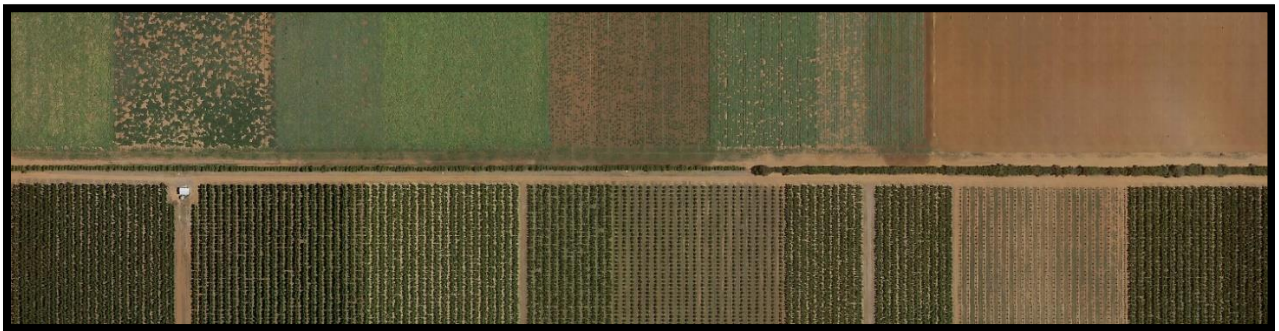




Irrigated crops in the Swan Hill LGA 1997 to 2018



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Authors: Sue Argus and Julie Hawtin, SunRISE Mapping & Research



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1. Introduction

This report was prepared for Swan Hill Rural City Council to provide accurate information on the status of irrigated horticulture in the Swan Hill LGA from 1997 to 2018 and provide an estimate of the value of irrigation production in 2018.

SunRISE Mapping and Research – mapping of irrigated crops

SunRISE Mapping and Research (SunRISE) is an enterprise of the Sunraysia Rural Counselling Service (SunRCS); a community based, not-for-profit organisation.

SunRISE has been mapping irrigated horticulture in the Lower Murray-Darling region since 1997. The crop mapping is undertaken in collaboration with irrigators, industry bodies and land and water managers.

Crops are mapped to the individual patch or variety level using scale accurate, high-resolution aerial imagery. Accurate irrigated crop areas are mapped from the imagery and crop details such as variety, year planted and irrigation method are input for property maps or interpreted from the imagery. Property maps assist farm businesses with planning and development, such as irrigation design, redevelopment, Freshcare quality assurance, spray diary records, export registration, organic certification and environmental management.

Details are also collected in collaboration with regional industry bodies for planning and management.

The privacy of individual property details is maintained and only aggregated information is published.

Analysis of the SunRISE crop mapping forms the basis of information in this report. Consistent and accurate mapping of irrigated areas from 1997 to 2018 provides information on changes and trends over twenty-one years, through a wine grape boom, millennium drought, unprecedented expansion with almond plantings, a global financial crisis and, more recently, renewed investment on the back of strengthening export markets.

The SunRISE crop mapping for 2018 (representing the 2017/18 season) was also used to estimate the gross value of irrigation production in the Swan Hill LGA, based on SunRISE hectares, estimates of yield (tonnes per hectare) and price (\$ per tonne) for the main irrigated crop types.

1.1 Study area

The report covers crop areas within the Swan Hill Local Government Area (LGA) that are irrigated from the Murray River (Figure 1). These areas covered 66,960 hectares in 2018, extending along the Murray River from Lake Boga to Wemen.

