware of the complexity of information gathering and analysis in a real situation. Through the interactions with the students, local stakeholders have the opportunity to widen their view on stakes they are concerned with in their every-day life. Compared to pure action research, our learning platform creates a collaborative environment facilitating interactions between stakeholders and therefore it creates a learning device for them as well. In this specific case, the action research methods proposed to the students and used in their interactions with the stakeholders allowed the group to prepare spatially explicit maps indicating where various ecosystem services are produced and where their benefits are delivered according to the stakeholders. These maps were eye-openers for the stakeholders but also for the researchers involved, because it allowed them to bridge the gap towards transdisciplinary approaches to address land management in an agricultural context. Moreover, it highlighted that the main challenge regards land use management and its coordination at territorial level, regardless of the specific ecosystem services stakeholders expect to receive or think they deliver through their activities. In particular, the participatory territorial foresight resulted in innovative land management proposals capable to overcome more traditional and sectorial perspectives.

1. The course structure

The various promoters of territorial development – namely farmers and other land managers such as water management consortia, nature reserve managers, and local communities, researchers, technical advisers, policy and administrative stakeholders – have few arenas to exchange knowledge. Training courses and educational programmes can provide a 'platform' (Lardon et al., 2012) to gather some of these actors and facilitate communication between people with different perceptions about the territory through comparison of hard data and more subjective information based on people's experiences (cf. Scherr 2016; Raymond et al. 2010). As far as agriculture is concerned, a specific challenge is to upscale local actions to a territorial level in order to understand how innovation of farming practices is both conditioned and affected by overall landscape management (Benoît, Rizzo et al. 2012). To this end, an international and interdisciplinary team of researchers has organized the Spring School in "Landscape and Territory Agronomy" since 2007.

The structure and aims of the Spring School were presented during previous IFSA Symposia (Moonen et al. 2010; Rapey et al. 2008) and have been maintained in time. Each year, this solid frame of the courses is applied to a specific core theme that is suitable to be explored by a landscape agronomy approach (sensu Benoît, Rizzo et al. 2012). In particular, the themes are selected for their power to address the relationships between land management issues that are often kept separate at the territorial level. During past editions, in 2007, 2009 and 2013, the courses focused respectively on environmental and water management and periurban agriculture. The course generally lasts 1 week and addresses PhD students. Generally, it takes place in spring and the key feature is to combine lectures and activities belonging to the domain of action research, so as to constitute the above mentioned learning platform that provides new experiences, knowledge and information to the students but also to the local stakeholders and researchers organising the course.

There are three types of lectures. First, there are theoretical lectures to introduce the background of landscape agronomy and of the theme chosen for the Spring School. Second, some applied lectures provide a toolbox grouping information on general action research techniques and case study specific tools. The last type of lectures addresses a characterisation of the study area in terms of land use, agro-pedo-climatic information, economic activities, and any piece of data that is relevant to relate the case study with the specific theme of the year.

An action research structure underpins the lectures following five steps: 1) a round table with local stakeholders to identify the issues at stake, 2) the assessment of land use management through the interpretation of available maps and databases, 3) field trips to observe the landscape and for open-ended interviews with some key actors involved in land use management, 4) classroom work to prepare a territorial participatory foresight following the method called "territory game" (Lardon, 2013) and 5) performing the territory game with local decision-makers, land use managers and other relevant stakeholders.

On the one hand, the five action research-steps are meant to stimulate students to interact at different levels with stakeholders. On the other hand, the lectures provide them with the concepts and the tools to analyse and integrate all the available information provided in the form of maps or databases. Altogether, the integration of lectures and action research builds an action learning platform that fosters three goals. First, it familiarizing the students with theory and practice of action research. In this way, the students can test the method reliability by interacting with local stakeholders and experience the complexity of information gathering and analysis in a real situation. Second, it has proven to be fruitful also for local stakeholders, who are challenged to

observe the stakes they are concerned with in their every-day life from different perspectives. Third, it helps the researchers to improve the reliability and saliency of their local data elaborations by checking it with the stakeholders and eventually integrating the local information. For both students and stakeholders, the action learning platform allows widening the individual viewpoints thanks to exchanges between stakeholders who do not meet regularly, and by breaking the silos between methods and disciplines like agronomy and geography.

In this paper, we will focus on the course structure and the main results from the 2015 edition that dealt with the management of ecosystem services (ESs), and in discussion we will provide an overview of the opportunities the four Spring School courses have offered students, local stakeholders and the involved researchers.

