RURAL RESILIENCE AS A NEW DEVELOPMENT CONCEPT

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1. INTRODUCTION

In modern ecology the concept of ecological resilience plays an important role (see, for example, Walker *et al.*, 2006 and the website of Resilience Alliance: http://www.resalliance.org). It is more or less defined as the capacity of a system to absorb shocks and disturbances, while still maintaining the same functions, structure and feedbacks (Walker and Pearson, 2007). The concept of resilience in ecological systems was introduced in Holling in 1973. Since its introduction, the term resilience has emerged in literature on psychology, ecology, food aid and famine, resources management, health (Gardner and Dekens, 2007). Yet, surprisingly little is known about the extent to which the concept of resilience can be applied to rural development. That is, although rural areas are facing rapid changes and uncertainties in the agricultural, forestry and landscape services that affect their future, little attention has been paid to the resilience of these areas. Of course, the rural area can be considered as a (complex) social-ecological system and there is already a huge literature on the resilience of these systems (see Folke, 2006). However, application of the principles of resilience in social-ecological systems to the analysis of specific rural issues has to the best of our knowledge not been studied before.

Rural resilience may be defined as the capacity of a rural region to adapt to changing external circumstances in such a way that a satisfactory standard of living is maintained. This also includes the capacity to recover from management or government mistakes. In analogy to urban resilience (see, for example, Colding, 2007; CSIRO, 2007), the concept of rural resilience determines the degree to which a specific rural area is able to tolerate alteration before reorganising around a new set of structures and processes. It can be described by how well a rural area can simultaneously balance ecosystem, economic and cultural functions. As such, the rural resilience perspective refers to a rural area's ability to cope with its inherent economic, ecological and cultural vulnerability. This perspective is based on, and consistent with the idea that ecological, economic and cultural systems become

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increasingly entangled, and interactions between these systems are increasing in intensity and scale. Consequently, it makes less sense to think of them as separate, and more sense to regard them as overlapping components. Not surprisingly thus that rural resilience builds on the interface of other types of resilience, in particular economic resilience, ecological resilience, and cultural resilience (Figure 1). It is obvious that these forms of resilience are mutually related.

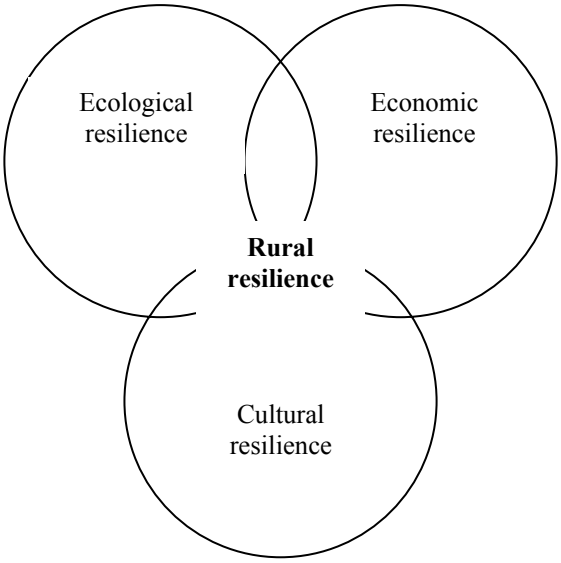

Figure 1 Rural resilience

This means that changes in one domain of resilience can affect resilience in the other domains. If a region would not be economically resilient – meaning that the region is vulnerable to economic shocks, such as a reduction in wealth, a sudden substantial rise in interest rates or increase job insecurity – the population would gradually move away and vulnerability increases. Due to this increased vulnerability it takes progressively smaller shocks to cause chaos and crisis in the rural system. If the region would not be ecologically resilient, conditions for agriculture or green services would deteriorate and – again – vulnerability of the rural system increases. Finally, cultural resilience is a necessary condition for rural resilience because it assures the presence of sufficient human capital in the region. Therefore, a declining cultural resilience contributes to the vulnerability of the rural system.[1] All in all, reducing resilience – be it economic, ecological or cultural –

[1] The concept of cultural resilience is otherwise known as social resilience. Adger (2000) reserves the term social resilience for what is generally denoted as the ability of human

increases vulnerability, exposing rural systems to greater risk of uncertainty and surprise. As a result, resilience building should be part of the agenda of rural spatial planning and design.

