« Landscape Economics : the Road ahead »

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DR n°2009-25
Landscape economics : the road ahead

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Abstract

The aims of this paper are to delineate some important topics in landscape economics, and also to put landscape policy in the perspective of the sustainable development. The research issue is about the relationships between the development paths and landscape changes, paved with examples of consensus, controversies, and conflicts.

Landscape is a polysemic term, many approaches and definitions exist for it, and as a consequence, economists should adopt or elaborate their own landscape definition or concept (the most suitable to their general methodology, and related to their most familiar concepts).

Landscape appears to be a local public good. That definition correspond to the property rights market failure arising from the co-visibility. Co-visibility makes it difficult in general to identify precisely the link between each owner action and the aggregate landscape outcome. As a consequence, landscape ownership appears to be scattered into a multiplicity of actors of various nature (individual, communal, statal…). How to exploit that analogy with non point source pollution is a challenge for landscape economics research. Each actor has his own objective and management criteria, either for agricultural, forestry, industrial or residential activities. Moreover, there are multiple public policies aimed at sustaining each activity. Inevitably, public policies failures arise, and so the need for coordination actions aimed at landscape maintenance and preservation. Because the local public good nature of the landscape, it’s worth to look at the models of public good joint production. How to aggregate actions from different land owners into a resulting landscape, or how to coordinate actions scattered among multiple landowners in order to get a specific desired outcome is a real challenge ? In some case, the responsibility of changes is concentrated in the hand of few decision makers, in some others, the responsibility is more diffuse, and the non point production function of the landscape could be approximated by an additive function. The issue of the aggregation of actions is closely related to the one of preferences heterogeneity and agregation. Because a specific landscape project could be appreciated as beneficial or detrimental by different people, it’s necessary to separate the stage of evaluation, the stage of decision making and the stage of implementation. Issues of coordination of actions arising at the implementation stage should take for granted the landscape objectives and the social value of the project. Eventually, the design of Institutional arrangements to manage landscape should take onto account his nature of common pool resource.

The paper is organized so as to take stock from the contributions of the research community in Landscape economics, and also to signal some missing links and promising paths. Naturally, our paper does not exhaust all the topics, we will concentrate on three topics : preferences definition and evaluation, joint production, and governance.

Key words : Landscape Evaluation, Stated Preferences, Revealed preferences, Landscape joint production function, Landscape governance, European Landscape Convention, Incentives, Public policies, Government failures, Property Rights

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Introduction

The aims of this paper are to delineate some important topics in landscape economics, and to put landscape policy in the perspective of the sustainable development. This perspective is challenging for economists, due to the two gaps observed between the development of landscape research in geography, ecology or sociology and the absence of a corresponding corpus in economics, on one hand, and the development of landscape policies compared to the development of research in economics, on the other one. Indeed, developing landscape economics is a scientific challenge of its own right, because landscape changes arise from the interaction between technological drivers and social preferences. Moreover, due to the importance of landscapes and their diversity for the tourism industry and the well-being of the population, the research on landscape policy is socially desirable.

Landscape is a polysemic term, many approaches and definitions exist for it (Cosgrove, 1984) and as a consequence, economists should adopt or elaborate their own landscape definition (the most suitable to their general methodology, and related to their most familiar concepts ). The definition given by the European Landscape Convention\(^2\) appears to be suitable for most economists, because it is streamlined with the methodological individualism they used to rely on. Economists think individual as having landscape preferences, and as a consequence, landscape preferences could be diverse, and their distribution in a society facing landscape changes, heterogenous. Landscape changes often concentrate unresolved social issues, and the road for the research is paved with examples of controversies, conflicts and consensus as well.

Price and al. presented a paper (Price, 2009) on a specific place of landscape economics inside economics and alongside others fields of economics (spatial economics, environmental and resources economics, public economics…). The case for landscape economics’ autonomy rely on the importance of cultural and aesthetics amenities and services produced by landscape and their diversity. They asserted that « In many ways, landscape is a social, cultural and economic construction », and, as a consequence, they place elicitation of social and individual landscape values at a first place amid the topics to be investigated. Because evaluation is mainly concerned by landscape changes, landscape economists face the specific issue of the transformation and evolution of norms and preferences. « The adoption of major changes in landscape or architectural items by citizens echoes the diffusion of other innovations ». Moreover, preferences’ elicitation and project management should take into account the very dynamic process of preferences updating.