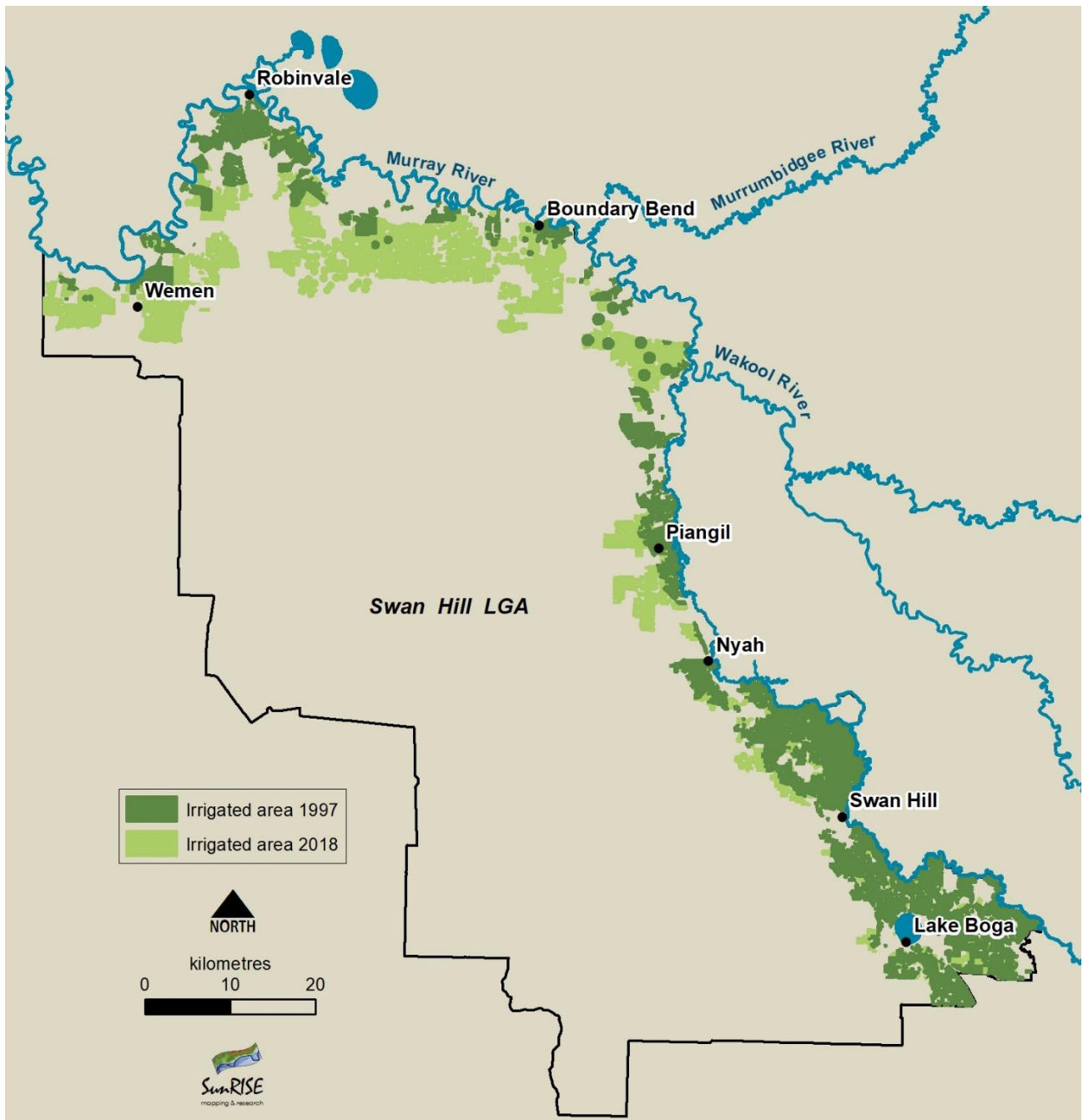


Figure 1: Map of irrigated areas in the Swan Hill LGA

1.2 Method

Aerial imagery

SunRISE crop mapping is based on aerial imagery that has been updated every three years since 1997 (Figure 2). The imagery is generally processed to sub-metre positional accuracy and the crop mapping has been captured at a scale of 1:2,000 or better from the imagery.

The 2018 crop mapping is based on aerial imagery acquired in February 2018 by the Coordinated Imagery Program, Department of Environment, Land, Water and Planning.

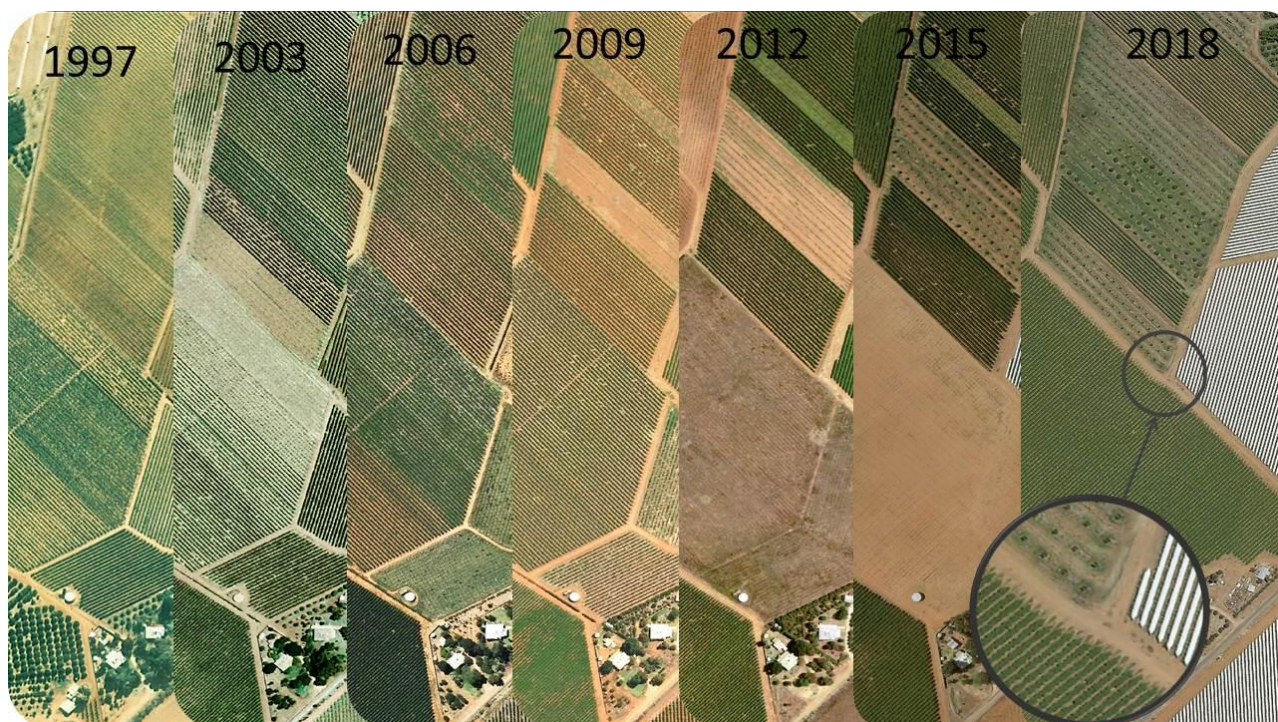


Figure 2: Three-yearly aerial imagery used by SunRISE to map irrigated horticulture

