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Explaining agricultural collapse: Macro-forces, micro-crises and the emergence of land use vulnerability in southern Romania

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ABSTRACT

Land use patterns influence the long-term productivity of agro-ecosystems and result from socio-economic as well as biophysical and climatic drivers. This paper qualitatively examines how past demographic and political-economic changes in southern Romania twice led to vulnerable socio-economic and agro-ecological systems. Drawing on this case study, we establish broad-brush hypotheses identifying some of the potential causes of vulnerability. We suggest that vulnerable systems appear more likely to occur when socio-political uncertainty combines with a lack of off-farm employment in regions where there are abundant natural capital stocks that can be quickly liquidated.

1. Introduction

Land use decisions depend on environmental conditions but also result from socio-economic and policy forces that farmers have little control over. This is important because the decisions farmers make affect the capacity of rural economies, and the land use systems they depend on, to remain stable in the face of external perturbations. Throughout human history, we can observe how "large-scale" socio-economic and policy forces have led to low-resilience land use systems that eventually collapsed. For example, Fraser (2003) shows how a combination of economic policy, population growth and industrialization caused land use patterns in Ireland to shift from being relatively diversified (circa 1820), towards being dominated by the potato. This system collapsed resulting in famine in the 1840s. Similarly, a laissez faire approach to trade and the British thirst for tea in the Victorian period led to the almost total deforestation of Sri Lanka (Schweinfurth, 1982) and created a system that collapsed in the 1870s when El Niño-induced droughts claimed tens of thousands of victims (Davis, 2001).

The importance of socio-economic and policy drivers in creating vulnerable rural economy and land use systems is such that some development economists argue that these collapses are not so much environmental tragedies as human-engineered problems (Sen, 1981). Nevertheless, there is an environmental component to many such crises and as we look towards a future that is likely to have increasingly severe environmental shocks (Intergovernmental Panel on Climate Change, 2007), the links between environmental, socio-economic, and policy drivers and outcomes need to be better theorized.

This poses a considerable challenge, and academics have suggested there are a range of factors – which include but are not exclusive to insecure land tenure (Ostrom, 2001), the trade of agricultural commodities (Fraser, 2006b), and population growth (Boserup, 1981) – that may create rural economies and land use systems that are vulnerable to environmental perturbation. There is little agreement within these bodies of theory, however, suggesting a need to investigate key case studies in order to discern more general patterns and drivers of vulnerability that transcend time and space.

In this paper, we consider how a range of historic socio-economic and policy factors influenced land use in southern Romania. Current understanding of the large-scale influences on vulnerability and resilience in Central and Eastern Europe largely focuses on the time period since the collapse of Communism (1989 onwards). We extend this by looking back before the Communist period over 250 years. Southern Romania provides a relevant case study because qualitative archival and primary field evidence suggests that since the 1800s there have been three periods in which socio-economic or policy pressures led to rapid land use

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change (the late nineteenth century, the mid twentieth century and the early 21st century). In the first two periods, these changes undermined the resilience of agro-ecosystems, precipitating significant environmental collapses that were characterised by soil erosion and a relative loss of net primary productivity.

By exploring this case, we contribute an important analysis of the environmental history of this region. While we acknowledge the rich diversity of Romanian language literature on this topic, it remains largely inaccessible without the assistance of an interpreter. English language publications incorporating pre-Communist analyses of environmental change issues in Romania and Eastern Europe in general are rarely found, and so our paper represents a valuable contribution. Second, we use our case study to identify some broad-brush hypotheses that link socio-economic forces with "resilient" and "vulnerable" land use systems. More specifically, we investigate the pathways whereby changes in three key socio-economic and policy forces (population growth, changes in land tenure arrangements and the transition from command and control to market-based economies) affected three key factors that the literature suggests are typical of vulnerability: (1) the ecological fragility of the agricultural landscape itself; (2) the range and abundance of capitals available to local households that would help promote adaptive capacity; and (3) the extent to which there is an institutional capacity to respond to problems. Although we acknowledge that it is impossible to develop rigorous theory out of only one historical case study, our broad hypotheses should be seen as part of a larger trend in the study of global environmental change where it is generally understood that case studies of the past may reveal much that is pertinent to our present situation (Turner et al., 2003b). Similarly, history may provide us with an evidence base through which to develop theory about future vulnerabilities in other locations experiencing similar changes (Glantz, 1991).

In terms of structure, Section 2 of this paper reviews two key bodies of theory. The first considers "resilient" and "vulnerable" rural economies and the land use systems they depend on. The second deals with the ways in which population growth, land tenure arrangements, and market versus command-and-control policy may affect land use patterns. Section 3 describes the background to the case study and the methods we used to collect data. Section 4 provides the results of our enquiry in the form of a qualitative environmental history of the region going back to the mid-18th century. In this section, we establish two broad links (1) between population growth, new land tenure arrangements and new agricultural policies and changes in land use patterns, and (2) between changes in land use patterns and changes in resilience. Section 5 discusses the implications of these results, and attempts to explore why changes in the socio-economic and policy factors affected changes in resilience. Section 6 presents a possible theoretical framework for future applications to other areas that hypothesises the more generic links between socio-economic and policy drivers and the resilience of rural economies and land use systems.

