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**Connecting resilience, food security and climate change:  
lessons from flooding in Queensland, Australia**

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**TITLE**                    **Connecting resilience, food security and climate change: Lessons from flooding in Queensland, Australia**

**Abstract**

The Australian food system is often assumed to be largely secure in the face of global environmental challenges such as climate change. In 2010/2011 serious flooding in Queensland left towns isolated, major roads and highways cut, and incurred significant loss of life and property. In terms of food security, large areas of agricultural land were inundated and food supply chains, including both long and short chains, were affected in significant ways. The impacts included increases in food prices, deterioration in food quality, reduced consumer access to food, and disruption to the sourcing, transportation, and distribution of food, grocery and other items. Examining the discourses and policies surrounding food supply during and after the floods, this paper asks, *what lessons for building a more resilient food system have emerged from the 2011 floods?* To explore this question, we consider policy documents, media reports, interviews and fieldwork with key stakeholders. We find evidence of strong collaboration of state government and long supply chain operators, but to the general exclusion of civil society-based community supported agriculture networks. Long chains provide the vast bulk of food to Queensland consumers, but are vulnerable when roads are cut; community supported agriculture showed resilience, but remained marginal to the food needs of most Queensland consumers. Both resilience and vulnerability were present within both long and short food supply chains. Yet, there is limited evidence that food security issues, beyond productivity enhancement, are being considered in discussions and policies for climate change and natural disasters. We suggest that a broader view of climate change, beyond disasters and food production, has yet to be fully integrated into food security policy - and supply chain governance and practice - in Australia.

**Keywords**

Resilience; disasters; governance; food supply chains; alternative food networks; supermarkets

**Introduction**

The Australian State of Queensland experienced significant flooding throughout late 2010 and early 2011. Intensive and prolonged rain from a low pressure system and several cyclones (also termed ‘hurricanes’ in the Atlantic and North East Pacific regions and ‘typhoons’ in the South Pacific and Indian Oceans) in the far north of the State resulted in over 200 towns and suburbs being affected (Queensland Government 2013). Some 300 roads and highways were closed (Sydney Morning Herald 2010) and 33 people lost their lives with thousands more forced from their homes (Queensland Floods Commission of Inquiry 2011, 2012). During the time of flooding, and beyond, there were numerous impacts on the food system, including availability of food, transport, processing facilities and production.

On a national level, the Australian food system is considered to be largely secure (CSIRO 2011a; DAFF 2012). However, the Queensland floods of 2010/2011 have represented a major challenge to this accepted view and, increasingly, researchers have begun to question Australia’s perceived food security, highlighting potential challenges to productivity in light of a changing climate (Lawrence, Richards and Lyons 2013). Links between climate change and food security are currently overly focused on production (see CSIRO 2011a, 2012; DAFF 2014) at the expense of socio-political factors, such as the negative environmental and social impacts of neoliberal policies and agricultural intensification (Almås and Campbell 2012; Lawrence et al. 2013; Sage 2012). The vulnerability to climate change and food insecurity that is embedded in social, political and economic processes is understated in much of the food security and climate change research in Australia (Lawrence et al. 2013).

There is also concern regarding the duopoly of the two major supermarkets in the retail sector, and their power and influence throughout the supply chain (Burton et al. 2013). For example, supermarkets have been viewed as potentially creating a more vulnerable (long) food chain via a just-in-time delivery logic reliant upon long-haul road transportation (Richards et al. 2012; Simms 2008). However, long food chains that utilize regional or global networks have also been credited as being more resilient to environmental hazards, with food security shortfalls in one region able to be addressed by sourcing food from other areas. By contrast, alternative (or short) food chains, such as civic food networks, local food movements, urban agriculture and organic agriculture, have

also been highlighted in the literature for their potential contribution to food security and food system resilience (Burton et al. 2013; Dixon et al. 2009; Goodman, DuPuis and Goodman 2011; MacMahon 2011; Renting, Schermner and Rossi 2012; Scrinis 2007). These networks can also be criticized for their small-scale nature, and thus their inability to respond to widespread food security challenges (Jarosz 2008). In all, there is evidence that the Australian food sector is not entirely secure or resilient (Farmar-Bowers, Higgins and Millar 2013; Watson and Merton 2013). There is a need to better understand the social and political aspects of food security and climate change impacts, especially for supermarkets, civic food actors and government.

### **Exploring food security, ‘resilience’ and food system transformation in Australia**

Using the 2010/2011 Queensland floods as a case study, this paper explores lessons, ideas and opportunities for improving the resilience of food supply chains within Australia. We define resilience as a process of adaptation and transformation in response to ‘critical signals’ (Almås and Campbell 2012) which can be applied to understanding food systems. Such analysis can highlight gaps in the ways in which food security is conceptualized in the context of climate hazards. As Boyd et al. (2008, p. 392) assert:

In the context of climate change, a resilience approach is one that allows undesirable socioeconomic states (for example a system characterized by deep deficits in income, power, education and social capital) to be transformed into more desirable ones without threatening the integrity of the atmosphere or the ecological systems on which humans depend.

We situate ‘transformation’ as central to the notion of resilience, understood as a set of adaptive capacities alongside a strategy for change. Furthermore, transformation has informed climate change adaptation and mitigation discourse to varying degrees (Cork 2010; Park et al. 2012). While elements of resilience have been explored in the spheres of disasters (Cutter et al. 2008; Norris et al. 2008), communities (Magis 2010; Crowe and Smith 2010) and food supply chains (Christopher and Peck 2004), bringing these together remains a significant challenge (see also Smith and Lawrence 2014; Smith et al. forthcoming). Within the Australian Research Council (ARC)-funded project entitled *Governing Food Security in an Era of Climate Change* we have examined food supply chains in Australia in the context of increasing risks and threats brought about by climate change. The project has conceptualized the floods as an example of a ‘climate hazard’. While not necessarily attributable to climate change *per se*, the 2011 floods can be examined as a case study of the kind of event that regions of Australia may experience with greater frequency and with more severity, in an era of predicted climate change. Australia is expected to experience a range of both slow-onset and sudden climatic impacts including rainfall variability, increased average temperature and heatwaves, drought and an increasing number of tropical cyclones. The risk of serious flooding in particular is expected to increase (Cai et al. 2015). These will have significant impacts on major agricultural industries, including beef and sugar (Australian Government 2014). In the context of a major flooding disaster (such as that occurred in Queensland in 2011), it is important to ask: *how resilient were key food supply chain actors, in terms of food security? How do their disaster response and recovery activities contribute to the capacity of communities, governments and businesses to reshape food chains to be more resilient to climate-related disasters in the future?*