Information presented in this report is for the years: 1997, 2003, 2006, 2009, 2012, 2015 and 2018. The imagery used for each of these years was captured at the start of the year. Hence the information represents the 1996-97, 2002-03, 2005-06, 2008-09, 2011-12, 2014-15 and 2017-18 irrigation seasons respectively.

1.3 Definitions and limitations

The following definitions apply in this report.

Irrigable area

Irrigable area is the irrigated area and vacant, not irrigated, areas that were irrigated and could still be irrigated. Some vacant areas may eventually be retired or they may be in redevelopment. An increase in irrigable area can arise from new 'greenfield' development as well as expansion on existing irrigation properties; including redevelopment to more efficient planting layouts following the removal of furrow irrigation, drying racks etc.

Retired

Areas 'retired' from irrigation have undergone a change in land use that precludes them from being irrigated. SunRISE generally relies on updated aerial imagery, or digital cadastre for evidence of land use change such as residential development, buildings, sheds and dams. Areas set aside for conservation purposes are also 'retired' from the crop mapping.

Vacant

The crop mapping includes a crop type of 'vacant'. Vacant areas were irrigated, but not in the season that the crop mapping refers to. Where the vacant area was previously a permanent planting, it is termed **Vacant P**. Where the vacant area was previously a seasonal planting, such as pasture or vegetables, it is termed **Vacant S**.

Vacant areas could be in redevelopment, temporarily out of production, or dried-off indefinitely.

Limitation of areas for seasonal crops

Hectares for seasonal crops of vegetables and field crops (such as pasture) have a lesser reliability than for permanent plantings as the imagery provides only one snapshot of the season, making it difficult to determine irrigation activity in a given year. Broad-acre field crops and vegetables cover large areas and misinterpretation of a single planting can have a significant impact on accuracy of the information. Information for seasonal cropping should be treated as indicative only.

Hectare totals were rounded to the nearest five hectares. Rounding of hectares and percentages in tables may lead to small discrepancies in totals.

2. 2018 irrigated crops and gross value of production

2.1 Irrigated crop types in 2018

Figure 3 shows the main crop types irrigated in the Swan Hill LGA in 2018. The irrigable area was 66,960 ha comprising 34,200 ha (51%) of permanent plantings, 20,395 ha (31%) of seasonal crops and 12,365 ha (18%) of vacant, not irrigated areas.

The ten most dominant crop types were:

1. almonds; 19,615 ha (29% of the irrigable area);
2. field crops; 14,550 ha (22% of the irrigable area);
3. table grapes; 4,410 ha (7% of the irrigable area);
4. olives; 2,970 ha (4% of the irrigable area);
5. stone fruit; 2,845 ha (4% of the irrigable area);
6. vegetables other than carrots and potatoes; 2,345 ha (4% of the irrigable area);
7. wine grapes; 2,170 ha (3% of the irrigable area);
8. potatoes; 1,800 ha (3% of the irrigable area);
9. carrots; 1,700 ha (3% of the irrigable area); and
10. avocados; 560 ha (1% of the irrigable area).

	Crop type	2018 (ha)	2018 %	Description
Permanent plantings	Grape Dried	260	<1%	
	Grape Table	4,410	7%	
	Grape Wine	2,170	3%	Includes a very small proportion of juiced grapes
	Citrus	510	1%	Grapefruit, lemon, lime, mandarin, navel, other orange, pumelo, tangelo, valencia
	Fruit Avocado	560	1%	
	Fruit Olive	2,970	4%	
	Fruit Stone fruit	2,845	4%	Apricot, nectarine, peach, plum
	Fruit Other	60	<1%	Date palm, fig, mango, persimmon, pome fruit, pomegranate
	Nut Almond	19,615	29%	
	Nut Other	405	1%	Pistachio (385 ha), walnut (20 ha)
	Miscellaneous	395	1%	Aquaculture, berry, fresh flowers, nursery, passionfruit, tree plantation
		34,200	51%	
Seasonal crops	Field Crop	14,550	22%	Includes canola, cereal, cotton, cover crop, lucerne, lupin, maize, pasture
	Veg. Carrot	1,700	3%	Includes juicing and fresh carrots
	Veg. Potato	1,800	3%	Includes processed and fresh potatoes
	Veg. Other	2,345	4%	Asparagus, bean, beetroot, broccoli, cabbage, capsicum, cauliflower, chili, cucumber, eggplant, garlic, lettuce, melon, onion, pea, pumpkin, salad greens, sweet corn, tomato, zucchini
			20,395	31%
Vacant	Vacant P	2,555	4%	Vacant (not irrigated), previously an irrigated permanent crop
	Vacant S	9,810	14%	Vacant (not irrigated), previously an irrigated seasonal crop
	Total	66,960	100%	

Figure 3: Irrigated crop types in the Swan Hill LGA in 2018

2.2 Gross value of production in 2018: method

Gross value of production is the income to the producer without deduction of any costs of production. It was calculated from the area of bearing crops irrigated in 2018 sourced from the SunRISE crop mapping and average income per hectare (\$/ha) derived from a range of sources (Figure 6).