2. AIM AND SCOPE OF THE PAPER

Rural areas have the potential to fulfil various functions simultaneously. That is, a large number of functions of the rural area can be identified. The multitude of these functions can be grouped into three main categories:

Agriculture. The agricultural function is by far the most important activity in rural landscapes. This category consists of the supply of primary agricultural (and marketable) products, such as food, livestock, and fibre.

Rural services. These services are defined as non-agricultural services linked to rural areas, for example: rural tourism, landscape management, water storage, cultural heritage, nature management, etc. This category refers to the joint benefits of non-food outputs and is important features from agriculture to sustain the rural countryside. The concept of multi-functionality – which is, roughly speaking, the joint production of commodities and non-commodities – is often implicitly connected to the supply of these rural services (Brouwer, 2004).

Nature. This category includes the possibility to designate the rural area as a nature reserve, where agricultural and other economic activities are limited or completely forbidden.

In this article, we restrict ourselves to the first two categories. The reason for this is that the concept of rural resilience is pre-eminently applicable to areas where economic, ecological and cultural dimensions are closely connected. In a rural area that is primarily devoted to nature conservation, economic and cultural resilience – two of the three pillars of rural resilience – are not or only marginally relevant. Analysing specific issues in these nature areas by applying the concept of rural resilience does not provide more distinguishing information than by using the concept of ecological resilience. That is, in these areas, rural resilience closely corresponds, and is more or less limited to the notion of ecological resilience.

Because of external economies of scale, the functions that fall into the first two categories – agriculture and rural services – can only be fulfilled in an effective and efficient way if they are embedded in clusters. A concentrated cluster of agricultural structures, the so-called agro-cluster, includes activities associated with

communities to withstand external shocks to their social infrastructure, such as environmental variability (for example, agricultural pests or the impact of climatic extremes) or social, economic and political upheaval.

primary production. Likewise, rural service clusters involve activities that are self-evidently related to the supply of rural services. In general, the presence of these clusters enhances regional competitiveness and enhances rural wealth on the basis of external economies of scale.

The rural landscape is the carrier of these two functionally specialised clusters. However, both types of clusters require different types of landscapes. The agro-cluster requires a landscape aiming at agricultural production in the first place, whereas the rural services cluster functions best in a landscape that focuses primarily on rural services. Because of this difference in landscape requirements, regional specialisation is a necessity. The complexity of the relations between rural resilience, regional competitiveness, regional specialisation, and landscape design is shown in a schematic way in Figure 2.

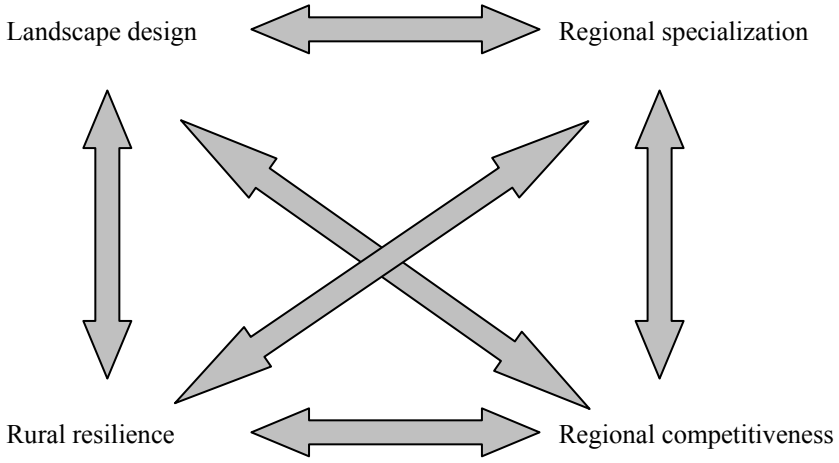

Figure 2 The various links between landscape design, rural resilience, regional specialisation and regional competitiveness

What this paper aims to do is to further explore the links between the various attributes depicted in Figure 2. To that end, it synthesises information on rural land-use configurations that more optimally support the two types of clusters and promote resilience in rural settings. It tries to consider the rural area against ecological, economic and cultural changes in view of its resilience, and thus to clarify the effects of changes on the rural system as well as the mechanisms

through which they appear to buffer external shocks. We also elucidate some guiding principles for rural landscape planning and design.

