

2015 Irrigated Horticulture Crop Report

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Cover images

Top: Grape Vines
Middle: Crops being irrigated
Bottom: Almond Blossom
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Executive summary

This report is the continuation of a series of triennial crop reports first produced in 1997 with the aim of accurately measuring irrigation status and development in the Victorian Mallee region; along the Murray River from Nyah to the South Australian border.

The crop mapping is based on a time series of high resolution orthophoto imagery (scale accurate, digital, aerial photography). Crop details, such as crop type, area and irrigation method, are derived from grower input or interpretation of the imagery and field surveys.

Key findings from the report

Crop types

Nut tree plantings (of which 99% were almonds) were the dominant crop type in 2015.

The area of nut trees increased by 18,980 hectares; a 986% increase from 1,925 hectares in 1997 to 20,905 hectares in 2015. This was predominantly driven by the expansion of almond properties in private diverter areas, in which the area of almond trees increased from 1,635 hectares in 1997 to 20,470 hectares in 2015.

Prior to 2015, grapevines were the dominant crop type grown in the region. Other regional crops include citrus, olives and other fruit trees (including avocados, stonefruit, and pomegranate trees), field crops (lucerne, pasture, cereal crops) and vegetables (carrots, potatoes, cucurbits, asparagus).

The dominant crop in 2015 across the private diverter areas and in each of the pumped irrigation districts is shown in Table 1.

Table 1: Dominant crop in 2015 across private diverter areas & in each pumped irrigation district

Study area	2015 dominant crop	Hectares	% of the study area's irrigable area
Private diverters	Almond trees	20,470	37%
Nyah irrigation district	Wine grapes	460	30%
Robinvale irrigation district	Table grapes	1,920	79%
Red Cliffs irrigation district	Wine grapes	1,295	29%
Mildura irrigation district	Table grapes	1,595	27%
Merbein irrigation district	Dried grapes	710	23%
Murray–Mallee region total	Almond trees	20,620	28%

Grapevines

Grapevines were the dominant crop type in the region prior to 2015. Plantings peaked around 2006, driven by a wine grape boom, but with the following drought period and an over-supply of wine grapes the area of grapevines continued to decline from 2006 to 2015.

The net area of grapevines increased by just 45 hectares between 1997 and 2015.

- Wine grapes continued to be the main type of grapevine in the Victorian Murray-Mallee; 49% of grapevine plantings were for wine production in 2015. Wine grape plantings peaked around 2006 but decreased by 35% (5,430 hectares) between 2006 and 2015. Net expansion was 2% (190 hectares) between 1997 and 2015; from 9,945 hectares to 10,135 hectares.
- Table grape plantings comprised 36% of the region's grapevines in 2015. Plantings expanded by 77% (3,170 hectares) between 1997 and 2015; from 4,120 hectares to 7,290 hectares.
- Dried vine fruit plantings comprised 15% of the region's grapevines in 2015. Plantings decreased by 52% (3,265 hectares) between 1997 and 2015; from 6,305 hectares to 3,040 hectares.

In 2015, 50% of grapevine plantings were grown in private diverter areas and 50% in the irrigation districts.

While the area of grapevines has been on the decline since 2006 with removal of plantings, there has still been redevelopment in the vineyard and diversification to new varieties.

- Wine grape varieties new to the region included Pinot Gris, Fiano, Montepulciano, Nero d'Avola, Vermentino and other Muscat and Italian varieties.
- New dried grape varieties included Sunmuscat, Sunglo, Diamond Muscat, Black Gem, Selma Pete and Summer Muscat.
- New seedless table grape varieties included Sable, Scarlotta, Adora, Ralli, Luisco, Melody, Magic, Timco and Magenta.

Vacant / not irrigated areas

Across the Victorian Murray-Mallee region the area categorised as 'Vacant' (i.e. not irrigated but previously irrigated and could potentially be irrigated again) increased from 3% of the total area in 1997 to 20% by 2009. Vacant areas of 3 to 5% are typical of areas in redevelopment in a given year, but the proportion of vacant areas after 2006, as shown in Table 2, indicates other influences, in particular, an extended drought period from 2006 to 2010 resulting in high water prices and dewatering of less productive crops.

- The high percentage in 2009, 20% vacant, coincides with an extended drought period from 2007 to 2010. There appears to be a slight recovery with 18% vacant in 2012 and 17% in 2015.
- Prior to 2009, vacant areas were predominantly areas that had been irrigated seasonal crops, but after 2009 vacant areas were predominantly areas that had been permanent plantings.

Table 2: Murray-Mallee region vacant (not irrigated) areas

Murray-Mallee region	1997	2003	2006	2009	2012	2015
Vacant <10 years - seasonal crop areas	725	2,025	3,605	7,215	3,825	2,950
Vacant <10 years – permanent crop areas	420	920	1,890	6,275	7,520	7,215
Vacant >10 years - seasonal & permanent	0	0	270	660	1,625	2,475
Total vacant hectares	1,145	2,945	5,765	14,150	12,970	12,640
% of irrigable area vacant	3%	6%	10%	20%	18%	17%

Table 3 shows vacant areas in 2015 across the private diverter areas and in each of the pumped irrigation districts.

- 14% of the region's irrigable area had been vacant for less than ten years in 2015. Only private diverters and the Robinvale irrigation district had a smaller proportion of their irrigable area vacant in 2015; 10% and 6% respectively.
- 3% of the region's irrigable area had been vacant for more than ten years in 2015. Only the Robinvale irrigation district had a smaller proportion of its irrigable area vacant in 2015, at 1%, while Nyah and Merbein districts had a larger proportion of their irrigable area vacant; at 14% and 5% respectively.

Table 3: Vacant areas in 2015 across private diverter areas & in each pumped irrigation district

Study area	Vacant (ha)		% of the study area's irrigable area	
	< 10years	> 10 years	< 10years	> 10 years
Private diverters	5,835	1,810	10%	3%
Nyah irrigation district	395	215	25%	14%
Robinvale irrigation district	145	20	6%	1%
Red Cliffs irrigation district	1,090	115	24%	3%
Mildura irrigation district	1,645	170	27%	3%
Merbein irrigation district	1,055	145	34%	5%
Murray–Mallee region total	10,165	2,475	14%	3%

Irrigation methods

Drip irrigation was the dominant irrigation method from 2006 to 2015. Prior to this, dominant irrigation methods were overhead sprinklers in 2003 and furrow irrigation in 1997.

- The proportion of the total irrigable area (across the Murray-Mallee region) under drip irrigation increased from 10% to 56% (3,930 to 41,250 hectares) between 1997 and 2015, while furrow irrigation decreased from 38% to 4% (15,225 to 3,195 hectares).
- 66% (2,100 hectares) of furrow irrigation was in the Nyah river reach in 2015, predominantly for irrigating broad-acre field crops.

Table 4 illustrates the dominant irrigation method for each study area (private diverters, and each pumped district) in 2015.

Table 4: Dominant irrigation type in 2015 across private diverter areas & in each irrigation district

Study area	Dominant irrigation type	Hectares	% of the study area's irrigable area in 2015
Private diverters	Drip	35,205	63%
Nyah irrigation district	Drip	630	41%
Robinvale irrigation district	Low level	1,520	63%
Red Cliffs irrigation district	Drip	1,895	42%
Mildura irrigation district	Drip	1,930	32%
Merbein irrigation district	Drip	895	29%
Murray–Mallee total	Drip	41,250	56%

Salinity impact zones

Crops in the Victorian Murray-Mallee are predominantly irrigated in the low salinity impact zones (LIZ).

Across the Murray-Mallee region:

- In 2015, 15% of the irrigable area was in the high salinity impact zone (HIZ) and 85% was in the LIZ comprising 48% in LIZ 1, 21% in LIZ 2, 3% in LIZ 3 and 13% in LIZ 4.
- The area irrigated in the HIZ was 3,655 hectares (34%) less in 2015 than in 1997; 10,845 hectares in 1997 and 7,190 hectares in 2015.
- The irrigable area in the HIZ was 605 hectares (5%) less in 2015 than in 1997; 11,435 hectares in 1997 and 10,830 hectares in 2015.
- 775 hectares (31%) of the area that had been vacant for over ten years in 2015 (2,475 hectares) was in the HIZ, and approximately 950 hectares (8%) of the total areas in the HIZ in 1997 were retired from irrigation by 2015.

Table 5 illustrates the dominant salinity impact zone in each study area (private diverters and each pumped irrigation district) in 2015.

Table 5: Dominant salinity impact zone in 2015 across private diverter areas & in each district

Study area	Dominant salinity impact zone	Hectares	% of the study area's irrigable area in 2015
Private diverters	LIZ 1	28,955	52%
Nyah irrigation district	LIZ 1	1,330	86%
Robinvale irrigation district	LIZ 2	2,400	99%
Red Cliffs irrigation district	HIZ	1,915	43%
Mildura irrigation district	HIZ	3,835	64%
Merbein irrigation district	HIZ	2,025	67%
Murray-Mallee total	LIZ 1	34,920	48%

Irrigation development

Across the Murray-Mallee region the irrigable area expanded by 33,310 hectares, an 84% increase from 39,705 hectares in 1997 to 73,015 hectares in 2015. Most of this expansion occurred between 1997 and 2009, with only 8% occurring after 2009.

The net irrigable area increase of 33,310 hectares comprised 1,520 hectares retired¹ from irrigation and 34,830 hectares of expansion. Expansion mostly occurred in the private diverter areas where the net irrigable area increased by 150% (33,365 hectares) from 22,220 hectares in 1997 to 55,585 hectares in 2015; comprising 501 hectares retired from irrigation and 33,875 hectares of new development.

The total increase across the Murray-Mallee region was offset in the five pumped irrigation districts with a net decrease in the irrigable area by 55 hectares; 1,010 hectares retired from irrigation and 955 hectares of expansion. The irrigable area was 17,485 hectares in 1997 decreasing to 17,430 hectares in 2015.

The Boundary Bend and Wemen river reaches reported the largest growth in irrigable area, increasing by 283% and 398% respectively. The irrigable area in the Boundary Bend river reach increased from 5,365 hectares in 1997 to 20,540 hectares in 2015, and in the Wemen river reach it increased from 2,150 hectares in 1997 to 10,710 hectares in 2015.

¹ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

Irrigation properties

In 2015, there were approximately 2,047 irrigation properties in the Victorian Murray-Mallee with an average property size (irrigable area) of 36 hectares.

- 79% of properties were in the pumped irrigation districts and 21% of properties were private diverters.
- Average property size in the private diverter areas increased by 180%; from 44 hectares in 1997 to 124 hectares in 2015, while in the pumped districts it increased by 20%; from 9 hectares to 11 hectares.
- The number of properties in the private diverter areas decreased by 11%; from 502 properties in 1997 to 448 properties in 2015, while in the pumped districts it decreased by 17%; from 1,987 properties in 1997 to 1,646 properties in 2015.
- Across the Murray-Mallee region, the number of properties less than 40 ha (irrigable area) declined by 483, while the number over 40 ha increased by 78.

Table 6 illustrates the approximate number of properties and average property size in each study area (private diverter areas and each pumped irrigation district) in 2015.

Table 6: Property numbers and size in 2015 across private diverter areas & in each district

Study area	Number of properties ²	Average size (irrigable area in hectares)	% of the region's properties in 2015
Private diverters	448	124	21%
Nyah irrigation district	156	10	79%
Robinvale irrigation district	112	22	
Red Cliffs irrigation district	434	10	
Mildura irrigation district	681	9	
Merbein irrigation district	298	10	
Murray-Mallee total	2,047	36	100%

² The sum of the number of properties in each study area (2,129) is greater than the regional total (2,047) as some properties have holdings in more than one study area.

Introduction

This report was commissioned by the Mallee Catchment Management Authority (Mallee CMA) to provide an accurate snapshot of irrigation status and change in the Victorian Mallee region; along the Murray River from Nyah to the South Australian border.

SunRISE Mapping & Research – crop mapping

Information in the report is produced from analysis of spatial crop mapping and databases that have been consistently maintained by SunRISE Mapping & Research (SunRISE) since 1997.

The crop mapping is based on a time series of high resolution orthophoto imagery (scale accurate, digital, aerial photography). Crop details such as type, variety, year planted, area, irrigation method etc., are derived from interpretation of the imagery, field surveys and input from the region's irrigators.

Since 1997 the orthophoto imagery, crop mapping and crop reports have been contributed to and used by many regional agencies, industry organisations, local businesses, individual irrigators and land managers.

Purpose of the report

Information from the report enhances understanding of the dynamics of irrigation and its impact on salinity and water quality. This facilitates better management of these issues through planning of irrigation development and investment in on-ground activities that support biodiversity and minimise salinity and water quality impacts.

The report will inform the Mallee CMA with respect to:

- Monitoring and evaluating implementation of the Victorian Mallee Irrigation Region - Land and Water Management Plan (LWMP);
- Planning for future irrigation modernisation programs;
- Analysis and modelling of salinity impacts from new irrigation development;
- Mallee region reporting to State and Commonwealth Governments including review of regional items on the Basin Salinity Management Strategy registers;
- Achieving high level, long-term goals of the Mallee Regional Catchment Strategy 2013-2019. Specifically:
 - 'To protect and enhance the environmental values of the Mallee's watercourses and their associated riparian ecosystems and, in turn, the social, economic and environmental services that they provide to the community';
 - 'To protect and enhance the environmental values of the Mallee's wetlands and, in turn, the social, economic and environmental services that they provide to the community'; and
 - 'To optimise the productive capacity of Mallee agricultural landscapes, while minimising any adverse impacts of associated management practices (both current and historical) on our natural and cultural landscapes'.
- Investment priorities of State programs, in particular Sustainable Irrigation Program priorities:
 - Reduce the adverse environmental impacts of irrigation;
 - Increase the capacity of the irrigation sector to respond to a variable water future; and
 - Guide irrigation rationalisation and consolidation in a water scarce future to maximise productive, social and environmental benefits of irrigation water use and enhance the resilience of regional communities.

Method

SunRISE crop mapping is captured to the individual patch or variety level using a map base of high resolution orthophoto imagery (scale accurate imagery processed from aerial photography). Details for each crop patch such as type, variety, year planted and irrigation method are collected from irrigators, field surveys and orthophoto imagery interpretation. Some details are discernible from the imagery while others, such as variety, are only obtained from irrigators.

Details are also collected in collaboration with local agencies and industry bodies to support specific programs, such as planting statistics for industry planning and management, and spatial information for infrastructure development, biosecurity, economic assessments and environmental monitoring.

SunRISE records crop and property details from irrigators on an on-going basis. This is generally in response to mapping and information needs for property planning and development, such as irrigation design, redevelopment, property sales, soil surveys, spray records, export registration, organic certification and environmental management. The privacy of individual property details is maintained and only aggregated information is published.

Details provided by irrigators are more accurate and comprehensive than those derived from imagery interpretation. When more accurate details are collected, the earlier databases are backfilled where relevant, and the SunRISE databases are continually improved. This may also mean that numbers in current reports vary slightly from those in older reports.

Orthophoto imagery

SunRISE crop mapping is based on orthophoto imagery that has been updated every three years since 1997 (Figure 1).



Figure 1: High resolution orthophoto series used by SunRISE to maintain regional crop mapping

Information presented in this report is for the years; 1997, 2003, 2006, 2009, 2012 and 2015. The orthophoto 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 and 2014-15 irrigation seasons respectively.

The 2015 crop mapping is based on imagery acquired in January 2015 by the Department of Environment, Land, Water and Planning's Coordinated Imagery Program.

Positional and area accuracies

The orthophoto imagery is generally processed to sub-metre positional accuracy. The crop mapping has been captured at a scale of 1:2,000 or better from the imagery. Hectares for seasonal plantings of vegetables and field crops (such as pasture) have a lesser reliability as the imagery provides only one snapshot of the season, making it difficult to determine irrigation activity in a given season.

Totalled area figures in this report have been rounded to the nearest five hectares.

Field surveys

Field surveys are undertaken to check interpretation of data sources, in particular in areas where it is unclear whether cultivated land is vacant, being prepared for annual cropping or has a newly planted permanent crop.

Definitions

The following definitions apply in this report.

Irrigable area Irrigable area is the area that has been irrigated in the past and is still irrigated or could be irrigated. It is the sum of the irrigated area plus the 'Vacant' area. An increase in irrigable area can arise from new 'greenfield' development and/or from an increase in the area irrigated following redevelopment and the removal of furrow irrigation, drying racks etc.

Property One property is a holding with the one owner or corporate entity. A property generally comprises more than one 'farm', 'fruit block' or land parcel. Property numbers are estimates only due to difficulties in resolving and maintaining ownership details.

Note that some property owners have irrigated land in more than one pumped district and/or have irrigated land in pumped districts and private diverter areas. Hence, property numbers across the Murray-Mallee are less than the sum of property numbers for each of the study areas.

Retired 'Retired' areas are those that were irrigated in the past but have undergone a change in land use that precludes the area from being irrigated. SunRISE generally relies on updated orthophoto imagery, or digital cadastre, for evidence of land use change such as residential development and building construction. Areas known to have been set aside for conservation purposes are also 'retired' from the crop mapping. Note that the 'retired' category is separate from 'vacant' categories and is considered to be non-irrigable land. 'Retired' areas are presented on maps in this report, but not in tables.

Vacant The crop mapping includes a crop type of 'vacant'. Vacant areas were previously irrigated but not irrigated in the season that the crop mapping refers to. Where the vacant area was previously a permanent planting, it is referred to in this report as **Vacant P**. Where the vacant area was previously a seasonal planting, such as pasture or vegetables, it is referred to as **Vacant S**. Where the vacant area was not irrigated for over ten years, it is referred to as **Vacant >10**.

Salinity impact zones Salinity impact zones are mapped zones in north-west Victoria that correlate to tonnes of salt displaced to the Murray River from new irrigation. The salinity impact zones in this report refer to 'Hazard B' zones; comprising four 'Low Impact Zones' (LIZ) and one 'High Impact Zone' (HIZ).

Hazard B zones are used for determining levy charges for new developments, and have been used in this study, purely for ease of presentation, rather than the 'Hazard A' zones (seven low impact zones and 5 high impact zones) which are used for reporting river salinity impacts to the Murray-Darling Basin Authority (salinity register). The relationship between Hazard A and Hazard B zones is as follows:

Salinity impact zone	Hazard B Zones	Hazard A Zones
Low impact zone (LIZ)	LIZ 1	LIZ 1, LIZ 2
	LIZ 2	LIZ 3
	LIZ 3	LIZ 4, LIZ 5
	LIZ 4	LIZ 6, LIZ 7
High impact zone (HIZ)	HIZ	HIZ 1, HIZ 2, HIZ 3, HIZ 4, HIZ 5

Crop type descriptions

Table 7 describes crop types and categories that are irrigated in the Murray-Mallee study area, and how they have been classified for presentation in this report.

Table 7: Description of irrigated crop types and categories

	Crop type	Category	Description
Permanent plantings	Grapevine	Wine	
		Table	
		Dried	
		Other	Canning, Juice, Research
	Citrus		Grapefruit, Lemon, Lime, Mandarin, Navel, Blood Orange, Other, Pummelo, Tangelo, Valencia
	Fruit tree	<i>unspecified</i>	
		Avocado	
		Olive	
		Stone fruit	Apricot, Nectarine, Peach
		Other	Date Palm, Fig, Jujube, Mango, Persimmon, Pome Fruit, Pomegranate
	Nut tree	Almond	
		Other	Pecan, Pistachio, Walnut
	Other	Nursery	
		Tree Plantation	Arboretum, Native Plantation, Windbreak, Woodlot
Miscellaneous		Aquaculture, Flowers, Herbs, Mushroom, Native Plants, Passionfruit, Roses, Strawberry	
Permanent crops (sub-total)			
Vacant P	≤ 10 years	Vacant (not irrigated) for ten years or less, previously a permanent crop	
Vacant >10	> 10 years	Vacant (not irrigated) for over ten years	
Seasonal crops	Field crop	<i>unspecified</i>	<i>field crop category not recorded</i>
		Cereal	Oats, Wheat
		Lucerne	for grain, forage or fodder
		Pasture	Pasture and fodder crops (fodder crops may be cereal crops)
		Other	Canola, Cover crop, Field pea, Maize, Turf
	Vegetable	<i>unspecified</i>	<i>vegetable category not recorded</i>
		Asparagus	
		Carrot	for juicing and fresh
		Cucurbit	Butternut, Cucumber, Honey dew, Pumpkin, Rockmelon, Squash, Watermelon, Zucchini
		Potato	
		Other	Bean, Beetroot, Broccoli, Cabbage, Capsicum, Cauliflower, Chilli, Eggplant, Garlic, Lettuce, Onion, Pea, Salad Greens, Sweet Corn, Tomato
	Seasonal crops (sub-total)		
	Vacant S	≤ 10 years	Vacant (not irrigated) for ten years or less, previously a seasonal crop
	Vacant >10	> 10 years	Vacant (not irrigated) for over ten years
Total all crop areas			

'Unspecified' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Irrigation type descriptions

There is a vast range of irrigation systems and these were classified into four irrigation methods; drip, low level, overhead and furrow as described in Table 8.

Many irrigators use dual irrigation systems, such as drip with overhead sprinklers or misters; however, only the area (hectares) of the main irrigation method has been used in this report.

Table 8: Description of irrigation methods

Irrigation method	Description
Drip	Including; Subsurface-drip, Trickle
Low level	Including; Micro jet, Micro Sprinkler, Sprinkler, Under Canopy, Waterbird
Overhead	Including; Hand Shift, Hand spray, Nelson, Pivot, Spray, Travel (lateral move)
Furrow	Gravity systems including laser-levelled flood
Vacant	Vacant (not irrigated) areas that were previously irrigated & could still be irrigated

Study area

This 2015 crop report covers irrigated horticulture in Victoria along the Murray River and within the Mallee catchment. The region has been divided into eleven study areas: five pumped irrigation districts and six river reaches (Map 1).

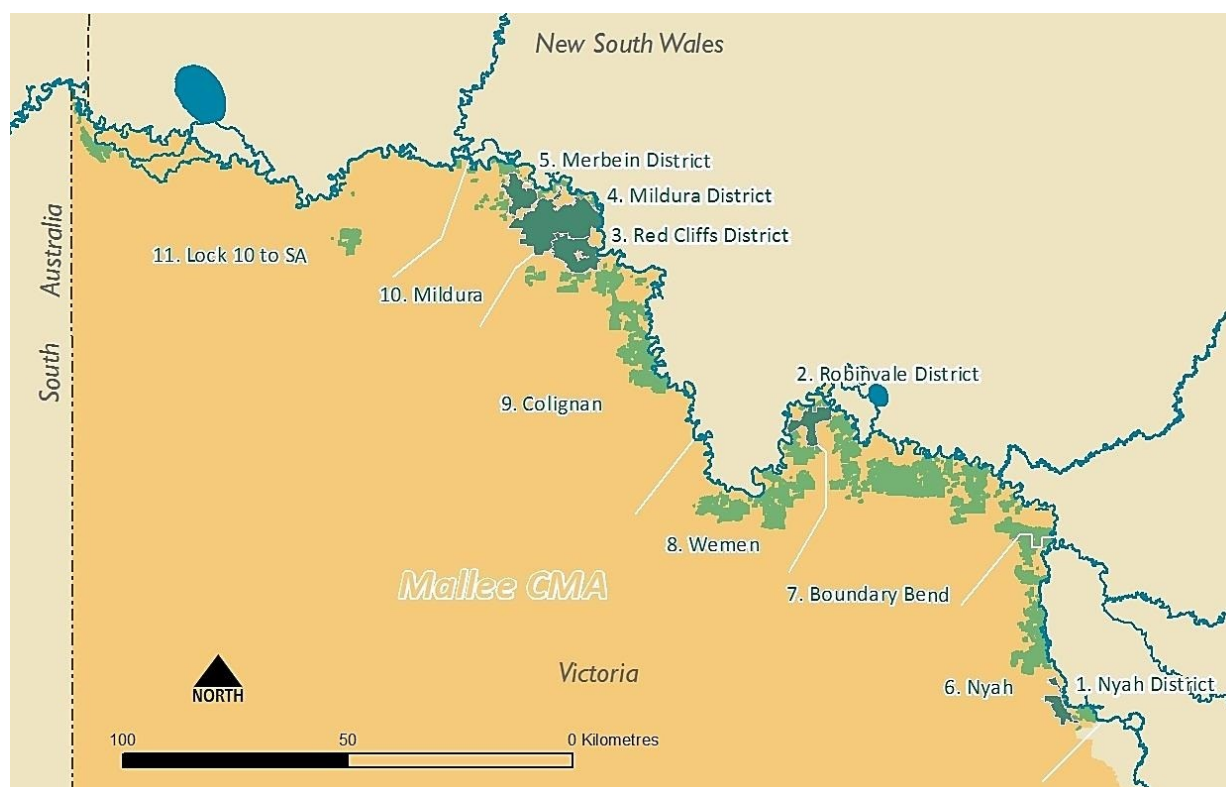
Pumped irrigation districts

1. Nyah irrigation district
2. Robinvale irrigation district
3. Red Cliffs irrigation district
4. Mildura irrigation district
5. Merbein irrigation district

River reaches (private diverters)

- | | |
|-------------------------------|--|
| 6. Nyah river reach | - Nyah to the Wakool River junction |
| 7. Boundary Bend river reach | - Wakool River junction to the Euston weir |
| 8. Wemen river reach | - Euston weir to Liparoo |
| 9. Colignan river reach | - Colignan to Yatpool |
| 10. Mildura river reach | - Mildura to Lock 10 |
| 11. Lock 10 to SA river reach | - Lock 10 to the South Australian border |

Map 1: Map of the Victorian Murray-Mallee region and its eleven study areas



1. Victorian Murray-Mallee summary

In summary for irrigated horticulture in the Victorian Murray-Mallee from 1997 to 2015

Crop types

- Nut tree plantings (of which 99% were almonds) were the dominant crop type in the Murray-Mallee region in 2015. The area of nut trees increased by 18,980 hectares (ha); a 986% increase from 1,925 ha in 1997 to 20,905 ha in 2015. This was predominantly driven by expansion of almond properties in private diverter areas where almond plantings increased from 1,635 ha in 1997 to 20,470 ha in 2015.
- Grapevines were the dominant crop type in the region from 1997 to 2012.
- The irrigable area in 2015 was 73,015 ha comprising;
 - 70% (50,565 ha) irrigated permanent plantings;
 - 13% (9,810 ha) irrigated seasonal crops;
 - 14% (10,165 ha) vacant or not irrigated for less than 10 years; and
 - 3% (2,475 ha) vacant or not irrigated for more than 10 years.
- 78% of permanent plantings and 89% of seasonal crops were irrigated in the private diverter areas in 2015.

Grapevines

- Grapevines were predominantly grown in the Murray-Mallee region for wine production from 1997 to 2015.
- 50% of grapevine plantings were grown in private diverter areas and 50% in the pumped irrigation districts in 2015.
- The net area of grapevines increased by just 45 ha; a < 1% increase from 20,465 ha in 1997 to 20,510 ha in 2015. Plantings peaked around 2006 at 25,630 ha.
- In 2015, the 20,510 ha of grapevine plantings comprised:
 - 49% (10,135 ha) wine grapes;
 - 36% (7,290 ha) table grapes;
 - 15% (3,040 ha) dried grapes; and
 - < 1% (45 ha) of grapevines for other purposes; research or trial varieties, juicing or canning.
- Wine grape plantings increased by 190 ha, a 2% increase from 9,945 ha in 1997 to 10,135 ha in 2015.
 - Wine grape plantings peaked around 2006 at 15,565 ha.
- Table grape plantings expanded by 3,170 ha, a 77% increase from 4,120 ha in 1997 to 7,290 ha in 2015.
- Dried grape plantings decreased by 3,265 ha, a 52% decrease from 6,305 ha in 1997 to 3,040 ha in 2015.

Irrigation methods

- Drip irrigation was the dominant irrigation method across the Murray-Mallee region from 2006 to 2015. Prior to 2006, the dominant irrigation method changed from furrow in 1997 to overhead sprinklers by 2003.

- In 2015, the irrigable area of 73,015 ha comprised:
 - 57% (41,250 ha) drip irrigation;
 - 12% (8,635 ha) low level irrigation;
 - 10% (7,295 ha) overhead sprinklers or pivots;
 - 4% (3,195 ha) furrow and flood irrigation; and
 - 17% (12,640 ha) not irrigated.
- From 1997 to 2015 (Figure 2 and Figure 8):
 - Drip irrigation increased by 37,320 ha, a 950% increase from 3,920 ha to 41,250 ha.
 - Low level irrigation increased by 2,725 ha, a 46% increase from 5,910 ha to 8,635 ha.
 - Overhead irrigation decreased by 6,200 ha, a 46% decrease from 13,495 ha to 7,295 ha.
 - Furrow irrigation decreased by 12,030 ha, a 79% decrease from 15,225 ha to 3,195 ha.

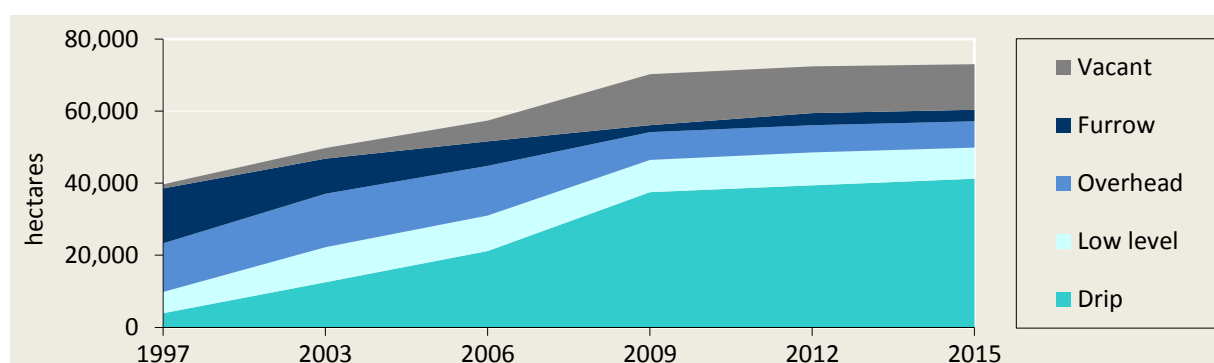


Figure 2: Change in irrigation methods from 1997 to 2015 across the Murray-Mallee region

- 66% (2,100 ha) of the 3,195 ha of furrow irrigation in 2015 was in the Nyah river reach, predominantly for irrigating broad-acre field crops.
- The proportion of irrigable land under furrow irrigation decreased to less than 3% in 2009 when irrigating of seasonal crops was greatly reduced due to drought conditions and high water prices. The decrease was most apparent in the Nyah river reach (Figure 61). A return to 4% furrow/flood irrigation by 2015 corresponds to improved water availability for broad-acre field crops, countered by an increase in the use of overhead sprays and subsurface-drip to irrigate field crops.
- In 2015, drippers were the dominant irrigation method across the private diverter areas and in each of the pumped irrigation districts, except for the Robinvale pumped district where low level sprinklers were the dominant method (Table 4).

Salinity impact zones

- Irrigated crops in the Victorian Murray-Mallee are predominantly in the lowest river salinity impact zone, LIZ 1 (Figure 3).
- In 2015, the irrigable area of 73,015 ha comprised:
 - 48% (34,920 ha) in LIZ 1;
 - 21% (15,295 ha) in LIZ 2;
 - 3% (2,480 ha) in LIZ 3;
 - 13% (9,490 ha) in LIZ 4; and
 - 15% (10,830 ha) in the high impact zone, HIZ.

- The area irrigated in the HIZ decreased by 3,655 ha, a 34% decrease from 10,845 ha in 1997 to 7,190 ha in 2015.
- The irrigable area in the HIZ decreased by 605 ha, a 5% decrease from 11,435 ha in 1997 to 10,830 ha in 2015. The 605 ha net decrease was the balance of HIZ areas retired from irrigation and an increase in HIZ areas on existing HIZ properties. The irrigable area on existing properties can increase when more efficient planting layouts are adopted and redundant drying racks and headlands are removed.
- 775 ha (31%) of the area that had been vacant for over ten years in 2015 (2,475 ha) was in the HIZ, and approximately 950 ha (8%) of the total areas in the HIZ in 1997 were retired from irrigation by 2015.

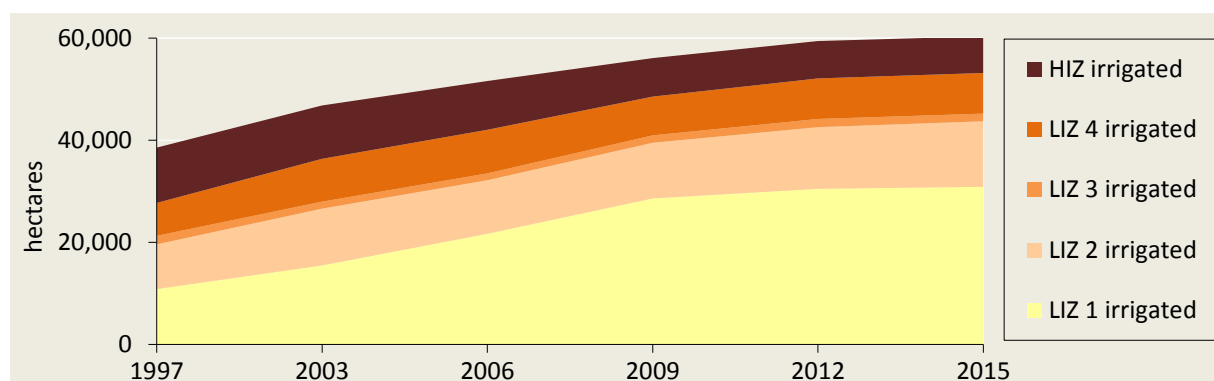


Figure 3: Change in salinity impact zones from 1997 to 2015 across the Murray-Mallee region

Irrigation development

- Across the Murray-Mallee region the irrigable area increased by 33,310 ha, an 84% increase from 39,705 ha in 1997 to 73,015 ha in 2015. The net increase of 33,310 ha comprised 1,520 ha retired³ from irrigation and 34,830 ha of expansion.
- Across the five pumped irrigation districts the irrigable area decreased by 55 ha, a < 1% decrease from 17,485 ha in 1997 to 17,430 ha in 2015. The net decrease of 55 ha comprised 1,010 ha retired from irrigation and 955 ha of expansion.
- Across the private diverter areas the irrigable area increased by 33,365 ha, a 150% increase from 22,220 ha in 1997 to 55,585 ha in 2015. The net increase of 33,365 ha comprised 510 ha retired from irrigation and 33,875 ha of expansion. Expansion predominantly occurred in the Boundary Bend (+15,175 ha) and Wemen (+8,560 ha) river reaches.

Irrigation properties

- There were approximately 2,047 irrigation properties (land holdings) in the Victorian Murray-Mallee region in 2015.
- 79% of properties were in the pumped irrigation districts and 21% of properties were private diverters. Average property size was 11 ha and 124 ha respectively (Figure 22 and Figure 57).
- Change in property numbers and size from 1997 to 2015:
 - Property numbers declined by 405, a 17% decrease from 2,452 in 1997 to 2,047 in 2015.
 - The number of properties with an irrigable area of less than 40 ha declined by 483, while the number over 40 ha increased by 78.
 - Average property size (irrigable area) more than doubled; from 16 ha in 1997 to 36 ha in 2015.

³ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds and dam construction.

1.1 Victorian Murray-Mallee - crop types in 2015

Crops irrigated in 2015 along the Murray River in the Victorian Mallee catchment are shown in Table 9.

- Dominant plantings in 2015 were:
 - Almond trees, 28% of the irrigable area; and
 - Wine grapes, 14% of the irrigable area.

Table 9: Victorian Murray-Mallee - irrigated crops in 2015

	Crop type	Category	2015 (ha)	2015 %	Description
Permanent crops	Grapevine	Wine	10,130	14%	
		Table	7,295	10%	
		Dried	3,040	4%	
		Other	45	<1%	
	Citrus		3,720	5%	Grapefruit, Lemon, Lime, Mandarin, Navel, Blood Orange, Other, Tangelo, Valencia
	Fruit tree	<i>unspecified</i>	60	<1%	<i>Fruit tree category unknown</i>
		Avocado	560	1%	
		Olive	3,625	5%	
		Stone fruit	580	1%	Apricot, Nectarine, Peach, Plum
		Other	155	<1%	Apple, Date Palm, Fig, Jujube, Lychee, Mango, Pear, Persimmon, Pomegranate, Quince
	Nut tree	Almond	20,620	28%	
		Other	285	<1%	Pecan, Pistachio, Walnut
	Other	Nursery	180	<1%	
		Woodlot	250	<1%	Tree Plantation, Wind Break, Willow
		Misc.	20	<1%	Flowers, Native Plants, Passionfruit, Roses
	Permanent crops	(sub-total)	50,565	70%	
Seasonal crops	Vacant P	≤ 10 years	7,215	10%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	475	1%	Vacant (not irrigated) for over ten years
	Field crop	<i>unspecified</i>	840	1%	<i>Field crop category unknown</i>
		Cereal	1,825	2%	
		Lucerne	590	1%	
		Pasture	730	1%	
		Other	555	1%	Canola, Cover Crop, Maize, Turf
	Vegetable	<i>unspecified</i>	345	<1%	<i>Vegetable category unknown</i>
		Asparagus	405	1%	
		Carrot	2,590	4%	
		Cucurbit	535	1%	
		Potato	940	1%	
		Other	455	1%	Beetroot, Broccoli, Cabbage, Capsicum, Chili, Corn, Eggplant, Garlic, Salad Greens, Tomato
	Seasonal crops	(sub-total)	9,810	13%	
	Vacant S	≤ 10 years	2,950	4%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	2,000	2%	Vacant (not irrigated) for over ten years
	Total all crop areas		73,015	100%	

Note: '*unspecified*' refers to unknown crop categories that may be categories already listed OR other categories not listed.

1.2 Victorian Murray-Mallee – change in crop types

Figure 4 summarises crop types across the Victorian Murray-Mallee from 1997 to 2015.

- In 2015, the Murray-Mallee region had an irrigable area of 73,015 ha comprising:
 - 70% (50,565 ha) irrigated permanent plantings;
 - 13% (9,810 ha) irrigated seasonal crops;
 - 14% (10,165 ha) vacant or not irrigated for less than 10 years; and
 - 3% (2,475 ha) vacant or not irrigated for more than 10 years.
- Grapevines were the dominant crop type from 1997 to 2012, but were overtaken by nut trees by 2015. Grapevines peaked around 2006 at 25,630 ha, but areas continued to decrease from 2006 to 2015.
- Nut tree plantings (99% almonds) increased by 18,980 ha, a 986% increase from 1,925 ha in 1997 to 20,905 ha in 2015.
- The highest recorded proportion of vacant (not irrigated) areas was 20% in 2009 when drought, high water prices and low commodity prices impacted. Vacant areas decreased slightly to 18% in 2012 and 17% in 2015.

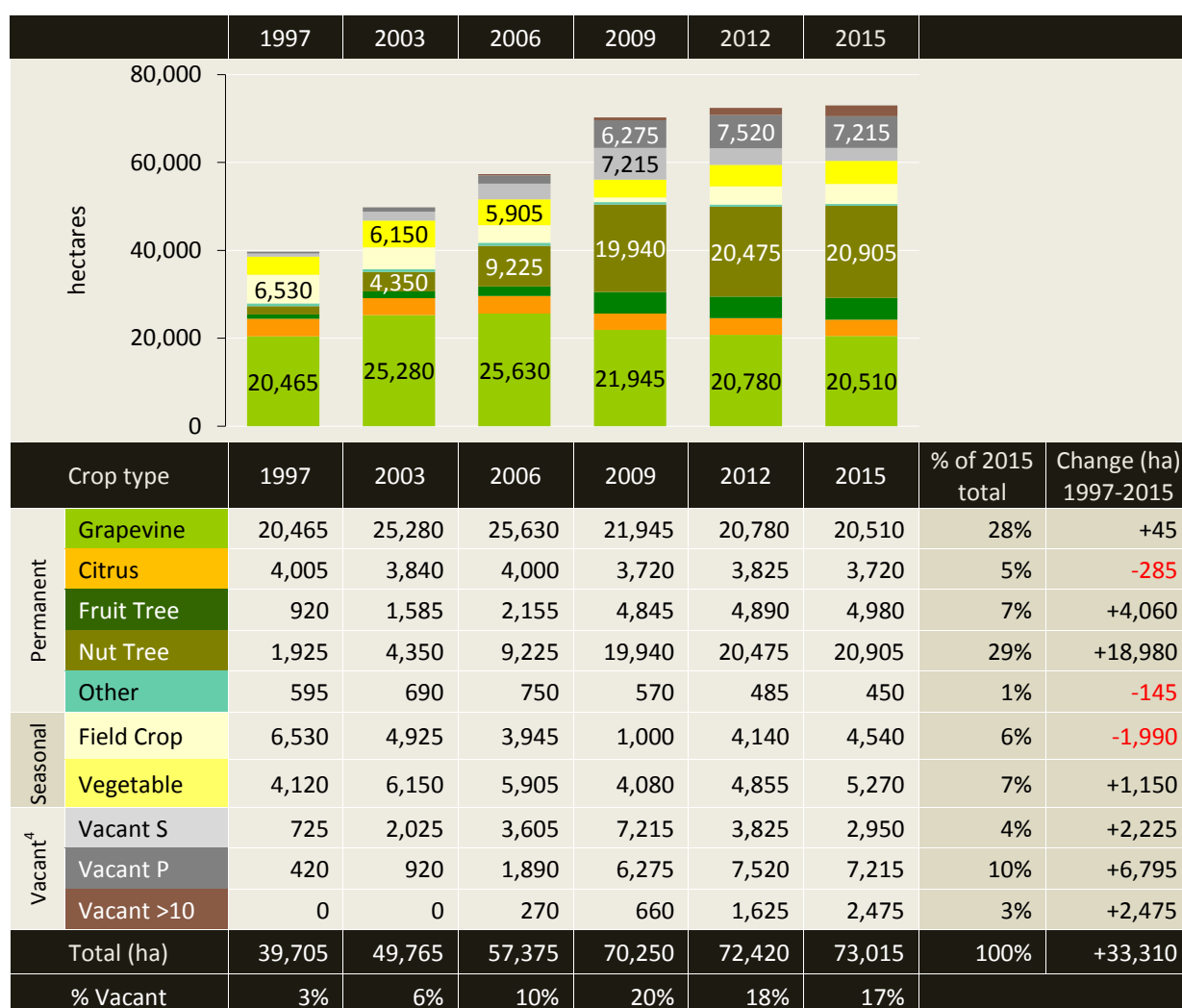


Figure 4: Victorian Murray-Mallee - crop types from 1997 to 2015

⁴ Vacant S: not irrigated but previously an irrigated seasonal crop. Vacant P: not irrigated but previously an irrigated permanent planting. Vacant >10: not irrigated for over ten years but previously an irrigated area.

1.3 Victorian Murray-Mallee - crop type in each study area

Figure 5 shows the proportion of permanent crops, seasonal crops and vacant areas in each of the Murray-Mallee study areas in 2015.

- Private diverters in the Murray-Mallee region in 2015 irrigated:
 - 78% of permanent crops; the largest area, 16,315 ha, was in the Boundary Bend river reach; and
 - 89% of seasonal crops; the largest area, 2,795 ha, was in the Nyah river reach.
- 82% of areas vacant for less than ten years, but previously seasonal crops (VS <10) were in private diverter areas, predominantly the Nyah and Boundary Bend river reaches.
- 53% of areas vacant for less than ten years, but previously permanent crops (VP <10) were in pumped irrigation districts, predominantly the Mildura, Red Cliffs and Merbein districts.
- 86% of areas vacant for over ten years, but previously seasonal crops (VS >10) were in private diverter areas, predominantly the Boundary Bend, Nyah and Lock 10 to South Australia river reaches.
- 81% of areas vacant for over ten years, but previously permanent crops (VP >10) were in pumped irrigation districts, predominantly the Merbein, Mildura and Red Cliffs districts.

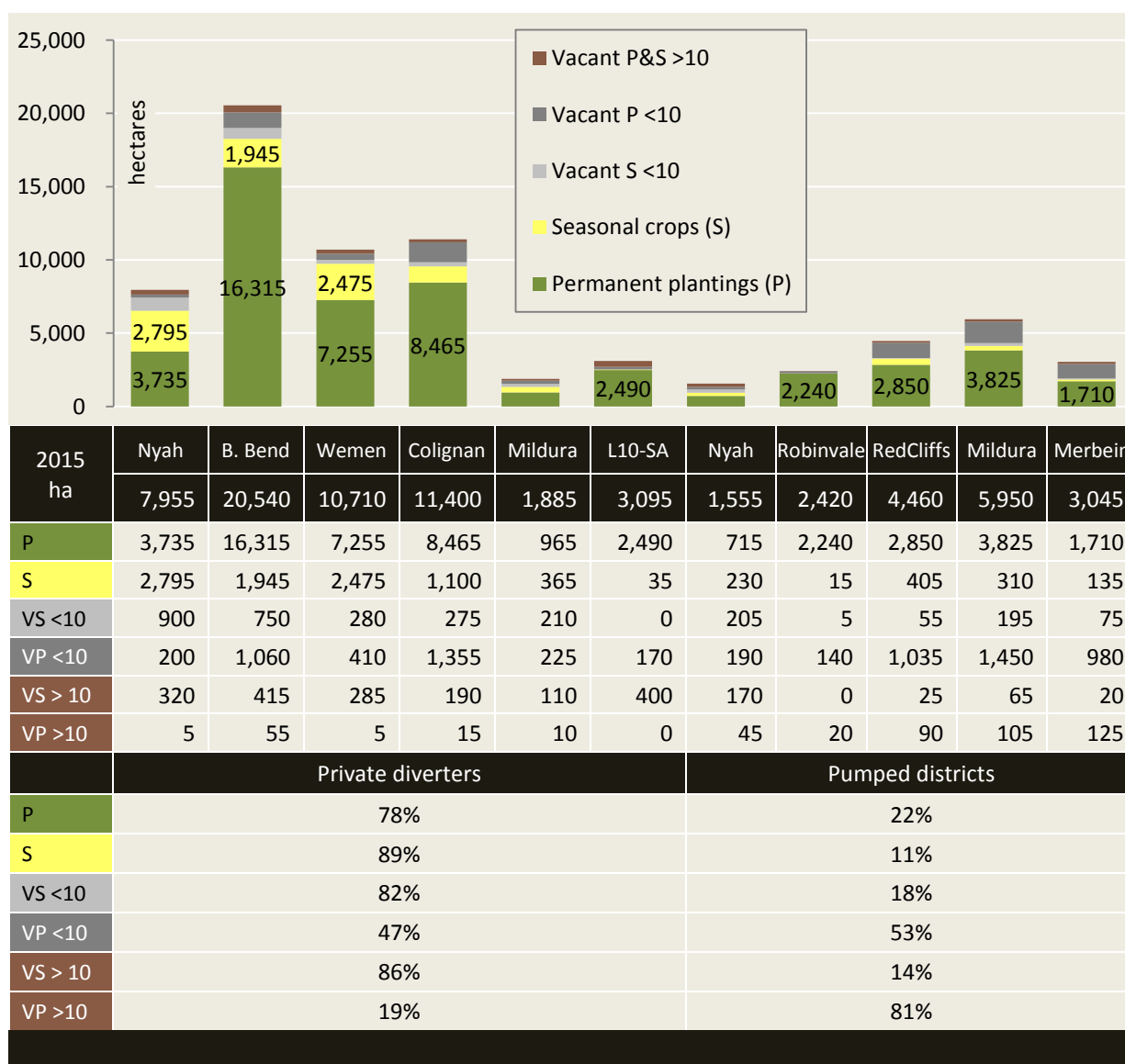


Figure 5: Victorian Murray-Mallee - seasonal crops, permanent crops and vacant areas in 2015

1.4 Victorian Murray-Mallee - grapevines

Figure 6 summarises grapevine types across the Victorian Murray-Mallee from 1997 to 2015. Grapevines were the dominant crop from 1997 to 2012.

- The area of grapevines increased by 45 ha; a < 1% increase from 20,465 ha in 1997 to 20,510 ha in 2015. Plantings peaked around 2006 at 25,630 ha.
- In 2015, the 20,510 ha of grapevines comprised:
 - 49% (10,135 ha) wine grape plantings;
 - 36% (7,290 ha) table grape plantings;
 - 15% (3,040 ha) dried grape plantings; and
 - < 1% (45 ha) grapevines for other purposes.
- Wine grape plantings increased by 190 ha, a 2% increase from 9,945 ha in 1997 to 10,135 ha in 2015.
 - Wine grapes were the main type of grapevine across the Victorian Murray-Mallee from 1997 to 2015. Plantings peaked around 2006 at 15,565 ha.
- Table grape plantings increased by 3,170 ha, a 77% increase from 4,120 ha in 1997 to 7,290 ha in 2015.
- Dried grape plantings decreased by 3,265 ha, a 52% decrease from 6,305 ha in 1997 to 3,040 ha in 2015.
- Grape plantings for other purposes decreased by 50 ha, a 53% decrease from 95 ha in 1997 to 45 ha in 2015.

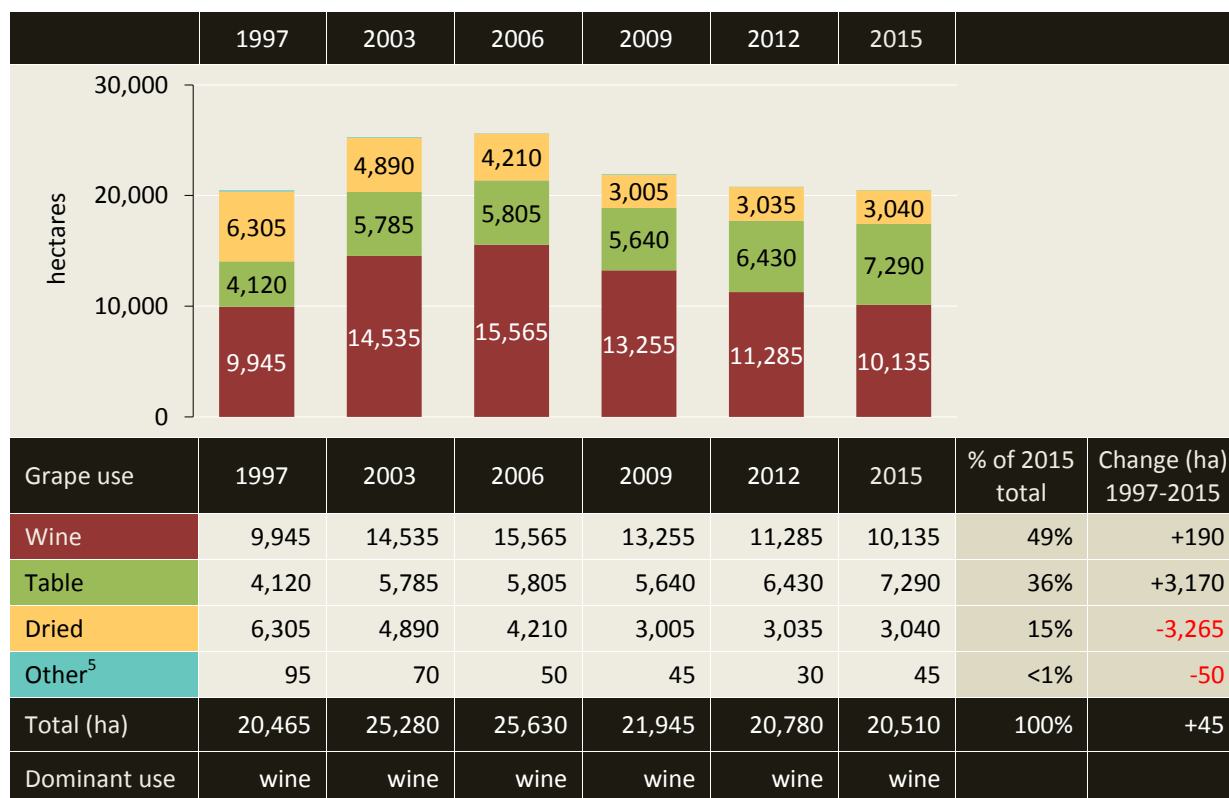


Figure 6: Victorian Murray-Mallee - grapevine plantings from 1997 to 2015

⁵ Other: grapes for juicing, cannery, research and trial varieties.

Grapevines in 2015 in each of the study areas

Figure 7 summarises grapevine types in 2015 in each of the eleven Victorian Murray-Mallee study areas.

- 50% of grapevine plantings were grown in private diverter areas (10,160 ha) in 2015 and 50% grown in the pumped irrigation districts (10,350 ha).
- Grapevines in 2015 were predominantly grown for:
 - Wine grapes across the private diverter areas; and
 - Table grapes across the irrigation districts.
- The Colignan river reach grew the largest area of grapevines in 2015; 22% (4,575 ha) of the total area of grapevines (20,510 ha) grown in the Murray-Mallee region.
- In 2015 in the pumped irrigation districts, Red Cliffs grew the largest area of wine grape plantings (1,295 ha), Robinvale grew the largest area of table grapes (1,920 ha) and Mildura grew the largest area of dried grape plantings (780 ha).