Due to the nature of the landscape as local public good, and because landscape changes are driven by individual and collective decisions, landscape governance, though necessary, appears to be very complex and even in some circumstances, controversial or conflictual. Economist could help in analyzing and looking at procedures and institutional arrangements most suited to manage and organize it.

In order to give policy makers or politicians some relevant guidance in coping with landscape changes, economists should also help to understand mechanisms of landscape transformations. The understanding of the landscape making up (as cultural and aesthetical services) should rely on the understanding of the patterns and process at stake, arising from

\(^2\) « Paysage » désigne une partie de territoire telle que perçue par les populations, dont le caractère résulte de l’action de facteurs naturels et/ou humains et de leurs interrelations » Convention européenne du paysage, www.coe.int/conventioneuropeennedu paysage
spatial economics and economic geography, but it should also rely on the understanding of landscape innovations and emergence, and on their interactions with changes in preferences. That is a strong argument in favor of the landscape economics autonomy.

In this paper, I will not deal with all the issues relevant for the development of landscape economics. I will instead concentrate on three topics only: Preferences formation and evaluation, joint production, governance and policy design.

1. Evaluation of landscape changes

1.1 Valuation approaches

We first describe the most popular methods and the theoretical basis they are grounded on, and examine the limitations they face in regard of the process of landscape perception. As we mentioned above, landscape should be considered together as a public good, and as an external effect of scattered decisions of land use emanating from a variety of landowners. As a consequence, evaluating the impact of landscape changes on the social welfare could not rely on usual measures of welfare using market prices. In that context, economists have two main approaches in their toolbox.

By observing the behaviour of inhabitants or tourists on markets exhibiting a (weak) complementarity with landscape, they could try to estimate the willingness to pay for some landscape attributes or changes. This revealed preferences approach uses data collected on transport and accommodation expenses, or on housing market (Cavailhes, 2008). The shortcomings of the method are lying precisely on two main characteristics: the first is about the intensity of the complementarity between landscape attributes and the indicating market, the second is about the cost of performing marginal analysis of the impact of attributes values on the prices observed on the indicating market. For that reason, revealed preferences approaches are challenged by stated preferences approach.

Stated preferences are based upon the construction of virtual market, offering to the inhabitant or to the tourist choices among scenarios or choice sets, and balancing them by a monetary attribute. The aim of landscape evaluation is to give monetary value to landscape changes, not to the landscape portfolio as a whole. Because they intend to build a virtual market for landscape changes, stated preferences methods face criticism for their potential constructivism: they are shedding light only on the changes chosen by the designer of the survey, and encompass potential biases. Stated preferences methods are now widely used in landscape changes evaluation (Santos, 1998, Bonnieux, 1997, Idda, 2005, Rambonilaza, 2004). Due to some criticism and limitations brought about contingent valuation (Noublanche, 1999, Willinger, 1996), but also due to the ability of choice experiment methods to deal with complementarity and substituability issues, one could observe a switch from CV to CE during the last decade.

Stated preferences methods are mainly based on the MAUT (Multi Attributes Utility Theory), and rely on analytical characterization of landscape changes. Because stated preferences are usually performed in an local context, the global characterization of landscape remains implicit. It is then possible to proceed in decomposing a specific landscape unit into his components or attributes. And to measure the complementarity or the substituability between those components.

Based on the seminal paper by Hoehn (Hoehn, 1991), Santos pointed out two main issues arising in landscape evaluation, and involving complementarity and substituability (Santos, 1998). The first is a multi-site problem, the second is a multi-attribute one-site problem. The
multi-site problem raises the issue of the structure of the landscape portfolio. The preference for a diversified landscape portfolio implies a degree of complementarity between sites, while a high degree of substitutability among sites implies a landscape portfolio having a low diversification. Obviously, the multi-sites problem relies on some degree on the ability of people to discriminate sites as similar or different, with regard to some attributes relevant for preferences. During the one-site evaluation process, interactions among attributes impact heavily on the outcome. If interactions are not taken onto account by the evaluation procedure, this lead to bias the benefit estimate. Interactions in evaluation could encompass both structural features (for instance hedgerow, stoneswall and meadows in the so-called « bocage ») and functionnal or management features (the share of openwater and the seasonnal water management, or the way of controlling mosquitoes in the case of wetlands). Complementarity and substitutability among attributes or landscape components are certainly useful dimensions of landscape evaluation, but they are not the only one.

