



Impact of water scarcity in Australia on global food security

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Outline

- Importance of water for irrigation
- Forces challenging global food security
- Global water supply and demand
- Global food supply and demand and the drivers
- Water scarcity and food security linkages
- Global food market and virtual water flows
- Australia's agricultural production and impact of recent droughts – linkage to global food supply
- Future food security measures
- Conclusions



Importance of water for irrigation

- Water is a key driver of agricultural production and critical for future global food security.
- Irrigation has helped boost agricultural production in semi-arid and even arid environments and stabilized food production and prices and the revenue from farming.
- Only 18% of agricultural land cultivated through irrigation supplies 40% of the world's food and has thus brought substantial socio-economic gains.
- Water scarcity can cut production and adversely impact food security.
- However, water for agriculture and food security has been threatened by increasing non-agricultural uses, such as industry, households and the environment.



Global water supply and demand

- Global demand for water has tripled since the 1950s, but the supply of fresh water has been declining.
- Half a billion people live in water-stressed or water-scarce countries, and by 2025 that number will grow to three billion.
- Irrigated agriculture is the dominant user of water, accounting for about 70% of global water use.
- Population and income growth will increase the demand for irrigation water to meet food production requirements and household and industrial demand.
- By 2025, global population is projected to increase to about 9 billion.



Global water supply and demand conti...

- The limited easily accessible freshwater resources are declining due to over-exploitation and water quality degradation.
- Worldwide cereal and meat demand will increase by 65% and 56%, respectively.
- Fulfillment of calorie requirements and dietary trends will translate into even higher water demand if the food produced is to supply more nutrition.
- Water is no longer abundant and the high economic and environmental costs of developing new water resources limit expansion in its supply.
- Climate change is believed to increase water scarcity in the coming decades.



Water scarcity concerns

- About 450 million people in 29 countries currently face severe water shortages;
- About 20% more water than is now available will be needed to feed the additional three billion people by 2025;
- As much as two-thirds of the world population could be water-stressed by 2025;
- Aquifers, which supply one-third of the world's population, are being pumped out faster than nature can replenish them;
- Half the world's rivers and lakes are seriously polluted; and Major rivers (such as Murray, Ganges and Colorado) do not flow to the sea for much of the year because of upstream withdrawals.



Severe water shortages

- Some of the most densely populated regions of the world, such as the Mediterranean, the Middle East, India, China, and Pakistan will face severe water shortages in the coming decades (Postel and Wolf, 2001)
- Even areas of the USA (such as the southwest and parts of the Midwest) and Australia are vulnerable to water shortages.
- Rosegrant and Cai (2002) estimated that under their baseline scenario, total global water withdrawals for agricultural, domestic, and industrial use will increase by 23% from 1995 to 2025.
- The challenges of water scarcity are heightened by the increasing costs of developing new water sources, land degradation in irrigated areas, groundwater depletion, water pollution, and ecosystem degradation.



Global food supply

- Global food production comes from 1.5 billion ha of cultivated land, representing 12% of the total land area (Schultz and De Wrachien, 2002).
- Irrigated agriculture covers about 270 million ha or 18% of arable land but contributes 40% of agricultural output.
- In the last 50 years, cropland has been reduced by 13% and pasture by 4%.
- World agricultural production growth is expected to fall to 1.5% per year to 2030 and further to 0.9% to 2050, compared with 2.3% per year since 1961 (FAO, 2003).
- Deceleration of agricultural growth will affect world food security.



Drivers impacting food supply

- The key drivers which have impacted and will impact on food production include: water (and to some extent land) crisis along with climate change crisis, credit crisis and energy prices:
 - Water scarcity
 - Climate change
 - Energy crisis
 - Credit crisis
- Other key factors affecting food supply
 - Decline in per capita arable land
 - Decline in investments in agricultural research



