issues insights

10.4

Adapting to ongoing drought: irrigation in the Murray-Darling Basin

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March 2010

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ABARE project 3472

Introduction

Irrigated agriculture has faced many challenges over the past decade including severe and prolonged drought, reduced water availability, fluctuations in commodity prices and ongoing reform of government water policies. In particular, managing uncertainty in water availability has been a key challenge for irrigators.

The responses of individual farmers to their changing circumstances has implications for the well-being of farming families, regional communities, and regional, state and national economic growth.

Since 2006-07, ABARE has been surveying irrigated horticulture, dairy and broadacre farms throughout the Murray-Darling Basin to monitor the changes occurring in irrigation industries. Using data obtained from these surveys, a range of research projects have been undertaken to draw insights into the characteristics of irrigation farms and the way in which irrigation farms are adapting to ongoing drought.

This paper presents the results of detailed analysis of irrigation farm financial performance and observed adaptation responses occurring on these farms across the Murray-Darling Basin. In the first part of the paper, an analysis of farm financial performance provides insights into the circumstances facing irrigators including farm incomes, investment, debt and the role of off-farm income. The second part of the paper examines some of the observed changes being made by irrigation farms including changes in farm enterprise mix, water trading and use of irrigation technologies.

The survey results show that the responses of irrigators to the challenges they are facing vary significantly among individual farms across the Murray-Darling Basin.

Farm financial performance

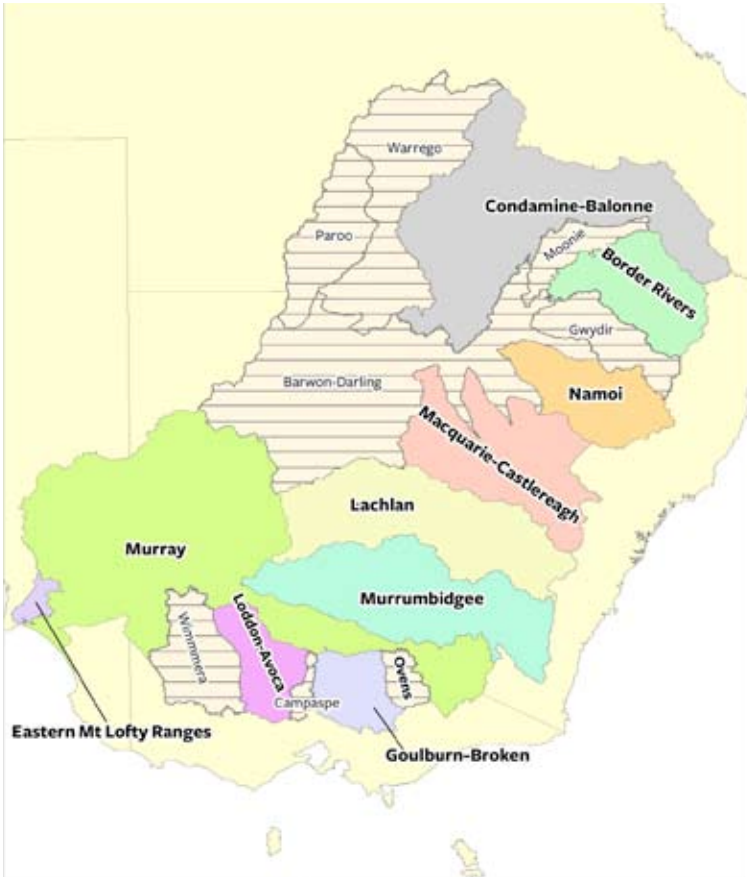
Seasonal conditions and water availability in 2007-08

Seasonal conditions varied across the Murray-Darling Basin in 2007-08 with dry conditions persisting in the southern part of the Basin (particularly South Australia, Victoria and southern New South Wales). The central and northern parts of the Basin received average to above average rainfall in 2007-08 (map 2).