2. Action research on ecosystem services as a learning platform

2.1 Study area

The case study for the 2015 course edition was the urban region nearby Pisa (Tuscany, Italy). The area covers approximately 49 000 ha (49% of which are agricultural areas) and spans from the coastal plain to the inland hills with the typical climate and land management conflicts of a Mediterranean landscape (Marraccini et al. 2013). From a geo-morphological point of view the region can be divided in two contrasting areas the Pisa plain along the coast and of the north-eastern hill system called *Monte Pisano* (i.e., Pisa mountain).These two areas are connected by the movement and activities of land users and local inhabitants and from previous studies it emerged clearly that the perception of local land users about these areas are very different.

The Pisa plain is mainly a production area dominated by arable crop and forage. Semi-natural habitats (SNH) are concentrated in the Regional Natural Park (Parco di Migliarino, San Rossore, Massaciuccoli) that is dominated by woodland, covering most of the coastline near Pisa. In the cropped area SNH consist of drainage channels and small, mostly herbaceous, field margins. Water discharge is a great challenge in order to allow farmers to cultivate their fields timely and avoid water stagnation.

The Monte Pisano is a hilly landscape composed by olive groves on the foot- and mid-hill, and by mixed forest and Mediterranean garrigue, pinewood and abandoned chestnut plantations on the top-hill. Nowadays, most of the olive groves are managed by hobby farmers (Gennai-Schott et al. 2014). About 50% are organic growers and the understory consists of spontaneous vegetation managed through cutting. Dry-stone wall terraces characteristic of these olive groves are only partially maintained and collapsed walls are frequently observed (Rizzo et al. 2007). Abandonment is increasing in the area due to the high costs of maintaining the olive groves while harvest is at risk of olive fly attack. Furthermore, the Monte Pisano is at high risk of wild fire during the dry summer period. The patches of olive groves create many SNH connected through the understories and the elements of the terraces system.

2.2 The Ecosystem Services as example to address territorial development

Daily (1997) defined ESs as “the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human life”. According to the Millennium Ecosystem Assessment (2005), these ESs can be classified into four main categories: provisioning, supporting, cultural (non-marketed), and regulating services. Agro-ecosystems are composed of cropped and SNH and are therefore at the same time providers and consumers of ESs (Power, 2010). Management practices influence the potential for ‘disservices’ from

agriculture, including loss of habitat for conserving biodiversity, nutrient runoff, sedimentation of waterways, and pesticide poisoning of humans and non-target species (Zhang et al., 2007). At the same time, good management practices of both the cropped and SNH will reduce the disservices from agriculture while increasing the services from SNH to agriculture and from agriculture to society. From this short description of complex interactions, it becomes clear that land management for ES is an interesting theme to be approached through action research. Due to the multiple spatial and functional relations between the various territorial parts, it is almost impossible to draw clear conclusions about the services an area delivers and receives from neighbouring areas or local land use activities.

The theme of the 2015 course focussed on the relation between ESs and land management and the contribution of ESs to territorial development. Interactions between stakeholders and researchers in a running research project on ESs provisioning by SNH (QuESSA; www.quessa.eu) revealed a gap between ESs expected by farmers and the ones actually provided, or even the problems they perceived as originating from SNH. The causes for lack of ESs provision by the SNH could in most cases be brought back to lack of management or mismanagement of the semi-natural areas. From this mismatch, the idea was born to organise the Spring School around this theme in order to determine the context for future research in a participatory way. Students and relevant actors were guided to assess the local land use typologies and the services these systems deliver both to agriculture and to society. At the same time, the students were required to find out how stakeholders from the two areas (i.e., the plain and the hills) perceived possible services provided to them from the other area or, vice versa, if they felt their area was providing services to the other area. In this regard, it was clear that talking about ESs facilitated the local land managers to formulate an opinion because in one way or another, everyone receives some services from the territory he/she lives in, and consciously or not, may provide a service to the territory through his/her activities. Hence, the choice of ESs appeared as a relevant and salient example to address the territorial development, though remaining a very complex object to deal with. In an action-research context this means that the students performed only the planning phase by analysing the current situation and identifying the possible openings for innovative territorial management aimed at increasing delivery of ESs desired by farmers while having some consensus on alternative management options for the SNH that should deliver these services to farmers and the society as a whole.

2.3. Contents and tool presented in the course

The lecture modules of the Spring School 2015 covered the following theoretical lectures: ‘Overview of ESs to and from agriculture’, ‘Overview of SNH typology and management in northern and southern Europe’, ‘How do policies affect land use management’, ‘Farmers typologies: understanding behaviour and attitude, conflicts and synergies especially in relation to multi-functionality’, ‘Background concepts of landscape and territory agronomy’ and ‘Governance aspects ESs’. The applied module (toolbox) consisted in lectures on ‘Spatial Models’ (Choremes in French (Lardon, 2006)), ‘Mapping Local Spatial Knowledge’, ‘Methods to perform local stakeholder surveys’, ‘The territory game’ and ‘Methods for analysing ecosystem services to and from agriculture’. At last, the case study area was presented by showing and discussing maps, pictures and statistical data about the land use, economic activities and the population.