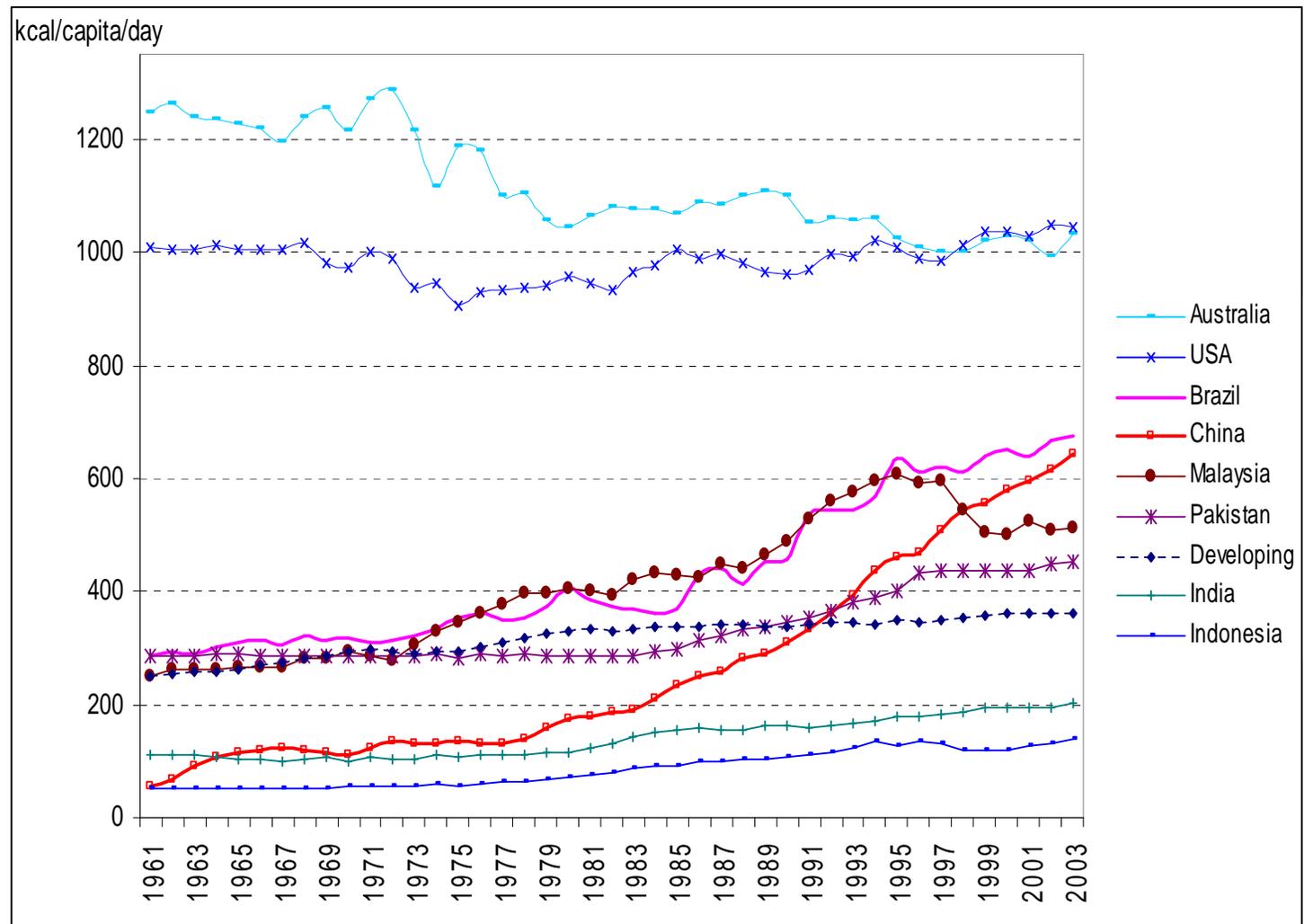
Drivers impacting food demand

- Growing populations.
 - Growing population in Asia requires an increase in cereal grain production of 344 million metric tons (MMT) from 1997 to 2020.
 - Of the 557 MMT global increases, China comprises 26% and India 12%.



Trends in calorie consumption from animal food items 1961 – 2003.

More affluent population tend to diversify diets towards animal food items which require several multiples of water per calorie of dietary energy.