Findings have been drawn from media and policy reviews and interviews with key stakeholders in Queensland’s capital city, Brisbane (population 2 million), and the major regional center of Rockhampton (population 60,000), and via other field observations. We begin with a timeline of events, examining the experiences of supply chain actors, tracing the impacts and responses of actors in both long (supermarket-based) and short (locally-based) food chains. We then examine key government actions and policies concerning food security during the floods, and discuss whether climate change adaptation and ideas on transformation have been incorporated into multi-stakeholder responses, both during and after the flooding. While not explicitly adopting a supply/value chain or food network conceptual framework (as do other political/cultural economy-oriented studies interested in the emergence of, or tensions between, mainstream and alternative food systems - see Goodman, DuPuis and Goodman 2011), the methodology here is certainly informed by critical agri-food studies’ interest in the social production and reproduction of knowledge, power, and agency in food production-consumption networks. Exploring the activities, relationships and tensions between supply chain actors is a well-established tradition in global commodity and value chain analysis; bringing consumers and the environment into the analysis draws from the more recent ‘network’ turn in agri-food studies; and our inclusion of governance and policy actors reflects the embeddedness of food systems in social and institutional networks (see Wilkinson 2006).

Interviews<sup>1</sup> were conducted with 14 key actors responsible for ensuring food security during the Queensland floods, between May 2013 and January 2014. This included representatives from:

- Two peak industry bodies, Ausveg and Agforce
- Food collection charity, Foodbank
- Two supermarkets, one national (Coles) and one independent (Independent Grocers of Australia)
- State emergency volunteer search and rescue service (State Emergency Service) in Rockhampton
- Queensland Government Premier's Office
- The Queensland State Disaster Management Group
- Brisbane-based local food box scheme/ community supported agriculture
- Farmers' market in Brisbane
- Two community gardens in Brisbane
- The Rockhampton Local Disaster Management Group
- Rockhampton-based fruit and vegetable wholesaler
- Rockhampton Regional Council.

Interviews were accompanied by a document review. Some 61 online media articles and press releases were reviewed, with a focus on articles published during the flooding event. These articles were reviewed to gain a more detailed understanding of the flooding, and determine the actions and responses of key stakeholders during the flood. Seven state-level policy documents were also reviewed with a view to understanding the ways in which climate change and food issues are governed in the context of natural disasters.

### **Impacts of flooding throughout food supply chains**

The 2010/2011 floods were a substantial and unprecedented natural disaster in Queensland's history (Queensland Floods Commission of Inquiry 2012). Between November 2010 and March 2011 some 75 percent of the State had been flooded or declared a disaster zone (Australian Emergency Management Knowledge Hub 2014). The flooding was the result of a 'La Niña' event which combined cyclonic and heavy rainfall activities. Queensland experienced its wettest spring on record (Bureau of Meteorology 2011), along with three cyclones in three months (Queensland Government 2011). In Brisbane, water released from the city's main water dam, upstream of Brisbane, was a contributor to major downstream flooding (Queensland Floods Commission of Inquiry 2012). Flooding in Rockhampton reached its peak on 5 January, while the Brisbane River reached its peak on 13 January.

Throughout this time, there were significant impacts on stakeholders throughout Queensland food supply chains – producers, transport operators, processors, retailers, consumers and governments. Many actors experienced direct flooding and problems associated with flooded roads and supply routes, which prevented food from being delivered or received. The impacts mirrored those witnessed in the aftermath of other major climatic hazards around the world, in which food security can be compromised in relation to each of the four key 'dimensions' of food security - availability, accessibility, utilization and stability (FAO 2008). For example, in the wake of Hurricane Katrina in the US, there was evidence of enduring food insecurity and class/racial inequalities where food supply had stabilized (Rose et al. 2011). In Britain, flooding in 2014 highlighted the vulnerability of prime farmland (Doward et al. 2014). The 'polar vortex' experienced in the US in early 2014 resulted in some shortages of food for restaurants, supermarkets and food suppliers (Morton 2014). While there is no evidence that any Queensland residents suffered ongoing lack of food as a result of the floods, availability was compromised. Our analysis focuses on food security not only in terms of food consumption, but links this to the broader functioning of the food system at the regional/state level.

The following section outlines the impacts of flooding throughout the Queensland supply chain. We then focus upon the experiences, reactions and resilience of actors within: (1) long food supply chains, with a focus on supermarkets; (2) short food supply chains, with a focus on alternative food suppliers, and; (3) governments, at the national, state and local level.

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<sup>1</sup> Ethical approval was received for this project from the University of Queensland Behavioural and Social Sciences Ethical Review Committee. Ethical Clearance Number 2012000664.

### Impacts across the food chain

As flooding began in late November 2010, producers in different parts of the State began to feel the impacts, with floods ruining crops in fields, washing away topsoil and destroying farming machinery (CSIRO 2011b; Sydney Morning Herald 2011a). One representative from an agricultural peak body reported that: *“I saw people with acres of land just gone, gone. Never to be farmed again”*. Interviews indicated differential impacts based on farm size and farming approach. In the case of the Brisbane floods, one supplier in the community supported agriculture (CSA) sector reported a good level of resilience and stability among their local farmers, which they argued was due to *“smaller infrastructure”* and the fact that *“they can walk into their paddocks, whereas the other farmers need a tractor...they don’t need big armies of people to come out to work, they don’t need big machinery”*. By late December, flooding was causing closures of major roads. Sections of the Bruce Highway – one of the most heavily trafficked coastal roads in Queensland – faced closure for over a week between 3 January and 12 January. This highway is crucial for food supply and distribution, with 40 percent of the vehicles on the Bruce Highway typically carrying food (DAFF 2012). Road closures prevented food from reaching distribution centers and retailers, resulting in food shortages in some areas. The Bruce Highway enters Rockhampton via a large floodplain which is regularly subject to flooding. Since 2013, a key response from government has been to raise the level of the road to mitigate future flooding impacts. The Rockhampton airport is also located adjacent to this floodplain, and was also temporarily closed during the peak of flooding.