This information was deemed sufficient to initiate action research by listening to local stakeholders in the round table discussion. Based on the first impressions emerging after the round table discussion (Figure 1a), students formulated the objectives for the field visit and individual interviews with stakeholders (Figure 1 b and c). This information was processed

fostering spatially explicit outputs that highlighted the location and direction of ESs provisioning within and between the two areas, the hills and the plain. These spatially explicit elaborations were combined with the available thematic maps of the study area.

All the elaborations were targeted to prepare the cards and the maps used for the territory game. The cards join spatially explicit analyses of available data and information with a short explanation of the key findings; they are kept as simple as possible, each focused on a single topic (e.g., drainage channels in the Pisa plain; demography dynamics in the whole area). The maps are blank mute supports for the first two stages of the game. These maps require the students to identify the limits of the study area related to the spatial extent of the selected theme; in addition, they have to select and represent the relevant infrastructure and spatial objects helping the actors orienting on the map without conditioning their expression (Debolini et al. 2013).

The game was played by selected stakeholders and the students, with the latter covering either the role of players or of game managers (Figure 1d). The territory game was guided by a researcher and two students acted as observers taking notes about the interactions between the players. This is very important for the analyses of the results by the researchers afterwards.

We split the class into two groups, dealing respectively with the hill or the plain area. The groups played on separate tables each with five players. Each player was given a set of three cards and was asked to select the most relevant one according to his/her viewpoint in relation to ESs provisioning. The set of cards is given by the game managers fostering the mix across stakeholders. For instance, farmers received cards about water management or demography, whereas local administrators received cards about farming practices. In the first stage of the game, each player presented the chosen card to the other players and together the players had to draw a diagnostic map representing all of the issues they discussed. In the second stage, a new empty map is provided and the game managers guided the players to define a foresight scenario for the local landscape. The players were asked which actions would be needed to develop a shared territorial management of the ESs in the following 20 years. The scenarios need to be exaggerated, in positive or negative sense (paradise or disaster), so as to break the possible locks of the business as usual scenario. In both stages, the diagnosis and the scenario, the crucial aspect it that maps pushed the participants to discuss around a spatially explicit representation of their discussion, eventually highlighting agreements and conflicts. In addition, each group must elect a representative to present the scenario to the other group. Finally, the third stage is the formalization of realistic actions inspired by the scenario and answering the initial diagnosis. These actions draw upon the intense interactions of the first two stages, thus helping to capitalize the crossing of viewpoints.

Figure 1. Representation of the three forms of direct interactions between students and local stakeholders: a) round table; b, c) individual interviews during the field trip; d) the territory game (pictures by A.C. Moonen and D. Rizzo).

3. Results from the 2015 course

The action learning platform gathered results both on the educational and the research sides. In this paragraph, we present the main results that emerged from the five action research steps (defined in paragraph 1) that represented the various interactions between students and local actors.

The round-table discussion with the stakeholders and the interviews performed during the field visit were processed and summarized by the students into four maps about ESs provisioning. These maps were incorporated in some of the cards played during the territory game. Figure 2 shows the summary of the key ESs and where their service is received. Figure 3 shows the services or disservices agriculture receives from SMH surrounding cropped fields. This issue was mostly highlighted by the farmers. Figure 4 shows the relations between ESs from the Pisa plain to the Monte Pisano and vice versa, as perceived by the interviewees. A fourth map was created in relation to vegetation management on the Pisa Mountain, because in this area lack of adequate management was frequently indicated as the cause of suboptimal ESs delivery and socio-economic problems in the study area.