2. Theory

It is generally accepted that vulnerable landscapes emerge from multiple social and environmental stressors and that vulnerability analyses need to be placed within a specific spatial scale that is linked to other scales (Turner et al., 2003a; Adger et al., 2005). Preliminary work proposes an exciting interdisciplinary research agenda that includes location-specific studies in key contexts as well as the development of large-scale predictive models about the effects of climate change under different socio-economic scenarios (Schroëter et al., 2005). To move forward in this field, we believe that we need to develop theory that links specific socio-economic drivers with land use changes and then link these land use changes with resilience. To do this, we must first consider what constitutes resilience and then review the theoretical ideas that seek to explain how socio-economic and policy factors may affect this.

2.1. Ways of assessing resilience

Dictionaries generally define resilience as the ability to bounce back. In academic circles, this resonates with the widely cited "Pimm's" definition (Pimm, 1991) that defines resilience as the time it takes for a system to return to its pre-disturbance state after a shock (see also Ludwig et al., 1997). Seen in this way, an ecosystem that "bounces back" very quickly after a disturbance (like a flood or fire) is considered resilient. When it comes to agro-ecosystems, however, this is problematic because if a drought destroys a crop, then a farmer may lose a year's income and choose to leave farming entirely. In this case, Holling's (1973) definition, that resilience is the size of a perturbation required to shift a system, is more pertinent. Where a large perturbation causes only a small impact, then the system may be considered resilient and vice versa (Fraser, 2006a).

The empirical basis of this comes from Gunderson and Holling (2002) who draw on ecological studies to show that vulnerability to environmental shocks can be explained by three key biophysical characteristics: (1) the amount of biomass present in the ecosystem; (2) the degree of "functional" diversity present in the ecosystem; and (3) the extent to which individual members of the ecosystem are tightly connected in time or space. If an ecosystem is observed gaining biomass and connectivity, but losing diversity, it is likely becoming more vulnerable. This models matches key historic cases. For example, the pre-famine landscapes in Sri Lanka (circa 1870) and Ireland (circa 1840) were all rich in biomass, tightly connected but low in biological diversity (Ireland was a monoculture of potatoes, Sri Lanka a monoculture of tea).

Despite its merits as a way of recognising vulnerable and resilient ecosystem characteristics, this model does not adequately capture the capacity of land manager to adapt to problems as they emerge (see Fraser, 2003). As a result, the literature suggests that resilient systems should also be able to self-organise or display high levels of adaptive capacity to help them move smoothly from one type of system to another. According to Adger (2006), this emphasis on adaptability is itself a synthesis of a number of different bodies of literature including entitlement theory and livelihoods, the study of natural hazards and political ecology, and development work on the ways in which households responded in the past to droughts. Terms like social capital, trust, social networks and community coping strategies are all important when describing resilient social groups that have the ability to respond to disturbances.

Other important aspects in understanding resilience are the institutional factors that may either provide direct assistance in times of crisis or help empower groups to be pro-active in preparing for future problems. Scott (2001) elaborates and argues that any conceptualization of "institution" must include both formal and informal social groups that establish norms that govern behaviour and social interaction. Ellis (2000) provides an alternative view, suggesting that institutions must involve groups of ideas that are passed between different social actors. North (1991) takes still another approach and argues that institutions are the rules that constrain social interactions, while Vincent (2007) concludes that institutional factors are a key element in understanding resilience.

Based on this brief literature review, we suggest that there are at least three important generic factors that characterise resilient or adaptive rural economies and the land use systems they depend

on (see Fraser, 2007 for a more thorough review of this literature). The first is ecological and draws on Gunderson and Holling's work. If a landscape loses diversity but gains in connectivity and biomass then the land use system is likely to be losing resilience. The second dimension is socio-economic and suggests that if a region loses wealth, social networks, trust between individuals, or access to different types of capital, then it is less likely to be able to adapt to disturbances. The third factor is institutional and refers to the ability of formal and informal institutions to help mitigate perturbations. Although there is some overlap between these concepts (especially the social and institutional elements) and these elements are inter-related, a considerable body of work on vulnerability suggests that it is appropriate to disaggregate case study data along these lines (for example, see Watts and Bohle, 1993; Kasperson et al., 1995). As such, if an area loses environmental resilience, social assets and institutional capacity, it may become "…an accident waiting to happen" (Holling, 2001:396).

2.2. Ways of assessing the links between "global forces" and land use change

The literature reviewed above provides the conceptual and empirical foundations through which to observe changes in resilience for rural economies and land use systems. However, this is only part of the story. We need a generalized understanding of the socio-economic and policy trends or "pathways" that may lead to increased (or decreased) levels of environmental resilience, social assets and institutional capacity. There are huge bodies of literature devoted to this task, each of which explores how different social, economic or policy drivers may affect rural economies and land use patterns. We focus on three key socio-economic and policy drivers that are considered important in Central and Eastern Europe and more specifically, southern Romania's history, but which may also be of relevance in other parts of the world.