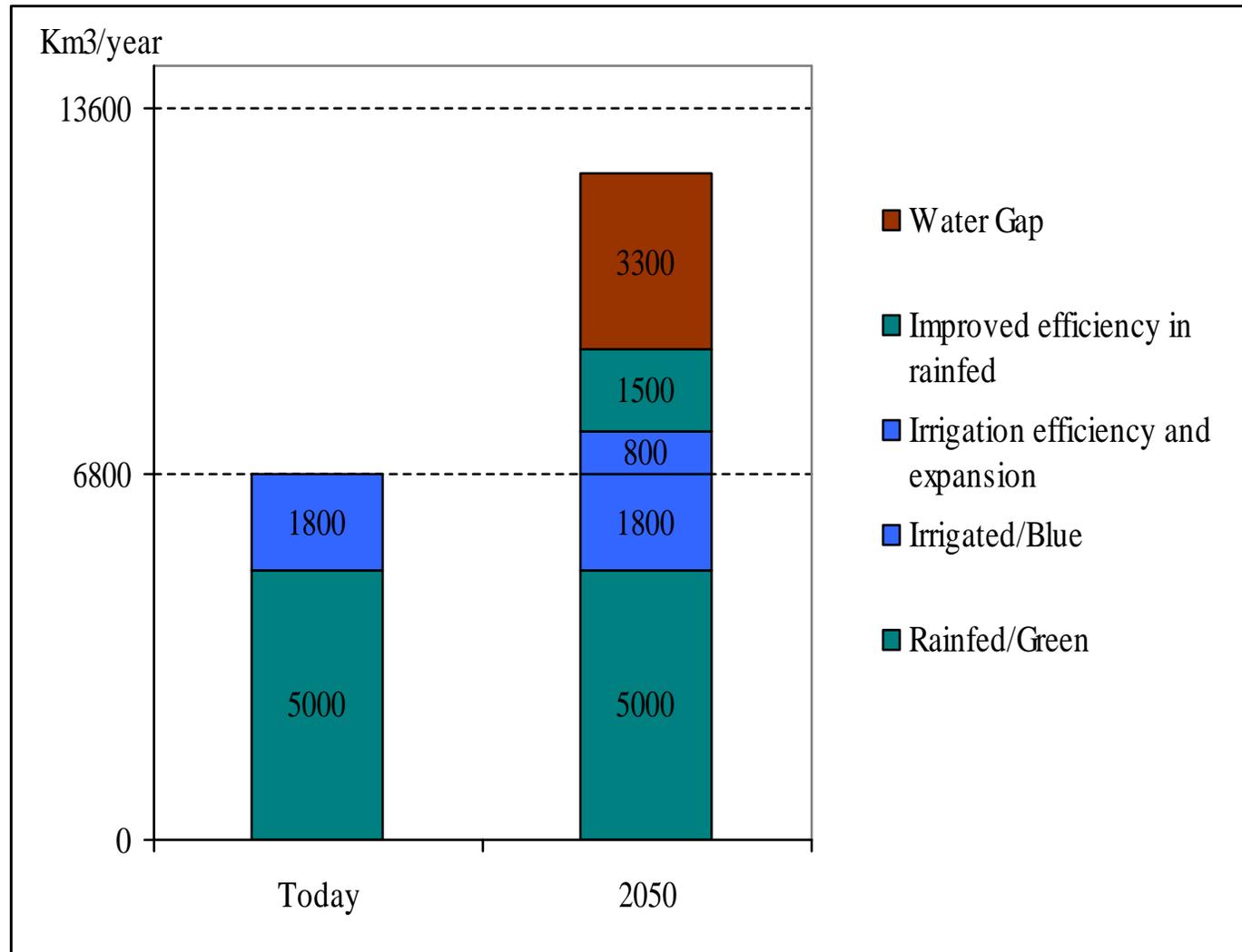
Global food demand for agricultural commodities (million tons)

	Cereals			Other crops			Animal products		
Year	1989	2025	2050	1989	2025	2050	1989	2025	2050
World	1694	2834	3380	2980	5248	6764	872	1569	2065



World water demand to 2050 food security

•The challenge is to fill the Water Gap of 3,300 Km³/year to feed the population by 2050. The Water Gap will leave a Food Gap.



Source: De Fraiture et al., 2007; Molden et al., 2007).