Throughout December and January, there were reports of shortages of food (milk, bread and fresh foods) and other essential items (petrol) throughout the State (Brisbane Times 2010, 2011a; Sunshine Coast Daily 2011). In Mackay, fast food chains ran out of chicken (Daily Mercury 2011) and the state beer, Fourx, was in short supply in many areas (Brisbane Times 2011a).

Direct flooding at Queensland’s largest central fruit and vegetable market, Brisbane’s Rocklea Markets, located on a known floodplain, also caused major issues in food supply (Singh-Peterson and Lawrence 2014). Flood waters peaked at Rocklea on 11 January (Brisbane Times 2011d), rendering the markets unusable for over a week (see Figure 1). Businesses, including the supermarkets, which relied on Rocklea for fresh fruit and vegetables, faced difficulties in sourcing fresh food. In Rockhampton, one wholesaler reported that: *“we can practically get back to normal as soon as the trucks start running. But because of the Brisbane situation that made it even more difficult”*. Retailers were forced to access food from interstate, despite delays and impacts on food quality and cost as a result.

Similar challenges were faced by food processors – milk processor Queensland Dairy Farmers reported that their processing capacity was down to only 10 percent of the usual volume, with difficulties getting the milk from farms to processing plants, and transportation complications in delivering milk and milk products to retailers in flooded areas (Brisbane Times 2011a). This crucial link between power and service outages and food security was also a strong theme for industry representatives in our interviews.

Customers were thus faced with limited availability of some fresh foods during and after the floods. Some interviewees, as well as media articles, indicated that food costs rose slightly as a result of the flooding, and there were reports of violent scuffles over food. However, ‘panic buying’ also had an important role to play in food shortages. There is an overall discourse of self-reliance and preparedness from government; for example, a storm-preparedness campaign by the Queensland government advises people to have three days’-worth of dry food available in their homes (Queensland Government 2014). Still, the Australian Department of Agriculture, Fisheries and Forestry (DAFF) reported instances of ‘inappropriate food purchases’, including people panic buying foods that perished when power went out, such as frozen foods and dairy products (DAFF 2012). As one agricultural peak body representative reported: *“As soon as [the food] got in, people just went and panic bought...all the major suppliers said, we’ll get food in.... But of course ... people panic and go ape”*. DAFF also reported that some sections of the community suffered from low levels of ‘food literacy’<sup>2</sup> during and after the floods, whereby people were not able to distinguish between ‘best before’ and ‘used by’ dates, leading to food wastage, particularly of dairy products. Some consumers had an inability to select otherwise safe fruit and vegetables in supermarkets, despite minor water damage; while others were either unable or unwilling to cook with the dry, packaged foods still available and plentiful during and after the floods (DAFF 2012). Our discussions with a community development officer in Rockhampton suggested that some lower socio-economic groups were particularly affected. Figure 2 illustrates the progression of key flooding and food security-related impacts in Queensland from December 2010 to January 2011.

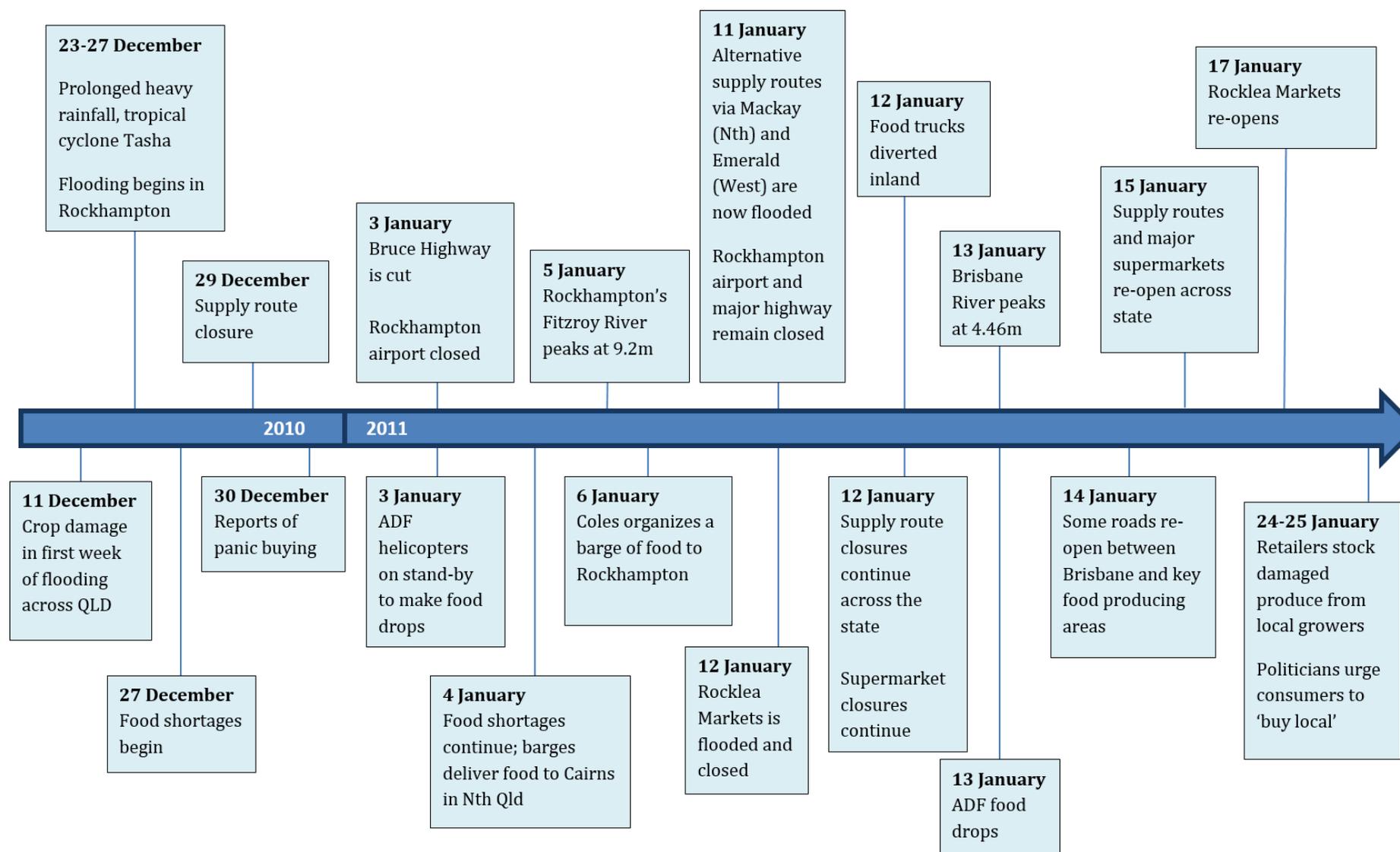
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<sup>2</sup> Food literacy captures people’s ability to identify and use fresh and nutritious food, ensuring a healthy diet and avoiding waste (DAFF 2012).

