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Water sharing risk in agriculture: Perceptions of farm dam management accountability in Australia

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ABSTRACT

Sources of water have always been critical to the success and sustainability of agricultural businesses. But with demand for food and climate variability increasing globally, pressures have been mounting on farmers to capture, store and use more water to achieve higher yields under worsening extremes of drought and flood. These pressures are causing farmers to store excessive water for irrigation unfairly in times of drought. This has the secondary consequence of creating unsafe structures in times of flood, which can be devastating for downstream communities and businesses. Hence the need for accounting and accountability for fair and safe water sharing has arisen in Australia. However, prior research has found complacency amongst farmers to be common. When combined with a disjointed policy response by government, in addition to recent objective evidence of different farm dam water storage and sharing practices around Australia, further investigation of how farmers perceive dam management, regulators, regulations, and other stakeholders in different farm dam policy environments is critical. A survey of 404 farmers in four different states in Australia finds a large percentage of farmers undertaking high risk farm dam behaviours because of concerns about the future of runoff in their region. Whilst farmers in weaker policy environments are more likely to undertake high risk behaviours, farmers across the sample identify farm dam financial and operational concerns such as budgeting and bank lending to be of importance. The findings further highlight the need for involvement of other key stakeholders, such as banks and financial institutions to be involved in developing strategies to generate improved accountability for risk reduction.

1. Introduction

Agriculture uses 70% of all fresh water (Food and Agriculture Organisation of the United Nations (FAO), 2013) with irrigation accounting for 66% of all water withdrawals (Scanlon et al., 2007). Internationally in tropical, subtropical and Mediterranean climates, it is often essential for dams to be constructed on streams or to capture surface water runoff to facilitate off-season storage of vital water supplies for farming operations (Stephens, 2010). Farm dams are an especially critical component for dryland agriculture (Savadamuthu, 2002; Teoh, 2002) where year-round reliance is solely on rainfall and runoff (Callow and Smettem, 2009).

Water storage behind farm dams means a reduction of the total quantity of water available to other farmers, businesses, community members and the downstream environment. This impact is greater the larger the dam, such as with public dams and, more commonly, when many small dams create a cumulative barrier to run-off (Pisaniello et al., 2011). It is acknowledged that most farm dams are relatively small and designed for stock and domestic use, however farm dams capture all of the runoff that reaches them until they are full (and then flows occur through the spillway[1] (Lewis, 2002)) and as such, 'many small dams can add up to a lot of interception' (Young and McColl, 2009, p. 31). Because of this cumulative effect of farm dams, it means the first significant rains are taken and then the magnitude of flows is progressively reduced before reaching downstream water-dependent ecosystems and habitats of plants and animals (McMurray, 2007; National Water Commission (NWC), 2005). Furthermore, with growing global food requirements and greater climate variability, there is an incentive

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[1] The spillway is a critical part of surface water storage design as it provides the release of flows from a dam into a downstream area for equitable continuation of water flows throughout a catchment and ensures that the water does not overtop and damage or destroy the dam.

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for farmers to store excessive water unfairly in times of drought (Gordon et al., 2010) through relatively simple activities such as spillway blocking[2] (Pisaniello et al., 2012; Smith, 2001).

Such unfair water management is exacerbated by the additional risk of structural failure and downstream disaster in times of intense rainfall (Lewin et al., 2003; Pisaniello and McKay, 2007). As Pisaniello et al. (2012) report, farm dams usually are only designed to withstand the risk of 1-in-100 year floods (i.e. 1% in any given year) as they are generally perceived to pose a low hazard, however in Australia most private farm dams, including many that are hazardous, actually have design lives much less than this minimum standard (Pisaniello and McKay, 2007). Fourteen lives have been lost from 52 recorded dam failures in Australia, but the failure incidence has doubled every quarter century and as the dams get older the annual number of failures and disasters are set to rise (Pisaniello et al., 2012), highlighting the need to account for the risks of unfair farm dam water storage sharing (Water Accounting Standards Board (WASB), 2010). This provision of an account for farm dam water provides an accountability mechanism for government, who through the reporting of water accounting data use an information strategy to help stakeholders and the community make decisions (Gunningham and Grabosky, 1998; Pisaniello et al., 2011).Whilst Young (2014) reinforces the need for hydrological integrity in water management, prior research reveals that diversity in policy settings and incoherent implementation of accounting for farm dam water sharing risks by agricultural businesses mean that it is difficult to establish accountability for water management at the farm dam level (Pisaniello et al., 2012; Tingey-Holyoak et al., 2013).