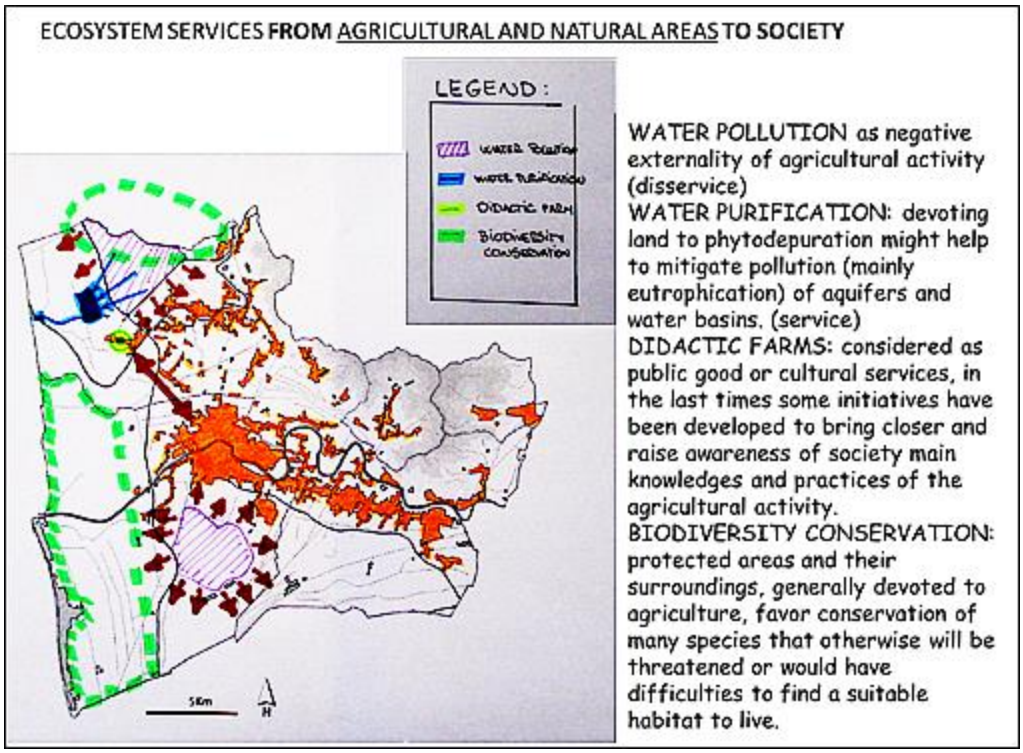

Figure 2. Ecosystem services from agricultural and natural areas to society. The north-eastern grey areas indicate the Monte Pisano and the remaining part the Pisa plain.

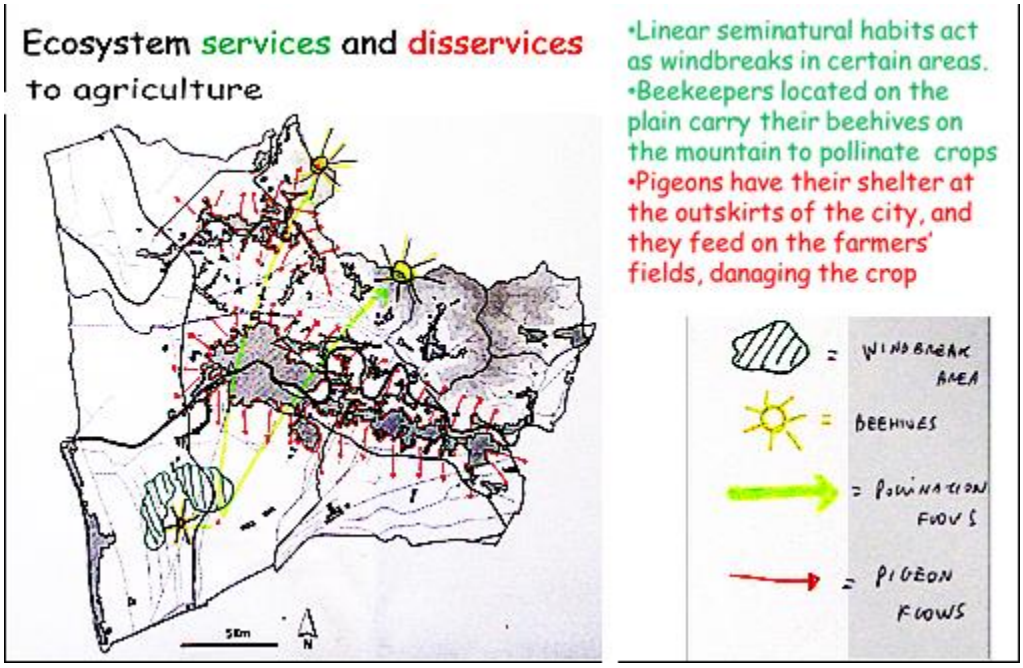

Figure 3. Ecosystem services and disservices to agriculture. The north-eastern grey areas indicate the Monte Pisano and the remaining part the Pisa plain.

