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Scalar alignment and sustainable water governance: The case of irrigated agriculture in Turkey

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ABSTRACT

Irrigated agriculture plays a significant role in global food security and poverty reduction. At the same time its negative impacts on water and land resources threaten environmental sustainability. With the objective of improving the understanding on the complexity of governing water resources for irrigated agriculture, this paper introduces the concept of scalar alignment, which is used to analyse governance implications of spatial and temporal scales. Using empirical data from irrigated agriculture in Turkey, implications of spatial and temporal alignment on environmental sustainability are examined. The findings indicate that both spatial and temporal alignment influence the design, implementation, monitoring and evaluation of policy instruments. Increasing the degree of scalar alignment in irrigated agriculture can contribute to sustainable water governance by contributing to the alleviation of negative impacts and the prevention of further degradation.

1. Introduction

Irrigated agriculture is strongly associated with global food security and with poverty reduction in developing countries. Since the 1960s, the way that irrigated agriculture is practiced and managed has been fundamentally changing. The practice of irrigated agriculture became more spatially extensive, as areas of irrigated land continually have been expanding, and more intensive at the same time, as amounts of inputs such as labour, water, fertilisers, agrochemicals and fuel have increased (Ramankutty et al., 2002; FAO, 2010). Additionally, the management of irrigation has been changing in many countries that have embarked upon institutional reforms to implement integrated water resources management, irrigation management transfer or participatory irrigation management (Meinzen-Dick, 1997, 2007; Vermillion, 1997; Garces-Restrepo et al., 2007). Due to these changes, the sustainable governance of water and land, the two key natural resources used for irrigated agriculture, becomes a challenging endeavour.

A major concern rises as a result of the impact of irrigated agriculture on water and land resources (Ananda and Herath, 2003; Cassman and Wood, 2005). The alleviation, let alone the prevention, of these impacts is not straightforward given the complexity of water governance. Two key concepts that capture this complexity are scale and level, both of which are increasingly emphasised in natural resource governance (Lovell et al., 2002). Some scholars use "scale" as a synonym to "level", particularly in the multi-level governance literature (Blomquist, 2009). These concepts are differentiated in this paper by conceptualising scale as "*a dimension of an object or process*", and level as "*the unit of analysis on a given scale*"

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(Turner et al., 1989; Gibson et al., 2000; Silver, 2008). For instance, the time dimension of processes constitutes the temporal scale, whereas days, months, years and decades are the possible levels on the temporal scale.

The relevance of scale and level is pinpointed by water governance scholars who also caution against imposing an ''optimal solution'' or ''panacea'' that promises sustainable governance at a specific scale or level (Meinzen-Dick, 2007; Molle, 2008, 2009a; Ingram, 2011; Pahl-Wostl et al., 2012; Vinke-de Kruijf and Özerol, 2013). The need is acknowledged to better understand the phenomena that occur at multiple scales and the contextual factors that have effects at multiple levels (Bressers and Rosenbaum, 2003; Molden et al., 2010; Gerlak, 2014; Hill Clarvis et al., 2014). The governance of water is considered scale-sensitive due to crossing hydrological and jurisdictional boundaries (Huitema and Bressers, 2006; Moss and Newig, 2010; Molle and Mamanpoush, 2012). However, elaborations on scale-related issues in water governance should go beyond the institutional fit between hydrological and jurisdictional boundaries since water governance spans over various policy sectors, mainly including water, energy, agriculture, land use and environmental protection. A multi-scalar and multi-sectoral perspective to water governance becomes more crucial since, in many countries, coupled water and land problems are experienced and concerned policies are fragmented (Knoepfel, 1995; Ananda and Herath, 2003; Hamdy et al., 2003; Tabara et al., 2008; Herrfahrdt-Pähle, 2010; Özerol et al., 2012). Recent scholarly literature points out that there is a need to better understand the scale-related factors that affect the efficiency and effectiveness of water governance systems (Moss and Newig, 2010). This paper addresses such a need by focusing on the role of scales in the governance of water resources in irrigated agriculture.

A scale-based analysis of irrigated agriculture is relevant due to four interrelated reasons. Firstly, irrigated agriculture has a high impact on environmental sustainability since it is a major user of water and land resources, while the availability of these resources varies at both spatial and temporal scales (Siebert et al., 2005; Molden, 2007). Secondly, negative impacts of irrigated agriculture are rooted at multiple levels, such as excessive use of water at the plant and plot level, application of inappropriate irrigation techniques at the farm level, and lack of communication and coordination among the actors at all levels (Wichelns, 1999; Wichelns and Oster, 2006). Thirdly, spatial and temporal levels of water and land problems resulting from irrigated agriculture, such as waterlogging and soil salinisation, do not always overlap, despite the fact that they influence each other (Pearson, 2003). Fourthly, policy responses to negative environmental impacts of irrigated agriculture do not match the spatial and temporal levels of these problems due to a lack of spatially and temporally comprehensive data about the social, environmental and economic impacts of policy interventions (Scherr, 2000; Molden, 2007; Prager et al., 2011). Through contemplating on these reasons, this paper aims to contribute to the scholarly debate on scale-related issues in the governance of water resources in irrigated agriculture. Three research questions are specifically addressed:

(1) How is the governance of water resources in irrigated agriculture characterised by multiple scales?
(2) What is the degree of scalar alignment among the scales of irrigated agriculture?
(3) What are the implications of the degree of scalar alignment on the sustainable governance of water resources in irrigated agriculture?

Despite having a common focus on a scale-based analysis of irrigated agriculture, these three questions have different aims. Answering the first question aims to improve the theoretical foundation of a scalar analysis in irrigated agriculture. Second and third questions, on the other hand, are more practice-oriented and they aim to generate empirical insights regarding the case of irrigated agriculture.

The paper is organised as follows: in Section 2, key perspectives on scales in natural resource governance are presented and those perspectives are utilised to operationalise the concept of scalar alignment. Section 2 is devoted to characterising the scales of irrigated agriculture and hence answering the first research question. In Section 4, scalar alignment is assessed and its implications are analysed using empirical data from Turkey and thus the second and third research questions are answered. Finally, conclusions are drawn in Section 5.

2. Conceptual framework

Knowledge and tools from social and ecological sciences need to be incorporated to investigate the mutual relations of social and ecological processes and thus to improve the understanding about the relevance and influence of scales in natural resource governance. Regarding ecological sciences, common definitions and uses of scale-related concepts have been established (Gibson et al., 2000). The relevance of scales for social processes and the importance of dealing with the scale issues in social processes were pointed out even earlier (Tilly, 1984).

As opposed to ecological sciences, there is a lack of common understanding about scale-related concepts in social sciences and different meanings are attributed to these concepts (Gibson et al., 2000; Görg, 2007). In the sections below, first a review is presented regarding the two main perspectives on the understanding and use of scale and other related concepts in natural resource governance. Building on these perspectives, ''scalar alignment'' is proposed as a novel concept to assess the implications of multiple scales in natural resource governance.

2.1. *Analytical perspective*

According to the analytical perspective, scale refers to an objectively observable reality (Neumann, 2009). This implies that the hierarchical levels of scales are given and they can be used to understand the interactions of human and environmental elements of social–ecological systems. *Grain* (resolution) and *extent* (size of the study area or the duration of the study) are the two elements that characterise a scale from an analytical perspective. Both elements are crucial to observe social and ecological phenomena as a whole and not to overlook the essential details (Turner et al., 1989; Allen and