Global Environmental Change 46 (2017) 23–33

Contents lists available at ScienceDirect

Global Environmental Change

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

Maladaptive outcomes of climate insurance in agriculture

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ARTICLE INFO

Keywords:
Index insurance
Resilience
Climate change adaptation
Smallholder agriculture
Vulnerability
Agroecology

ABSTRACT

Agricultural insurance programs are currently being championed by international donors in many developing countries. They are acclaimed as promising instruments for coping with climate risk. However, research on their impacts has mainly focused on economic considerations. Studies on broader social and ecological consequences are sparse and have produced ambiguous and inconclusive results. We address this knowledge deficit by (a) advocating for a holistic view of social-ecological systems and vulnerability when considering insurance impacts; (b) offering a systematic overview highlighting the potential beneficial and adverse effects of 'climate insurance' in agriculture, particularly where programs target intensifying agricultural production; and (c) suggesting preliminary principles for avoiding maladaptive outcomes, including specific recommendations for designing appropriate impact studies and insurance programs. Our synopsis brings together scientific knowledge generated in both developing and developed countries, demonstrating that agricultural insurance programs shape land-use decisions and may generate serious economic, social, and ecological consequences. If insurance is to be an appropriate tool for mitigating the impacts of climate change, it needs to be carefully developed with specific local social-ecological contexts and existing risk coping strategies in mind. Otherwise, it is liable to create long-term maladaptive outcomes and undermine the ability of these systems to reduce vulnerability.

1. 'Climate insurance' in agriculture: a topical issue

Weather risk is an issue of extraordinary socio-economic concern, not least for rural agricultural households in developing countries. This holds especially true in the face of climate change. Governments and international donors currently promote 'climate insurance', which has emerged as an umbrella term for a host of financial mechanisms that make payouts following extreme weather events (cf. Table 1). The G7 'InsuResilience' initiative, for instance, pledged USD 400 million at the Paris climate conference (GIZ, 2015), and the Global Index Insurance Facility has a portfolio of 148 million US dollars (GIIF, 2016).

The global volume of subsidies for novel insurance programs targeting weather risk in agriculture is hard to estimate but has most likely surpassed a billion US dollars. A rough approximation can be made based on the global volume of agricultural insurance premiums, which is estimated at USD 5 billion in emerging markets (SwissRe, 2013). The World Bank estimates that 44 percent of agricultural insurance premiums consist of subsidies (Mahul and Stutley, 2010). Despite the lack of more recent data, these two figures combined suggest an annual volume of subsidies to agricultural insurance (not just index insurance) in emerging markets of at least two billion dollars. This estimate has been corroborated in personal communications with several practitioner experts.

Technologically innovative insurance programs, particularly 'index insurance' linking payouts to environmental proxy variables rather than measured losses, are heralded as promising strategies for decreasing poverty and improving climate risk management and resilience in developing countries that are heavily dependent on smallholder agriculture. Associated rationales include boosting food security and agricultural productivity (SwissRe, 2013). As donor and government interest in these insurance programs grows, a large number of pilot studies are ongoing worldwide (Karlan et al., 2014; Greatrex et al., 2015; Jensen and Barrett, 2017).

A debate on the social and ecological effects of such insurance programs in agriculture is urgent given the development and climate adaptation funds poised to pour into this sector in the next five years. New subsidies will amount to at least hundreds of millions of dollars, yet the social and ecological ramifications of these policies have thus far been neglected by funders and advocates. Recent scholarly publications have hinted at the possibility of non-adaptive outcomes (Capitanio et al., 2015; Müller and Kreuer, 2016), which may ultimately increase both risks and insurance premiums (Surminski et al., 2016). Donor and practitioner forums have recently begun developing guidelines for assessing the value of index insurance to clients (Stoeffler et al., 2015). A crucial yet neglected corollary of this work is to evaluate insurance's

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http://dx.doi.org/10.1016/j.gloenvcha.2017.06.010
Received 4 November 2016; Received in revised form 27 June 2017; Accepted 28 June 2017
Available online 01 August 2017

Table 1
Glossary of insurance-related terms.

Agricultural insurance	Agricultural insurance has a long history dating back to 18th-century Europe (Smith and Glauber, 2012). Today, it remains largely a developed-country business. Crop insurance may directly cover losses in crops that occur due to natural hazards or, in some cases, insure a farmer against a loss of revenue due to changing prices. Similar programs exist for livestock, fisheries, and forestry.
Climate insurance	An umbrella term to refer to a host of financial mechanisms making payouts following extreme weather events. These include weather index insurance products, sovereign macro-level insurance policies, and catastrophe bonds (which act as alternative insurance policies where investors' principal is paid out to the country in case of a natural disaster). While some of these programs have covered an entire region (e.g. weather index insurance in Mexico, Fuchs and Wolff, 2011) or even country (e.g. Ethiopia, Hellmuth et al., 2009), many address private households and thus operate on local scales. Although these programs are routinely referred to as 'climate risk insurance,' in the case of agriculture, they are annual policies that technically insure farmers against seasonal weather events and not the occurrence of climate change per se.
Index insurance	In contrast to conventional crop insurance where payouts are explicitly based on measured loss, payouts are triggered by an environmental proxy variable selected as an index. For instance, to insure against drought, an index may be based directly on measured rainfall or on remotely sensed data such as a vegetation index. If the index crosses a predefined threshold in a given season, this triggers payouts to insured farmers. Another increasingly popular trigger is calculated on the basis of measured average crop yields for a specific area ('area-based yield').
Microinsurance	Microinsurance schemes are characterized by relatively small sums insured, and are usually specifically targeted at low-income households.

potential maladaptive social-ecological outcomes. Maladaptation refers to outcomes where action taken to reduce vulnerability produces the opposite effect for other systems, sectors or social groups (Barnett and O'Neill, 2013).