The first is the way that more or less market-based agricultural systems affect land use. Important policies include command and control regimes (where policymakers dictate what farmers produce), versus moderate situations (where governments subsidize key crops or protect producers), and pure market-based systems (where farmers chose what to produce). One school of thought, which Marsden (1998) characterises as "neo-classical", posits that as a region moves away from command and control policies and towards a market economy, it should develop a more diversified landscape that may be more resilient. This draws on simple logic: if governments lower farm supports, it will encourage farmers to plant a wider range of crops to protect themselves against the risk that one crop may fail. Farm supports (e.g. price guarantees for specific crops, crop insurance programmes, or even the assumption on the part of farmers that governments will offer "bailout packages" if crops fail), mean that farmers have no such incentives to diversify. Relatively little empirical work has been undertaken on this, however, and only a few studies are able to draw a direct comparison between reduced farm supports and the development of different land use patterns (see Bradshaw, 2004). As such, it is unsurprising that other authors present different arguments and reach different conclusions (see Ervin, 1997; Bonilla and May, 1997).

A second key body of literature deals with the way property regimes affect land use patterns. For decades, scholars have debated whether private property is necessary to create incentives for long-term conservation (Hardin, 1968). This argument has been thoroughly investigated, and the literature generally agrees that if the landscape produces goods or services where it is relatively easy for an owner to exclude other people and generate a specific marketable product (such as an agricultural product that comes from a field), then private ownership is often an appropriate way of ensuring management is oriented towards the long-term (Fraser, 2004). However, not all of the Earth's resources fall into this category and there are some types of goods, such as community scale irrigation schemes, where private property regimes can undermine conservation (Panayotou, 1993). In these cases, small communities have been able to sustainably manage natural resources so long as they can exclude outsiders (Ostrom et al., 1999). However, if technological innovation allows specific individuals to increase the rate at which they can extract the resource, or the policy regime changes and outsiders enter a traditional system, then common-pool resources may be quickly exploited and become degraded (Matthews, 1993).

A third important body of literature on land use is presented by those who generalize the effects of population growth. Malthusians and neo-Malthusians like Ehrlich et al. (1993) or Ponting (2007) show how population growth can lead to rural economy and land use systems that are productive in the short-term but less resilient in the long-term. Alternatively, others argue that there is no link between fragile agro-ecological landscapes and population, and even suggest high population densities are the key source of social innovation (Boserup, 1981).

One possible reason for the tensions across all three bodies of literature is that site-specific variables affect the way that large-scale policy, demographic, or economic drivers are manifest. For example, the same increased trade in horticultural products that has resulted in industrial landscapes in places like parts of the south of Spain has resulted in quite diversified landscapes in western Canada (Fraser, 2006b). This is largely due to these regions' respective ecological endowments, social characteristics and proximity to markets. Nevertheless, there is still a need for academics to search for broad trends and generic processes that regularly undermine resilient land use systems.

3. Background to case study and methods

Our case study focuses on Dolj county, southern Romania (Fig. 1) where fieldwork was undertaken during April and May 2007. Initially, archival sources documenting the area's landscape and agricultural history were identified, translated and combined with primary field data to reveal that there have been a number of different land use regimes in the region. These include the indigenous forest, peasant agriculture, early capitalist agriculture,

Fig. 1. Map of Romania, indicating Dolj county and the study area. Modified from: http://en.wikipedia.org/wiki/Image:Romania_counties_blank_big.png.

socialist agriculture and post-socialist land uses. A household questionnaire survey was administered to families within the study area ($n = 100$) to inform a better understanding of the reasons for these changes in more recent times, and to elucidate their socio-economic outcomes. This was administered by an interpreter, and covered themes such as land ownership, land use dynamics, the changing contribution of agriculture to livelihood strategies, perceived productivity dynamics and environmental changes since the collapse of Communism. In addition, interviews were conducted with key informants from a number of institutions including the area's Association of Local Forest Owners (ALFOs), private forest enterprises and the Romanian National Forest Administration (Romsilva). These institutions were selected due to the key roles they play in making land-use decisions in the study area, yet many of the informants requested that their anonymity be upheld. The mayors of three communities (Mârşani, Daneţi and Urzica) were also interviewed. Focus groups were held with school teachers in Mârşani and with final year high school students in Dabuleni, where an additional focus group was held with elderly community members to provide a local historical perspective. These data were integrated with information obtained using participatory techniques such as transect walks with our key informants through currently degraded and recently reforested areas. Data analysis included processes of coding, discourse analysis and triangulation to resolve any contradictions. In an ideal situation, our qualitative analysis would be further supported with quantitative measures of productivity (e.g. using fossil pollen data as a proxy, or through the use of official statistics). However, a combination of the site-specific environmental characteristics of the study area in relation to the rest of the country (particularly with regard to climate and soils), the disturbance of the soil profile with heavy machinery during the Communist era, the extensive time period that we take into consideration, and the unreliability of more recent official statistics, meant that this was not possible. Our analysis is thus necessarily qualitative but nevertheless, the combination of primary data, with documentary archival data, has allowed us to build a broad-brush picture of the land use shifts that have taken place since the 18th century.