Box 1: Survey of irrigation farms

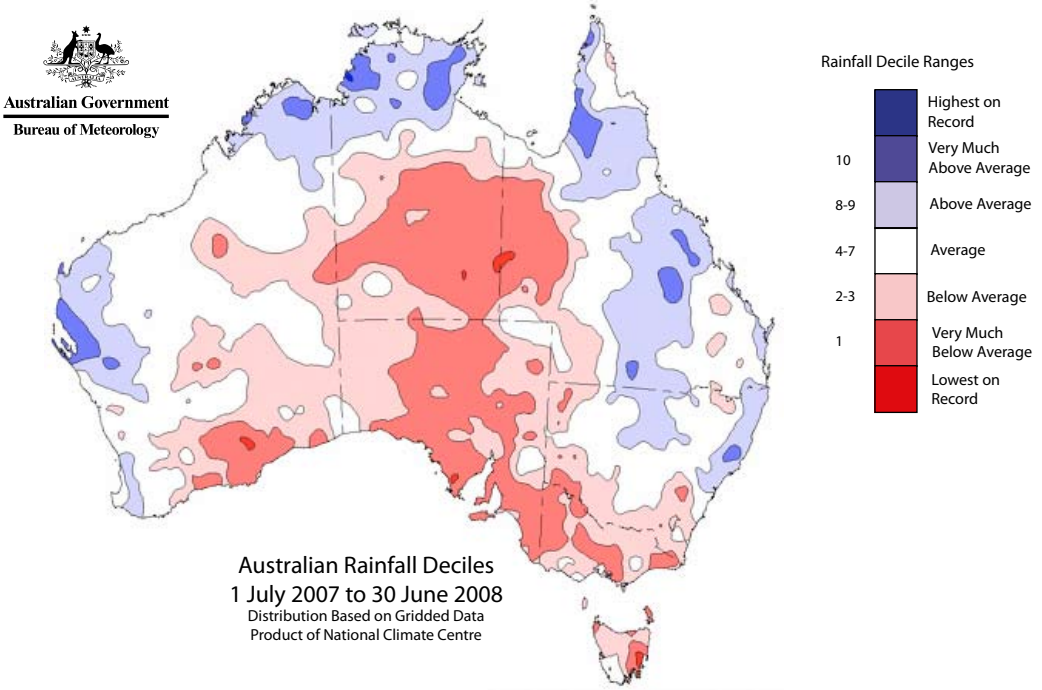
The ABARE survey of irrigation farms in the Murray-Darling Basin provides coverage of irrigated broadacre (including rice and cotton), dairy and horticulture (vegetable, citrus, stone fruit, pome fruit and wine grapes) farms in 10 regions of the Basin, namely: Condamine-Balonne; Border Rivers; Namoi; Macquarie-Castlereagh; Lachlan; Murrumbidgee; Murray; Goulburn-Broken; Loddon-Avoca; and Eastern Mount Lofty Ranges (map 1).

map 1 Reporting regions



The survey regions were chosen to cover the major irrigation regions in the Basin and were based on those defined by CSIRO in its 'Sustainable Yields Project' (CSIRO 2007). Some of the CSIRO regions were not covered by the survey because of relatively small numbers of irrigation farms. More detail of the survey design can be found in Ashton, Hooper and Oliver (2009).

map 2 Australian rainfall deciles, 2007–08



In some regions such as the southern Basin, the volume of water held in major storages remained at record lows. Consequently, irrigation water allocations were generally lower in 2007-08 than in 2006-07 with licence holders in many regions receiving record low allocations depending on the source of water and type of licence.

The total area of land irrigated in the Murray-Darling Basin in 2007-08 was around 13 per cent lower than in 2006-07 and 42 per cent lower than in 2005-06. Similarly, the total volume of water applied in 2007-08 was around 30 per cent lower than in 2006-07 and 57 per cent lower than in 2005-06 (ABS 2009).

For the southern part of the Basin, the Murray-Darling Basin Commission estimated that 1480 gigalitres of water were diverted in 2007-08, which represents around 55 per cent of 2006-07 diversions and around 40 per cent of average diversions between 1997 and 2008 (MDBC 2008).

Components of financial performance

Broadacre farms

Despite an overall improvement in farm cash income and farm business profit in 2007-08, varying seasonal conditions and water availability across the regions meant there were significant differences in financial outcomes among irrigators.

Farm cash income (box 2) for irrigated broadacre farms in the Murray-Darling Basin rose by around 38 per cent to average $97 729 in 2007-08 (table 1). However, average farm cash income fell in both the Condamine-Balonne and Lachlan regions. For the remaining regions, the increases in average farm cash incomes were mainly because of increased cash receipts (mainly a result of increased production and higher prices for wheat, sorghum and cotton). However, higher receipts were partly offset by higher farm cash costs in 2007-08.

Box 2: Key financial performance measures

Farm cash income: total cash receipts (revenues received by the business during the financial year) less total cash costs (payments made by the farm business for materials and services and for permanent and casual hired labour, excluding owner manager, partner and family labour). Farm cash income is the surplus farm based income available after paying for cash operating costs.

Farm business profit: refines farm cash income by adding changes in trading stocks and deducting depreciation and imputed value of family labour. Farm business losses do not necessarily mean negative cash flows. In practice, positive cash flows can be maintained by reducing expenditure on capital asset replacement and forgoing wages for family labour.

Rate of return: farm business profit with the interest, lease and rent payments added (adjusted to full equity basis), expressed as a percentage of total farm capital. It represents the ability of the farm business to generate a return to all capital used by the business, including that which is borrowed or leased.

1 Financial performance, irrigated broadacre farms, by region

average per farm

	farm cash income		farm business profit		rate of return	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
	$	$	$	$	%	%
Condamine–Balonne	74 377	61 596	–29 770	20 760	0.2	2.7
Border Rivers	122 931	282 596	23 788	163 316	3.0	4.5
Namoi	177 521	309 336	117 840	201 810	3.6	4.1
Macquarie–Castlereagh	21 513	41 638	–74 448	–78 759	–0.6	1.1
Lachlan	38 386	–17 557	–75 996	–156 658	–1.2	–1.1
Murrumbidgee	56 078	60 864	–32 932	–72 289	0.4	–0.6
Murray	54 939	67 652	–36 607	–57 131	–0.7	–0.2
Goulburn–Broken	9 797	105 445	–60 116	27 143	–2.1	2.0
Loddon–Avoca	114 393	117 976	20 024	12 885	1.8	1.5
Murray-Darling Basin	67 334	97 729	–24 192	–19 948	0.5	1.2

Source: ABARE survey of irrigation farms in the Murray-Darling Basin. *Note:* Caution should be used when comparing estimates between years because of changes in the survey sample. Relative standard errors provide a guide to comparing the significance of changes between estimates and are provided in Ashton, Hooper and Oliver (2009).