1.3 Holistic versus Analytic Approaches

While the MAUT and the related evaluation methods are largely used in landscape evaluation, it’s worth to raise the question of the relevance of such an approach for revealing the preferences without bias. If preferences are based on perceptions, and perceptions are holistic rather than analytic, one could ask whether our evaluation methodology are suitable and efficient. It could then be worth to look at another type of preferences. In a literature review published in 1982, Zube and al., provided a general, transactionnist framework « in which landscape perception is considered as a function of the interaction of humans and landscape » (Zube, 1982). « The human component encompasses past experience, knowledge, expectations and the socio-cultural context of individuals and groups. The landscape components include both individual elements and landscapes as entities. The interaction results in outcomes which in turn affect both the human and the landscape components » (Zube and al, 1982). In conclusion of their review, the authors stressed the fact that research in landscape had the tendency « to focus on elements (elements of the human components of the landscape) rather than on the perceptual interaction. This « elemental » focus leads to descriptive research, concentrating on the « what » of landscape perception rather than on the « how » or « why ». « Investigation of the connections and relationships between and among elements already found to be important in previous research…is an important step towards understanding interactions and towards developing a theory of landscape perception ».

« It’s not clear whether individuals actually do distinguish between individual features across the landscape, or whether it is the interaction of the features across the landscape of a particular area which influences the intensity of an individual preferences. Indeed, both Appleton (1994) and Brahm (1996) speculate that it is the totality of the landscape and not just the individual features within it that leads to positive preferences ». Litton (Litton et al., 1974) focused more on landscape patterns and their organization inside the framework of « a visual conspicuous entity ». Relying on some case studies from the U.S.A. and from Netherland, he stressed the importance and the difficulty of a holistic approach, but proposed a description of landscape units through the combinaison of land use pattern and networks (stream system ). The perceptual framework is generally made from three different units that are in a hierarchical relationship: the landscape unit, the setting unit and the waterscape unit ». That perceptual organization seems to be related both to the cultural and artistic influence of landscape painters, and to the human capacity to distinguish units.
The existence of a (three step) hierarchy in dimension and scope of interrelated spaces and of interconnected patterns in land use has a strong influence on aesthetic satisfaction. The aesthetic satisfaction could eventually rely on three values: the sense of order (how parts fit together), the need to be able to recognize, explain and identify (congruence, transparency, legibility), the need for spatial orientation (presence of local and distant landmarks). Obviously, landscape perceptions and evaluations should be related to landscape entities. But landscape entities could be defined either by physical boundaries, or by the nature of perceptions and the perceived differences among neighboring entities. Homogenous perception in the landscape entity and heterogenous perception among landscape entities create the map of different landscapes.

Homogeneity of perception is compatible with heterogeneity of composition. For instance, if a landscape is perceived like a chessboard, the perception is homogenous and we talk about a mosaic landscape. Take for instance a agricultural landscape made from fields and forested area. With the same area of fields and forest spatially arranged in contiguous and compacts patches, we will recognize two different landscape entities, one being an open field landscape, and the other one being a forested massif. A « forest » or a forested massif, or an open field landscape, are homogenous in both dimensions, composition and perception. They are saturated by one only element.

The fragmentation of both forest and fields, characterize instead the mosaic, and help to recognize it as a distinct and homogenous landscape. But in some situations, where the land abandonment creates a dynamical process of transition toward the forested state, the perception could be more confuse and fading. What does make the difference in perception?