4. Results: three phases of landuse change and collapse since the 18th century

Overall, our combined primary and secondary data suggest three waves of land use change and agricultural collapse have occurred in our study area since the 1700s (Fig. 2). In the lead up to the first two collapses, a combination of population increases, new land tenure arrangements and government policy all undermined ecological resilience, socio-economic adaptability, and institutional capacity.

Phase I lasted until approximately 1850. It was marked by a transition from the native forest to early mixed agricultural cultivation ("A" in Fig. 2), the development of an early feudal system that further intensified agricultural production and removed still more forest ("B" in Fig. 2) and a period where erosion (primarily aeolian) led to considerable degradation and an overall loss of net primary productivity ("C" in Fig. 2). Phase II lasted from the end of the nineteenth century until just after the collapse of Communism in Romania in late 1989. Initially, Phase II was characterised by increases in forest cover and a shift towards a feudal system that emphasized conservation. This allowed soils to stabilise and productivity to recover ("D" in Fig. 2). Later however, collective socialist agriculture dominated, initially replacing the land already under cultivation, but then expanding into forested and re-forested areas ("E" in Fig. 2). This system collapsed into a state of serious degradation and social disintegration in the period immediately following the fall of Communism ("F" in Fig. 2). Over the last 10 years, there are signs that this system is recovering through small-scale agro-forestry enterprises ("G" in Fig. 2). This suggests that this region may be in the early stages of a third wave.

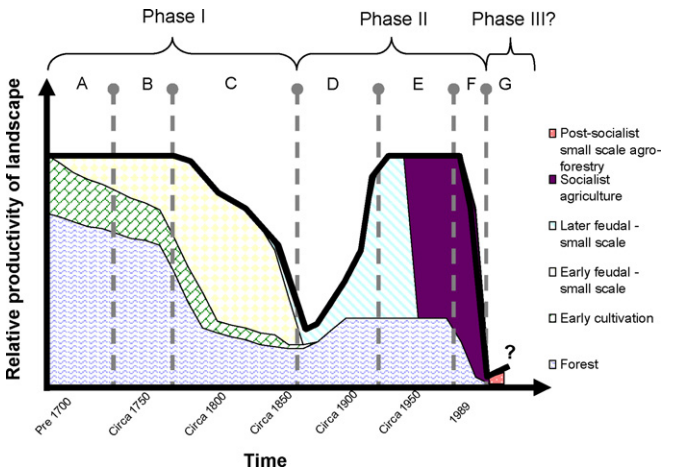

Fig. 2. Heuristic illustration of the likely trends in agricultural landscape in southern Romania, 1700–present day. The illustration has been inferred from interviews with key informants, transect walks with farmers and historical archives. Different land use regimes are illustrated through the differently shaded series. Three possible cycles of land use change and collapse are identified and labelled as Phases I, II, and III. Distinct stages within each phase are noted by the dashed lines and labels A–G. Note: this illustration should not be interpreted to imply that early phases had the same agricultural productivity as Communism. Rather this provides a simple visual profile of the rises and declines of productivity in the region. See text for full explanation.

4.1. Phase 1, circa 1700–1850

There was little cultivation prior to 1700, though the eighteenth century saw some basic early agriculture expand. In the early/mid 1800s, peasants were enticed to settle in the area (part of the then Wallachia region of the country) with the promise of land, and a basic feudal structure emerged (Georgescu, 2000). Agriculture was the mainstay of the economy, while princes and the powerful boyar class dominated society, largely owing their status to control over land and to posts in government (Van Meurs, 1999). Production on the boyar estates in the study area was largely undertaken by the peasants, many of whom were either serfs or dependent upon the aristocracy in other ways. At this time:

> *. . .people were given land to build their homes on, as well as 5 ha of land just outside the village. This encouraged them to come to the area* (Mayor of Urzica, 27 April, 2007).

Land use intensified, with the growth of more cereal crops (e.g. rye, maize, wheat and sorghum), fruit trees (plums, cherries and walnuts) and vegetables (carrots, onions, potatoes, etc.). This reflected a broader shift towards an agricultural export economy, as the Black Sea opened to international commerce in 1829. As such, the extensive forests in the area were gradually cleared in an attempt to expand production and increase yields. Over time, cereals dominated the landscape. For example, although Russian maps from 1828 to 1832 show large areas of woodland south of Craiova (Turnock, 1988), and also in Teleorman county (between the Călmăţui and Olt Rivers), by the mid-nineteenth century these had become degraded (Nastase, 1971; Turdeanu, 1975).

Overall, there seems to have been three major land uses during this period. First, was the original forest that was slowly felled to make room for agriculture. Second was a phase of early mixed cultivation, where small, low-intensity, plots provided a modest local rural economy. Third, was the feudal phase marked by

increases in cereal production, motivated by market forces, and a doubling of the population in rural parts between 1800 and 1860 (Chirot and Ragin, 1975; Hitchins, 1996).

