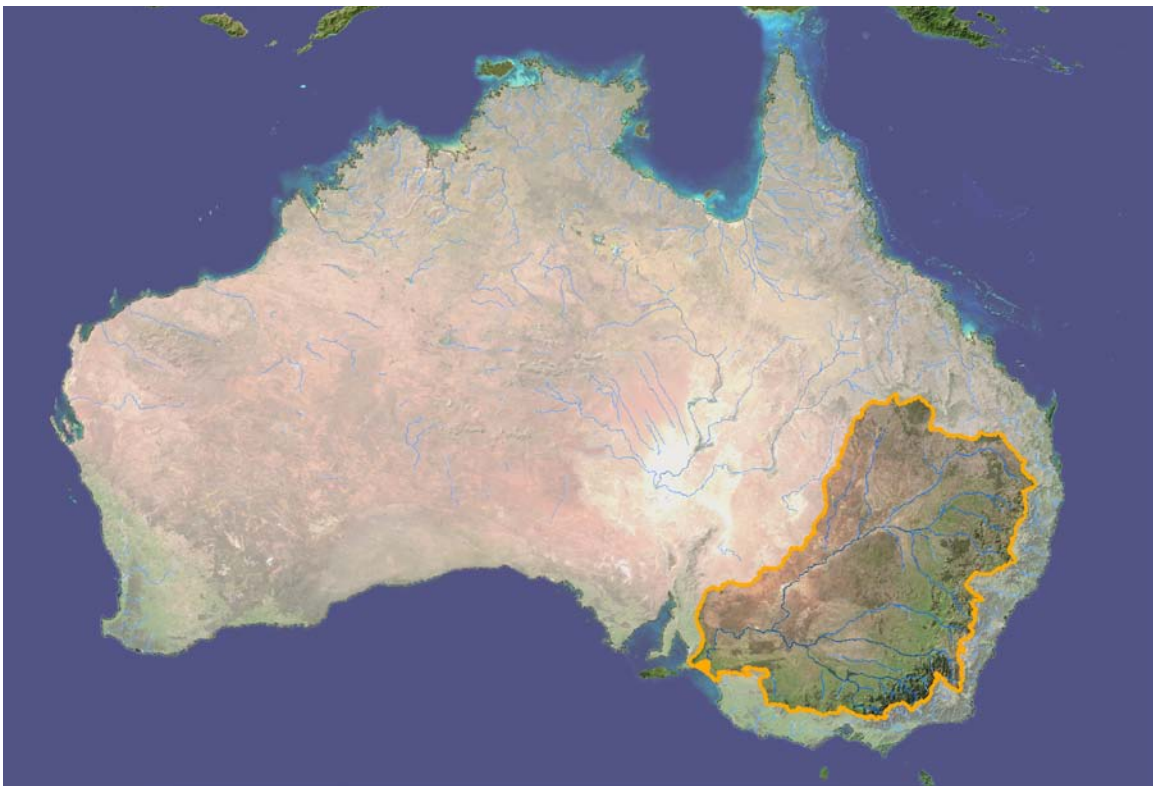

Murray-Darling Basin Authority, Australia

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Context

The Murray and Darling are the longest rivers in Australia and drain the Murray-Darling Basin (MDB or the Basin), a region in the southeast part of the country of over a million square kilometers that comprises around a seventh of Australia’s land mass (Pittock and Finlayson 2011a). The MDB is very flat, old, and salty, and the rivers have some of the most variable flows in the world. The Basin is characterized by high biodiversity—from alpine ecosystems in the Australia Alps in the southeast to semi-desert in the northwest and an extensive area of lakes and estuaries where the Murray enters the Southern Ocean. Large floodplain forests and other wetlands occur over 5.7 million hectares, 637,000 hectares of which are designated as Ramsar wetlands of international importance (sixteen sites total) (Kingsford et al. 2004; Pittock et al. 2010). The northern Basin receives erratic summer rainfall and supplies around 10% of inflows. The southern Basin has been dominated by winter rainfall: runoff derived from the Alps supplying 50% of Basin river flows (Chiew, F.H.S. et al. 2008).