**Figure 1** Flooding at the Central Brisbane Rocklea Markets (*source: nearmap.com*)



**Figure 2** Timeline of key flood and food security events, 2010-2011



### Long food supply chains

In Queensland, and throughout Australia, two supermarket chains are the main source of food for the majority of consumers, with Coles and Woolworths gaining 80 cents of every dollar spent on groceries in Australia (Millar and Fyfe 2012). Alongside alternative food networks, supermarkets represent a key interface between the supply chain and consumers, and in recent times, these two main supermarkets have come to wield significant power over other actors in the supply chain (Millar and Fyfe 2012). As such, an assessment of the role and reaction of supermarkets can offer useful insights into the resilience of the ‘long food chains’ in Australia.

Supermarket chains Coles and Woolworths have been highlighted as being vulnerable to natural disasters, with ‘just in time’ supply systems posing serious risks in times of emergencies (Burton et al. 2013; PMSEIC 2010). As one supermarket representative reported, *“15 years ago we'd probably have 10 days' worth of food in the supply chain, now I think we're down to about three and a half”*.

During the flooding, supermarkets were closed in many areas throughout the state, some due to direct flooding and others as a result of power outages or the inability of staff to travel to work (Brisbane Times 2011a; Food News 2011). By mid-January during the floods, around 25 supermarkets had closed, many more were experiencing shortages, and dramatic images of empty supermarket shelves emerged (Sydney Morning Herald 2011b, 2011c; see Figure 3). This was in part due to road closures and damage to farmland, but also to panic buying (as described earlier).

Consumers outside the capital, Brisbane, are almost completely reliant upon fresh and processed foods from other regions or from interstate – mostly provided by supermarket chains. When Rockhampton was physically isolated due to road, rail and air closures, the supply chains were effectively broken. While in some areas supermarkets responded by increasing commitments to stock local produce following the floods, to assist *“farmers to get back on their feet”*, there were few local producers who were capable of stepping in to ensure food supply. This was a major problem, according to both industry and emergency relief groups, because *“[food supply] has to be consistent; it has to be a reasonable standard and quality.”*

**Figure 3** Empty supermarket shelves in Brisbane, January 2011



One interviewee reported that Woolworths had moved to distributed storage and delivery systems, reducing their reliance on the central market by establishing a number of distribution centers in different areas, thus introducing a diversity of options for where food could be stored or collected. As a supermarket representative reported: *“Woolworths had an external [distribution center] so they were in a position to get back on their feet a lot quicker than us. We [Coles] were relying on the [Rocklea] market which was not only compromised, it was devastated”*.

However, food shortages were temporary. Coordinated emergency response measures – bringing together retailers, logistics companies, charities and government agencies, as well as alternative transport options – allowed supermarkets to mobilize alternatives to road transportation. Barges, helicopters, planes and army vehicles helped to deliver food throughout the State (Brisbane Times 2011b, 2011c; Courier Mail 2011; Sydney Morning Herald 2011d). Transportation was organized by retailers themselves, as well as by local governments and the State government. Australian Defence Force planes and helicopters were also used.

Consumers remained more likely to rely on supermarket chains, regardless of the actual capacity of retailers to meet this expectation<sup>3</sup>. Some interviewees reported that smaller retailers and corner stores were not as impacted by shortages as large supermarkets. As a State Emergency Service Controller reported, *“people had a*

<sup>3</sup> Many supermarkets ran out of other essential goods (such as nappies, toilet paper, etc) - not just food - and most had less than three days' worth of food in the supply chain at any one time.

*better chance of actually getting milk and bread from service stations and the small shops than [from] the large shopping centers*". However, throughout the floods, responsibility for ensuring food re-supply to flooded areas sat mostly with large retailers. This was also the case for emergency supplies: the State Emergency Service, local council services (such as temporary refuges or information centers), and charity services (such as with the provision of food and drink vouchers) acted as intermediaries between supermarkets and end-point consumption, rather than extending their own strategies for procuring food from alternative sources when retailers themselves were unable to ensure food supply.

Throughout the floods, supermarkets were able to access significant assistance from governments in order to facilitate re-supply; the use of Australian Defence Force planes and helicopters is a striking example. Reliance on private retailers to ensure food security during a crisis appears to be an explicit strategy in food resupply discourse and policy by the Queensland Government. As one State government representative said: *"Wherever possible normal retail or wholesale resupply systems will be used"*. This highlights the general lack of public sector involvement in resupply of fresh food after a disaster, with the exception of facilitating transport where commercial arrangements were not possible. In contrast, commercial suppliers (that is, the major retailers) *"appear to be strongly motivated to maintain market share through rapid resupply"* (Dobes et al. 2012, p. 5), supporting a business-as-usual approach. Smaller retailers and alternative food networks were not able to access this level of government support.