Farm business profit rose more modestly from an average loss of $24 192 in 2006-07 to a loss of around $19 948 in 2007-08. Irrigated broadacre farms in the Basin recorded an average rate of return to capital of 1.2 per cent in 2007-08 compared with an average of 0.5 per cent in 2006-07.

Dairy farms

Dairy farmers' incomes at the national level rose sharply in 2007-08 because of higher farm-gate milk prices, despite falls in average milk yield per cow as dry seasonal conditions restricted milk production (table 2). High total cash receipts were partly offset by increased expenditure on major dairy farm inputs including hay, feed-grains, fertilisers, chemicals and fuel, together with higher interest rates and increased farm expenditure on repairs and maintenance.

2 Financial performance, irrigated dairy farms, by region

average per farm

	farm cash income		farm business profit		rate of return	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
	$	$	$	$	%	%
Condamine–Balonne	41 058	69 975	–46 395	24 226	–0.6	3.8
Murray	97 429	128 777	3 134	6 924	1.7	2.1
Goulburn–Broken	17 916	56 225	–62 981	–44 630	–1.7	–0.3
Loddon–Avoca	43 536	95 689	–33 643	26 578	–0.2	3.0
Eastern Mt Lofty Ranges	67 877	189 112	482	79 891	0.9	3.4
Murray-Darling Basin	54 836	91 379	–30 312	–8 178	0.1	1.5

Source: ABARE survey of irrigation farms in the Murray-Darling Basin. *Note:* Caution should be used when comparing estimates between years because of changes in the survey sample. Relative standard errors provide a guide to comparing the significance of changes between estimates and are provided in Ashton, Hooper and Oliver (2009).

Farm cash income for irrigated dairy farms in the Murray-Darling Basin increased by 67 per cent to average $91 379 a farm in 2007-08, with an average farm business loss of $8178 a farm. Overall, irrigated dairy farms in the Basin recorded an average rate of return to capital of 1.5 per cent in 2007-08, compared with an average of 0.1 per cent in 2006-07.

Horticulture farms

Farm cash income for irrigated horticulture producers in the Murray-Darling Basin increased by around 34 per cent to average $68 196 a farm in 2007-08 (table 3). An increase in cash receipts was mainly a result of increased production and higher prices for vegetables and fruit, partly offset by lower receipts from the sale of wine grapes. Cash costs increased by an estimated 44 per cent to average $259 435 a farm, mainly because of increases in cropping related costs such as hired labour, cropping contracts, fertiliser, and temporary water purchases.

On average, farm business profit rose slightly for these farms to around $7313 a farm in 2007-08. Irrigated horticulture producers in the Basin recorded an average rate of return to capital of 2 per cent in 2007-08, compared with an average of 1.5 per cent in 2006-07.

3 Financial performance, irrigated horticulture farms, by region
average per farm

	farm cash income		farm business profit		rate of return	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
	$	$	$	$	%	%
Condamine–Balonne	46 172	148 978	–262	98 606	0.4	3.9
Border Rivers	136 545	189 167	61 886	102 222	6.3	8.8
Macquarie–Castlereagh	–5 852	50 544	–56 551	–11 630	–1.6	0.1
Lachlan	7 931	153 464	–35 885	77 602	0.4	4.7
Murrumbidgee	48 176	125 144	–421	62 832	1.3	5.2
Murray	41 679	35 090	–3 873	–17 984	1.1	0.2
Goulburn–Broken	64 666	35 745	–8 161	–52 631	1.6	0.1
Loddon–Avoca	75 094	117 670	5 892	37 681	0.7	2.0
Eastern Mt Lofty Ranges	83 731	116 765	39 756	57 138	3.7	4.0
Murray-Darling Basin	50 717	68 196	1 142	7 313	1.5	2.0

Source: ABARE survey of irrigation farms in the Murray-Darling Basin. *Note:* Caution should be used when comparing estimates between years because of changes in the survey sample. Relative standard errors provide a guide to comparing the significance of changes between estimates and are provided in Ashton, Hooper and Oliver (2009).

Farm performance to 2009-10

Although 2008-09 and 2009-10 data for irrigation farms in the Murray-Darling Basin are not yet available, overall farm financial performance is likely to have remained weak in these years. The 2008-09 irrigation season continued to be among the driest on record for the Basin as a whole, with irrigation water allocations in some regions remaining at record lows. Opening allocations were slightly higher at the beginning of 2009-10 in many regions, but overall irrigation allocations remain low.