Crop yields and prices vary widely for different varieties within each crop type and within a given season; yields, prices and crop values are estimated annual averages.

Bearing and non-bearing crops

Crop values were only applied to bearing crops; 29,810 ha of permanent plantings and 20,395 ha of seasonal crops (a total of 50,205 ha). Non-bearing permanent plantings were excluded from the analysis based on their age as listed in Figure 5. There were 4,390 ha of 'non-bearing' plantings in 2018, 13% of permanent plantings.

Plantings can have light crops for several years before coming into full production, in particular avocados and nut trees, so the allocation of 'non-bearing' is not definitive.

Crop type in 2018		Age of non-bearing plantings	Non-bearing ha	% of crop type non-bearing	Bearing ha
Permanent plantings	Grape Dried	< 3 years	40	15%	220
	Grape Table	< 3 years	700	16%	3,710
	Grape Wine	< 3 years	140	6%	2,030
	Citrus	< 5 years	95	19%	415
	Fruit Avocado	< 4 years	165	29%	395
	Fruit Olive	< 4 years	615	21%	2,355
	Fruit Stone fruit	< 4 years	500	18%	2,345
	Fruit Other	< 4 years	15	25%	45
	Nut Almond	< 5 years	1,925	10%	17,690
	Nut Other	< 7 years	185	46%	220
	Miscellaneous	< 2 years	10	3%	385
				4,390	13%

Figure 4: Bearing and non-bearing permanent plantings in the Swan Hill LGA in 2018

Dual cropping and organic produce

There were over 1,300 ha of broad-acre areas with sub-surface drip irrigation in 2018. These areas can have a summer and winter crop; however only 400 ha of dual crops were known and factored into the value of production. If there was dual cropping across the other 900 ha, it would add \$1.8 million to the value of production at a conservative \$2,000 per ha.

The crop values are for conventional crops, the value of organic produce is not factored into the estimates.

Extrapolation of crop types

The SunRISE mapping did not have exact areas for all of the crops listed in Figure 6, but for permanent plantings there was at least 75% recorded in the databases, sufficient to extrapolate and arrive at weighted averages. For instance, the proportion of red and white grapes for 75% of wine grapes was known. Figures were extrapolated for the remaining 25% so that the different prices for red and white grapes (\$474/ha and \$344/ha respectively) could be proportionally applied.

2.3 Gross value of production for irrigated crops in 2018

Figure 5 shows an estimated gross value of production for bearing crops irrigated in the Swan Hill LGA in 2018. The value of production was calculated from bearing areas (hectares) sourced from SunRISE crop mapping and an average price (\$/ha) as listed in Figure 6.

The 2018 gross value of production for irrigated crops in the Swan Hill LGA was estimated at \$1.18 billion.

In 2018, in the Swan Hill LGA:

- Permanent plantings accounted for 80% of the gross value of production for irrigated crops and seasonal crops (field crops and vegetables) accounted for 20% of the gross value.
- Almond and table grape plantings accounted for 63% of the gross value for irrigated crops.
- The following crop types accounted for 94% of the gross value for irrigated crops:
 - Almonds (42%);
 - Table grapes (21%);
 - Vegetables including potatoes and carrots (17%);
 - Stone fruit (8%);
 - Field crops (3%); and
 - Olives (3%).

Crop type in 2018		Bearing ha	Value of production \$ million	% of total Value	
Permanent	Grape Dried	220	\$2.4	<1%	Permanent plantings \$941.0 m 80%
	Grape Table	3,710	\$252.1	21%	
	Grape Wine	2,030	\$21.3	2%	
	Citrus	415	\$9.6	1%	
	Fruit Avocado	395	\$25.1	2%	
	Fruit Olive	2,355	\$32.8	3%	
	Fruit Stone fruit	2,345	\$91.4	8%	
	Fruit Other	45	\$1.3	<1%	
	Nut Almond	17,690	\$495.3	42%	
	Nut Other	220	\$7.3	1%	
	Miscellaneous	385	\$2.5	<1%	
Seasonal	Field Crop	14,550	\$38.4 ¹	3%	Seasonal crops \$238.5 m 20%
	Veg. Carrot	1,700	\$66.5	6%	
	Veg. Potato	1,800	\$38.7	3%	
	Veg. Other	2,345	\$94.9	8%	
Total		50,205	\$1,179.5	100%	

Figure 5: Estimated gross value of production for irrigated crops in the Swan Hill LGA in 2018

¹ Includes value for 415 ha of dual (summer and winter) cropping

2.4 Data sources for crop values in 2018

Figure 6 lists the main data sources used to estimate a gross value for crops irrigated in 2018. Where the source isn't noted, it is an estimate based on yields and prices for similar crops or information from industry websites, prices received at the Melbourne Market and people involved in the industry.