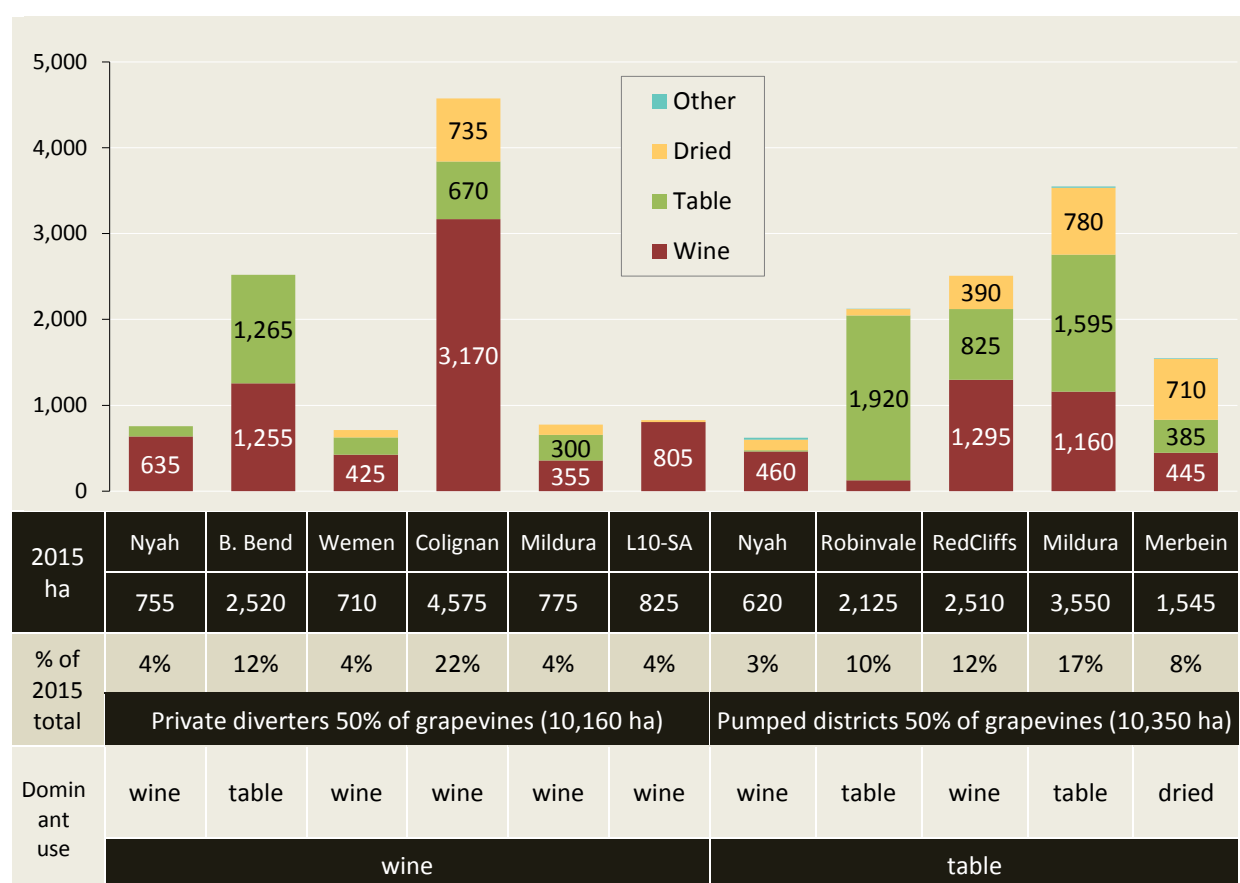


Figure 7: Victorian Murray-Mallee - grapevine plantings in each study area in 2015

1.5 Victorian Murray-Mallee - irrigation methods

Figure 8 summarises irrigation methods across the Victorian Murray-Mallee region from 1997 to 2015.

- In 2015, the irrigable area of 73,015 ha comprised:
 - 57% (41,250 ha) drip irrigation;
 - 12% (8,635 ha) low level irrigation;
 - 10% (7,295 ha) overhead sprinklers and pivots;
 - 4% (3,195 ha) furrow irrigation; and
 - 17% (12,640 ha) not irrigated.
- Drip irrigation increased by 37,320 ha, a 950% increase from 3,930 ha in 1997 to 41,250 ha in 2015.
 - Drip irrigation was the dominant irrigation method from 2006 to 2015.
- Low level irrigation increased by 2,725 ha, a 46% increase from 5,910 ha in 1997 to 8,635 ha in 2015.
- Overhead irrigation decreased by 6,200 ha, a 46% decrease from 13,495 ha in 1997 to 7,295 ha in 2015. Overhead sprinklers were the dominant irrigation method in 2003.
- Furrow irrigation decreased by 12,030 ha, a 79% decrease from 15,225 ha in 1997 to 3,195 ha in 2015.
 - Furrow irrigation was the dominant irrigation method in 1997.
- The proportion of irrigable land under furrow irrigation decreased to less than 3% in 2009 when irrigating of seasonal crops was greatly reduced due to drought conditions and high water prices. The decrease was most apparent in the Nyah river reach (Figure 61). A return to 4% furrow/flood irrigation by 2015 corresponds to improved water availability for broad-acre field crops, countered by an increase in the use of overhead sprays and subsurface-drip to irrigate field crops.

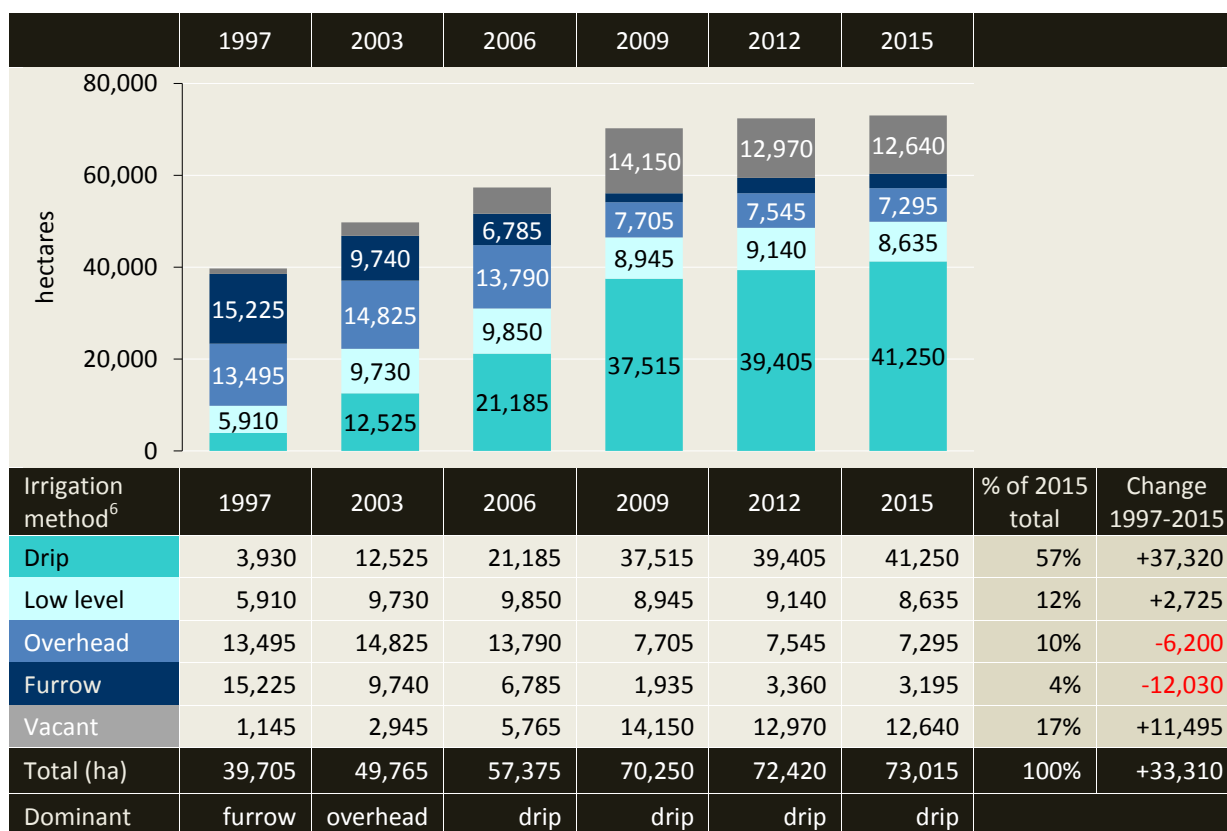


Figure 8: Victorian Murray-Mallee - irrigation methods from 1997 to 2015

⁶ Overhead irrigation includes pivots and lateral move systems. Furrow includes flood irrigation. (Table 8)

Irrigation methods in 2015 in each of the study areas

Figure 9 compares irrigation methods in each of the eleven Victorian Murray-Mallee study areas in 2015.

- Drip irrigation was the dominant method in each of the study areas in 2015, except for the Robinvale pumped district where low level sprinklers were the dominant method.

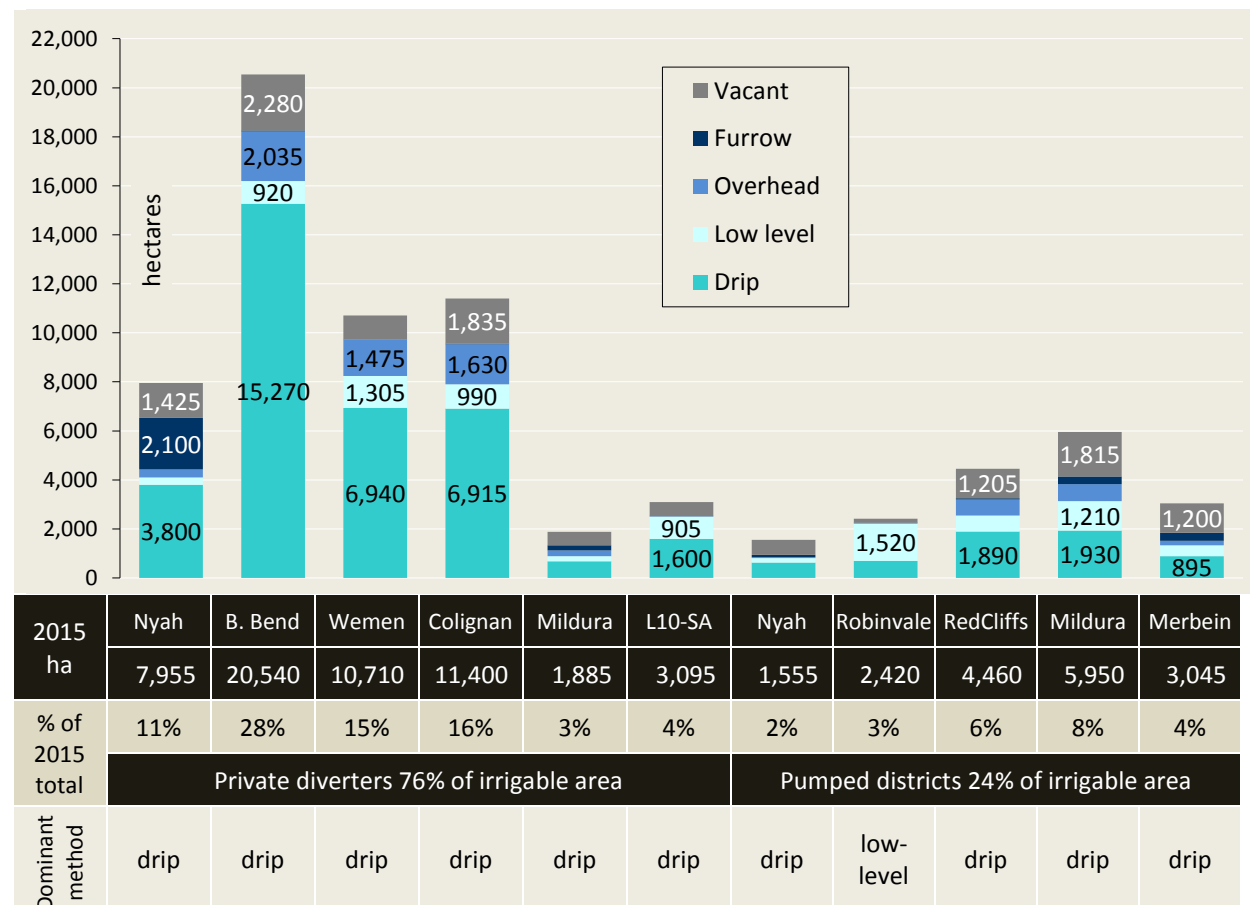


Figure 9: Victorian Murray-Mallee - irrigation methods in each study area in 2015

1.6 Victorian Murray-Mallee - salinity impact zones

Figure 10 summarises the irrigable area in each river salinity impact zone across the Victorian Murray-Mallee from 1997 to 2015.

- In 2015, irrigable areas across the Murray-Mallee were predominantly in the lowest salinity impact zone, LIZ 1. The irrigable area of 73,015 ha comprised:
 - 48% (34,920 ha) in LIZ 1;
 - 21% (15,295 ha) in LIZ 2;
 - 3% (2,480 ha) in LIZ 3;
 - 13% (9,490 ha) in LIZ 4; and
 - 15% (10,830 ha) in the high impact zone, HIZ.
- The area irrigated in:
 - LIZ increased by 25,470 ha, a 92% increase from 27,715 ha in 1997 to 53,185 ha in 2015; and
 - HIZ decreased by 3,655 ha, a 34% decrease from 10,845 ha in 1997 to 7,190 ha in 2015.
- The irrigable area in:
 - LIZ increased by 33,915 ha, a 120% increase from 28,270 ha in 1997 to 62,185 ha in 2015; and
 - HIZ decreased by 605 ha, a 5% decrease from 11,435 ha in 1997 to 10,830 ha in 2015. The decrease is the balance of HIZ areas retired from irrigation and areas brought into production when redevelopment to larger, more efficient planting layouts occurs.

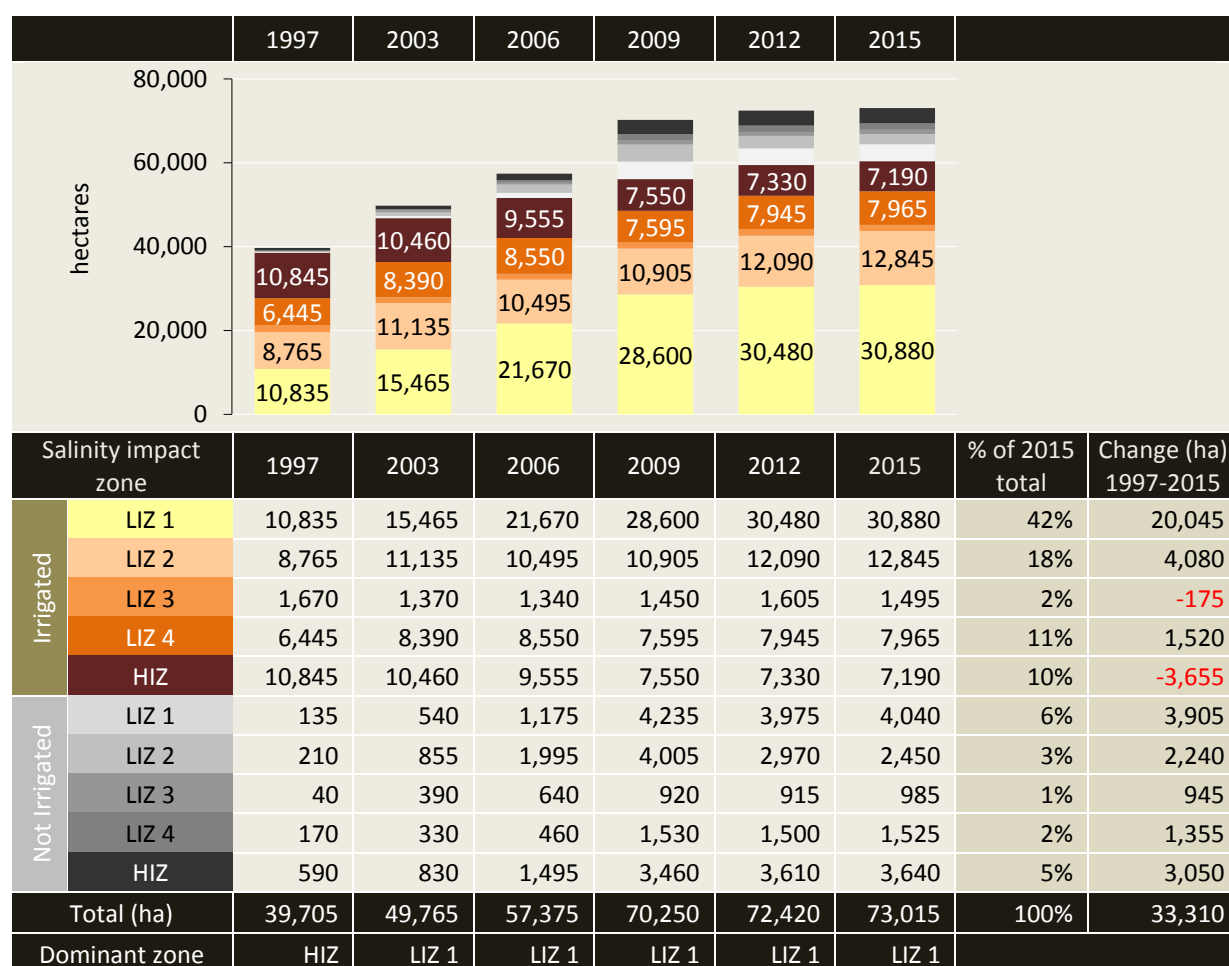


Figure 10: Victorian Murray-Mallee - irrigable area in each salinity impact zone from 1997 to 2015

Salinity zones in each of the study areas in 2015

Figure 11 compares the salinity impact zones in each of the eleven Victorian Murray-Mallee study areas in 2015.

- The total irrigable area in the high salinity impact zone was 10,830 ha:
 - 28% (3,055 ha) of the HIZ area was in the private diverter river reaches; and
 - 72% (7,775 ha) of the HIZ area was in the pumped irrigation districts.
- The Mildura irrigation district had the highest proportion of HIZ areas; 35% of the Murray-Mallee's HIZ areas.

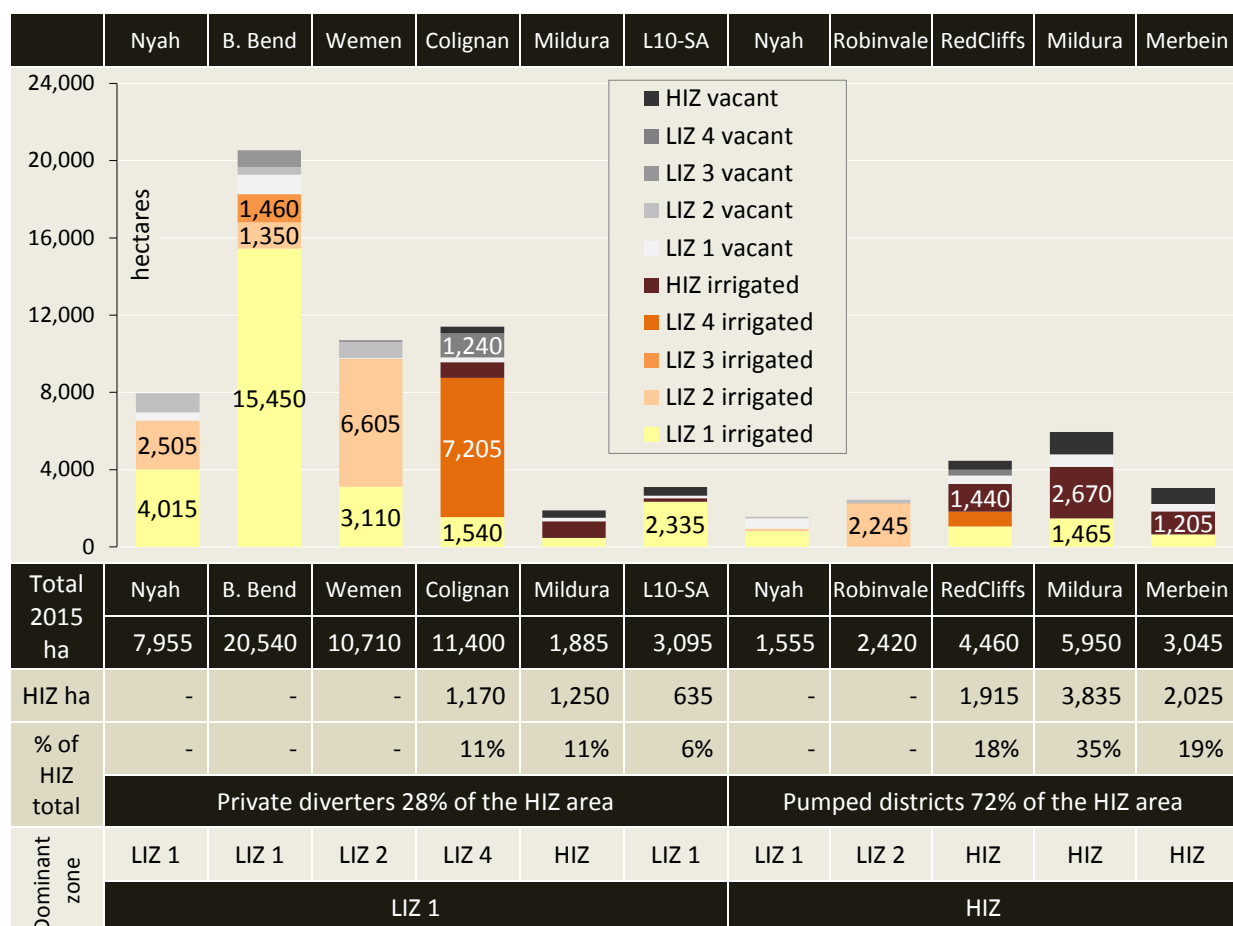


Figure 11: Victorian Murray-Mallee - salinity impact zones in each study area in 2015

1.7 Victorian Murray-Mallee - irrigation development

Figure 12 summarises irrigation development from 1997 to 2015 with respect to new development (expansion) and areas retired from irrigation across the Victorian Murray-Mallee region.

- The irrigable area increased by 33,310 ha, an 84% increase from 39,705 ha in 1997 to 73,015 ha in 2015. The net increase of 33,310 ha comprised 1,520 ha retired from irrigation and 34,830 ha of expansion. Only 8% of this expansion occurred after 2009.
- Across the pumped districts the irrigable area decreased by 55 ha, a < 1% decrease from 17,485 ha in 1997 to 17,430 ha in 2015. The net decrease comprised 1,010 ha retired and 955 ha of expansion.
- In the private diverter areas the irrigable area increased by 33,365 ha, a 150% increase from 22,220 ha in 1997 to 55,585 ha in 2015. The net increase of 33,365 ha comprised 510 ha retired and 33,875 ha of expansion. Expansion predominantly occurred in the Boundary Bend and Wemen reaches.

	Study area	1997 (ha)	1997 to 2015		2015 (ha)	Change (ha) 1997-2015	Growth % 1997-2015
			Retired ⁷	New			
Pumped irrigation districts	Nyah	1,120	-10	+445	1,555	+435	+39%
	Robinvale	2,320	-25	+125	2,420	+100	+4%
	Red Cliffs	4,450	-125	+135	4,460	+10	+<1%
	Mildura	6,450	-745	+245	5,950	-500	-8%
	Merbein	3,145	-105	+5	3,045	-100	-3%
	Sub-total	17,485	-1,010	+955	17,430	-55	<-1%
Private diverters	Nyah	4,695	-30	+3,290	7,955	+3,260	+69%
	Boundary Bend	5,365	-170	+15,345	20,540	+15,175	+283%
	Wemen	2,150	-40	+8,600	10,710	+8,560	+398%
	Colignan	6,925	-70	+4,545	11,400	+4,475	+65%
	Mildura	1,445	-55	+495	1,885	+440	+30%
	Lock10 to SA	1,640	-145	+1,600	3,095	+1,455	+89%
	Sub-total	22,220	-510	+33,875	55,585	+33,365	+150%
Vic. Murray-Mallee total		39,705	-1,520	+34,830	73,015	+33,310	+84%

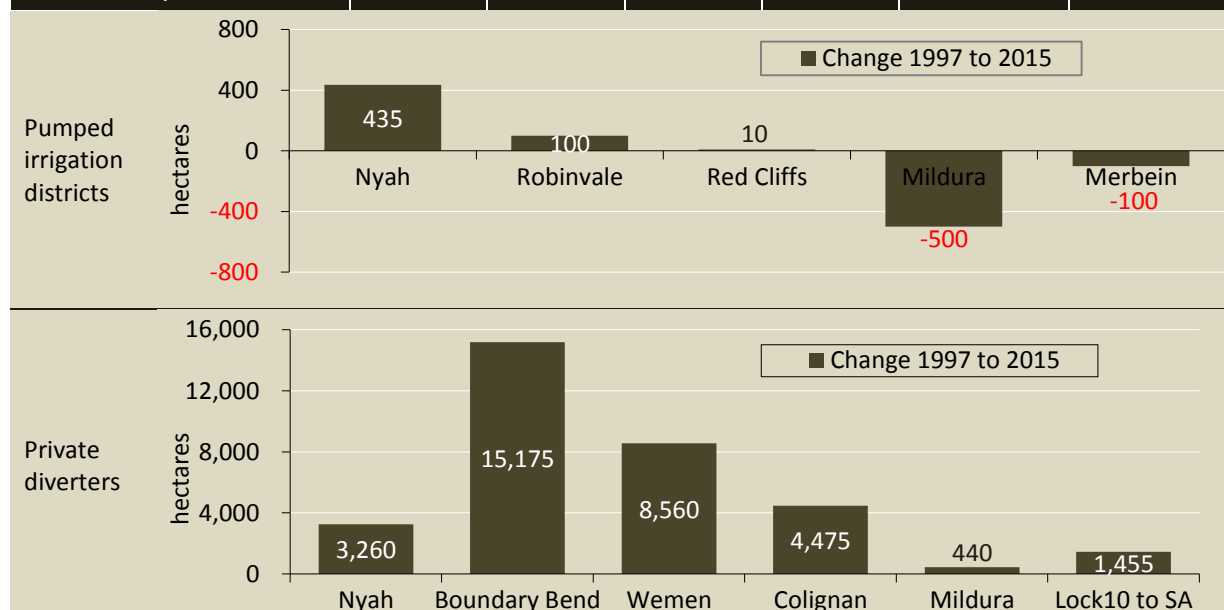


Figure 12: Victorian Murray-Mallee - irrigation development from 1997 to 2015

⁷ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

1.8 Victorian Murray-Mallee - property change

Figure 13 provides estimates of property numbers and average property size (irrigable area) across the Victorian Murray-Mallee from 1997 to 2015.

- There were approximately 2,047 irrigation properties (land holdings) in the Victorian Murray-Mallee region in 2015.
- Property numbers declined by 405, a 17% decrease from 2,452 in 1997 to 2,047 in 2015.
- The number of properties less than 40 ha (irrigable area) declined by 483, while the number over 40 ha increased by 78.
- Average property size (irrigable area) increased from 16 ha in 1997 to 36 ha in 2015.
- 79% of properties were in the pumped irrigation districts and 21% of properties were private diverters. Average property size was 11 ha and 124 ha respectively (Figure 22 and Figure 57).

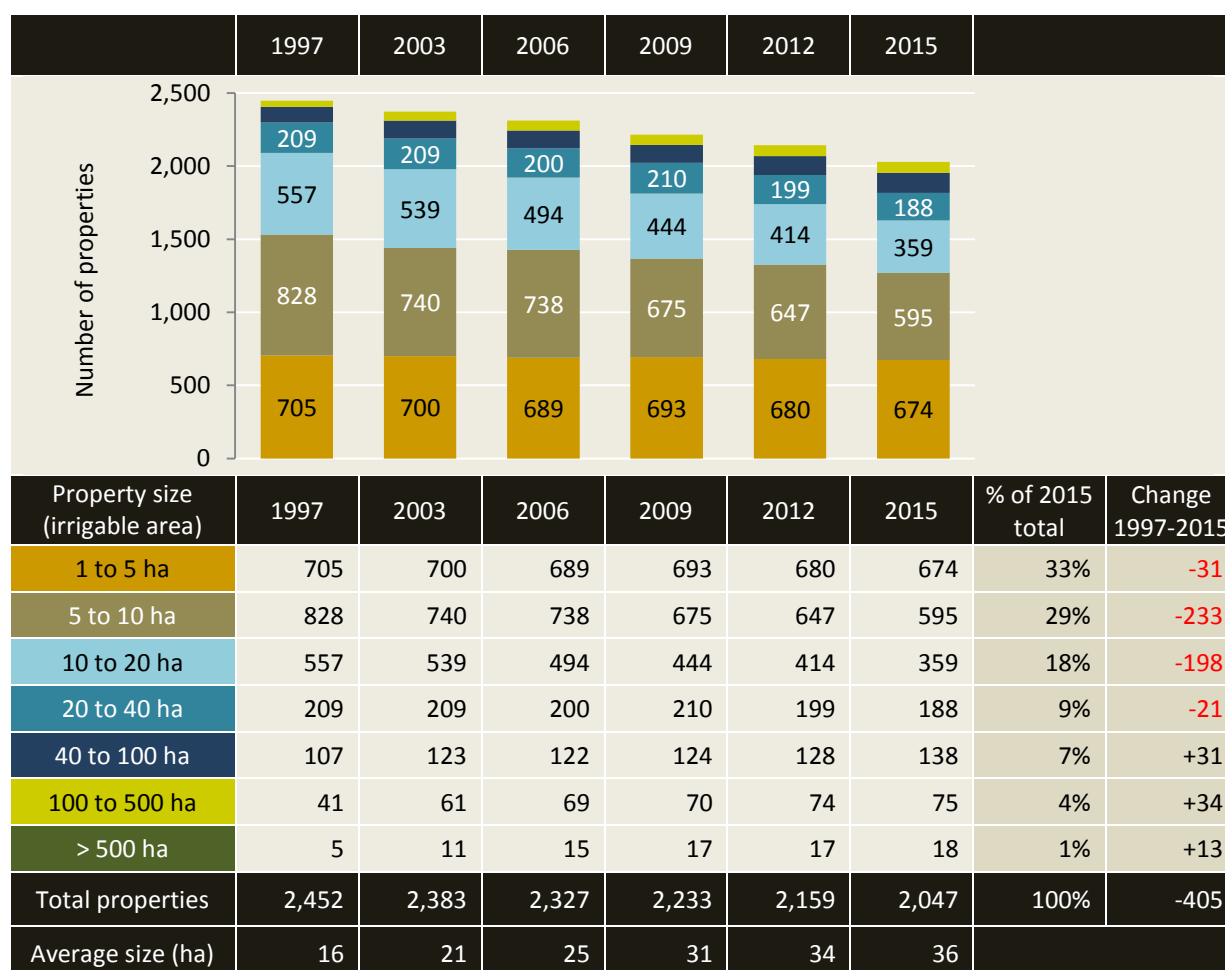


Figure 13: Victorian Murray-Mallee - property numbers and sizes from 1997 to 2015

Note: Total property numbers across the Victorian Murray-Mallee are less than the sum of property numbers in each of the eleven study areas as some property owners have irrigated land in more than one study area.

2. Pumped irrigation districts

2.1 Pumped irrigation districts summary

In summary for the pumped irrigation districts; Nyah, Robinvale, Red Cliffs, Mildura and Merbein

Crop types

- Grapevines remained the dominant crop type irrigated in the pumped districts from 1997 to 2015.
- Of the irrigated crops, vegetables increased by the largest area, 160 ha; a 34% increase from 470 ha in 1997 to 630 ha in 2015.
- The irrigable area in 2015 was 17,430 ha of which:
 - 65% (12,435 ha) was irrigated permanent plantings;
 - 6% (1,095 ha) was irrigated seasonal crops;
 - 25% (4,330 ha) was vacant or not irrigated for less than 10 years; and
 - 4% (665 ha) was vacant or not irrigated for more than 10 years.

Grapevines

- Across the pumped irrigation districts, grapevines were predominantly grown for table grapes from 2012 to 2015. Prior to 2012, the dominant grapevine produce changed from dried grapes in 1997 to wine grapes from 2003 to 2009.
- The area of grapevines decreased by 4,550 ha, a 31% decrease from 14,900 ha in 1997 to 10,350 ha in 2015. Plantings peaked around 2003 at 15,230 ha.
- In 2015, the 10,350 ha of grapevines comprised:
 - 34% (3,490 ha) wine grape plantings;
 - 46% (4,735 ha) table grape plantings;
 - 20% (2,080 ha) dried grape plantings; and
 - < 1% (45 ha) grapevines for other purposes.

Irrigation methods

- Drip irrigation was the dominant irrigation method from 2012 to 2015. Prior to 2012, the dominant method changed from furrow in 1997 and 2003 to low level sprinklers in 2006 and 2009.
- In 2015, the irrigable area of 17,430 ha across the pumped irrigation districts comprised:
 - 35% (6,045 ha) drip irrigation;
 - 23% (4,005 ha) low level irrigation;
 - 9% (1,585 ha) overhead sprinklers;
 - 4% (800 ha) furrow irrigation; and
 - 29% (4,995 ha) not irrigated.
- Drip irrigation increased by 5,275 ha, a 685% increase from 770 ha in 1997 to 6,045 ha in 2015.
- Low level irrigation increased by 1,315 ha, a 49% increase from 2,690 ha in 1997 to 4,005 ha in 2015.
- Overhead irrigation decreased by 2,750 ha, a 63% decrease from 4,335 ha in 1997 to 1,585 ha in 2015.
- Furrow irrigation decreased by 8,570 ha, a 91% decrease from 9,370 ha in 1997 to 800 ha in 2015.

In summary for the pumped irrigation districts; Nyah, Robinvale, Red Cliffs, Mildura and Merbein

Salinity impact zones

- In 2015, irrigable areas across the pumped districts were predominantly in the high salinity impact zone, HIZ. The irrigable area of 17,430 ha comprised:
 - 34% (5,965 ha) in the lowest salinity impact zone, LIZ 1;
 - 15% (2,625 ha) in LIZ 2;
 - < 1% (20 ha) in LIZ 3;
 - 6% (1,045 ha) in LIZ 4; and
 - 45% (7,775 ha) in HIZ.
- The irrigable area in the HIZ decreased by 725 ha, a 9% decrease from 8,500 ha in 1997 to 7,775 ha in 2015.

Irrigation development

- Across the pumped irrigation districts the irrigable area decreased by 55 ha, a < 1% decrease from 17,485 ha in 1997 to 17,430 ha in 2015.
- The net decrease of 55 ha comprised 1,010 ha retired from irrigation and 955 ha of expansion.
- The irrigable area in the Nyah⁸, Robinvale and Red Cliffs irrigation districts increased by 39% (435 ha), 4% (100 ha) and <1% (10 ha) respectively.
- The irrigable area in the Mildura and Merbein irrigation districts decreased by 8% (500 ha) and 3% (100 ha) respectively.

Irrigation properties

- There were approximately 1,646 irrigation properties (land holdings) in the pumped irrigation districts in 2015.
- Change in property numbers and size from 1997 to 2015:
 - Property numbers declined by 341, a 17% decrease from 1,987 in 1997 to 1,646 in 2015.
 - The number of properties with an irrigable area of less than 20 ha declined by 400, while the number over 20 ha increased by 59.
 - Average property size (irrigable area) increased from 9 ha in 1997 to 11 ha in 2015.

⁸ Nyah Irrigation District includes areas outside the district supplied with irrigation water from the district.

2.1.1 Pumped districts summary - crop types in 2015

Crops irrigated in the 2014-2015 season across the five pumped irrigation districts are shown in Table 10.

- Dominant plantings across the pumped irrigation districts in 2015 were:
 - Table grapes, 27% of the irrigable area; and
 - Wine grapes, 20% of the irrigable area.

Table 10: Pumped irrigation districts - irrigated crops in 2015

	Crop type	Category	2015 (ha)	2015 %	Description
Permanent crops	Grapevine	Wine	3,485	20%	
		Table	4,740	27%	
		Dried	2,080	12%	
		Other	45	<1%	
	Citrus		230	1%	Grapefruit, Lemon, Lime, Mandarin, Navel, Blood Orange, Other, Tangelo, Valencia
	Fruit tree	<i>unspecified</i>	45	<1%	<i>Fruit tree category unknown</i>
		Avocado	135	1%	
		Olive	115	1%	
		Stone fruit	60	<1%	Apricot, Nectarine, Peach, Plum
		Other	70	<1%	Date Palm, Fig, Mango, Persimmon, Pomegranate
	Nut tree	Almond	150	1%	
		Other	60	<1%	Pecan, Pistachio, Walnut
	Other	Nursery	80	<1%	
		Woodlot	35	<1%	
		Misc.	10	<1%	Flowers, Native Plants, Passionfruit, Roses
Permanent crops	(sub-total)	11,340	65%		
Vacant P	≤ 10 years	3,795	22%	Vacant (not irrigated) for ten years or less	
Vacant >10	> 10 years	385	2%	Vacant (not irrigated) for over ten years	
Seasonal crops	Field crop	<i>unspecified</i>	5	<1%	<i>Field crop category unknown</i>
		Cereal	100	1%	
		Lucerne	85	<1%	
		Pasture	260	1%	
		Other	15	<1%	Turf
	Vegetable	<i>unspecified</i>	180	1%	<i>Vegetable category unknown</i>
		Asparagus	160	1%	
		Carrot	80	<1%	
		Cucurbit	155	1%	
		Potato	-	-	
		Other	55	<1%	Capsicum, Chili, Corn, Eggplant
		Seasonal crops	(sub-total)	1,095	6%
	Vacant S	≤ 10 years	535	3%	Vacant (not irrigated) for ten years or less
Vacant >10	> 10 years	280	2%	Vacant (not irrigated) for over ten years	
Total all crop areas		17,430	100%		

Note: '*unspecified*' refers to unknown crop categories that may be categories already listed OR other categories not listed.

2.1.2 Pumped districts summary – change in crop types

Figure 14 summarises crop types across the Mallee pumped irrigation districts of Nyah, Robinvale, Red Cliffs, Mildura and Merbein from 1997 to 2015.

- Grapevines remained the dominant crop type from 1997 to 2015. Plantings peaked around 2003 at 15,230 ha, but continued to decline from 2003 to 2015.
- Of the irrigated crops, vegetables increased by the largest area, 160 ha; a 34% increase from 470 ha in 1997 to 630 ha in 2015.
- In 2015, the irrigable area of 17,430 ha comprised:
 - 65% (12,435 ha) irrigated permanent plantings;
 - 6% (1,095 ha) irrigated seasonal crops;
 - 25% (4,330 ha) vacant or not irrigated for less than 10 years; and
 - 4% (665 ha) vacant or not irrigated for more than 10 years.

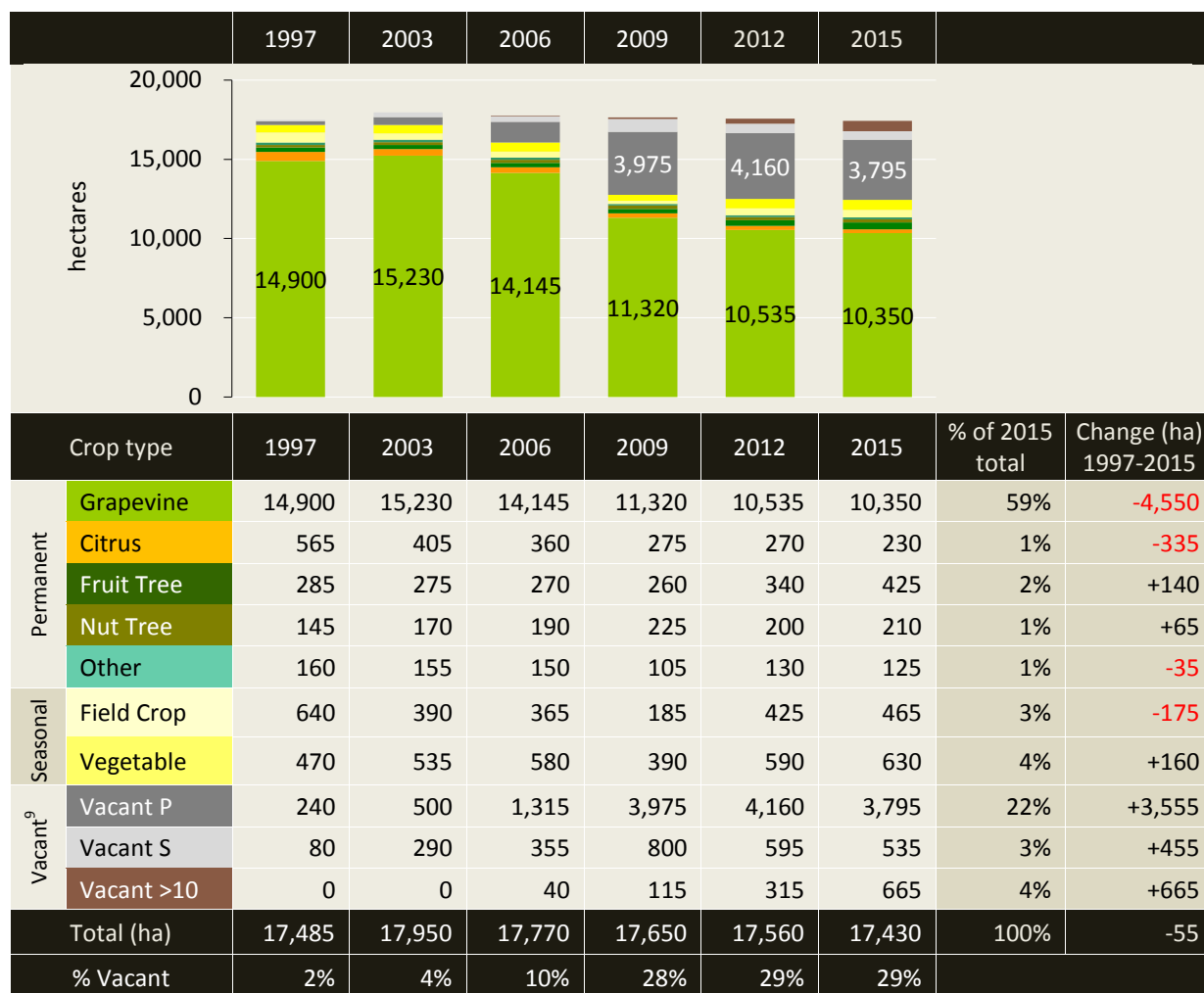


Figure 14: Pumped irrigation districts - crop types from 1997 to 2015

⁹ Vacant S: not irrigated but previously an irrigated seasonal crop. Vacant P: not irrigated but previously an irrigated permanent planting. Vacant >10: not irrigated for over ten years but previously an irrigated area.

2.1.3 Pumped districts summary – grapevines

Figure 15 summarises grape use across the Mallee pumped irrigation districts from 1997 to 2015.

- The area of grapevines decreased by 4,550 ha, a 31% decrease from 14,900 ha in 1997 to 10,350 ha in 2015. Plantings peaked around 2003 at 15,230 ha.
- In 2015, the 10,350 ha of grapevines comprised:
 - 34% (3,490 ha) wine grape plantings;
 - 46% (4,735 ha) table grape plantings;
 - 20% (2,080 ha) dried grape plantings; and
 - < 1% (45 ha) grapevines for other purposes.
- Wine grape plantings decreased by 2,380 ha, a 41% decrease from 5,870 ha in 1997 to 3,490 ha in 2015.
 - Wine grapes were the main type of grapevine across the irrigation districts from 2003 to 2009.
- Table grape plantings increased by 1,735 ha, a 58% increase from 3,000 ha in 1997 to 4,735 ha in 2015.
 - Table grapes were the main type of grapevine across the irrigation districts from 2012 to 2015.
- Dried grape plantings decreased by 3,855 ha, a 65% decrease from 5,935 ha in 1997 to 2,080 ha in 2015.
 - Dried grapes were the main type of grapevine across the irrigation districts in 1997.

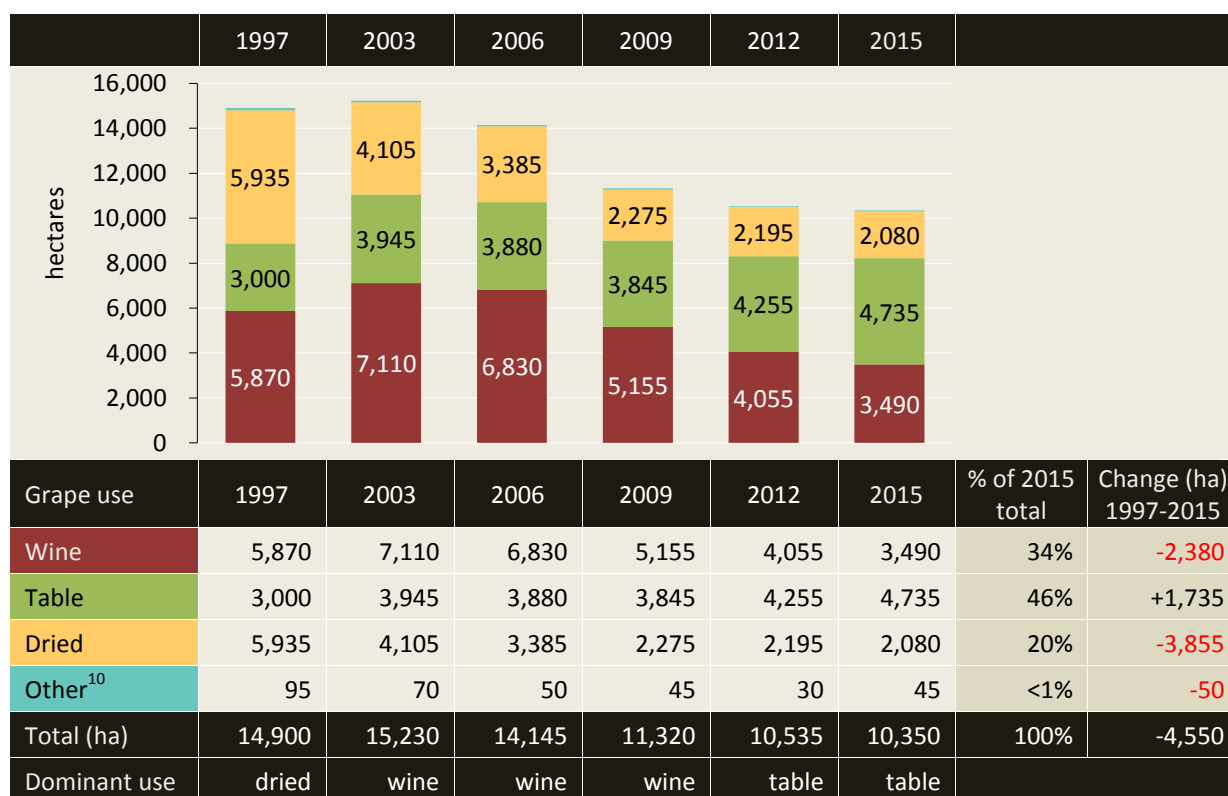


Figure 15: Pumped irrigation districts – grapevine plantings from 1997 to 2015

¹⁰ Other: grapes for juicing, cannery, research and trial varieties.

Grapevines in 2015 in each of the irrigation districts

Figure 16 compares grape use in each of the pumped irrigation districts in 2015.

- Grapevines were predominantly grown for:
 - Wine production in the Nyah and Red Cliffs irrigation districts;
 - Table grapes in the Robinvale and Mildura irrigation districts; and
 - Dried grapes in the Merbein irrigation district.
- The Mildura irrigation district grew the largest area of grapevines in 2015; 34% (3,550 ha) of the total area of grapevines (10,350 ha) grown in the pumped districts.
- In 2015 in the pumped irrigation districts, Red Cliffs grew the largest area of wine grape plantings (1,295 ha), Robinvale grew the largest area of table grapes (1,920 ha) and Mildura grew the largest area of dried grape plantings (780 ha).

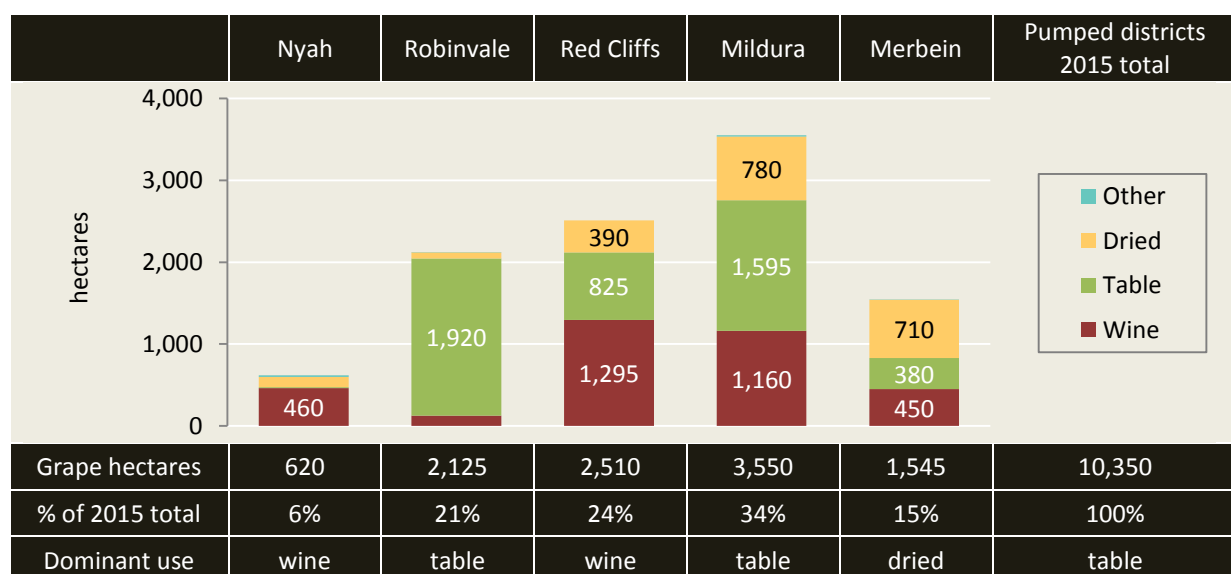


Figure 16: Pumped irrigation districts - grapevine plantings in each district in 2015

2.1.4 Pumped districts summary – irrigation methods

Figure 17 summarises irrigation methods across the pumped irrigation districts from 1997 to 2015.

- In 2015, the irrigable area of 17,430 ha comprised:
 - 35% (6,045 ha) drip irrigation;
 - 23% (4,005 ha) low level irrigation;
 - 9% (1,585 ha) overhead sprinklers;
 - 4% (800 ha) furrow irrigation; and
 - 29% (4,995 ha) not irrigated.
- Drip irrigation increased by 5,275 ha, a 685% increase from 770 ha in 1997 to 6,045 ha in 2015.
 - Drip irrigation was the dominant irrigation method from 2012 to 2015.
- Low level irrigation increased by 1,315 ha, a 49% increase from 2,690 ha in 1997 to 4,005 ha in 2015.
 - Low level irrigation was the dominant method in 2006 and 2009.
- Overhead irrigation decreased by 2,750 ha, a 63% decrease from 4,335 ha in 1997 to 1,585 ha in 2015.
- Furrow irrigation decreased by 8,570 ha, a 91% decrease from 9,370 ha in 1997 to 800 ha in 2015.
 - Furrow irrigation was the dominant irrigation method in 1997 and 2003.

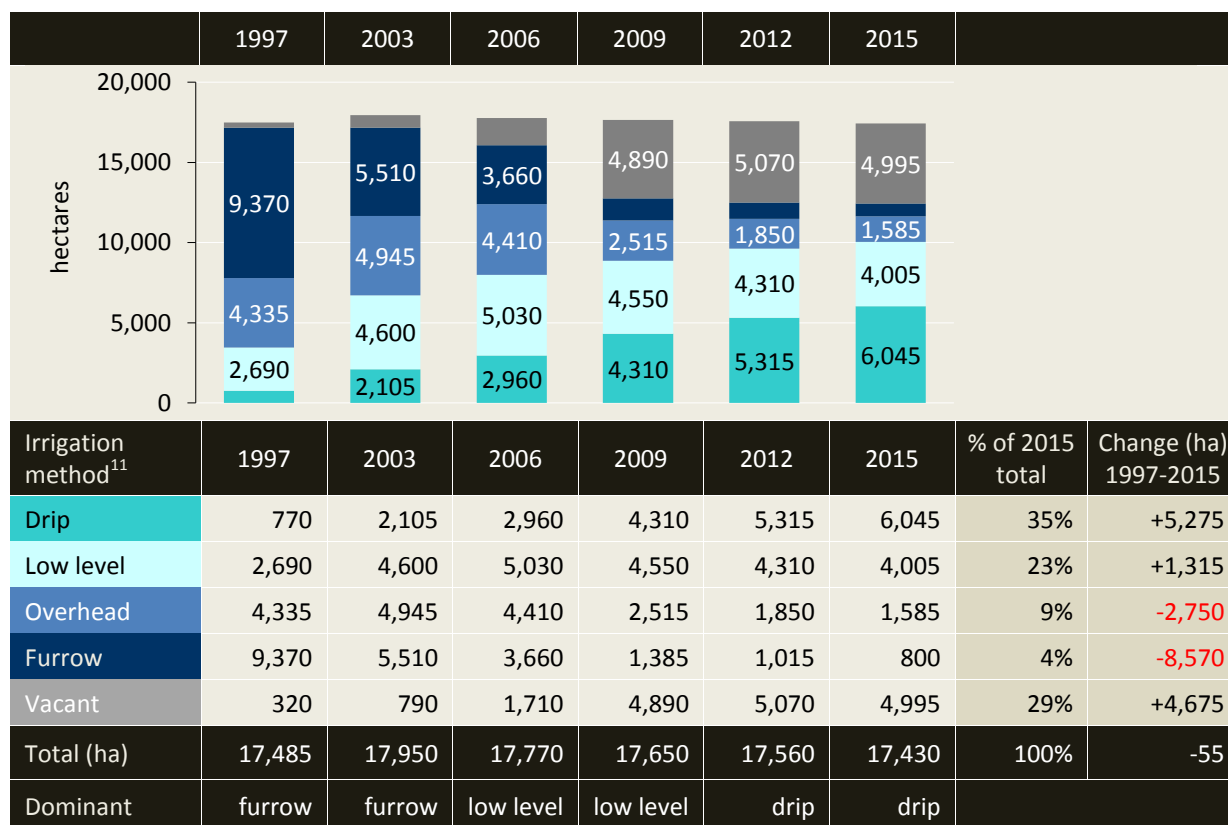


Figure 17: Pumped irrigation districts - irrigation methods from 1997 to 2015

¹¹ Overhead irrigation includes pivots and lateral move systems. Furrow includes flood irrigation. (Table 8)

Irrigation methods in each pumped irrigation district in 2015

Figure 18 compares irrigation methods in each of the pumped irrigation districts in 2015.

- Drip irrigation was the dominant method in each of the pumped districts in 2015, except for the Robinvale district where low level sprinklers were dominant.

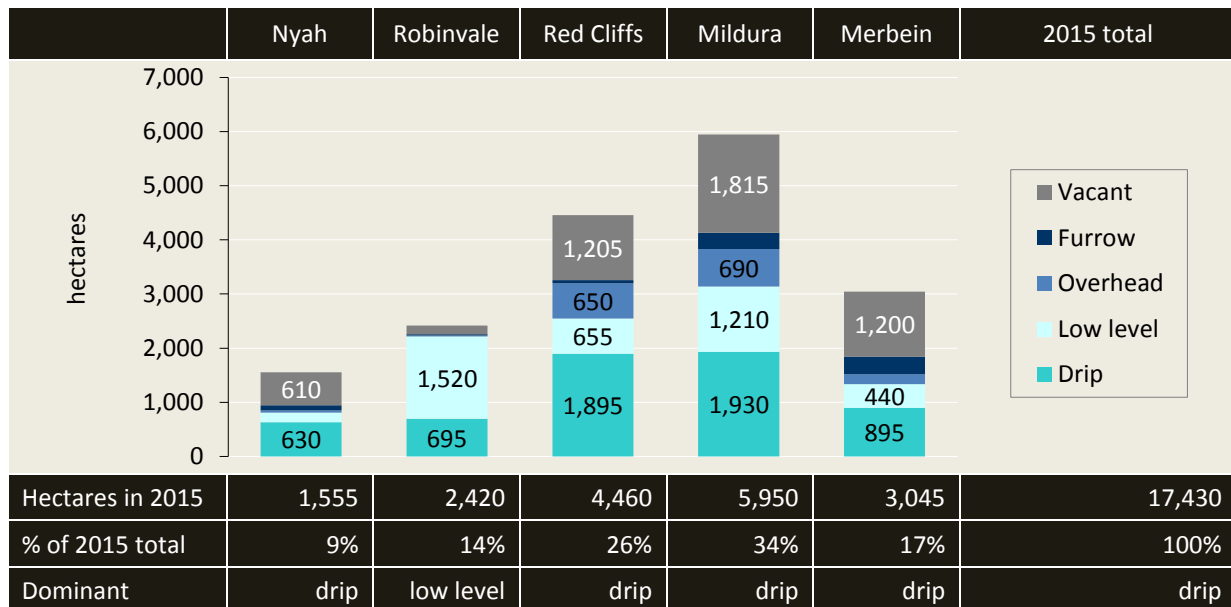


Figure 18: Pumped irrigation districts - irrigation methods in each district in 2015

2.1.5 Pumped districts summary – salinity impact zones

Figure 19 summarises the irrigable areas in each river salinity impact zone across the five pumped irrigation districts from 1997 to 2015.

