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Why do we not pick the low-hanging fruit? Governing adaptation to climate change and resilience in Tyrolean mountain agriculture

Heidelinde Grüneis[a,*], Marianne Penker[a], Karl-Michael Höferl[b], Markus Schermer[c], Patrick Scherhaufer[a]

[a] Institute for Sustainable Economic Development University of Natural Resources and Life Sciences, Feistmantelstr. 4, 1180, Vienna, Austria
[b] Institute of Geography University of Innsbruck, Innrain 52, 6020 Innsbruck, Austria
[c] Department of Sociology University of Innsbruck, Universitätsstraße 15, 6020, Innsbruck, Austria

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ABSTRACT

Impacts of climate change have become more and more evident and can be observed in ecosystems, societies and economies worldwide. Mountain agriculture is especially vulnerable to climate change, and adaptation seems crucial. Thus, certain adaptation activities, such as installing irrigation technology, switching to drought-resistant crop varieties or shifting planting dates, can already be observed. Despite these efforts, the barriers for climate change adaptation are still manifold and lead to adaptation gaps. One problem is that many approaches ignore non-climatic drivers, such as economic conditions or cultural aspects, which have a strong influence on farmers´ decisions. In the literature, the focus is mostly on planned, "top-down" induced adaptations, where climate change is considered the most important driver. Within this study, we focus on local, "bottom-up" adaptation actions in Tyrolean mountain agriculture that may be triggered by climatic as well as by non-climatic drivers. We identify 27 adaptation practices and cluster them into six types of climate change adaptation: ´Resilience-raising products and production´, ´Hidden actions by farmer organizations´, ´CC motivated agronomic actions´, ´CCA scientific knowledge production´, ´Risk-driven adaptations´ and ´Hidden governmental actions´. These types are helpful to show the broad range of local practices contributing to climate change adaptation. Several adaptation actions from practice are not motivated by climate change and thus are termed "hidden" adaptations, as they do not fit into common adaptation concepts. Hidden climate change adaptation practices, although not considered to date in official CCA policy documents, constitute "low-hanging fruit" for decision makers as they have already proved their feasibility and gained legitimacy by actors on the ground. We argue that additional support for such hidden adaptation practices can help to overcome present adaptation barriers and adaptation gaps.

1. Introduction

The availability and productivity of agriculturalland is particularly exposed to climate variability and affected by climate change (Lobell et al., 2008; Vermeulen et al., 2012). The structure of the current food system is extremely fragile, and food security in affluent regions can no longer be taken for granted (IPCC, 2014a; Candel, 2014). In addition, people in countries of the Global North increasingly recognize their global responsibility regarding consumer and dietary behaviors (de Boer et al., 2016) and their vulnerability to impacts from disruptions of food trade and rising prices for production input supplies (Van der Ploeg, 2010). Hence, as a leading consumer of fossil fuels and a large contributor to GHG emissions, the agriculture and food sector has an important role to play in climate change mitigation and adaptation (McMichael, 2011).

At least since the negotiations of the Kyoto Protocol, climate change has been perceived as a global threat and a major future challenge by science (Perry, 2015) as well as by the public (Moser and Dilling, 2004). The media presence increases considerably with the release of IPCC reports or international climate conferences, such as the very prominent UNFCCC COP 21 2015 in Paris with its agreement on the 'two degrees' goal. There is a growing consensus that, in addition to mitigation, adaptation to climate change is imperative (Adger et al., 2009; Berrang-Ford et al., 2011; Rickards and Howden, 2012). Political commitment

* Corresponding author.
E-mail addresses: hgrueneis@hotmail.com (H. Grüneis), marianne.penker@boku.ac.at (M. Penker), karl-michael.hoeferl@uibk.ac.at (K.-M. Höferl), markus.schermer@uibk.ac.at (M. Schermer), patrick.scherhaufer@boku.ac.at (P. Scherhaufer).

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to climate change adaptation (CCA) is expressed at multiple levels. Since the millennium the world of states under the UNFCCC umbrella declared and established the concept of adaptation next to mitigation as a second very important pillar of any climate policy, and the Cancun Adaptation Framework (2010) called for further national adaptation planning. In April 2013, the EU adopted an Adaptation Strategy (EC, 2013), followed by several National Adaptation Strategies by EU member states. Hence, there is a strong need to implement various adaptive practices – understood as a "*process of adjustment to actual or expected*" (IPCC, 2014b:118) climate change effects – and measures that increase resilience ("*the capacity of social, economic and environmental systems to cope with a hazardous event[s]*") (IPCC, 2014b:127) or adaptive capacities ("*the ability of systems, institutions, humans and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences*") (IPCC, 2014b:118).

Despite this broad political commitment, barriers for implementing CCA are still manifold, especially on a local level (Adger et al., 2007; Dow et al., 2013; Ford and King, 2015; Klein et al., 2014; Moser et al., 2010). National strategies cannot be easily transferred to the local level by top-down processes. The problem-solving capacity is critically determined by concrete local actions (Tompkins et al., 2010; Smit and Wandel, 2006), and its effectiveness depends on institutionalized local networks that are locally knowledgeable and locally responsive (Campos et al., 2014). The resulting difference between stated adaptation needs and existing adaptation efforts has become known as the "adaptation gap" (Chen et al., 2016). To overcome barriers and thresholds and to avoid maladaptation, a better understanding of adaptation processes is needed that allows interventions *"at the most appropriate scales"* (Adger, 2001:921).