### Short food supply chains

Much of the literature on food-system restructuring suggests that alternative food networks – such as local community gardens, farmers' markets, producer-consumer cooperatives, CSA and box schemes – represent a more resilient structure, particularly in the context of rural and community development, and social capital building (McCarthy 2014). For example, McCarthy (2014, p. 12) found 'sustainable food systems' in North Queensland – capturing community gardens, s, community farms, organics, farmers markets, farm gate sales, and box schemes - to be embracing *"self-help solutions in an unforgiving environment"*. Goodman et al. (2011) have argued that alternative networks are more ecologically-sustainable and socially-responsible than the mainstream supermarket food chains. However, there are concerns regarding the capacity of alternative systems to 'scale-up' (Mount 2011) or respond effectively during times of crisis.

We have found some evidence of resilience among alternative food networks during the floods. Our interviews suggested that some CSAs and farmers' markets were able to continue to source and deliver food from local producers during the crisis, while the larger retailers were not. For example, well-developed networks of trust and communication, and highly flexible modes of delivery enabled one particular not only to continue to provide fresh fruit and vegetables to members, but also to assist other food retailers, wholesalers and processors with their own flood responses, and to contribute fresh produce to emergency and charity organizations. As one representative recounted:

*People rang us and said 'the roads are closed, the police are blocking us and the army aren't allowed to drop produce into [a flood-affected community on the edge of Brisbane]... We could hear their pleas of distress on the radio, and residents who knew the community said, 'listen we've got boats, we know how to get around the cops, can we arrange a big delivery'... so we took the van full of produce, left the key in a hiding place and at about 3 o'clock in the morning they turned up, unloaded the van, took off and delivered it through the middle of the night. [Director Brisbane]*

In addition, these local organizations were able to use small trucks to access narrow back streets, where large food trucks would not be allowed to drive. Local geographical knowledge assisted with the identification of new road routes, to avoid flooded streets.

The quality of fresh produce from Alternative Food Networks was seen to be higher than that provided by supermarkets, due to the efficiency of the local distribution model in contrast to the long-haul road reliance of supermarkets. But unless consumers were already part of a box scheme, or regularly bought from farmers' markets, few ventured to the short supply chains to meet their needs during the floods. Those used to shopping at supermarkets simply awaited their re-opening.

Not all Alternative Food Networks were resilient in the short term. Some smaller community gardens, for example, were completely flooded, losing soil, food crops, flowers, trees and garden plots. They also lost volunteers who did not see a future for the garden. Lack of finance and people-power meant that recovery was slow. This was seen as low resilience, in terms of contributing to food security, as one garden manager explained:

*When the floodwaters went down, it was just a corner of mud basically. Volunteers said, 'there's no garden, so we'll just throw in the towel'... So our particular garden, I don't think offers a lot of resilience in that respect. It's probably easier for community garden-style things to contribute to San Francisco's food resilience than they are for Brisbane's.*

While the internal flexibility, diversity and adaptive capacity was generally high in Alternative Food Networks, their capacity to contribute to the resilience of the food system more broadly was limited by their exclusion from formal flood response or recovery processes. None of the Alternative Food Network actors in this study were engaged with government-led local disaster management groups or multi-stakeholder activities (such as those run by local or regional councils or retail consortia). One director explained that they had not been invited to council emergency response meetings in their area, despite playing a key role in assisting other actors with food storage, distribution and preparation. Instead, they set up their own collaborations with other civic groups on the ground.

Our interviews suggest a high degree of frustration from civic food actors with government processes. While both long and short food supply chains were able to mobilize resources and knowledge to maintain food supply, short chain actors came up against 'red tape' that delegitimized community members and groups' efforts at ensuring food security. For example, relief food not originating from a certified kitchen was rejected at Brisbane City Council depots; this prompted community members experienced at providing such food (*"we're talking about mothers who had supplied food to emergency relief efforts, grandmothers, who for years and years and years - and probably some of them supplied the war effort - [the Country Women's Association]"*) to provide this food to alternative supply chain actors instead.

Food charities also played an important role for some sections of the community. In some cases, charity services acted as intermediaries between retailers and end-point consumption (Smith et al. forthcoming 2015). These organizations were also excluded from discussions with governments. As one food charity suggested, *"that was frustrating, because we wanted to get food to [Rockhampton]. People were calling for food, and we had the food here [in Brisbane]."* For another farmers' market and community garden, interactions with local council were limited to immediate assistance for clean-up, rather than any longer-term discussions about their contribution to food security for the local community, or even to the productive viability of local food producers.

## Governments

Throughout the floods, local, state and federal governments played an important role in distributing food or assisting with food distribution. Local Disaster Management Groups and Local Disaster Coordination Centres overseen by local mayors were the most active in coordinating the flood response, including at times the emergency provision of food to residents who were cut-off from city centers by rising flood waters. The groups provided support to the community in terms of information and refuge (i.e. a council information 'tent' and community flood shelters), facilitating communication with electricity and other infrastructure providers (with implications for food safety), food vouchers to spend at local supermarkets, and some small grants to assist with flood damages (such as for buying new fridges to safely store food). They also coordinated with charities (such as the Red Cross) and other community groups (e.g. church groups) to some extent, although many key food charities were also left out, as described earlier. The Local Disaster Management Groups were also responsible for coordinating requests for assistance to state and national levels, where the required flood or food security response required exceeded the capacity of local actors. In terms of food security, the State Disaster Management Group was mostly responsible for managing road access and facilitating regulatory approvals for alternative modes of transport such as barges and boats, in coordination with the Department for Main Roads and Emergency Services Queensland. The national government was called in as a last resort; Australian Defence Force helicopters carried out emergency food drops as part of 'Operation Queensland Flood Assist', with around 45 tons of food distributed (PM Transcripts 2011). Nation-wide campaigns educating consumers to 'stock-up' on food essentials occurred both before, during and continued after the floods.