	National Value \$ million	National tonnes	Average \$/tonne ²	Average yield tonnes/ha	Average \$/ha	
Permanent plantings	Grape Dried	\$30.6	16,953	\$1,805	(dried) 6.0 ³	\$10,830
	Grape Table	\$543.7	177,416	\$3,065	22.2 ⁴	\$67,963
	Grape Wine Red	<i>Source: 2018 MV Utilisation Survey</i>		\$474	25.0	\$11,850
	Grape Wine White			\$344	25.0	\$8,600
	Citrus Mandarin			\$1,000	35.0	\$35,000
	Citrus Navel	<i>Source: citrus production managers</i>		\$800	30.0	\$24,000
	Citrus Other			\$400	30.0	\$12,000
	Fruit Avocado	\$543.0	77,032	\$7,049	9.0 ⁵	\$63,441
	Fruit Olive	<i>Source: local olive oil producers</i>		\$5,350	(oil) 2.6	\$13,910
	Fruit Stone fruit	\$397.8	153,148	\$2,597	15.0	\$38,962
	Fruit Other	\$5,015.4	2,657,597	\$1,887	15.0	\$28,308
	Nut Almond	<i>Source: local almond producers</i>		\$8,000	(kernel) 3.5	\$28,000
	Nut Pistachio	\$35.4	3,200	\$11,063	3.0 ⁶	\$33,188
	Misc. Nursery	<i>Estimate</i>				\$25,000
	Misc. Woodlot	<i>No value assigned as predominantly non-commercial areas</i>				\$0
	Misc. Other	<i>Estimate</i>				\$25,000
Seasonal crops	Field Cotton	<i>Source: AgEcon 2017-18 Cotton Industry Gross Margins</i>				\$5,951
	Field Canola			\$580	3.0	\$1,740
	Field Cereal hay			\$300	10.0	\$3,000
	Field Cereal grain	<i>Source: Irrigated Cropping Council</i>		\$370	6.0	\$2,220
	Field Lucerne			\$550	10.0	\$5,500
	Field Maize			\$400	14.0	\$5,600
	Field Pasture	<i>Source: Farm Gross Margin & Planning Guide, Rural Solutions SA</i>				\$630
	Field Other/Unknown	<i>Estimate</i>				\$1,800
	Veg. Asparagus	\$61.0	7,576	\$8,052	5.0	\$40,259
	Veg. Carrot	\$215.7	330,655	\$652	60.0	\$39,140
	Veg. Melons	\$124.2	215,519	\$576	30.0	\$17,288
	Veg. Potato	\$745.9	1,388,968	\$537	40.0 ⁷	\$21,481
	Veg. Pumpkin	\$68.8	119,546	\$576	30.0	\$17,265
Veg. Salad Greens	\$147.1	138,485	\$1,062	20.0	\$21,244	
Veg. Tomato	\$609.9	484,073	\$1,260	90.0	\$113,394	
Veg. Other	\$4,345.7	3,695,345	\$1,176	30.0	\$35,280	

Figure 6: Data sources and assumptions used to estimate the value of irrigation production in 2018

Figures shaded in grey were sourced from *Australian Horticulture Statistics Handbook 2017/18, Horticulture Innovation Australia Limited*.

² Calculated from National Value / National tonnes unless otherwise stated

³ Source: Dried Fruits Australia Database Project 2018, SunRISE Mapping and Research

⁴ Based on 20 kg per vine and 1,200 vines/ha

⁵ Based on Australian industry average of 9 t/ha in 2017, AgriFutures Australia

⁶ Source: Pistachio Growers' Association website

⁷ Based on 39 t/ha in 2017, Agricultural Statistics Australia, Potato Pro website

3. Irrigation development from 1997 to 2018

3.1 Planting trends: permanent, seasonal & vacant areas

Figure 7 summarises planting trends in the Swan Hill LGA with respect to the proportion of permanent plantings, seasonal crops and vacant, not irrigated, areas.

From 1997 to 2018, permanent plantings increased by 25,460 ha (+ 291%), seasonal cropping decreased by 2,260 ha (- 10%) and vacant, not irrigated, areas increased by 8,510 ha (+ 219%).

The net result was an increase in the irrigated area of 23,200 ha (+ 74%) and an increase in the irrigable⁸ area of 31,710 ha (+ 90%).

Permanent planting trends

Permanent plantings were on an upward trend from 1997 to 2009 with a net increase of 23,500 ha, an average of 1,958 ha per year over the twelve-year period. Expansion was largely driven by wine grape plantings in the late 1990's, almond plantings from 2001 to 2008 and olive plantings from 2005 to 2008.

This level of development ceased around 2009 with the impact of the millennium drought, 2008 global financial crisis and collapse of managed investment schemes. Relatively little development occurred from 2009 to 2015; on average permanent plantings increased by 78 ha per year over the six-year period. This trend changed from 2015 to 2018 with renewed investment and activity in irrigated horticulture. Permanent plantings increased by 1,490 ha (an average of 497 ha/year), mainly the net result of a 1,185 ha decrease in wine grape plantings, a 1,495 ha increase in almonds and a 675 ha increase in table grape plantings.