Prior research on farmer perceptions about on-farm water storage risks, indicates how regional location may influence these perceptions and findings suggest broad scale obliviousness amongst farmers (Pisaniello, 2010). This has been furthered recently by actual objective evidence of spillway blocking behaviour demonstrating the great extent of the on-farm water storage risks around Australia (Pisaniello et al., 2012). To support the necessary development of policy benchmarks insurance policy mechanisms to overcome unsafe farm dam practices, Pisaniello et al. (2012) garnered widespread photographic confirmation of high risk of farmer behaviour around Australia with 55% of spillways blocked across a sample of 504 publicly visible dams.

This paper advances the previous farmer perceptions studies, combined with evidence from the field, to investigate farmer perceptions of dam management, regulators, regulations, and other stakeholders, such as insurers, to further understanding of how potentially unfair and unsafe water sharing can be avoided.

The following section presents the background to the problem including the environment of accounting and accountability for farm dam water sharing in Australia.

2. Water sharing risks in agriculture in Australia

Regional and global water planning must address questions of environmental, social and economic resources and the equity of how water is shared, for example, for satisfaction of stock and domestic use, irrigation for farming businesses, agricultural community needs, water trade, maintenance of ecological systems and environmental flows and services, for current and future generations (Goodland and Daly, 1996; Wheeler et al., 2013, 2014). To this end, multiple tools have been developed for accounting for agriculture water resources, for example: 'spatial-scales' approaches to areas of interest such as catchments, or basins (Cooper and Bottcher, 1993), water pricing (European Environment Agency, 2008), water sustainability indices and guidelines (Loucks, 2000), Integrated Water Resources Management (IWRM) (European Commission (EC), 2000), water foot printing (Ridoutt and Pfister, 2010) and more recently general purpose water accounting (Water Accounting Standards Board (WASB), 2010). These seek to measure, monitor and report on water in order to achieve trade-offs between different water management objectives, including environmental sustainability, economic efficiency and social equity, all with implications for fair water sharing and disaster mitigation (Global Water Partnership (GWP), 2000; Muller, 2007; Tol, 2005).

However, in Australia, water use associated with surface water storage is usually only partially accounted for (National Water Commission (NWC), 2005). The general purpose Australian Water Accounting Standard 1 (AWAS1) established based on financial accounting principles was designed to provide a solution to disaggregated and varied systems and failure to capture small surface water stores (Water Accounting Standards Board (WASB), 2010). Major challenges have been identified and the lack of widespread adoption could be attributed to the fact that entities are only vaguely defined (Water Accounting Standards Board (WASB), 2010, p. 31), in addition to the unsuitability of financial accounting based methods for internal (farmer) decision making about water (see Chalmers and Godfrey, 2012). Furthermore, the standard being voluntary means it is not likely to be by managers of the hundreds and thousands of smaller storages in Australia (Baillie, 2008) that, when considered on a cumulative scale, need to be accounting for their water sharing risks, including structural safety, if lives and the environment are to be placed at less risk (Tingey-Holyoak et al., 2012).

The main drive for government level accountability for agricultural surface water storage has been on accounting for 'new' dam applications or very large irrigation dams. As such, for existing dams, most states are currently developing a range of new accountability tools, such as structured metering and accounting initiatives. However, such schemes have been fully realised to a limited extent at the present time, and whilst it is possible to include existing dams through metering and accounting programs, so far these have been poorly implemented (National Water Commission (NWC), 2011). This inadequate metering and accounting also limits participation in market-based water trading mechanisms by farmers storing surface water in farm dams. New systems are being developed that would allow farm dam storages to be a part of market-based water trading through computer modelling that captures investment decisions for new agricultural water storages (e.g. "Dam Ea$y", Lisson et al., 2003), but again these are only for new, rather than existing storages of this type.

Despite the drives toward accounting and accountability tools such as metering and market-based mechanisms, these do not take the safety risks of unfair sharing into account and may even provide an incentive to hold excess surface water. Australian agricultural businesses are already storing more than their entitlement (Pisaniello et al., 2012) and consequently dams have failed in the thousands (Pisaniello and McKay, 2007). Safety must be considered as a critical part of the accounting and accountability for on-farm surface water sharing risks in agriculture (Pisaniello and Burritt, 2010; Pisaniello et al., 2011) and internationally, best practice policy mechanisms, requiring the proper management of farm dams at both the individual and cumulative levels, are emerging to provide assurance about equity and safety to communities and businesses downstream (such as the UK and Canada, see Pisaniello et al., 2013 for more detail).

[2] When a spillway is blocked in times of water shortage, water is inequitably stored, flow volumes are reduced and the susceptibility and vulnerability of businesses, the agricultural industry, society, and ecosystems to the problems that arise from water scarcity are increased (Pisaniello et al., 2011).