The contested management of this resource dominates institutions in the water-scarce Basin (Connell 2007). The Basin is home to 2 million Australians and supplies water to a million more. Agriculture uses 68% of the Basin’s area to produce 41% of total national farm output, valued at more than AUD$14 billion on average per year. Half of this farmland is supplied by irrigation

(ABS et al. 2009). This extensive exploitation for human use has led to over-extraction, with end-of-system flows falling from 41% before development to an average of 16% now. The river mouth was closed from 2002 to 2010 due to over-extraction and climatic variability (CSIRO 2008; Pittock et al. 2010). Further complicating the situation, indigenous communities are increasingly reasserting their traditional rights to the resources of the Basin (Weir 2011; Jackson 2011).

Climate Change

The Basin's ecosystems have been extensively impacted by habitat conversion for agriculture, exploitation for water resources, and invasion by exotic species. Currently, and in the medium term, these factors have a greater influence than any forecast impacts of climate change (Pittock et al. 2010). The Basin's climate is extremely variable, oscillating between drought and flood. Because much of the Basin's inflows are derived from the Mediterranean climate zone in the southern Basin, inflows are at great risk from increased temperatures and evapo-transpiration (Cai and Cowan, 2008).

A major government climate and hydrological modeling program has produced forecasts of water availability in the Basin for the period up to 2030. Under these models inflows are predicted to change between +7% and -37% of current availability and outflows to change between +20% and -69% (CSIRO 2008). This range of possible outcomes has created challenges for effective adaptation. During the historically unprecedented 2002-2010 Millennium Drought, by 2010 inflows had fallen by 63%, and the river mouth had closed and was being maintained by dredging. In the southern Basin there is emerging evidence of higher temperatures and declines in snowfall, snow melt, and autumn and spring rainfall as the subtropical ridge moves farther south, off the continent (Cai and Cowan 2008; Murphy and Timbal 2008; Timbal 2009; Timbal and Jones 2008; Schofield 2011; Fredericksen et al. 2010). Also during the Millennium Drought, higher temperatures, water exploitation, and reduced inflows resulted in loss of floodplain forests and other wetlands and increased salinity, cyanobacteria blooms, and the oxidation of sulphate sediments to form acid. Climate change is likely to exacerbate these impacts (Pittock and Finlayson 2011a; Pittock et al. 2010).

Institutional Description and Response to Climate Change

The Basin is governed through a complex set of institutions that emerged from 18th-century debates over how to manage the transboundary river system under a federal system of government (Connell 2007). Connell describes eight periods of institutional reform in basin management, beginning in the late 19th century with a focus on water allocations and river transport and broadening late in the 20th century to focus on water quality and quantity and other natural resources. The focus was radically reformed again in 2007 in response to the Millennium Drought and the prospect of climate change (Connell 2007). From 1994 to 2007, the six state governments and the Australian federal government shared oversight through a consensus-based Murray-Darling Basin Commission. Unfortunately, the commission was criticized for being slow and for taking lowest common-denominator decisions (Connell 2007). Numerous national policy decisions for more sustainable water management have been made, including those to regulate inflow interception activities (such as farm dams and plantations) and for adequate environmental flows, but none have substantial incentives or penalties for compliance and as a result have been inadequately implemented by state governments (NWC 2009; Young 2010; Pittock and Connell 2010).

Climate Change is water change, and therefore water management is a key component of adaptation (Bates 2008). In the Basin, management of non-climate and climate change impacts on water are inextricably linked (Pittock et al. 2010). The natural variability in the climatic and hydrologic cycles has required Australian water to be managed adaptively, for example, through high per-capita levels of storage (Pittock and Connell 2010). However, the Millennium Drought revealed that some agriculture portfolio drought adaptation measures conflict with water portfolio climate change adaptation measures. For example, subsidies for storing more water on farms and drought subsidies to encourage farmers to stay until conditions return to “normal” (versus a scheme to purchase water entitlements from irrigators) decrease river flows (Pittock and Connell 2010).

