Journal of Rural Studies 59 (2018) 1–9

Contents lists available at ScienceDirect

Journal of Rural Studies

journal homepage: www.elsevier.com/locate/jrurstud

A coevolutionary perspective on the adoption of sustainable land use practices: The case of afforestation on degraded croplands in Uzbekistan

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ARTICLE INFO

Keywords:
Coevolution
Land degradation
Lock-in
Socio-ecological systems
Sustainability

ABSTRACT

Cotton export substantially contributes to Uzbekistan's economy. To produce cotton, the state imposes output targets on farmers which results in intensified cotton production practices, and consequently in land degradation. Improving degraded croplands via afforestation is an option explored through research experiments in the region, yet is currently not practiced by farmers. Using the example of the Amu Darya River lowlands of Uzbekistan, we analyze afforestation and its implementation constraints, by developing a coevolutionary socio-ecological systems framework that leans on evolutionary economics and evolutionary governance theories. Our study shows that farmers' perceptions and rationalities, in close association with governance configurations of actors, institutions and knowledges, make them unreceptive towards afforestation. Altering relations between agricultural institutions and actors that are currently present in the cotton-centric configuration is difficult given the path-, inter- and goal dependencies. To change rural sustainable development paths, we conclude that the adoption of innovations requires a tailoring of knowledge and technology fitting local situation, as well as the reassembling of relations between actors, institutions and knowledge.

1. Introduction

The management of ecosystems is a core concern in sustainable development. Overexploitation of ecosystems persists in many resource management practices, even where sustainability is a stated goal. Unsustainable land use policies and practices are one of the major drivers of global environmental degradation (Bernard et al., 2014). Land degradation reduces agricultural production, and on a global scale costs about USD 400 billion annually, affecting the livelihoods of 1.5 billion people (Lal, 1998; Bai et al., 2008).

In Central Asia, land degradation is a major issue (Gupta et al., 2009; Mirzabaev et al., 2016) as can be exemplified by the case of the Amu Darya River lowlands with 23% of its croplands degraded (Dubovyk et al., 2013). Land degradation is a sign of agriculture overexploiting its embedding ecosystems, setting in motion negative feedback loops that affect both the socio-economy and the ecosystem. Previous research has shown that afforestation on degraded croplands in the Amu Darya River lowlands could provide a pathway to sustainability; it would be more environmentally friendly and financially profitable for farmers than currently grown crops such as cotton (Khamzina et al., 2012). However, neither farmers nor policy makers adopt such options (Djalilov et al., 2016; Djanibekov et al., 2016).

Previous studies analyzing possible options for afforestation on degraded croplands in the region mainly focused on suitability of particular tree species for such lands (e.g., Lamers et al., 2006), their provided ecosystem services (e.g., Khamzina et al., 2012), and financial costs and benefits (e.g., Djanibekov et al., 2012b). According to Djalilov et al. (2016) afforestation on degraded croplands is not adopted as a result of barriers created by state policies that create regulations to impose agricultural production targets on farmers. In addition, both formal and informal institutions such as officially-recognized clarity about the resource endowment, the land tenure and water access, recognition of the sites as degraded and informal rules regarding social acceptance and marketing are designed to support state policies. They

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https://doi.org/10.1016/j.jrurstud.2018.01.007
Received 28 February 2017; Received in revised form 14 June 2017; Accepted 20 January 2018
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bring up the institutionalization of the knowledge base for afforestation, which is currently fragile and therefore not likely to encourage the spread of this likely sustainable innovation.

While we agree on the points made, this and other existing studies tend to overlook the interactions between social and ecological systems, and between different social systems at present and in the past. We argue that ignoring these interactions underestimates rigidities in evolving practices and policies, and underestimates obstacles to reform.

The objective of this paper is therefore to illuminate path dependencies in the evolution of rural land use and interdependencies among social and ecological systems in order to understand the (non-) adoption of afforestation on degraded croplands. Our research question is twofold. How does the coevolution of socio-ecological systems influence the adoption of afforestation on degraded croplands in the Amu Darya River lowlands in Uzbekistan, and accordingly, how can adoption be fostered? This case in a transitional country is particularly relevant for coevolutionary socio-ecological research as it allows studying how the previous centralized economy influences the current market economy. It will be shown that understanding the evolving linkages between social and ecological systems is important to discern the effects of agriculture on its ecosystems.

The paper proceeds as follows. The next section develops the theoretical frame and describes the study area and farm survey procedure. Section 3 sketches the historical developments of cotton agriculture in Uzbekistan, its legacies, institutions and policies as well as alternative options for sustainable land use. Section 4 analyzes the reasons for the issues on adoption of afforestation options. Section 5 confronts discussion and policy recommendations, before section 6 concludes.