Despite the existence of a number of planning instruments for disaster management in Queensland at national, state, district and local levels, an independent commission of enquiry, following the 2011 floods, revealed that poor communication across levels of government was a significant challenge (Queensland Floods Commission of Inquiry 2012). Our interviews with supply chain and governance actors supported this, particularly when it came to organizing the resupply of food. A representative from Coles – a major retailer in constant dialogue with government processes during the floods – reported that:

*...unfortunately the way these things are structured, the state can't act until they've got a problem from the local government. These disaster management committees are key. So unless these guys admit there's a problem, the state won't get involved.*

Our analysis of the content of seven key Queensland Government planning documents<sup>4</sup> that guide disaster management at local, district, and state levels revealed two key limitations to the way that food security during flooding is currently governed. First, food availability is dependent on the ability of private retailers to secure their own food supply chains, with government playing a facilitation role rather than one of ensuring food security per se. As one State government representative stated: *“The major food wholesalers have taken measures to improve their holdings of essential supplies in Northern Queensland prior to the onset of the wet season as part of their risk management arrangements. So, in essence, this relationship facilitates implementation of business continuity by industry”*. This emphasis on retailers to maintain food supply emerges from all of the documents reviewed, as well as from interviews. The Local Disaster Management Group is the main government agency responsible for ensuring food supply to emergency shelters and isolated communities. Requests for further assistance move from local, to district and then to state Disaster Management Groups, with the State government only intervening when major retailers are unable to solve transport or logistics problems themselves. Normal retail channels are used wherever possible, with government playing a coordinating role, and facilitating alternative means of transport only when normal transport links are broken. One local State Emergency Service officer pointed out, however, that this process was confusing for retailers, consumers and emergency personnel:

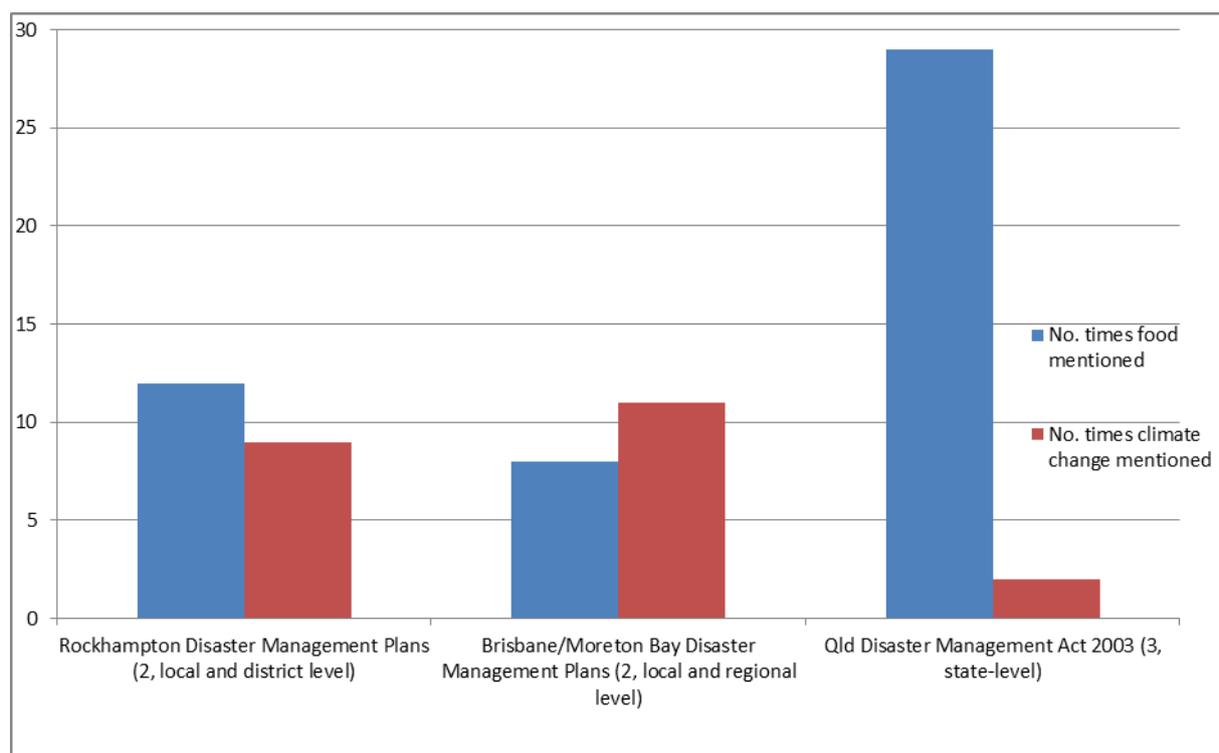
*Part of the resupply process is that people who need foods are encouraged to contact a shopping center or contact their chemist or whatever and organize for a food order and payment of those foods. We [the State Emergency Service] only have authorization to pick that food up. That worked relatively okay, but there were times where people just weren't able to pay for it - like when they had no power and no phones or internet - and ultimately the State Emergency Service has no capacity to actually go and buy it on their behalf. [State Emergency Service local controller Rockhampton]*

Second, the planning documents analyzed here are vague (at best) on the links between food security and climate change in a disaster context. For example, the Queensland Disaster Management Act mentions climate change only twice (see Figure 4), with food security mostly associated with short-term emergency relief or resupply. Climate change is identified as a hazard with medium overall risk to people, environment, business, lifelines, facilities and buildings. In some local plans the high risk of local flooding is specified, and the intermediate and long-term impacts of climate change are identified as posing a risk to specific local areas. Flood mapping by local councils is seen as a task related to climate change management projects, while other plans simply state that disaster risk reduction, disaster mitigation, disaster resilience and climate change adaptation policy and actions are aligned with international and national reforms, without giving more detail. Furthermore, Queensland no longer has an Office of Climate Change, abolished in 2012 with the return of a conservative government (Jones 2013), and only a limited number of climate change adaptation projects are managed within the Department of Environment and Heritage Protection.

The general invisibility of climate change connections was also reflected in the mainstream media at the time whereby, throughout the duration of the floods, there were very few media articles that made any reference to climate change, and no articles that pointed out climatic differences between the 2011 floods and previous floods of similar magnitudes (Holmes 2013).