From the perspective of resilience (see Section 2.1), this would have been a socio-ecological landscape becoming more vulnerable and less resilient: larger expanses of more homogenous land use practices were emerging, socio-economic resources became concentrated and there was little institutional support. Indeed, peasants who had become used to operating within the feudal socio-economic structure depended on plenty of natural capital for economic security. As agriculture commercialised and expanded, the basis of this security was destroyed. It is perhaps unsurprising, therefore, that the historical record suggests the mid-nineteenth century was marked by an increasingly degraded agro-ecosystem:

> *The dunes are not an inevitable consequence of the climate. . .[but are] due to imprudent deforestation, aggravated by cultivation and grazing. The sheep eat away at the roots of the plants that have been uprooted by their feet, which easily penetrate the dune surface. Rhizomes such as Agropyrum repens, which stabilise the sand, are devoured by the sheep, especially during times of drought when the grass cover is sparse. The movement of pigs over the dunes is even more damaging. They completely trample the soil crust by seeking out roots to eat. This exposes the soil leaving it vulnerable to aeolian action* . . . (Jonesco-Balea, 1923, pp. 121–122).

This leads us to qualitatively surmise a relative downturn in productivity (Fig. 2).

4.2. Phase II: circa 1850–2000

The period following the 1848 revolution saw a number of important political changes, beginning with the union of Wallachia with Moldavia in 1856 and independence in 1877 (Georgescu, 2000). In terms of the corresponding landscape changes, between the 1850s and the start of the Communist era in 1947, there was a gradual period of reforestation, driven by the necessity to stabilise the expanding and advancing dune systems. Farmers established shelter belts and a mosaic of forest, grazing and arable land once again evolved in the area:

> *In the late 1800s, from about 1860 forests of Robinia [R. pseudoacacia] were planted to stop the dunes from moving. There were problems with the sand and at that time the Robinia was used to stabilise it. The type of tree was brought from America* (Private Forestry Enterprise representative, 27 April, 2007).

The success of this afforestation/reforestation programme was enough to trigger the state to begin plantations over a larger area in 1884, resulting in a more diverse landscape, as dune crests were covered with trees, flanks were used mostly to grow grapes, and inter-dune areas were grazed. From the perspective of vulnerability, this appears to be a system gaining resilience. The landscape became more heterogeneous, and the land owners were making profits, while peasant cooperatives provided a level of institutional and economic support (Knight, 1920). Correspondingly, based on this qualitative evidence, we infer an increase in overall productivity from the lows in the 1850s (Fig. 2).

This system did not last. After the 1907 Peasant's Revolt (which led to some rebalancing of the land distribution between the peasantry and the aristocracy), and the two World Wars, Communism brought the next large-scale shift in agricultural practices, as the government transformed agricultural production to meet the objectives of the Socialist regime (Lerman, 2000). This was notoriously inefficient, its main objective being to achieve production targets (Kideckel, 1976). Input and output prices were centrally controlled and there was little focus on sales, profitability or cost-efficiency (Lerman et al., 2002). Agriculture was disregarded as a strategic branch of economic activity (Verdery, 1991). To exert maximum control over production, land was confiscated from the people and re-organised into mainly state and agricultural collective farms and agro-industries, as traditional farming practices were rejected (Bleahu and Janowski, 2002).

In our study area, the push to reach centrally planned production targets required new measures to be taken to increase agricultural productivity. The sand dunes were levelled in order to increase the area for cultivation and an extensive irrigation system was built over 75,058 ha (World Bank, 2003). 11,000 ha of forest were felled in order to provide flat, irrigated land for labourers on the state and cooperative farms to work. As described by one of our key informants:

> *The land here was forested until the 1970s. The hills and dunes were flattened to make better terrain for agriculture and to allow the irrigation scheme to be developed. At this time a system of forest walls was constructed to protect the crops from the weather and to keep the soil in place. But forests and forest walls are different. A large area of forest can give more benefits – it can keep the humidity a bit higher and help the ground cover remain green. The forest wall didn't do that so well and so the irrigation became more and more necessary* (Private Forestry Enterprise representative, 25 April, 2007).

As described by our key informant, a network of new forest shelter belts was planted. Nevertheless, the success of the state and cooperative farms in meeting their production targets remains uncertain. While an increase in real agricultural output by an annual average of around 7% at the national level is reported during the 1980s (Demekas and Khan, 1991), many of our interviewees suggested that the statistics from the Communist era should be treated with extreme caution. Indeed, participants in the focus group of elderly people recalled the day that President Ceauşescu visited the area, describing the agricultural engineers' fears that their leader would find out that they had lied about reaching their targets. There was even the suggestion that bunches of grapes had been transported in from other areas and draped over the vines to give the impression of productivity. Such ambiguity in the reliability of the official production statistics (cf. Rakowska-Harmstone, 1984) makes it difficult to apply a quantitative measure of productivity in the region, even in more recent times.

From the perspective of vulnerability, the Communist system had a mixed effect. It disrupted social networks and community spirit and created a highly productive landscape in a degradation-prone region. Productivity was maintained, according to our interviewees, through the irrigation system, intensive fertiliser application and the plantation of shelterbelts. This brought considerable economic stability as well as the institutional organisation that maintained the irrigation system. This combination of factors was enough to keep this system stable for about five decades. Immediately following the fall of Nicolae Ceauşescu in 1989, however, the institutional support suddenly disappeared, and agriculture in the region very quickly went into a very steep decline with agriculture's contribution to Romania's GNP dropping from 13.7% in 1989 to 12.9% in 1999 and 11.4% in 2000 (Jäntschi et al., 2007).