1.2 Lexicographic Preferences in landscape evaluation

While performing stated preferences methods, economists often face difficulties in dealing with the attitudes and responses of some people, who express disapproval with the principle of using the monetary metric in order to put value on nature or landscape or landscape projects. Such a situation frequently occurs for projects involving biodiversity, but also landscape. For instance, the opponents to the wind power development could refuse to trade off any attribute related to the wind turbine high, or with the number of turbines. They will refuse answering the questionnaire, or will place protest bids (zero or very high). This type of situation, frequently observed in environmental evaluation (some time one out of four questionaires) are called lexicographic order or lexicographic preferences, due to the analogy with the lexicon organization.

« Decision alternatives are examined initially on the basis of the first, or most important criterion. If more than one alternative is « best » or « satisfactory » on this basis, these are then compared under the second most important criterion and so forth… » (Fishburn, 1974). Thats the so-called principle of order by first difference. Lexicographic preferences are often called « preferences without trade-off », because they prevents balancing compensation between criteria. In particular, no compensation trough monney could be made in that case (Rekola, 2003, Rosenberger, 2003).

The issue of lexicographic preferences is particularly important in biodiversity evaluation, because some people are reluctant to place monney value on nature and life. The same difficulties could arise in landscape evaluation, but for different reasons (Shaeffer, 2007).

In « Landscape economics », C. Price emphasized the complexity of values involved in the interactions between the physical elements of the landscape, on one side, and the nature of psychological needs ans desires that may be satisfied by that perceived landscape (Price, 1978) . Some perceived characteristics could be appraised in reference to social norms.
The former could involve preferences for status quo, while the first could involve or be compatible with landscape changes. But if they are not by themselves opposed to trade-off, they could induce protest behavior and objections to put monetary value on some landscape or sites.

Consider now a consumer facing the choice of the next holiday destination. He could use a list of place of destination (Paris, Sydney, New York, The Great reef Barrier, The Great Colorado’s Canyon …) or select the place through a hierarchy of criteria, like Urban/Rural, Mountain/Littoral, Desert/Countryside, Forest/ Savanah … The choice clearly involves hierarchy of criteria, and rely on the destinations’ portfolio and on landscape diversity.

We then could suppose that choices among destinations involves often lexicographic preferences, while choices inside landscape types, involves continuous preferences and enables trade-off among landscape attributes (Fleicher, 2009).

1.4 New developments in landscape evaluation

As economists, we are used to assume that people have stable preferences, because they are sovereign, fully informed and rational agents. If we could accept that model as a benchmark in some area of economics, it’s certainly more difficult to accept it to investigate domains or times of great social and environmental changes. People adapt themselves to changes, but also promote changes (Palmer, 1997). People form their own judgments in interaction with other agents, being firms or others consumers and citizens.

This raises the important question of informed preferences. How the provision of information impact on the choices made and in addition, how the possibility of interacting with others influences the decision-making process and the final choice?

Moreover, in the field of environment and natural resources management, how uncommensurable metrics could be accommodated? Does the opportunity of social interactions and learning modify the preferences, and are they differences in the decision-making process between consumers and citizens?

The development of evaluation workshops, in complementarity with stated preferences methods, or the use of citizen juries, could help in investigating this new area. They face difficult issues, but it seems not impossible to find creative solutions. Beyond the academic valorisation of the results of our CBA, are we yet able to use them as input in concrete negotiations about projects design and implementation?

Land use changes and technological innovations are shaping the landscape changes and have certainly a two ways impact on the social preferences for landscape. As they introduce new artefacts in the landscape, they produce constrained evaluations and uses of the emerging landscape. The new landscape is confronted to the old, unchanged one, and social forces to preserve it are emerging. In the same time, opposition to changes and the heterogeneity of preferences are changing the way the changes could be implemented. As a consequence, a new acceptable landscape emerges. And so do the new social norms.

Even if collective norms does exist, they are often characterized by the presence of heterogeneity which make reaching a consensus on a project very difficult. As a consequence, some projects could be delayed or even rejected. Eventually, the pressure for landscape changes, arising from the responses to emerging challenges like energy transition, food crisis, or population increase, produce opportunities of renewing old landscape preferences, and make the landscape preferences evolve.