For irrigated broadacre farms in the northern parts of the Murray-Darling Basin, incomes are likely to be boosted by increased cotton production and higher average prices in 2009-10 (ABARE 2009). The opposite is likely to be the case for irrigated dairy farms in the Basin, with a forecast decline in milk production and sharply lower farm-gate milk prices in 2009-10 (ABARE 2009).

Investment on irrigated farms

Components of capital

The total value of capital for irrigated broadacre farms averaged around $4.8 million a farm in 2007-08. Land accounted for an estimated 54 per cent of the total value of capital, while water entitlements accounted for a further 31 per cent. On-farm irrigation infrastructure and equipment accounted for around 2 per cent of the total value of capital in 2007-08.

For horticulture farms, the total value of capital averaged around $1.7 million a farm in 2007-08. Land accounted for an estimated 50 per cent of total capital value, while water entitlements accounted for a further 30 per cent. On-farm irrigation infrastructure and equipment

accounted for around 9 per cent of the total value of capital in 2007-08. Much of the irrigation capital for horticulture farms included technologies such as drip and micro-sprinkler systems. Relatively high profitability in the horticulture industry, and higher security water allocations that provide greater certainty of access to water, appear to have been important factors influencing this investment pattern.

The total value of capital for dairy farms in the Murray-Darling Basin averaged around $2.6 million a farm in 2007-08. Land accounted for an estimated 43 per cent of total capital value, while water entitlements accounted for a further 35 per cent and livestock accounted for 10 per cent. On-farm irrigation infrastructure and equipment accounted for around 3 per cent of the total value of capital in 2007-08.

Additions and disposals of capital

The survey results show an estimated 41 per cent of irrigation farms made net additions (additions minus disposals) to total farm capital in 2007-08, compared with an estimate of 30 per cent in 2006-07 (table 4). Higher farm incomes and improved prospects for most commodities were possibly key drivers of the increase in the proportion of irrigation farms making additions to total capital in 2007-08. The proportion of farms making net additions to capital rose across each of the industries but was highest among dairy farms in 2007-08.

4 Capital additions/disposals, irrigation farms by industry, Murray-Darling Basin average per farm

	horticulture		broadacre		dairy	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
	%	%	%	%	%	%
Percentage of farms making net capital additions	23	33	31	49	43	52
Percentage of farms making net capital disposals	4	6	5	11	7	17

Source: ABARE survey of irrigation farms in the Murray-Darling Basin. *Note:* Caution should be used when comparing estimates between years because of changes in the survey sample. Relative standard errors provide a guide to comparing the significance of changes between estimates and are provided in Ashton, Hooper and Oliver (2009).

For those farms making net additions to total capital, purchases of land and permanent irrigation water entitlements were the largest components of additions (table 5). Although average debt increased during both 2006-07 and 2007-08, as the value of capital additions was greater than the increase in debt there were small increases in equity ratios for these farms in 2007-08.

In comparison, an estimated 5 per cent of farms had net disposals of capital in 2006-07 and 10 per cent in 2007-08. Again, dairy farms had the highest proportion of farms making net capital disposals in both 2006-07 and 2007-08.

5 Selected estimates, irrigation farms making net capital additions, by industry, Murray-Darling Basin average per farm

	horticulture		broadacre		dairy	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
	$	$	$	$	$	$
Population	1 320	1 760	1 152	1 301	1 100	977
Net capital additions						
Irrigation plant and equipment	1 702	1 569	1 807	6 544	1 655	2 075
Fixed irrigation infrastructure	557	21 741	0	5 246	766	4 961
Water entitlements	13 462	36 812	19 165	28 500	4 755	17 453
Land	33 042	98 569	124 474	94 321	42 779	83 141
Total	73 720	188 072	189 294	214 001	76 606	154 045
Total cash receipts	342 749	498 943	468 375	678 328	462 264	656 787
Total cash costs	271 896	400 542	381 167	561 652	391 833	562 855
Farm cash income	70 853	98 401	87 208	116 676	70 432	93 932
Farm business profit	13 026	26 610	–30 115	–23 593	–9 802	20 719
Total capital at 30 June	1 908 788	2 254 846	4 244 738	6 184 424	2 593 397	2 756 316
Farm debt at 1 July	293 199	381 548	609 787	1 008 407	411 038	525 375
Farm debt at 30 June	311 993	422 537	670 562	1 103 971	478 394	583 856
Change in debt	18 794	40 989	60 776	95 564	67 356	58 481

Source: ABARE survey of irrigation farms in the Murray-Darling Basin. *Note:* Caution should be used when comparing estimates between years because of changes in the survey sample. Relative standard errors provide a guide to comparing the significance of changes between estimates and are provided in Ashton, Hooper and Oliver (2009).