- In 2015, irrigable areas across the pumped districts were predominantly in the high salinity impact zone, HIZ. The irrigable area of 17,430 ha comprised:
 - 34% (5,965 ha) in the lowest salinity impact zone, LIZ 1;
 - 15% (2,625 ha) in LIZ 2;
 - < 1% (20 ha) in LIZ 3;
 - 6% (1,045 ha) in LIZ 4; and
 - 45% (7,775 ha) in HIZ.
- The area irrigated in:
 - LIZ decreased by 1,705 ha, a 19% decrease from 8,825 ha in 1997 to 7,120 ha in 2015; and
 - HIZ decreased by 3,025 ha, a 36% decrease from 8,340 ha in 1997 to 5,315 ha in 2015.
- The irrigable area in:
 - LIZ increased by 670 ha, a 7% increase from 8,985 ha in 1997 to 9,655 ha in 2015; and
 - HIZ decreased by 725 ha, a 9% decrease from 8,500 ha in 1997 to 7,775 ha in 2015.

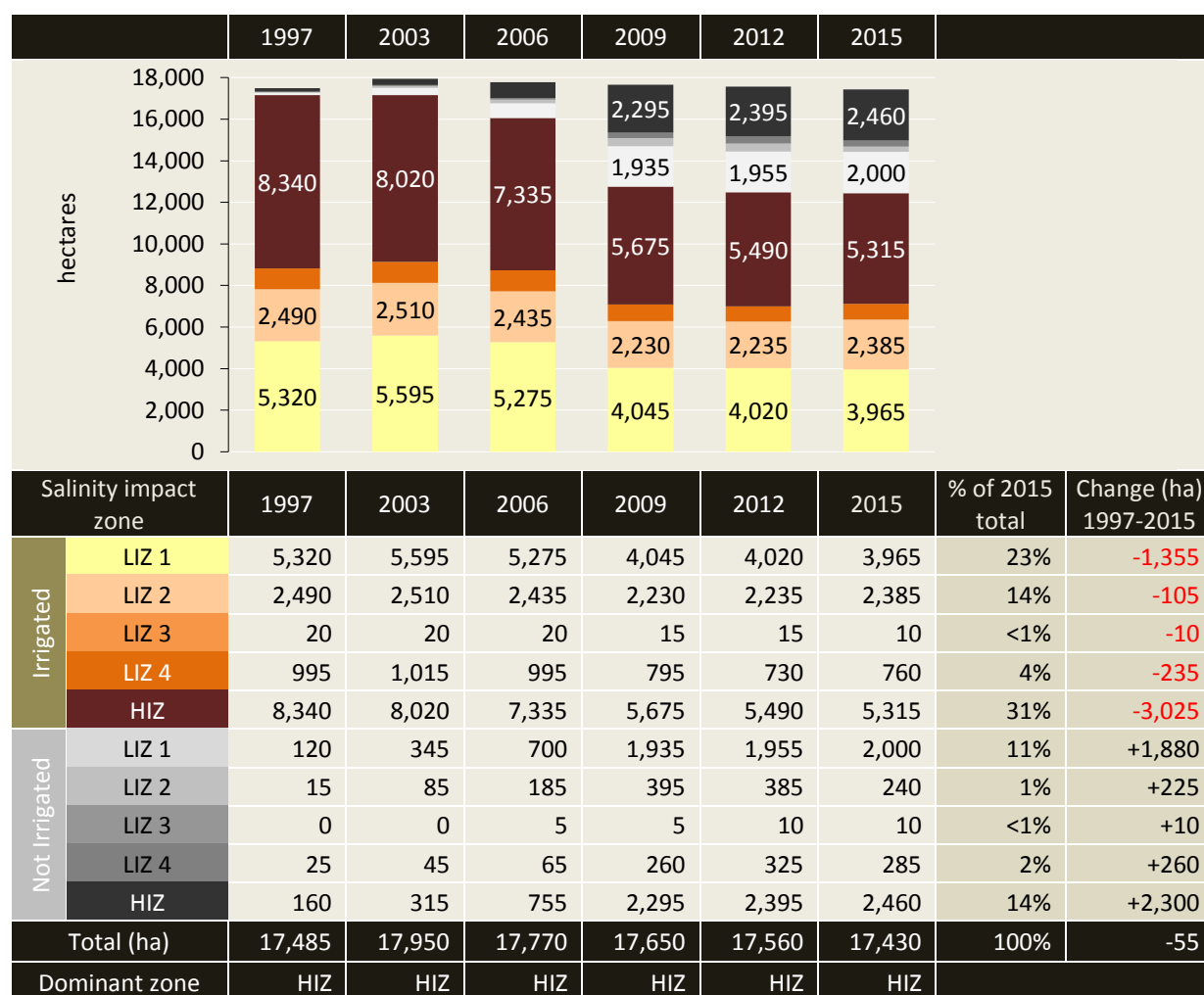


Figure 19: Pumped irrigation districts – irrigable area in each salinity impact zone from 1997 to 2015

Salinity impact zones in each pumped irrigation district

Figure 20 compares salinity impact zones in each of the pumped irrigation districts in 2015.

- The Nyah and Robinvale irrigation districts are predominantly in LIZ 1 and LIZ 2 respectively, and have no irrigable areas in HIZ.
- The Red Cliffs, Mildura and Merbein irrigation districts are predominantly in the HIZ.

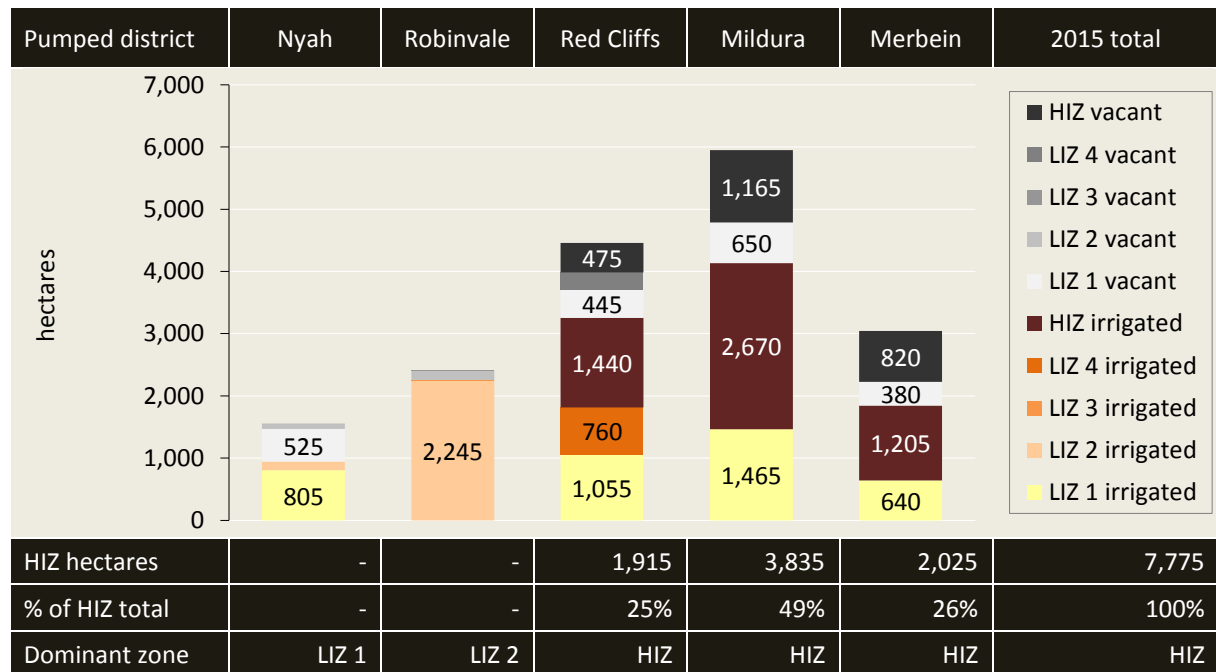


Figure 20: Pumped irrigation district - salinity impact zones in each district in 2015

2.1.6 Pumped districts summary – irrigation development

Figure 21 summarises irrigation development from 1997 to 2015 in the pumped irrigation districts with respect to new development (expansion) and areas retired¹² from irrigation.

- Across the pumped irrigation districts the irrigable area decreased by 55 ha, a < 1% decrease from 17,485 ha in 1997 to 17,430 ha in 2015. The net decrease of 55 ha comprised 1,010 ha retired from irrigation and 955 ha of expansion.
- The irrigable area in the Nyah, Robinvale and Red Cliffs irrigation districts increased by 39% (435 ha), 4% (100 ha) and <1% (10 ha) respectively.
- The irrigable area in the Mildura and Merbein irrigation districts decreased by 8% (500 ha) and 3% (100 ha) respectively.

District	1997 (ha)	1997 to 2015		2015 (ha)	Change 1997-2015	Growth 1997-2015
		Retired	New			
Nyah ¹³	1,120	-10	+445	1,555	+435	+39%
Robinvale	2,320	-25	+125	2,420	+100	+4%
Red Cliffs	4,450	-125	+135	4,460	+10	<1%
Mildura	6,450	-745	+245	5,950	-500	-8%
Merbein	3,145	-105	+5	3,045	-100	-3%
Total	17,485	-1,010	+955	17,430	-55	<1%

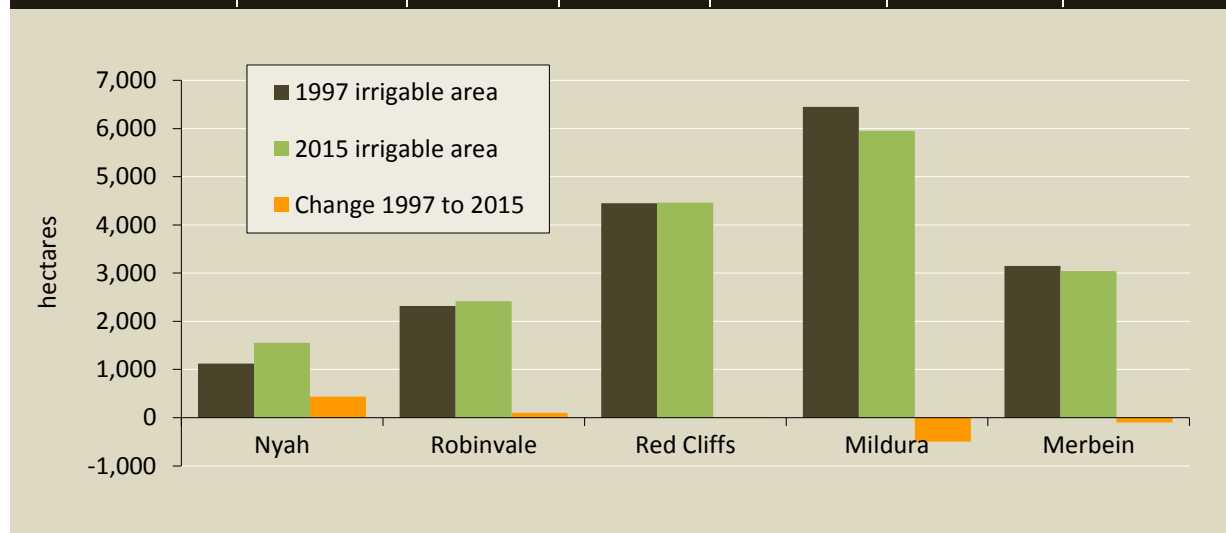


Figure 21: Pumped irrigation districts - irrigation development from 1997 to 2015

¹² Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

¹³ Hectares for the Nyah irrigation district include areas outside the district but supplied with water from the district, whereas figures for the other districts only include areas inside the district boundary.

2.1.7 Pumped districts summary – property change

Figure 22 provides an estimate of property numbers and average property size (irrigable area) across the five pumped irrigation districts from 1997 to 2015.

- There were approximately 1,646 irrigation properties (land holdings) in the pumped irrigation districts in 2015.
- Property numbers declined by 341, a 17% decrease from 1,987 in 1997 to 1,646 in 2015.
- The number of properties less than 20 ha (irrigable area) declined by 400, while the number over 20 ha increased by 59.
- Average property size (irrigable area) increased from 9 ha in 1997 to 11 ha in 2015.

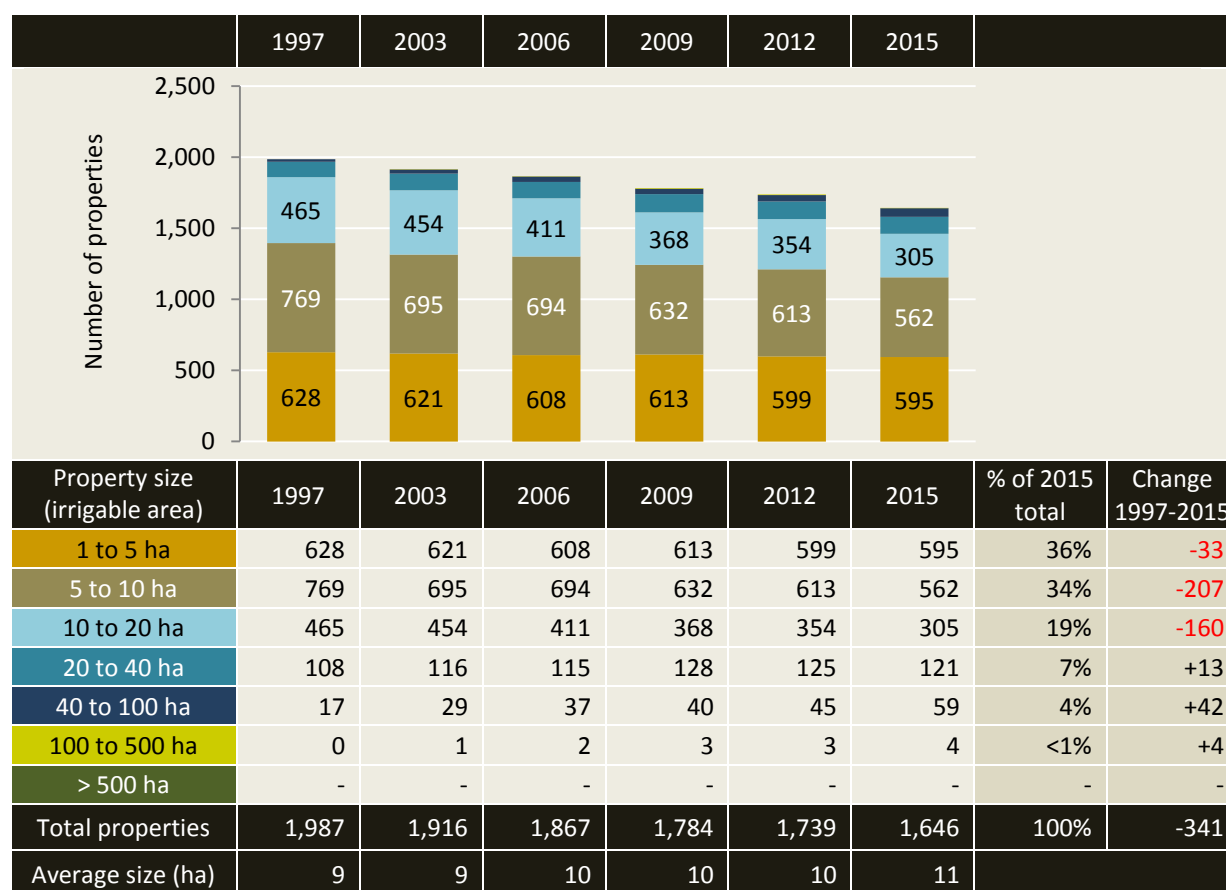


Figure 22: Pumped irrigation districts - property numbers and sizes from 1997 to 2015

Irrigation properties in each of the pumped districts in 2015

Figure 23 provides an estimate of property numbers and average property size (irrigable area) in each of the five pumped irrigation districts in 2015.

- The largest number of irrigation properties, 680 (40%), were in the Mildura irrigation district in 2015.
- Average irrigable area for a property in the pumped districts was 11 ha (Figure 22) in 2015.
- Each of the districts was comparable with the 11 ha average except for the Robinvale district where the average irrigable area was 22 ha.

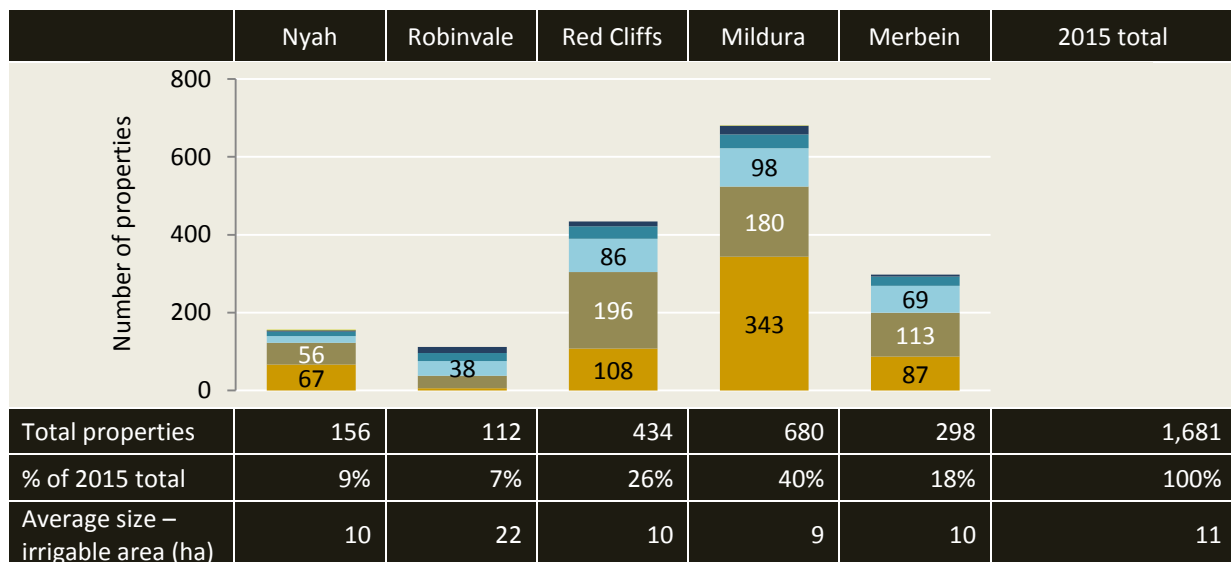


Figure 23: Pumped irrigation districts - property numbers and average size in each district in 2015

Note: The total number of properties in Figure 23 (1,681 properties) is the sum of properties from each irrigation district and is greater than the total number of properties across the irrigation districts in Figure 22 (1,646 properties) as some property owners have irrigated land in more than one district.

2.2 Nyah irrigation district

In summary for the Nyah irrigation district

Crop types

- Grapevines remained the dominant crop type in the Nyah irrigation district from 1997 to 2015. Plantings peaked around 2003, but continued to decline from 2003 to 2015.
- The irrigable area in 2015 was 1,555 ha of which:
 - 46% (715 ha) was irrigated permanent plantings;
 - 15% (230 ha) was irrigated seasonal crops;
 - 25% (395 ha) was vacant or not irrigated for less than 10 years; and
 - 14% (215 ha) was vacant or not irrigated for more than 10 years.

Grapevines

- Grapevines in the Nyah irrigation district were predominantly grown for wine production from 1997 to 2015.
- The area of grapevines increased by 40 ha, a 7% increase from 580 ha in 1997 to 620 ha in 2015.
- In 2015, the 620 ha of grapevines comprised:
 - 74% (460 ha) wine grape plantings;
 - 3% (15 ha) table grape plantings;
 - 20% (125 ha) dried grape plantings; and
 - 3% (20 ha) grapevines for other purposes.

Irrigation methods

- Drip irrigation was the dominant irrigation method in the Nyah irrigation district from 2006 to 2015. Prior to 2006, furrow irrigation was the dominant method from 1997 to 2003.
- In 2015, the irrigable area of 1,555 ha comprised:
 - 40% (630 ha) drip irrigation;
 - 12% (180 ha) low level irrigation;
 - 3% (40 ha) overhead sprinklers;
 - 6% (95 ha) furrow irrigation; and
 - 39% (610 ha) not irrigated.

Salinity impact zones

- The Nyah irrigation district is in low salinity impact zones LIZ 1 and LIZ 2.
- In 2015, the irrigable area of 1,555 ha comprised:
 - 86% (1,330 ha) in the lowest salinity zone LIZ 1; and
 - 14% (225 ha) in LIZ 2.

In summary for the Nyah irrigation district

Irrigation development

- In the Nyah irrigation district the irrigable area increased by 435 ha, a 39% increase from 1,120 ha in 1997 to 1,555 ha in 2015.
- The net increase of 435 ha comprised 10 ha retired from irrigation and 445 ha of expansion.

Irrigation properties

- There were approximately 156 irrigation properties (land holdings) in the Nyah irrigation district in 2015.
- Change in property numbers and size from 1997 to 2015:
 - Property numbers declined by 5, a 3% decrease from 161 in 1997 to 156 in 2015.
 - The number of properties with an irrigable area of less than 20 ha declined by 14, while the number over 20 ha increased by 9.
 - Average property size (irrigable area) increased from 7 ha in 1997 to 10 ha in 2015.

2.2.1 Nyah irrigation district - crop types in 2015

Crop types grown in the Nyah irrigation district in 2015 are shown in Table 11 and Map 2.

- Dominant plantings in the Nyah irrigation district in 2015 were:
 - Wine grapes, 30% of the irrigable area; and
 - Dried grapes, 8% of the irrigable area.

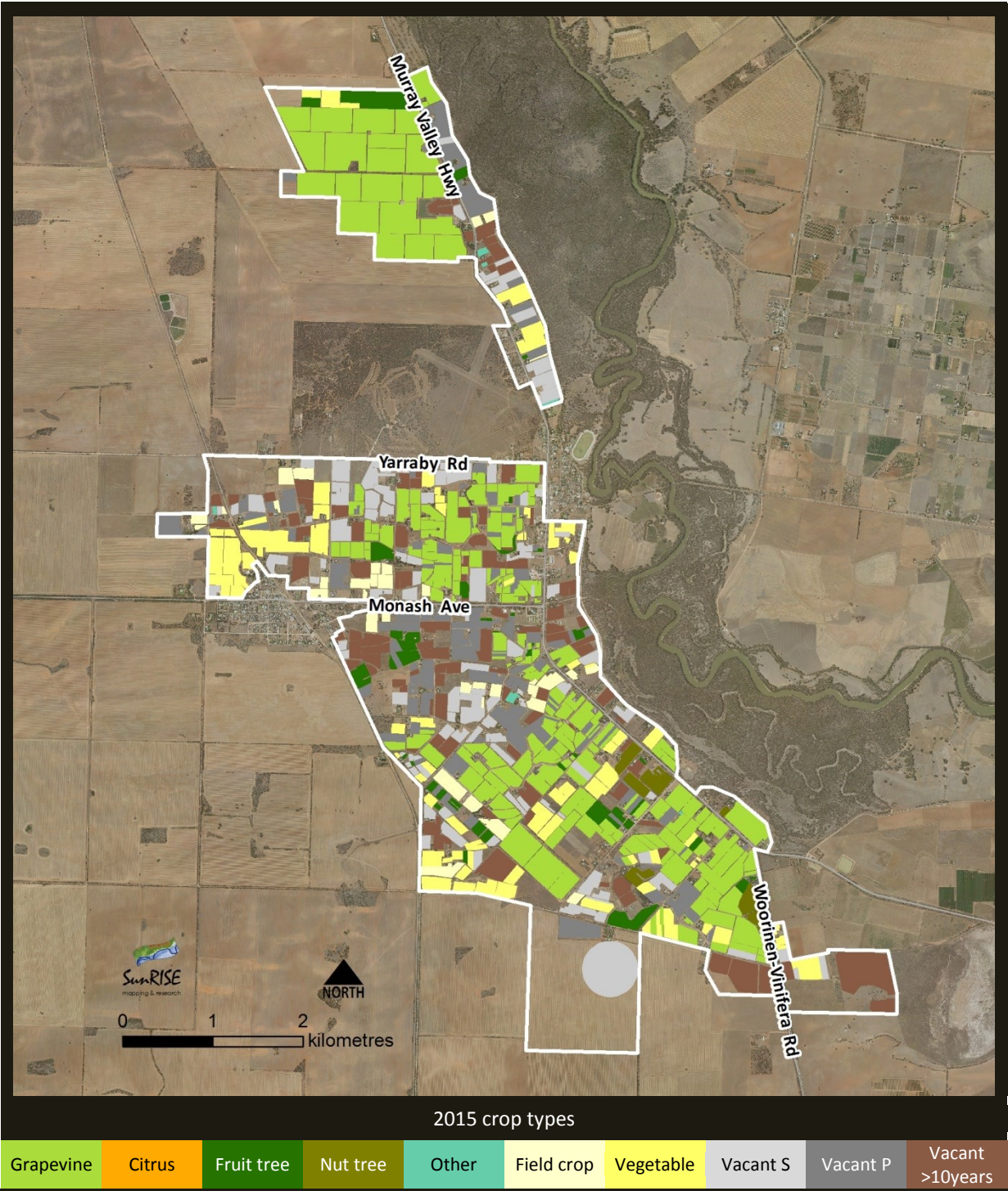
Table 11: Nyah irrigation district - crop types in 2015

	Crop type	Category	2015 (ha)	2015 %	Description
Permanent crops	Grapevine	Wine	460	30%	
		Table	15	1%	
		Dried	125	8%	
		Other	20	1%	
	Citrus		-	-	<2ha
	Fruit tree	<i>unspecified</i>	5	<1%	<i>Fruit tree category unknown</i>
		Avocado	-	-	
		Olive	10	1%	
		Stone fruit	50	3%	
		Other	-	-	
	Nut tree	Almond	5	<1%	
		Other	20	1%	Pistachio, Walnut
	Other	Nursery	-	-	< 2 ha
		Woodlot	5	<1%	
		Misc.	-	-	< 1 ha Passionfruit
	Permanent crops (sub-total)		715	46%	
Seasonal crops	Vacant P	≤ 10 years	190	12%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	45	3%	Vacant (not irrigated) for over ten years
	Field crop	<i>unspecified</i>	-	-	
		Cereal	20	1%	
		Lucerne	5	<1%	
		Pasture	30	2%	
		Other	-	-	
	Vegetable	<i>unspecified</i>	80	5%	<i>Vegetable category unknown</i>
		Asparagus	-	-	
		Carrot	45	3%	
		Cucurbit	25	2%	
		Potato	-	-	
		Other	25	2%	Beetroot, Cabbage, Onion
	Seasonal crops (sub-total)		230	15%	
	Vacant S	≤ 10 years	205	13%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	170	11%	Vacant (not irrigated) for over ten years
	Total all crop areas		1,555	100%	

Note: '*unspecified*' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Nyah irrigation district 2015 crop types

Map 2: Nyah irrigation district showing 2015 crop types



Note: The Nyah irrigation district as shown in this map is not the gazetted district. It has been extended to include expansion adjacent to the original district that is supplied with irrigation water from the district.

2.2.2 Nyah irrigation district – change in crop types

Figure 24 summarises crop types in the Nyah irrigation district from 1997 to 2015.

- Grapevines remained the dominant crop type from 1997 to 2015. Plantings peaked around 2003, but continued to decline from 2003 to 2015.
- Of the irrigated crops, grapevines increased by the largest area, 40 ha; a 7% increase from 580 ha in 1997 to 620 ha in 2015.
- In 2015, the irrigable area of 1,555 ha comprised:
 - 46% (715 ha) irrigated permanent plantings;
 - 15% (230 ha) irrigated seasonal crops;
 - 25% (395 ha) vacant or not irrigated for less than 10 years; and
 - 14% (215 ha) vacant or not irrigated for more than 10 years.

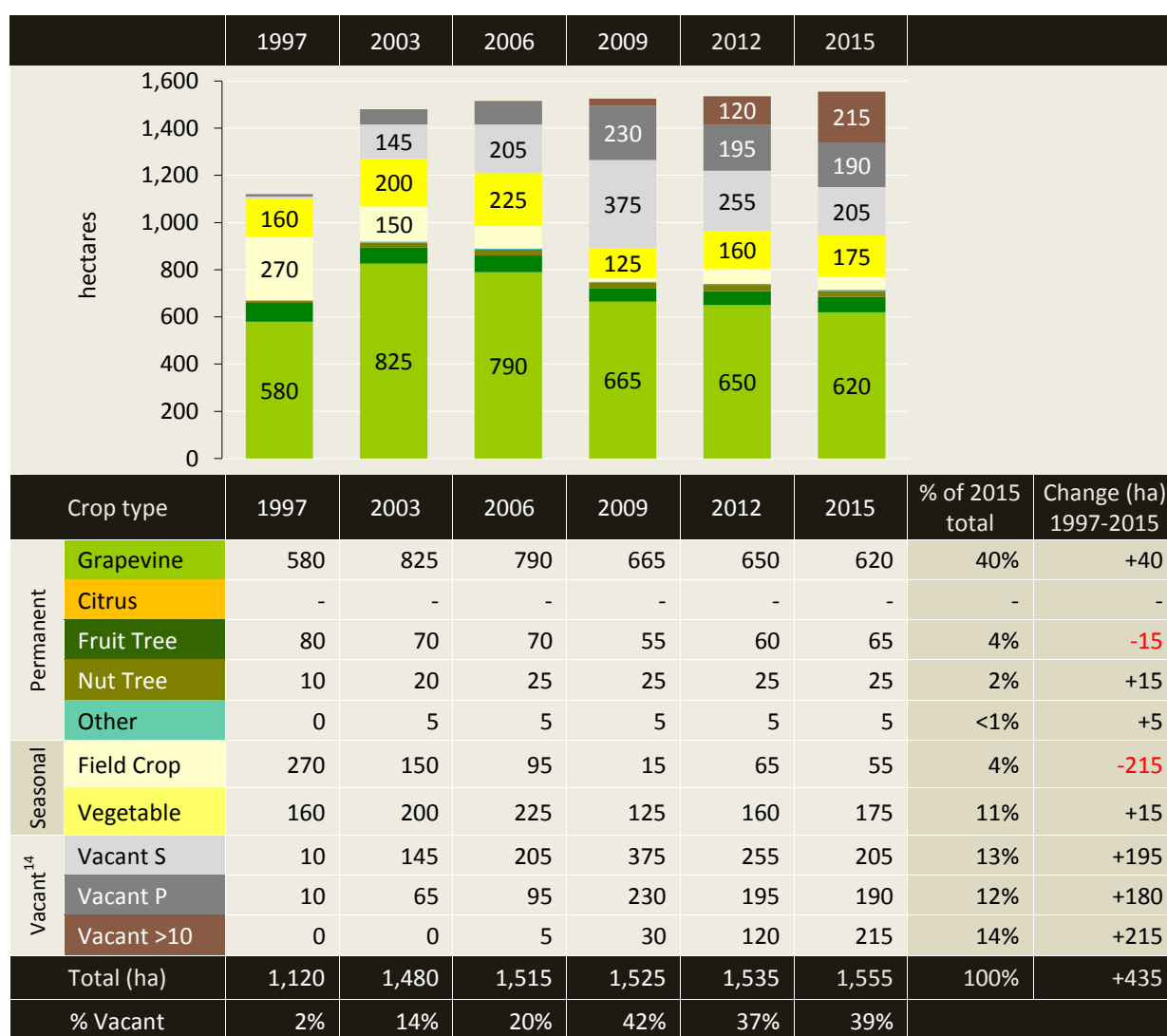


Figure 24: Nyah irrigation district - crop types from 1997 to 2015

¹⁴ Vacant S: not irrigated but previously an irrigated seasonal crop. Vacant P: not irrigated but previously an irrigated permanent planting. Vacant >10: not irrigated for over ten years but previously an irrigated area.

2.2.3 Nyah irrigation district – grapevines

Figure 25 summarises grapevine types in the Nyah pumped irrigation district from 1997 to 2015.

- The area of grapevines increased by 40 ha, a 7% increase from 580 ha in 1997 to 620 ha in 2015.
- In 2015, the 620 ha of grapevines comprised:
 - 74% (460 ha) wine grape plantings;
 - 3% (15 ha) table grape plantings;
 - 20% (125 ha) dried grape plantings; and
 - 3% (20 ha) grapevines for other purposes.
- Wine grape plantings increased by 135 ha, a 42% increase from 325 ha in 1997 to 460 ha in 2015.
 - The net increase of 135 ha comprised an increase of 300 ha between 1997 and 2003, then a decrease of 165 ha between 2003 and 2015.
- There was no net change in table grape plantings between 1997 (15 ha) and 2015 (15 ha).
- Dried grape plantings decreased by 85 ha, a 40% decrease from 210 ha in 1997 to 125 ha in 2015.

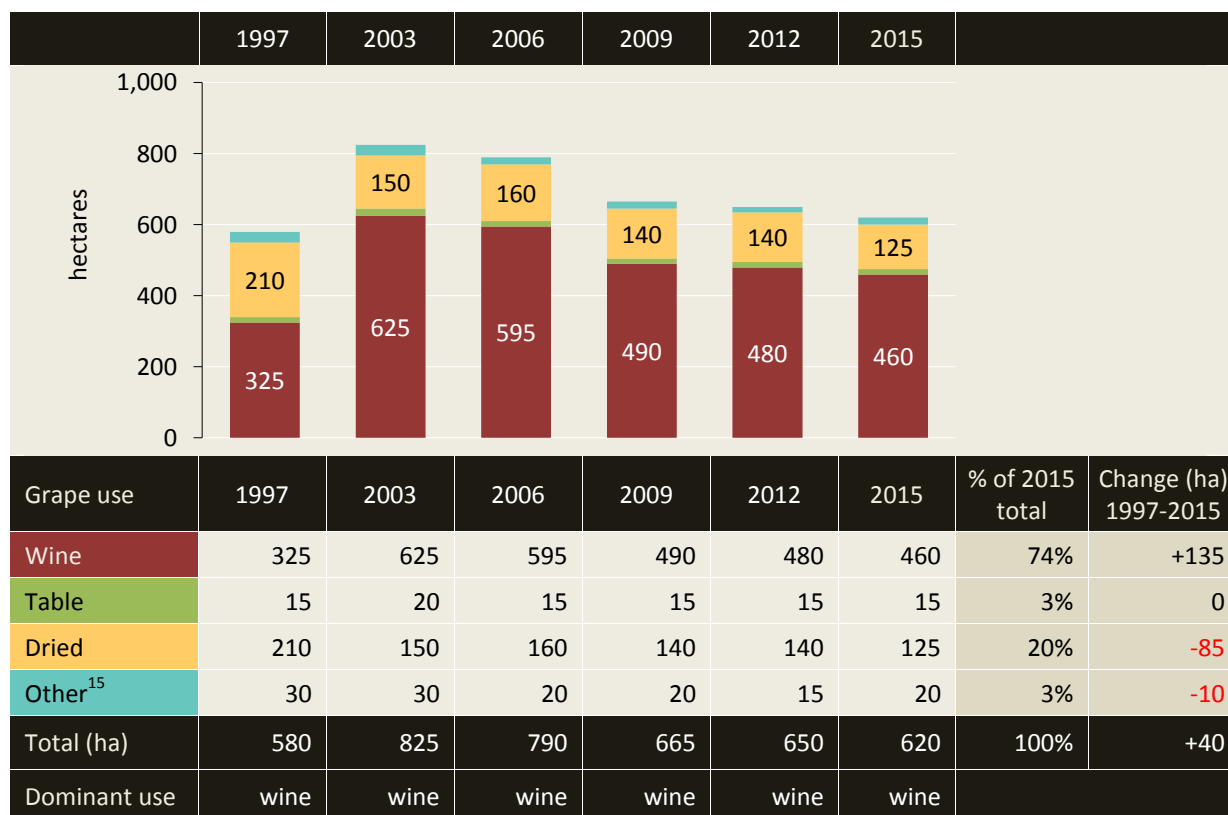


Figure 25: Nyah irrigation district - grapevine plantings from 1997 to 2015

¹⁵ Other: grapes for juicing, cannery, research and trial varieties.

2.2.4 Nyah irrigation district – irrigation methods

Figure 26 summarises irrigation methods in the Nyah irrigation district from 1997 to 2015.

- In 2015, the irrigable area of 1,555 ha comprised:
 - 40% (630 ha) drip irrigation;
 - 12% (180 ha) low level irrigation;
 - 3% (40 ha) overhead sprinklers;
 - 6% (95 ha) furrow irrigation; and
 - 39% (610 ha) not irrigated.
- Drip irrigation increased by 545 ha, a 641% increase from 85 ha in 1997 to 630 ha in 2015.
 - Drip irrigation was the dominant irrigation method from 2006 to 2015.
- Low level irrigation increased by 80 ha, an 80% increase from 100 ha in 1997 to 180 ha in 2015.
- Overhead irrigation decreased by 205 ha, an 84% decrease from 245 ha in 1997 to 40 ha in 2015.
- Furrow irrigation decreased by 575 ha, an 86% decrease from 670 ha in 1997 to 95 ha in 2015.
 - Furrow irrigation was the dominant irrigation method in 1997 and 2003.

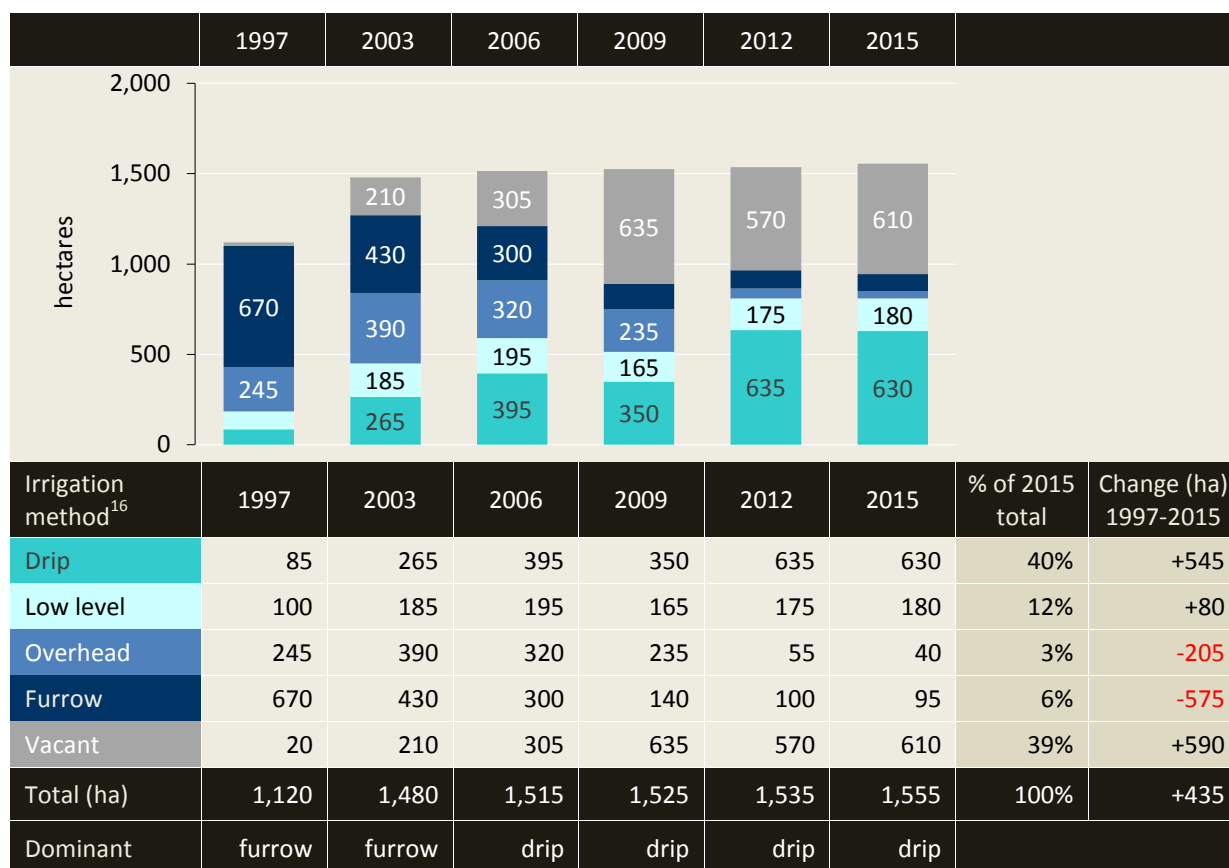


Figure 26: Nyah irrigation district - irrigation methods from 1997 to 2015

¹⁶ Overhead irrigation includes pivots and lateral move systems. Furrow includes flood irrigation. (Table 8)

2.2.5 Nyah irrigation district – salinity impact zones

Figure 27 summarises the irrigable area in each river salinity impact zone in the Nyah irrigation district from 1997 to 2015. The Nyah district is in low salinity impact zones; LIZ 1 and LIZ 2. No irrigable areas are in the high salinity impact zone.

- In 2015, the irrigable area of 1,555 ha comprised:
 - 86% (1,330 ha) in the lowest salinity impact zone, LIZ 1; and
 - 14% (225 ha) in LIZ 2.
- The area irrigated in:
 - LIZ 1 decreased by 100 ha, an 11% decrease from 905 ha in 1997 to 805 ha in 2015; and
 - LIZ 2 decreased by 55 ha, a 28% decrease from 195 ha in 1997 to 140 ha in 2015.
- The irrigable area in:
 - LIZ 1 increased by 415 ha, a 45% increase from 915 ha in 1997 to 1,330 ha in 2015; and
 - LIZ 2 increased by 20 ha, a 10% increase from 205 ha in 1997 to 225 ha in 2015.

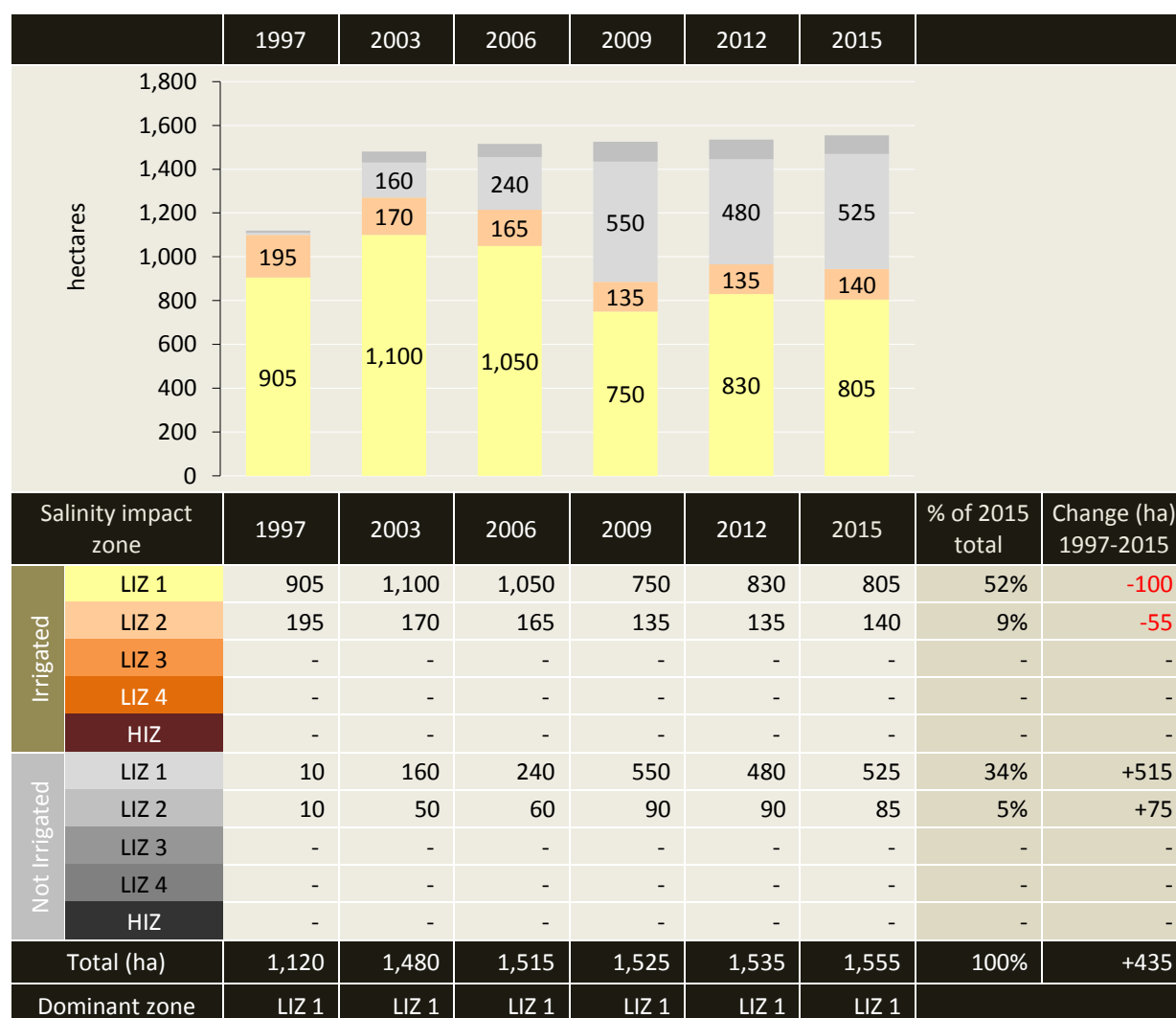


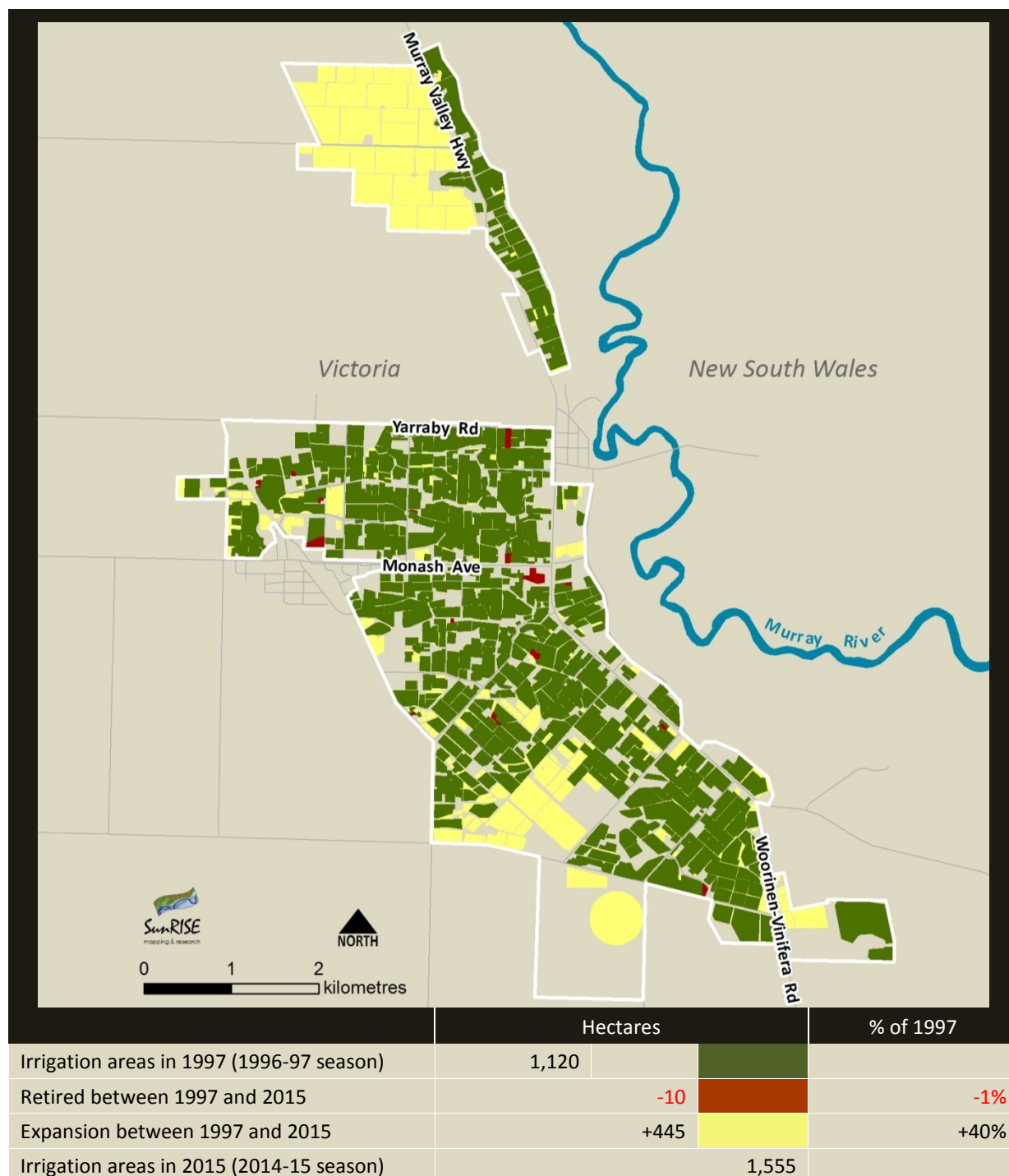
Figure 27: Nyah irrigation district - irrigable area in each salinity impact zone from 1997 to 2015

2.2.6 Nyah irrigation district – irrigation development

Map 3 shows irrigation development from 1997 to 2015 in the Nyah irrigation district with respect to new development (expansion) and areas retired¹⁷ from irrigation.

- The irrigable area increased by 435 ha, a 39% increase from 1,120 ha in 1997 to 1,555 ha in 2015. The net increase of 435 ha comprised 10 ha retired from irrigation and 445 ha of expansion.

Map 3: Nyah irrigation district – irrigation development from 1997 to 2015



¹⁷ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

2.2.7 Nyah irrigation district – property change

Figure 28 provides estimates of property numbers and average property size (irrigable area) in the Nyah irrigation district from 1997 to 2015.

- There were approximately 156 irrigation properties (land holdings) in the Nyah irrigation district in 2015.
- Property numbers declined by 5, a 3% decrease from 161 in 1997 to 156 in 2015.
- The number of properties less than 20 ha (irrigable area) declined by 14, while the number over 20 ha increased by 9.
- Average property size (irrigable area) increased from 7 ha in 1997 to 10 ha in 2015.

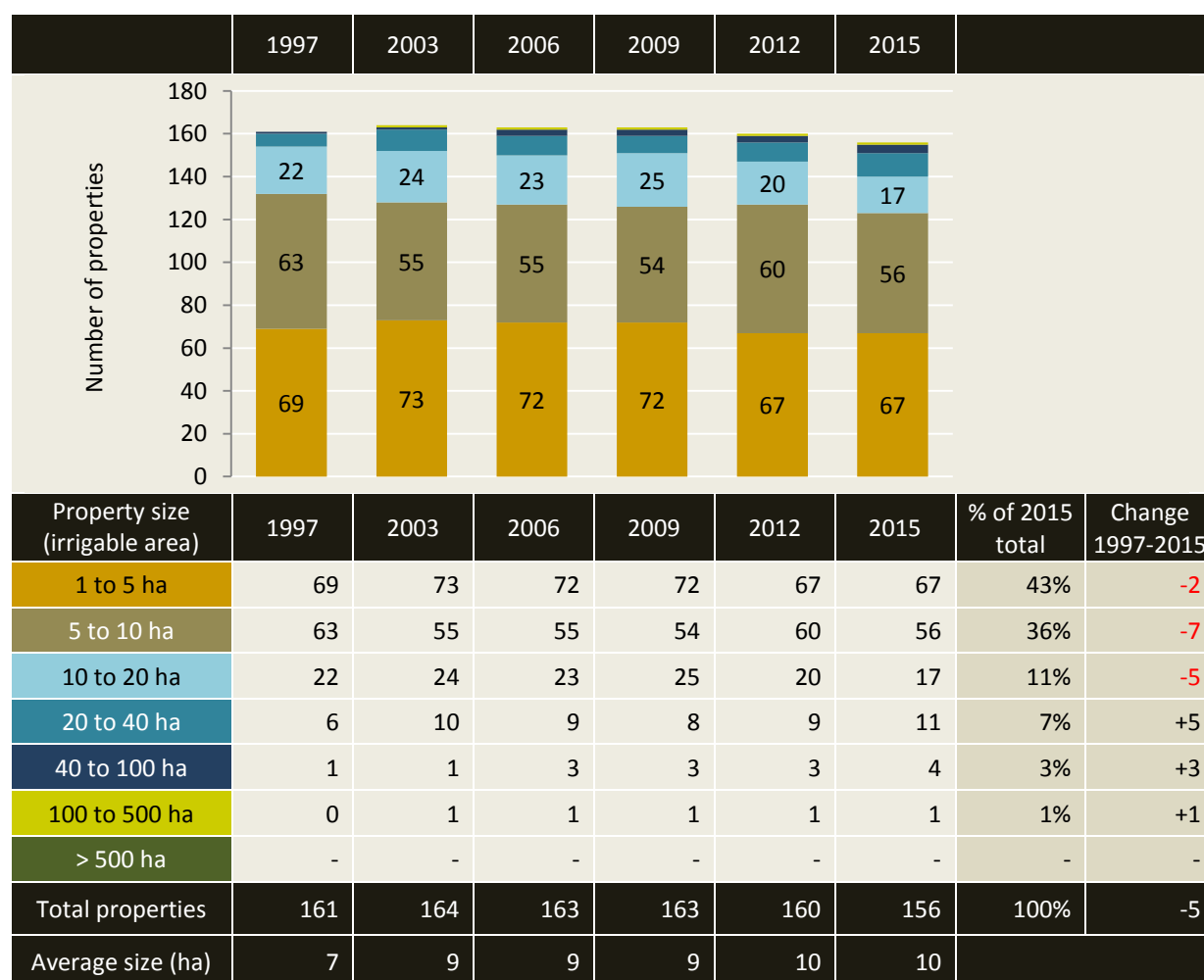


Figure 28: Nyah irrigation district - property numbers and sizes from 1997 to 2015

2.3 Robinvale irrigation district

In summary for the Robinvale irrigation district

Crop types

- Grapevines remained the dominant crop type in the Robinvale irrigation district from 1997 to 2015. Plantings peaked around 2003, declined from 2003 to 2012, then increased slightly between 2012 and 2015.
- Of the irrigated crops, fruit trees (predominantly avocados (Table 12)) increased by the largest area, 80 ha; a 320% increase from 25 ha in 1997 to 105 ha in 2015.
- The irrigable area in 2015 was 2,420 ha of which:
 - 93% (2,240 ha) was irrigated permanent plantings;
 - <1% (15 ha) was irrigated seasonal crops;
 - 6% (145 ha) was vacant or not irrigated for less than 10 years; and
 - <1% (20 ha) was vacant or not irrigated for more than 10 years.