As a result of lessons learned from problems in the United States, Australia’s water entitlements system is largely based on the principle of ownership of a share in the available water resource in a particular period—more generous in wet periods and reduced proportionally in dry periods—rather than the less flexible prior appropriation (“first in time, first in right”) or riparian (“any reasonable use by riverside landholders”) doctrines (Pittock and Connell 2010). After the 1990s Australia moved to harmonize water entitlements between states and to separate water and land titles in order to establish water markets that would reduce transaction costs. This allowed low-value water users to sell entitlements to higher-value users (Connell 2007; Productivity Commission 2010; Young 2010). Following the capping of surface water diversions in the Basin based on 1994 levels, water trading has enabled economic growth with limited water and greatly reduced the economic impact of drought (Grafton 2011). However major flaws and loopholes in the regulatory framework for the water market have temporarily increased water diversions and had adverse impacts on the environment, such as conjunctive management of groundwater and inflow interception activities, that are still being rectified (Young 2010).

In response to the stress of the Millennium Drought, the federal government adopted a new Water Act in 2007-08 (the Act) with a constitutional mandate drawn largely from implementation of the Convention on Biological Diversity and the Ramsar Convention on Wetlands (Pittock et al. 2010). The Act establishes a process for adopting a “sustainable diversion limit” and centralized management through its new Murray-Darling Basin Authority (the Authority), which has a difficult relationship with the states because they retain local management capacities (Connell 2007; Commonwealth of Australia 2008). The Authority has been charged with producing a Basin Plan (after consultation with stakeholders) for the consideration of the federal parliament in 2012. The Basin Plan will set new sustainability standards for managing water in the Basin (including measures to address anticipated climate change impacts) that the states are then to implement through approximately twenty sub-basin plans that must be accredited by the federal government (MDBA 2010). It is anticipated that the Basin Plan will be revised on up to a ten-year cycle. In 2010 a science-based but compromised Guide to the Basin Plan was published, proposing a reallocation of 3,000-4,000 GL (27%-37% of the current diverted water) to the environment. However, due to irrigation industry backlash, further compromises that will jeopardize the effectiveness of the Basin Plan are being considered (Pittock and Finlayson 2011b).

At the same time as the establishment of the Authority, three other institutions were created that may enhance adaptive management through greater accountability and polycentric governance. Water accounting was nationalized through the Bureau of Meteorology (BoM) to ensure adequate and consistent data for management. The water market is now regulated

by the Australian Competition and Consumer Commission (ACCC). Most important for the environment, federal government water entitlements are now owned and managed by the Commonwealth Environmental Water Holder (CEWH). Connell argues that this mechanism for central management of growing environmental water holdings may obviate flaws in the Basin Plan institutions (Connell 2011). In particular, the CEWH model makes environmental water a legal entitlement equal to commercial holdings, rather than the previous approach by the states where the environment was supposed to be supplied by "rules-based" (leftover) water that largely disappeared through administrative reallocation in times of scarcity (CSIRO 2008; Connell 2007).

The Authority is required to specifically consider climate change, but bases its response on the Commonwealth Scientific and Industrial Research Organisation's (CSIRO) median-impact scenario rather than on the equally likely and more risky extreme dry scenario (Pittock and Finlayson 2011b; CSIRO 2008). In the Guide to the Basin Plan, the Authority proposes to manage climate change risk in three ways: reallocating 3% of diversions to the environment in the first Basin Plan period, relying on the proportional reduction of water entitlements in dry periods, and revising the Basin Plan every ten years (Pittock and Finlayson 2011b; Schofield 2011). This limited approach to managing risk has been criticized for failing to adequately anticipate and manage the types of severe impacts experienced in the Millennium Drought (Pittock and Finlayson 2011b).