Vacant areas that were previously irrigated permanent plantings increased from 235 ha in 1997 to 2,850 ha by 2015, again, largely due to impacts of the millennium drought and 2008 global financial crisis. A reverse of the upward trend finally occurred between 2015 and 2018 when areas out of production finally decreased, from 2,850 ha to 2,555 ha.

Seasonal planting trends

Irrigated seasonal cropping was also impacted by the millennium drought. Areas declined from 22,655 ha in 1997 to 5,480 ha by 2009 when water allocations were particularly low and prices high. Once the drought broke, irrigated seasonal cropping increased to around 15,000 ha from 2012 to 2015, then trended upward again from 2015 to 2018 with a 3,125 ha increase in irrigated field crops and a 1,285 ha increase in vegetable crops.

⁸ Irrigable area is the irrigated area plus vacant areas

In summary for planting trends in the Swan Hill LGA

In 2018, the irrigable area of 66,960 ha comprised:

- 51% (34,200 ha) irrigated permanent plantings;
- 31% (20,395 ha) irrigated seasonal crops;
- 4% (2,555 ha) vacant, previously irrigated permanent plantings; and
- 14% (9,810 ha) vacant, previously irrigated seasonal crops.

The proportion of permanent plantings, seasonal cropping and vacant areas changed from:

- 25% permanent, 64% seasonal and 11% vacant in 1997; to
- 51% permanent, 31% seasonal and 18% vacant in 2018.

From 1997 to 2018:

- irrigated permanent crops increased by 25,460 ha, a 291% increase;
- irrigated seasonal crops decreased by 2,260 ha, a 10% decrease;
- vacant, not irrigated permanent planting areas increased by 2,320 ha, a 987% increase; and
- vacant, not irrigated seasonal cropping areas increased by 6,190 ha, a 219% increase.

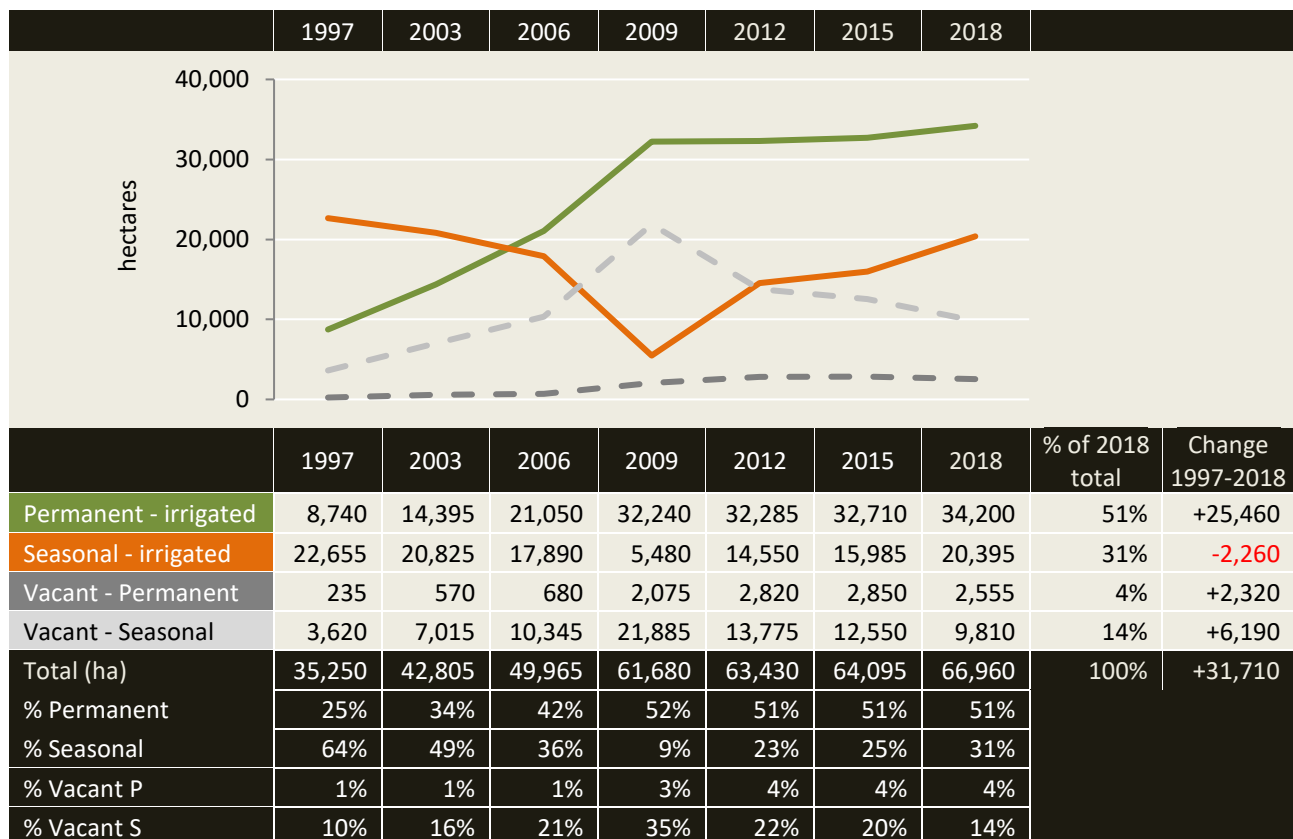


Figure 7: Planting trends in the Swan Hill LGA from 1997 to 2018

3.2 Change in crop types from 1997 to 2018

Figure 8 summarises the change in irrigated crop types from 1997 to 2018 in the Swan Hill LGA.