Grapevines

- Grapevines in the Robinvale irrigation district were predominantly grown for table grapes from 1997 to 2015.
- The area of grapevines decreased by 125 ha, a 6% decrease from 2,250 ha in 1997 to 2,125 ha in 2015.
- In 2015, the 2,125 ha of grapevines comprised:
 - 6% (125 ha) wine grape plantings;
 - 90% (1,920 ha) table grape plantings;
 - 4% (75 ha) dried grape plantings; and
 - < 1% (5 ha) grapevines for other purposes.

Irrigation methods

- Low level sprinklers were the dominant irrigation method in the Robinvale district from 2003 to 2015. Furrow irrigation was the dominant method in 1997.
- In 2015, the irrigable area of 2,420 ha comprised:
 - 29% (695 ha) drip irrigation;
 - 63% (1,520 ha) low level irrigation;
 - 1% (20 ha) overhead sprinklers;
 - 1% (20 ha) furrow irrigation; and
 - 7% (165 ha) not irrigated.

Salinity impact zones

- The Robinvale irrigation district is in low salinity impact zones LIZ 2 and LIZ 3.
- In 2015, the irrigable area of 2,420 ha comprised:
 - 99% (2,400 ha) in the second lowest salinity impact zone, LIZ 2; and
 - 1% (20 ha) in LIZ 3.

In summary for the Robinvale irrigation district

Irrigation development

- In the Robinvale irrigation district the irrigable area increased by 100 ha, a 4% increase from 2,320 ha in 1997 to 2,420 ha in 2015.
- The net increase of 100 ha comprised 25 ha retired from irrigation and 125 ha of expansion.

Irrigation properties

- There were approximately 112 irrigation properties (land holdings) in the Robinvale irrigation district in 2015.
- Change in property numbers and size from 1997 to 2015:
 - Property numbers declined by 57, a 34% decrease from 169 in 1997 to 112 in 2015.
 - The number of properties with an irrigable area of less than 20 ha declined by 68, while the number over 20 ha increased by 11.
 - Average property size (irrigable area) increased from 14 ha in 1997 to 22 ha in 2015.

2.3.1 Robinvale irrigation district - crop types in 2015

Crop types grown in the Robinvale irrigation district in 2015 are shown in Table 12 and Map 4.

- Dominant plantings in the Robinvale irrigation district in 2015 were:
 - Table grapes, 79% of the irrigable area; and
 - Wine grapes, 5% of the irrigable area.

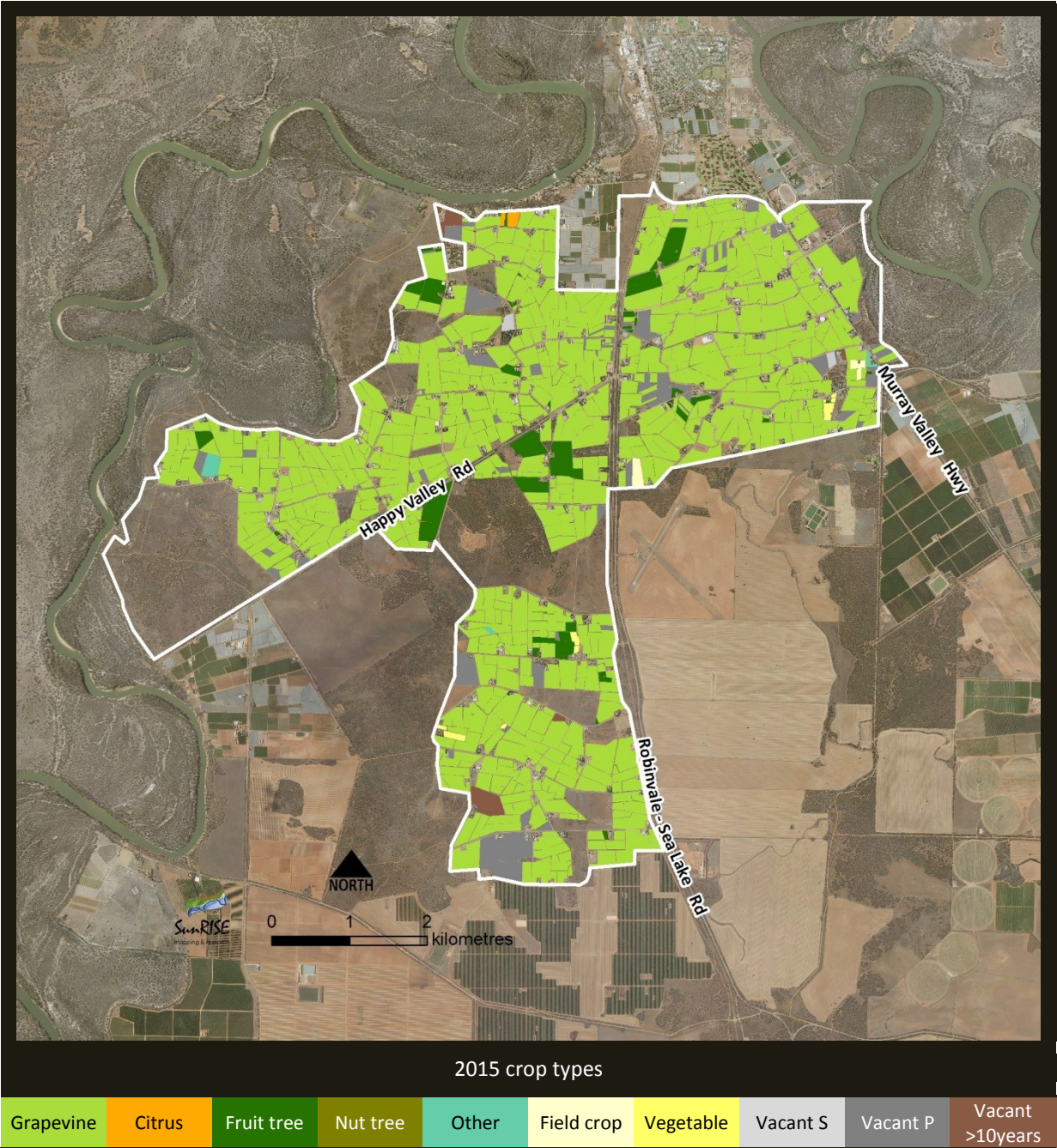
Table 12: Robinvale irrigation district - crop types in 2015

	Crop type	Category	2015 (ha)	2015 %	Description
Permanent crops	Grapevine	Wine	125	5%	
		Table	1,920	79%	
		Dried	75	3%	
		Other	5	<1%	
	Citrus		5	<1%	Mandarin, Tangelo
	Fruit tree	<i>unspecified</i>	-	-	
		Avocado	90	4%	
		Olive	0	0%	<1ha
		Stone fruit	0	0%	<1ha
		Other	15	1%	Date Palm, Mango, Pome Fruit, Pomegranate
	Nut tree	Almond	-	-	
		Other	-	-	
	Other	Nursery	5	<1%	
		Woodlot	-	-	
		Misc.	-	-	
	Permanent crops (sub-total)		2,240	93%	
	Vacant P	≤ 10 years	140	6%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	20	1%	Vacant (not irrigated) for over ten years
Seasonal crops	Field crop	<i>unspecified</i>	-	-	
		Cereal	-	-	
		Lucerne	-	-	
		Pasture	-	-	
		Other	5	<1%	Cover Crop
	Vegetable	<i>unspecified</i>	10	<1%	Vegetable category unknown
		Asparagus	-	-	
		Carrot	-	-	
		Cucurbit	-	-	
		Potato	-	-	
		Other	-	-	
	Seasonal crops (sub-total)		15	1%	
	Vacant S	≤ 10 years	5	<1%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	-	-	Vacant (not irrigated) for over ten years
	Total all crop areas		2,420	100%	

Note: '*unspecified*' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Robinvale irrigation district 2015 crop types

Map 4: Robinvale irrigation district showing 2015 crop types



2.3.2 Robinvale irrigation district – change in crop types

Figure 29 summarises crop types in the Robinvale irrigation district from 1997 to 2015.

- Grapevines remained the dominant crop type from 1997 to 2015. Plantings peaked around 2003, declined from 2003 to 2012, then increased slightly between 2012 and 2015.
- Of the irrigated crops, fruit trees (predominantly avocados (Table 12)) increased by the largest area, 80 ha; a 320% increase from 25 ha in 1997 to 105 ha in 2015.
- In 2015, the irrigable area of 2,420 ha comprised:
 - 93% (2,240 ha) irrigated permanent plantings;
 - <1% (15 ha) irrigated seasonal crops;
 - 6% (145 ha) vacant or not irrigated for less than 10 years; and
 - <1% (20 ha) vacant or not irrigated for more than 10 years.

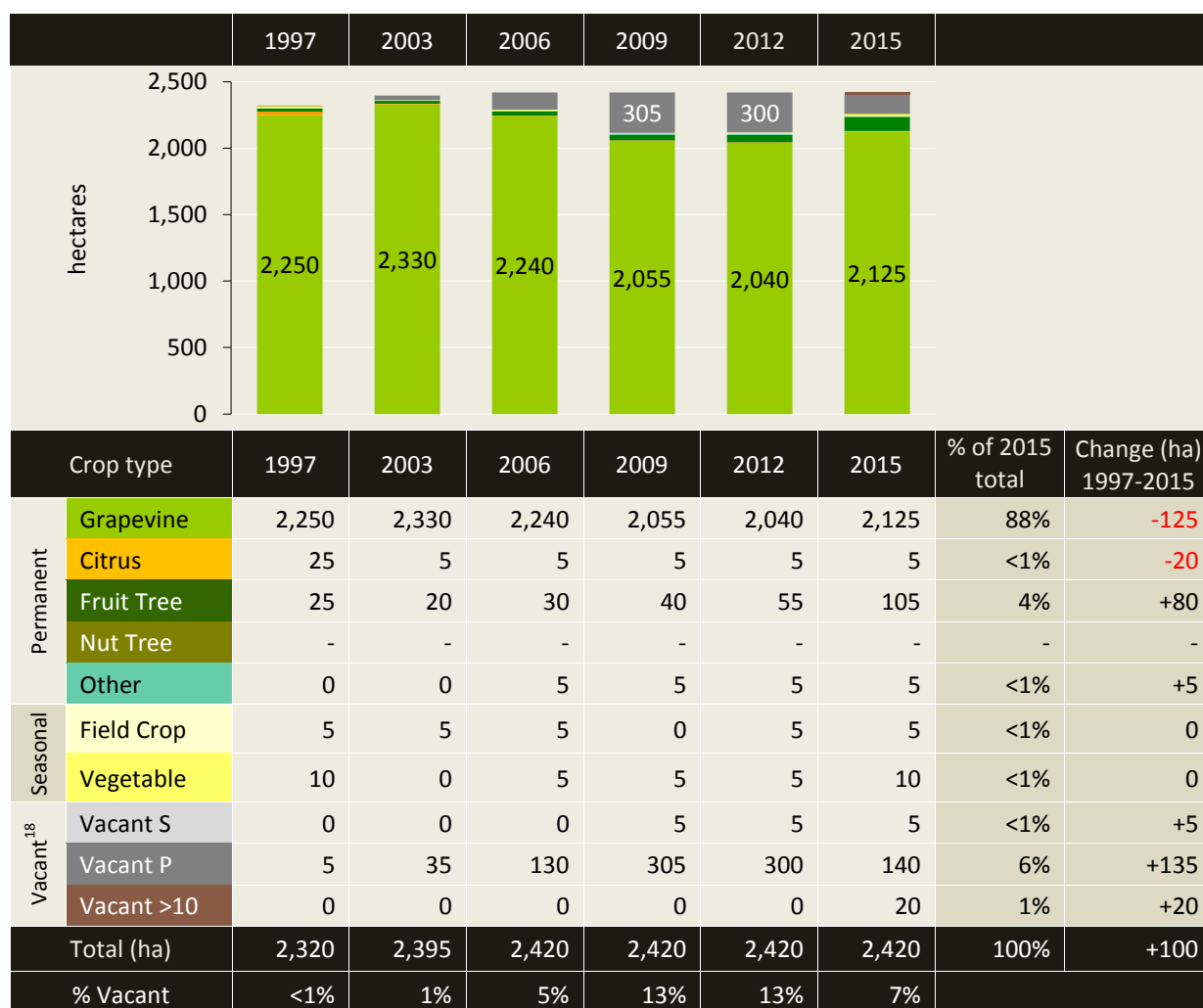


Figure 29: Robinvale irrigation district - crop types from 1997 to 2015

¹⁸ Vacant S: not irrigated but previously an irrigated seasonal crop. Vacant P: not irrigated but previously an irrigated permanent planting. Vacant >10: not irrigated for over ten years but previously an irrigated area.

2.3.3 Robinvale irrigation district – grapevines

Figure 30 summarises grape use in the Robinvale irrigation district from 1997 to 2015.

- The area of grapevines decreased by 125 ha, a 6% decrease from 2,250 ha in 1997 to 2,125 ha in 2015.
- In 2015, the 2,125 ha of grapevines comprised:
 - 6% (125 ha) wine grape plantings;
 - 90% (1,920 ha) table grape plantings;
 - 4% (75 ha) dried grape plantings; and
 - < 1% (5 ha) grapevines for other purposes.
- Wine grape plantings decreased by 330 ha, a 73% decrease from 455 ha in 1997 to 125 ha in 2015.
- Table grape plantings increased by 545 ha, a 40% increase from 1,375 ha in 1997 to 1,920 ha in 2015.
- Dried grape plantings decreased by 310 ha, an 81% decrease from 385 ha in 1997 to 75 ha in 2015.
- Grape plantings for other purposes decreased by 30 ha, an 86% decrease from 35 ha in 1997 to 5 ha in 2015.

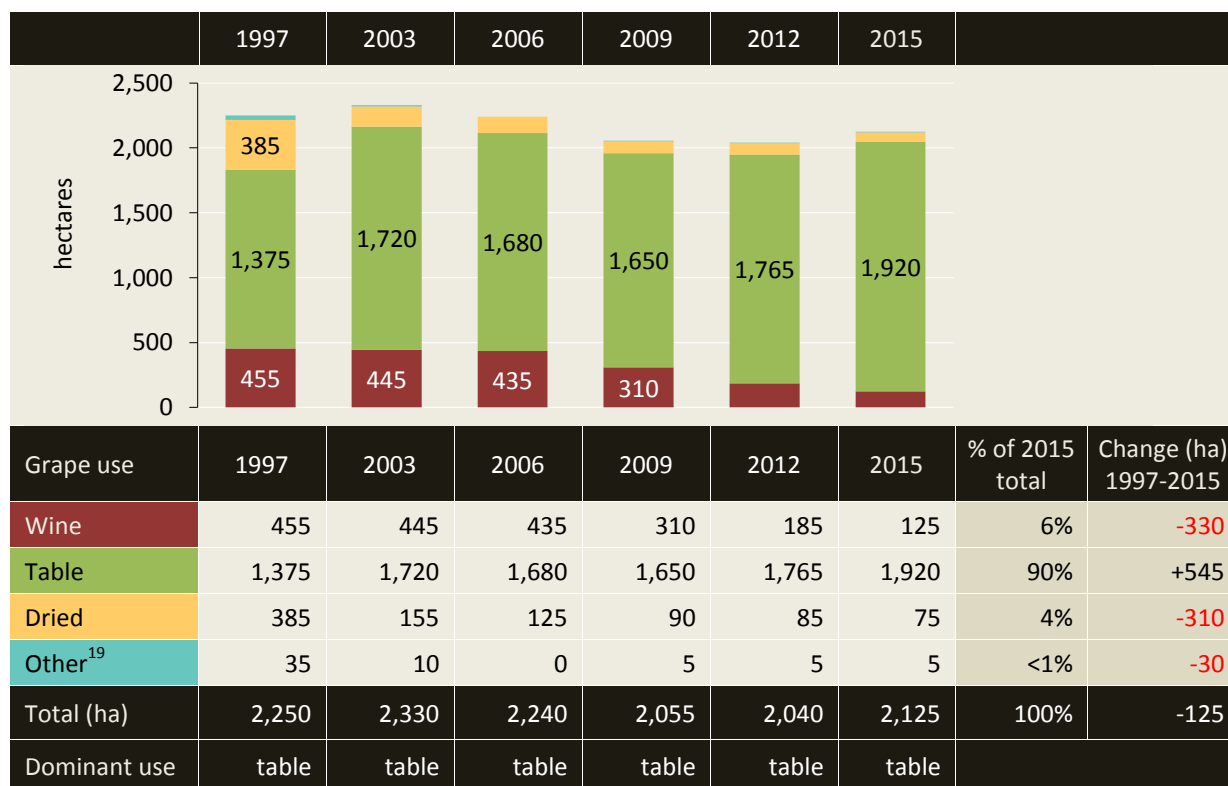


Figure 30: Robinvale irrigation district - grapevine plantings from 1997 to 2015

¹⁹ Other: grapes for juicing, cannery, research and trial varieties

2.3.4 Robinvale irrigation district – irrigation methods

Figure 31 summarises irrigation methods in the Robinvale irrigation district from 1997 to 2015.

- In 2015, the irrigable area of 2,420 ha comprised:
 - 29% (695 ha) drip irrigation;
 - 63% (1,520 ha) low level irrigation;
 - 1% (20 ha) overhead sprinklers;
 - 1% (20 ha) furrow irrigation; and
 - 7% (165 ha) not irrigated.
- Drip irrigation increased by 655 ha, a 1,638% increase from 40 ha in 1997 to 695 ha in 2015.
- Low level irrigation increased by 575 ha, a 61% increase from 945 ha in 1997 to 1,520 ha in 2015.
 - Low level irrigation was the dominant method from 2003 to 2015.
- Overhead irrigation decreased by 235 ha, a 92% decrease from 255 ha in 1997 to 20 ha in 2015.
- Furrow irrigation decreased by 1,055 ha, a 98% decrease from 1,075 ha in 1997 to 20 ha in 2015.
 - Furrow irrigation was the dominant irrigation method in 1997.

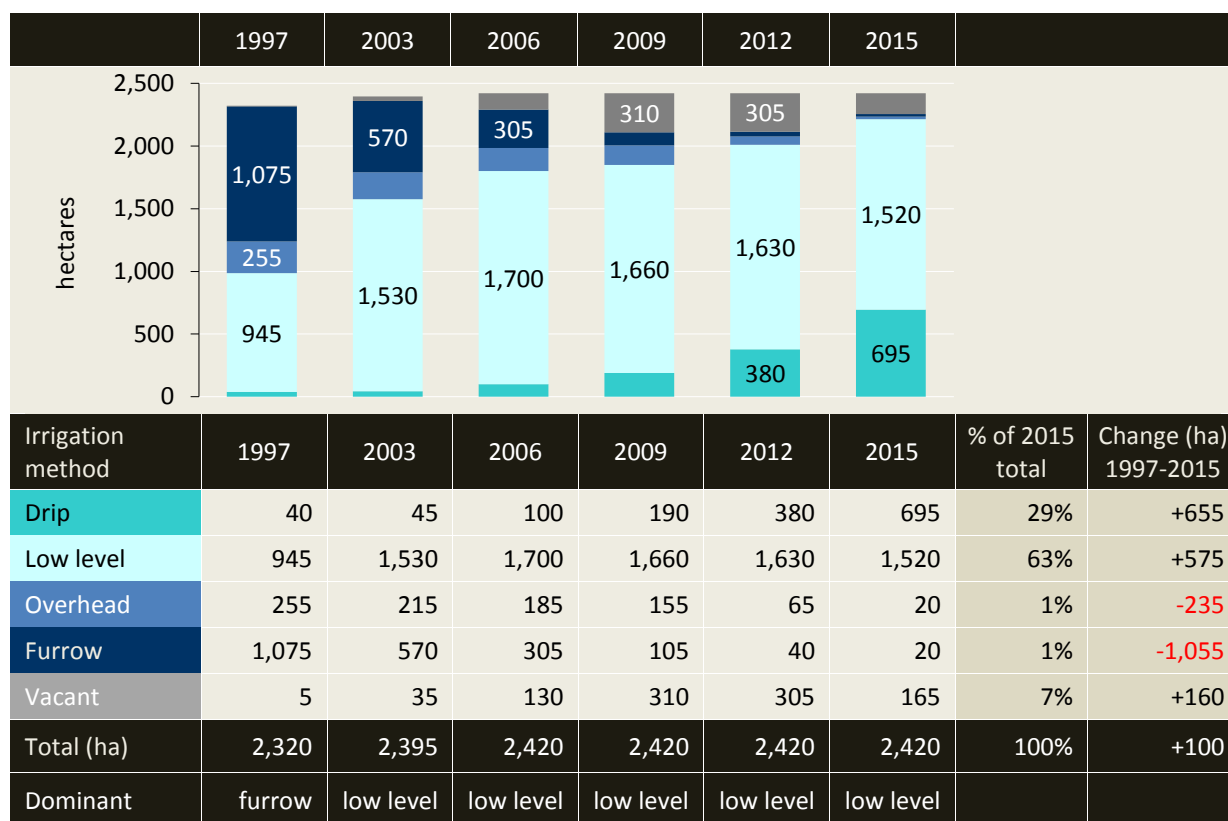


Figure 31: Robinvale irrigation district - irrigation methods from 1997 to 2015

2.3.5 Robinvale irrigation district – salinity impact zones

Figure 32 summarises the irrigable area in each river salinity impact zone in the Robinvale irrigation district from 1997 to 2015. The Robinvale district is in low salinity impact zones; LIZ 2 and LIZ 3. No irrigable areas are in the high salinity impact zone.

- In 2015, the irrigable area of 2,420 ha comprised:
 - 99% (2,400 ha) in the second lowest salinity impact zone, LIZ 2; and
 - 1% (20 ha) in LIZ 3.
- The area irrigated in:
 - LIZ 2 decreased by 50 ha, a 2% decrease from 2,295 ha in 1997 to 2,245 ha in 2015; and
 - LIZ 3 decreased by 10 ha, a 50% decrease from 20 ha in 1997 to 10 ha in 2015.
- The irrigable area in:
 - LIZ 2 increased by 100 ha, a 4% increase from 2,300 ha in 1997 to 2,400 ha in 2015; and
 - LIZ 3 was 20 ha in 1997 and 2015.

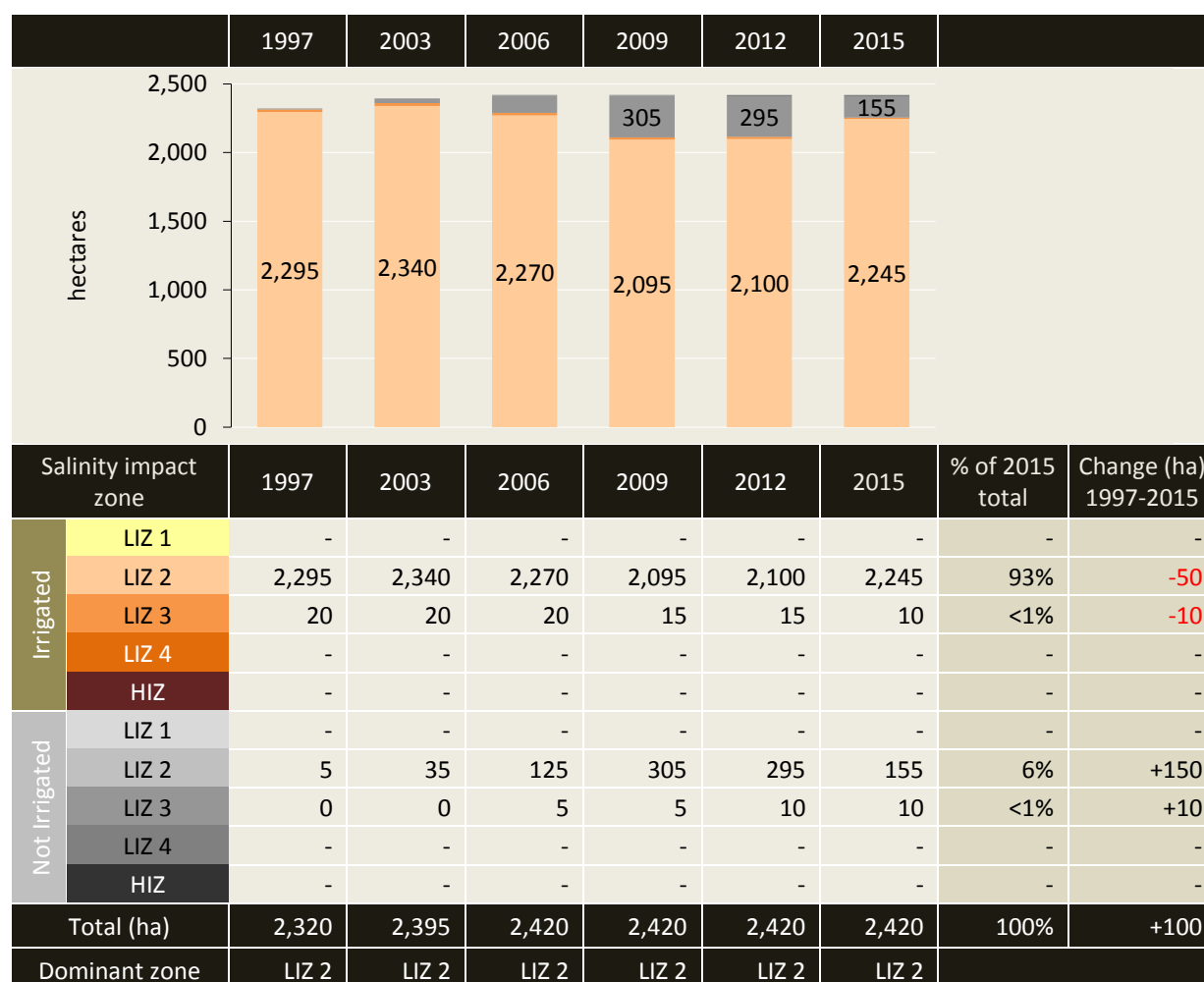


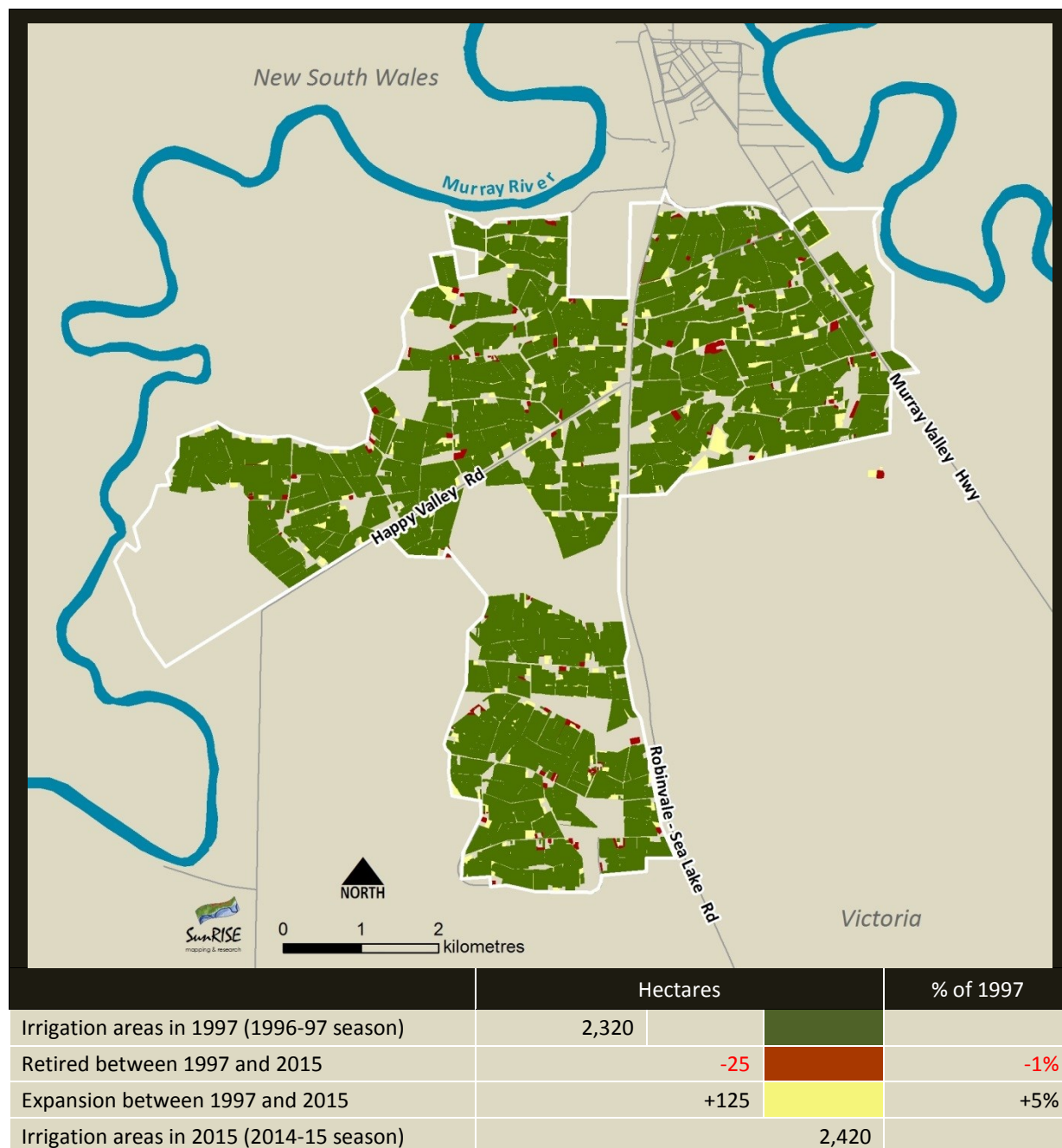
Figure 32: Robinvale irrigation district - irrigable area in each salinity impact zone from 1997 to 2015

2.3.6 Robinvale irrigation district – irrigation development

Map 5 shows irrigation development from 1997 to 2015 in the Robinvale irrigation district with respect to new development (expansion) and areas retired²⁰ from irrigation.

- The irrigable area increased by 100 ha, a 4% increase from 2,320 ha in 1997 to 2,420 ha in 2015.
- The net increase of 100 ha comprised 25 ha retired from irrigation and 125 ha of expansion.

Map 5: Robinvale irrigation district – irrigation development from 1997 to 2015



²⁰ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

2.3.7 Robinvale irrigation district – property change

Figure 33 provides estimates of property numbers and average property size (irrigable area) in the Robinvale irrigation district from 1997 to 2015.

- There were approximately 112 irrigation properties (land holdings) in the Robinvale irrigation district in 2015.
- Property numbers declined by 57, a 34% decrease from 169 in 1997 to 112 in 2015.
- The number of properties less than 20 ha (irrigable area) declined by 68, while the number over 20 ha increased by 11.
- Average property size (irrigable area) increased from 14 ha in 1997 to 22 ha in 2015.

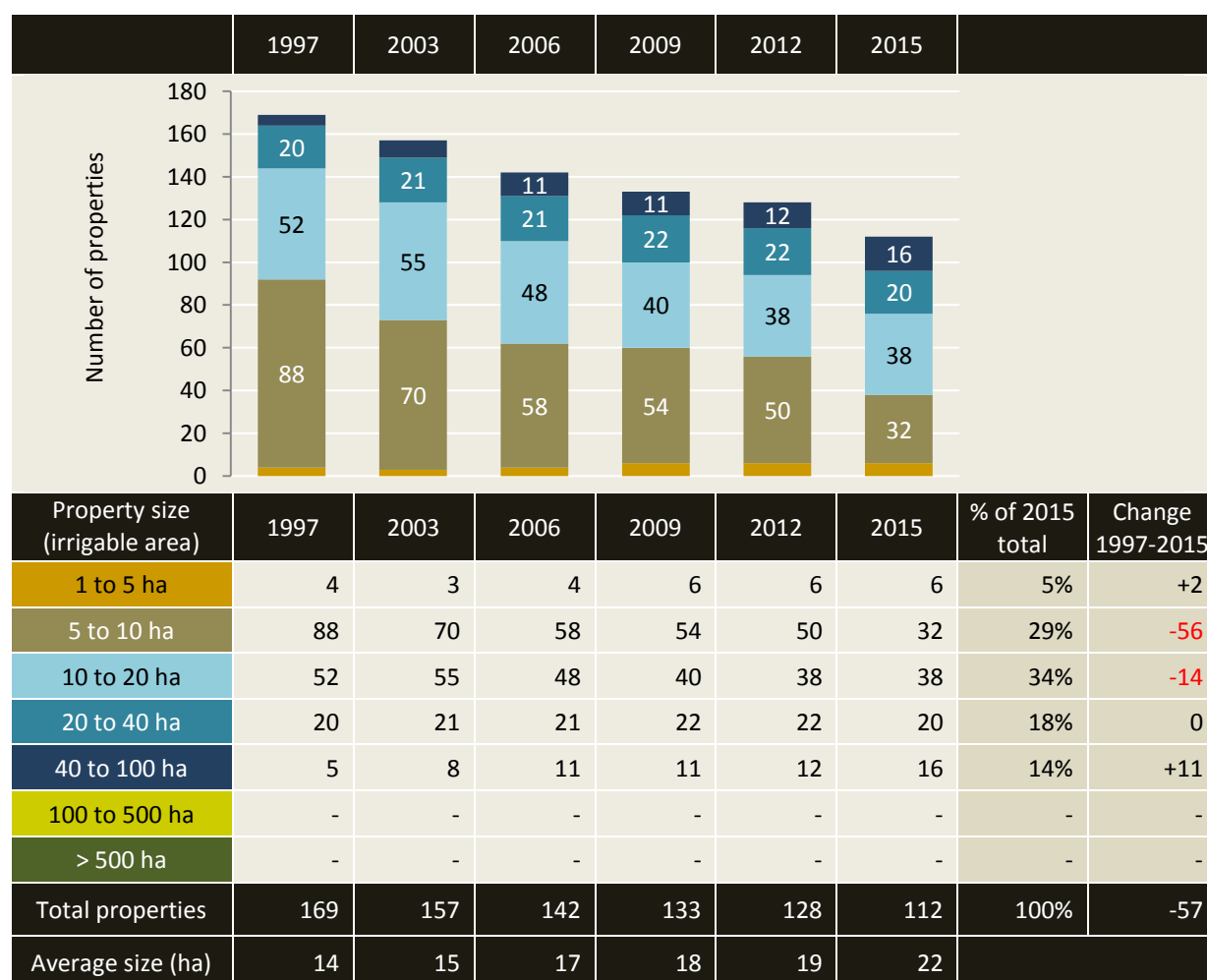


Figure 33: Robinvale irrigation district - property numbers and sizes from 1997 to 2015

2.4 Red Cliffs irrigation district

In summary for the Red Cliffs irrigation district

Crop types

- Grapevines remained the dominant crop type in the Red Cliffs irrigation district from 1997 to 2015. Plantings peaked around 2003, but continued to decline from 2003 to 2015.
- Of the irrigated crops, vegetable increased by the largest area, 105 ha; a 34% increase from 175 ha in 1997 to 280 ha in 2015.
- The irrigable area in 2015 was 4,460 ha of which:
 - 64% (2,850 ha) was irrigated permanent plantings;
 - 9% (405 ha) was irrigated seasonal crops;
 - 24% (1,090 ha) was vacant or not irrigated for less than 10 years; and
 - 3% (115 ha) was vacant or not irrigated for more than 10 years.

Grapevines

- Grapevines in the Red Cliffs irrigation district were predominantly grown for wine production from 1997 to 2015.
- The area of grapevines decreased by 1,290 ha, a 34% decrease from 3,800 ha in 1997 to 2,510 ha in 2015.
- In 2015, the 2,510 ha of grapevines comprised:
 - 52% (1,295 ha) wine grape plantings;
 - 33% (825 ha) table grape plantings; and
 - 15% (390 ha) dried grape plantings.

Irrigation methods

- Drip irrigation was the dominant irrigation method in the Red Cliffs district from 2009 to 2015. Prior to 2009, the dominant method changed from furrows in 1997 to overhead sprinklers from 2003 to 2006.
- In 2015, the irrigable area of 4,460 ha comprised:
 - 42% (1,895 ha) drip irrigation;
 - 15% (655 ha) low level irrigation;
 - 15% (650 ha) overhead sprinklers;
 - 1% (55 ha) furrow irrigation; and
 - 27% (1,205 ha) not irrigated.

Salinity impact zones

- The Red Cliffs irrigation district is in salinity zones; LIZ 1, LIZ 4 and HIZ.
- In 2015, the irrigable area of 4,460 ha comprised:
 - 34% (1,500 ha) in the lowest salinity impact zone, LIZ 1;
 - 23% (1,045 ha) in LIZ 4; and
 - 43% (1,915 ha) in HIZ.
- The irrigable area in the HIZ decreased by 40 ha, from 1,955 ha in 1997 to 1,915 ha in 2015.

In summary for the Red Cliffs irrigation district

Irrigation development

- In the Red cliffs irrigation district the irrigable area increased by 10 ha, a < 1% increase from 4,450 ha in 1997 to 4,460 ha in 2015.
- The net increase of 10 ha comprised 125 ha retired from irrigation and 135 ha of expansion.

Irrigation properties

- There were approximately 434 irrigation properties in the Red Cliffs irrigation district in 2015.
- Change in property numbers and size from 1997 to 2015:
 - Property numbers declined by 80, a 16% decrease from 514 in 1997 to 434 in 2015.
 - Properties with an irrigable area of less than 20 ha declined by 104, while the number over 20 ha increased by 24.
 - Average property size (irrigable area) increased from 9 ha in 1997 to 10 ha in 2015.

2.4.1 Red Cliffs irrigation district - crop types in 2015

Red Cliffs irrigation district crop types in 2015 are shown in Table 13 and Map 6.

- Dominant plantings in the Red Cliffs irrigation district in 2015 were:
 - Wine grapes, 29% of the irrigable area; and
 - Table grapes, 18% of the irrigable area.

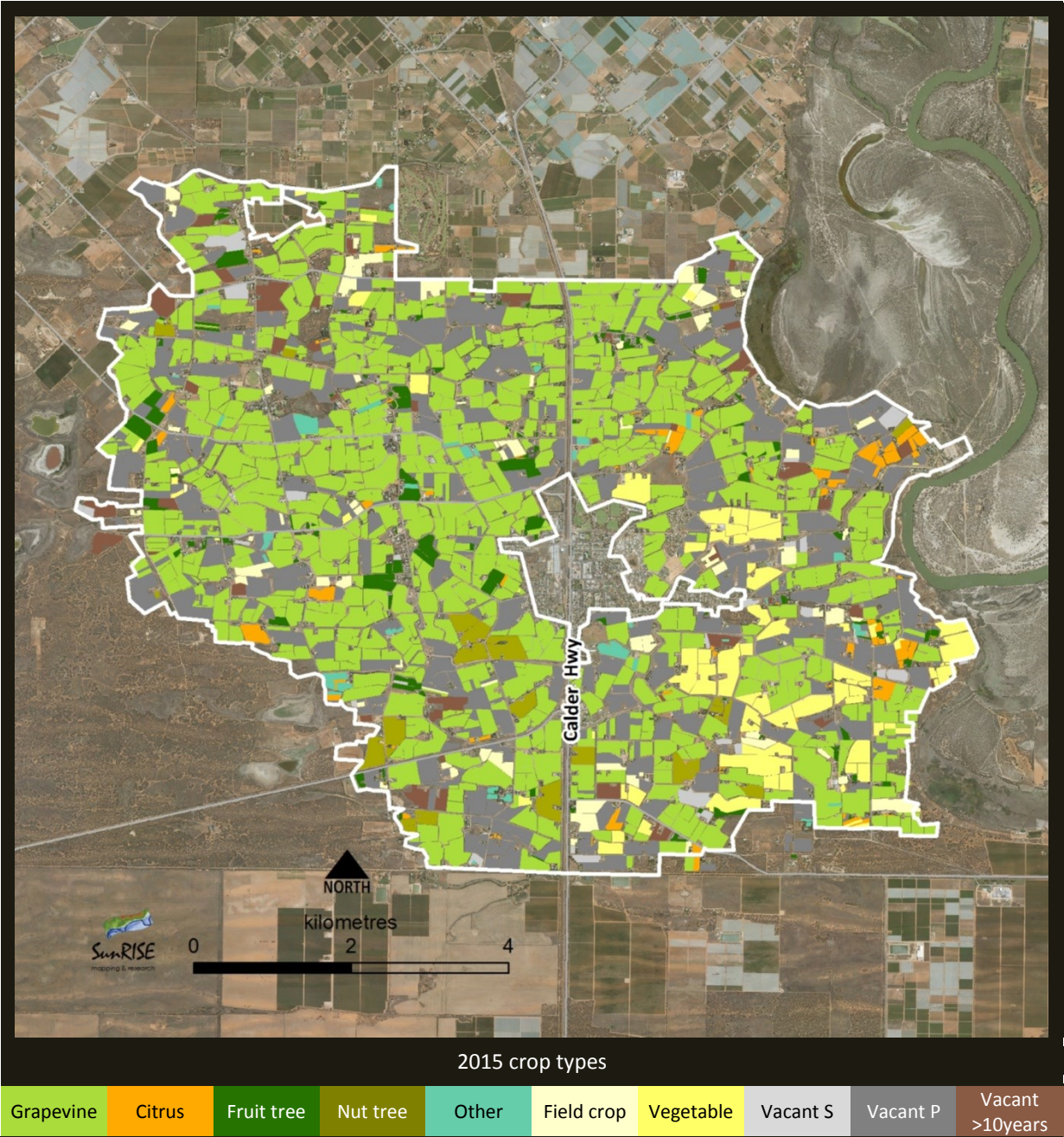
Table 13: Red Cliffs irrigation district - crop types in 2015

	Crop type	Category	2015 (ha)	2015 %	Description
Permanent crops	Grapevine	Wine	1,295	29%	
		Table	825	18%	
		Dried	390	9%	
		Other	-	-	
	Citrus		80	2%	
	Fruit tree	<i>unspecified</i>	15	<1%	<i>Fruit tree category unknown</i>
		Avocado	15	<1%	
		Olive	50	1%	
		Stone fruit	-	-	
		Other	30	1%	
	Nut tree	Almond	95	2%	
		Other	15	<1%	
	Other	Nursery	30	1%	
		Woodlot	-	-	
		Misc.	10	<1%	
	Permanent crops (sub-total)		2,850	64%	
	Vacant P	≤ 10 years	1,035	23%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	90	2%	Vacant (not irrigated) for over ten years
Seasonal crops	Field crop	<i>unspecified</i>	-	-	
		Cereal	40	1%	
		Lucerne	10	<1%	
		Pasture	75	2%	
		Other	-	-	
	Vegetable	<i>unspecified</i>	30	1%	<i>Vegetable category unknown</i>
		Asparagus	130	3%	
		Carrot	-	-	
		Cucurbit	115	3%	
		Potato	-	-	
		Other	5	<1%	
	Seasonal crops (sub-total)		405	9%	
	Vacant S	≤ 10 years	55	1%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	25	1%	Vacant (not irrigated) for over ten years
	Total all crop areas		4,460	100%	

Note: '*unspecified*' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Red Cliffs irrigation district 2015 crop types

Map 6: Red Cliffs irrigation district showing 2015 crop types



2.4.2 Red Cliffs irrigation district – change in crop types

Figure 34 summarises crop types in the Red Cliffs irrigation district from 1997 to 2015.

- Grapevines remained the dominant crop type from 1997 to 2015. Plantings peaked around 2003, but continued to decline from 2003 to 2015.
- Of the irrigated crops, vegetable increased by the largest area, 105 ha; a 34% increase from 175 ha in 1997 to 280 ha in 2015.
- In the 2011-2015 irrigation season the irrigable area of 4,460 ha comprised:
 - 64% (2,850 ha) irrigated permanent plantings;
 - 9% (405 ha) irrigated seasonal crops;
 - 24% (1,090 ha) vacant or not irrigated for less than 10 years; and
 - 3% (115 ha) vacant or not irrigated for more than 10 years.

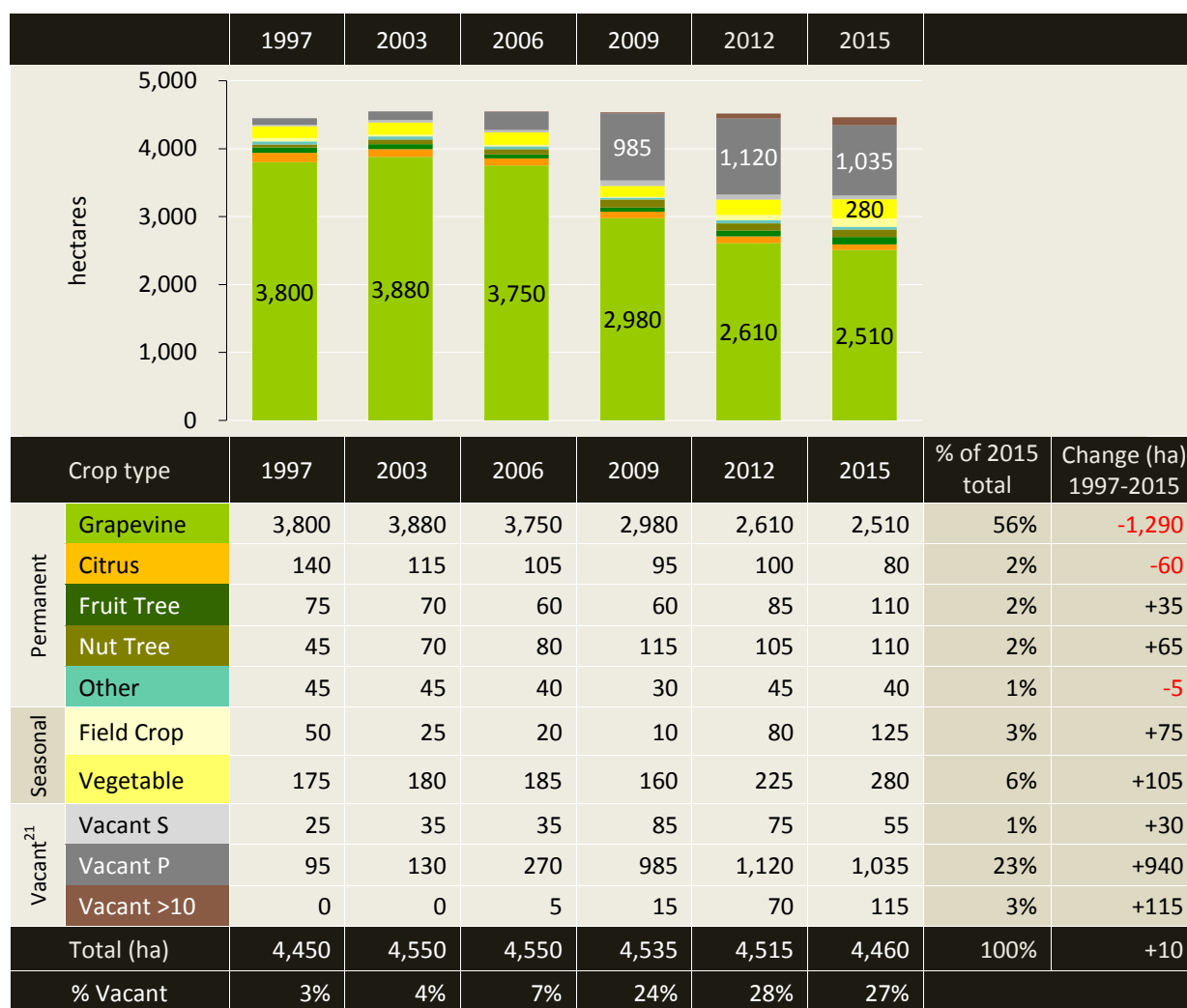


Figure 34: Red Cliffs irrigation district - crop types from 1997 to 2015

²¹ Vacant S: not irrigated but previously an irrigated seasonal crop. Vacant P: not irrigated but previously an irrigated permanent planting. Vacant >10: not irrigated for over ten years but previously an irrigated area.

2.4.3 Red Cliffs irrigation district – grapevines

Figure 35 summarises grape use in the Red Cliffs irrigation district from 1997 to 2015.

- The area of grapevines decreased by 1,290 ha, a 34% decrease from 3,800 ha in 1997 to 2,510 ha in 2015.
- In 2015, the 2,510 ha of grapevines comprised:
 - 52% (1,295 ha) wine grape plantings;
 - 33% (825 ha) table grape plantings; and
 - 15% (390 ha) dried grape plantings.
- Wine grape plantings decreased by 655 ha, a 34% decrease from 1,950 ha in 1997 to 1,295 ha in 2015.
 - The net decrease of 655 ha comprised an increase of 480 ha between 1997 and 2006, then a decrease of 1,135 ha between 2006 and 2015.
- Table grape plantings increased by 350 ha, a 74% increase from 475 ha in 1997 to 825 ha in 2015.
- Dried grape plantings decreased by 985 ha, a 72% decrease from 1,375 ha in 1997 to 390 ha in 2015.

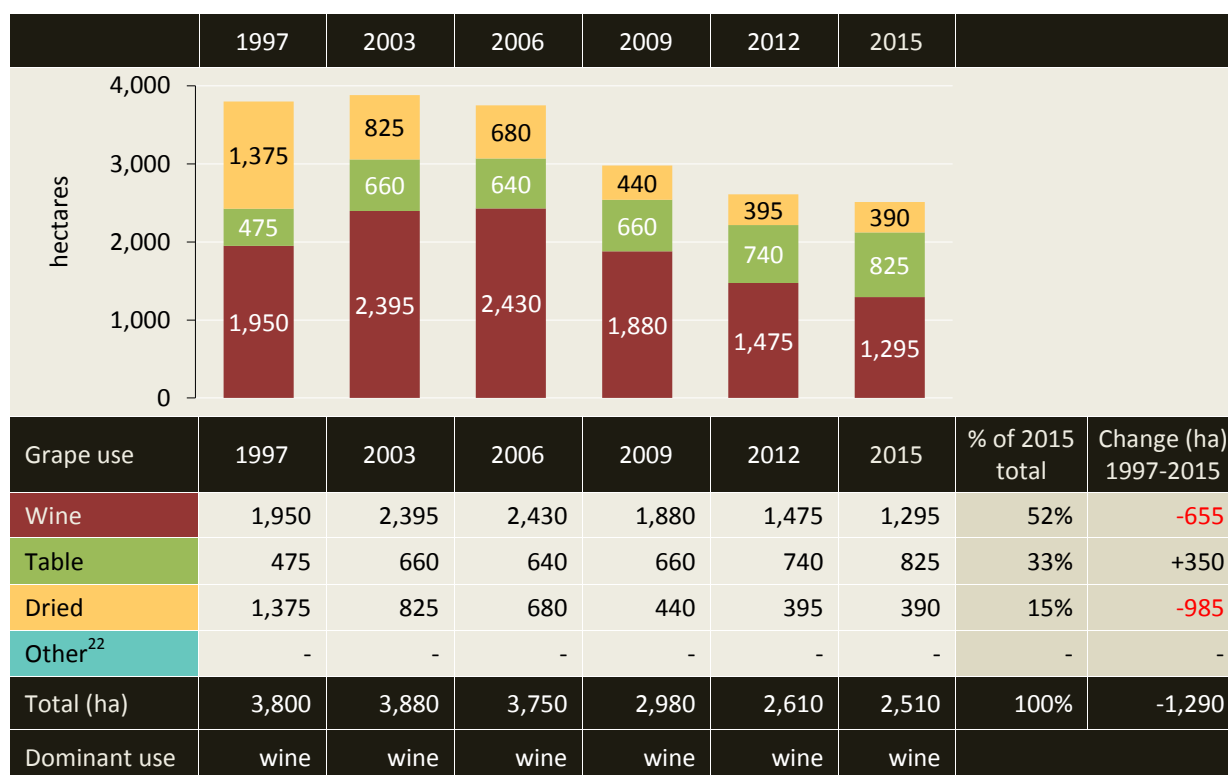


Figure 35: Red Cliffs irrigation district - grapevine plantings from 1997 to 2015

²² Other: grapes for juicing, cannery, research and trial varieties.

2.4.4 Red Cliffs irrigation district – irrigation methods

Figure 36 summarises irrigation methods in the Red Cliffs irrigation district from 1997 to 2015.

- In 2015, the irrigable area of 4,460 ha comprised:
 - 42% (1,895 ha) drip irrigation;
 - 15% (655 ha) low level irrigation;
 - 15% (650 ha) overhead sprinklers;
 - 1% (55 ha) furrow irrigation; and
 - 27% (1,205 ha) not irrigated.
- Drip irrigation increased by 1,525 ha, a 412% increase from 370 ha in 1997 to 1,895 ha in 2015.
 - Drip irrigation was the dominant method from 2009 to 2015.
- Low level irrigation increased by 175 ha, a 36% increase from 480 ha in 1997 to 655 ha in 2015.
- Overhead irrigation decreased by 845 ha, a 57% decrease from 1,495 ha in 1997 to 650 ha in 2015.
 - Overhead irrigation was the dominant irrigation method from 2003 to 2006.
- Furrow irrigation decreased by 1,930 ha, a 97% decrease from 1,985 ha in 1997 to 55 ha in 2015.
 - Furrow irrigation was the dominant irrigation method in 1997.