6 Selected estimates, irrigation farms making net capital disposals, by industry, Murray-Darling Basin average per farm

	horticulture		broadacre		dairy	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
	$	$	$	$	$	$
Population	237	339	180	270	148	308
Net capital additions						
Irrigation plant and equipment	–132	–748	–384	0	0	220
Fixed irrigation infrastructure	0	–4 725	–3 842	0	4 946	385
Water entitlements	–30 076	–36 100	–174 250	–209 660	–124 740	–329 453
Land	–74 972	–341 850	–228 759	–391 999	–280 108	–224 730
Total	–105 180	–383 423	–407 235	–601 659	–399 902	–553 578
Total cash receipts	124 415	133 360	489 264	345 463	531 630	398 029
Total cash costs	88 137	95 137	386 480	312 297	483 243	294 199
Farm cash income	36 278	38 224	102 784	33 165	48 387	103 829
Farm business profit	1 109	4 967	–37 123	–82 023	–72 343	–100 107
Total capital at 30 June	953 671	1 023 000	3 219 496	3 571 642	2 465 438	2 634 864
Farm debt at 1 July	239 639	178 640	795 169	726 539	450 483	594 369
Farm debt at 30 June	220 348	119 014	703 015	551 399	348 315	393 774
Change in debt	–19 292	–59 625	–92 154	–175 140	–102 169	–200 595

Source: ABARE survey of irrigation farms in the Murray-Darling Basin. *Note:* Caution should be used when comparing estimates between years because of changes in the survey sample. Relative standard errors provide a guide to comparing the significance of changes between estimates and are provided in Ashton, Hooper and Oliver (2009).

For those farms making net capital disposals, sales of permanent irrigation water entitlements and land accounted for the largest component of disposals, although the results differed by industry (table 6). For both irrigated broadacre and horticulture farms, land was the major component of net disposals of capital in 2007-08 while sales of permanent water entitlements by dairy farms increased in 2007-08.

Regardless of the source of net capital disposals, the survey results suggest that many farms used at least part of the proceeds from these sales to reduce debt in 2006-07 and 2007-08 (table 6).

Analysis of debt

Average farm business debt for irrigated broadacre and horticulture farms in the Murray-Darling Basin rose by an estimated 4 per cent in 2007-08 (table 7). For dairy farms, there was a small decline in average debt for the Basin as a whole, with lower debt in the Murray region being largely offset by increased debt in the other dairy regions.

For horticulture, average debt increased in the Goulburn-Broken, Loddon-Avoca, Murray and Murrumbidgee regions and fell in other regions. Average farm business debt for irrigated broadacre farms increased in all regions except the Lachlan, Macquarie-Castlereagh and Namoi regions.

Most irrigation farms entered 2007-08 with relatively high farm equity (more than 80 per cent); however, overall farm business equity ratios were slightly lower in most regions in 2007-08 because of increases in average debt.

The ability of farmers to service debts from their revenue stream is an important aspect of farm viability. The debt servicing ratio shown in table 7 measures the ratio of interest payments to total farm cash receipts. A low ratio means interest payments account for a small proportion of cash receipts.

The debt servicing ratio for horticulture farms is relatively low, averaging around 8 per cent for the Basin as a whole in 2007-08, compared with 7 per cent in 2006-07. In each region, the debt servicing ratio for irrigated broadacre farms is higher than for horticulture or dairy farms, averaging around 14 per cent for the Basin as a whole in 2007-08 compared with 11 per cent in 2006-07.

In comparison, the debt servicing ratio for Australian broadacre farms has averaged around 7 per cent since 1977-78. More recently, the debt servicing ratio for broadacre farms was 10 per cent in both 2006-07 and 2007-08.

7 Components of farm business debt, irrigation farms, Murray-Darling Basin average per farm

	horticulture		broadacre		dairy	
	2006-07	2007-08	2006-07	2007-08	2006-07	2007-08
	$	$	$	$	$	$
At 1 July	214 944	259 991	419 737	743 676	370 466	491 211
At 30 June	213 016	270 283	439 010	776 766	402 610	489 783
Change in debt	–1 928	10 292	19 273	33 090	32 144	–1 428
Debt at 30 June, by purpose						
Land purchase	88 882	109 973	200 397	315 109	298 570	306 146
Land development	29 646	34 000	18 621	18 809	3 318	3 994
Building and structures	11 775	19 266	3 584	26 309	15 684	18 759
Vehicles and machinery	13 195	12 588	33 120	54 727	19 567	25 746
Livestock	165	200	841	1 273	1 137	1 461
Working capital	53 825	73 887	155 194	288 210	50 376	116 760
Debt reconstruction	8 057	18 921	18 820	66 793	16 681	17 373
Other purpose	7 910	2 953	9 562	6 246	2 172	388
Farm business equity ratio	85	82	85	83	82	81
Debt servicing ratio	7	8	11	14	8	8

Source: ABARE survey of irrigation farms in the Murray-Darling Basin. *Note:* Caution should be used when comparing estimates between years because of changes in the survey sample. Relative standard errors provide a guide to comparing the significance of changes between estimates and are provided in Ashton, Hooper and Oliver (2009).