Discussion of Most Important Climate-Adaptive Principles

Resources

Also parallel to the organizational reforms have been efforts by the federal government to acquire more water for environmental flows—including for reduction of climate change impacts—through the expenditure of around AUD$14 billion (AUD$1.00 ~= USD$1.06) in the past decade. Initially the conservative federal government invested only in agricultural water efficiency and in "environmental works and measures" (environmental "water demand management") that proved to be uncertain, expensive, and inefficient in its efforts to return water to the environment (Pittock and Lankford 2010; Productivity Commission 2010; Grafton and Hussey 2007). A new federal administration in 2008 allocated AUD$3.1 billion to purchase water entitlements and AUD$5.8 billion for agricultural water efficiency projects (DEWHA 2010). Since then, the federal government has acquired around a quarter (750 GL bought in average annual entitlements to June 2011) (DSEWPAC 2011) of the water required to reach a sustainable level of extraction, and it could achieve an adequate outcome if the "efficiency" funds were reallocated (Pittock et al. 2010; WGCS 2010).

In the current round of reforms, federal funds were used to gain agreements from the states through reforms by infrastructure grants for agricultural water efficiency of dubious value (Pittock and Connell 2010; Grafton and Hussey 2007). However, these funds have not been adequately used as outcomes-based incentives for the states to make necessary changes—unlike with the microeconomic reforms to the water sector in the 1990s (Pittock and Finlayson 2011b). Market-based incentives through water trading have had positive socioeconomic results but adverse environmental impacts due to design flaws (Young 2010; Grafton, 2011). Consequently, there have been adequate resources for effective adaptation, but these need to be better targeted to be effective.

External Regime

As mentioned previously, the Federal Water Act largely draws its mandate from implementation of the Convention on Biological Diversity and the Ramsar Convention on Wetlands, which establish high “environment first” standards, such as the requirement in most circumstances to maintain the “ecological character” of wetlands—even in the face of climate change (Pittock et al. 2010). This has created conflict with irrigators and politicians who favor trading environmental measures for socioeconomic benefits, and it may lead to the Basin Plan being contested in the courts.

The federal government has attempted to codify who bears the water loss anticipated due to climate change, but conflicting policies are proposed. The National Water Initiative states that after dealing with historical over-extraction that additional reductions will be borne by consumptive users, whereas the Authority proposes to share losses equally between the environment and users (MDBA 2010; Commonwealth of Australia 2004; Pittock and Finlayson 2011b). This issue is unresolved and is becoming more complicated (or the risk is being spread) as the environment is increasingly being supplied by a mixture of entitlement- and rules-based water (as discussed above).

Finally, there is a significant threat to water in the Basin thanks to poorly integrated policies of other sectors, such as climate change mitigation measures (Pittock 2011). For example, federal government climate change policies favor thirsty renewable energy and carbon sequestration technologies; energy policy favors unconventional natural gas production, which will have substantial impacts on aquifers (Pittock 2011; NWC 2010). While the National Water Commission has strongly argued for better policy integration (with little success), the Authority has been largely silent on these questions. More effective integrated governance is needed to minimize adverse impacts of policies from other sectors.

Legitimacy and Accountability

Australians largely expect governments to intervene to set high standards for environmental management, especially for water (McAllister 2008). The legislation establishing the Authority and the Basin Plan process was adopted with bipartisan support, but the Authority has squandered its legitimacy through an overly technical, backroom planning process that did not adequately engage stakeholders.

The Authority and the Basin Plan are accountable to the federal parliament. However the options for enforcing the legislation and the Basin Plan are limited. The Water Act does not include third-party enforcement provisions. While the federal government must accredit the state sub-basin implementation plans and, in theory, could write its own plans if the states fail to adequately do so, in practice it is hard to see how they could effectively supplant the states in day-to-day local management. This means that further compromises are likely with the states. A major gap in the Australian system is the lack of a provision for noncompliant states to be taken to court (versus, for example, the European Commission’s capacity to prosecute EU member states in the European Court of Justice when they fail to adhere to the Water Framework Directive). More effective accountability mechanisms would aid the Authority’s implementation of the Basin Plan and allow the Authority to be more climate-adaptive.

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