Global food market and virtual water flows

- Food trade improves the physical and economic access to food by increasing food availability and lowering food prices for domestic consumers.
- Food trade enables the global exchange of surplus food.
- From 1961 to 2000, the worldwide food export increased by 400% (De Fraiture et al., 2007).
- Through food trade there is a virtual flow of water from producing and exporting countries to importing and consuming countries



Top 6 virtual water exporting and importing countries (1995-1999)

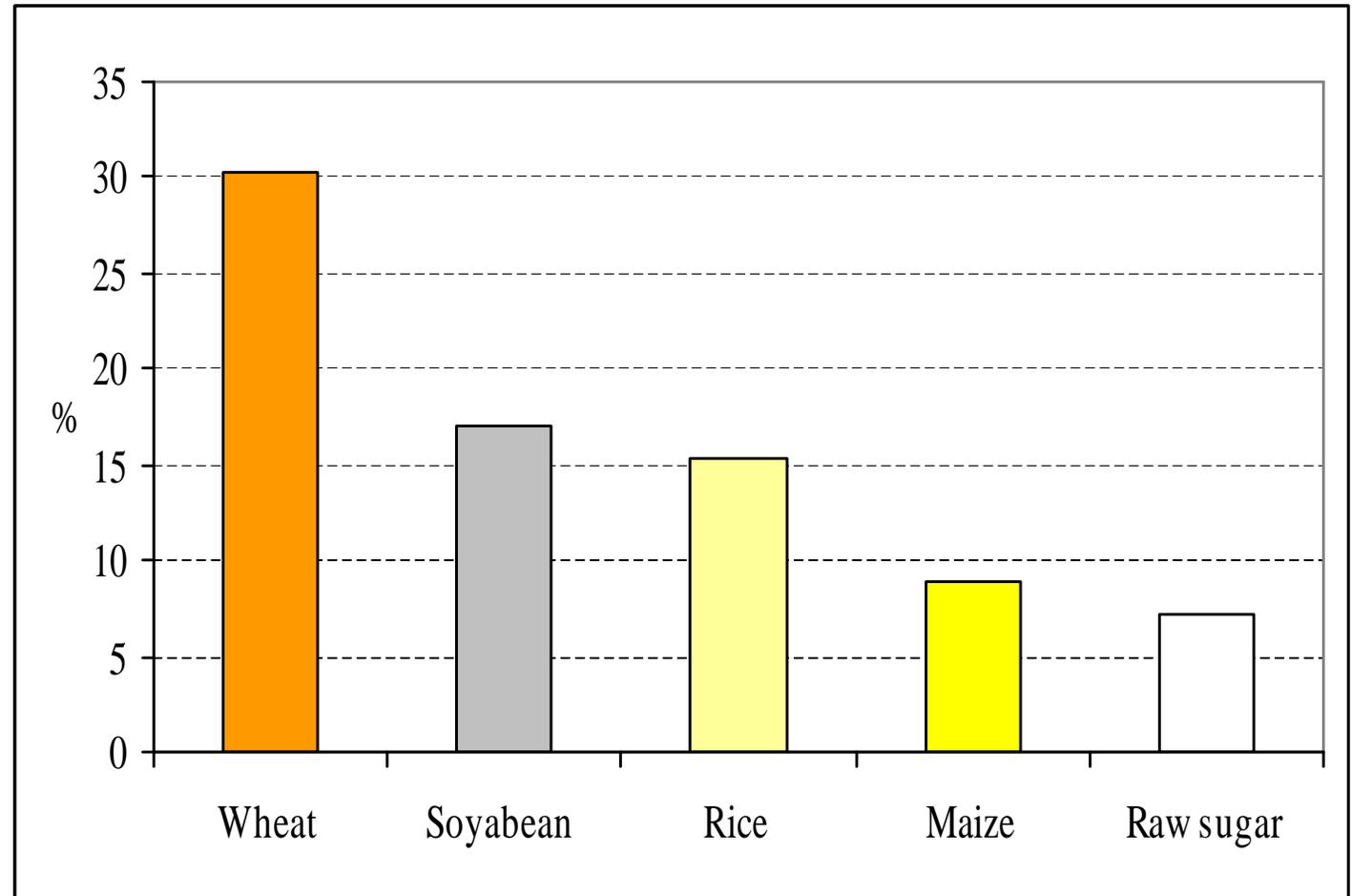
Exporters		Importer	
Country	Net export volume (10 ⁹ m ³)	Country	Net import volume (10 ⁹ m ³)
USA	758.3	Sri Lanka	428.5
Canada	272.5	Japan	297.4
Thailand	233.3	Netherlands	147.7
Argentina	226.3	Korea Republic	112.6
India	161.1	China	101.9
Australia	145.6	Indonesia	101.7

Source: Hoekstra and Chapagain (2007)



Global virtual water trade in top five crop products (1995-1999)

Wheat is the single largest contributor to the global virtual water export (30% of the total volume of crop-related virtual water export between 1995 and 1999).