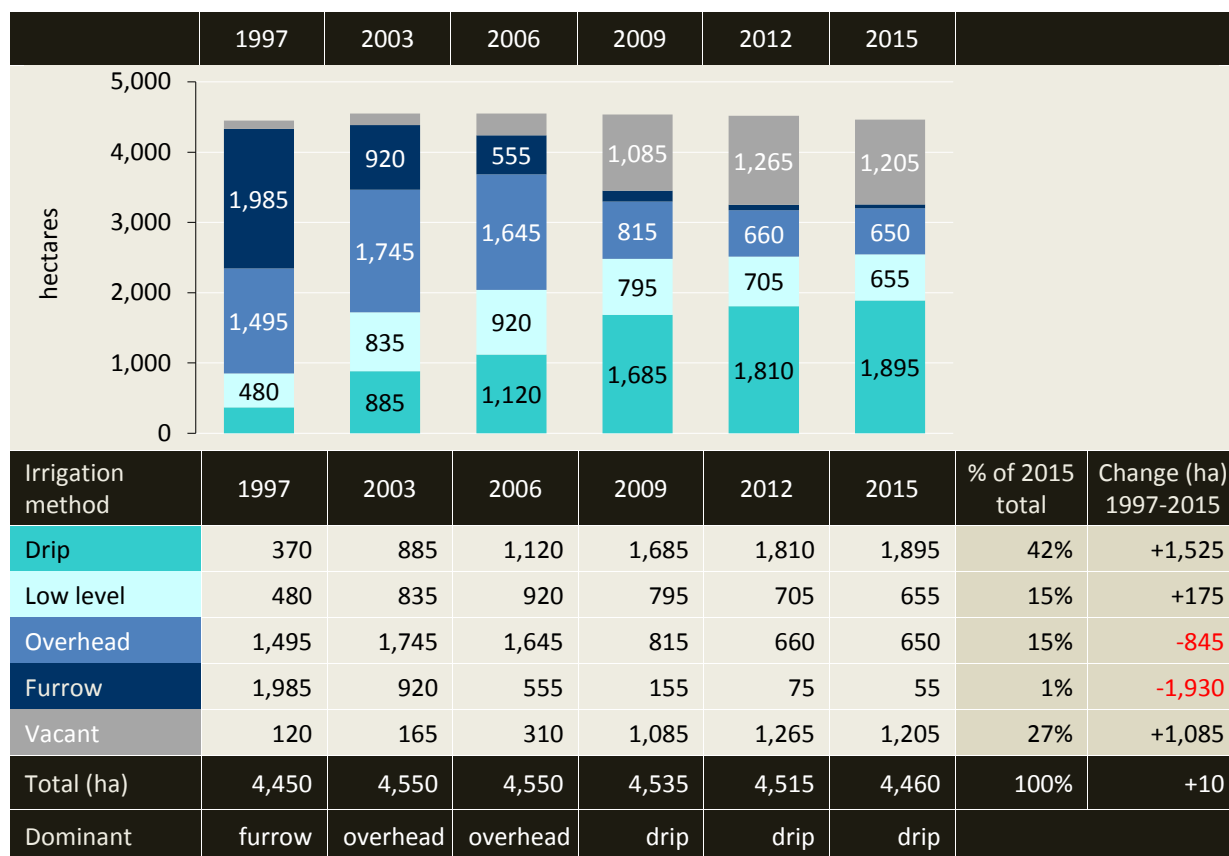


Figure 36: Red Cliffs irrigation district - irrigation methods from 1997 to 2015

2.4.5 Red Cliffs irrigation district – salinity impact zones

Figure 37 summarises the irrigable area in each river salinity impact zone in the Red Cliffs irrigation district from 1997 to 2015. The Red Cliffs district is in low salinity impact zones LIZ 1 and LIZ 4, and in the high salinity impact zone, HIZ.

- In 2015, the irrigable area of 4,460 ha comprised:
 - 34% (1,500 ha) in the lowest salinity impact zone, LIZ 1;
 - 23% (1,045 ha) in LIZ 4; and
 - 43% (1,915 ha) in HIZ.
- The area irrigated in:
 - LIZ 1 decreased by 375 ha, a 26% decrease from 1,430 ha in 1997 to 1,055 ha in 2015;
 - LIZ 4 decreased by 235 ha, a 24% decrease from 995 ha in 1997 to 760 ha in 2015; and
 - HIZ decreased by 465 ha, a 24% decrease from 1,905 ha in 1997 to 1,440 ha in 2015.
- The irrigable area in:
 - LIZ 1 increased by 25 ha, a 2% increase from 1,475 ha in 1997 to 1,500 ha in 2015;
 - LIZ 4 increased by 25 ha, a 2% increase from 1,020 ha in 1997 to 1,045 ha in 2015; and
 - HIZ decreased by 40 ha, a 2% decrease from 1,955 ha in 1997 to 1,915 ha in 2015. The net decrease of HIZ was predominantly areas retired from irrigation for housing development.

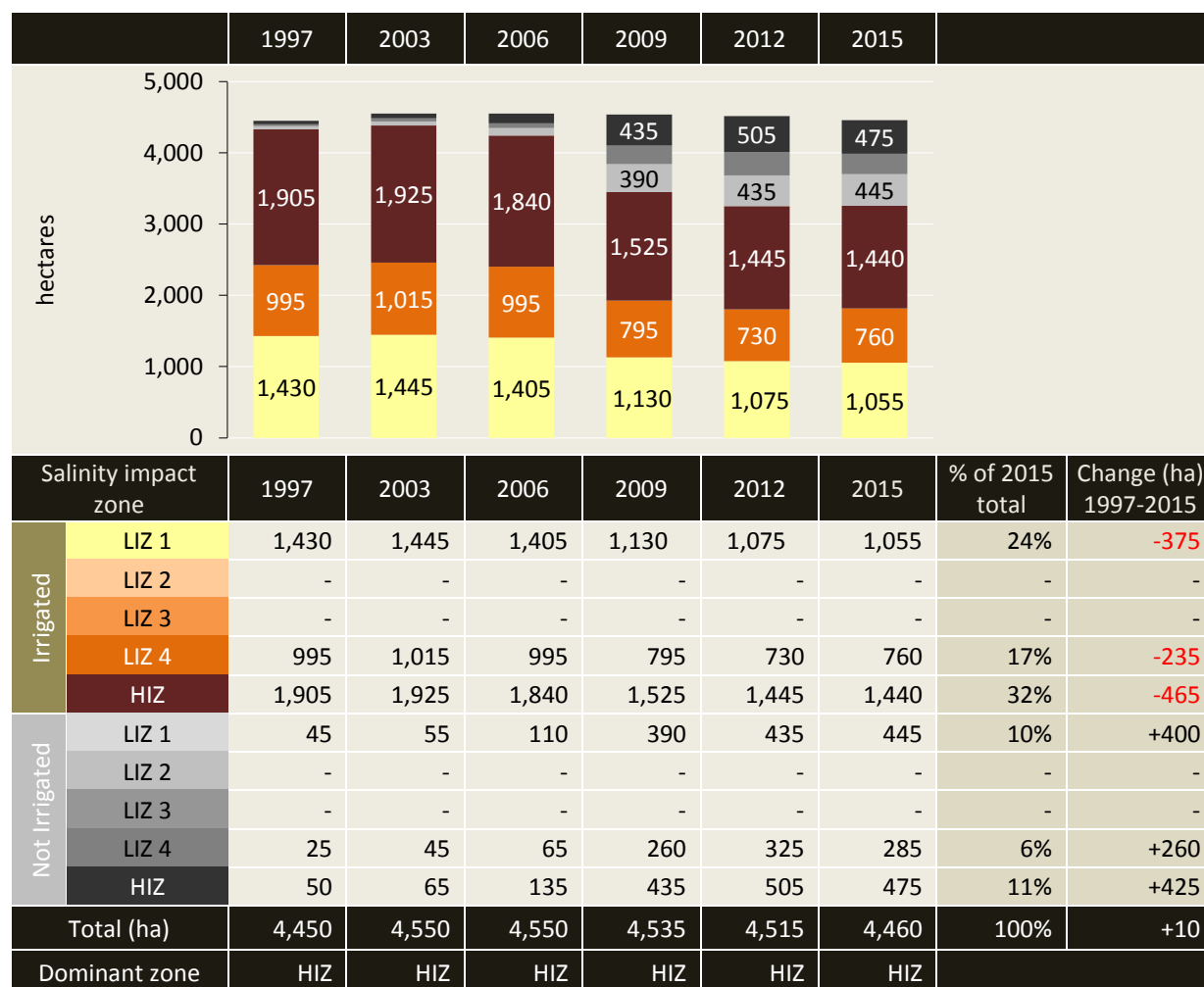


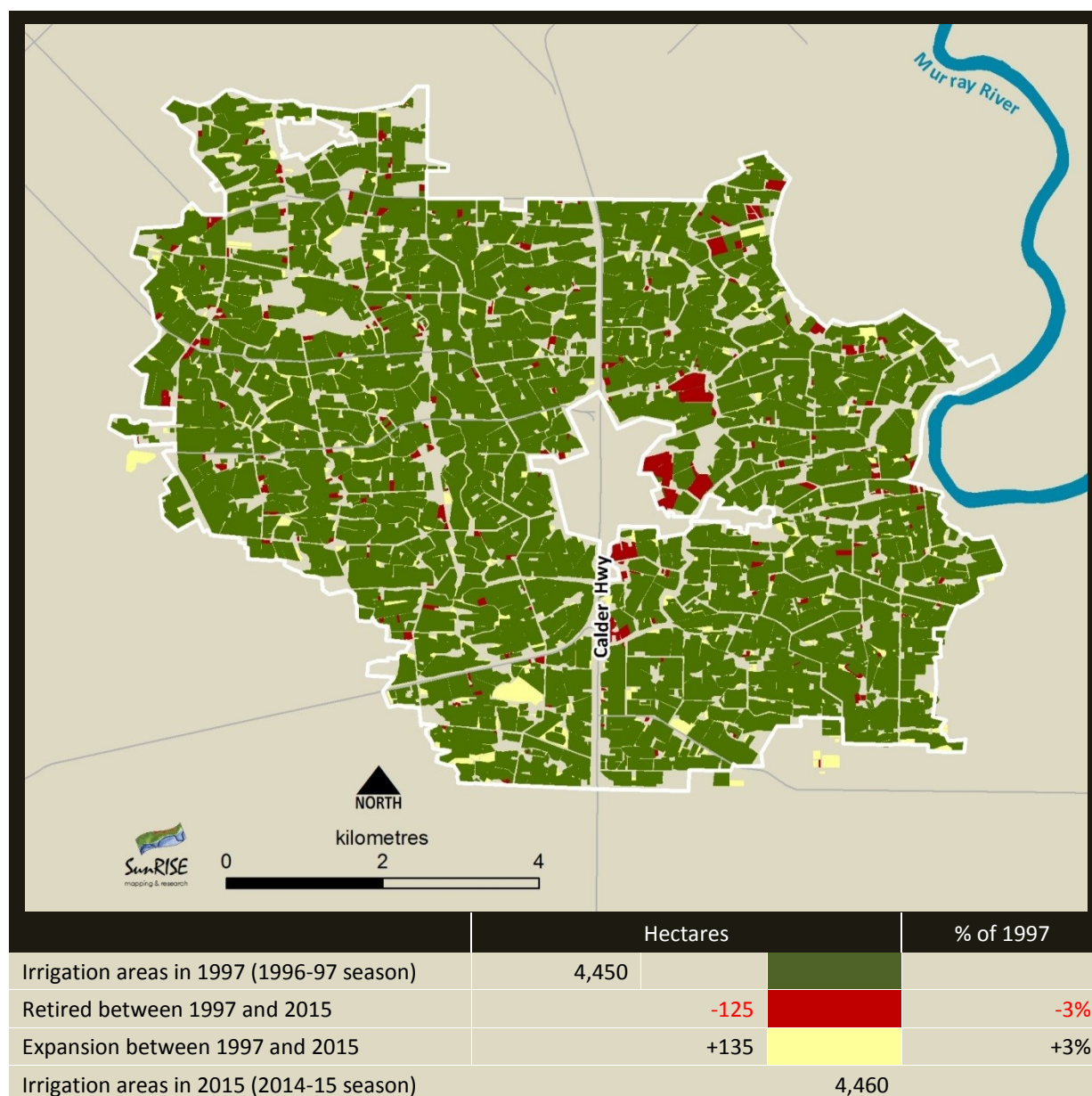
Figure 37: Red Cliffs irrigation district - irrigable area in each salinity impact zone from 1997 to 2015

2.4.6 Red Cliffs irrigation district – irrigation development

Map 7 shows irrigation development from 1997 to 2015 in the Red Cliffs irrigation district with respect to new development (expansion) and areas retired²³ from irrigation.

- The irrigable area increased by 10 ha, a < 1% increase from 4,450 ha in 1997 to 4,460 ha in 2015.
- The net increase of 10 ha comprised 125 ha retired from irrigation and 135 ha of expansion.

Map 7: Red Cliffs irrigation district – irrigation development from 1997 to 2015



²³ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

2.4.7 Red Cliffs irrigation district – property change

Figure 38 provides estimates of property numbers and average property size (irrigable area) in the Red Cliffs irrigation district from 1997 to 2015.

- There were approximately 434 irrigation properties (land holdings) in the Red Cliffs irrigation district in 2015.
- Property numbers declined by 80, a 16% decrease from 514 in 1997 to 434 in 2015.
- The number of properties less than 20 ha (irrigable area) declined by 104, while the number over 20 ha increased by 24.
- Average property size (irrigable area) increased from 9 ha in 1997 to 10 ha in 2015.

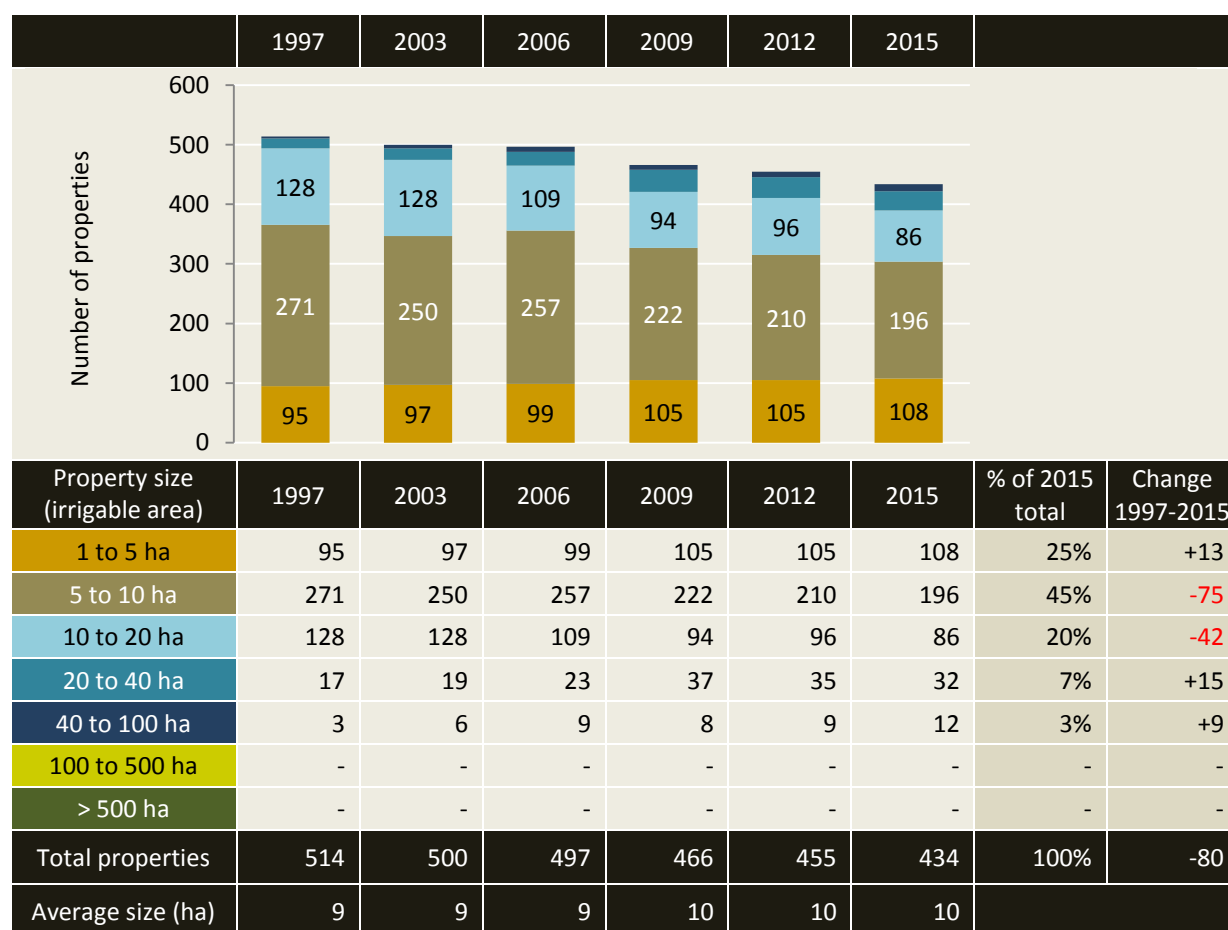


Figure 38: Red Cliffs irrigation district - property numbers and sizes from 1997 to 2015

2.5 Mildura irrigation district

In summary for the Mildura irrigation district

Crop types

- Grapevines remained the dominant crop type in the Mildura irrigation district from 1997 to 2015. Plantings peaked around 2003, but continued to decline from 2003 to 2015.
- Of the irrigated crops, vegetable increased by the largest area, 105 ha; a 34% increase from 175 ha in 1997 to 280 ha in 2015.
- The irrigable area in 2015 was 5,950 ha of which:
 - 64% (3,825 ha) was irrigated permanent plantings;
 - 5% (310 ha) was irrigated seasonal crops;
 - 28% (1,645 ha) was vacant or not irrigated for less than 10 years; and
 - 3% (170 ha) was vacant or not irrigated for more than 10 years.

Grapevines

- Grapevines in the Mildura irrigation district were predominantly grown for table grapes from 2012 to 2015. Prior to 2012, the dominant grape use changed from dried grapes in 1997 to wine grapes from 2003 to 2009.
- The area of grapevines decreased by 2,015 ha, a 36% decrease from 5,565 ha in 1997 to 3,550 ha in 2015.
- In 2015, the 3,550 ha of grapevines comprised:
 - 33% (1,160 ha) wine grape plantings;
 - 45% (1,595 ha) table grape plantings;
 - 22% (780 ha) dried grape plantings; and
 - < 1% (15 ha) grapevines for other purposes.

Irrigation methods

- Drip irrigation was the dominant irrigation method from 2009 to 2015 in the Mildura district. Prior to 2009, the dominant method changed from furrows in 1997 and 2003 to overhead sprinklers in 2006.
- In 2015, the irrigable area of 5,950 ha comprised:
 - 32% (1,930 ha) drip irrigation;
 - 20% (1,210 ha) low level irrigation;
 - 12% (690 ha) overhead sprinklers;
 - 5% (305 ha) furrow irrigation; and
 - 31% (1,815 ha) not irrigated.

In summary for the Mildura irrigation district

Salinity impact zones

- The Mildura irrigation district is in the lowest salinity impact zone, LIZ 1 and in the high impact zone, HIZ.
- In 2015, the irrigable area of 5,950 ha comprised:
 - 36% (2,115 ha) in LIZ 1; and
 - 64% (3,835 ha) in the HIZ.
- The irrigable area in the HIZ decreased by 595 ha, a 13% decrease from 4,430 ha in 1997 to 3,835 ha in 2015; predominantly due to areas retired from irrigation for urban development.

Irrigation development

- In the Mildura irrigation district the irrigable area decreased by 500 ha, an 8% decrease from 6,450 ha in 1997 to 5,950 ha in 2015.
- The net decrease of 500 ha comprised 745 ha retired from irrigation and 245 ha of expansion.

Irrigation properties

- There were approximately 680 irrigation properties (land holdings) in the Mildura irrigation district in 2015.
- Change in property numbers and size from 1997 to 2015:
 - Property numbers declined by 159, a 19% decrease from 839 in 1997 to 680 in 2015.
 - Properties with an irrigable area of less than 20 ha declined by 168, while the number over 20 ha increased by 9.
 - Average property size (irrigable area) increased from 8 ha in 1997 to 9 ha in 2015.

2.5.1 Mildura irrigation district - crop types in 2015

Mildura irrigation district crop types in 2015 are shown in Table 14 and Map 8.

- Dominant plantings in the Mildura irrigation district in 2015 were:
 - Table grapes, 27% of the irrigable area; and
 - Wine grapes, 19% of the irrigable area.

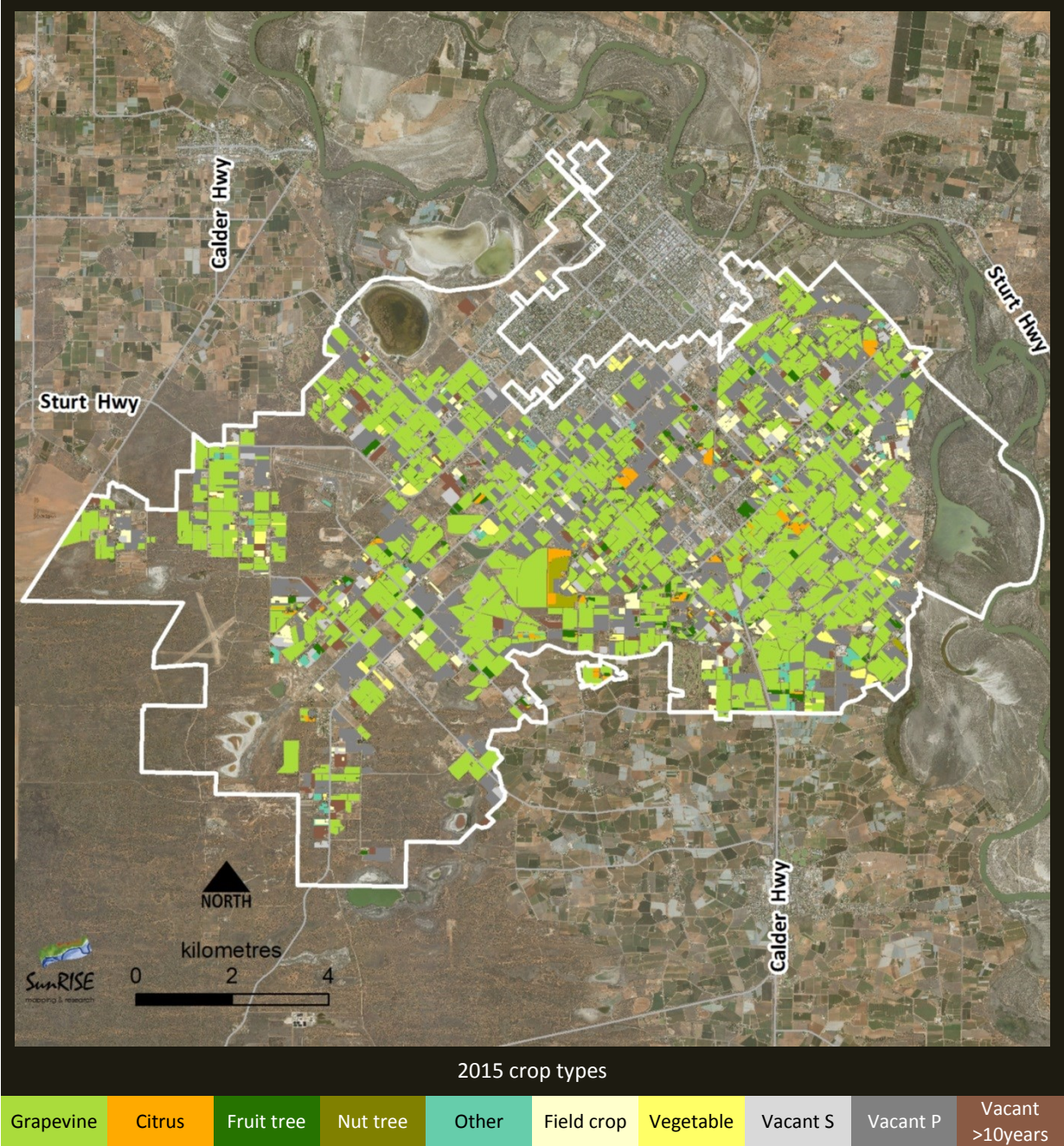
Table 14: Mildura irrigation district - crop types in 2015

	Crop type	Category	2015 (ha)	2015 %	Description
Permanent crops	Grapevine	Wine	1,160	19%	
		Table	1,595	27%	
		Dried	780	13%	
		Other	15	<1%	
	Citrus		85	1%	Grapefruit, Lemon, Mandarin, Navel, Other Orange, Tangelo, Valencia
	Fruit tree	<i>unspecified</i>	10	<1%	<i>Fruit tree category unknown</i>
		Avocado	20	<1%	
		Olive	40	1%	
		Stone fruit	5	<1%	
		Other	15	<1%	Date Palm, Fig, Mango, Pomegranate
	Nut tree	Almond	30	1%	
		Other	5	<1%	Pistachio, Walnut
	Other	Nursery	40	1%	
		Woodlot	25	<1%	
		Misc.	-	-	
	Permanent crops (sub-total)		3,825	64%	
	Vacant P	≤ 10 years	1,450	24%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	105	2%	Vacant (not irrigated) for over ten years
Seasonal crops	Field crop	<i>unspecified</i>	5	<1%	<i>Field crop category unknown</i>
		Cereal	10	<1%	
		Lucerne	55	1%	
		Pasture	125	2%	
		Other	10	<1%	
	Vegetable	<i>unspecified</i>	45	1%	<i>Vegetable category unknown</i>
		Asparagus	-	-	
		Carrot	35	1%	
		Cucurbit	-	-	
		Potato	-	-	
		Other	25	<1%	Beans, Capsicum, Chilli, Eggplant, Snow pea, Tomato
	Seasonal crops (sub-total)		310	5%	
	Vacant S	≤ 10 years	195	3%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	65	1%	Vacant (not irrigated) for over ten years
Total all crop areas			5,950	100%	

Note: '*unspecified*' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Mildura irrigation district 2015 crop types

Map 8: Mildura irrigation district showing 2015 crop types



2.5.2 Mildura irrigation district – change in crop types

Figure 39 summarises crop types in the Mildura irrigation district from 1997 to 2015.

- Grapevines remained the dominant crop type from 1997 to 2015. Plantings peaked around 1997, but continued to decline from 1997 to 2015.
- Of the irrigated crops, fruit trees increased by the largest area, 25 ha; a 38% increase from 65 ha in 1997 to 90 ha in 2015.
- In 2015, the irrigable area of 5,950 ha comprised:
 - 64% (3,825 ha) irrigated permanent plantings;
 - 5% (310 ha) irrigated seasonal crops;
 - 28% (1,645 ha) vacant or not irrigated for less than 10 years; and
 - 3% (170 ha) vacant or not irrigated for more than 10 years.

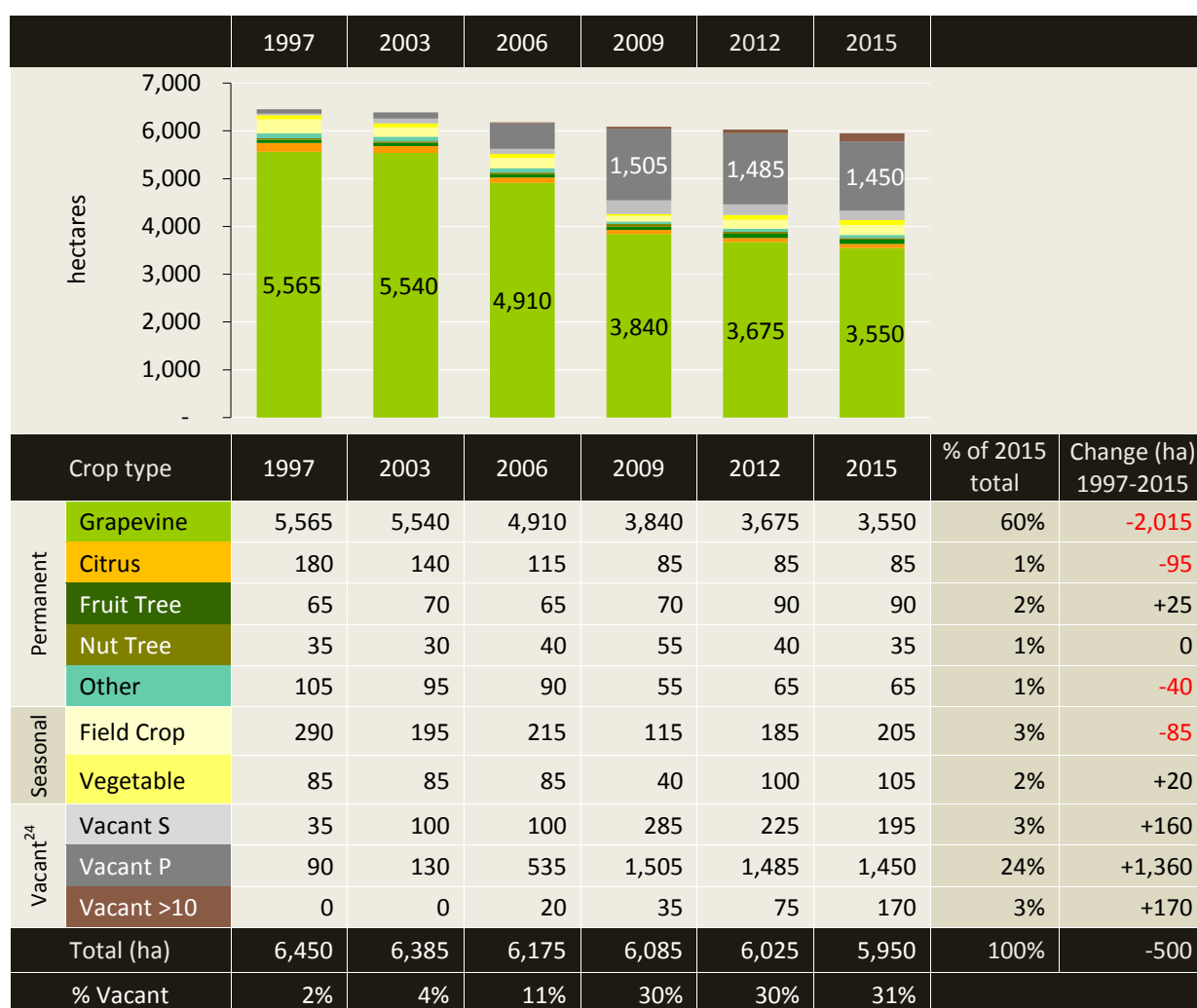


Figure 39: Mildura irrigation district - crop types from 1997 to 2015

²⁴ Vacant S: not irrigated but previously an irrigated seasonal crop. Vacant P: not irrigated but previously an irrigated permanent planting. Vacant >10: not irrigated for over ten years but previously an irrigated area.

2.5.3 Mildura irrigation district – grapevines

Figure 40 summarises grape use in the Mildura pumped irrigation district from 1997 to 2015.

- The area of grapevines decreased by 2,015 ha, a 36% decrease from 5,565 ha in 1997 to 3,550 ha in 2015.
- In 2015, the 3,550 ha of grapevines comprised:
 - 33% (1,160 ha) wine grape plantings;
 - 45% (1,595 ha) table grape plantings;
 - 22% (780 ha) dried grape plantings; and
 - < 1% (15 ha) grapevines for other purposes.
- Wine grape plantings decreased by 1,075 ha, a 48% decrease from 2,235 ha in 1997 to 1,160 ha in 2015.
 - The net decrease of 1,075 ha comprised an increase of 300 ha between 1997 and 2003, then a decrease of 1,375 ha between 2003 and 2015.
- Table grape plantings increased by 610 ha, a 62% increase from 985 ha in 1997 to 1,595 ha in 2015.
- Dried grape plantings decreased by 985 ha, a 72% decrease from 1,375 ha in 1997 to 390 ha in 2015.
- Grapevines in the Mildura irrigation district were predominantly grown for table grapes from 2012 to 2015. Prior to 2012, the dominant grape use changed from dried grapes in 1997 to wine grapes from 2003 to 2009.

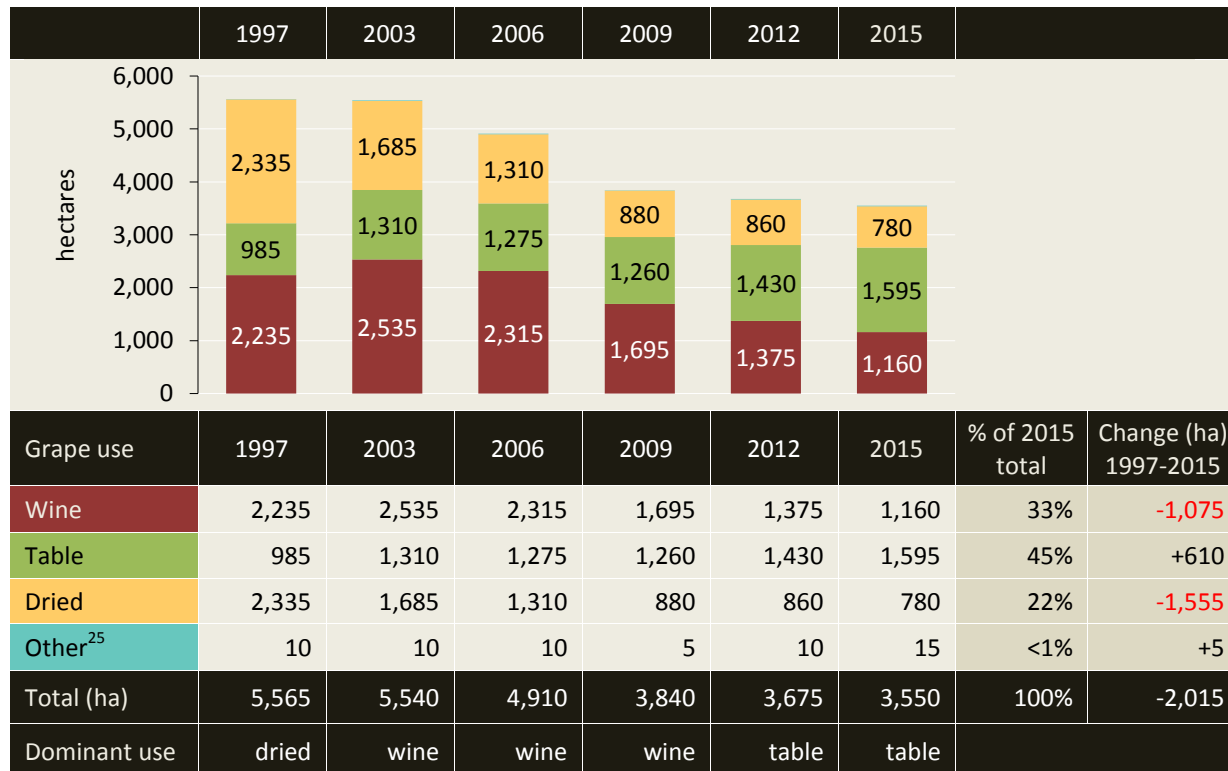


Figure 40: Mildura irrigation district - grapevine plantings from 1997 to 2015

²⁵ Other: grapes for juicing, cannery, research and trial varieties.

2.5.4 Mildura irrigation district – irrigation methods

Figure 41 summarises irrigation methods in the Mildura irrigation district from 1997 to 2015.

- In 2015, the irrigable area of 5,950 ha comprised:
 - 32% (1,930 ha) drip irrigation;
 - 20% (1,210 ha) low level irrigation;
 - 12% (690 ha) overhead sprinklers;
 - 5% (305 ha) furrow irrigation; and
 - 31% (1,815 ha) not irrigated.
- Drip irrigation increased by 1,730 ha, an 865% increase from 200 ha in 1997 to 1,930 ha in 2015.
 - Drip irrigation was the dominant irrigation method from 2009 to 2015.
- Low level irrigation increased by 450 ha, a 59% increase from 760 ha in 1997 to 1,210 ha in 2015.
- Overhead irrigation decreased by 1,195 ha, a 63% decrease from 1,885 ha in 1997 to 690 ha in 2015.
 - Overhead irrigation was the dominant irrigation method in 2006.
- Furrow irrigation decreased by 3,175 ha, a 91% decrease from 3,480 ha in 1997 to 305 ha in 2015.
 - Furrow irrigation was the dominant irrigation method in 1997 and 2003.

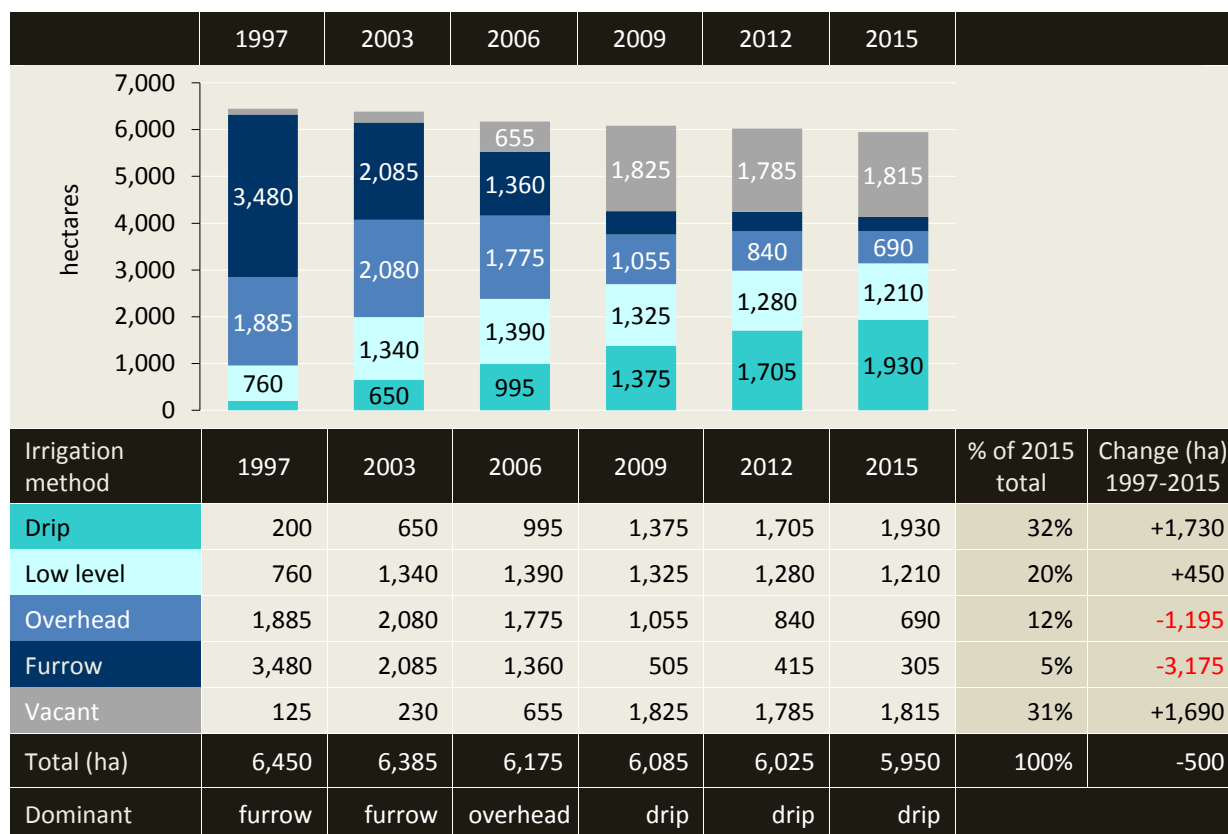


Figure 41: Mildura irrigation district - irrigation methods from 1997 to 2015

2.5.5 Mildura irrigation district – salinity impact zones

Figure 42 summarises the irrigable area in each river salinity impact zone in the Mildura irrigation district from 1997 to 2015. The Mildura district is in the lowest salinity impact zone, LIZ 1 and in the high salinity impact zone, HIZ.

- In 2015, the irrigable area of 5,950 ha comprised:
 - 36% (2,115 ha) in LIZ 1; and
 - 64% (3,835 ha) in the HIZ.
- The area irrigated in:
 - LIZ 1 decreased by 505 ha, a 26% decrease from 1,970 ha in 1997 to 1,465 ha in 2015; and
 - HIZ decreased by 1,685 ha, a 39% decrease from 4,355 ha in 1997 to 2,670 ha in 2015.
- The irrigable area in:
 - LIZ 1 increased by 95 ha, a 5% increase from 2,020 ha in 1997 to 2,115 ha in 2015; and
 - HIZ decreased by 595 ha, a 13% decrease from 4,430 ha in 1997 to 3,835 ha in 2015. The net decrease of irrigable area in the HIZ was predominantly a result of areas retired from irrigation for urban development.

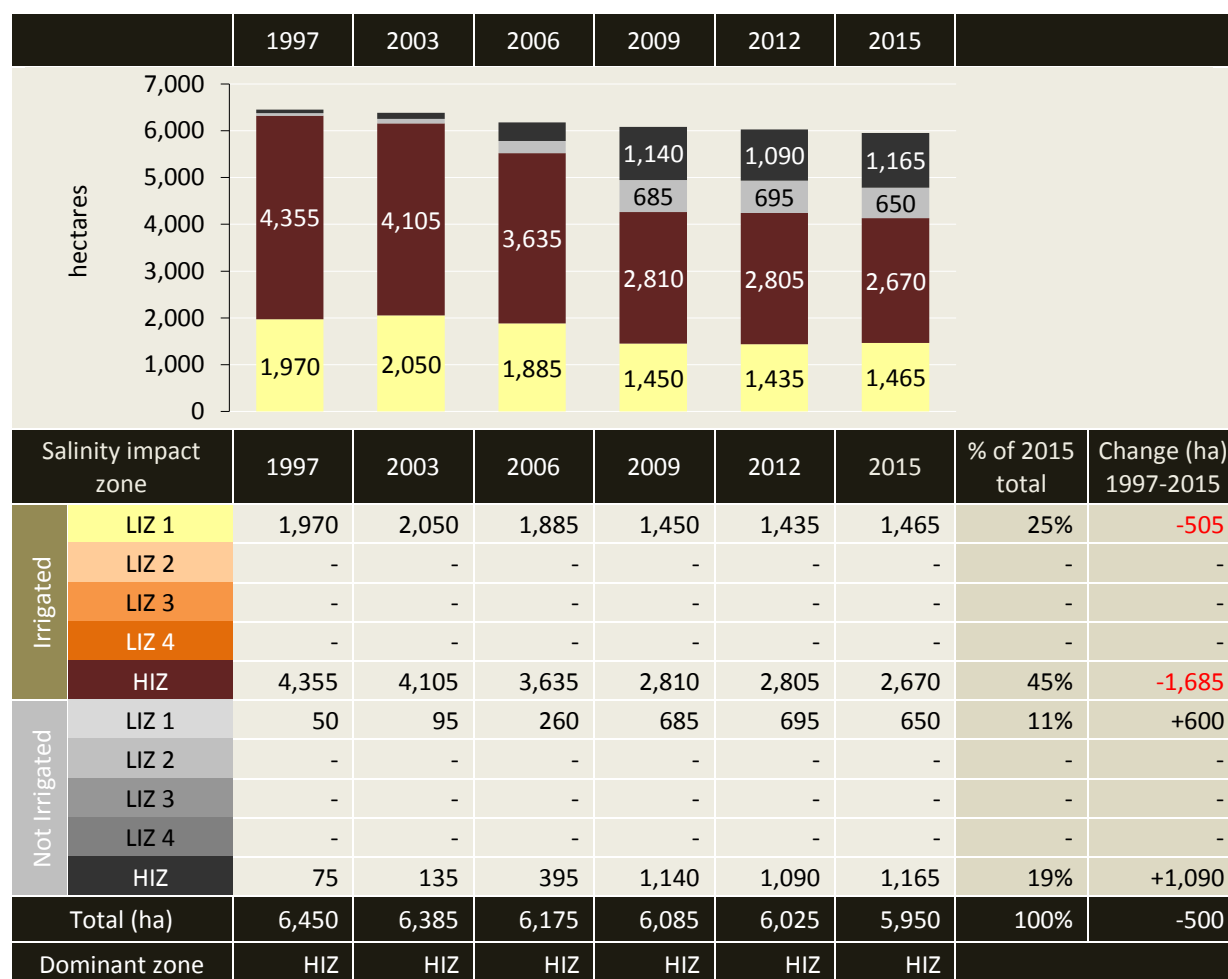


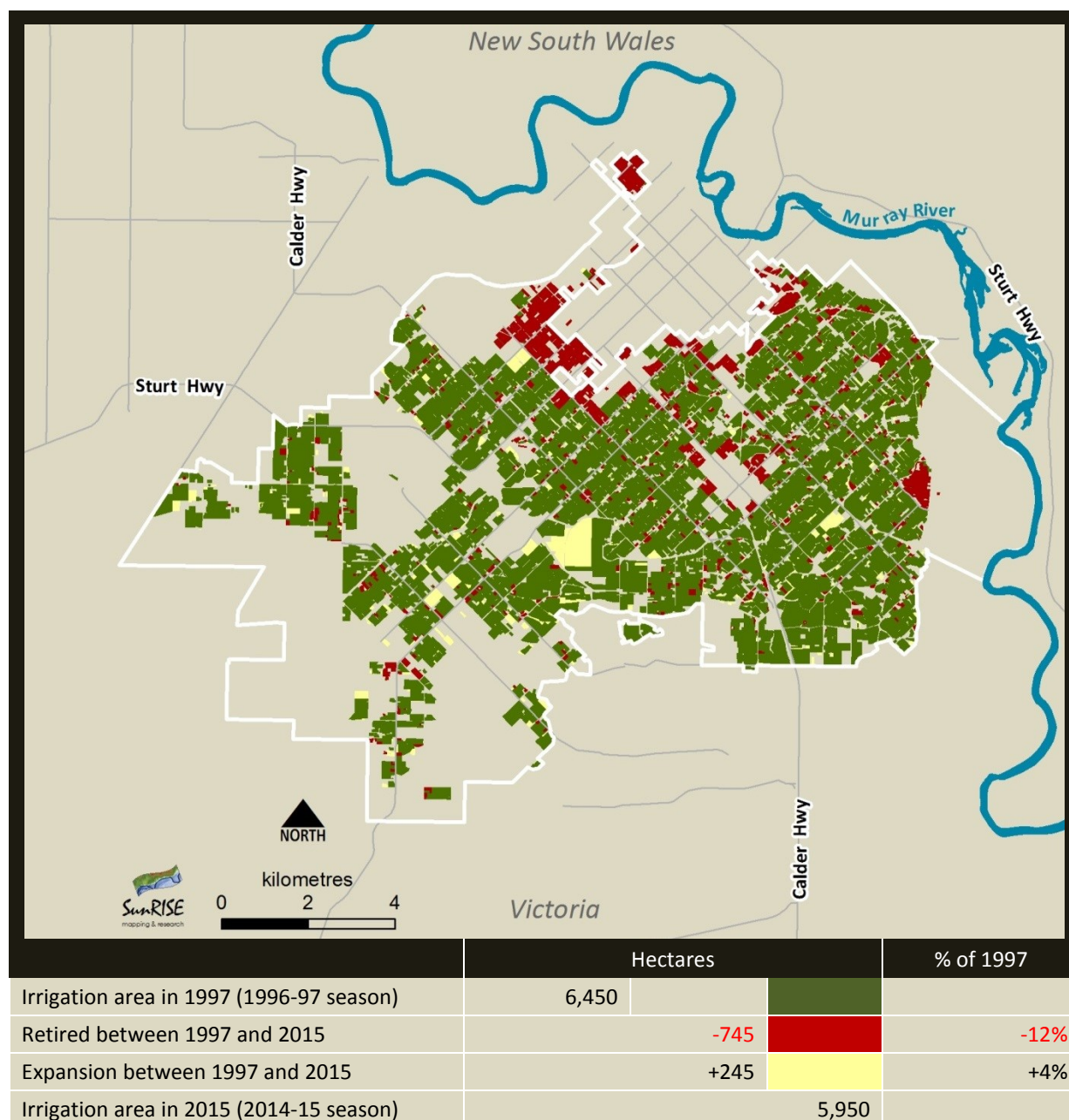
Figure 42: Mildura irrigation district - irrigable area in each salinity impact zone from 1997 to 2015

2.5.6 Mildura irrigation district – irrigation development

Map 9 shows irrigation development from 1997 to 2015 in the Mildura irrigation district with respect to new development (expansion) and areas retired²⁶ from irrigation.

- The irrigable area decreased by 500 ha, an 8% decrease from 6,450 ha in 1997 to 5,950 ha in 2015.
- The net decrease of 500 ha comprised 745 ha retired from irrigation and 245 ha of expansion.

Map 9: Mildura irrigation district – irrigation development from 1997 to 2015



²⁶ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

2.5.7 Mildura irrigation district – property change

Figure 43 provides estimates of property numbers and average property size (irrigable area) in the Mildura irrigation district from 1997 to 2015.

- There were approximately 680 irrigation properties (land holdings) in the Mildura irrigation district in 2015.
- Property numbers declined by 159, a 19% decrease from 839 in 1997 to 680 in 2015.
- The number of properties less than 20 ha (irrigable area) declined by 168, while the number over 20 ha increased by 9.
- Average property size (irrigable area) increased from 8 ha in 1997 to 9 ha in 2015.

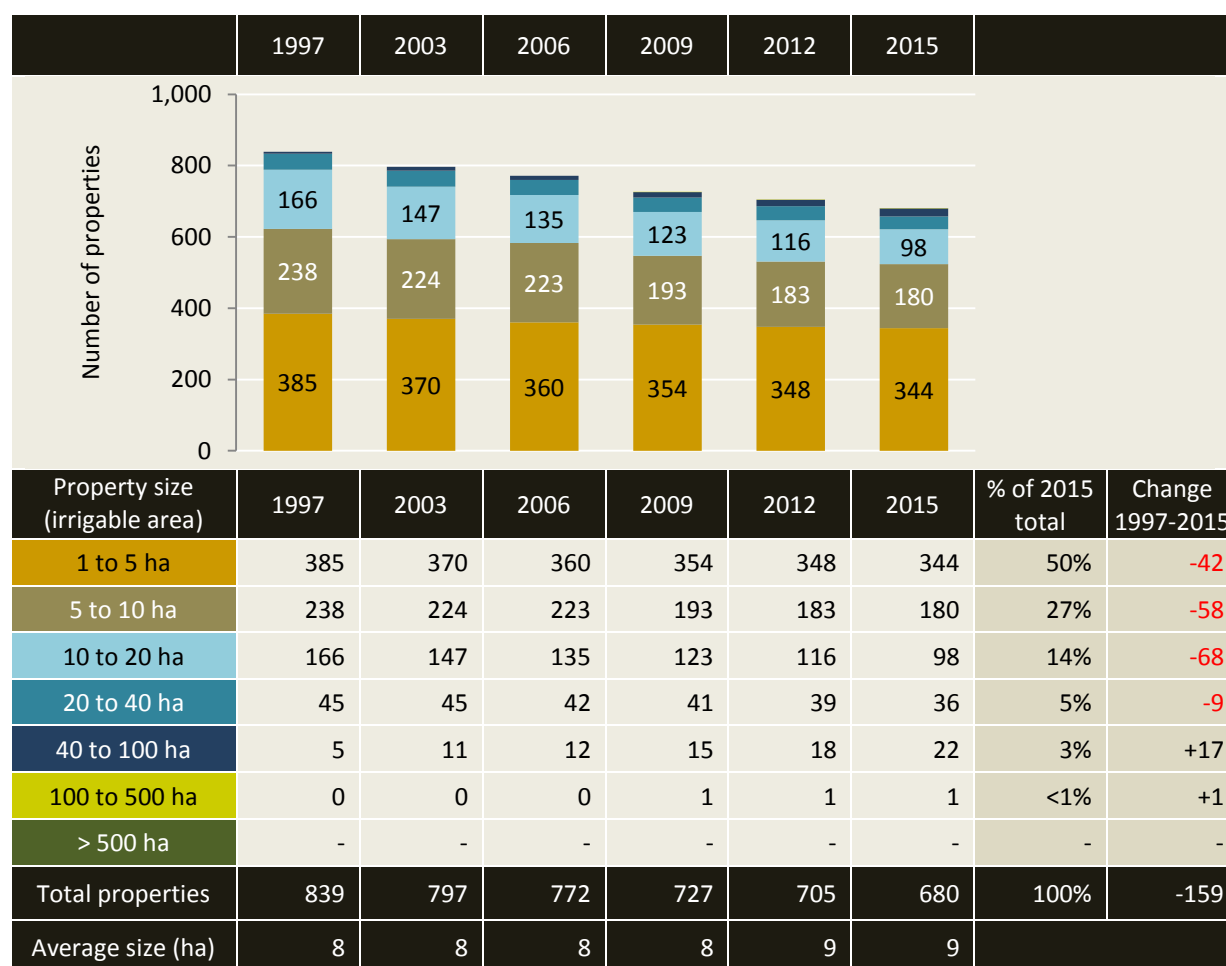


Figure 43: Mildura irrigation district - property numbers and sizes from 1997 to 2015

2.6 Merbein irrigation district

In summary for the Merbein irrigation district

Crop types

- Grapevines remained the dominant crop type from 1997 to 2015 in the Merbein irrigation district. Plantings peaked around 1997, but continued to decline from 1997 to 2015.
- Of the irrigated crops, field crops increased by the largest area, 50 ha; a 200% increase from 25 ha in 1997 to 75 ha in 2015.
- The irrigable area in 2015 was 3,045 ha of which:
 - 56% (1,710 ha) was irrigated permanent plantings;
 - 4% (135 ha) was irrigated seasonal crops;
 - 35% (1,055 ha) was vacant or not irrigated for less than 10 years; and
 - 5% (145 ha) was vacant or not irrigated for more than 10 years.

Grapevines

- Grapevines in the Merbein irrigation district were predominantly grown for dried vine fruit production from 1997 to 2015, except in 2009 when wine grape plantings dominated temporarily.
- The area of grapevines decreased by 1,160 ha, a 43% decrease from 2,705 ha in 1997 to 1,545 ha in 2015.
- In 2015, the 1,545 ha of grapevines comprised:
 - 29% (450 ha) wine grape plantings;
 - 25% (380 ha) table grape plantings;
 - 46% (710 ha) dried grape plantings; and
 - < 1% (5 ha) grapevines for other purposes.

Irrigation methods

- Drip irrigation was the dominant irrigation method in the Merbein district from 2009 to 2015. Furrow irrigation was the dominant method prior to 2009; from 1997 to 2006.
- In 2015, the irrigable area of 3,045 ha comprised:
 - 29% (895 ha) drip irrigation;
 - 15% (440 ha) low level irrigation;
 - 6% (185 ha) overhead sprinklers;
 - 11% (325 ha) furrow irrigation; and
 - 39% (1,200 ha) not irrigated.

In summary for the Merbein irrigation district

Salinity impact zones

- The Merbein district is in the lowest salinity impact zone, LIZ 1 and in the high salinity impact zone, HIZ.
- In 2015, the irrigable area of 3,045 ha comprised:
 - 33% (1,020 ha) in LIZ 1; and
 - 67% (2,025 ha) in the HIZ.
- The irrigable area in the HIZ decreased by 90 ha, a 4% decrease from 2,115 ha in 1997 to 2,025 ha in 2015; predominantly a result of areas retired from irrigation for urban development.

Irrigation development

- In the Merbein district the irrigable area decreased by 100 ha, a 3% decrease from 3,145 ha in 1997 to 3,045 ha in 2015.
- The net decrease comprised 105 ha retired from irrigation and 5 ha of expansion.

Irrigation properties

- There were approximately 298 irrigation properties in the Merbein irrigation district in 2015.
- Change in property numbers and size from 1997 to 2015:
 - Property numbers declined by 32, a 10% decrease from 330 in 1997 to 298 in 2015.
 - Properties with an irrigable area of less than 20 ha declined by 42, while the number over 20 ha increased by 10.
 - Average property size (irrigable area) increased from 9 ha in 1997 to 10 ha in 2015.

2.6.1 Merbein irrigation district - crop types in 2015

Merbein irrigation district crop types in 2015 are shown in Table 15 and Map 10.