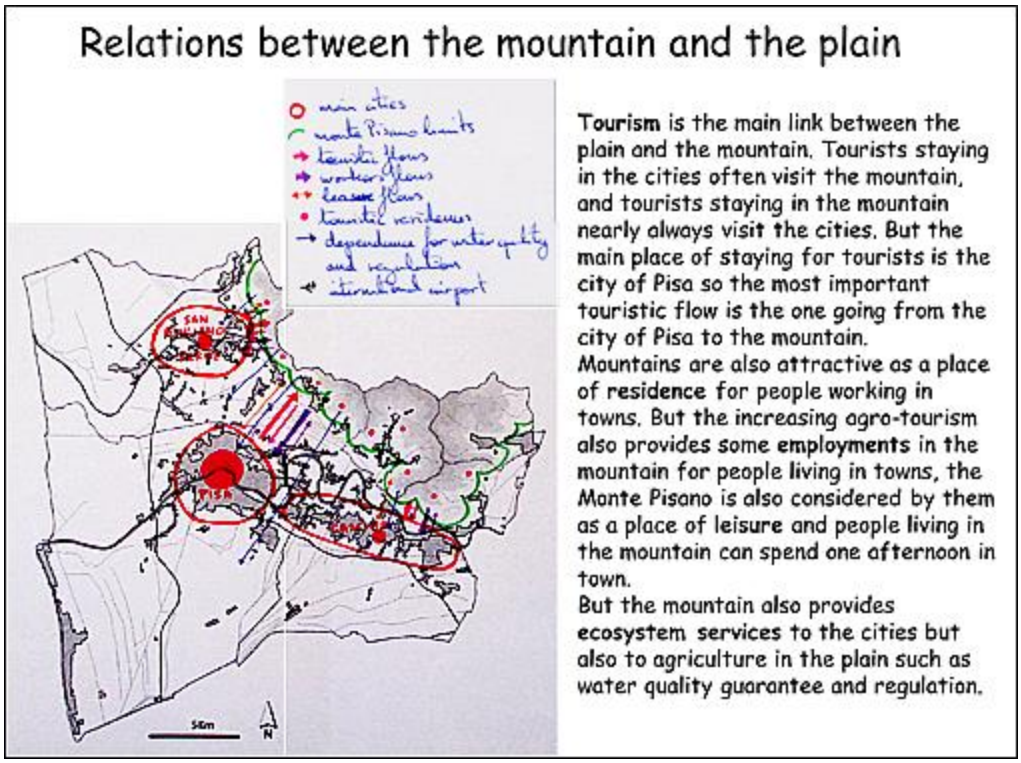

Figure 4. Economic, social and environmental relations between the Monte Pisano (grey area) and the Pisa plain (white polygons).

From their viewpoint, the stakeholders of Monte Pisano regarded the lack of policy support to sustain olive production as the key issue for land management. In fact, they consider that olive groves play a central role in some ESs like the erosion control and leisure provision (e.g., manifested by attracting tourists from the region but also from abroad). The abandonment of correct management of pinewoods was pointed out as the main cause of large fires, possibly initiated by not controlled burning practices of pruning residues by olive growers. Overall, a well-managed mountain agroecosystem provides clean water, water regulation and leisure area to the Pisa Plain. Stakeholders in the Pisa Plain perceived lack of correct management of the drainage system as a key problem for successful agricultural production. Most SNH in the Pisa Plain are woodland of a nature park, and this is perceived as the origin of wildlife (e.g., wild boars) that damages their crops. Beekeepers value SNH, especially on the Monte Pisano, for the provisioning of non-polluted flower resources.

Altogether, the action learning platform was successful at providing the students with concepts and tools to elicit and analyse differences in the perception of stakeholders from the plain and hill areas, although these areas are close and within a range of 10 km from Pisa. A common perception was that both areas have a below optimal ESs delivery due to lack of landscape-based management of SNH and infrastructures.

The territory game resulted in a diagnostic map and a foresight scenario both for the Monte Pisano and for the Pisa plain area. In each scenario the players explicitly addressed the relation they fostered with the other area, respectively the plain with the hills and vice versa, in a 20-year future (Figure 5). As an example, we present the results obtained for the Monte Pisano.