Various examples could be found in the transport technology and network, the energy, the urban growth and the population concentration on the coastal area, the agricultural and forestry uses, and so on.
II. Divided ownership and landscape joint production

2.1 Multiple actors: property rights issues on landscape

Landscape appears to be a public good. That definition correspond to the market failure arising from the co-visibility. Co-visibility makes it difficult for landowners to control the access to and the use of the scenic beauty of his land. But it makes also difficult to identify precisely the link between each owner action and the aggregate landscape outcome. As a consequence, landscape ownership appears to be scattered into a multiplicity of actors of various nature (private, communal, statal...). While each could have an impact on the characteristic of the landscape, no one is usually able to claim alone the whole ownership on the landscape. For that reason, in much countries, State had designed rules to control the external effects arising from the exercise of property rights by landowners. If landscape as a cultural service and amenities provider would not have social value, the regulators would not have developed a bulk of rules in order to control the landscape changes arising from the decisions of landowners.

De facto, use rights and disposal rights, specially when they are related to land, could have significant effects on the other’s welfare. For that reason, the property rights have been « dismantled » in to a bunch of separate rights, and are constrained by various environmental and safety law and regulations.

At that point, the debate is really a political one, and it’s about the very nature of the landownership. The tension is between the conception of property rights (and specially, those on land) as an absolute and intangible right of the owner, without any interferences or restrictions from any other player, and an instrumental conception, for which the property rights are related to some social goals, and should be adapted to the changing goals of the Society.

The various landowners have each different objectives, management criteria and constraints, and are not mainly focused on their contribution to the visual aspect of the resulting landscape. There are also multiple public policies aimed at sustaining each activity. Inevitably, public policies failures arise, and the need for coordination actions aimed at landscape maintenance and preservation arise.

In the context of international negotiation at WTO, the multifunctionality of agriculture has been promoted as a main arguments to legitimize public support to agriculture. As a result, a vast amount of literature has been produced on the contribution of agriculture to landscape maintenance and to the production of landscape amenities. In such a literature, landscape maintenance is analyzed as a by-product, or a joint production of agricultural activity. As a matter of fact, the theory of joint production of landscape by agriculture use the theory of production, and avoid to go deeper in the difficult issue of the spatial agregation of actions taken by different farmers inside one landscape unit.

Such an analysis has several flaw and drawbacks. First of all, it’s obvious that agriculture and agricultural policy had and could have detrimental effects on the landscape components, structure and functions, depending on the region and on the type of production. Land abandonment is among the main of them, but one could also account for hedgerows removal, wetlands drainage and excessive afforestation. Even spatially important, agriculture is not the only activity contributing to the landscape local character, and moreover, it’s importance in the public perceptions could be very diverse.
Finally, public policies failures, due mainly to the lack of coordination among regulatory bodies, and to the lack of adequate planning instruments, could turn agri-environmental policy in a purely redistributive policy. As a matter of fact, very few efforts are devoted to integrate the territorial and landscape dimensions into the implementation of agri-environmental policy. Public subsidies are mainly allocated to farmers without taking into account the contribution of their proposed actions to the landscape local characteristics.

2.3 Landscape non point and joint production

The issue of the aggregation of actions is in theory closely related to the one of preferences heterogeneity and aggregation. But, because a specific landscape project could be appreciated as beneficial or detrimental by different people, it’s a methodological necessity to separate the stage of evaluation, the stage of decision making and the stage of implementation. Issues of coordination of actions arising at the implementation stage should take for granted the landscape objectives and the social value of the project.

On that basis, it’s useful to introduce the distinction between point changes and non point changes.

Point changes could be managed either through the use of command and control instruments or bilateral bargaining, because the producer of the externality and those impacted could be easily identified.

Non point changes, arising from the uncoordinated actions of a variety of actors, make the organization of the bargaining between those group liable for changes and those impacted by the externality more difficult. Even it has been possible to determine the amount of compensation to be payed to avoid changes, or the amount of compensation to be payed to promote positive changes, it remains difficult to find a way to share the collected amount among the landowners or to collect the contribution from them to compensate those affected.

The main reason for that stems at the higher transaction costs induced by the division of the liability for changes, which is an obstacle to the efficient use of negotiation. Dividing landscape ownership among a variety of landowner make the Coasian bargaining inefficient. But there is another reason, stemming to the difficulty of identifying precisely the contribution of each landowner’ actions to the resulting landscape changes. We wonder here if the general model of the joint production of public good could be useful or not. We will briefly recall the basic models, before going back to the specific case of landscape changes.