- Dominant plantings in the Merbein irrigation district in 2015 were:
 - Dried grapes, 23% of the irrigable area; and
 - Wine grapes, 15% of the irrigable area.

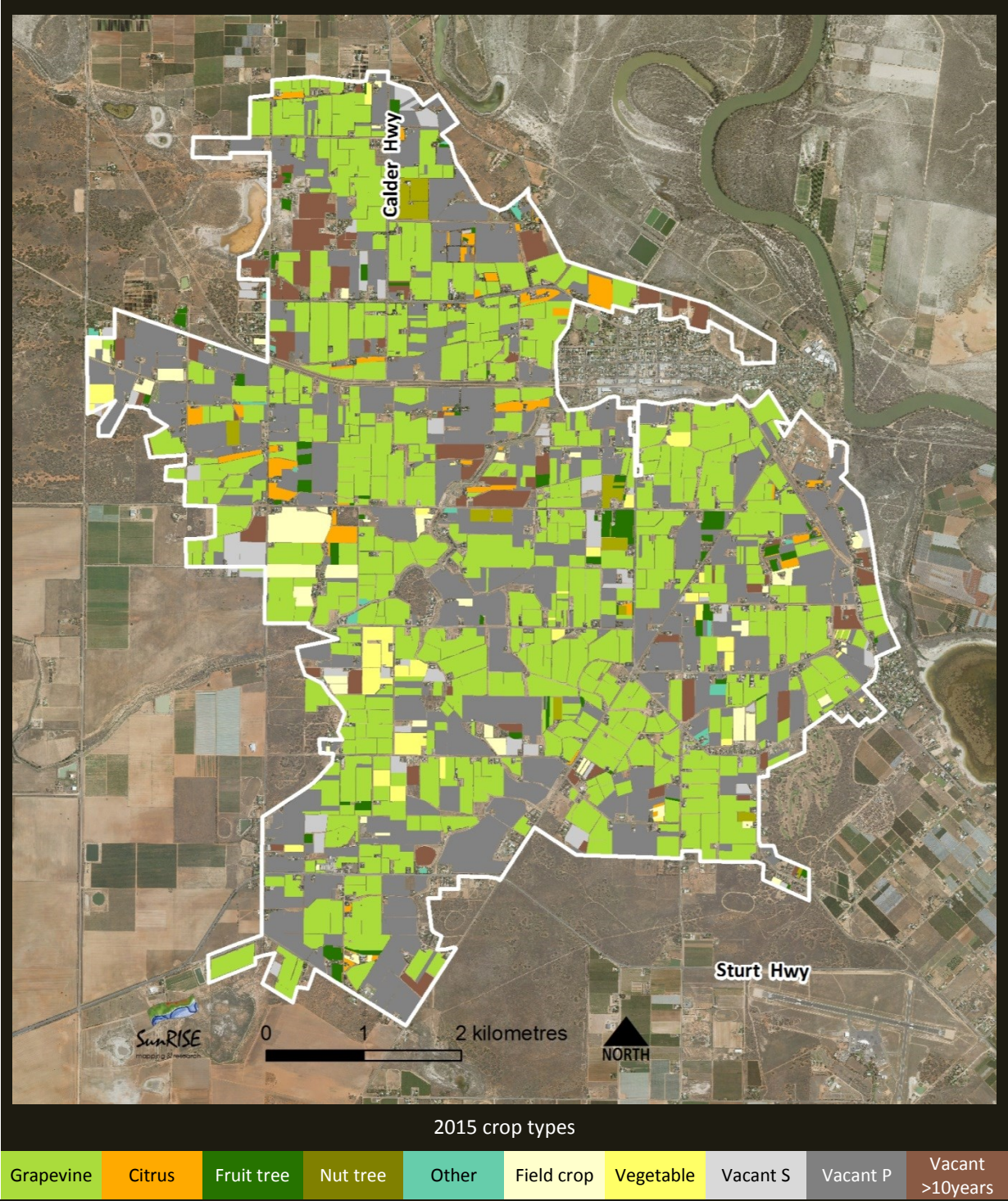
Table 15: Merbein irrigation district - crop types in 2015

	Crop type	Category	2015 (ha)	2015 %	Description
Permanent crops	Grapevine	Wine	445	15%	
		Table	385	13%	
		Dried	710	23%	
		Other	5	<1%	
	Citrus		60	2%	Grapefruit, Lemon, Mandarin, Navel, Other Orange, Tangelo, Valencia
	Fruit tree	<i>unspecified</i>	15	<1%	<i>Fruit tree category unknown</i>
		Avocado	10	<1%	
		Olive	15	<1%	
		Stone fruit	5	<1%	
		Other	10	<1%	Fig, Jujube, Mango, Persimmon, Pomegranate, Quince
	Nut tree	Almond	20	1%	
		Other	20	1%	Pistachio, Walnut
	Other	Nursery	5	<1%	
		Woodlot	5	<1%	
		Misc.	-	-	
	Permanent crops	(sub-total)	1,710	56%	
Seasonal crops	Vacant P	≤ 10 years	980	32%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	125	4%	Vacant (not irrigated) for over ten years
	Field crop	<i>unspecified</i>	-	-	
		Cereal	30	1%	
		Lucerne	15	<1%	
		Pasture	30	1%	
		Other	-	-	
	Vegetable	<i>unspecified</i>	15	<1%	<i>Vegetable category unknown</i>
		Asparagus	30	1%	
		Carrot	-	-	
		Cucurbit	15	<1%	
		Potato	-	-	
		Other	-	-	
	Seasonal crops	(sub-total)	135	4%	
	Vacant S	≤ 10 years	75	2%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	20	1%	Vacant (not irrigated) for over ten years
	Total all crop areas		3,045	100%	

Note: '*unspecified*' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Merbein irrigation district – crop types in 2015

Map 10: Merbein irrigation district showing 2015 crop types



2.6.2 Merbein irrigation district – change in crop types

Figure 44 summarises crop types in the Merbein irrigation district from 1997 to 2015.

- Grapevines remained the dominant crop type from 1997 to 2015. Plantings peaked around 1997, but continued to decline from 1997 to 2015.
- Of the irrigated crops, field crops increased by the largest area, 50 ha; a 200% increase from 25 ha in 1997 to 75 ha in 2015.
- In 2015, the irrigable area of 3,045 ha comprised:
 - 56% (1,710 ha) irrigated permanent plantings;
 - 4% (135 ha) irrigated seasonal crops;
 - 35% (1,055 ha) vacant or not irrigated for less than 10 years; and
 - 5% (145 ha) vacant or not irrigated for more than 10 years.

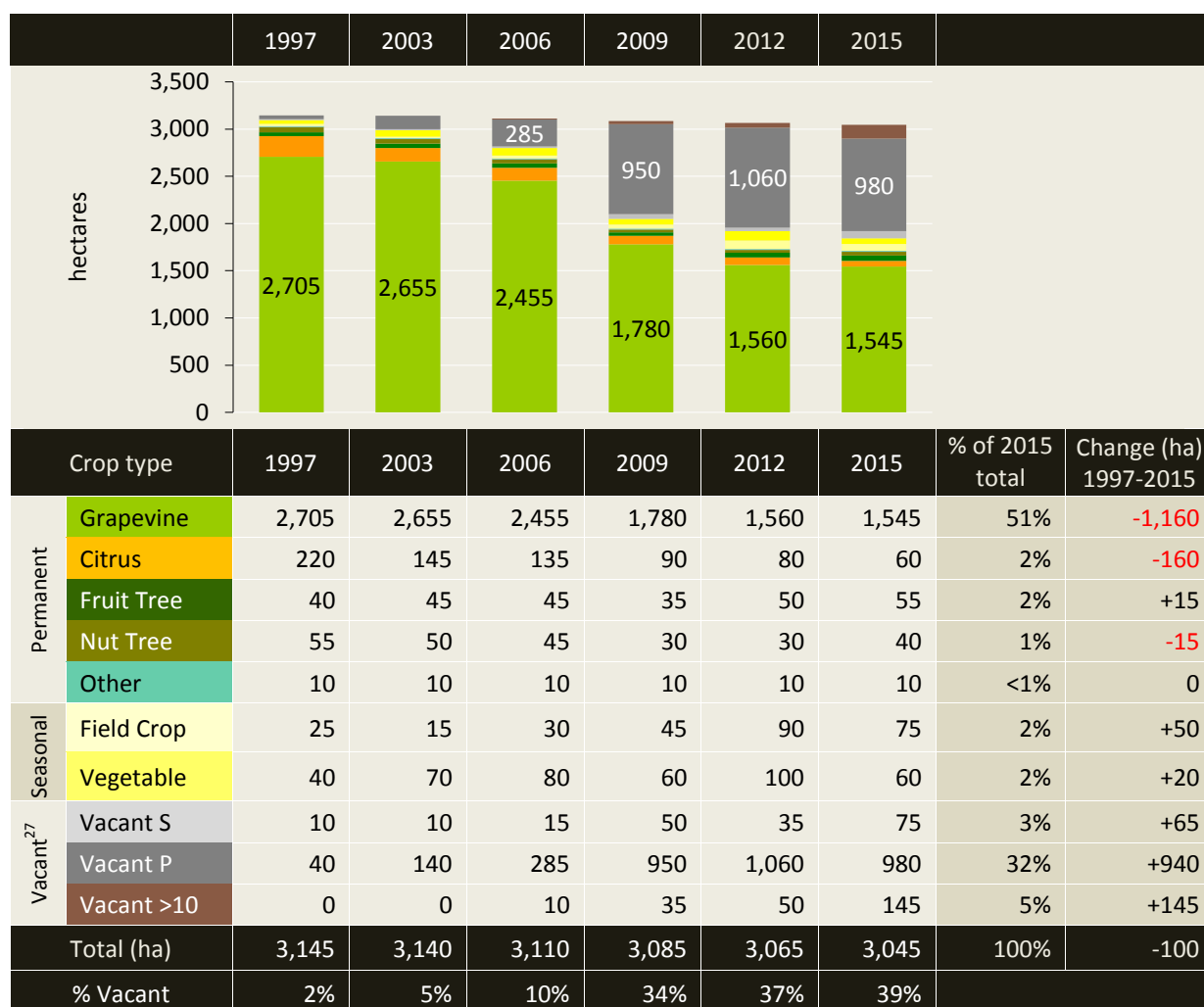


Figure 44: Merbein irrigation district - crop types from 1997 to 2015

²⁷ Vacant S: not irrigated but previously an irrigated seasonal crop. Vacant P: not irrigated but previously an irrigated permanent planting. Vacant >10: not irrigated for over ten years but previously an irrigated area.

2.6.3 Merbein irrigation district – grapevines

Figure 45 summarises grape use in the Merbein irrigation district from 1997 to 2015.

- The area of grapevines decreased by 1,160 ha, a 43% decrease from 2,705 ha in 1997 to 1,545 ha in 2015.
- In 2015, the 1,545 ha of grapevines comprised:
 - 29% (450 ha) wine grape plantings;
 - 25% (380 ha) table grape plantings;
 - 46% (710 ha) dried grape plantings; and
 - < 1% (5 ha) grapevines for other purposes.
- Wine grape plantings decreased by 455 ha, a 50% decrease from 905 ha in 1997 to 450 ha in 2015.
 - The net decrease of 455 ha comprised an increase of 205 ha between 1997 and 2003, then a decrease of 660 ha between 2003 and 2015.
- Table grape plantings increased by 230 ha, a 153% increase from 150 ha in 1997 to 380 ha in 2015.
- Dried grape plantings decreased by 920 ha, a 56% decrease from 1,630 ha in 1997 to 710 ha in 2015.
- Grapevines were predominantly grown for dried vine fruit production from 1997 to 2015, except in 2009 when wine grape plantings dominated temporarily.

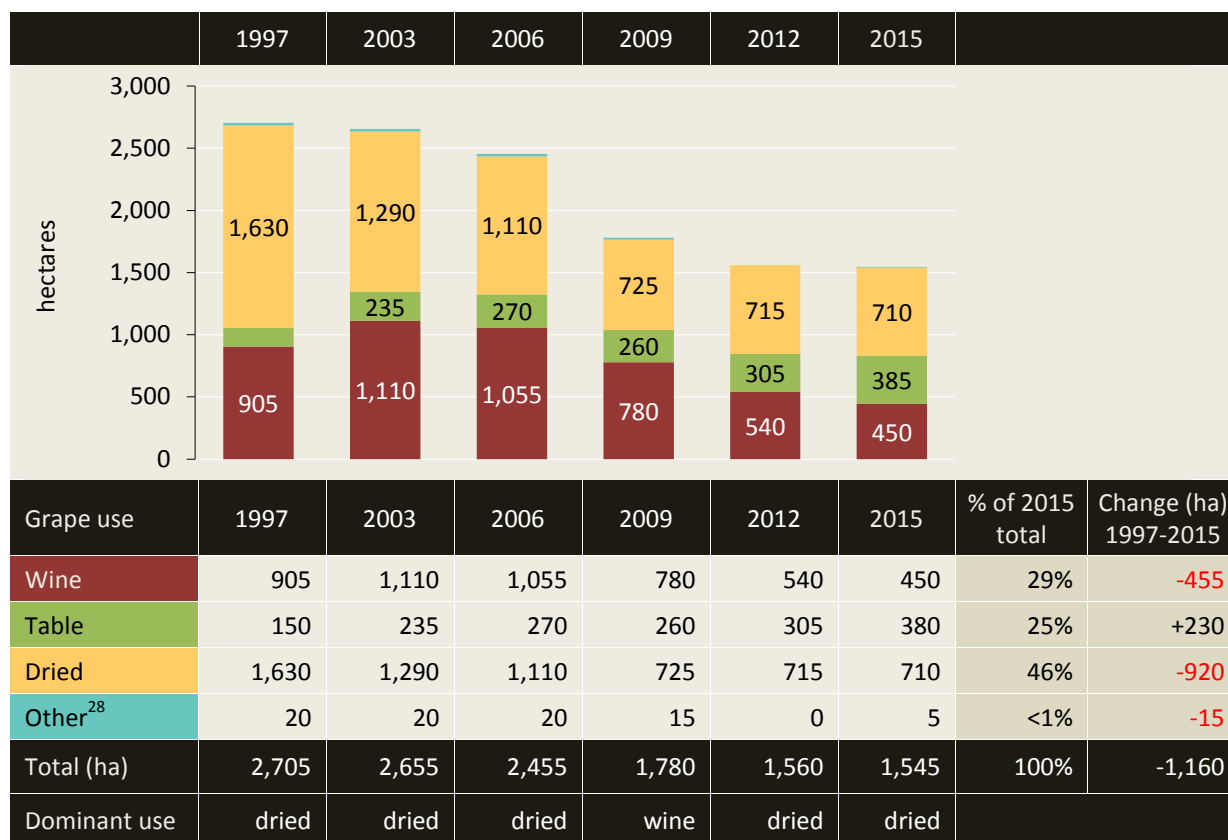


Figure 45: Merbein irrigation district - grapevine plantings from 1997 to 2015

²⁸ Other: grapes for juicing, cannery, research and trial varieties.

2.6.4 Merbein irrigation district – irrigation methods

Figure 46 summarises irrigation methods in the Merbein irrigation district from 1997 to 2015.

- In 2015, the irrigable area of 3,045 ha comprised:
 - 29% (895 ha) drip irrigation;
 - 15% (440 ha) low level irrigation;
 - 6% (185 ha) overhead sprinklers;
 - 11% (325 ha) furrow irrigation; and
 - 39% (1,200 ha) not irrigated.
- Drip irrigation increased by 820 ha, a 1,093% increase from 75 ha in 1997 to 895 ha in 2015.
 - Drip irrigation was the dominant irrigation method from 2009 to 2015.
- Low level irrigation increased by 35 ha, a 9% increase from 405 ha in 1997 to 440 ha in 2015.
- Overhead irrigation decreased by 270 ha, a 59% decrease from 455 ha in 1997 to 185 ha in 2015.
- Furrow irrigation decreased by 1,835 ha, an 85% decrease from 2,160 ha in 1997 to 325 ha in 2015.
 - Furrow irrigation was the dominant irrigation method from 1997 to 2006.

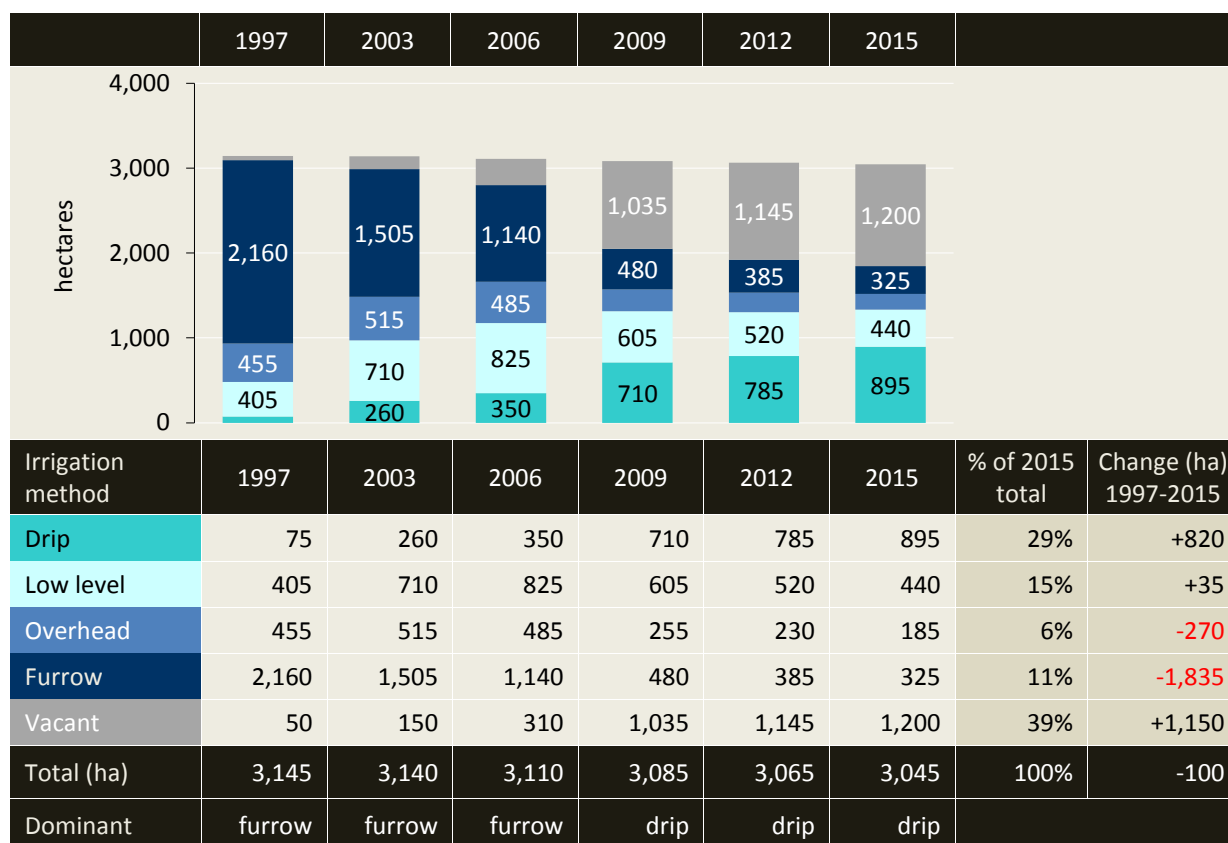


Figure 46: Merbein irrigation district - irrigation methods from 1997 to 2015

2.6.5 Merbein irrigation district – salinity impact zones

Figure 47 summarises the irrigable area in each river salinity impact zone in the Merbein irrigation district from 1997 to 2015. The Merbein district is in the lowest salinity impact zone, LIZ 1 and in the high salinity impact zone, HIZ.

- In 2015, the irrigable area of 3,045 ha comprised:
 - 33% (1,020 ha) in LIZ 1; and
 - 67% (2,025 ha) in the HIZ.
- The area irrigated in:
 - LIZ 1 decreased by 375 ha, a 37% decrease from 1,015 ha in 1997 to 640 ha in 2015; and
 - HIZ decreased by 875 ha, a 42% decrease from 2,080 ha in 1997 to 1,205 ha in 2015.
- The irrigable area in:
 - LIZ 1 decreased by 10 ha, a 1% decrease from 1,030 ha in 1997 to 1,020 ha in 2015; and
 - HIZ decreased by 90 ha, a 4% decrease from 2,115 ha in 1997 to 2,025 ha in 2015.
- The net decrease in irrigable area was due to areas being retired from irrigation, predominantly for housing and urban development.

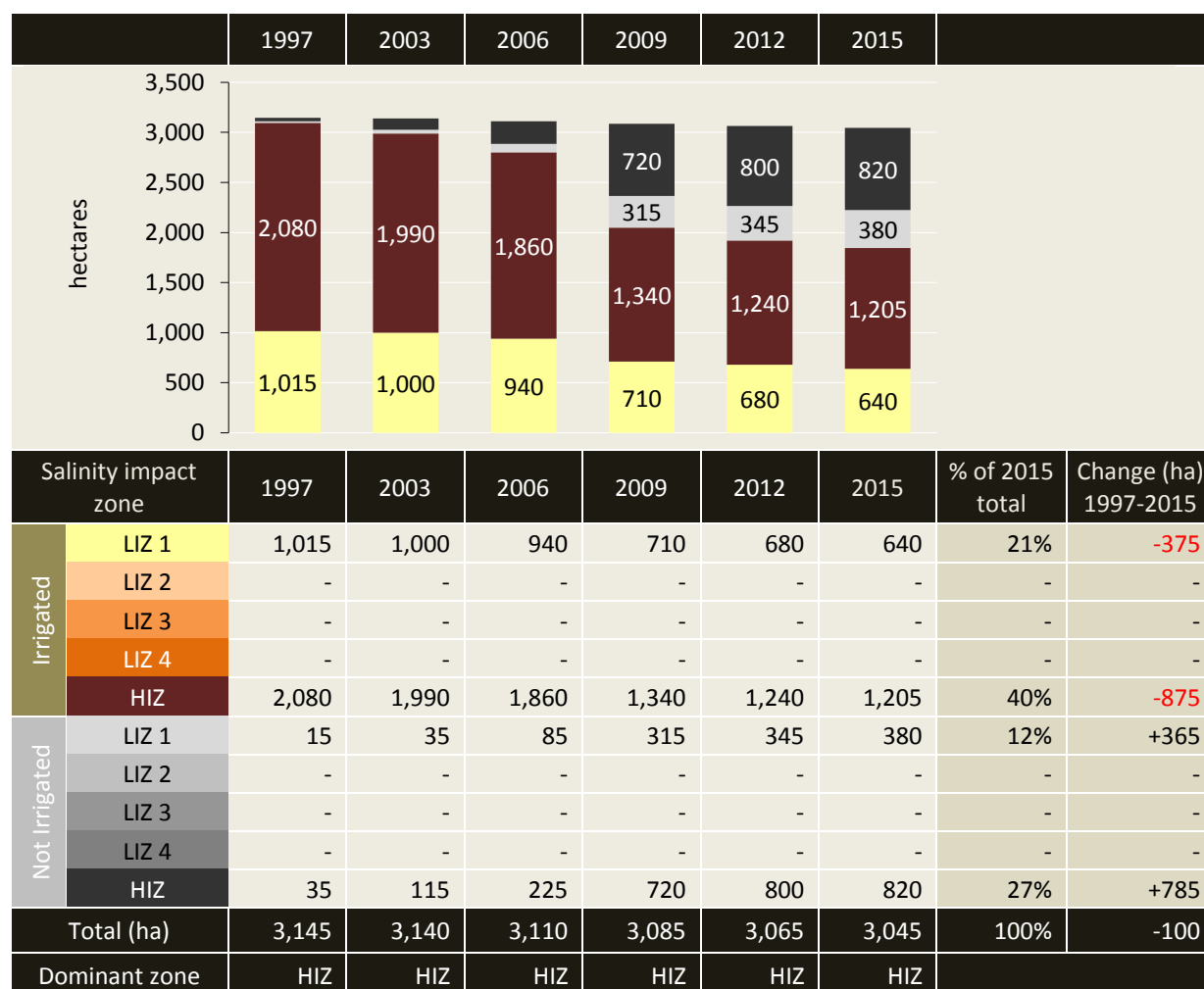


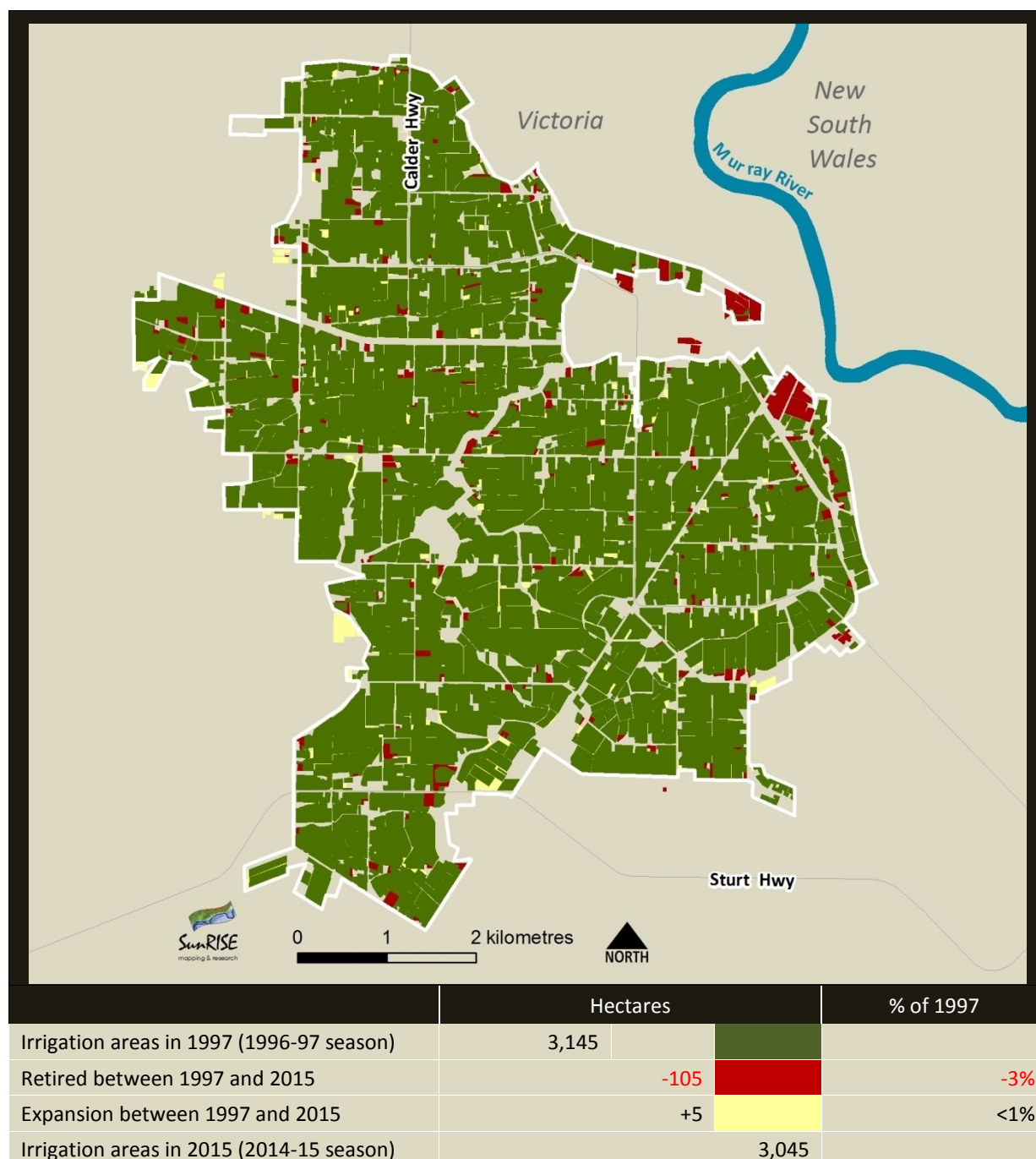
Figure 47: Merbein irrigation district - irrigable area in each salinity impact zone from 1997 to 2015

2.6.6 Merbein irrigation district – irrigation development

Map 11 shows irrigation development from 1997 to 2015 in the Merbein irrigation district with respect to new development (expansion) and areas retired²⁹ from irrigation.

- The irrigable area decreased by 100 ha, a 3% decrease from 3,145 ha in 1997 to 3,045 ha in 2015.
- The net decrease of 100 ha comprised 105 ha retired from irrigation and 5 ha of expansion.

Map 11: Merbein irrigation district – irrigation development from 1997 to 2015



²⁹ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

2.6.7 Merbein irrigation district – property change

Figure 48 provides estimates of property numbers and average property size (irrigable area) in the Merbein irrigation district from 1997 to 2015.

- There were approximately 298 irrigation properties (land holdings) in the Merbein irrigation district in 2015.
- Property numbers declined by 32, a 10% decrease from 330 in 1997 to 298 in 2015.
- The number of properties less than 20 ha (irrigable area) declined by 42, while the number over 20 ha increased by 10.
- Average property size (irrigable area) increased from 9 ha in 1997 to 10 ha in 2015.

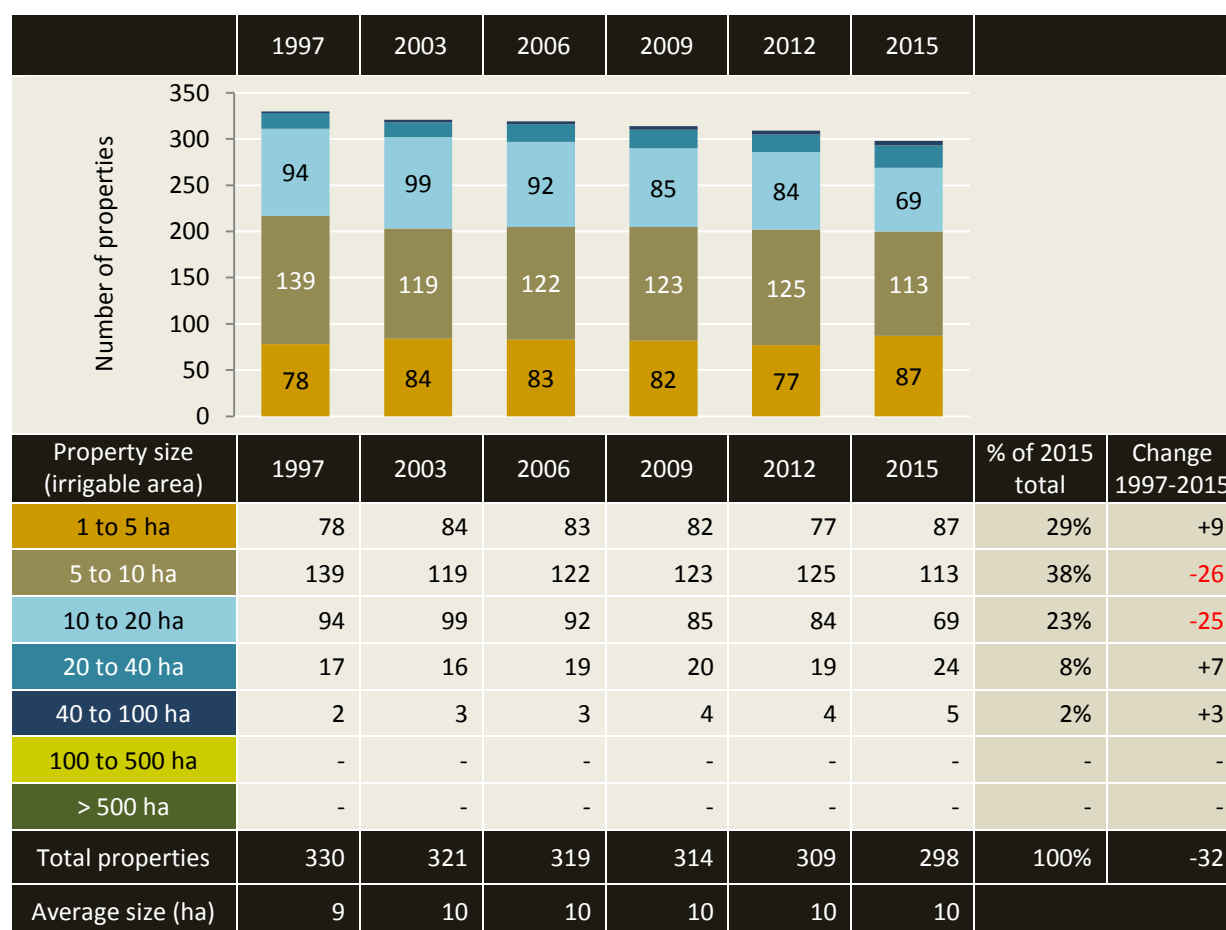


Figure 48: Merbein irrigation district - property numbers and sizes from 1997 to 2015

3. Private diverters

3.1 Private diverters summary

In summary for private diverters, Nyah to South Australia

Crop types

- The dominant irrigated crop across the private diverter areas was field crops in 1997, grapevines (predominantly wine grapes) from 2003 to 2006 and nut trees (predominantly almonds) from 2009 to 2015.
- Nut trees dominated development from 1997 to 2015. Plantings increased by 18,915 ha, a 1,063% increase from 1,780 ha in 1997 to 20,695 ha in 2015.
- The irrigable area in 2015 was 55,585 ha of which:
 - 71% (39,225 ha) was irrigated permanent plantings;
 - 16% (8,715 ha) was irrigated seasonal crops;
 - 10% (5,835 ha) was vacant or not irrigated for less than 10 years; and
 - 3% (1,810 ha) was vacant or not irrigated for more than 10 years.

Grapevines

- Wine grape plantings remained the dominant grape type across the private diverter river reaches from 1997 to 2015.
- The area of grapevines increased by 4,595 ha, an 83% increase from 5,565 ha in 1997 to 10,160 ha in 2015. Plantings peaked around 2006 at 11,485 ha, then decreased by 1,325 ha (12%) between 2006 and 2015.
- In 2015, the 10,160 ha of grapevines comprised:
 - 65% (6,645 ha) wine grape plantings;
 - 25% (2,555 ha) table grape plantings; and
 - 10% (960 ha) dried grape plantings.

Irrigation methods

- Drip irrigation was the dominant irrigation method in the private diverter areas from 2003 to 2015. Overhead sprinklers were the dominant method in 1997.
- In 2015, the irrigable area of 55,585 ha comprised:
 - 64% (35,205 ha) drip irrigation;
 - 8% (4,630 ha) low level irrigation;
 - 10% (5,710 ha) overhead sprinklers;
 - 4% (2,395 ha) furrow irrigation; and
 - 14% (7,645 ha) not irrigated.
- Drip irrigation increased by 32,045 ha, a 1,014% increase from 3,160 ha in 1997 to 35,205 ha in 2015.
- Low level irrigation increased by 1,410 ha, a 44% increase from 3,220 ha in 1997 to 4,630 ha in 2015.
- Overhead irrigation decreased by 3,450 ha, a 38% decrease from 9,160 ha in 1997 to 5,710 ha in 2015.
- Furrow irrigation decreased by 3,460 ha, a 59% decrease from 5,855 ha in 1997 to 2,395 ha in 2015.

In summary for private diverters, Nyah to South Australia

Salinity impact zones

- Irrigable areas across the private diverter river reaches in 2015 were predominantly in the lowest salinity impact zone, LIZ 1.
- In 2015, the irrigable area of 55,585 ha comprised:
 - 52% (28,955 ha) in LIZ 1;
 - 23% (12,670 ha) in LIZ 2;
 - 5% (2,460 ha) in LIZ 3;
 - 15% (8,445 ha) in LIZ 4; and
 - 5% (3,055 ha) in the high salinity impact zone, HIZ.
- The irrigable area in the HIZ increased by 120 ha, a 4% increase from 2,935 ha in 1997 to 3,055 ha in 2015. Some areas classed as HIZ in 1997 were retired from irrigation, while others were brought into irrigation production, resulting in a net increase of 120 ha in the total irrigable area in the HIZ.

Irrigation development

- Across the private diverter river reaches the irrigable area increased by 33,365 ha, a 150% increase from 22,220 ha in 1997 to 55,585 ha in 2015.
- The net increase of 33,365 comprised 510 ha retired from irrigation and 33,875 ha of expansion. Only 9% of this expansion occurred between 2009 and 2015.
- Expansion occurred in all of the six river reaches between 1997 and 2015. The largest growth areas were:
 - The Boundary Bend river reach with expansion of 15,175 ha, a 283% increase from 5,365 ha in 1997 to 20,540 ha in 2015; and
 - The Wemen river reach with expansion of 8,560 ha, a 398% increase from 2,150 ha in 1997 to 10,710 ha in 2015.

Irrigation properties

- There were approximately 448 irrigation properties in the private diverter river reaches in 2015.
- Change in property numbers and size from 1997 to 2015:
 - Property numbers declined by 54, an 11% decrease from 502 in 1997 to 448 in 2015.
 - Properties with an irrigable area of less than 40 ha declined by 92, while the number over 40 ha increased by 38.
 - Average property size (irrigable area) increased from 44 ha in 1997 to 124 ha in 2015.

3.1.1 Private diverters summary – crop types in 2015

Crops in the private diverter river reaches irrigated in 2015 are shown in Table 16.

- Dominant plantings across the private diverter river reaches in 2015 were:
 - Almond trees, 37% of the irrigable area; and
 - Wine grapes, 12% of the irrigable area.

Table 16: Private diverters - irrigated crops in 2015

	Crop type	Category	2015 (ha)	2015 %	Description
Permanent crops	Grapevine	Wine	6,645	12%	
		Table	2,555	5%	
		Dried	960	2%	
		Other	-	-	
	Citrus		3,490	6%	Grapefruit, Lemon, Lime, Mandarin, Navel, Blood Orange, Other, Tangelo, Valencia
	Fruit tree	<i>unspecified</i>	15	<1%	<i>Fruit tree category unknown</i>
		Avocado	425	1%	
		Olive	3,510	6%	
		Stone fruit	520	1%	Apricot, Nectarine, Peach, Plum
	Nut tree	Other	85	<1%	Apple, Fig, Mango, Persimmon, Pomegranate
		Almond	20,470	37%	
		Other	225	<1%	Pistachio, Walnut
	Other	Nursery	100	<1%	
		Woodlot	215	<1%	
		Misc.	10	<1%	
Permanent crops	(sub-total)	39,225	71%		
Vacant P	≤ 10 years	3,420	6%	Vacant (not irrigated) for ten years or less	
Vacant >10	> 10 years	90	<1%	Vacant (not irrigated) for over ten years	
Seasonal crops	Field crop	<i>unspecified</i>	835	2%	<i>Field crop category unknown</i>
		Cereal	1,725	3%	
		Lucerne	505	1%	
		Pasture	470	1%	
		Other	540	1%	Canola, Maize
	Vegetable	<i>unspecified</i>	165	<1%	<i>Vegetable category unknown</i>
		Asparagus	245	<1%	
		Carrot	2,510	5%	
		Cucurbit	380	1%	
		Potato	940	2%	
		Other	400	1%	Beetroot, Broccoli, Cabbage, Garlic, Salad Greens, Tomato
		Seasonal crops	(sub-total)	8,715	16%
	Vacant S	≤ 10 years	2,415	4%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	1,720	3%	Vacant (not irrigated) for over ten years
	Total all crop areas			55,585	100%

Note: '*unspecified*' refers to unknown crop categories that may be categories already listed OR other categories not listed.

3.1.2 Private diverters summary – change in crop types

Figure 49 summarises crop types across the six private diverter study areas from 1997 to 2015.

- The dominant irrigated crop across the private diverter areas was field crops in 1997, grapevines (predominantly wine grapes) from 2003 to 2006, and nut trees (almonds) from 2009 to 2015.
- Nut trees dominated development from 1997 to 2015. Plantings increased by 18,915 ha, a 1,063% increase from 1,780 ha in 1997 to 20,695 ha in 2015.
- In 2015, the irrigable area of 55,585 ha comprised:
 - 71% (39,225 ha) irrigated permanent plantings;
 - 16% (8,715 ha) irrigated seasonal crops;
 - 10% (5,835 ha) vacant or not irrigated for less than 10 years; and
 - 3% (1,810 ha) vacant or not irrigated for more than 10 years.

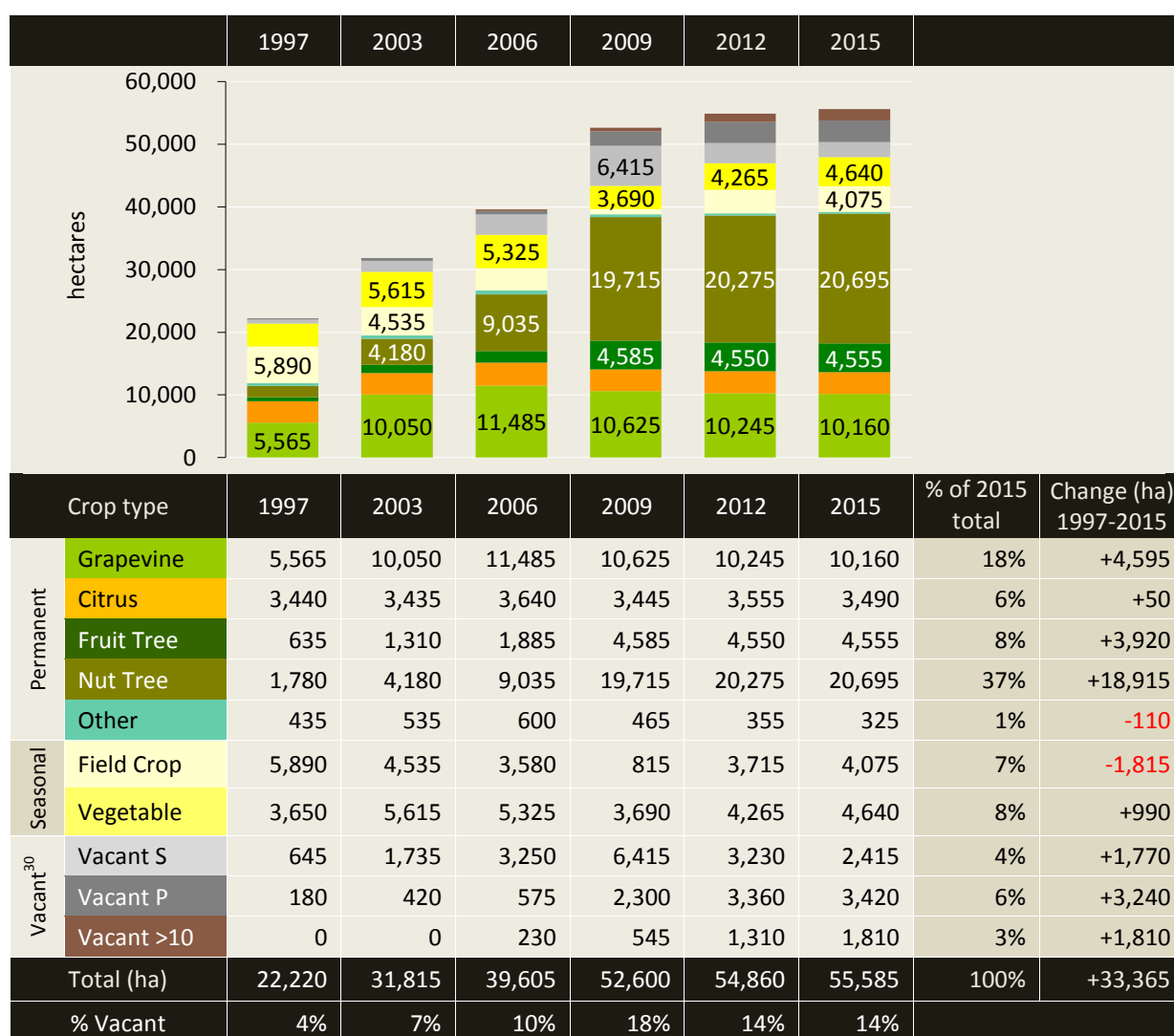


Figure 49: Private diverters - crop types from 1997 to 2015

³⁰ Vacant S: not irrigated areas previously a seasonal crop. Vacant P: not irrigated areas previously permanent plantings. Vacant >10: areas not irrigated for over ten years

3.1.3 Private diverters summary – grapevines

Figure 50 summarises grape use for all private diverters, Nyah to the South Australian border, from 1997 to 2015.

- The area of grapevines increased by 4,595 ha, an 83% increase from 5,565 ha in 1997 to 10,160 ha in 2015. Plantings peaked around 2006 at 11,485 ha, then decreased by 1,325 ha (12%) between 2006 and 2015.
- In 2015, the 10,160 ha of grapevines comprised:
 - 65% (6,645 ha) wine grape plantings;
 - 25% (2,555 ha) table grape plantings; and
 - 10% (960 ha) dried grape plantings.
- Wine grape plantings increased by 2,570 ha, a 63% increase from 4,075 ha in 1997 to 6,645 ha in 2015.
 - Wine grape plantings remained the dominant grape type from 1997 to 2015.
- Table grape plantings increased by 1,435 ha, a 128% increase from 1,120 ha in 1997 to 2,555 ha in 2015.
- Dried grape plantings increased by 590 ha, a 159% increase from 370 ha in 1997 to 960 ha in 2015.

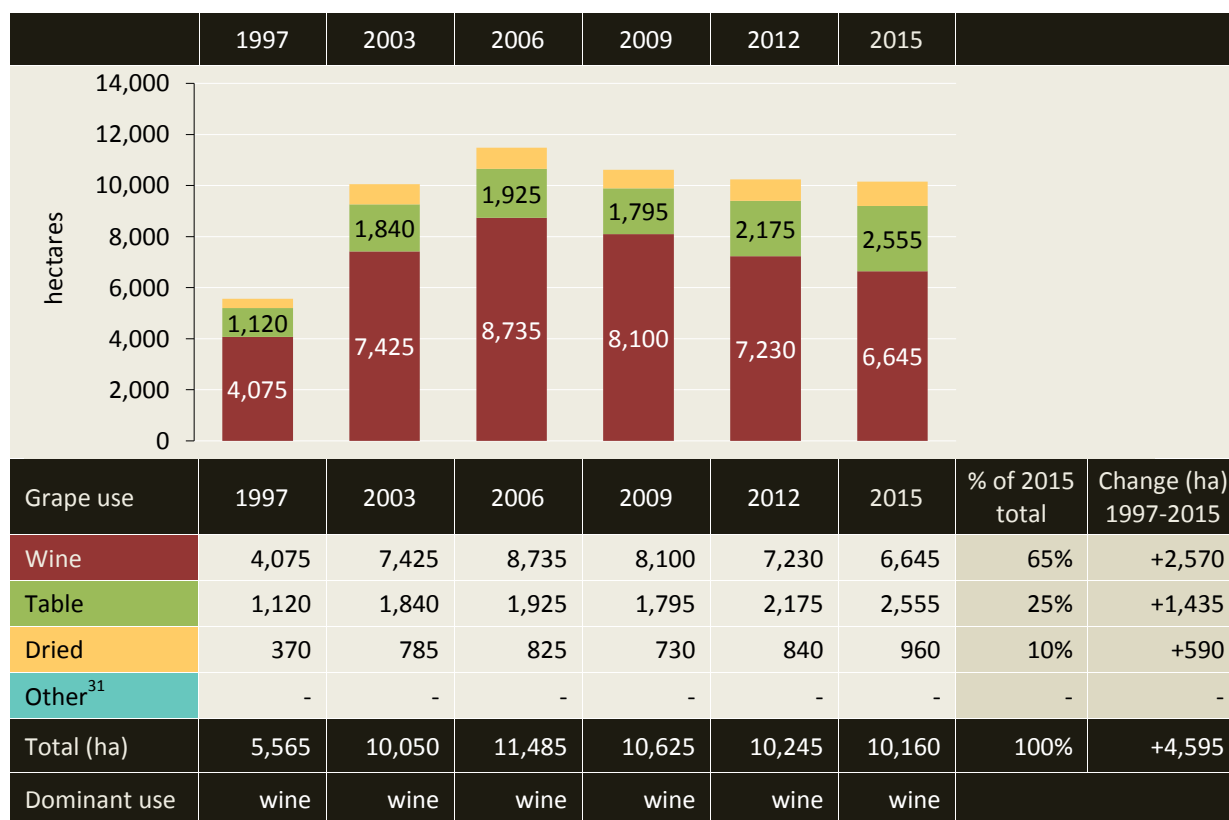


Figure 50: Private diverters - grapevine plantings from 1997 to 2015

³¹ Other: grapes for juicing, cannery, research and trial varieties.

Grapevines in 2015 in each of the private diverter areas

Figure 51 summarises grape use in each of the private diverter river reaches in 2015.

- Grapevines were predominantly grown for wine production in each of the private diverter river reaches, except for Boundary Bend where table grapes were the dominant grapevine type.
- The largest area of grapevines in the private diverter areas was in the Colignan river reach where 45% (4,575 ha) of the total area of grapevines (10,160 ha) was grown in 2015.
- In the private diverter areas in 2015, Colignan grew the largest area of wine grape plantings (3,170 ha) and the largest area of dried grape plantings (735 ha), while Boundary Bend grew the largest area of table grape plantings.

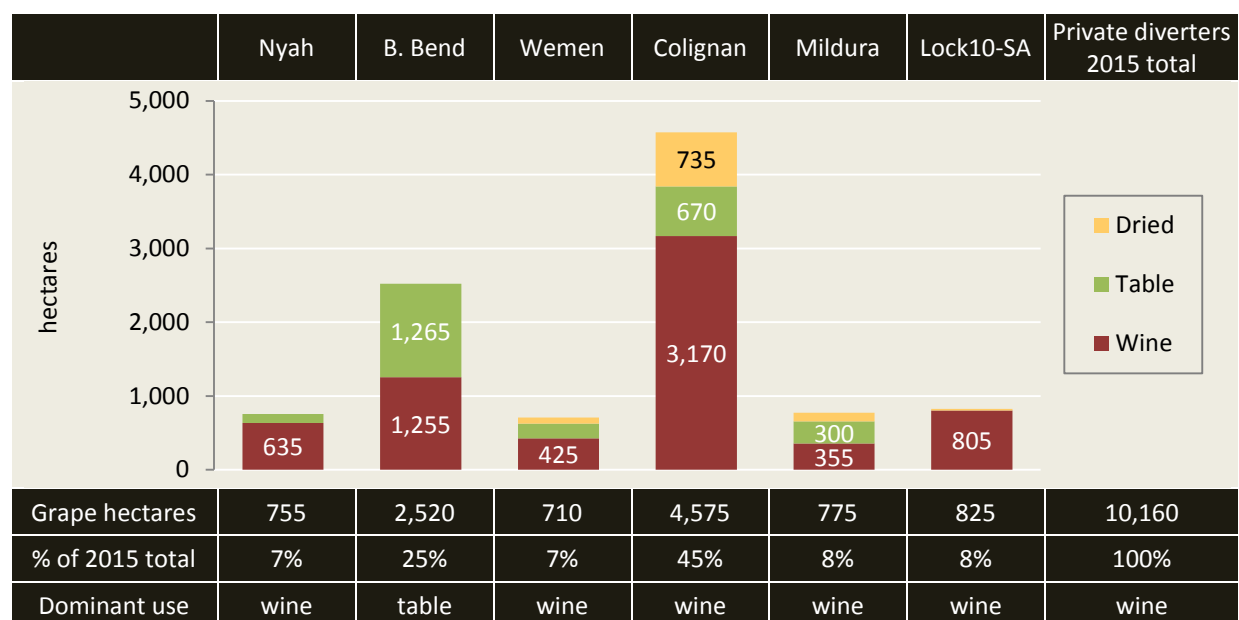


Figure 51: Private diverters - grapevine plantings in each of the river reaches in 2015

3.1.4 Private diverters summary – irrigation methods

Figure 52 summarises irrigation methods for private diverters in the Victorian Murray-Mallee from 1997 to 2015.

- In 2015, the irrigable area of 55,585 ha comprised:
 - 64% (35,205 ha) drip irrigation;
 - 8% (4,630 ha) low level irrigation;
 - 10% (5,710 ha) overhead sprinklers;
 - 4% (2,395 ha) furrow irrigation; and
 - 14% (7,645 ha) not irrigated.
- Drip irrigation increased by 32,045 ha, a 1,014% increase from 3,160 ha in 1997 to 35,205 ha in 2015.
 - Drip irrigation was the dominant irrigation method from 2003 to 2015.
- Low level irrigation increased by 1,410 ha, a 44% increase from 3,220 ha in 1997 to 4,630 ha in 2015.
- Overhead irrigation decreased by 3,450 ha, a 38% decrease from 9,160 ha in 1997 to 5,710 ha in 2015.
 - Overhead and pivot irrigation was the dominant irrigation method in 1997.
- Furrow irrigation decreased by 3,460 ha, a 59% decrease from 5,855 ha in 1997 to 2,395 ha in 2015.
 - The proportion of irrigable land under furrow irrigation decreased to 1% (550 ha) in 2009 when irrigating of seasonal crops was greatly reduced in response to drought conditions and high water prices. The decrease was most apparent in the Nyah river reach (Figure 61).

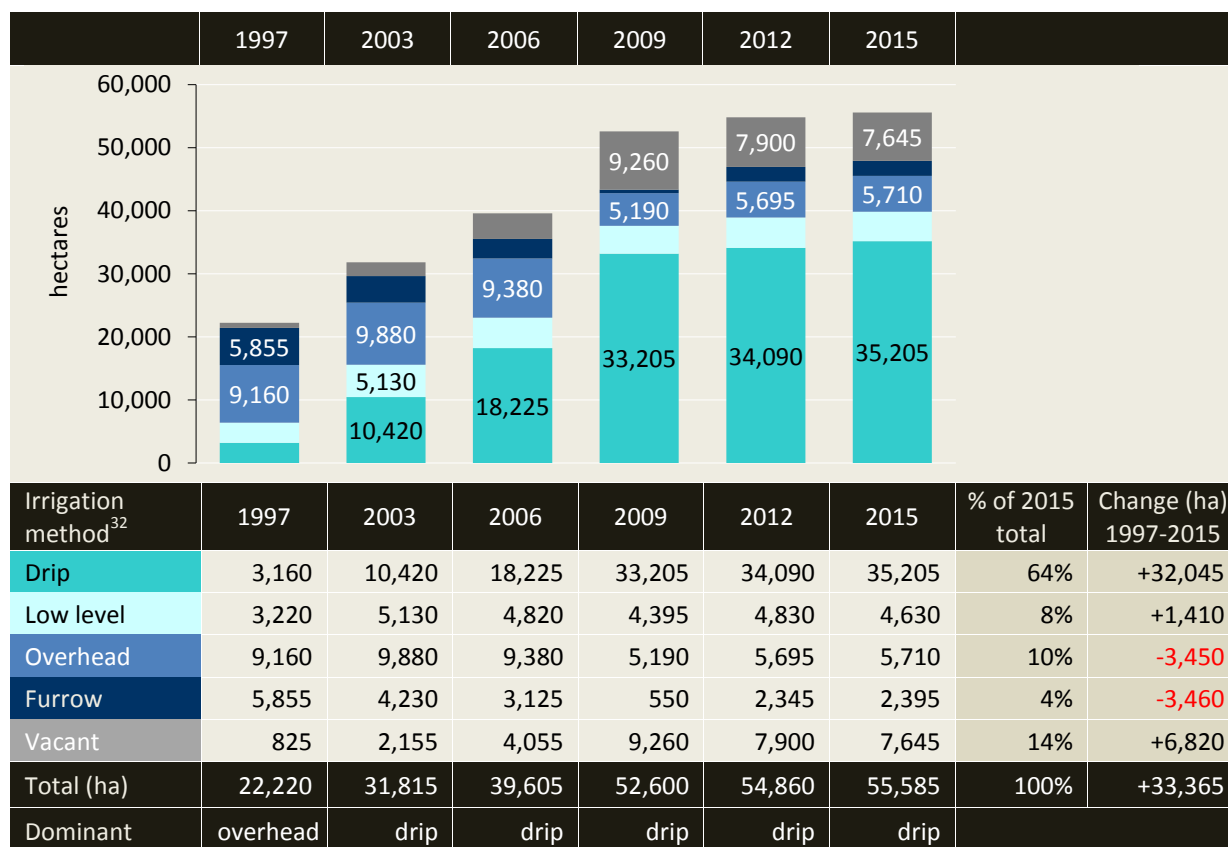


Figure 52: Private diverters - irrigation methods from 1997 to 2015

³² Overhead irrigation includes pivots and lateral move systems. Furrow includes flood irrigation. (Table 8)

Irrigation methods in the private diverter areas

Figure 53 compares irrigation methods in each of the private diverter river reaches in 2015.