Crucial for rural resilience is the system's flexibility to adapt to (significant) external shocks, or, to put it in more prosaic language, its ability to transform from one state to another when an external disturbance occurs. Rural resilience is thus the capacity for renewal in a dynamic environment, and provides a kind of 'buffer' or 'cushion of safety' that protects the system from the failure of management or policy actions. The change of the Common Agricultural Policy as a possible result of the negotiations within the framework of the WTO provides such an external change. As a consequence, in a number of rural regions, primary agriculture might not be able to provide a decent or satisfactory standard of living for future generations. This triggers the need for change in the direction of the production of rural services. The ability of the rural system to transform in that direction is a clear criterion for rural resilience. In this respect, is should be noted that adaptability of the rural system implies the capacity not only to respond within the cultural and economic domain, but also to respond to and shape ecosystem dynamics in an informed manner. Landscape design and planning has therefore a crucial role in a rural system's ability to withstand external shocks without losing controls on it structures and functions. The question is, however, how to accomplish such a landscape. Nowadays, it is widely acknowledged that society is full of inspiration and ideas on how to create the 'perfect' landscape. Based on this notion, we argue in this article that the necessary information to (re)shape the landscape is available in the region itself, and only to a very limited extent at higher governmental levels, so that for the design of a landscape that shows resilience in the face of change, the participation and involvement of regional stakeholders is necessary.

The remainder of the article is organized as follows. In the next section, we further elaborate on the concept of rural resilience. We pay particular attention to (i) the relationships between diversity and resilience; and (iii) to the relationship between rural resilience and sustainability. Sections 4 to 7 address the transition from theory to practice. Section 4 contains a general description of agro-clusters. Accordingly, in Section 5, the rural services cluster is described. Section 6 examines the role of the landscape and its design, where Section 7 concentrates on the role of the central and regional government. Section 8 contains the conclusions.

3. RURAL RESILIENCE: KEY TERMINOLOGY AND CONCEPTS

This section describes several features of the concept of rural resilience, as well as some theoretical ideas that are necessary for a deeper understanding of the concept and its usefulness. These are discussed in two sub-sections. The first (3.1) addresses the (expected) relationship between diversity and rural resilience, and the

second (3.2) deals with the question of how rural resilience underpins the sustainability of rural areas..

3.1. Diversity and rural resilience

In the last two decades, many ecological studies have shown the coupling between diversity and resilience (for example, Tilman and Downing, 1994, Hilborn *et al.*, 2003, Tilman *et al.*, 2005). To put it in other words, most ecological studies on the subject suggests that an increase in species richness means an increase in complexity, with profound implications for the ecosystem's total productivity, stability, and resilience in the face of environmental changes and disturbances. More specifically, nowadays most ecologists seem to acknowledge the fact that the greater the richness of species in a system, the greater its resilience.

In an interesting paper, Garmestani *et al.* (2006) focus on the effects of 'richness' across farm size on the ability of industries to survive in the face of economic change. They show that manufacturing industries with greater functional richness – which is a measure of the diversity of firms, calculated by simply counting the number of different types of firms in different size classes – suffer from less volatility in employment. The outcome seems to support common intuition, which suggests that the more resilient industries will be those with functions spread across the range of farm size.

The question relevant to the present paper is whether a similar relationship can be found between diversity and rural resilience. Or more general, how does diversity influence rural resilience? Does high rural diversity – whatever this may be – confer strong rural resilience? To answer this question, it is necessary or even desirable to know what is meant by the term 'rural diversity' and how it can be measured. 'Rural diversity' can, for example, refer to the number of different farm types in a given geographical area, or to the number of income generated activities within different categories of farms. Although we will return to this issue in more detail later in this paper, it is important to realise that rural resilience is often context specific. This means that, in an operational sense, building resilience involves specific measures and not a one-size fits all approach. As we will see below, closely related to this is the notion that resilience can be observed and conceived at different spatial scales.

3.2. Sustainability and rural resilience

According to Carpenter *et al.* (2005), resilience theory provides, from a practical standpoint, a conceptual basis for sustainability. Indeed, if we assume that "sustainability is the ability of a system to maintain productivity in spite of a major

disturbance, such as caused by intensive stress or a large perturbation" (Conway as quoted by Lien *et al.*, 2007, p. 541), then we see strong similarities between the concepts of sustainability and resilience.