Income and equity analysis

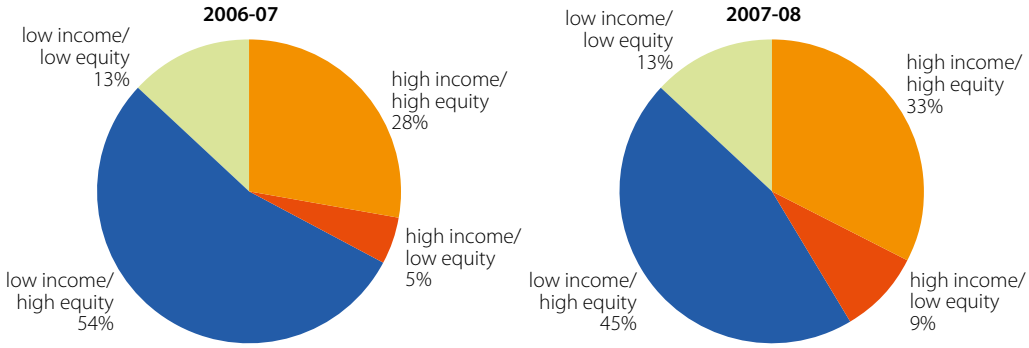
To gain greater insight into the financial performance of irrigated farms in each region, farms were allocated to one of four groups based on income (farm cash income above or below $50 000) and equity (farm business equity ratio above or below 80 per cent). The four groups were high income/high equity, high income/low equity, low income/high equity and low income/low equity.

In 2007-08, an estimated 42 per cent of irrigation farms had farm cash incomes greater than $50 000, compared with 33 per cent in 2006-07 (figure a). In both years most of these farms also had equity of more than 70 per cent.

Around 13 per cent of irrigation farms in both 2006-07 and 2007-08 had low income and low farm business equity. These farms are facing the greatest financial pressures and are likely to experience difficulty servicing their debts in the short term.

On average, the irrigation farms with low farm incomes in 2007-08 tended to be those that relied more heavily on irrigated crops than other enterprises, with around one-third of the area operated by these farms set up for irrigation. In comparison, around one-quarter of the area operated by high income farms was set up for irrigation. In 2007-08, there was little difference in the proportion of irrigable area that was actually irrigated across farms by income and equity, although high income farms tended to have larger areas of dryland crops than for the group of low income farms.

a Percentage of farms by income and equity, irrigation farms, Murray-Darling Basin



The distribution of high and low income irrigation farms can be partly explained by the scale of operations. Quite simply, the group of high income farms were significantly larger on average in terms of area operated than the low income farms and were therefore able to generate higher total cash receipts. The survey results also suggest that larger irrigation farms were able to generate higher receipts per megalitre of irrigation water used than smaller farms in 2006-07 and 2007-08, although it is not clear from the data why this was so.

Role of off-farm income

Results from the survey show that most irrigation farms in the Murray-Darling Basin have some form of off-farm income. On average, around one-third of total off-farm income earned by irrigation farms in 2007-08 was from wages or salaries, while around one-half was from non-farm income sources such as government assistance and non-farm investments.

Around one-third of irrigation farms obtained more than 50 per cent of total family income (defined as farm cash income plus off-farm wages/salaries and other non-farm income) from off-farm sources. Overall, horticulture farms accounted for 59 per cent of these farms in 2007-08, while irrigated broadacre and dairy farms accounted for 22 per cent and 19 per cent, respectively. On average, given the high proportion of horticulture farms, those farms with high reliance on off-farm income tended to be smaller farms in terms of area operated than the remaining two-thirds of farms that had relatively low reliance on off-farm income (table 8).

8 Sources of non-farm income, irrigation farms, Murray-Darling Basin

average per farm

	High reliance on off-farm income		Low reliance on off-farm income	
	2006-07	2007-08	2006-07	2007-08
	$	$	$	$
Off-farm contracting	6 526	13 250	2 686	3 200
Sharefarming	2 504	1 566	140	633
Wages/salaries	21 216	20 029	4 263	5 741
Other non-farm income	22 602	27 085	7 947	10 573
Total off-farm income	52 848	61 929	15 036	20 147
Farm cash income **a**	11 369	17 002	78 576	110 396
Total farm family income	55 187	64 115	90 786	126 710
	ha	ha	ha	ha
Area operated	264	268	502	824
Area set up for irrigation	62	99	116	172
Area irrigated	34	28	78	67
Area of dryland crops	55	78	90	166

a Includes receipts from off-farm contracting and sharefarming.
Source: ABARE survey of irrigation farms in the Murray-Darling Basin. *Note:* Caution should be used when comparing estimates between years because of changes in the survey sample. Relative standard errors provide a guide to comparing the significance of changes between estimates and are provided in Ashton, Hooper and Oliver (2009).

Farm adaptation

Farmers are continually responding to changes in a range of factors that affect their farm business. Some of these responses involve relatively short-term decision making such as crop areas, fertiliser and irrigation water applications. Other responses might involve longer term decisions that require significant investment in capital equipment or management practices.

Using data from the ABARE survey of irrigation farms in the Murray-Darling Basin, a range of changes being made by irrigators have been examined including changes in farm enterprise mix, use of irrigation technologies and management practices, and trading in permanent water entitlements and seasonal water allocations.

Enterprise mix and net returns

Enterprise mix

One of the factors affecting irrigators' responses to the current water situation will be the differing returns from various land uses. The allocation of land and water among farm enterprises is determined in part by the relative expected returns from the different enterprises. An irrigator seeking to maximise farm profits will allocate land and water according to that combination of enterprises which yields the highest expected marginal return.