Policy-oriented reviews of the impacts of insurance in agriculture (e.g. Miranda and Farrin, 2012; Blampied, 2016; Schickele, 2016) have focused largely on near-term economic effects and practical challenges accompanying the introduction of insurance products in developing countries (Marenya et al., 2014). Studies that have endeavored to investigate the sustainability of such types of insurance have defined sustainability in narrow financial terms (Hazell et al., 2010; Hess and Hazell, 2009; Smith and Watts, 2009; Wang et al., 2011). Surprisingly few studies have considered the possible effects of agricultural insurance on social relations and ecological features. Research on the topic is scattered across various disciplines, methodologies, and national contexts. Examples of such effects include the expansion of croplands into environmentally sensitive areas (statistical analysis of historical data by Lubowski et al., 2006), a shift towards riskier production choices (randomized experiment by Karlan et al., 2014, which does not consider this shift to be problematic), or a weakening of informal social networks (Boucher and Delpierre, 2014). To our knowledge, no publication has provided an inventory of potential adverse effects of insurance programs on the social-ecological dimensions of local agricultural systems.

Our paper addresses this research deficit by (a) advocating for a holistic view of social-ecological systems and vulnerability when considering insurance impacts; (b) offering a systematic overview highlighting the potential beneficial and adverse effects of 'climate insurance' in agriculture, particularly where programs target intensifying agricultural production; and (c) suggesting preliminary principles for avoiding maladaptive outcomes, including recommendations for designing appropriate impact studies and insurance programs. We include studies of agricultural insurance in OECD countries despite significant differences in social and political-economic contexts, since these experiences provide insights and cautions that should inform the programs being currently piloted or proposed in developing countries.

2. Agricultural insurance in intertwined social-ecological systems

So far, systematic reviews of insurance tend to neglect the importance of a broad social-ecological viewpoint and focus narrowly on economic drivers and outcomes (e.g. Cole et al., 2012, Fig. 1.1 on 'Causal mechanism for index insurance'). Fig. 1 represents the scale and units of analysis of such studies, which tend to focus on the insurance purchase, production, and consumption decisions of individual producers and the ramifications of such decisions on household income and welfare.

Yet accurately assessing the impacts of agricultural insurance projects requires investigating beyond the short-term metrics that can be most easily captured to include effects on contextual vulnerability (O'Brien et al., 2007), existing social and ecological coping mechanisms, and entitlements used to respond to a range of shocks including weather and market events (Turner et al., 2003; Ribot, 2010).

We argue that it is indispensable to consider the system as a coupled social-ecological system with key features, such as feedbacks and combined effects, that operate on multiple time scales. Our schematic Fig. 2 illustrates this (for a similar attempt with respect to agricultural policies in general see also Lubowski et al., 2006, Fig. 1.1). Rather than just a producer and consumer, we conceptualize a farming household as a set of land users that interact with both a local ecological system and complex social networks, which provide ecosystem services and risk coping/sharing mechanisms, respectively.

Two key features of this social-ecological systems conceptualization are particularly salient for assessing the ultimate adaptive impacts of insurance provision: feedbacks and combined effects.

(1) Feedbacks on different scales

Farmers with insurance alter traditional land use strategies to manage climate risk (Sumner and Zulauf, 2012; Smith and Glauber, 2012; Capitanio et al., 2015; see Section 3.1). Responses will differ depending on the type of insurance offered (e.g., insurance for weather risk, yield variation, or revenue fluctuation, see discussion in Finger et al., 2016). Moreover, management strategies will differ from one person to another, depending on available livelihood assets (see Table 2), gender, or attitude towards risk (Lubowski et al., 2006; Peterson, 2012). Furthermore, there is some evidence that land users with insurance may reconsider their engagement in social networks (see Section 3.2).

To the extent that these effects materialize, both can generate crucial feedbacks on environmental and social systems, respectively. On the ecological side, a change of land use strategy affects the flows of ecosystem services (i.e., the benefits people obtain from ecosystems) to an individual farmer (cf. Section 3.1 for further details). These might be positively affected in the short term (high yield from monoculture of insured cash crops), but negatively impacted in the long term (lower pest control and disease resistance). This may have further ramifications for ecosystem service flows at the community level; if, for instance, insurance leads to a decreased use of conservation tillage practices by individual households, valuable water quality services could be negatively affected for the whole community (cf. Schoengold et al., 2015). On the social side, if the effectiveness of risk sharing through social networks deteriorates, this could lead to increased vulnerability of the poorest who cannot afford formal insurance (cf. Section 3.2).

(2) Combined or contradictory effects with other policy instruments, types of risk, and global change processes in general