Both resilience and sustainability deal with the future. Because the future is unpredictable and uncertain, and surprise is likely, it is important or even essential to explore the resilience of a system as a key aspect of its sustainability. In our view rural resilience is a condition for sustainability. Rural resilience opens up the idea that there are different balances possible within a rural area. Depending on the gravity of the disturbance stakeholders can opt for maintaining productivity within the same system or altering the system in search for a new balance between ecology and economics. In this way sustainability is reached through a change in the system. The ability to tolerate change or to reorganise around a new set of structures and procedures though which sustainability is reached is called rural resilience. Hence resilience is forward-looking (Folke *et al.*, 2002).

4. AGRO-CLUSTERS

The share of agricultural production in total GDP in the EU is relatively small and decreasing. Even in the new member states the share of agriculture in total GDP is only 3.1 % (Hungary: 3.8%, Czech Republic: 1.7%) (Baldwin *et al.*, 2004). However, it should be taken into account that agriculture and agribusiness are regionally embedded in agro-clusters. Here, agribusiness refers to the various businesses involved in the food production processes. The regional clustering of agricultural activities leads to a more efficient and a more environmentally friendly production (Heijman, 2004; LEI, 2004). Both market mechanisms and governmental interference stimulate the development of clusters. The competitiveness of these clusters on the market determines their success.

For example, in the Netherlands, the agricultural sector has a share of about 3.8% in total GDP, where the agribusiness has a share of 6.7%. Each Euro value added generated in Dutch agriculture generates a spill over in agribusiness of another € 1.33 (Heijman, 2002). Applying the same ratio to the EU as a whole, it is estimated that today about 10% of total GDP in the EU is generated in the EU agro-cluster. The strong relationship between the larger part of primary production and other farm-related businesses indicates that agribusiness is not a footloose activity, but is embedded in regional agro-clusters.

The establishment of clusters is a market phenomenon that can be facilitated, but never generated, by the government. According to the new economic geography of Krugman et al. a cluster develops on the basis of cost reduction and innovation originating from the sharing of knowledge (Krugman, 1999). In the EU the gradual dismantling of the CAP will lead to a more global and competitive environment for

agriculture. Agro-clusters or so-called 'greenparks' might be the answer to that. Also Porter comes up with the idea that it is not so much the firm itself that is competing, but the region in which it is situated (Porter, 1990). Of course, agro-clusters do not only use primary agricultural inputs from there own region. They will be global actors on the world agricultural commodity markets.

The increase of rural services in certain areas may impede the development of regional agro-clusters and vice versa. This is especially the case in densely populated areas. In these areas agriculture tends to be intensive on the one hand, where the need for rural services is high on the other hand. Because of conflicting interests with respect to rural land use, regional specialisation either in agro-cluster activities (connected with intensive agricultural land use) or rural services connected with low input organic agriculture should be considered. Normally these conflicting interests would be solved in the market, but because a large part of rural services are of a public nature they do not have a market price. Therefore, rural planning with respect to rural services is necessary.

5. RURAL SERVICES CLUSTERS

Rural service clusters may boost economic development and can be initiated by both private (farmers and non-farmers) and public organizations alike (van der Ploeg, 2002). Especially agro-tourism has a high spill-over effect on the rest of the rural economy. Thus, whereas the agricultural function is primarily exercised by farmers, rural services can be provided by a range of different parties, such as nature conservation organisations, water boards and non-farming inhabitants of the countryside. Therefore, rural services can be distinguished in:

Agricultural rural services: supplied by farmers;

Non-agricultural rural services: supplied by non-farmers.

Due to the fact that land is a finite resource and individuals have different interests, many actors compete for the same space. Especially in densely populated areas, such as the Netherlands, different land claims exert a constant pressure on rural areas.

Rural services can further be distinguished in:

Private rural services (agro-tourism, "care"-farms, etc.);

Public rural services (management of nature and landscape, water storage, etc.)

As far as private rural services are concerned, farmers have an advantage over non-farmers because they dispose of the necessary land and buildings, so they can supply these services at competitive prices.

Finally, it can be stated that there is a strong link between public rural services (e.g. managing the landscape) and private rural services (e.g. services for renting bicycles). The last category does not exist without the first. The whole of public and private regional rural services may be called a rural service cluster. The rural service cluster competes with the agro-cluster for land. Because of the public nature of a large part of the rural services there is probably a lack of supply of these services. This means that the government should try to discover the optimum supply of it.