Irrigated field crops, such as pasture and lucerne, were the dominant crop type from 1997 to 2006, whereas almond plantings were dominant from 2009 to 2018. The main changes from 1997 to 2018 were:

- Almond tree plantings increased by 18,815 ha, a 2,352% increase from 800 ha to 19,615 ha;
- Field crops decreased by 4,330 ha, a 23% decrease from 18,880 ha to 14,550 ha;
- Olive tree plantings increased by 2,870 ha, a 2,870% increase from 100 ha to 2,970 ha;
- Table grape plantings increased by 1,935 ha, a 78% increase from 2,475 ha to 4,410 ha;
- Wine grape plantings increased by 210 ha, an 11% increase; the net result of a 2,925 ha increase from 1997 to 2006 followed by a 2,715 ha decrease from 2006 to 2018;
- Stone fruit plantings increased by 1,305 ha, an 85% increase from 1,540 ha to 2,845 ha; and
- Vegetables, including potatoes and carrots, increased by 2,070 ha, a 55% increase from 3,775 ha to 5,845 ha.

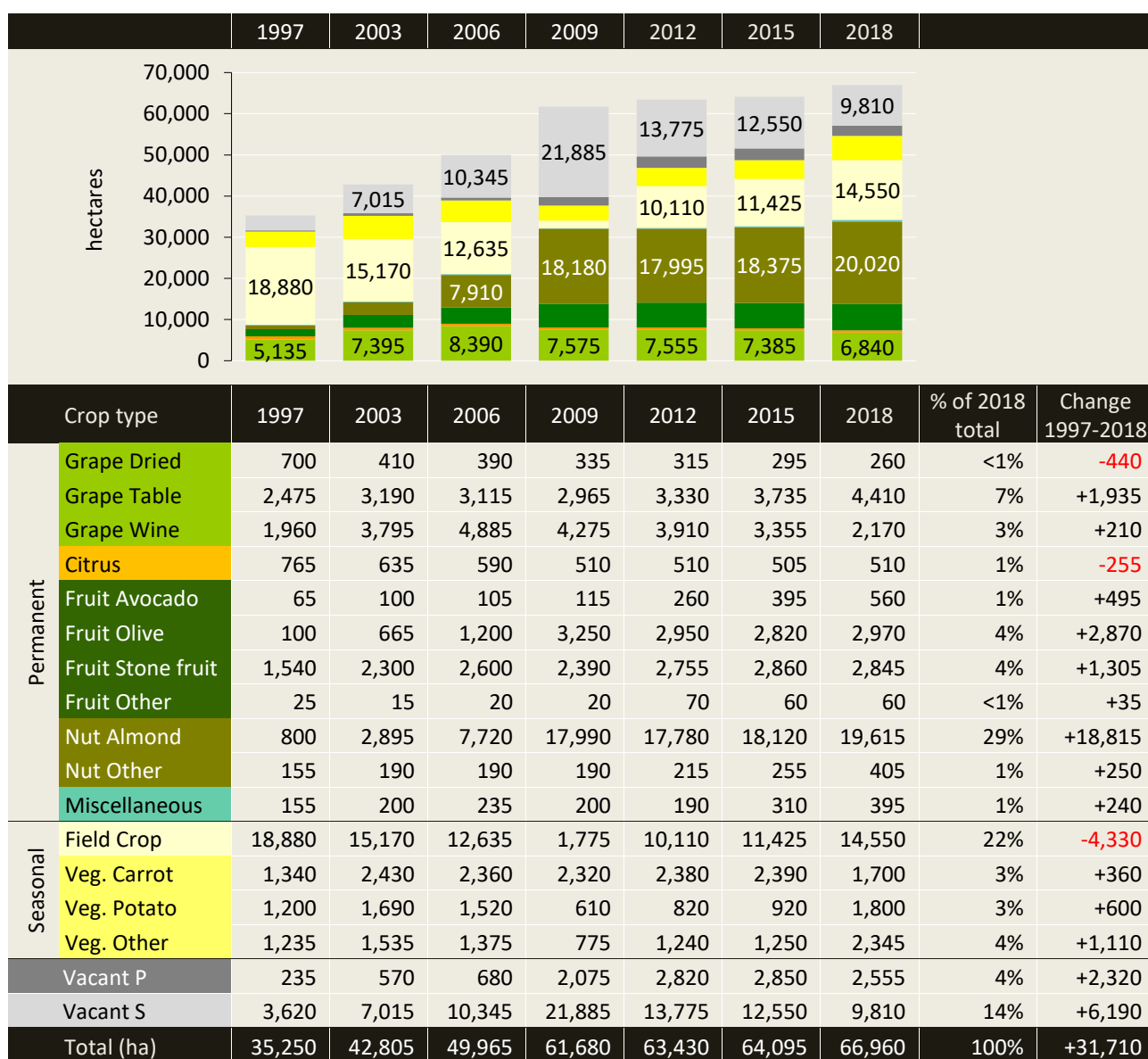


Figure 8: Change in irrigated crop types in the Swan Hill LGA from 1997 to 2018

3.3 Irrigation expansion and retired areas

Figure 9 summarises irrigation development with respect to new areas (expansion) and areas retired from irrigation in the Swan Hill LGA.