An individual farmer would not consider the relative returns from all irrigated enterprises, but rather would consider a suite of enterprises to suit each farm's resource base (including soil capability and existing investment in on-farm infrastructure) and the farmer's management experience and capabilities. The farm survey data reveal the mix of enterprises present on individual farms in a given year, but it is not possible to identify or draw conclusions about potential alternative crops farmers might be able to consider.

Using the survey data, the average proportion of total cash receipts which were generated by each enterprise were examined. Generally, the results show that there were relatively minor shifts in enterprise mix across the Basin as a whole between 2006-07 and 2007-08, with a reduction in rice and increased areas of dryland wheat the most notable changes observed.

Net returns

Analysis of the survey data shows there is wide variation in unit receipts, costs and net returns per hectare across enterprises and farms within the Murray-Darling Basin (Hughes, Mackinnon and Ashton 2009). Some industries, such as vegetables, tended to show greater variation in returns across farms than others, such as dairy. The variation in returns is likely to be the result of several factors including availability of irrigation water, prices received and crop yields.

Farm level returns per hectare were calculated by subtracting estimated farm costs per hectare from farm receipts per hectare. Distributions of estimated unit returns for 2006-07 are shown in table 9.

The highest average returns were estimated for pome fruit and vegetables, although significant variation in returns across farms was observed for both these enterprises. Returns for citrus were also strong on average and tended to be less variable across farms, with a relatively smaller proportion of farms having negative returns compared with other enterprises.

9 Percentile distributions of estimated returns per hectare, by enterprise, 2006-07 average per farm

	25th percentile	50th percentile	75th percentile	mean
	$	$	$	$
Dairy	–857	–189	781	–105
Pome fruit	–5 255	3 788	11 747	7 662
Stone fruit	–5 796	–1 333	4 911	875
Citrus	–530	2 054	6 143	3 287
Wine grapes	–1 056	1 113	3 259	1 148
Table grapes	–1 548	1 664	8 386	4 202
Vegetables	–5 698	600	9 470	4 364
Cotton	–2 240	–1 618	–850	–1 286
Rice	–2 300	–1 231	–513	–1 022
Irrigated wheat	–509	–220	192	–144

Source: ABARE survey of irrigation farms in the Murray-Darling Basin. *Note:* Caution should be used when comparing estimates between years because of changes in the survey sample. Relative standard errors provide a guide to comparing the significance of changes between estimates and are provided in Ashton, Hooper and Oliver (2009).

Technology and water application

Irrigation technologies

One of the ways irrigators are responding to the current and likely future water situation in the Murray-Darling Basin is through the use of various irrigation technologies and management practices. Such responses have varied across farms depending on factors such as enterprise type, region, availability of irrigation water and seasonal variations in rainfall.

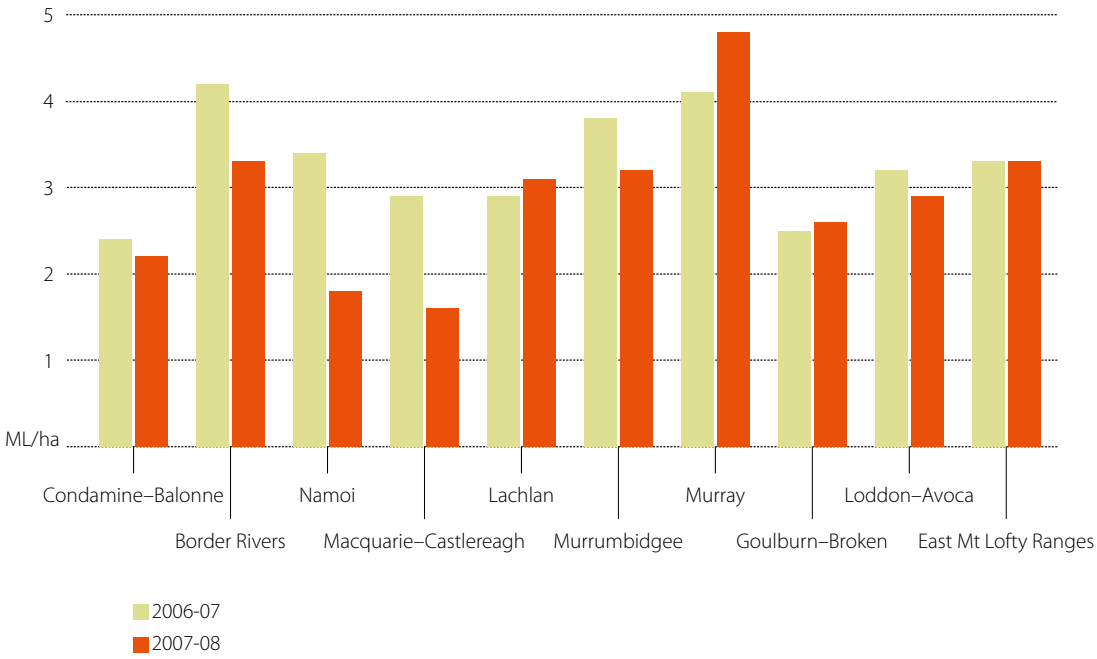
Across the Murray-Darling Basin, flood/furrow systems were the most commonly used technologies for applying water on both dairy and broadacre farms (82 per cent and 75 per cent, respectively). Much smaller proportions of farms in these two groups made use of travelling irrigators and moveable spray line systems.