6. THE LANDSCAPE

As already mentioned in the section 2 of this paper, different types of economic clusters require different kinds of landscapes. A rural area that relies almost exclusively on production agriculture creates and is dependent on a landscape that differs considerably from an area in which rural services are the primary dimensions. The spatial pattern of the rural area is created through both chance and necessity. Through the design and planning of landscapes, augmenting rural resilience to external changes can be achieved. As such, landscape design and spatial organisation determine and influence system resilience at multiple scales, from the scale of a farm or village through communities to regions. Choosing the right landscape design is therefore of paramount importance, as it influences the adaptation between the domains of rural resilience; the economic structure and cultural domain. However, which design is the right design?

Traditionally, the knowledge of so-called ‘landscape experts’ has been regarded as objective and neutral, meaning that their knowledge seemingly provides an objective basis for developing landscape composition and structure. In recent years, however, this assumption has been questioned. Nowadays, it is widely acknowledged that society is full of inspiration and ideas on how to create an ‘optimal’ landscape. After all, spatial planning is highly subjective. It involves, in other words, inherently subjective decisions. If several individuals are asked how to design a landscape, they will probably give several different answers, depending on their personal goals, motives, and social and economic backgrounds. From a point of view of rural resilience we stress the interactive character of the spatial design. Indeed, from the different domains of resilience different and possibly conflicting demands are put to the design of the landscape. These demands are voiced by individuals or organizations who represent (a part of) a domain of resilience.

Therefore, positive changes in landscape design and spatial planning are more likely to be initiated when the attitudes, beliefs or preferences of the people managing or depending on the countryside are considered in the identification of

problems and the development of solutions. In the Netherlands, for example, the awareness is growing that government is not the only party which can take sole responsibility for public affairs. Also private actors and social organisations should contribute to the public cause (see van der Heijden and Slob, 2005, p. 7).

The importance and necessity of including individual and subjective perspectives in the planning and design of rural areas has encouraged the development of a range of approaches and methodologies, such as deliberative valuation, stakeholder-oriented approaches, and participatory decision making. Each of these methods has its strengths and weaknesses. A promising method for landscape planning and design is currently being developed at Wageningen University, and is called (in Dutch) RITA. At the core of this method is the representation of individuals by representatives of relevant parties in processes of landscape planning and decision. Moreover, the method is based on a trade off between various spatial elements, such as types and spatial configuration of nature reserves and number of cycle paths. The model is interdisciplinary in nature; that is, it combines ecological and economic knowledge.

7. GOVERNANCE

Terms like 'stakeholder involvement' and 'participatory decision making' lead to the concept of governance. This so-called steering concept relates to the cooperation between parts of government, civilians, companies and interest groups (NGO's) (van der Heijden, 2005, p. 11; van Tatenhove *et al*., 2000). When adopting this concept to rural resilience, a number of practical questions arises, such as which strategic possibilities are there to develop rural areas? And which (public and private) actors are involved in the policy network to develop a rural area?

As already indicated by Gunderson and Folke (2005), a major challenge in the context of ecological resilience is to "build knowledge, incentives, and learning capabilities into institutions and organizations for governance that allows for the adaptive management of local, regional, and global ecosystems and to incorporate actors in new and imaginative roles." This, of course, also applies to rural resilience. To that end, the concept of governance is crucial. Within a network of public and private actors, problems in the public domain (i.e. issues related to rural resilience) are approached and dealt with. Each actor contributes on the basis of their existing knowledge, responsibilities, policy domain or field of interest and resources. The outcome of such an endeavour is a combination of those existing possibilities shared by actors of the network.

Rural resilience is a policy object which can be characterized as complex. We label rural resilience as complex because of the multi-disciplinary knowledge needed to

understand this policy object, the possible conflicting norms and values of actors involved and conflicting interests between actors (see Roelofs, 2000). Confronted with such a complexity, the problem solving capacity has to be increased. To be able to define policy questions, to take decisions and interventions, increasingly demands cooperation and consensus between actors concerned (Knippenberg *et al*., 2006, 67). Between those actors dependency will develop because of the need for knowledge, coordination and adaptation of perceptions and expectations and finally the adaptation of interests, activities and resources. One governmental authority can not direct the policy object rural resilience, but such an authority needs other public and private actors as well.

Building on the idea that rural resilience is typically subjected to *Governance* one can suppose that the choice for a certain development, either agro-business or rural service, includes a different set of actors involved. Ultimately those actors have to agree on the combination of the type of landscape and the amount of land to be used for a special function. The assumption is that a certain strategy employed in a specific rural resilience situation will trigger a specific constellation of actors involved (see Todeva, 2006; Hagelaar and Zuurbier, 1996).