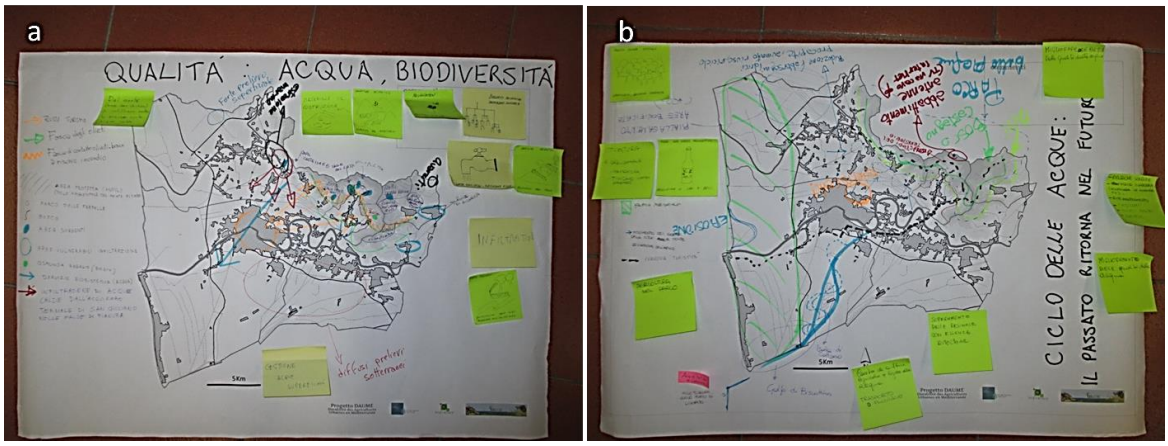

Figure 5. The diagnostic (a) and foresight (b) study of the Pisa Mountain area as result of the foresight territory game. The diagnostic map is entitled 'Quality: Water and Biodiversity' while the foresight map is entitled 'Water cycle: the past returns to the future'.

The ESs selected by the various players were biodiversity conservation, water regulation, landscape aesthetics and recreation. Water regulation emerged as the key service of the Monte Pisano, both in terms of production of clean water through infiltration of rainwater and regulations of the water arriving to the Pisa plain from the mountain area. Correct vegetation management and maintenance of the terraced olive groves, the main agricultural activity, were identified as key actions to be improved. Players unanimously indicated the Monte Pisano as a service provider to the Pisa plain, especially in terms of water provisioning and run-off regulation. Tourist fluxes was the only ESs they indicated from the plain to the hills. These fluxes indicate indeed further services of the Monte Pisano to the Pisa plain: provisioning of food (olive oil and products from the woods) and recreational space for walking, biking and holiday destination. In the second stage of the game, the main question was about the future for the services linking agriculture and natural resources of the territory. A revolutionary foresight was presented where participants envisaged to give part of the Pisa plain back to the water and naturalise the area south of the main river (i.e. the Arno river). This scenario emerged as an extreme workaround for the insufficient drainage capacity of the plain, subject to several reclamations, also suffering from subsidence near the coast. From the players' perspective such a scenario would increase the attractiveness of the foothills as residential area and would therefore increase the management of the related landscape. Traditional knowledge would be used to govern the area and to maintain traditional agricultural systems that would be sponsored by agro-tourism. In this scenario, the upper part of the Monte Pisano would be managed for the conservation of species-rich ecosystems where planted pinewoods would be replaced by the native chestnut and oak woods, which are furthermore resistant to fires, all in all contributing to increased carbon storage. Energy production for the local settlements could be secured by exploitation of hot groundwater sources and this would contribute to the reduction of the local carbon footprint. In the newly created alluvial plain, rice production was envisaged as the most sustainable cropping system because instead of fighting against the water, which has a high energy cost and contributes to the mineralisation of the soil, it would make use of the water while conserving soil organic matter.

4 Meta-analysis of the learning process

Building on the learning arrangements presented in the previous paragraph, we analysed the learning process. First, we addressed the contribution of the action learning platform to the topic of territorial development. Then, we focused on the viewpoint of the three major participants to this platform: the students, the local actors and the researchers. At the end of the course, both students and researchers discussed about the strengths and weakness, and possible improvements for the Spring School.

4.1 Knowledge and experience sharing in landscape agronomy

Classical learning and knowledge transfer arrangements like lectures are well-established methods for PhD courses. Also within the action learning platform, the lectures confirmed their usefulness to provide all participants with a minimum amount of technical information and lexis needed to grasp the content of some of the issues they encountered during the action research activities. Likewise the previous editions, the participants of the 2015 course had very diverse educational backgrounds; therefore, some lectures might have been partly redundant for some but very informative for others. Using the landscape and territory agronomy approach and the ALaDyn framework (Benoît, Rizzo et al., 2012) helped the students to locate the various lectures inside the complete picture (cf. Marraccini et al. 2012). Beforehand, this framework helped the teachers defining the issues that needed to be presented to the students. The goal was to provide them with the necessary knowledge and tools for the action research approach to the case study. After this necessary alignment of knowledge, the course was mainly based on experience sharing between the researchers, students and stakeholders.