For a better understanding and well-targeted support of CCA, it is helpful to differentiate among different types of adaptations. Differentiation receives much attention in the literature (Biagini et al., 2014; Eakin et al., 2014; Smit et al., 2000), and spontaneous vs. planned as well as reactive vs. anticipatory adaptations are the most common types (Fankhauser et al., 1999; Füssel, 2007; Malik et al., 2010). Smit and Skinner (2002) have developed a typology of adaptation options in agriculture considering two dimensions: scale and stakeholders. Another typology can be found in Tompkins et al. (2010): eight main types represent adaptation outputs, namely, research, planning, networking, awareness raising, training and advocacy, legislation and implementing adaptation. Altogether, the literature focuses strongly on theoretical adaptation, while only a few studies have examined actual CCA practices (Berrang-Ford et al., 2011; Chen et al., 2016; Tompkins et al., 2010).

This paper draws attention to actual adaptation actions and policies on a local scale, and thus does not include CCA on a national and EU level. It investigates a specific vulnerable land use system – mountain agriculture in Tyrol (Austria). Mountain agriculture is affected by various climate change impacts and effects and particularly requires adaptation strategies to exploit opportunities and avert potential loss (Poetsch et al., 2014). Farmers act in a very complex field with various challenges (Mitter et al., 2015), and decisions are made in response to political, economic, institutional, and biophysical conditions (Risbey et al., 1999; Wandel and Smit, 2000; Campos et al., 2014). Hence, climate change often plays only a minor role as a trigger for actions in farmers´ daily lives (Tompkins et al., 2010, Berrang-Ford 2011). Therefore, our approach focuses on local every-day adaptation practices and the driving forces and motives behind them. Resilience plays a central role within our approach as it leads to better adapted (agricultural) systems (Adger et al., 2005). We show the full spectrum of already implemented adaptation practices in the mountain agriculture sector of Tyrol. Based on a cluster analysis, a CCA characterization is introduced, and different adaptation types are identified. We compare the identified CCA practices with the Tyrolean climate strategy to identify further adaptation needs. With this practical orientation and integrated perspective, we wish to show the diversity of local adaptation practices and to identify low-hanging fruit for policy and decisions makers.

In the following section, we critically assess the effects of top-down CCA policies; then, we follow with a description of mountain agriculture in Tyrol. Subsequently, we describe the methods used and present the dimensions chosen for differentiation between CCA types. Based on these dimensions, we introduce our CCA typology for Tyrolean mountain agriculture. By contrasting this typology with action fields from the Tyrolean climate strategy we identify adaptation gaps. Finally, we end with a discussion of our results and conclusions.

2. Critical assessment of the effects of climate change adaptation policies

The scientific debate about the effectiveness of CCA policies is comprehensive (cf. Bauer et al., 2012; Casado-Asensio and Steurer, 2014). It essentially refers to the question of whether it is enough to rely on international and national CCA policies implemented top-down at the local scale or whether there is a need for complementary bottom-up measures. Since the publication of the European Commission's Green and White Papers (EC, 2007, 2009), many EU countries have adopted national strategies to bring adaptation to the national policy agenda and to mainstream adaptation, which means to facilitate the integration and coordination of climate change adaptation policies with other public policy fields and related funding streams. In Austria, as in other EU member states, the national adaptation strategy was approved by the federal government in 2012 (Federal Ministry of Agriculture, Forestry, Environment and Water Management, 2013).

In sum, all of these top-down adaptation policies are planned, and the related measures can be either reactive or anticipatory (Smit et al., 2000; Smit and Wandel, 2006). However, government-driven top-down approaches have limits in stimulating concrete local adaptation practices (for the UK, see Tompkins et al., 2010). Many reasons could be advanced to explain such a gap. Local actors, for example, are simply not aware of CCA policies (Grüneis et al., 2016); their behavior is motivated instead by different non-climate related stimuli such as cost savings, social pressure or individual risk perceptions (Adger et al., 2005; Grothmann and Patt, 2005), or the CCA governance at lower scales "*is hampered by the autonomy enjoyed by the municipalities*" (Juhola et al., 2011:244).

The discourse on "second generation" adaptation (Burton et al., 2002; Moser and Boykoff, 2013; Boyd and Cornforth, 2013) takes more account of local contexts and pluralistic drivers of adaptation. In contrast to first generation adaptations, which aim at "planned" adaptation solutions to particular CC problems (Boyd and Cornforth, 2013; Kates et al., 2012; Moser, 2009), second generation adaptations also consider environmental, social, political and economic factors (Grasso, 2009). They address the context in which hazards occur (Burton et al., 2002) and contribute to increased systems resilience.

Practices that increase the adaptive capacity may occur at the local level without being triggered by any national or sub-national adaptation policy or by the issue of climate change at all. These non-climatic conditioned efforts must be considered if we are interested in grasping the whole picture of adaptation, as argued by Tompkins et al. (2010) or the literature on community-based adaptation which emphasizes the social, political, and economic drivers of vulnerability (Ayers and Forsyth, 2009; Forsyth, 2013). In order to integrate and simplify all these different concepts and adaptation practices, Grüneis et al. (2016) suggest a framework that distinguishes three types of CCA according to their climate-related motivations: explicit adaptations, multi-purpose adaptations, and hidden adaptations. Explicit adaptations are directly and solely motivated by climate change, whereas hidden adaptations are motivated only by non-CC drivers, such as agricultural policies, markets, or lifestyle changes. Multi-purpose adaptations represent a hybrid form, where CC is one driver among other non-climatic drivers.

Hence, in this paper, we extend the common definition of climate