As already stated rural resilience can take different balances between ecology and economy e.g. within rural areas stakeholders can develop traditional agriculture or one can develop an ecological agro-cluster. In the latter option ecology values dominate the choice for usage of land. This function can be combined with an ecology-adapted form of agricultural production and/or a broad range of rural services. The latter probably will have a higher added value than the agricultural production function. These choices depend on f.i the ecological potential and the economic potential. The network of stakeholders and their individual interests will differ from option to option. The consequence is that if the design of the rural area changes from the option traditional agriculture to ecological agro-cluster, the network of stakeholders including their interests will have to change as well.

8. CONCLUSIONS

The functions of the rural areas are: 1. Agriculture and agribusiness, 2. Rural services. The importance of the agricultural sector is bigger than only the share of agriculture in total GDP or total employment, because the total agro-cluster consisting of primary (agricultural) production plus agribusiness has to be taken into account.

Agro-cluster and rural services are often conflicting. Therefore, it would be a good idea to develop a classification of rural regions in the EU. Rural regions that are especially qualified for public and private rural services should be facilitated with regulations in that area. Regions that are specially endowed for the agro-cluster

(agriculture plus agribusiness) should specialise in that area, for example by developing so-called "green parks" in which agribusiness is concentrated and embedded in primary production. These clusters of which the flower business in the Netherlands is a good example should be highly competitive on the world market (Dignum, 2004). Of course this should be carried out in accordance with the environmental regulations. This would increase the efficiency in agro-production and probably would decrease the environmental damage caused by the sector.

Further, in the area of nature management, the development of a European cross border ecological main structure could be considered. With this is meant a system of parks and natural areas that are connected through natural corridors in order to facilitate the migration of wildlife. This would enhance the genetic variety of a number of rare species and increase the attractiveness of natural parks for tourists because the population of wild animals would be more diverse and sustainable.

Rural services are partly private. For this part, government should concentrate on the creation of the right conditions. The other part of rural services has a public character (nature and landscape, water storage etc.). The payment for public rural services might take two forms: 1. compensation for the non-optimal management of the farm because of the deliverance of public rural services, 2. payment for the service delivered by the farmer. The government exercises the demand for these rural services on behalf of society. Determining the proper price for these kinds of services and the arrangements for paying the farmer in absence of the market is an important topic of research.

The general conclusion is that in order to facilitate the efficient production of goods and services asked for, rural regions should specialize either in products generated by the agro-cluster, or in rural services, in this way limiting the conflict between the two functions. Multifunctional land use should be a matter of weighing and adapting ecological values and economic potential. A region, represented by actors in the policy network concerned, chooses a certain strategy and tries to jointly implement the strategy in the region. Economic specialisation, distinctive design of landscapes and a well demarcated, specifically composed policy network go hand in hand to shape rural resilience in a certain region.

REFERENCES

1. Adger, W.N. 2000. Social and ecological resilience: are they related? *Progress in Human Geography,* 24 (3), pp. 347-364.
2. Baldwin, R and C. Wyplosz. 2004. *The Economics of the European Union*. London, McGraw-Hill.