Australia's agricultural production and impact of recent droughts

- A spatio-temporal approach is used to examine the impacts of Australia's drought on agricultural production and likely effect on global food market.
- We use the spatial typology of crops produced in various regions, their water scarcity and food production situation in a temporal context, and the destination of export for those impacted crops to help trace the plausible links between water scarcity in Australia and global food market.



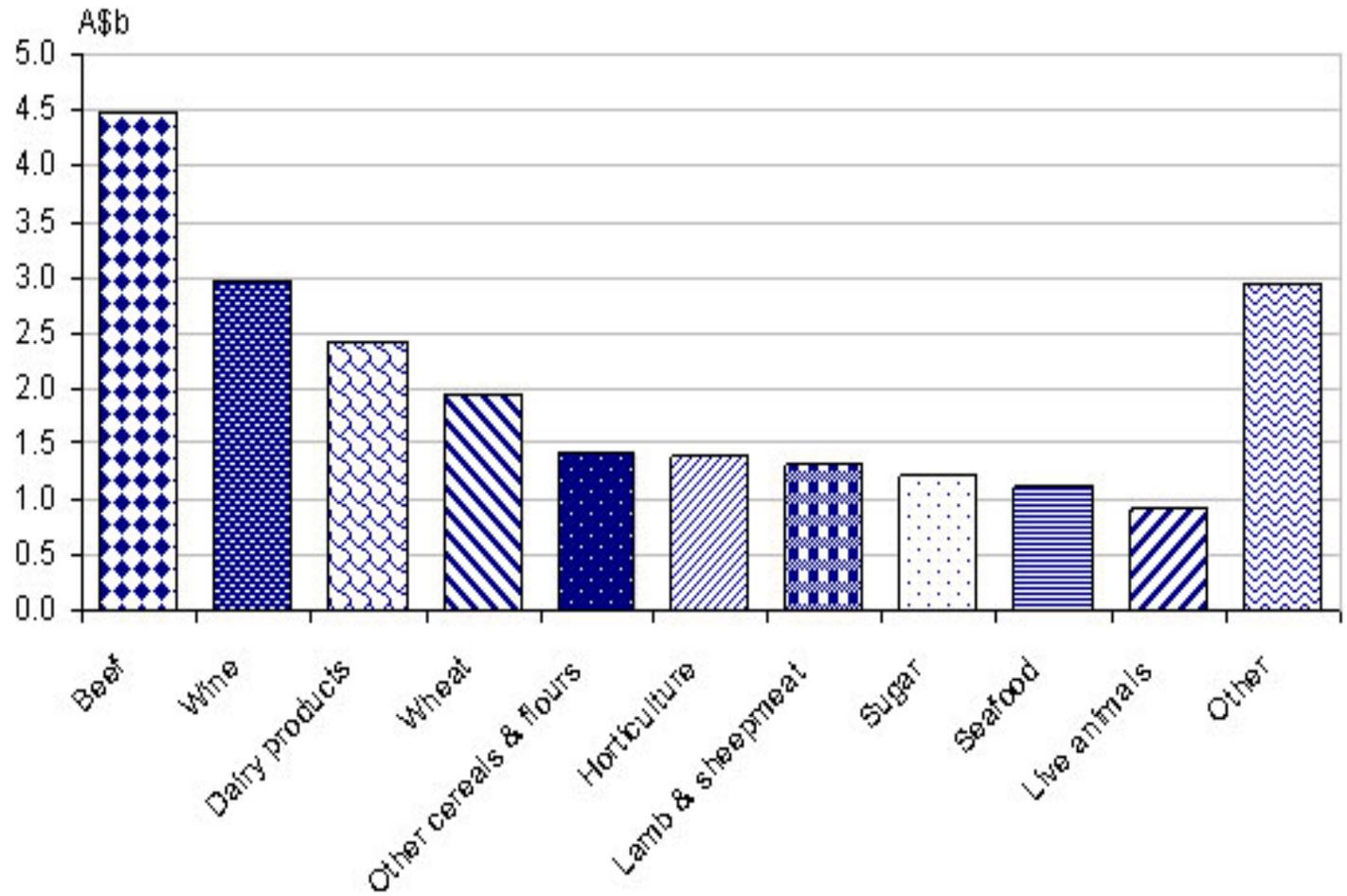
Australian exports