The concept of joint production of a public good relies on three main functional forms. The most widely used is the additive one, arising in case of the perfect substitutability of actions by each contributor. The others two forms are the best-shot (one or few efficient contributions are enough to provide almost all the value of the public good, and the weakest link (if only one contribution is missing, the public good is not provided).

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One could ask whether this very general model is applicable to the landscape provision. To go further, it’s necessary to proceed with some examples. Take for instance a project of restoration of an steppic openland in a context of land abandonment and afforestation process (Figures 1, 2, 3). A choice experiment survey has been implemented and the outcome give evidence that the preferred landscape is about a low level of forested patches at the scale of landscape unit. Alternatively, one could make the same reasoning if the stated social preference was about forested landscape. Due to the existence of perceptual thresholds, it will certainly make no difference for people if 4/5 of patches are cleared or all the patches. The difference will be certainly lower in the case of a preference for a forested landscape. In that case we could assume that above a threshold of 2/3 forested patches, there will be no difference for the visitor. The perceptive asymmetry induces an asymmetry in the functional forms chosen to represent the joint production of the desired landscape by landowner. In the case of preference for forested land, we could assume a form close to best shot, while in the opposite case, we could assume a function closer to the weakest link. In both cases, the convexity-concavity of the landscape joint production function is just related to the perception process, and to the perceptive asymmetry. The landscape preference is related to a very simple attribute, the rate of forested patches in the landscape unit. For more complex preferences, some problems could arise due to the existence of non-convexity. Consider now the case of preferences for a diversified landscape, with a mix of forested patches and fields equally scattered in the landscape unit. The initial conditions could be either an openfield or a forested landscape. The whole value of the landscape change should be given not only by the global proportion of cultivated fields and forested patches. We need to take into account an additional criterium, which is the degree of fragmentation of each set of forest and fields. To translate the preference for a mosaic landscape, we need to take on to account the local distribution of forest and fields inside the neighbourhood of each patch. Obviously, the global rate of landowner choosing to afforest their land is not able to fulfill the characteristics of the preferences expressed by the public. We need to introduce an additional requirement, that the global rate of forest and field should be also meet locally in each local neighbourhood (Figure 5). For landowners, the problem become an anti-coordination game, able to promote local diversity. For the landscape planner, the problem is to introduce an additional argument in the joint production function of the landscape, which is the number of patches with a right proportion of forest and fields in their surroundings.
Figure 1: Landscape with 1/9 forested patches

Figure 2: Forested landscape with 4/9 forested patches

Figure 3: Landscape with 6/9 of forested patches
Figure 4: Forested Landscape joint production function
Figure 5: Importance of the spatial arrangements of landscape components: Three landscapes arising from different arrangements of the same proportion of Black and white patches.
2.4 Institutional arrangements and landscape governance

The definition of landscape as a public good, or as an external effects, does not provide by itself any solution to the issue of his governance. Moreover, landscape is also a resource for a set of actors, and support the local employment. Obviously, landscape has « the element of communality ». But the best way to manage that element in a Pareto improving direction is not so clear.

In the case of sites of outstanding or historical value, the regulator issued early rules and constraints to limit the exercise of property rights by private landowners in the co-visibility area. In some cases, the taking of the full range of rights could be used. That case is called « eminent domain with compensation » solution. For ordinary landscapes, zoning is a widespread instrument used by public authorities in order to manage external effects arising from land development. Zoning by public authorities does mean that they are acting on behalf of the Society as a whole to share the use rights with the landowner.

Does the local character of the landscape as a public good gives some clues for designing institutional arrangements to govern landscape changes? What is the optimal or satisfactory level of authority to manage landscape? Traditionally, the answers to that question depends on the importance of the spill-over between jurisdictions and the extent of external effects. But as soon as we are taking an political economics view of the problem, we know that the local elected authority should be protected from the pressure of individual interests.

As a consequence, State as a legal entity is entitled with a part of the property rights attached to land, and should be considered as a co-owner of its own right. Nevertheless, the precise conditions under which this rights sharing could be organized remains under scrutiny. When some stakeholders only have vested interest in the landscape management, one could invokes the doctrine of public trust, where individual people could stand in the trust to defends their interest against landowners (Brewer and al., 2009).