3. Brouwer, F. (ed.). 2004. *Sustaining Agriculture and the Rural Environment; Governance, Policy and Multifunctionality.* Cheltenham, UK, and Northampton, MA, USA, Edward Elgar.
4. Carpenter, S.R., F. Westley and M.G. Turner. 2005. Surrogates for resilience of social-ecological systems. *Ecosystems,* 8, pp. 941-944.
5. Colding, J. 2007. 'Ecological land-use complementation' for building resilience in urban ecosystems. *Landscape and Urban Planning,* 81 (1-2), pp. 46-55.
6. CSIRO. 2007. *Research Prospectus for Urban Resilience; A Resilience Alliance Initiative for Transitioning Urban Systems towards Sustainable Futures.* Canberra, CSIRO.
7. Dignum, M., 2004. Clusters in agribusiness: the case of flowers in the Netherlands. Tokyo, ISS-conference Proceedings.
8. Folke, C. 2006. Resilience: the emergence of a perspective for social-ecological systems analyses. *Global Environmental Change,* 16 (3), pp. 253-267.
9. Folke, C., S. Carpenter, T. Elmqvist, L. Gunderson, C.S. Hollang and others. 2002. *Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations.* Scientific Background Paper on Resilience of the World Summit on Sustainable Development on behalf of The Environmental Advisory Council to the Swedish Government. Text available from the Internet. URL: http://www.sou.gov.se/mvb/pdf/resiliens.pdf.
10. Gamper, C.D. and C. Turcanu. 2007. On governmental use of Multi-criteria Analysis, *Ecological Economics,* 62 (2), pp. 298-307.
11. Gardner, J.S. and J. Dekens. 2007. Mountain hazards and the resilience of social-ecological systems: lessons learned in India and Canada. *Natural Hazards,* 41 (2), pp. 317-336.
12. Garmestani, A.S., C.R. Allen, J.D. Mittelstaedt, C.A. Stow and W.A. Ward. 2006. Firm size diversity, functional richness, and resilience. *Environmental and Development Economics,* 11 (4), pp. 533-551.
13. Gunderson, L. and C. Folke. 2005. Resilience – now more than ever. *Ecology and Society,* 10 (2), article 22.
14. Hagelaar, G. en P.J.P. Zuurbier. 1996. Doelgerichte ontwikkeling van verticale samenwerking door lokale en regionale overheden. *Openbaar bestuur*, 6 (9), pp. 18-27 (in Dutch).
15. Hajkowicz, S.A. Article in press. Supporting multi-stakeholder environmental decisions, *Journal of Environmental Management.*
16. Heijden, J. van der (red.). 2005. *Recombinatie van Overheid en Samenleving. Denken over Innovatieve Beleidsvorming*. Delft, Eburon, XPIN-reeks deel 7 (in Dutch).

17. Heijden, G.M.A. and A.F.L. Slob. 2005. *Meervoudig Ruimtegebruik Enkelvoudig Recht. De spanningsvolle relatie tussen recht en innovatie*. Delft, Eburon (in Dutch).
18. Heijman, W.J.M. 2004. Regionale agro-complexen in Nederland (Regional agro-complexes in the Netherlands). *Economenblad*, februari 2004, pp. 8-9 (in Dutch).
19. Heijman, W.J.M. 2002. *Regionale economie* (Regional Economics). Delft, Eburon (in Dutch).
20. Hilborn, R., T.P. Quinn, D.E. Schindler and D.E. Rogers. 2003. Biocomplexity and fisheries sustainability. *PNAS,* 100 (11), pp. 6564-6568.
21. Knippenberg, L.W.J., F.L.P. Hermans en W.M.F. Haarman. 2006. Towards assessment for sustainability. In: H. Mommaas (ed.). *The Organisation of Innovation and Transition*. Transforum Agro & groen, working papers no. 2, pp. 62-86.
22. Krugman, P. 1999. *Development, Geography, and Economic Theory*. Cambridge (Mass.), MIT.
23. LEI. 2003. *Landbouw-Economisch Bericht*. Den Haag (in Dutch).
24. LEI. 2004. *Het Nederlandse agrocluster in kaart* (The Dutch agro-cluster). Den Haag (in Dutch).
25. Lien, G., J.B. Hardaker and O. Flaten. 2007. Risk and economic sustainability of crop farming systems. *Agricultural Systems,* 94, pp. 541-552.
26. Ploeg, J.D. van der, A. Lng en J. Banks. 2002. *Living Countrysides*. Doetinchem, Elsevier.
27. Tatenhove, J. van, B. Arts and P. Leroy (eds.). 2000. *Political Modernisation and the Environment. The Renewal of Environmental Policy Arrangements*. Dordrecht/Boston/London, Kluwer Academic Publishers.
28. Tilman, D. and J.A. Downing. 1994. Biodiversity and stability in grasslands. *Nature,* 367, pp. 363-365.
29. Tilman, D., S. Polasky and C. Lehman. 2005. Diversity, productivity and temporal stability in the economies of humans and nature. *Journal of Environmental Economics and Management,* 49 (3), pp. 405-426.
30. Todeva, E. 2006. *Business Networks: Strategy and Structure*. London, Routledge.
31. United Nations. 1994. *World Resources 1994-1995*. Oxford, University Press.
32. Walker, B.H., J.M. Andries, A.P. Kinzig and P. Ryan. 2006. Exploring resilience in social-ecological systems through comparative studies and theory development: introduction to the special issue. *Ecology and Society,* 11 (1), article 12.
33. Walker, B.H. and L. Pearson. 2007. A resilience perspective of the SEEA. *Ecological Economics,* 61 (4), pp. 708-715.