As such, we observe problems emerging immediately following 1989. As large-scale collective and state farms were disbanded, land was both redistributed and returned to its pre-collectivisation owners (Pamfil et al., 2000). However, the land was returned in small, scattered plots that questionnaire responses suggest were often too small and fragmented to support an economically viable livelihood. At the same time, results show a break down in community support structures and social capital. 63% of

respondents stated that they consider the community is "not close", while 81% pursue their agricultural activities at the household level rather than as members of agricultural associations, despite the economies of scale that could be gained through working cooperatively.

Together with the land restitution and redistribution, the various components of the irrigation networks became the property and responsibility of a variety of different companies, organisations, associations and individuals. As no single institution played a coordinating role, the system quickly fell into disrepair (see Stacey, 1999). The resulting small, fragmented plots and lack of irrigation had a dramatic negative effect on the land's productivity, as reflected in many of our questionnaire responses: 66% of households reported a decline in productivity since 1990; 22% considered their yields had remained the same and only 12% had increased productivity, usually through the application of more fertilisers or the development of small-scale privately administered irrigation systems. Similarly, when asked to describe the main challenges faced by today's farmers in the study area, 59% of respondents suggested a lack of irrigation as their primary concern.

Productivity declines coincided with high regional population growth as people returned to the countryside after the state owned enterprises were disbanded and urban unemployment sky-rocketed. This caused an increased demand for fuel wood for heating, construction and cooking (cf. Stringer et al., 2008) and many of the trees in the forest shelter belts established by the Communists were felled. Much of the deforestation was also deeply rooted in tenure changes and uncertainties over resource ownership. Interview evidence also suggests significant illegal felling by those who wanted the new privatised system to fail and by people who would rather cut and store the wood for their own use over the coming years rather than run the risk of other people illegally cutting their forest. At the same time, the formal community institutional structures (the police, mayorship, etc.) were weak and did little to intervene. In the absence of designated pasture, forest areas were also heavily grazed in a manner similar to that much earlier in the century. The combination of deforestation, overgrazing of remaining forest areas, sandy soils, a lack of financial inputs for soil fertility maintenance and the loss of the irrigation systems that quickly fell into disrepair contributed to increased desertification during drought periods over the last 15 years. This view is widely confirmed by national level statistics that suggest nitrogenous fertiliser use dropped by 60% over the period 1990–2004, whereas phosphate and potash fertiliser use decreased by around 90% (NIS, 2006). Data from UNECE (2001) also supports this, suggesting that frequent droughts and a lack of irrigation have increasingly affected a significant share of land across the country, increasing from 26.4% in 1992 to 48% in 1997. Furthermore, NIS (2002) finds that frequent droughts, particularly in the southern regions, appear to be one of the most significant factors affecting soil fertility, contributing almost 50% to agricultural land degradation in 2000, compared to 25% in 1992. As such, the system diversity in Phase II was low, connectivity was high (particularly later on, due to the irrigation system) and when the irrigation system fell into disrepair as a result of broader political-economic forces, the rural economy and land use system collapsed.

4.3. Phase III: 2000–present

Today, land use in the study area comprises a mixture of agriculture, forestry and pasture. The landscape and climate are amenable for the production of crops including grains, melons, early potatoes, grapes and tomatoes in garden plots that can be irrigated, while forests comprise mostly black locust (*Robinia pseudoacacia*). In the area between the three rivers that surround our study area (the Danube, Lower Jiu and Olt), soils remain sandy and have low fertility (Blujdea et al., 2006). Agricultural productivity is difficult to sustain outside garden plots in the absence of a large-scale functioning irrigation system because of both low and variable annual rainfall, with less than 20% of total precipitation falling in the summer when crop water demands are at their peak. The region also experiences higher temperatures than other parts of the country (Maff, 2002). Consequently, large areas have been abandoned since 1991 (mostly because they are inefficient and not economically viable to farm without irrigation). Indeed, 41% of respondents in the questionnaire survey reported that they do not farm all the land they own.

More recently, land owners in some communities in the study area have formed Associations of Local Forest Owners (ALFOs). Through the establishment of legally registered institutions, they have been able to access funds for afforestation and reforestation through government programmes aimed at rehabilitating degraded land. This has allowed farmers to give productive value to what is otherwise abandoned land, through production of wood that may be either used as fuel or sold to industry (e.g. for use in parquet floors). This land use shift also holds the potential to further diversify local livelihood opportunities through mono-floral honey production, while plans are also afoot to capitalise on international markets for carbon credits. In turn, this could decrease landscape connectivity, lead to a mosaic rather than a mono-culture of land uses and could once again build resilience and adaptive capacity in this region.

5. Discussion

Immediately before each crash was a short period of large-scale conversion from diverse agro-forestry systems to land use systems with fewer trees and more widespread agricultural intensification. These periods seem to have coincided with a decline in socio-economic assets and periods when the institutional capacity to support land managers through a crisis also declined. As such, although the agro-ecological changes in each phase created a more economically productive landscape in the short-term, they ultimately resulted in a less resilient rural economy and land use system. Seen in this light, the periods leading up to each collapse displayed little resilience and all the characteristics of vulnerability reviewed in Section 2.1.