Instruments like marketable development rights are seen as substitute to zoning and command and control instruments (CC). But are the markets instruments able to manage landscape changes and to accomodate the diversity of landscape preferences?

III. Landscape Policy: opportunities and challenges

Landscape policy could be aimed at preserving, conserving or promoting landscape with a specific features. Command and control instruments are the most efficient for preserving landscape, but they face the opposition of the supporters of the absolute conception of property rights. For that reason, incentives and markets instruments are complementary to CC instruments, but they also face specific challenges when the regulator is willing to use them to cope with landscape issues. Challenges arise from the necessity to integrate topology and spatial arrangements of artefacts and other landscape components as additional dimension in the incentives’ design.

3.1 Landscape Policy Instruments: how to take onto account topology?

As we have seen before, the main characteristic of landscape perception is the importance of topology. The identification of landscape components and their spatial arrangements matters in evaluation, not only the level of each components. Compacity or fragmentation,
connectivity are fundamental variables in the landscape perceptions. As a consequences, when designing policy instruments, it’s necessary to add some more constraints to fully accommodate that specific properties. I would just mention here the case of incentives able to promote agglomeration of patches having the same land uses or characteristic, and the case of incentives to promote diversity in the neighbourhood.

Agglomeration bonus is a simple incentive device, proposed by Parkhurst and Shogren (Parkhurst, 2002). The incentive is made of two part, one which is a lump sum payment related to a land use change desired by the community, the other one which is conditional to the proposed plot being contiguous to another with the same land use, the owner being the same or not. Because the strategic equilibria arising from that design are multiple, it’s necessary to explore experimentally or by local negotiation the potential outcome. It’s worth to compare the agglomeration bonus system with one we proposed, an coupled incentives scheme, designed in order to reach an environmental target and to spare public funds (Krawczyck, 2002). This second one is not able, by his own design, to get any spatially explicit outcome.

Landscape ecologists given evidence of the importance of landscape heterogeneity for enhancing both productivity and biodiversity. Then, beside compacity, the land planner could wish to promote diversity of land uses inside a specific area or neighbourhood. The problem is analogous to the production of gloves or socks, where the factory need to produce simultaneously right and left handside (foot). It’s known as an anti-coordination game. When agents are interacting in a set of fixed partners, the analysis shows that network effects are much stronger than when partners play a coordination game (Bramouille, 2003). At the landscape scale, the equivalent of the social network is made from the neighbourhood structure. Several solutions could be proposed at the landscape scale, from collective rotations (fallow and fields) to the allocation of production rights or quotas.

### 3.3 Public policies implementation: time consistency issues

The implementation of landscape policies face time consistency issues. They are arising from the discrepancy between the evolution of individual preferences and collective norms compared to the evolution of landscape itself. Landscape preferences are changing: some objective could be accepted or dominant at a given point in time, and rejected some decades after. But the socio-ecological process of landscape changes has his own viscosity, and it’s impossible to immediately streamline the new social norms with the current state of the landscape. Moreover, the landscape norms, specially those aimed at conserving historically dated landscape, could face difficulties due to the impossibility to restaurate the economical and social conditions prevalents at the time of reference (Van Haaren, 2007).

Some time, ecological processes interact with social processes and public policies implementation in a way of anhilating them.

To cope with this type difficulty, often met in epidemic process, Bradley has recently proposed the concept of chronotone. By analogy with the concept of ecotone, widely used in ecology, he proposes to use chronotone to describe the specific phase in the process of man-made environmental change (Bradley, ).