With much smaller areas irrigated on average, horticulture farms tended to use a wide variety of irrigation systems with drip/trickle (49 per cent) and low throw fixed sprinklers (27 per cent) being the most common systems.

Water application rates

Another adaptation response by irrigators has been to alter management of water application rates by crop. On average, the volume of irrigation water applied per hectare fell in most regions in 2007-08 (figure b). Variations in the mix of crops and the volume of water applied

b Irrigation water application rates, irrigation farms, by region, Murray-Darling Basin



to each crop were important factors affecting overall application rates across each region. As irrigators adjust their farm management, it would be expected that scarce water resources would tend to be allocated first to those activities that provide the greatest returns per megalitre of irrigation water used.

Average water application rates in the Murray and Goulburn-Broken regions increased in 2007-08, although the area irrigated and the total volume of water used declined. This was partly a result of changes in the mix of irrigated activities in these regions. The survey data suggest average application rates increased because some irrigators diverted water away from activities with low irrigation water requirements. These activities appear to have included irrigated field crops (such as wheat, barley and canola) and pasture.

Water trading

Results from the survey suggest water trading was effective in reallocating water among users in 2006-07 and 2007-08. The ability to trade water appears to have assisted some irrigators in avoiding substantial financial losses in these years, either by obtaining income from water sales or by purchasing water to maintain production.

Results from the survey show an estimated 4 per cent of irrigation farms were involved in trading permanent water entitlements in 2007-08, compared with 2 per cent in 2006-07. Around 30 per cent of irrigation farms across the Basin traded temporary water in 2007-08, which was higher than the estimate of 23 per cent in 2006-07.

The main buyers and sellers varied by industry. Dairy farmers were prominent buyers of temporary water in 2006-07 as they sought to offset relatively low seasonal allocations. Conversely, horticulture farms, with generally more reliable irrigation water entitlements, tended to be prominent sellers in most regions.

The situation was reversed in 2007-08 in the southern Basin, where perennial horticulture farmers became the most common buyers and irrigated broadacre farms were the most common sellers. As traded water prices rose, it became more cost effective for irrigated broadacre and dairy farmers to sell water and purchase feed. For horticulture, the incentive was to buy water in order to maintain permanent plantings.

Conclusions

Despite ongoing drought and other challenges facing irrigators in recent years, a large proportion of irrigation farms recorded positive farm incomes in 2006-07 and 2007-08. Generally, farm incomes were higher in 2007-08 as a result of increased production and higher prices for some commodities.

Partly in response to higher incomes, many irrigation farms made additions to total farm capital in 2007-08, with purchases of land and permanent water entitlements being the

largest components of additions. In comparison, a relatively small number of irrigators disposed of capital in 2007-08, primarily sales of permanent water entitlements and some land transactions.

Reflecting the above, average farm business debt for irrigated broadacre and horticulture farms rose in 2007-08, while for dairy farms there was a small decline in average farm business debt. Most irrigation farms entered 2007-08 with relatively high farm equity; however, overall farm business equity ratios were slightly lower in most regions in 2007-08 because of increases in average debt.

Around 13 per cent of irrigation farms in both 2006-07 and 2007-08 reported low farm incomes and low farm business equity ratios. These farms are facing the greatest financial pressures and are likely to experience difficulty servicing their debts in the short term.

The survey results also show that most irrigation farms in the Murray-Darling Basin have some form of off-farm income. Around one-third of farms have a relatively high proportion of total family income being derived from off-farm sources, with most of these being smaller horticulture farms.

A major response by irrigators to reduced water allocations has been increased trade in temporary water allocations. Results from the survey suggest water trading was effective in reallocating water among users in both 2006-07 and 2007-08. The ability to trade water appears to have assisted some irrigators in avoiding substantial financial losses in these years.

While longer term responses, such as changes in irrigation technologies and productivity growth, cannot yet be observed with the survey data, developments will be monitored as future irrigation surveys are undertaken.

References

ABARE 2009, *Australian commodities*, vol 16, no 4, December quarter, Canberra.

ABS 2009, *Experimental estimates of the gross value of irrigated agricultural production, 2000-01 to 2006-07*, catalogue no. 4610.0.55.008, Canberra.

Ashton, D, Hooper, S and Oliver, M 2009, *An economic survey of irrigation farms in the Murray-Darling Basin: industry overview and region profiles*, Canberra, December.

CSIRO 2007, The CSIRO Murray-Darling Basin sustainable yields project. Available from URL: http//www.csiro.au/partnerships/MDBSY.html.

Hughes, N, Mackinnon, D and Ashton, D 2009, *Irrigation in the Murray-Darling Basin: input costs, receipts and net returns in 2006-07*, ABARE research report 09.20, Canberra, December.

MDBC 2008, *Drought update*, Murray-Darling Basin Commission, Canberra, July.