In terms of driving forces in the creation of these non-resilient rural economy and land use systems, three features stand out. The first is that in each case, the creation of specialised land use systems was exacerbated by a lack of non-agricultural jobs (due to policy changes, economic down turns and population growth) such that people had few non-agricultural livelihood options. The second common feature was that people also had access to relatively abundant natural capital that initially acted as a safety net to provide a short-term economic gain, but when drawn down exacerbated the creation of the fragile land use system. Finally, each period was marked by considerable political or institutional uncertainty. Together, these three factors created the generic pathways that led to each successive collapse.

5.1. A lack of non-agricultural livelihoods

In each case, the absence of non-farm activities led to increasing pressure being placed on the land. In the feudal phase in the early/mid nineteenth century, this was because agriculture was the norm in the region and there was little industry (nor non-agricultural alternatives) open to the peasantry. As populations grew, thanks to the feudal land use system that encouraged immigration, people were obliged to depend ever-more heavily on a limited land base. This, therefore, ties into Malthusian population

debates cited earlier (Section 2.2), but suggests that it is population growth in combination with a lack of livelihood alternatives that may be crucial. In the later phase, and following the fall of the Communism, Romania's industrial/urban economy quickly declined once more, again leaving people few options but to turn to agricultural production. This was facilitated in the 1990s by the return of land to private ownership and the sudden outflow of urban workers back into rural areas.

It is likely that the lack of non-agriculture livelihoods may be common to a great many situations, and it seems appropriate to hypothesise that a lack of non-farm opportunities may consistently create incentives to intensify short-term productivity, even at the expense of long-term stability in yields. Although the lack of non-farm livelihoods may be caused by myriad factors like population changes or economic recessions, the causes may be less important than the actual lack of jobs itself. As a result, it is important to look to other locations in both Eastern Europe and beyond, to empirically test the hypothesis that as non-farm economic opportunities rise there may be a similar rise in indicators of resilience (such as less connected, more diverse land use patterns, increased wealth or improved institutional capacity).

Stepping aside from the narrow confines of this case study, however, the literature on this topic suggests that the relationship between resilience and non-farm livelihood options is highly complex. While it certainly seems that a lack of non-agricultural opportunities creates incentives to increase production, it is also the case that abundant non-farm livelihoods opportunities increase the opportunity costs associated with carefully managing agro-ecosystems. For example, research from the developing world suggests that as non-agricultural employment increases, soil conservation practices may decline as the additional time it takes to engage in careful environmental stewardship is simply not worth it when there are good non-farm opportunities (Holden et al., 2004). As a result, it may be that when there are very few non-farm related livelihood opportunities, there are incentives to create productive-yet-vulnerable land use systems. Alternatively, when there are abundant non-farm related activities, there may also be incentives to create vulnerable systems. In summary, therefore, we hypothesise that there may be an inverted relationship between the availability of non-farm jobs and the creation of vulnerable rural economies and associated land use systems. This forms an important starting point for future research.

5.2. An abundance of natural capital

Prior to both collapses in our case study, people drew down the natural capital that had accumulated. In the nineteenth century, this involved large-scale deforestation to make way for farming during the feudal phase. In the post-socialist period, forest shelter belts were removed for timber, to meet fuel wood needs, and to protect the interests of forest owners in the context of deepening levels of poverty and uncertainty over property rights. Also during the post-socialist period, institutional support for the irrigation system vanished and it quickly fell into disrepair, further exacerbating productivity challenges. In both cases, the loss of the tree cover made sense financially in the short-term but likely undermined important ecosystem buffers (particularly relating to the prevention of soil erosion and the movement of sand). The case study thus suggests that it is important to have some level of natural capital to liquidate in times of need. If natural capital had been more limited or other forms of capital (social, physical, financial, human) had been more easily accessible and substitutable, this environmental change would likely not have happened to the same extent. Indeed, in places where natural capital is less abundant, there is evidence of people being more careful and building natural capital stocks rather than drawing them down. For example, Vandana Shiva writes of India's water resources being over exploited during the mid twentieth century but, now that they are more scarce, they are much more carefully stewarded (Shiva, 2002). As such, we hypothesise that the emergence of vulnerable agro-ecosystems may be more likely when there is abundant natural capital, and when there is a disconnect between people's perceptions of natural capital as a security factor and the actual security it can offer. In cases where natural capital is not so abundant, it is unlikely that serious land use changes will be observed. Similar to our observations in Section 4.1, this hypothesis can and should be tested empirically using a range of case studies in different locations. Such research would further our understanding of this factor as one explanation for the emergence of rural economies and land use systems that are vulnerable to environmental perturbation.