As ecotone is a boundary in space between two ecosystems or habitats in which many complex process are at work, there are analogous boudaries in time between the two ecosystems or landscape phases. More precisely, ecotone is « the period of relatively rapid transformation separating the two long-term types of land use. It may last from months to over a decade for epidemiologically important habitat changes »
We take here the case study of public policies aimed at fighting the consequences of land abandonment and preserving the openness of landscape in the Great Causses area, South of Massif Central (France) (Lifran, 2009). Just after the second world war, the policy context was about to leave the area to the natural afforestation process and to harvest wood. An aided afforestation policy has even been promoted to accelerate the conversion. But around the 1980, the growing awareness of the negative external effects of afforestation and the desire to keep the landscape open motivated the design of a new policy aimed at fighting enroachment and preserving grassland. A huge amount of public funds has been devoted during two decades to that policy. But the impact on the landscape dynamics has been very low, except in some places with a agricultural community facing land constraints. As a matter of fact, the ecological process of enroachment is based on the long distance diffusion of pine’s seeds. The human process of land abandonment is based on substitution of imported resources to the locally exploited, and also on the disparition of some old practices like long term fallow. When the global society becomes aware of the negative external effect of land abandonment, and is willing to pay for restauring open landscape, it’s to late to go back at a bearable cost. Eventually, the policy end up with a purely redistributive effect.
The Balinese Paradox, among others, enlights another difficulty (Lorenzen, 2005). Rice fields terrace in Bali are among the most beautiful features and components of the tourism attractiveness of the Island. This agricultural system is very complex, and efficient, due to a very integrated management of water and cropping agendas. It needs a very high investment in labor to maintain his efficiency. Due to the boom in the tourism industry, people leave the rice fields, but also all the water infrastructure maintenance, for more profitable and amenable jobs. As a consequence, the attractiveness of the landscape erodes and could constitutes soon a threat to landscape quality and as a consequence, for the tourism. The same holds in the Philippines Islands, where the rice terraces have been promoted as World Heritage Landscape

IV. Conclusions and perspectives

In that paper, I voluntarily choose to concentrate my investigation on few topics. That does not means that I consider remaining topics as secondary. On the contrary, I choose to leave aside the question of the landscape formation and the main drivers of the landscape changes. The topic is difficult enough to devote much time than few minutes to it. Moreover, it’s overlapping in a large extent with spatial and economic geography, and its important to take care for identifying the specific point related to landscape economics to be developed. Among the most important and original factors of interest for landscape economics, I would mention the role of property rights, as the enforcement of property rights creates artefacts or reinforces natural components, which are important components of the landscape perception (stonewalls, hedgerows, fences…). Settlements are organized to a large extent as a response to social interactions regulated by property rights. In addition of the landscape making up, properties rights forms the basis of what we called the « viscosity forces ». Viscosity forces contribute to the landscape dynamics together with agglomerating and dispersing forces (Lifran and al., 2007). They are related to the high transaction costs of changing the spatial organization of enforcement devices.

Global trend and new stakes in economy, (demographic increase and urban sprawl, energy transition, infrastructures renewing), subsumed by the term « economic development », promote new landscape artefacts and networks, and constitute the main drivers of landscape changes together with changes in preferences. Take for instance the case of carbon markets. What will happen if agriculture is accepted to take part to them on the supply side ? Would some farmers decide to go back from cereal to grassland, or to afforest their land instead ? What could be a landscape emerging from the trade-off between conventional agriculture, bio-fuel, carbon, photo-voltaic and wind power, and recreational markets ? What could be for instance a carbon-neutral landscape ? And does that question make sense ? How the allocation of land to various uses could accommodates the balance between Carbon sources and sinks ? Is it about the balance between forest and agriculture, or between the allocation of land to food and to renewable energy production ? Eventually, how to adress the question of the balance between the technological choices and the landscape preferences ?

Hodge characterized the emergent situation as a « disintegration of interests in landscape » and suggested that multiple stakes could reinforce the stewardship dimension in the landownership. That could occurs because their are certainly a lot of difficulties in keeping the management of different components of landscape involved in different functions perfectly separable. How to take onto account the impact of those technology shift on landscape governance ?
The disintegration of interests among several markets, calls certainly for an increasing role of the landscape as mediating construct. Because his double nature of public good and common pool resource, the landscape could be certainly a good « go between » to reunite fragmented functions and interests, integrating them in the local or regional project of development. The local project approach has the advantage of disentangling the balance of interests and costs from the present day and to move it to a longer horizon. In addition, it is acting as a coordination of anticipation device, which is able to change the individual and social balance of the costs and benefits of the changes. This intuition should be investigated and explored both at the theoretical and empirical level. But the challenges ahead call for investing resources in the issue.

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