- Australia is a major producer of agricultural commodities such as wheat, rice and other food grains and livestock and dairy products and thus contributes significantly in the world's food supply.
- Australia is sixth largest food exporter.
- For example, Australian wheat export destinations include Africa; Asia (such as Indonesia, Japan, Korea, Malaysia, China, Middle East, Bangladesh and Pakistan); and Oceania (ABARE, 2008).
- Many of these countries are dependent on food imports for their food security.



Top 10 Australian food exports, 2007

Beef was the biggest export item, followed by wine, dairy products and wheat.

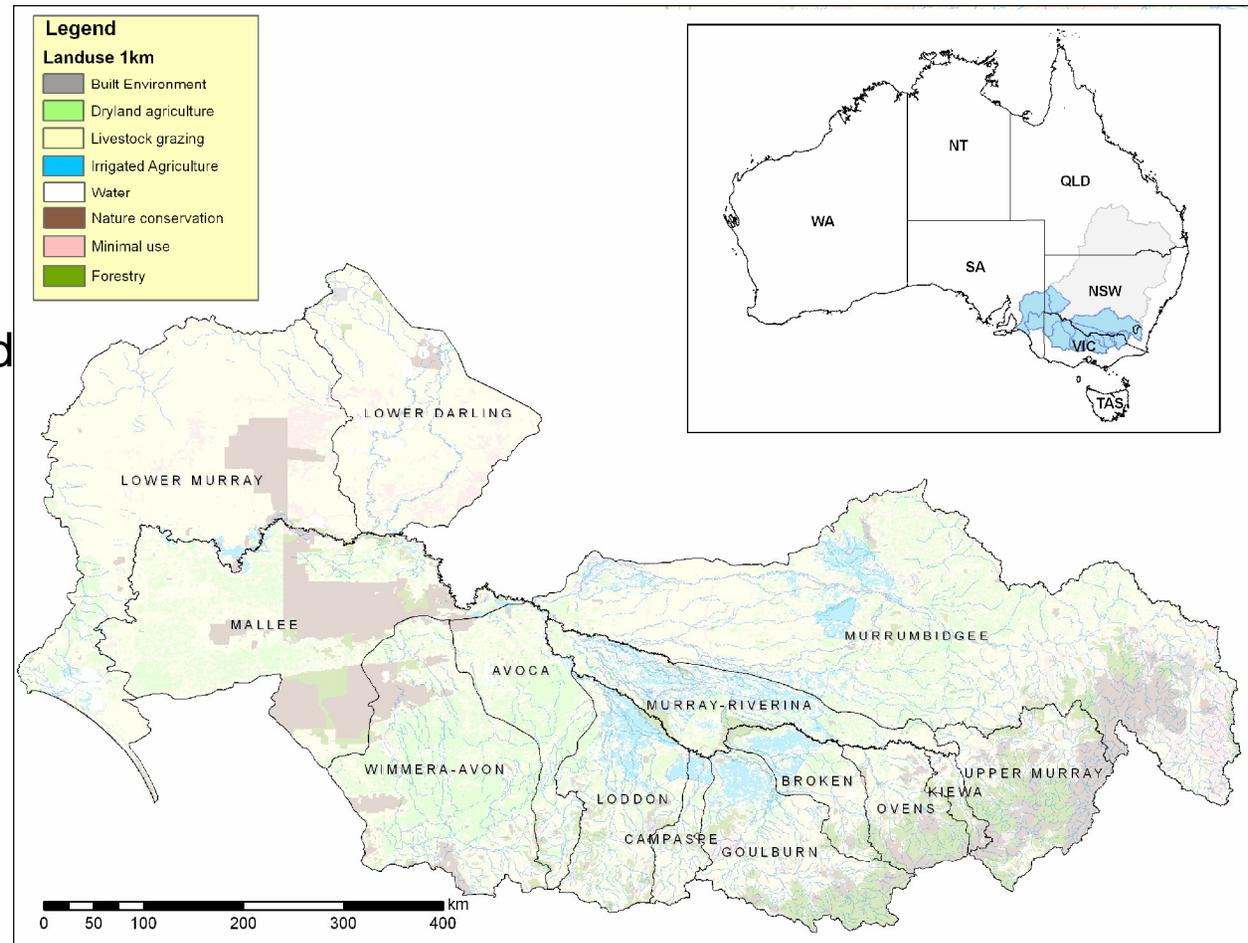


Source: (DFAT, 2008).