- Drip irrigation was the dominant method in each of the private diverter river reaches in 2015.

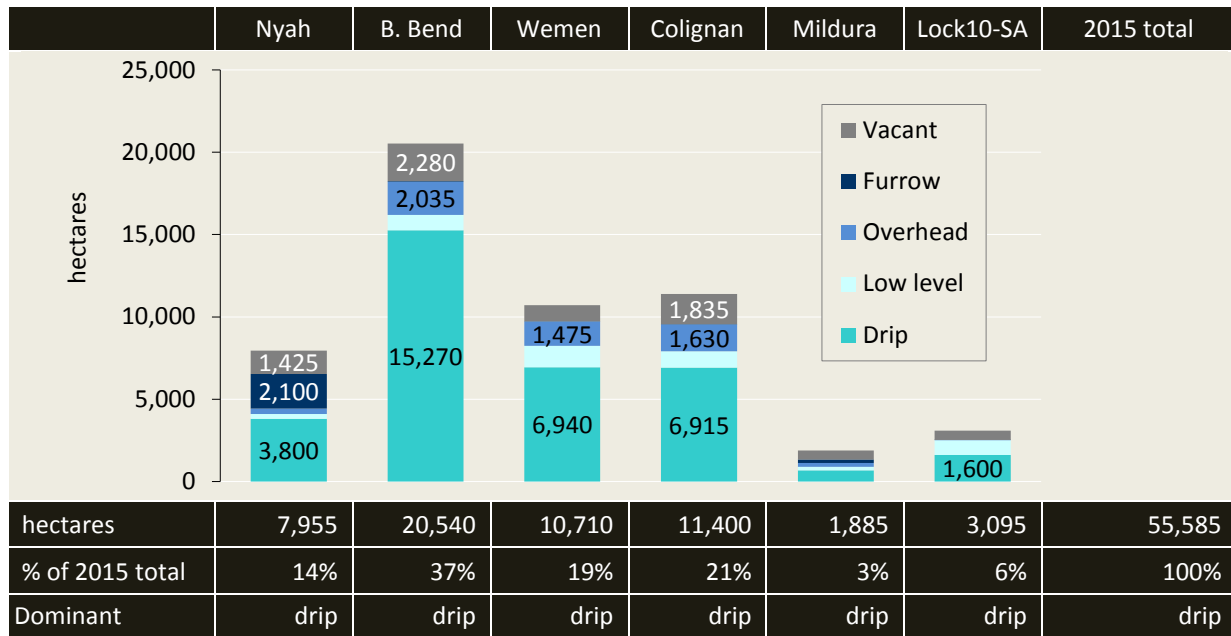


Figure 53: Private diverters - irrigation methods in each river reach in 2015

3.1.5 Private diverters summary – salinity impact zones

Figure 54 summarises the irrigable area in each river salinity impact zone across the private diverter river reaches from 1997 to 2015.

- Irrigation development was predominantly in the lowest salinity impact zone, LIZ 1, across the private diverter river reaches from 1997 to 2015. The dominant zone changed from LIZ 2 to LIZ 1 between 1997 and 2003.
- In 2015, the irrigable area of 55,585 ha comprised:
 - 52% (28,955 ha) in the lowest salinity impact zone, LIZ 1;
 - 23% (12,670 ha) in LIZ 2;
 - 5% (2,460 ha) in LIZ 3;
 - 15% (8,445 ha) in LIZ 4; and
 - 5% (3,055 ha) in the high salinity impact zone, HIZ.
- The area irrigated in:
 - LIZ increased by 21,175 ha, a 112% increase from 18,890 ha in 1997 to 46,065 ha in 2015; and
 - HIZ decreased by 630 ha, a 25% decrease from 2,505 ha in 1997 to 1,875 ha in 2015.
- The irrigable area in:
 - LIZ increased by 33,245 ha, a 172% increase from 19,285 ha in 1997 to 52,530 ha in 2015; and
 - HIZ increased by 120 ha, a 4% increase from 2,935 ha in 1997 to 3,055 ha in 2015.

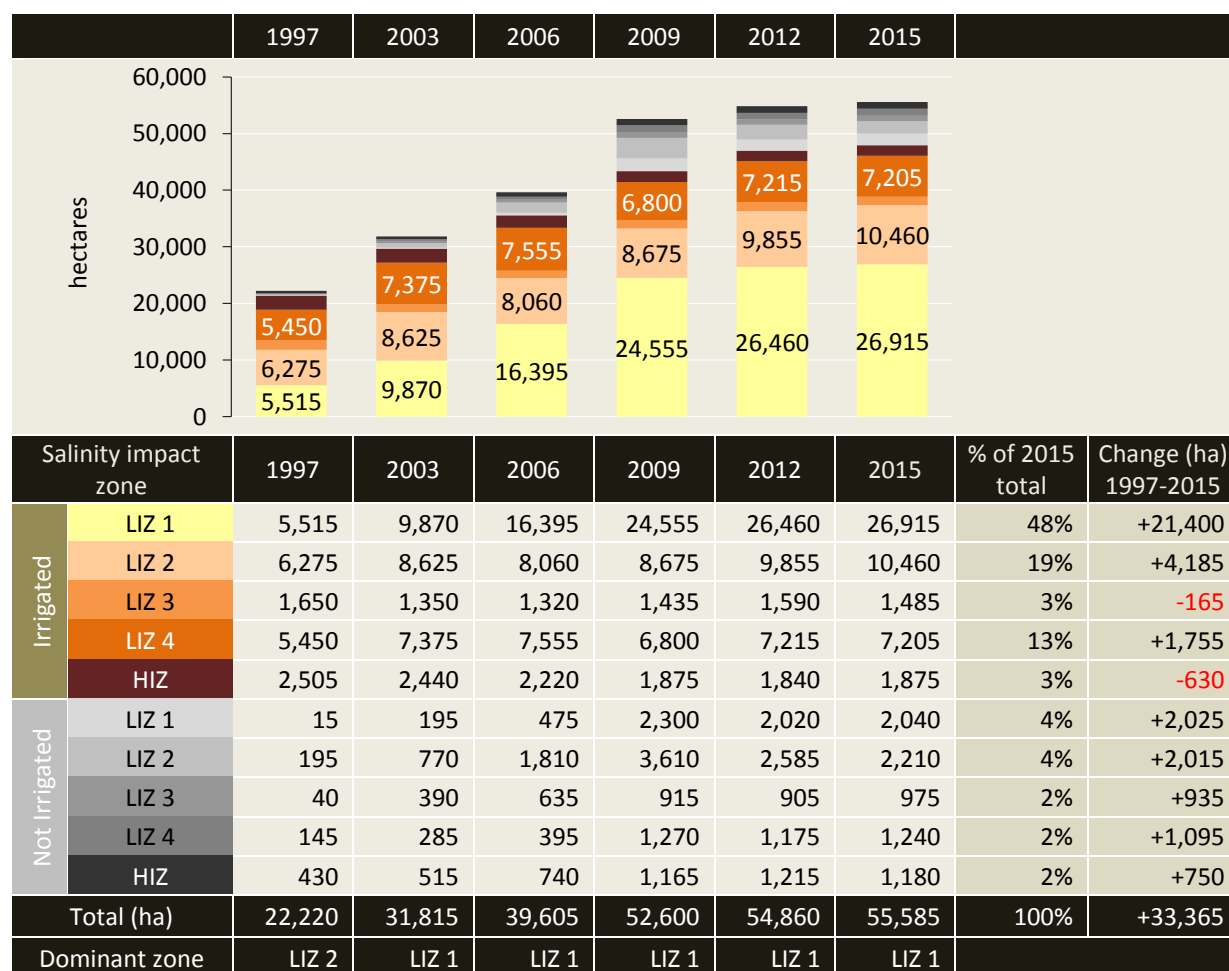


Figure 54: Private diverters - irrigable area in each salinity impact zone from 1997 to 2015

Salinity zones in each of the private diverter river reaches

Figure 55 compares salinity impact zones in each of the private diverter river reaches in 2015.

- The irrigable area in each of the private diverter river reaches was predominantly in low salinity impact zones, except for the Mildura river reach which was predominantly in the HIZ.

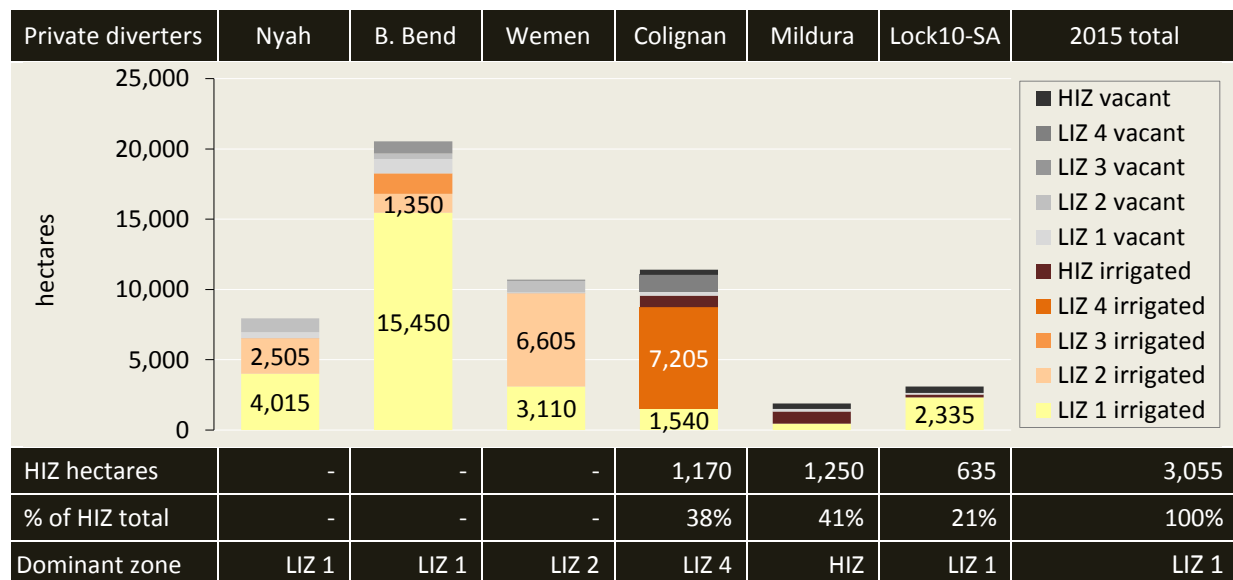


Figure 55: Private diverters - salinity impact zones in each river reach in 2015

3.1.6 Private diverters summary – irrigation development

Figure 56 summarises irrigation development, from 1997 to 2015, across the private diverter river reaches with respect to new development (expansion) and areas retired³³ from irrigation.

- The irrigable area increased by 33,365 ha, a 150% increase from 22,220 ha in 1997 to 55,585 ha in 2015.
- The net increase of 33,365 comprised 510 ha retired from irrigation and 33,875 ha of expansion. Only 9% of this expansion occurred between 2009 and 2015.
- Expansion occurred in all of the six river reaches between 1997 and 2015. The largest growth areas were:
 - The Boundary Bend river reach with expansion of 15,175 ha, a 283% increase from 5,365 ha in 1997 to 20,540 ha in 2015; and
 - The Wemen river reach with expansion of 8,560 ha, a 398% increase from 2,150 ha in 1997 to 10,710 ha in 2015.

River reach	1997 (ha)	1997 to 2015		2015 (ha)	Change 1997-2015	Growth 1997-2015
		Retired	New			
Nyah	4,695	-30	+3,290	7,955	+3,260	+69%
Boundary Bend	5,365	-170	+15,345	20,540	+15,175	+283%
Wemen	2,150	-40	+8,600	10,710	+8,560	+398%
Colignan	6,925	-70	+4,545	11,400	+4,475	+65%
Mildura	1,445	-55	+495	1,885	+440	+30%
Lock10 to Sth Aus.	1,640	-145	+1,600	3,095	+1,455	+89%
Total	22,220	-510	+33,875	55,585	+33,365	+150%

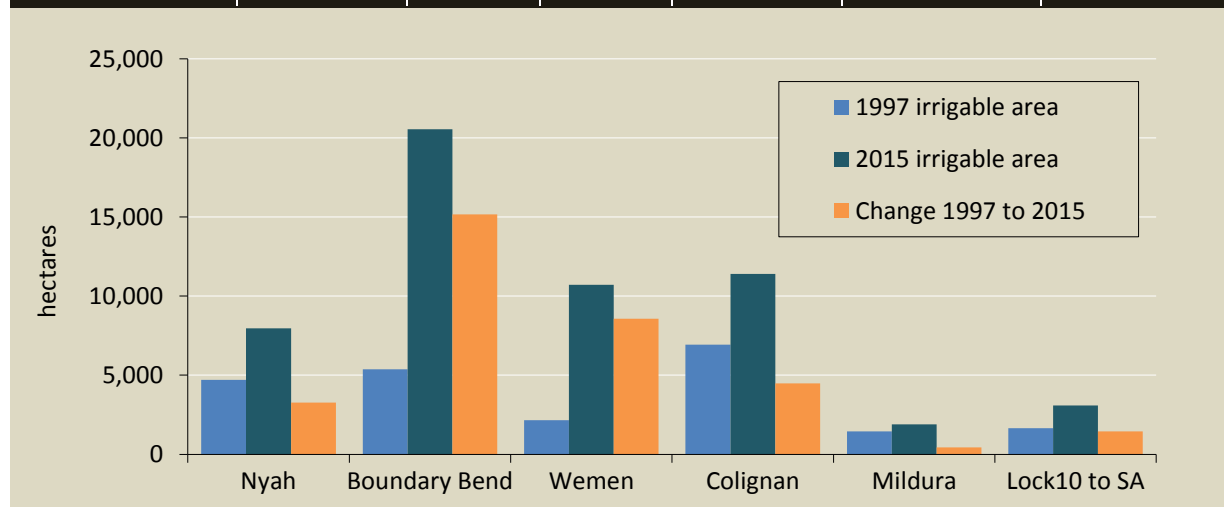


Figure 56: Private diverters - irrigation development from 1997 to 2015

³³ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

3.1.7 Private diverters summary – property change

Figure 57 provides estimates of property numbers and average property size (irrigable area) in the private diverter river reaches from 1997 to 2015.

- There were approximately 448 irrigation properties (land holdings) in the private diverter river reaches in 2015.
- Property numbers declined by 54, an 11% decrease from 502 in 1997 to 448 in 2015.
- The number of properties less than 40 ha (irrigable area) declined by 92, while the number over 40 ha increased by 38.
- Average property size (irrigable area) increased from 44 ha in 1997 to 124 ha in 2015.

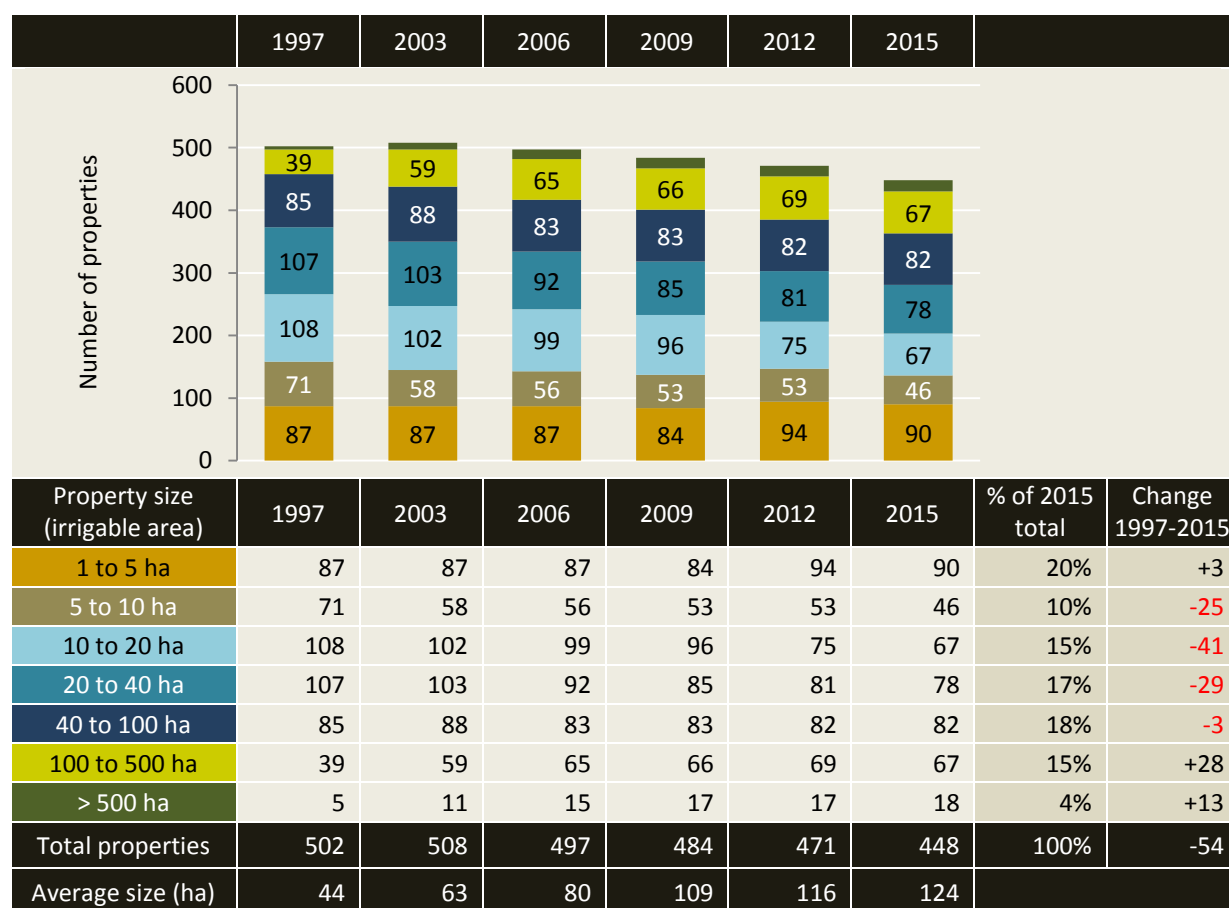


Figure 57: Private diverters - property numbers and sizes from 1997 to 2015

Irrigation properties in each of the private diverter areas

Figure 58 provides an estimate of property numbers and average property size (irrigable area) in each of the private diverter river reaches in 2015.

- The largest number of private diverter properties, 147 (32%), were in the Colignan river reach in 2015.
- Average irrigable area for a property in the private diverter areas was 124 ha (Figure 57) in 2015.
- The average irrigable area for a property in the Boundary Bend, Wemen and Lock 10 to South Australia river reaches was greater than the regional average of 124 ha in 2015.

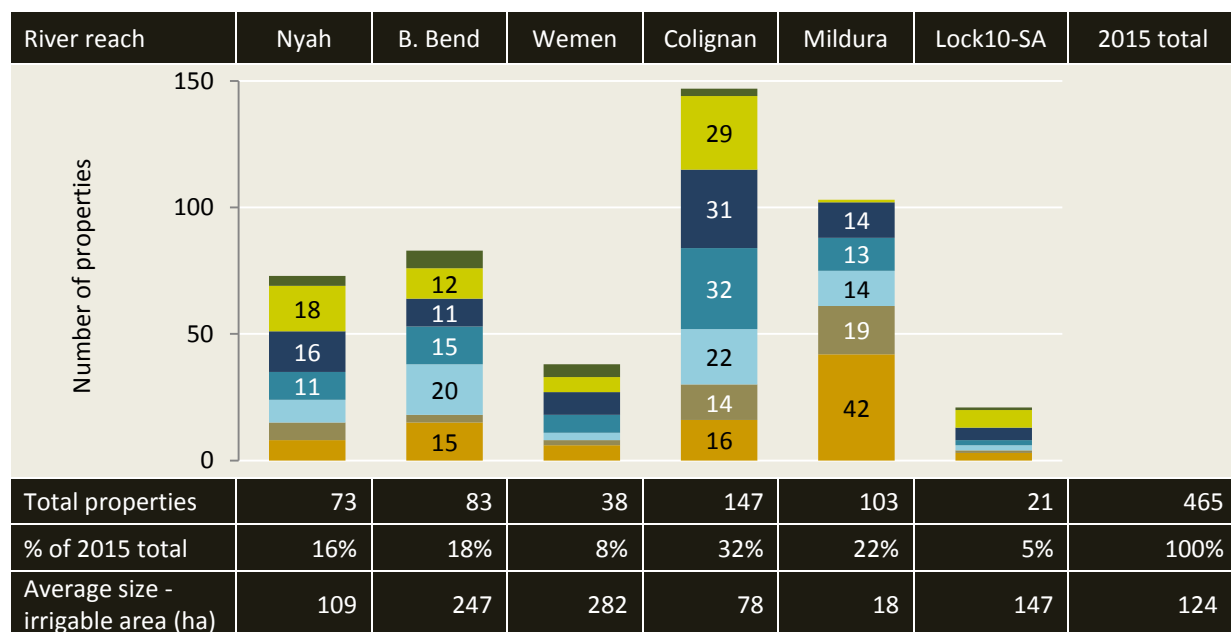


Figure 58: Private diverters - property numbers and average size in each river reach in 2015

Note: The total number of private diverters in Figure 58 (465 properties) is the sum of each river reach and is greater than the total across the private diverter areas in Figure 57 (448 properties) as some property owners have irrigated land in more than one river reach.

3.2 Nyah river reach (*Nyah to the Wakool junction*)

In summary for the Nyah river reach

Crop types

- In the Nyah river reach, broad-acre field crops were the dominant crop type from 1997 to 2015, except in 2009 when drought and low water allocations reduced seasonal cropping (field crops and vegetables) to just 410 ha. Nut trees (almonds) were temporarily the dominant crop in 2009.
- Almond plantings increased by 2,230 ha, from no plantings in 1997 and 2003 to 2,230 ha in 2015. 85% of the plantings occurred between 2006 and 2009.
- The irrigable area in 2015 was 7,955 ha comprising:
 - 47% (3,735 ha) irrigated permanent plantings;
 - 35% (2,795 ha) irrigated seasonal crops;
 - 14% (1,100 ha) vacant or not irrigated for less than 10 years; and
 - 4% (325 ha) vacant or not irrigated for more than 10 years.

Grapevines

- Grapevines in the Nyah river reach were predominantly grown for wine production from 1997 to 2015.
- The area of grapevines increased by 535 ha, a 243% increase from 220 ha in 1997 to 755 ha in 2015.
- In 2015, the 755 ha of grapevines comprised:
 - 84% (635 ha) wine grape plantings; and
 - 16% (120 ha) table grape plantings.

Irrigation methods

- Drip irrigation was the dominant irrigation method in the Nyah river reach from 2009 to 2015. Furrow irrigation was the dominant method prior to 2009, from 1997 to 2006.
- In 2015, the irrigable area of 7,955 ha comprised:
 - 48% (3,800 ha) drip irrigation;
 - 4% (305 ha) low level irrigation;
 - 4% (325 ha) overhead sprinklers;
 - 26% (2,100 ha) furrow irrigation; and
 - 18% (1,425 ha) not irrigated.

Salinity impact zones

- The Nyah river reach is in the low salinity impact zones; LIZ 1, LIZ 2 and LIZ 3.
- In 2015, the irrigable area of 7,955 ha comprised:
 - 55% (4,445 ha) in the lowest salinity impact zone, LIZ 1;
 - 44% (3,500 ha) in LIZ 2; and
 - <1% (10 ha) in LIZ 3.
- Irrigation development from 1997 to 2015 occurred predominantly in LIZ 1.

In summary for the Nyah river reach

Irrigation development

- In the Nyah river reach the irrigable area increased by 3,260 ha; a 69% increase from 4,695 ha in 1997 to 7,955 ha in 2015.
- The net increase of 3,260 ha comprised 30 ha retired from irrigation and 3,290 ha of expansion.

Irrigation properties

- There were approximately 73 irrigation properties (land holdings) in the Nyah river reach in 2015.
- Change in property numbers and size from 1997 to 2015:
 - Property numbers declined by 12, a 14% decrease from 85 in 1997 to 73 in 2015.
 - Properties with an irrigable area of less than 40 ha declined by 17, while the number over 40 ha increased by 5.
 - Average property size (irrigable area) increased from 55 ha in 1997 to 109 ha in 2015.

3.2.1 Nyah river reach - crop types in 2015

Nyah river reach crop types in 2015 are shown in Table 17 and Map 12.

- Dominant plantings in the Nyah river reach in 2015 were:
 - Almond trees, 28% of the irrigable area; and
 - Cereal crops, at least 12% of the irrigable area (10% of the irrigable area was unspecified field crops which may include cereal crops).

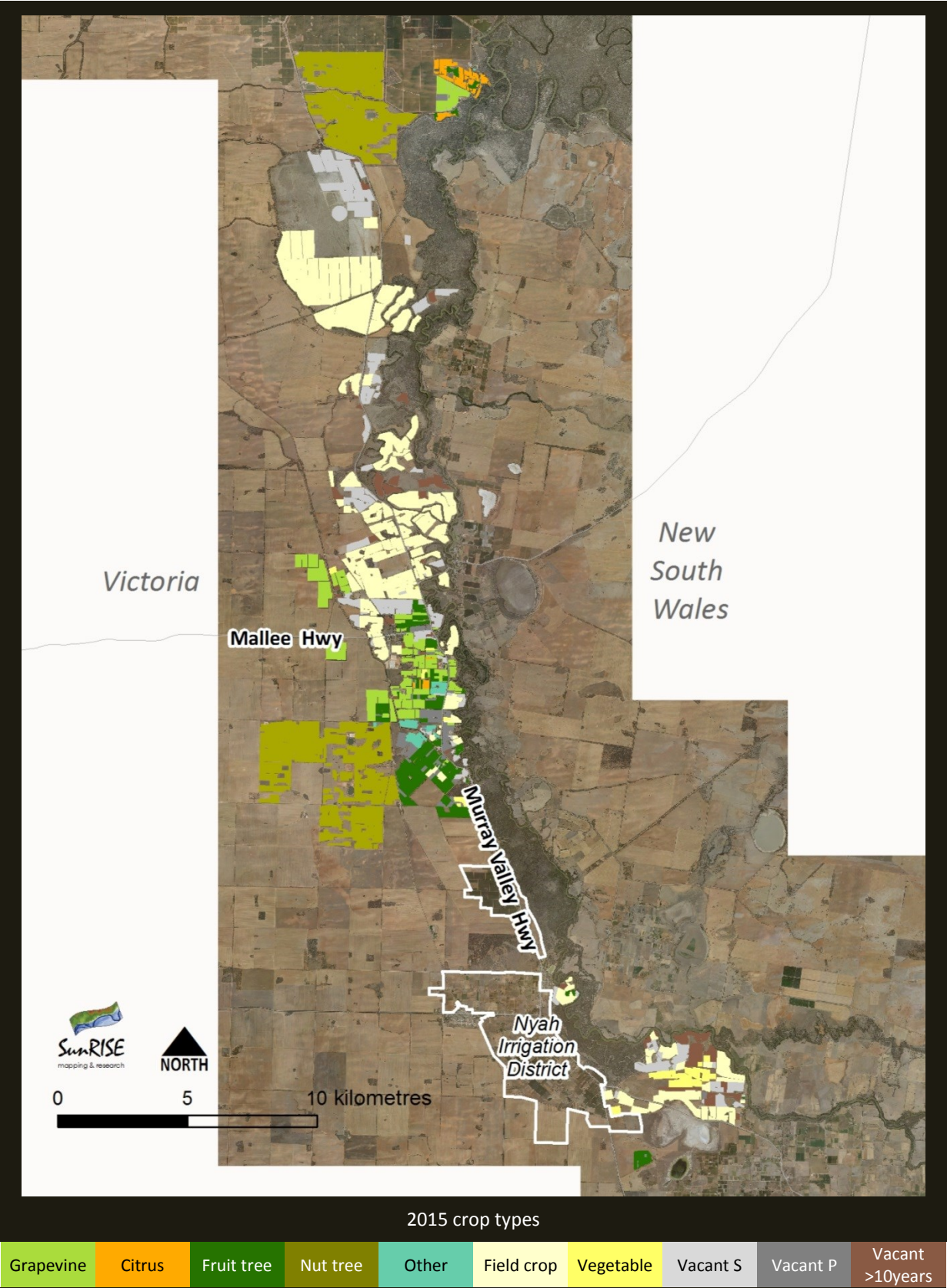
Table 17: Nyah river reach - crop types in 2015

Crop type		Category	2015 (ha)	2015 %	Description
Permanent crops	Grapevine	Wine	635	8%	
		Table	120	2%	
		Dried	-	-	
		Other	-	-	
	Citrus		130	2%	
	Fruit tree	<i>unspecified</i>	10	<1%	<i>Fruit tree category unknown</i>
		Avocado	15	<1%	
		Olive	5	<1%	
		Stone fruit	510	6%	
		Other	-	-	
	Nut tree	Almond	2,230	28%	
		Other	-	-	
	Other	Nursery	65	1%	
		Woodlot	15	<1%	
		Misc.	-	-	
	Permanent crops (sub-total)		3,735	47%	
	Vacant P	≤ 10 years	200	3%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	5	<1%	Vacant (not irrigated) for over ten years
Seasonal crops	Field crop	<i>unspecified</i>	770	10%	<i>Field crop category unknown</i>
		Cereal	950	12%	
		Lucerne	250	3%	
		Pasture	220	3%	
		Other	445	6%	
	Vegetable	<i>unspecified</i>	30	<1%	<i>Vegetable category unknown</i>
		Asparagus	-	-	
		Carrot	90	1%	
		Cucurbit	5	<1%	
		Potato	-	-	
		Other	35	<1%	
	Seasonal crops (sub-total)		2,795	35%	
	Vacant S	≤ 10 years	900	11%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	320	4%	Vacant (not irrigated) for over ten years
Total all crop areas			7,955	100%	

Note: '*unspecified*' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Nyah river reach 2015 crop types

Map 12: Nyah river reach showing 2015 crop types



3.2.2 Nyah river reach – change in crop types

Figure 59 summarises crop types in the Nyah river reach from 1997 to 2015.

- Field crops were the dominant crop type in the Nyah river reach from 1997 to 2015, except in 2009 when drought and low water allocations reduced seasonal cropping (field crops and vegetables) to just 410 ha. Nut trees (almonds) were temporarily the dominant crop in 2009.
- Between 1997 and 2015, the area of irrigated field crops decreased by 1,035 ha, while the area of almond plantings increased by 2,230 ha. 85% of the increase in almond plantings occurred between 2006 and 2009.
- In 2015, the irrigable area of 7,955 ha comprised:
 - 47% (3,735 ha) irrigated permanent plantings;
 - 35% (2,795 ha) irrigated seasonal crops;
 - 14% (1,100 ha) vacant or not irrigated for less than 10 years; and
 - 4% (325 ha) vacant or not irrigated for more than 10 years.

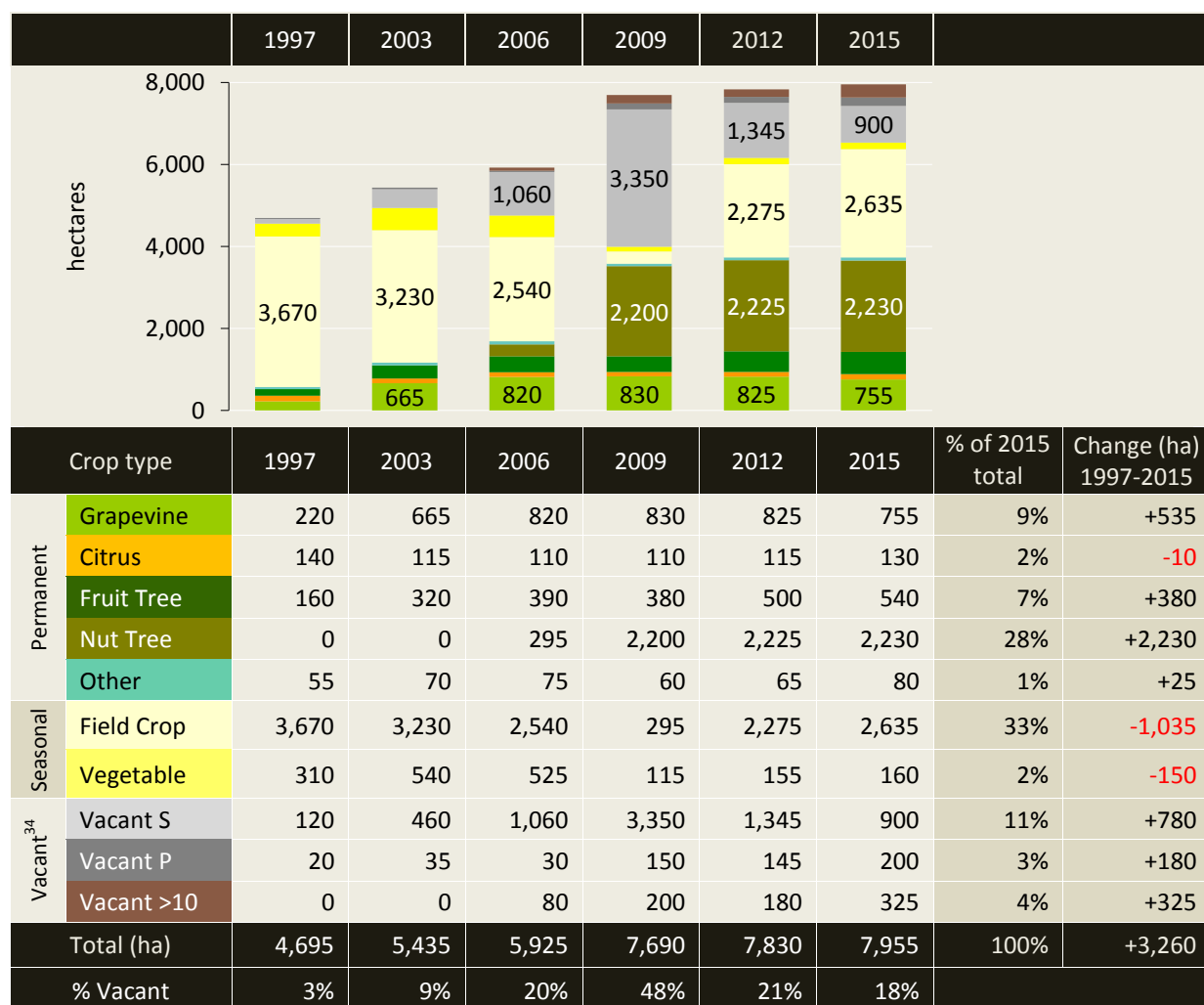


Figure 59: Nyah river reach - crop types from 1997 to 2015

³⁴ Vacant S: not irrigated but previously an irrigated seasonal crop. Vacant P: not irrigated but previously an irrigated permanent planting. Vacant >10: not irrigated for over ten years but previously an irrigated area.

3.2.3 Nyah river reach – grapevines

Figure 60 summarises grapevine types in the Nyah river reach from 1997 to 2015.

- The area of grapevines increased by 535 ha, a 243% increase from 220 ha in 1997 to 755 ha in 2015.
- In 2015, the 755 ha of grapevines comprised:
 - 84% (635 ha) wine grape plantings; and
 - 16% (120 ha) table grape plantings.
- Wine grape plantings increased by 510 ha, a 408% increase from 125 ha in 1997 to 635 ha in 2015.
 - Wine grape plantings were the dominant grapevine type from 1997 to 2015.
- Table grape plantings increased by 30 ha, a 33% increase from 90 ha in 1997 to 120 ha in 2015.
- Dried grape plantings decreased by 5 ha, from 5 ha in 1997 to 0 ha in 2015.

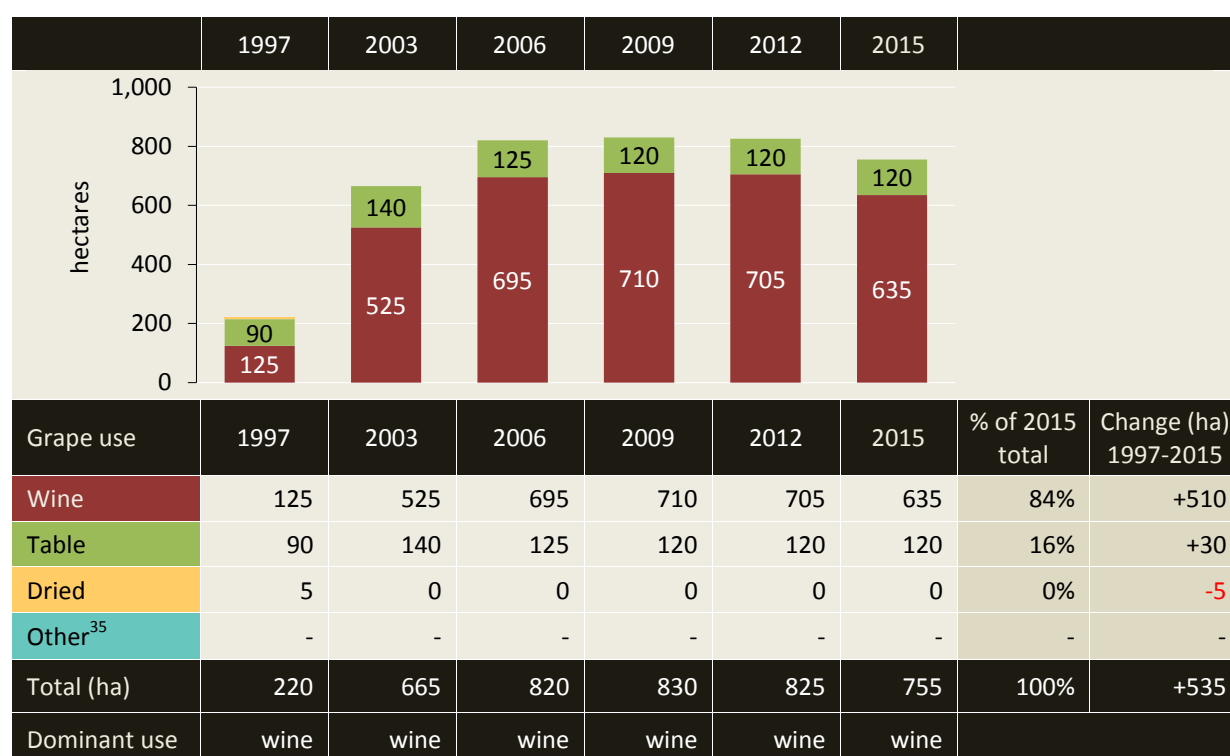


Figure 60: Nyah river reach - grapevine plantings from 1997 to 2015

³⁵ Other: grapes for juicing, cannery, research and trial varieties.

3.2.4 Nyah river reach – irrigation methods

Figure 61 summarises irrigation methods in the Nyah river reach from 1997 to 2015.

- In 2015, the irrigable area of 7,955 ha comprised:
 - 48% (3,800 ha) drip irrigation;
 - 4% (305 ha) low level irrigation;
 - 4% (325 ha) overhead sprinklers;
 - 26% (2,100 ha) furrow irrigation; and
 - 18% (1,425 ha) not irrigated.
- Drip irrigation increased by 3,735 ha, a 5,746% increase from 65 ha in 1997 to 3,800 ha in 2015.
 - Drip irrigation was the dominant irrigation method from 2009 to 2015.
- Low level irrigation increased by 145 ha, a 91% increase from 160 ha in 1997 to 305 ha in 2015.
- Overhead irrigation decreased by 270 ha, a 45% decrease from 595 ha in 1997 to 325 ha in 2015.
- Furrow irrigation decreased by 1,635 ha, a 44% decrease from 3,735 ha in 1997 to 2,100 ha in 2015.
 - Furrow irrigation was the dominant irrigation method from 1997 to 2006.
 - Furrow irrigation temporarily decreased to only 290 ha in 2009 when few seasonal crops were irrigated due to drought conditions and high water prices.

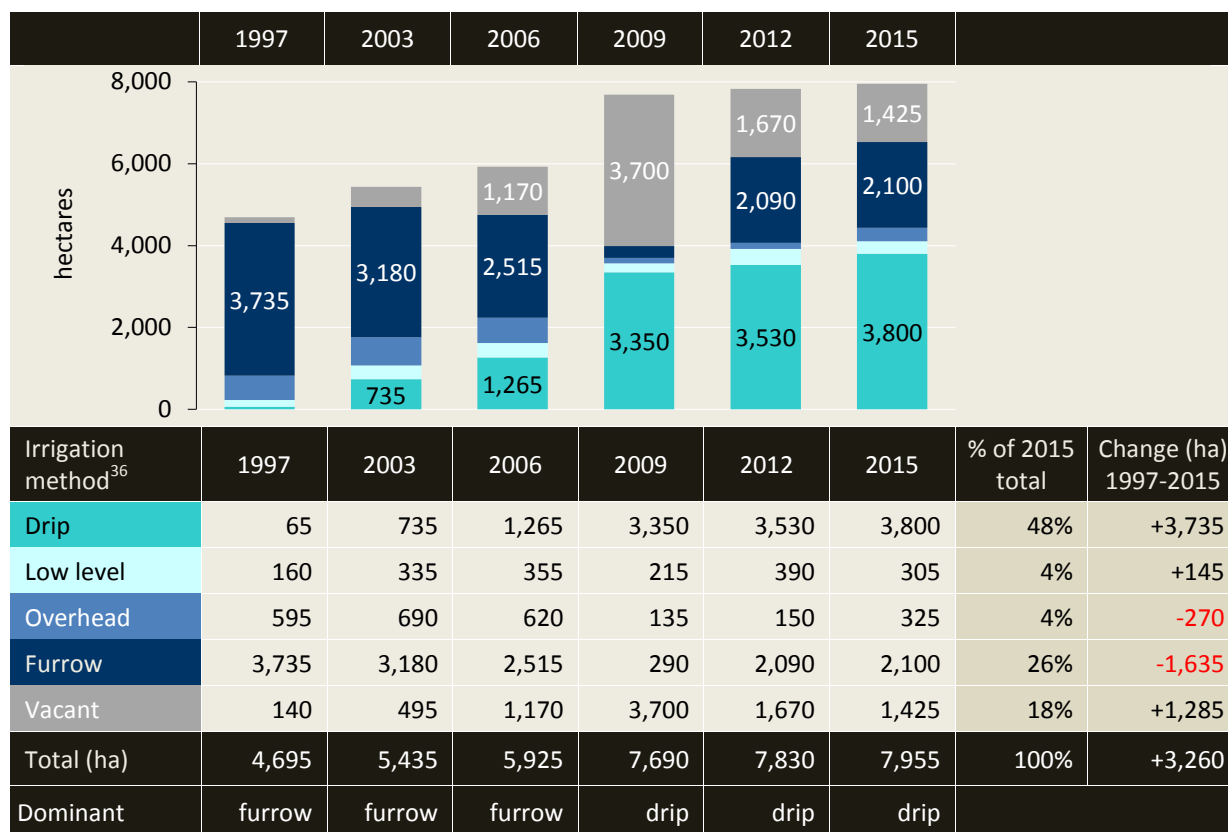


Figure 61: Nyah river reach - irrigation methods from 1997 to 2015

³⁶ Overhead irrigation includes pivots and lateral move systems. Furrow includes flood irrigation. (Table 8)

3.2.5 Nyah river reach – salinity impact zones

Figure 62 summarises the irrigable area in each river salinity impact zone in the Nyah river reach from 1997 to 2015.

- In 2015, the irrigable area of 7,955 ha comprised:
 - 55% (4,445 ha) in the lowest salinity impact zone, LIZ 1;
 - 44% (3,500 ha) in LIZ 2; and
 - <1% (10 ha) in LIZ 3.
- The area irrigated in:
 - LIZ 1 increased by 2,440 ha, a 155% increase from 1,575 ha in 1997 to 4,015 ha in 2015;
 - LIZ 2 decreased by 465 ha, a 16% decrease from 2,970 ha in 1997 to 2,505 ha in 2015; and
 - LIZ 3 was 10 ha in 1997 and 2015.
- The irrigable area in:
 - LIZ 1 increased by 2,865 ha, a 181% increase from 1,580 ha in 1997 to 4,445 ha in 2015;
 - LIZ 2 increased by 395 ha, a 13% increase from 3,105 ha in 1997 to 3,500 ha in 2015; and
 - LIZ 3 was 10 ha in 1997 and 2015.
- Irrigation development from 1997 to 2015 occurred predominantly in LIZ 1.

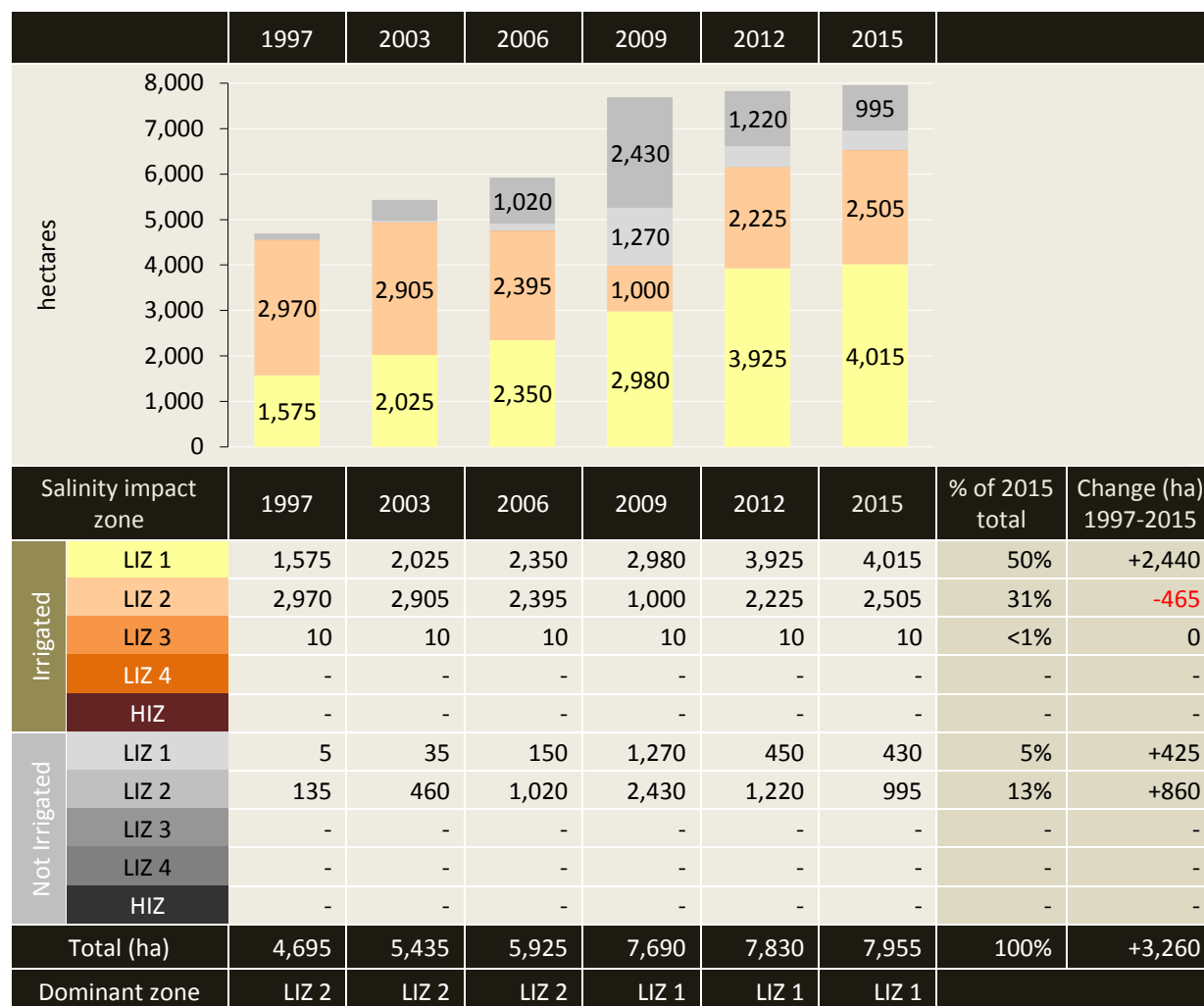


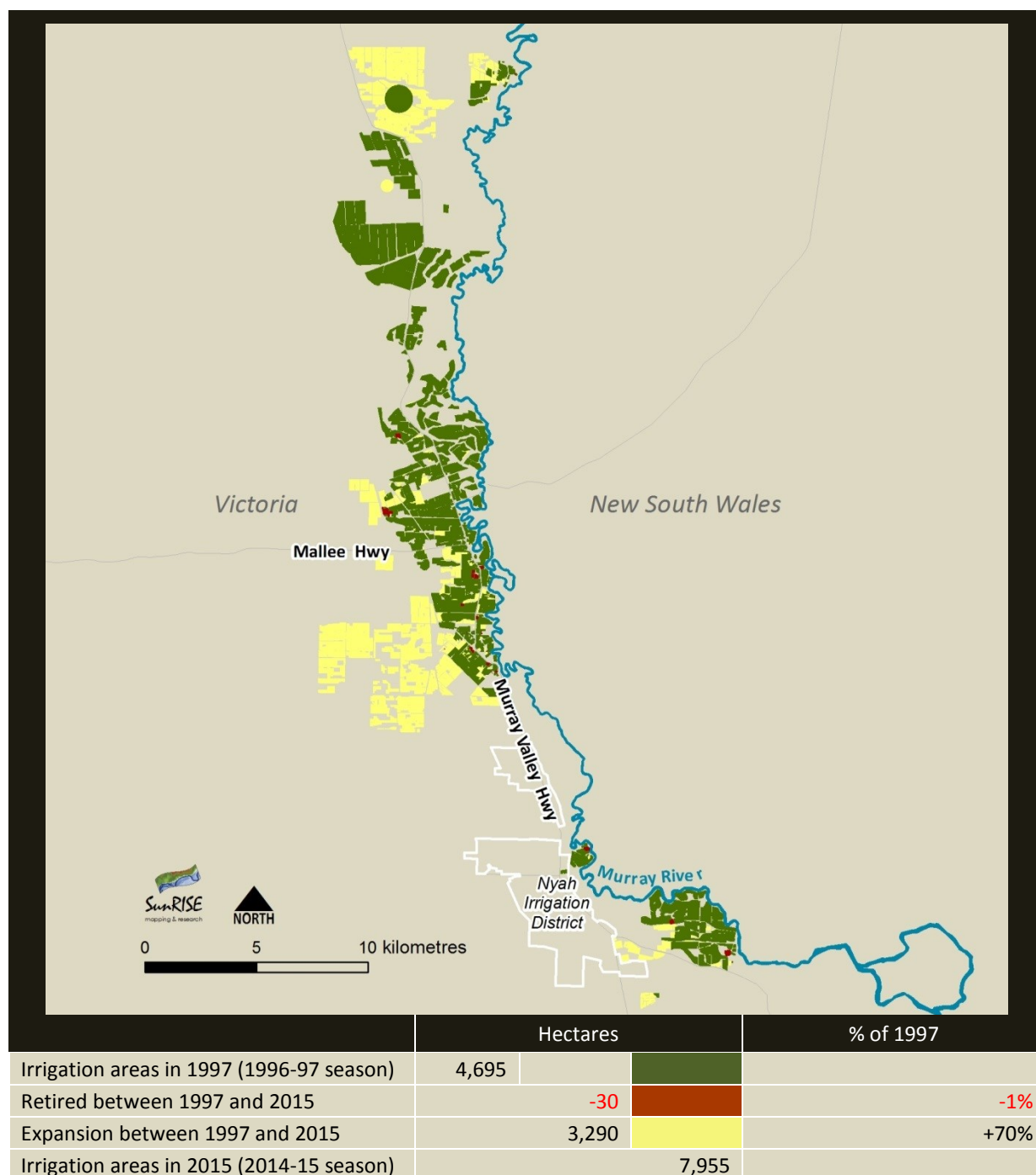
Figure 62: Nyah river reach - irrigable area in each salinity impact zone from 1997 to 2015

3.2.6 Nyah river reach – irrigation development

Map 13 shows irrigation development, from 1997 to 2015, in the Nyah river reach with respect to new development (expansion) and areas retired³⁷ from irrigation.

- The irrigable area increased by 3,260 ha; a 69% increase from 4,695 ha in 1997 to 7,955 ha in 2015.
- The net increase of 3,260 ha comprised 30 ha retired from irrigation and 3,290 ha of expansion.

Map 13: Nyah river reach – irrigation development from 1997 to 2015



³⁷ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

3.2.7 Nyah river reach – property change

Figure 63 provides estimates of property numbers and average property size (irrigable area) in the Nyah river reach from 1997 to 2015.

- There were approximately 73 irrigation properties (land holdings) in the Nyah river reach in 2015.
- Property numbers declined by 12, a 14% decrease from 85 in 1997 to 73 in 2015.
- The number of properties less than 40 ha (irrigable area) declined by 17, while the number over 40 ha increased by 5.
- Average property size (irrigable area) increased from 55 ha in 1997 to 109 ha in 2015.