In the course, we paid attention to refer to shared terms and definitions. Yet, the students faced also the lack of this harmonization in the interactions with the stakeholders. In a real action research situation there would probably be a first phase where all participants agree on commonly used terminology and definitions and professionals would have the opportunity to explain to other participants which are the technical issues related to their activities. For example, it is difficult for a farmer to understand why beekeepers are upset about the use of herbicides. For the farmer herbicides kill a plant, not the bees. However, there are side effects of herbicides on bee colony health and this technical knowledge needs to be shared by all participants of the action research group otherwise it will cause miscommunication. In the course, the stakeholders do not participate to the alignment and this sometimes causes misunderstandings during the interactions with the students. In some occasions the researchers who are always present during the interviews and discussions needed to intervene to provide clarification. This type of gap was also identified in discussions between various stakeholders, for example farmers discussing with policy makers. The same terminology may have completely different meanings for these two groups and they are hardly aware of this. A solution would be to invite the stakeholders to participate to the entire course session and take this as a life-long-learning event also for their own professional development. However, for these professionals it may be difficult to leave their job for an entire week.

4.2 Students viewpoint

Students appreciated the territory game although they felt it was not easy to prepare and to manage the territory game. The first problem in an international learning context is the language barrier. Often the stakeholders do not speak English, therefore the game needs to be played in the local language. Foreign students have difficulty to follow all interactions even though teachers translate. Connected to the language problem, there is also a cultural discrepancy. Sometimes to understand dynamics in a group of stakeholders with opposing viewpoints, you need to know their background and life style. Of course, in a one-week course this cannot be expected from

foreign students. However, they grasp the principle and they can interpret the results. This year's students also regretted that the course programme skipped the conclusive analysis of the territory game. In fact, from the researcher point of view, that would be the conclusive step in the action research process, before re-iterating interaction with the stakeholders about the findings and the consequence. However, to be able to include that aspect in the Spring School, more days should be added and that would result in objections about the length and intensity of the Spring School (which in fact happened in the year we decided to have a 7-day long Spring School). Since it is not the objective of the Spring School to provide a full course on action research, we think that in the end a 5-day course is long enough to give students the possibility to grasp what action research is about and where the difficulties lay. Experience with action research will have to be acquired in the real world, in a real action research project, but we think this course is a good first step to get acquainted with some benefits and difficulties of this participatory approach to research on territory management.

4.3 Stakeholders viewpoint

Stakeholders are involved in the course as learning aid for students. Indeed, they normally are very motivated in participating. Some of the actors involved in 2015 also participated in past courses. Their enthusiasm is a clear indicator of their interest in the course, but so far we never interviewed them to formalize their feedback on the learning process. Since they are invited as contributors to the course, they are more relaxed than they would have been in a real life case study on the subject. This may facilitate interactions and discussions among them. We have the impression that the analyses presented by the students of the territorial issues were received by the actors as relevant issues and not as criticisms. We have already discussed the possibility to invite the stakeholders to participate full-time to the course in order to make it a learning experience for them as well. Although time and language clearly appear as the main obstacles to make this a success. Alternatively, we should organise these Spring Schools in local languages, with only local students and stakeholders. That would make it another type of event.

4.4 Researchers viewpoint

The outcomes of the territory game are unpredictable and are always real eye-openers for researchers. For the example, we developed the ESs theme questioning the services provided by agriculture and by SNH. However, the action learning platform and, specifically the territory game, clearly highlighted that stakeholders perceived a lack of ESs provision eventually determined by the uncoherent land management. In the end, also the researchers were led to widen their perspective and break the silos. The interesting aspect of the 'ESs' theme is that it is wide enough to comprise various stakes at territory level and has the power to identify relationships between stakes that are often treated separately. Focussing on the results, the dissymmetry emerged between the hills and the plain in the provision of ESs, with the Monte Pisano providing more services to the plain. The spatially explicit and integrative methods thus helped to highlight the relevance of the landscape morphology to design innovative landscape management. The goal would be to account for this disparity in the ESs provision and put it in the balance to compensate, for instance, some dependencies of the hill from the plain (e.g., job opportunities)

5. Conclusions

'Ecosystem service' is a new term for a variety of benefits that are often not recognized by farmers as special features, but seem intrinsic in agriculture and landscape management. It is a new word for something that has always existed, but in this way policy makers at the EU level (in the CAP) have found a way to stress it and assign a value. By selecting the ESs as example issue for our action learning platform we realised that it is a very wide concept including a lot of diverse aspects as both ecosystems and society are affected. More in general, the course

programme that alternated lectures and action research methods resulted to be formative for the actors and the researchers as much as it was for the students. For a future course, the analysis of the territory game could be done by students who are interested in this activity as part of a final examination to obtain the full amount of study credits which nowadays are obtained after submitting a final report on the Spring School. However, it needs to be stressed that the territory game can also simply be used as a tool to set the scene and get acquainted with the territorial studies, thus stressing the use of this method for cross-checking research results with the stakeholders and hybridizing academic and local knowledge, without performing an in-depth foresight study.