2. Conceptual framework and methodological approach

2.1. Study area

Our case study example is the Amu Darya River lowlands in Uzbekistan, specifically the Khorezm region and the southern districts of the Autonomous Republic of Karakalpakstan. The agricultural sector accounts for 35% of the regions' gross domestic product with about 410,000 ha of arable land, of which 88% is leased to commercial farmers (hereafter farmers) by the government as land is owned by the state in Uzbekistan (MAWR, 2010). Agricultural production has been characterized by a cotton monoculture that occupies about 50% of farmers' land and is regulated by the state procurement policy. The main farm type is cotton-grain. Cropland degradation is rampant and is present on almost a quarter of arable land (Dubovyk et al., 2013). Afforestation on degraded croplands was analyzed as one way of restoring such lands (Khamzina et al., 2012). This land use type was tested through experimental research and was not yet adopted by farmers.

2.2. Conceptual frame of the study

Our conceptual frame is based on the theory of socio-ecological coevolution, leaning on concepts of governance (Van Assche et al., 2014; Beunen et al., 2015; Djanibekov et al., 2013a) and evolutionary economics theories (Norgaard, 1994, 2005). Coevolution, uncertainty, plural rationalities, path and goal dependencies and interdependency are central concepts. We develop this conceptual frame because an agricultural economic path influences, and is influenced, not only by the social system, but also by the ecological system. Humans adapt to new environments they produce by adjusting their institutions (including policies, laws, plans) and practices (Norgaard, 1994; Van Assche et al., 2014). In turn, the ecological system is not only evolving by itself, but also influenced by changes in the social system (Kallis and Norgaard, 2010; Berkes et al., 2008; Van Assche et al., 2017).

2.2.1. Coevolution in socio-ecological systems

Ecological and social systems are linked through feedback loops. In social systems, different images of the ecological system exist, as an environment for a community, yet in our socio-ecological perspective, we focus on ecological systems as biological systems marked by their own evolutionary process, i.e., a process of reproduction which can be affected by social system, leading to coevolution, but which can also exist independently from them. Once social system reshapes an ecosystem, coevolution between the social and ecological systems become more intricate, and the different images of the ecosystem will affect the ecosystem more structurally (Descola and Pálsson, 1996; Van Assche et al., 2017).

Once these linkages exist, the evolving knowledge and perceptions of decision and policy makers influence socio-ecological systems. In some cases, a deliberate governance of resources in their context emerges, while in others, the effects on and of context are there, but not considered in decision-making (Luhmann, 1989). The absence or presence and the circulating forms of knowledge on management of ecological systems influence the dissemination of sustainable practices (Rammel et al., 2007).

2.2.2. Rationalities and innovation

Evolutionary economics acknowledges that actors in governance are marked by bounded rationality (Simon, 1955; van den Bergh et al., 2006). Actors can be bounded rational because they may not be aware of the latest innovations and do not consider all available options for optimizing economic returns. A long history, widespread use and institutionally supported adoption of a particular practice can make a deep awareness of socio-ecological linkages prevalent, yet it can just as well limit reflection and constitute another boundary to rationality (Descola and Pálsson, 1996; Luhmann, 1989). In line with post-structuralism, different actors cannot only orient themselves towards different understandings of the socio-ecological system, but also do this in a manner which can be described as a unique rationality. This rationality is built on different choices and valuations of resources in a differently understood environment, using a different mix of formal and informal institutions, linked to different understanding of self and environment (Latour, 2004). Uncertainties in decision-making are best considered in the plural, as a correlate of the plurality of rationalities and perspectives always present in governance – even when some actors have a dominant position (Van Assche et al., 2014).

Innovations, as a rule, do introduce new uncertainties in governance (Christensen, 2013). Even when the new knowledge base is sound, the insights do not always seep into the decision-making, and if they do so, the plurality of perspectives in governance and the game of gaining influence on policy making and implementation introduce new selectivities (Miller, 2002). If policy-makers miss knowledge on innovations, or when the discourse or rationality of a policy maker clashes with the nature of the innovation, and innovation causes great anxiety within a particular discursive world of an actor, the innovation might be rejected. This can strengthen the reliance on past experience and established practices, thereby avoiding the uncertainty stemming from innovations and fostering reliance on the contingent quality of observation in traditional practices and further entrenching those practices and the underlying rationalities (Norgaard, 1994).

2.2.3. Dependencies

The coevolution of social and ecological systems, as well as the internal evolution of social systems is marked by rigidity and flexibility (Van Assche et al., 2011, 2014). We distinguish three types of rigidities: path dependencies, interdependencies and goal dependencies.

Path dependencies can be diverse, as legacies of past governance shape current decision-making. The presence of actors in current governance, of formal and informal institutions, of certain forms of knowledge, narratives and expertise, their entwining with power and association with actors and institutions, represent forms of path dependency in our coevolutionary perspective (Van Assche et al., 2014; Beunen et al., 2015). Path dependencies reinforce each other. For

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