From 1997 to 2018, the irrigable area increased by 31,710 ha, a 90% increase from 35,250 ha to 66,960 ha. The net increase of 31,710 ha was the balance of 32,280 ha expansion and 570 ha retired from irrigation. Expansion predominantly occurred from Piangil to Wemen with almond and olive plantings. Retired areas were predominantly for housing development and farm infrastructure such as sheds and dams.

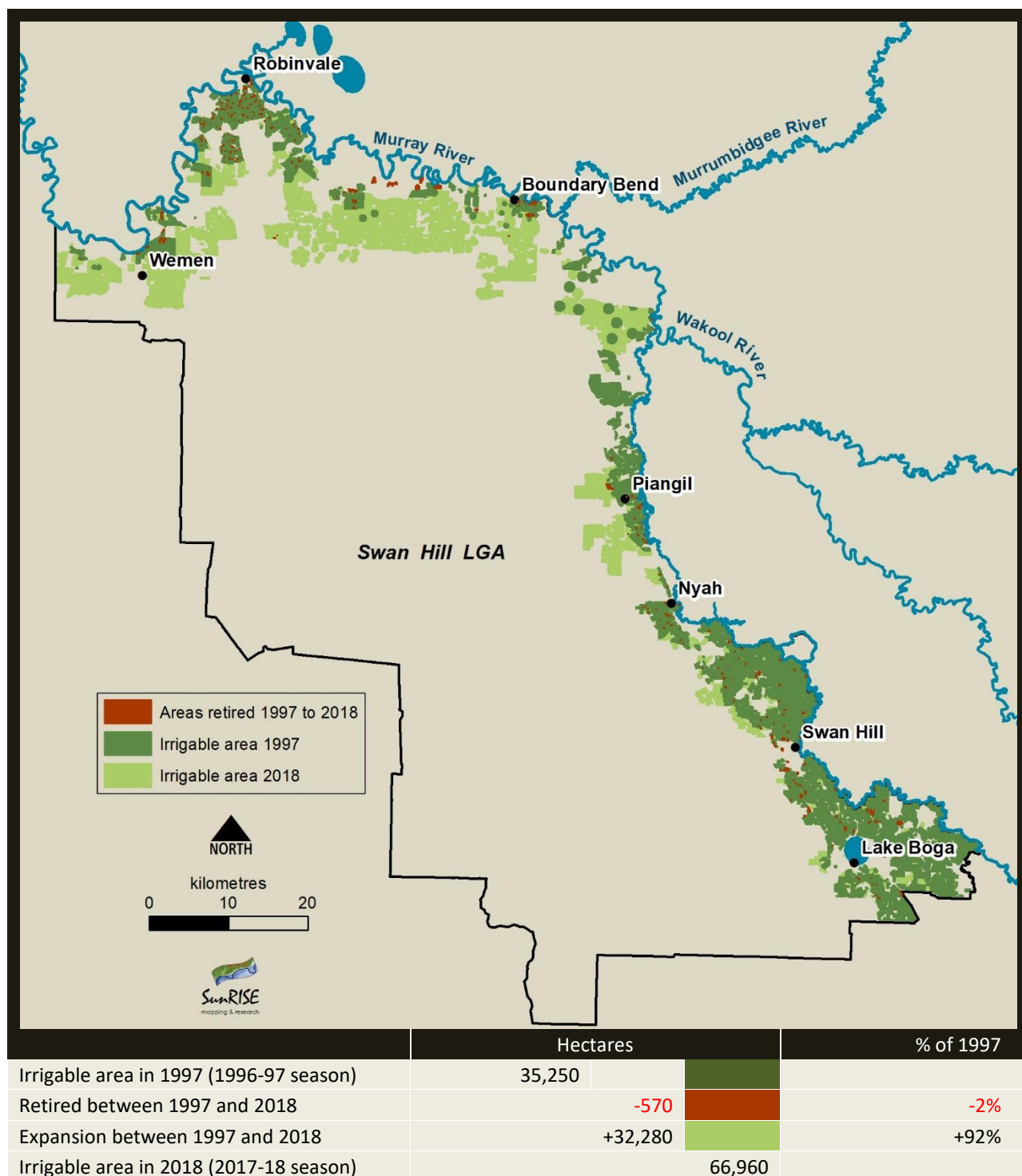


Figure 9: Irrigation expansion and retired areas in the Swan Hill LGA from 1997 to 2018