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<sup>4</sup> Documents reviewed included: Rockhampton Regional Council Local Disaster Management Plan (Rockhampton Regional Council 2013); Rockhampton District Disaster Management Plan (Rockhampton District Disaster Management Group 2011); Brisbane District Disaster Management Plan (Brisbane District Disaster Management Group 2011); Moreton Bay Local Disaster Management Plan (Moreton Bay Regional Council 2013); Queensland Local Disaster Management Guidelines (Queensland State Disaster Management Group 2012); Queensland Resupply Guidelines (Queensland State Disaster Management Group 2012); Queensland Recovery Guidelines (Queensland State Disaster Management Group 2011).

**Figure 4** Analysis of food and climate content within Disaster Management Plans in Queensland

### Lessons for food system resilience

In addition to the challenges already facing current farming practices in Australia - soil degradation, salinization, water scarcity, and species decline among them (Lawrence et al. 2013) - floods in Queensland in 2011, and again in 2013, have revealed further examples of both resilience and vulnerability within Australia's food supply chains (Bartos and Balmford 2010; Singh-Peterson and Lawrence 2014; Smith and Lawrence 2014). In terms of vulnerability, the 2010/2011 floods caused unprecedented losses in farm production and disruptions to food delivery in rural as well as urban areas. The Australian government's Emergency Management Committee identified 'severe limitations' in the capacity of the nation to deal with these natural disasters (Walker and Bitá 2011, p. 8; see also PMSEIC 2010), while a federal government report highlighted problems with stakeholder communication (DAFF 2012). In terms of resilience, however, there were some examples of creative responses - with stakeholders exhibiting characteristics including utilization of a diversity of resources, flexibility, and cohesion along networks.

In summary, three key observations emerged, with implications for the capacity for building resilience to climate change-related disasters into future food systems in Australia and, potentially, elsewhere:

1. While resilience is certainly a key concept shaping government policy and discourse around disaster management, it is framed mostly in terms of business continuity and/or community self-sufficiency. Alternative framings of food system resilience that emphasize adaptation, learning, relationship-building and social wellbeing are less obvious, especially at district and state levels, with implications for long term transformation.

In the context of socio-ecological resilience (see Almås and Campbell 2012) resilient systems may make use of crises as opportunities for transformation, with a focus on adapting to disturbances, rather than simply recovering (Folke 2006). However, the responses to flooding in Queensland largely represent a *business continuity* approach to food security in the context of climate hazards – a neoliberalization of disaster response. The neoliberal ethos places emphasis on the capacity of private sector actors to achieve the best economic outcomes for society, demands that limits be placed upon the role of the state in economic and social matters, and encourages 'self-help' among (rather than government support for) citizens and communities (Cheshire and Lawrence 2005; Lawrence and Campbell 2014). The limited role of the state in disaster relief is largely consistent with the

neoliberal desire to limit government-based support mechanisms and promote a market logic in solving society's problems – no matter how potentially damaging the consequences might be (Busch 2014). In terms of food chains, we question the neoliberal logic of trusting the marketplace in matters of reliable food supply, and suggest that many factors – scale, diversity, flexibility and cohesion – must be taken into account in any attempts to understand resilience (Smith et al. forthcoming 2015). In other words, it is desirable to move beyond a narrow view of supply chains as either mainstream (critiqued for being 'neoliberal' and, largely, unsustainable) or alternative (promoted as being more resilient and responsive to local needs). In terms of community resilience and food security, there is a need for a broader appreciation of the important role of (a) community resources, such as social/economic capital, equity and well-being; (b) relationships, connectedness, networking and cooperation; and (c) information, communication flows, decision-making and social learning (Smith and Lawrence 2014) in responding to a flooding crisis.

Some of these processes were evident at the micro, local, level – for example, the use of social capital in CSAs. As outlined in Figure 5, both long and short food chains demonstrated characteristics of resilience, and were able to draw upon resources, networks and expertise in different ways in response to the crisis. These processes could be built upon at district and state levels. For example, better communication between government actors and large retailers around opening up transport routes would result in opportunities for more flexible responses and less 'red tape' for retailers. The need to involve the State Disaster Management Group in local access decisions could be reduced by giving more powers to local authorities to make key decisions that affect the local movement of food. While cooperation was formalized between government and long food chains, the bureaucratic nature of these relationships tended to hinder ad hoc responses that were needed. At the same time, supermarkets also become 'community hubs' in times of crisis, and many of the retailers we spoke with expressed a great desire to assist, for reasons beyond business continuity.

CSAs, by contrast, represent a small market share in terms of the quantity of food they distribute, including during the floods. CSAs are a recent phenomenon in Australia. While farmers' markets are growing in popularity, box schemes and 'alternative' food distribution networks are only beginning to generate community interest. Their small-scale nature limits their ability to provide a genuine alternative to the supermarkets. Still, the 'model' offers useful lessons for actors throughout the supply chain. These civic actors seemed to be less constrained by rules around transport and access, although much of their activity was done 'under the radar' of authorities. The example of the CSA using smaller trucks, back roads and local knowledge showed that community resources and social capital are high in these networks, with positive outcomes for food security. Ongoing financial (or other) support for networks that formed during the floods (such as relationships between civic organizations) and that contribute to food security could assist these networks to strengthen their connections outside of the crisis context, thus turning a positive experience into one of 'social learning'.

2. The reliance on national retailers to ensure food supply and availability during times of crisis has both positive and negative implications. It does allow the large retailers to undertake the task of resupplying regional supermarkets and providing emergency responses. But it also means that other important food security actors remain overlooked, or become excluded from decision-making.