Hybridisation of available hard data from previous research projects with local knowledge, helped students to become aware of the complexity of the territorial system and all social and ecological interactions. Altogether, the various approaches and tools that were mobilized during the course highlighted the need to capitalize the existing knowledge and to operationalize it by crossing different points of view and academic silos. When it is well prepared, the cross fertilisation between an education programme and an action research approach can provide far more results than a single-discipline research project, mainly thanks to the outbreeding between students, researcher and actors viewpoints.

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References

Benoît M, Rizzo D, Marraccini E, et al. (2012) Landscape agronomy: a new field for addressing agricultural landscape dynamics. Landsc Ecol 10:1385–1394. doi: 10.1007/s10980-012-9802-8

Daily G C, Alexander S, Ehrlich P R, Goulder L, Lubchenco J, Matson P A, Mooney H A, Postel S, Schneider S H, Tilman D, Woodwell G M. (1997) Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems. Issues in Ecology 2, 16 p.

Debolini M, Marraccini E, Rizzo D, et al. (2013) Mapping local spatial knowledge in the assessment of agricultural systems: A case study on the provision of agricultural services. Appl Geogr 42:23–33. doi: 10.1016/j.apgeog.2013.04.006

Gennai-Schott S, Rizzo D, Sabbatini T, Marraccini E (2014) Uno studio dell'intensità dei sistemi olivicoli collinari terrazzati: il caso del Monte Pisano. Atti XLIII Convegno Naz. Della Soc. Ital. Agron.

Lardon S., 2006. La modélisation graphique. In Benoït M. Deffontaines J-P., Lardon S. "Acteurs et territoires locaux. vers une géoagronomie de l'aménagement", INRA, Quae, pp 33-55.

Lardon S. 2013. Developing a territorial project. The “territory game”, a coordination tool for local stakeholders. Revue FaçSADe, Research results of INRA-SAD department, n° 38, 4 p.

Lardon, S., Moonen, A-C., Marraccini, Debolini, M.,. Galli, M., Loudiyi, S., (2012). The territory agronomy approach in research, education and training. In The farming systems approach into the 21st century: the new dynamic, Darnhofer, I., Gibbon, D., Dedieu B., Spinger.

MEA 2005. Millennium ecosystem assessment. In Ecosystems and human well-being: biodiversity synthesis. Washington, DC: World Resources Institute.

Marraccini E, Lardon S, Loudiyi S, et al. (2013) Durabilité de l’agriculture dans les territoires périurbains méditerranéens : enjeux et projets agriurbains dans la région de Pise (Toscane, Italie). Cah Agric 22:517–525. doi: 10.1684/agr.2013.0658

Marraccini E, Rizzo D, Debolini M, et al. (2012) Contribution of agronomy to land management issues-a comparison of five interdisciplinary PhD theses. Prod. Reprod. Farming Syst. New Modes Organ. Sustain. Food Syst. Tomorrow 10th Eur. IFSA Symp. Aarhus Den. 1-4 July 2012

Moonen C, Galli M, Lardon S, et al. (2010) A winter school in landscape agronomy and the synergies it created. In: I. Darnhofer, M. Grötzer (eds) Build. Sustain. Rural Futur. Added Value Syst. Approaches Times Change Uncertain. University of Natural Resources and Applied Life Sciences, Wien (A), pp 2176–2183

Power A G, (2010) Ecosystem services and agriculture: tradeoffs and synergies. Philosophical Transactions of the Royal Society B. 365, 2959–2971. doi:10.1098/rstb.2010.0143

Rapey H, Lardon S, Galli M, et al. (2008) Experiences from a winter school on landscape agronomy: stakes, difficulties, perspectives.

Raymond C M, Fazey I, Reed M S, Stringer L C, Robinson G M, Evely A C, (2010) Integrating local and scientific knowledge for environmental management. Journal of Environmental Management 91, pp 1766 - 1777

Rizzo D, Galli M, Sabbatini T, Bonari E (2007) Terraced landscapes characterization. Developing a methodology to map and analyze the agricultural management impacts (Monte Pisano, Italy). Rev Int Géomat 17:431–447. doi: 10.3166/geo.17.431-447

Scherr SJ (2016) Leading integrated landscape partnerships. EcoAgriculture Partn.

Zhang W , Ricketts T H, Kremen C, Carney K, Swinton S M, 2007. Ecosystem services and dis-services to agriculture. Ecological Economics 64, 253–260. doi:10.1016/j.ecolecon.2007.02.024