Recent droughts in Australia

- Australia has an arid climate with recurring droughts.
- Large parts of Australia have been affected by drought since 2002, and ongoing drought is the most severe since records began (Australia, 2007).
- Recent droughts in Australia have intensified water scarcity in the Murray-Darling Basin – the breadbasket of Australia.





Water storage levels and allocations

- Due to severe drought in southeast Australia and despite huge storage capacity (26,000 gigalitres), the volume of water held in storages in the MDB fell to all times low (2,230 gigalitres) during 2007; only 5% in Hume dam and 8% in Snowy scheme – the nation's largest dams.
- The storage level fell from 43% in 2006 to 13% in 2007 in the Blowering dam on the Murrumbidgee catchment, the major food producing area in the New South Wales state (Goesch et al., 2007b).





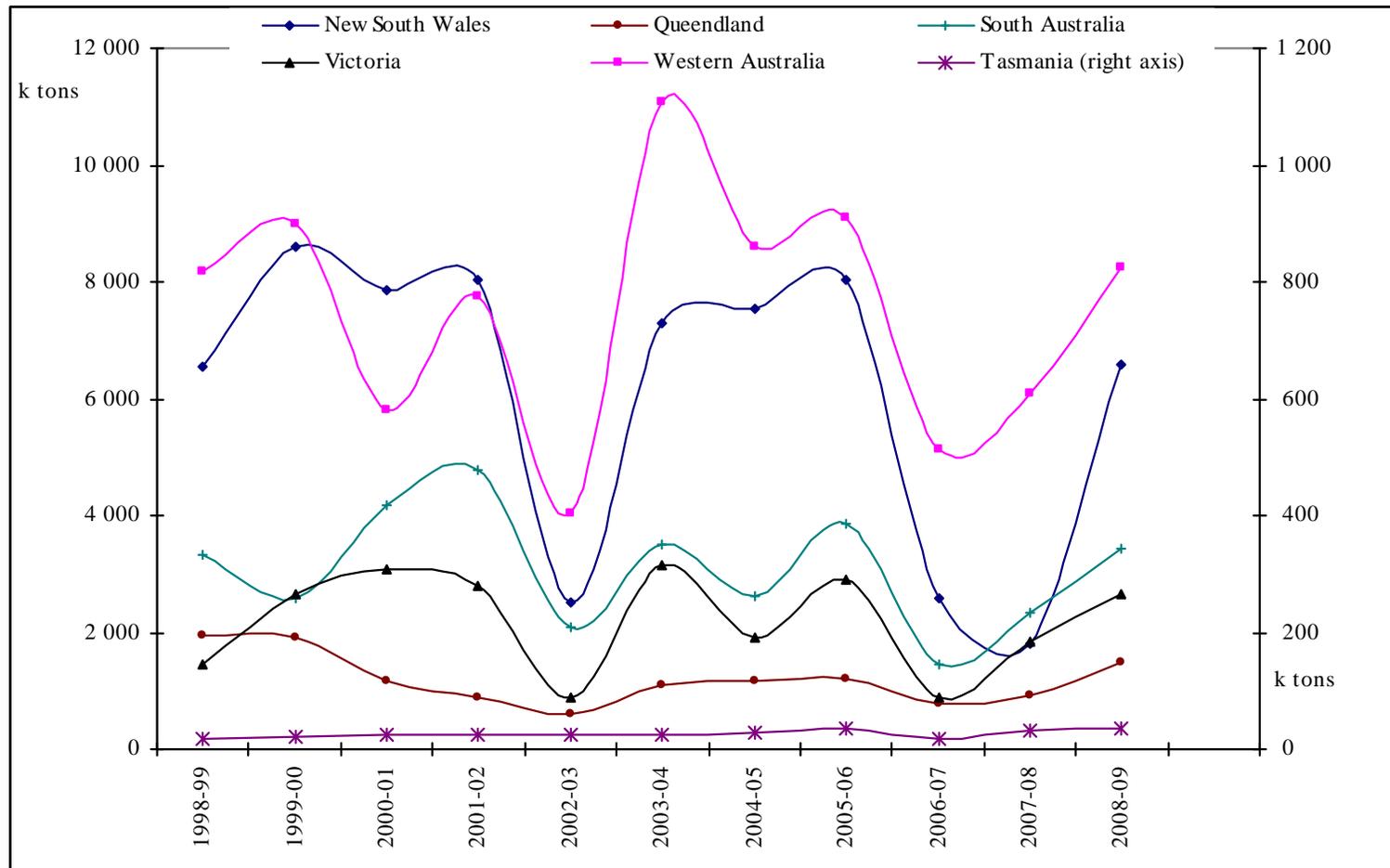


Impacts on agricultural production

- Reduced water allocations has a major impact on irrigated agriculture in the basin.
- Drought related water scarcity severally affected all of Australia's most agricultural intensive and food producing regions, reducing agricultural output by 20 percent or more (Horridge et al., 2005).
- Widespread rainfall failure caused a total failure of wheat crop in the Murrumbidgee catchment in 2007.
- Due to low allocations in 2007, rice production fell to just 161,000 tons compared to about 1.2 million tons of rice produced during 2002 when irrigators received full allocations, i.e. 84% decline in rice production.
- Sheep and lamb numbers during 2006-07 dropped to 80-year lows in southern states.



Wheat production across the Australian states also fell sharply during the drought years of 2002/3 and 2006/7



Source: ABARE (2008)



Impact of increase in water scarcity in Australia on global food supply

- Despite the fact that Australia is a major producer of agricultural commodities, it is a relatively smaller player in the global food security equation.
- Wheat is a major Australian export and this is significant since about one half of the cereal imports in Asia are wheat.
- Australian rice is mainly destined for export, yet small but important to food security in Asia.
- Export of meat, beef and live animals are significant.
- Although major importers of Australian food products may not always be food insecure countries, yet these exports make significant direct and indirect contribution to both stabilising global food market and maintaining food security.



Supply and export of Australian wheat and barley (‘000 tons)

Item	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09 (projected)