Our analysis indicates that the impacts of the floods were felt throughout the food-supply chain. However, governance responses focused heavily on the role of the major retailers – in this case, the supermarket duopoly of Coles and Woolworths – excluding the important contribution that smaller retailers, alternative food networks, charities and others provide. Within the policy documents reviewed, discourses around defining risks and responsibilities were stronger than specific references to 'food'. Indeed, only one document mentioned food, and another did not reference it at all. The main risks related to food security identified include: loss of electricity (affecting food storage and safety); lack of community self-sufficiency; significant agricultural losses; and, risks to businesses and economic recovery that "may cause hardship in terms of provision of services, food supply, communications and social dislocation" (Moreton Bay Regional Council 2013, p. 86). This perception of business vulnerability does not seem to apply to food retailers, however, considering the strong discourse of reliance on these actors described above. Within policy documents, little attention is given to the overall resilience of supply chain structures, or to the vulnerabilities of agricultural industries or food transport logistics. The organizational vulnerabilities of supermarkets and their established supply chains (for example, related to their centralized structure) did not appear to be of concern for government actors, beyond interest in improving road infrastructure. A whole-of-chain approach needs to be incorporated into policy and planning, acknowledging the interconnected role of actors throughout the supply chain. Overall, the concentration of power between the two major supermarkets – linking to Boyd et al.'s (2008) reference to "undesirable socioeconomic states" – may represent the key source of vulnerability in the food chain.

Retailers recognized the need to evolve their business models to encourage more local sourcing. This was both due to a practical need to ensure constant supply and quality, but also to respond to consumer demands for supporting local farmers. One retailer applauded the benefits of bringing consortia, or groups, of producers and retailers together to facilitate more diverse networks for food sourcing. Interestingly, such a network was not ‘local’, but regional and inter-state, which may represent a conceptual mid-way point between long and short food supply chain models. Fundamentally, being ‘Australian-made’ was seen as more important (and more feasible) than truly ‘local’ sourcing. Finding incentives for retailers to strengthen local networks of producers in ways that support local social and ecological resilience is needed, but remains a major challenge considering the power imbalances in contractual agreements between large retailers and smaller producers (Richards et al. 2012). Finding avenues for long and short food chain actors to share their experiences of having to provide food during crises – as interconnected parts of Australia’s food system - might be helpful in creating more opportunities for adaptation and transformation to occur.

Conceptualizations of food security in Australia that focus only on farm production, productivity and supermarket logistics as keys to future success, exclude the experiences and needs of other stakeholders throughout the supply chain. Our findings show that a range of civic food actors – local food networks, food charities and community groups – add to the robustness of the food system in times of crisis because they are often more flexible, adaptive, and communicative (an important component of resilience). But they were left out of formal multi-stakeholder responses. Government efforts tended to focus on centralized and regulated emergency food distribution, and the community provision of food (such as community-run kitchens, volunteer cooking, etc) seemed to be discouraged, and regulated against. Reversing this trend would be helpful for improving the ability of community groups to provide food that they have available, potentially taking some of the strain off major retailers and government agencies.

**Figure 5** Performance of long and short food chains during the 2010/2011 Queensland floods

<b>Performance of Long Food Chains</b>	<b>Performance of Short Food Chains</b>
Facilitated the supply of food from inter-state, using national networks	Used alternative road routes, using local knowledge
Used alternative routes and modes of transport	Acted as a distribution hub for other food supply companies (including elements of long supply chains)
Negotiated with governments regarding road closures	Connected with local charities and communities
Purchased locally where possible	Donated food
Relaxed fruit and vegetable quality standards	Facilitated ongoing supply of local food
Major concerns: near total reliance on major road networks and centralized distribution centres.	Major concerns: marginal status among mainstream consumers and among state-based disaster authorities.

3. During the flooding crisis, discourses and policies that connected the problems associated with food security with the broader challenges of climate change were largely missing.

With widespread scientific consensus on the occurrence of human-induced climate change (IPCC 2014), there is a need to incorporate the expected impacts of climate change throughout the supply chain, into planning, policy and disaster response. Overall, the flooding event does not appear to have resulted in significant changes and adaptation within Queensland’s food system, particularly with regards to climate change. Climate change scientists have predicted that Queensland is expected to experience increasing temperatures, water shortages, a 60-140% increase in severe storm activity, and more intense tropical cyclones, culminating in a 33.5% decline in beef production and a 17% decrease in sugar production by 2050 (beef and sugar are two of the State’s main farm outputs)(Australian Government 2014). Beyond some community-level planning between local government and citizen groups, we did not find evidence of retailers or other key food supply chain actors engaging with, or responding to, community perspectives on building a more resilient food system. The exception to this was in the discourses of transformation described by some civic foods CSAs. There appeared to be a gap between the kinds of food security challenges experienced during the acute period of crisis – with a strong focus on infrastructure, transport and ensuring continuity of business - and longer-term planning around climate change and food security, which will capture impacts on food production, availability, costs and health implications.

As such, adaptation and policy responses need to establish links between immediate, short-term food security challenges, such as those experienced during the floods (but potentially also other ‘disturbances’), and longer-term planning around climate change. One step towards this goal is to explicitly link the process of

constructing community-level food plans (as occurred in Rockhampton) with other participatory governance processes around climate change planning.

## Conclusion

While Queensland did not experience an enduring period of food insecurity, the Queensland floods have highlighted elements of vulnerability and resilience along both long and short food chains. While long food supply chains were able to leverage from relationships with government, and source food from other states and regions, their centralized distribution systems suffered when major centers were flooded. Short food supply chains, in contrast, were excluded from conversations with state and local governments, but some were able to use their smaller size and unique local knowledge to maintain supplies of food throughout the floods. Examination of the floods also opens insights into the links between climate change and food security, and the importance of acknowledging the impact that climatic hazards can have on all actors within supply chains. While the reactive responses witnessed during the floods are viable for immediate crises (including the use of army helicopters, barges, new trucking routes and temporary food distribution centers), there is a strong likelihood of increasing frequency and intensity of events such as the 2010/2011 floods. In this context, there is a need for deeper transformations within the food system, including mitigation as well as adaptation. This paper has shown that, beyond the need to meet immediate consumer demands, a broader view of food security is needed that also encompasses resilience concepts. Importantly, multi-stakeholder coordination at the local and state level needs to be improved to overcome what are currently real, and serious, communication difficulties. Longer-term solutions need to engage the creativity of stakeholders throughout the supply chain, encouraging diversity and ensuring that business goals align with goals of food security and community well-being.

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