5.3. Economic, social and/or policy uncertainty

Finally, it seems that rather than any specific policy regime, an atmosphere of political or economic uncertainty contributed to the liquidation of natural capital and the creation of less resilient rural economy and land use systems. In Phase I (see Fig. 2) uncertainty was created due to large-scale immigration, the feudal structure and a growing tendency towards capitalism. We may surmise based on our qualitative evidence that this created a broad socio-economic climate where existing livelihood options were no longer sufficient and people increased productivity to help compensate. In Phase II, uncertainty was aggravated by a sudden loss of the Communist safety nets that were previously provided by the central state. This builds on a well-developed literature about the effect high discount rates have on natural resource conservation and Panayotou (1993) suggests that during periods of uncertainty people will put short-term decision-making ahead of long-term conservation. This also resonates with the debates on common-pool resources we reviewed in Section 2.1, where Ostrom (2001) argues that as traditional property regimes break down, resources like the irrigation systems often become degraded.

However, the relationship between vulnerable land use systems and socio-political uncertainty is also extremely complex. While uncertainty may create incentives to ignore the long-term implications of different land uses, the reverse may not be true. It may be that under very stable conditions (for example, if a government policy provides high guaranteed prices to farmers), then there will be few incentives to reduce short-term productivity and create a more resilient landscape. This builds on the neo-classical arguments (reviewed in Section 2.2) that speculate government subsidies for specific crops may create incentives for farmers to create ecologically fragile landscapes. For example, in the Communist era the only incentive to change practices was the fear of reprimand should the centrally planned targets fail to be achieved. As such, farmers had every incentive to maximize production at the expense of long-term resilience.

This observation also builds on a body of literature that examines the risks and returns offered by a portfolio of activities. Usually applied to financial investment, "portfolio theory" suggests that in relatively stable political or economic periods, investors will specialise their investments in high-return options. Under more volatile conditions, investors will spread their risks, by diversifying their portfolios. This approach has been applied to biodiversity conservation (Figge, 2004) and to food and agriculture (Fraser et al., 2005). As such, our third and final hypothesis is that vulnerable rural economies and land use systems may be more likely to emerge under conditions of relatively low or high uncertainty, and would be less likely to emerge at medium levels of uncertainty.

Table 1
Summary of interactions between the abundance of natural capital in a region, the access to non-agricultural livelihood options, and the extent of socio-political uncertainty in terms of how these drivers may lead to the development of landuse systems vulnerable to collapse.

Likelihood that a rural landuse system vulnerable to collapse will emerge	Abundance of natural capital	Access to non-agricultural livelihood options	Extent of socio-political uncertainty	Comment
Extremely unlikely	Low	Medium	Medium	Low levels of natural capital provide few incentives to change things. Medium levels of uncertainty provide incentives to plan for future but not to over discount it. Medium levels of off-farm employment balances opportunity costs of soil conservation with pressures to maximize productivity.
Very unlikely	Medium	Medium	Medium	
Unlikely	High	Medium	Medium	
	Low	Medium	High	
	Low	Medium	Low	
	Low	High	Medium	
	Low	Low	Medium	
Neither likely nor unlikely	Medium	Medium	High	
	Medium	Medium	Low	
	Medium	High	Medium	
	Medium	Low	Medium	
Likely	High	Medium	High	
	High	Medium	Low	
	High	High	Medium	
	High	Low	Medium	
	Low	High	High	
	Low	Low	High	
	Low	High	Low	
	Low	Low	Low	
Very unlikely	Medium	High	High	
	Medium	Low	High	
	Medium	High	Low	
	Medium	Low	Low	
Extremely unlikely	High	High	High	High amounts of natural capital provides incentive to liquidate it; Uncertain social or political contexts lead to high discounting; stable circumstances may be due to assumption of government bail out in case of problems; Few sources of off-farm income creates a pressure to maximize productivity, while abundant off-farm employment increases opportunity cost of conservation.
	High	Low	High	
	High	High	Low	
	High	Low	Low	

6. Proposed framework and conclusion

This paper has employed a historical case study approach to illustrate how a series of socio-economic and political drivers led to the repeated collapse and re-growth of the rural land economy and associated land use system in southern Romania. From this, we have identified generic factors that may be applicable to other cases of collapse and have taken a modest step towards developing a possible framework to help explain the ways in which socio-economic drivers may predictably create vulnerable land use systems. Our hypothesised pre-conditions for collapse are based on three drivers that have emerged from our case study as significant: (1) access to non-agrarian livelihoods (where both access and non-access may provide incentives to create vulnerable land use systems); (2) the (perceived) abundance of natural capital (where abundance and/or perceived abundance may provide incentives to create vulnerable land use systems); and (3) economic, social or political uncertainty (where both low and high levels of uncertainty may provide incentives to create vulnerable land use systems).

When combined (see Table 1) these three drivers interact to change the overall likelihood for vulnerable land use systems to emerge. From this, it seems that situations giving most cause for concern are those with high levels of natural capital combined with either low or high amounts of off-farm employment and low or high amounts of socio-political instability (Table 1). Those situations where vulnerable land use systems are least like to emerge may be those in which low levels of natural capital coincide with medium levels of non-farm employment opportunities and medium levels of economic or political uncertainty.

While the identification of these three factors provide the basis for development of more robust frameworks or predictive models, the assessment we have undertaken here should be appropriately seen as a preliminary step. Due to the inherent complexity of each situation, these factors would need to be tested empirically, using quantitative indicators where possible in different socio-economic contexts over both time and space. As such, we have provided a starting point for future studies.

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