Wheat						
Production	26 132	21 905	25 150	10 822	13 039	22 460
Domestic use	5 738	6 024	6 540	7 381	6 419	6 699
Exports	17 868	14 675	15 969	8 685	7 279	15 689
Change in stocks	2 526	1 206	2 641	-5 245	- 659	71
Rice						
Production	553	339	973	167	553	
Domestic use	152	156	160	153	151	
Export	217	299	168	579	217	



Future food security

- Dealing with climate change
 - Use a river basin approach to adapt core water management programs to climate change challenges
 - Strengthen the link between water programs, food security and climate change research
 - Educate water program stakeholders on climate change impacts on water and food security
 - Establish the management capacity in food insecure hotspots to address climate change challenges on sustained basis.



Conserving water and energy resources

- Extending the yield frontier in areas where present yields are close to their potential
- Closing the yield gap where considerable yield gains can be achieved with modern technology.
- Water efficiency - producing more crop per drop of water and energy



Other approaches

- Green revolution
 - Bulk of the past investments targeted the foods of the common citizen while foods of the poorest (such as millet, oats and cassava) were largely neglected.
 - Future investments must address this imbalance.
- GM crops?
- Reengaging in agricultural investments in new technology, water infrastructure and management
- Water governance, policies and institutions
- Invest in global public agricultural research and development.
- Disseminate new food production technologies.
- Global Water Stewardship and Food Sovereignty as an alternative development paradigm.
- Shoring up domestic food supplies
- Reforming international food trade policies



Conclusions

- The analysis showed that population and income growth will increase the demand for food and water.
- Irrigation will be the first sector to lose water as water scarcity intensifies.
- Feeding the 2050 population will require significant additional volume of water and will leave a Water Gap of about 3300 Km³.
- The Water Gap will lead to Food Gap unless concerted actions are taken.
- Disrupted access to energy can further deepen the food production gap.
- Australia is one of the major food producing and exporting countries in the world and recent droughts have caused significant reduction in the agri production and their exports.
- A fundamental shift is needed in water and energy use in food systems policy to avoid a severe food crisis in the future.

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Thank You

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