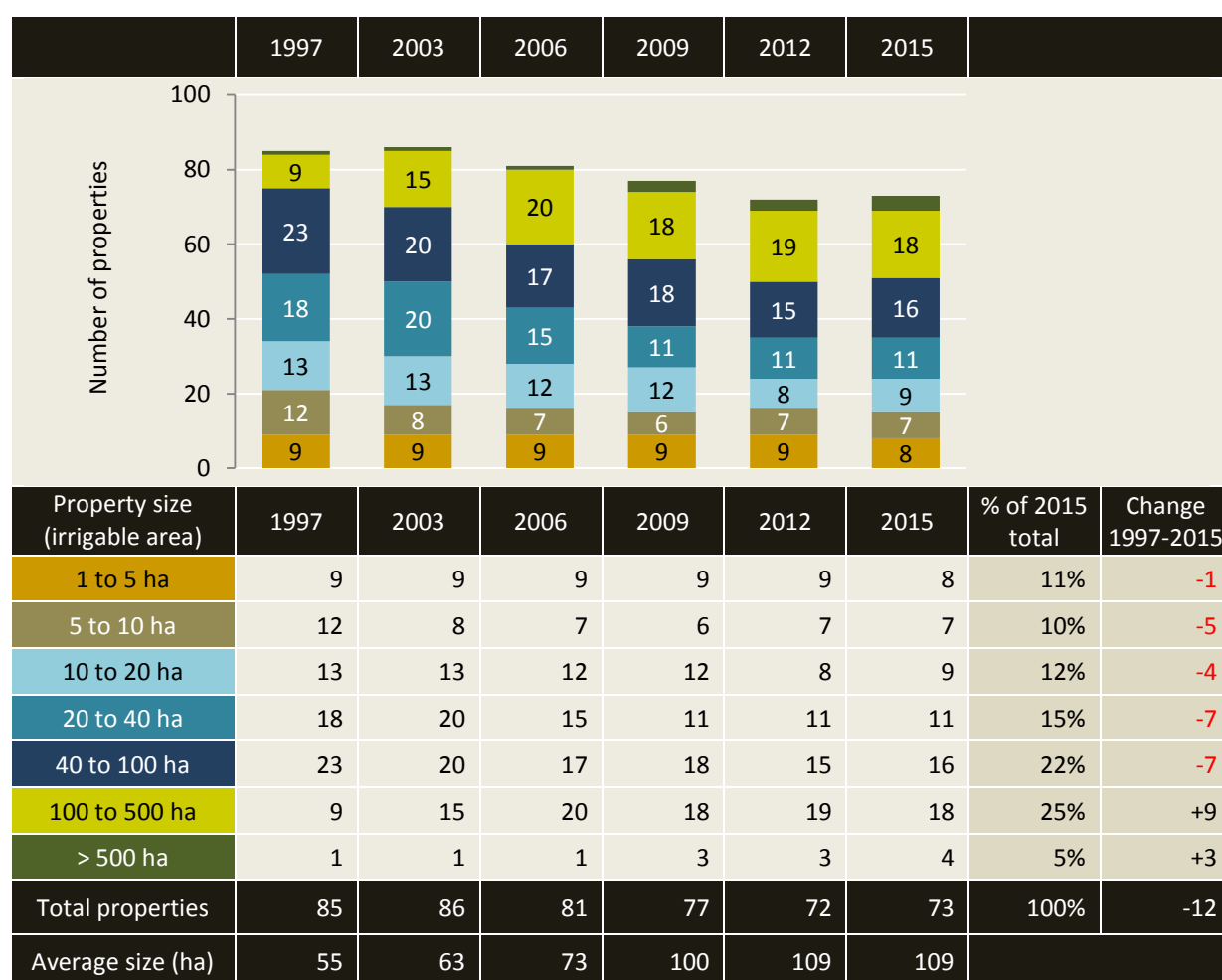


Figure 63: Nyah river reach - property numbers and sizes from 1997 to 2015

3.3 Boundary Bend river reach (*Wakool to Euston weir*)

In summary for the Boundary Bend river reach

Crop types

- Nut trees (99% almonds, (Table 18)) were the dominant crop type in the boundary Bend river reach from 2006 to 2015. Prior to 2006, vegetables were the dominant crop in 1997 and 2003.
- Nut trees dominated development from 1997 to 2015. Plantings increased by 9,825 ha, a 1,301% increase from 755 ha in 1997 to 10,580 ha in 2015.
- In 2015, the irrigable area was 20,540 ha comprising:
 - 80% (16,315 ha) irrigated permanent plantings;
 - 9% (1,945 ha) irrigated seasonal crops;
 - 9% (1,810 ha) vacant or not irrigated for less than 10 years; and
 - 2% (470 ha) vacant or not irrigated for more than 10 years.

Grapevines

- Grapevines in the Boundary Bend river reach were predominantly grown for table grapes in 1997 and in 2015. However, from 2003 to 2012, they were predominantly grown for wine production.
- The area of grapevines increased by 1,555 ha, a 161% increase from 965 ha in 1997 to 2,520 ha in 2015.
- In 2015, the 2,520 ha of grapevines comprised:
 - 50% (1,255 ha) wine grape plantings; and
 - 50% (1,265 ha) table grape plantings.

Irrigation methods

- Drip irrigation was the dominant irrigation method in the Boundary Bend river reach from 2006 to 2015. Overhead sprinklers were the dominant method prior to 2006, from 1997 to 2003.
- In 2015, the irrigable area of 20,540 ha comprised:
 - 74% (15,270 ha) drip irrigation;
 - 4% (920 ha) low level irrigation;
 - 10% (2,035 ha) overhead sprinklers;
 - < 1% (35 ha) furrow irrigation; and
 - 11% (2,280 ha) not irrigated.

Salinity impact zones

- The Boundary Bend river reach is in the low salinity impact zones; LIZ 1, LIZ 2 and LIZ 3.
- In 2015, the irrigable area of 20,540 ha comprised:
 - 80% (16,470 ha) in the lowest salinity impact zone, LIZ 1;
 - 9% (1,745 ha) in LIZ 2; and
 - 11% (2,325 ha) in LIZ 3.
- Irrigation development from 1997 to 2015 occurred predominantly in LIZ 1.

In summary for the Boundary Bend river reach

Irrigation development

- In the Boundary Bend river reach the irrigable area increased by 15,175 ha, a 283% increase from 5,365 ha in 1997 to 20,540 ha in 2015.
- The net increase of 15,175 ha comprised 170 ha retired from irrigation and 15,345 ha of expansion.

Irrigation properties

- There were approximately 83 irrigation properties (land holdings) in the Boundary Bend reach in 2015.
- Change in property numbers and size from 1997 to 2015:
 - Property numbers declined by 31, a 27% decrease from 114 in 1997 to 83 in 2015.
 - Properties with an irrigable area of less than 40 ha declined by 42, while the number over 40 ha increased by 11.
 - Average property size (irrigable area) increased from 47 ha in 1997 to 247 ha in 2015.

3.3.1 Boundary Bend river reach - crop types in 2015

Boundary Bend river reach crop types in 2015 are shown in Table 18 and Map 14.

- Dominant plantings in the Boundary Bend river reach in 2015 were:
 - Almond trees, 51% of the irrigable area; and
 - Olive trees, 13% of the irrigable area.

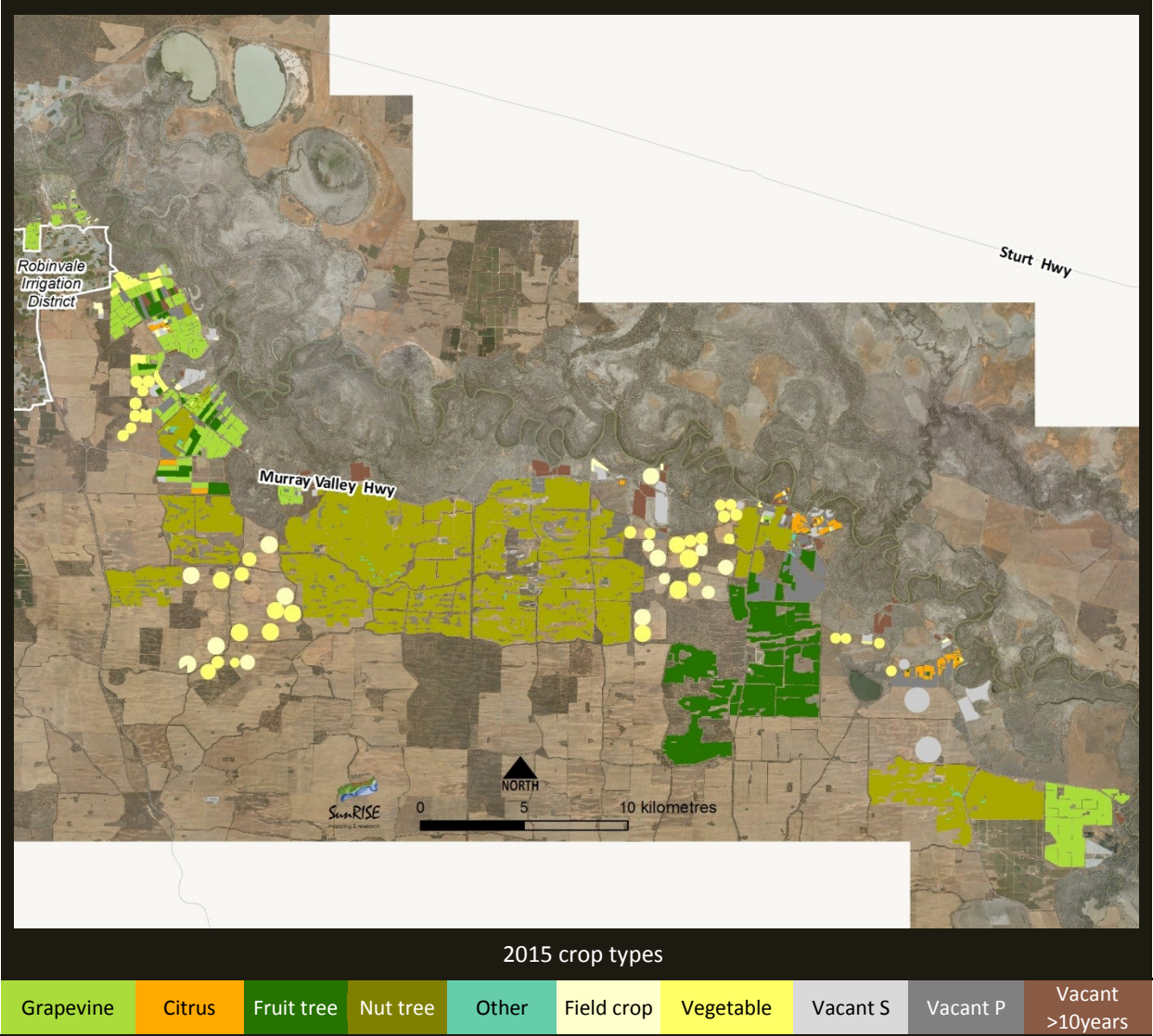
Table 18: Boundary Bend river reach - crop types in 2015

	Crop type	Category	2015 (ha)	2015 %	Description
Permanent crops	Grapevine	Wine	1,255	6%	
		Table	1,265	6%	
		Dried	-	-	
		Other	-	-	
	Citrus		275	1%	Grapefruit, Lemon, Mandarin, Navel, Blood Orange, Other Orange, Pummelo, Valencia
	Fruit tree	<i>unspecified</i>	-	-	
		Avocado	215	1%	
		Olive	2,630	13%	
		Stone fruit	5	<1%	
		Other	40	<1%	Fig, Mango, Persimmon, Pome Fruit, Pomegranate
	Nut tree	Almond	10,380	51%	
		Other	200	1%	Pistachio
	Other	Nursery	5	<1%	
		Woodlot	45	<1%	
		Misc.	-	-	
Permanent crops (sub-total)		16,315	79%		
Vacant P	≤ 10 years	1,060	5%	Vacant (not irrigated) for ten years or less	
Vacant >10	> 10 years	55	<1%	Vacant (not irrigated) for over ten years	
Seasonal crops	Field crop	<i>unspecified</i>	-	-	
		Cereal	570	3%	
		Lucerne	15	<1%	
		Pasture	50	<1%	
		Other	5	<1%	Cover crop
	Vegetable	<i>unspecified</i>	5	<1%	<i>Vegetable category unknown</i>
		Asparagus	105	1%	
		Carrot	260	1%	
		Cucurbit	5	<1%	
		Potato	905	4%	
		Other	25	<1%	Garlic
		Seasonal crops (sub-total)		1,945	9%
	Vacant S	≤ 10 years	750	4%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	415	2%	Vacant (not irrigated) for over ten years
Total all crop areas		20,540	100%		

Note: '*unspecified*' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Boundary Bend river reach 2015 crop types

Map 14: Boundary Bend river reach showing 2015 crop types



3.3.2 Boundary Bend river reach – change in crop types

Figure 64 summarises crop types in the Boundary Bend river reach from 1997 to 2015.

- Nut trees (99% almonds, (Table 18)) were the dominant crop type in the boundary Bend river reach from 2006 to 2015. Prior to 2006, vegetables were the dominant crop in 1997 and 2003.
- Nut trees dominated development from 1997 to 2015. Plantings increased by 9,825 ha, a 1,301% increase from 755 ha in 1997 to 10,580 ha in 2015.
- The increase in vacant areas that were previously permanent plantings (Vacant P) between 2009 and 2012 was largely due to loss of almond trees drowned in February 2011 flooding and removal of unproductive olive trees. The net area of nut trees still increased in this period as there were new plantings.
- In 2015, the irrigable area of 20,540 ha comprised:
 - 80% (16,315 ha) irrigated permanent plantings;
 - 9% (1,945 ha) irrigated seasonal crops;
 - 9% (1,810 ha) vacant or not irrigated for less than 10 years; and
 - 2% (470 ha) vacant or not irrigated for more than 10 years.

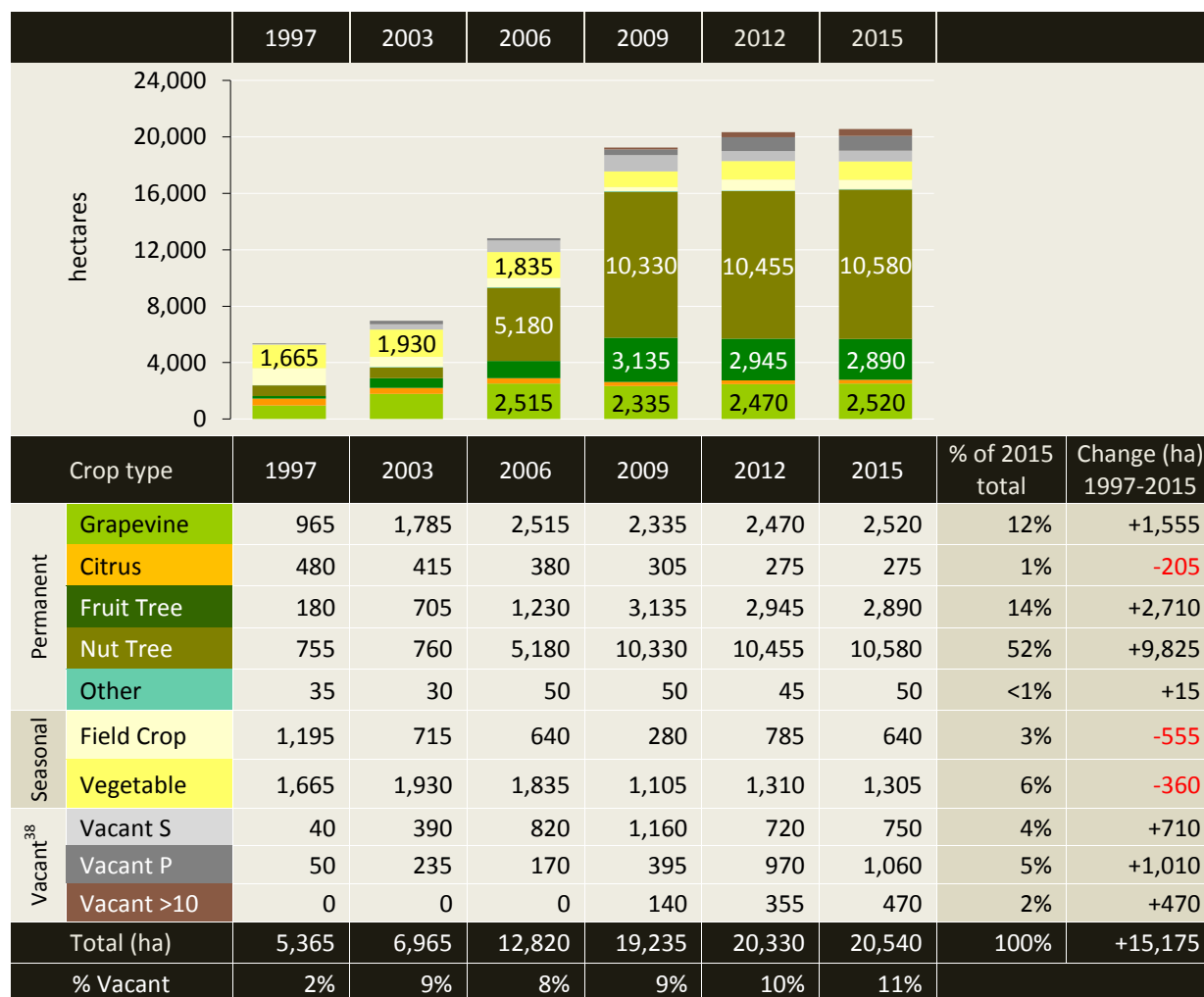


Figure 64: Boundary Bend river reach - crop types from 1997 to 2015

³⁸ Vacant S: not irrigated but previously an irrigated seasonal crop. Vacant P: not irrigated but previously an irrigated permanent planting. Vacant >10: not irrigated for over ten years but previously an irrigated area.

3.3.3 Boundary Bend river reach – grapevines

Figure 65 summarises grapevine types in the Boundary Bend river reach from 1997 to 2015.

- The area of grapevines increased by 1,555 ha, a 161% increase from 965 ha in 1997 to 2,520 ha in 2015.
- In 2015, the 2,520 ha of grapevines comprised:
 - 50% (1,255 ha) wine grape plantings; and
 - 50% (1,265 ha) table grape plantings.
- Wine grape plantings increased by 890 ha, a 244% increase from 365 ha in 1997 to 1,255 ha in 2015.
 - Wine grape plantings were the dominant grapevine type from 2003 to 2012.
- Table grape plantings increased by 710 ha, a 128% increase from 555 ha in 1997 to 1,265 ha in 2015.
 - Table grape plantings were the dominant grapevine type in 1997 and in 2015, by 10 ha.
- Dried grape plantings decreased by 45 ha, from 45 ha in 1997 to 0 ha in 2015.



Figure 65: Boundary Bend river reach - grapevine plantings from 1997 to 2015

³⁹ Other: grapes for juicing, cannery, research and trial varieties.

3.3.4 Boundary Bend river reach – irrigation methods

Figure 66 summarises irrigation methods in the Boundary Bend river reach from 1997 to 2015.

- In 2015, the irrigable area of 20,540 ha comprised:
 - 74% (15,270 ha) drip irrigation;
 - 4% (920 ha) low level irrigation;
 - 10% (2,035 ha) overhead sprinklers;
 - < 1% (35 ha) furrow irrigation; and
 - 11% (2,280 ha) not irrigated.
- Drip irrigation increased by 14,545 ha, a 2,006% increase from 725 ha in 1997 to 15,270 ha in 2015.
 - Drip irrigation was the dominant irrigation method from 2006 to 2015.
- Low level irrigation increased by 35 ha, a 4% increase from 885 ha in 1997 to 920 ha in 2015.
- Overhead irrigation decreased by 680 ha, a 25% decrease from 2,715 ha in 1997 to 2,035 ha in 2015.
 - Overhead irrigation was the dominant method from 1997 to 2003.
- Furrow irrigation decreased by 915 ha, a 96% decrease from 950 ha in 1997 to 35 ha in 2015.

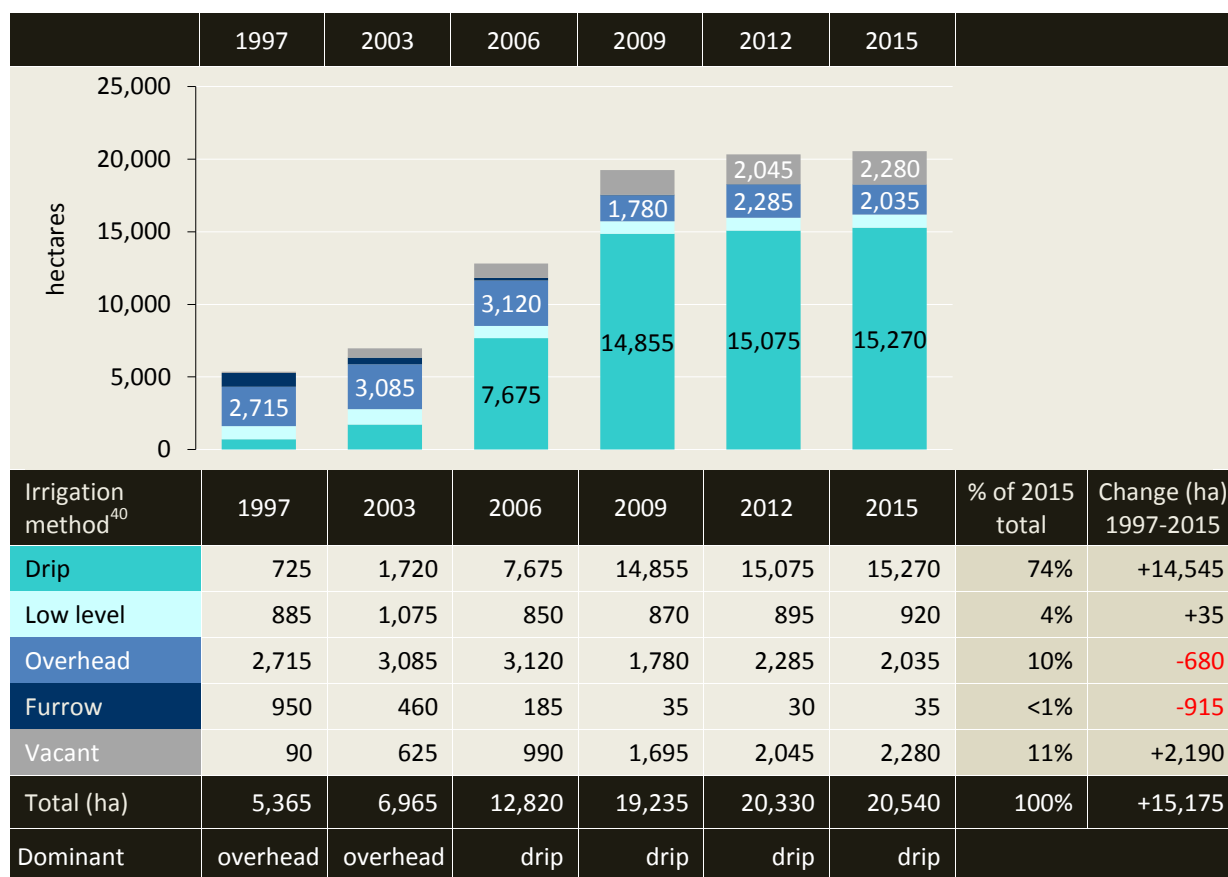


Figure 66: Boundary Bend river reach - irrigation methods from 1997 to 2015

⁴⁰ Overhead irrigation includes pivots and lateral move systems. Furrow includes flood irrigation. (Table 8)

3.3.5 Boundary Bend river reach – salinity impact zones

Figure 67 summarises the irrigable area in each river salinity impact zone in the Boundary Bend river reach from 1997 to 2015.

- In 2015, the irrigable area of 20,540 ha comprised:
 - 80% (16,470 ha) in the lowest salinity impact zone, LIZ 1;
 - 9% (1,745 ha) in LIZ 2; and
 - 11% (2,325 ha) in LIZ 3.
- The area irrigated in:
 - LIZ 1 increased by 13,155 ha, a 573% increase from 2,295 ha in 1997 to 15,450 ha in 2015;
 - LIZ 2 decreased by 100 ha, a 7% decrease from 1,450 ha in 1997 to 1,350 ha in 2015; and
 - LIZ 3 decreased by 70 ha, a 5% decrease from 1,530 ha in 1997 to 1,460 ha in 2015.
- The irrigable area in:
 - LIZ 1 increased by 14,170 ha, a 616% increase from 2,300 ha in 1997 to 16,470 ha in 2015;
 - LIZ 2 increased by 235 ha, a 16% increase from 1,510 ha in 1997 to 1,745 ha in 2015; and
 - LIZ 3 increased by 770 ha, a 50% increase from 1,555 ha in 1997 to 2,325 ha in 2015.
- Irrigation development from 1997 to 2015 occurred predominantly in LIZ 1.

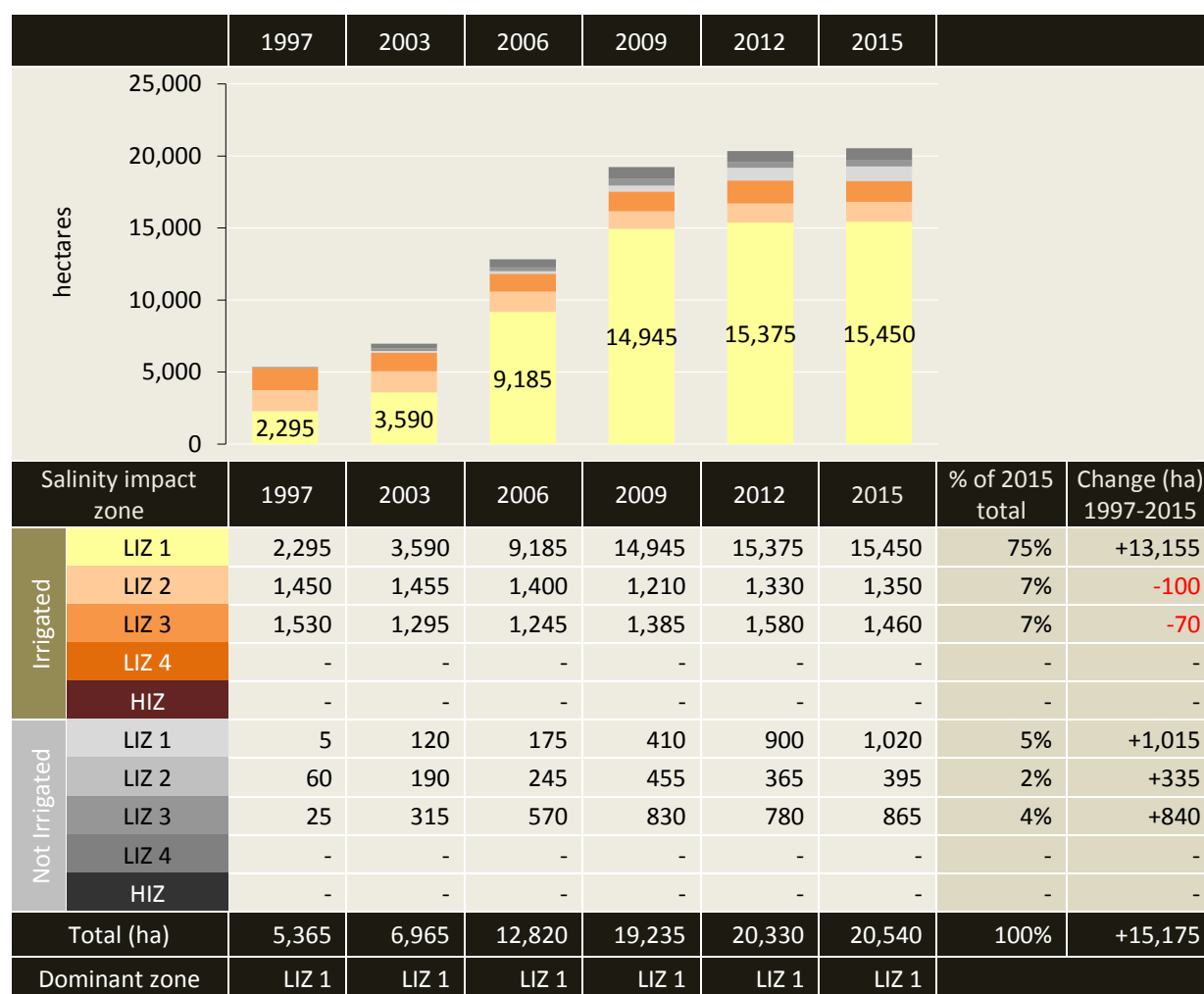


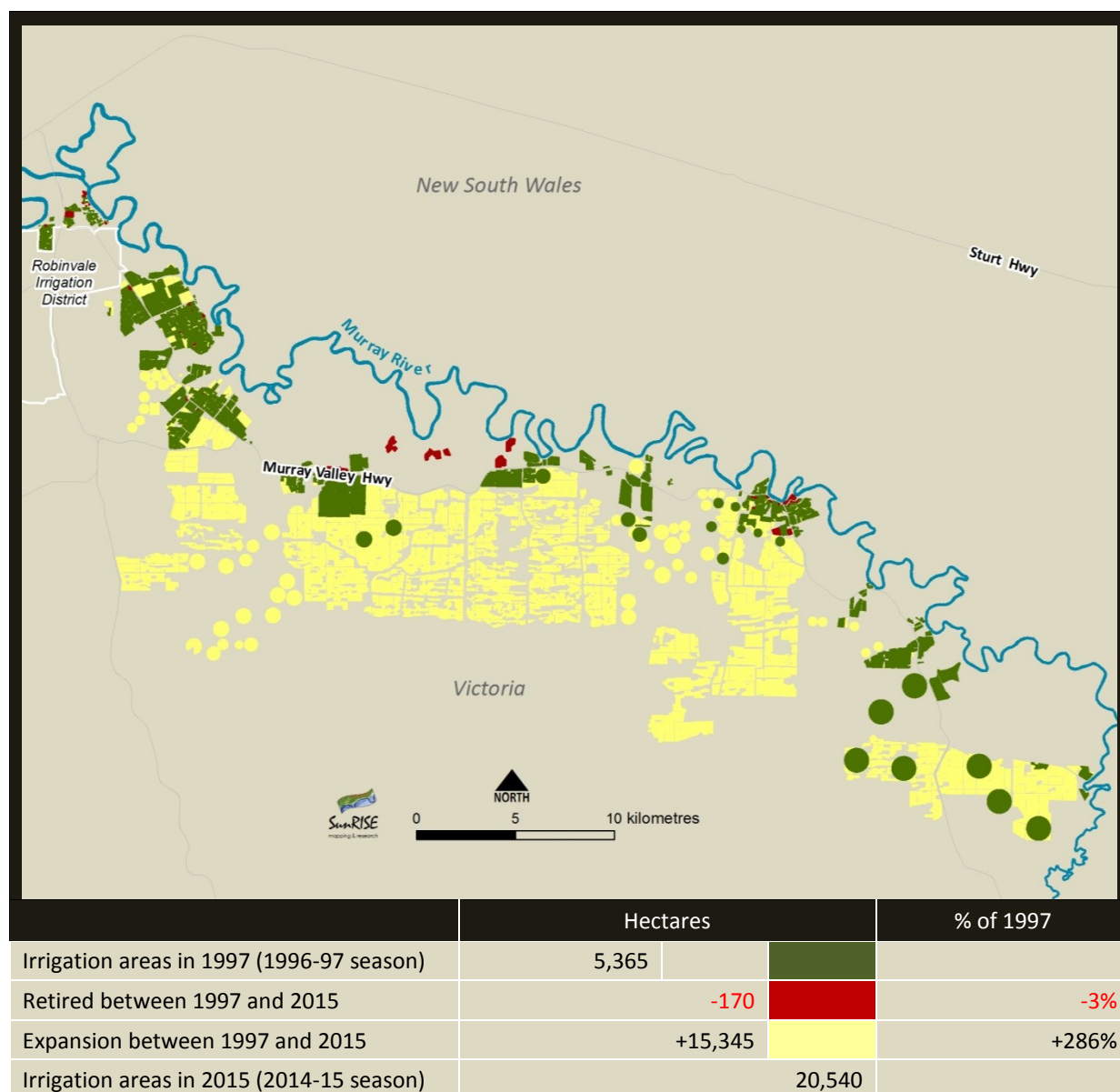
Figure 67: Boundary Bend river reach - irrigable area in each salinity impact zone from 1997 to 2015

3.3.6 Boundary Bend river reach – irrigation development

Map 15 shows irrigation development from 1997 to 2015 in the Boundary Bend river reach with respect to new development (expansion) and areas retired⁴¹ from irrigation.

- The irrigable area increased by 15,175 ha, a 283% increase from 5,365 ha in 1997 to 20,540 ha in 2015.
- The net increase of 15,175 ha comprised 170 ha retired from irrigation and 15,345 ha of expansion.

Map 15: Boundary Bend river reach – irrigation development from 1997 to 2015



⁴¹ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

3.3.7 Boundary Bend – property change

Figure 68 provides estimates of property numbers and average property size (irrigable area) in the Boundary Bend river reach from 1997 to 2015.

- There were approximately 83 irrigation properties (land holdings) in the Boundary Bend river reach in 2015.
- Property numbers declined by 31, a 27% decrease from 114 in 1997 to 83 in 2015.
- The number of properties less than 40 ha (irrigable area) declined by 42, while the number over 40 ha increased by 11.
- Average property size (irrigable area) increased from 47 ha in 1997 to 247 ha in 2015.

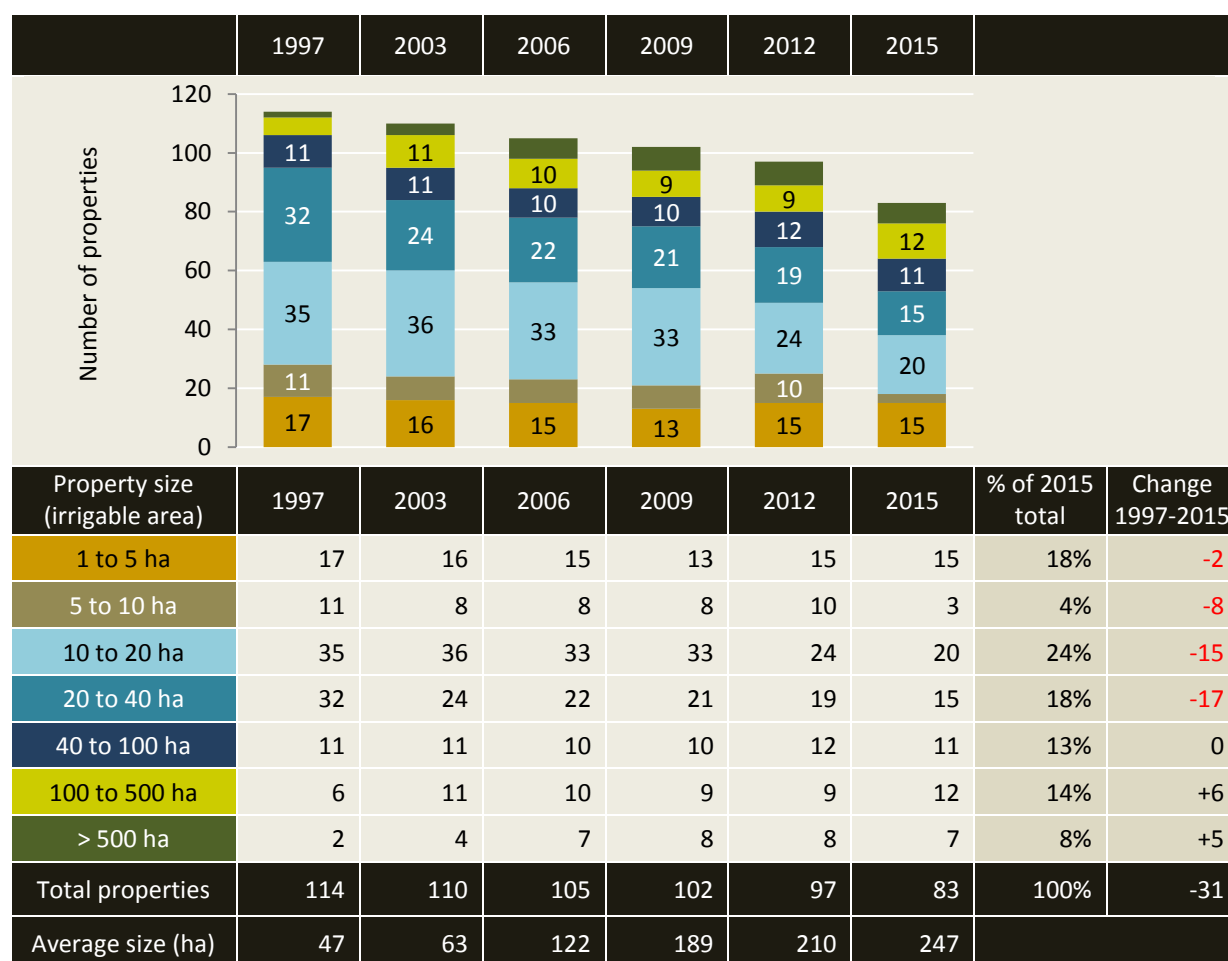


Figure 68: Boundary Bend river reach - property numbers and sizes from 1997 to 2015

3.4 Wemen river reach (*Euston weir to Liparoo*)

In summary for the Wemen river-reach

Crop types

- Nut trees (almonds) were the dominant crop type in the Wemen river reach from 2006 to 2015. Prior to 2006, vegetables were the dominant crop in 1997 and 2003.
- Nut trees dominated development from 1997 to 2015. Plantings increased by 5,355 ha, a 3,150% increase from 170 ha in 1997 to 5,525 ha in 2015.
- In 2015,, the irrigable area was 10,710 ha comprising:
 - 68% (7,255 ha) irrigated permanent plantings;
 - 23% (2,475 ha) irrigated seasonal crops;
 - 6% (690 ha) vacant or not irrigated for less than 10 years; and
 - 3% (290 ha) vacant or not irrigated for more than 10 years.
- The irrigable area increased by 398% (8,560 ha) between 1997 and 2015.

Grapevines

- Grapevines in the Wemen river reach were predominantly grown for wine production from 1997 to 2015.
- The area of grapevines increased by 170 ha, a 31% increase from 540 ha in 1997 to 710 ha in 2015.
- In 2015, the 710 ha of grapevines comprised:
 - 60% (425 ha) wine grape plantings;
 - 28% (200 ha) table grape plantings; and
 - 12% (85 ha) dried grape plantings.

Irrigation methods

- Drip irrigation was the dominant irrigation method in the Wemen river reach from 2003 to 2015. Overhead irrigation was the dominant method in 1997.
- In 2015, the irrigable area of 10,710 ha comprised:
 - 65% (6,940 ha) drip irrigation;
 - 12% (1,305 ha) low level irrigation;
 - 14% (1,475 ha) overhead sprinklers;
 - < 1% (10 ha) furrow irrigation; and
 - 9% (980 ha) not irrigated.

In summary for the Wemen river-reach

Salinity impact zones

- The Wemen river reach is in the low salinity impact zones; LIZ 1, LIZ 2 and LIZ 3.
- In 2015, the irrigable area of 10,710 ha comprised:
 - 30% (3,160 ha) in the lowest salinity impact zone, LIZ 1;
 - 69% (7,425 ha) in LIZ 2; and
 - 1% (125 ha) in LIZ 3.
- Irrigation development from 1997 to 2015 occurred predominantly in LIZ 2.

Irrigation development

- In the Wemen river reach the irrigable area increased by 8,560 ha, a 398% increase from 2,150 ha in 1997 to 10,710 ha in 2015.
- The net increase of 8,560 ha comprised 40 ha retired from irrigation and 8,600 ha of expansion.

Irrigation properties

- There were approximately 38 irrigation properties (land holdings) in the Wemen river reach in 2015.
- Change in property numbers and size from 1997 to 2015:
 - Property numbers declined by 1, a 3% decrease from 39 in 1997 to 38 in 2015.
 - Properties with an irrigable area of less than 40 ha declined by 7, while the number over 40 ha increased by 6.
 - Average property size (irrigable area) increased from 55 ha in 1997 to 282 ha in 2015.

3.4.1 Wemen river reach - crop types in 2015

Table 19 and Map 16 show crop types in the Wemen river reach in 2015.

- Dominant plantings in the Wemen river reach in 2015 were:
 - Almond trees, 52% of the irrigable area; and
 - Carrots, at least 19% of the irrigable area (1% of the irrigable area was unspecified vegetables and may include carrots).

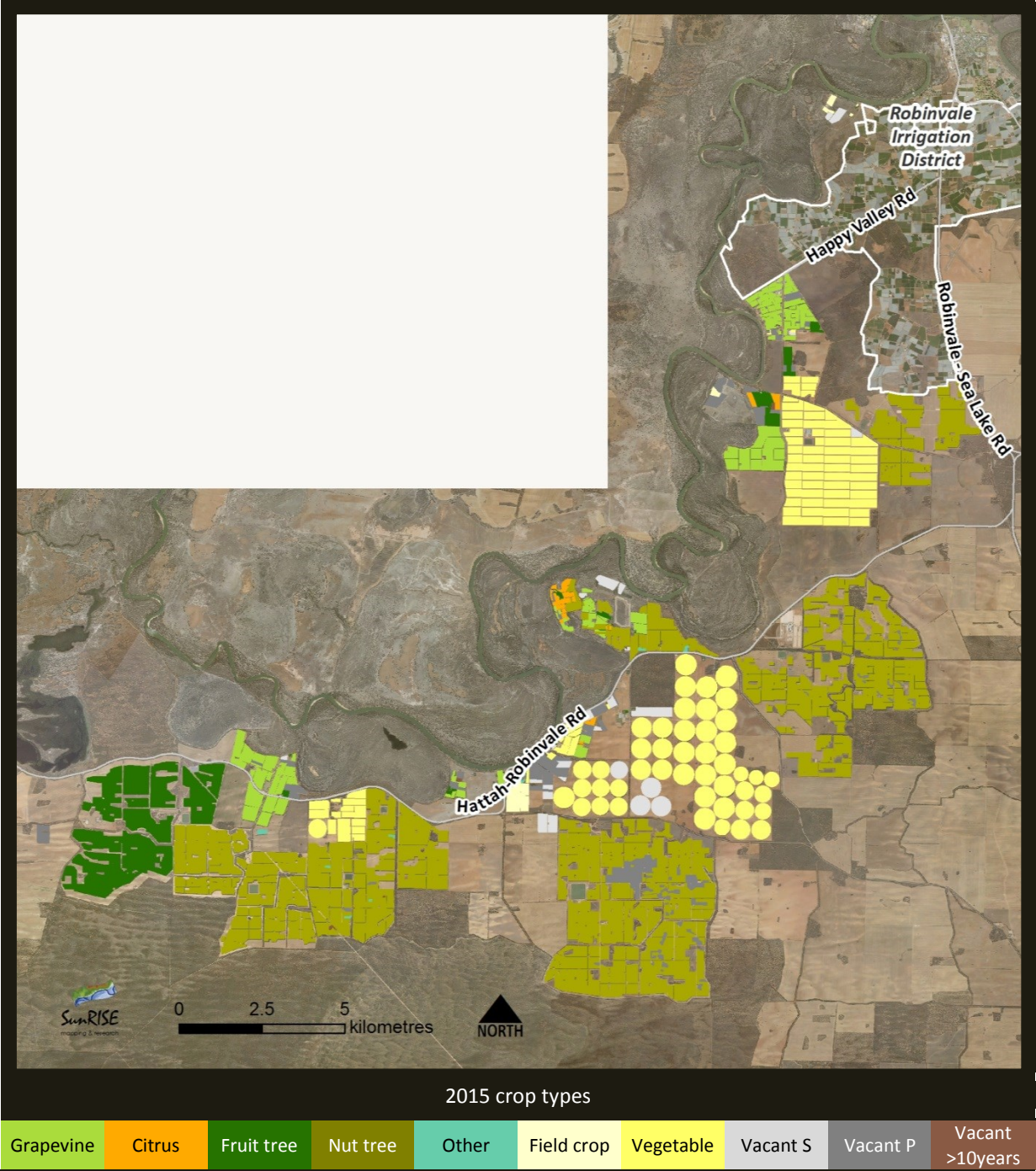
Table 19: Wemen river reach - crop types in 2015

	Crop type	Category	2015 (ha)	2015 %	Description
Permanent crops	Grapevine	Wine	425	4%	
		Table	200	2%	
		Dried	85	1%	
		Other	-	-	
	Citrus		65	1%	Lime, Mandarin, Navel, Tangelo, Valencia
	Fruit tree	<i>unspecified</i>	5	<1%	<i>Fruit tree category unknown</i>
		Avocado	70	1%	
		Olive	855	8%	
		Stone fruit	-	-	
		Other	10	<1%	Pomegranate, Lychee
	Nut tree	Almond	5,525	52%	
		Other	-	-	
	Other	Nursery	-	-	
		Woodlot	10	<1%	
		Misc.	5	<1%	Flowers
	Permanent crops	(sub-total)	7,255	68%	
	Vacant P	≤ 10 years	410	4%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	5	<1%	Vacant (not irrigated) for over ten years
Seasonal crops	Field crop	<i>unspecified</i>	-	-	
		Cereal	-	-	
		Lucerne	-	-	
		Pasture	15	<1%	
		Other	65	1%	Maize
	Vegetable	<i>unspecified</i>	75	1%	<i>Vegetable category unknown</i>
		Asparagus	-	-	
		Carrot	2,000	19%	
		Cucurbit	-	-	
		Potato	-	-	
		Other	320	3%	Broccoli, Salad Greens
	Seasonal crops	(sub-total)	2,475	23%	
	Vacant S	≤ 10 years	280	3%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	285	3%	Vacant (not irrigated) for over ten years
	Total all crop areas		10,710	100%	

Note: '*unspecified*' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Wemen river reach 2015 crop types

Map 16: Wemen river reach showing 2015 crop types



3.4.2 Wemen river reach – change in crop types

Figure 69 summarises crop types in the Wemen river reach from 1997 to 2015.

- Nut trees (almonds) were the dominant crop type in the Wemen river reach from 2006 to 2015. Prior to 2006, vegetables were the dominant crop in 1997 and 2003.
- Nut trees dominated development from 1997 to 2015. Plantings increased by 5,355 ha, a 3,150% increase from 170 ha in 1997 to 5,525 ha in 2015.
- The increase in vacant areas that were previously permanent plantings (Vacant P) between 2009 and 2012 was largely due to almond trees drowned in February 2011 flooding.
- In 2015, the irrigable area of 10,710 ha comprised:
 - 68% (7,255 ha) irrigated permanent plantings;
 - 23% (2,475 ha) irrigated seasonal crops;
 - 6% (690 ha) vacant or not irrigated for less than 10 years; and
 - 3% (290 ha) vacant or not irrigated for more than 10 years.

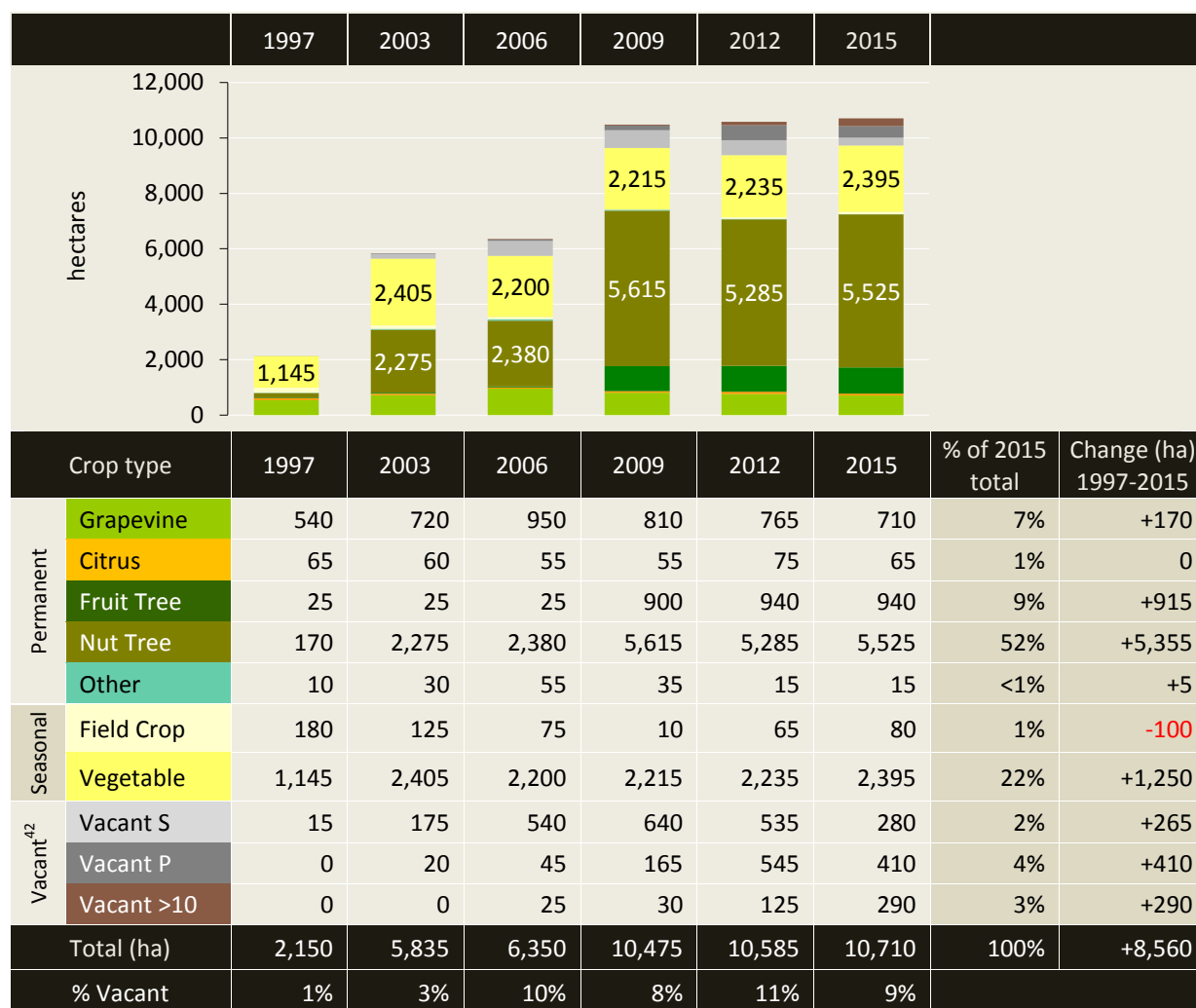


Figure 69: Wemen river reach - crop types from 1997 to 2015

⁴² Vacant S: not irrigated but previously an irrigated seasonal crop. Vacant P: not irrigated but previously an irrigated permanent planting. Vacant >10: not irrigated for over ten years but previously an irrigated area.

3.4.3 Wemen river reach – grapevines

Figure 70 summarises grapevine types in the Wemen river reach from 1997 to 2015.

- The area of grapevines increased by 170 ha, a 31% increase from 540 ha in 1997 to 710 ha in 2015.
- In 2015, the 710 ha of grapevines comprised:
 - 60% (425 ha) wine grape plantings;
 - 28% (200 ha) table grape plantings; and
 - 12% (85 ha) dried grape plantings.
- Wine grape plantings increased by 150 ha, a 55% increase from 275 ha in 1997 to 425 ha in 2015.
 - Wine grape plantings were the dominant grapevine type from 2003 to 2012.
- Table grape plantings increased by 30 ha, a 33% increase from 90 ha in 1997 to 120 ha in 2015.
 - Table grape plantings were the dominant grapevine type in 1997 and in 2015.
- Dried grape plantings decreased by 45 ha, from 45 ha in 1997 to 0 ha in 2015.

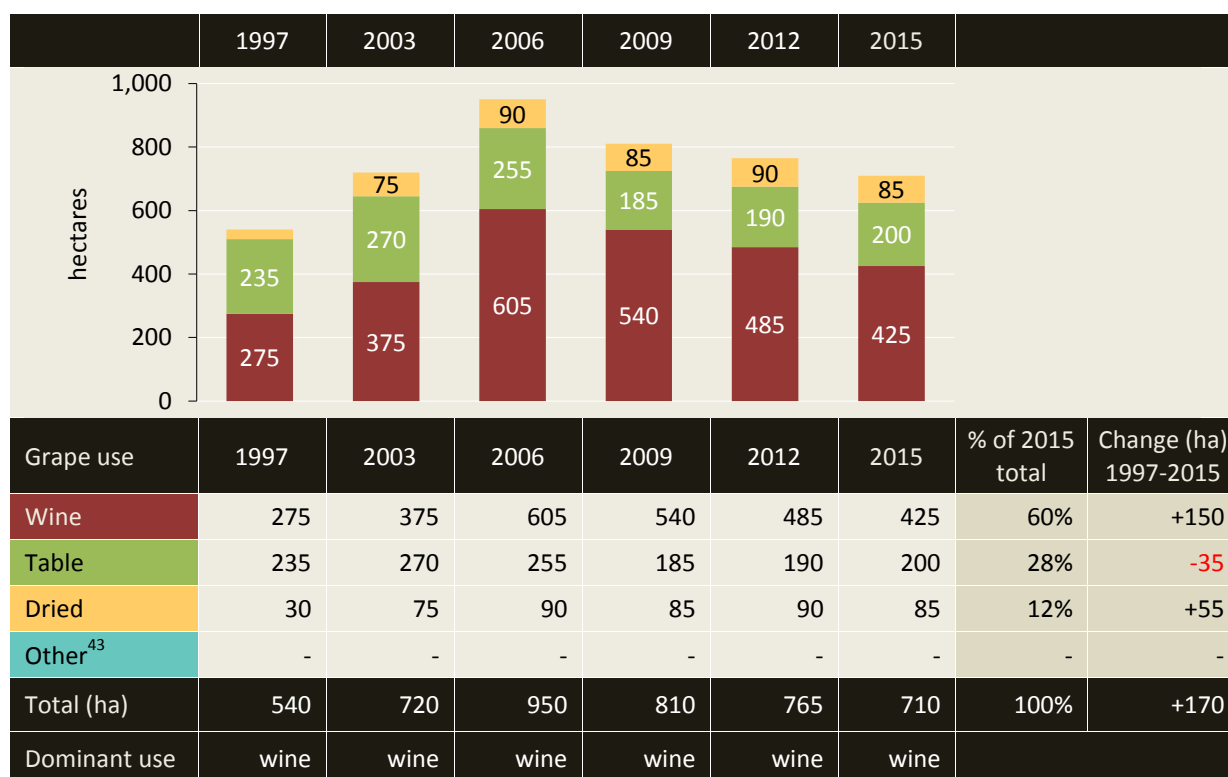


Figure 70: Wemen river reach - grapevine plantings from 1997 to 2015

⁴³ Other: grapes for juicing, cannery, research and trial varieties.

3.4.4 Wemen river reach – irrigation methods

Figure 71 summarises irrigation methods in the Wemen river reach from 1997 to 2015.

- In 2015, the irrigable area of 10,710 ha comprised:
 - 65% (6,940 ha) drip irrigation;
 - 12% (1,305 ha) low level irrigation;
 - 14% (1,475 ha) overhead sprinklers;
 - < 1% (10 ha) furrow irrigation; and
 - 9% (980 ha) not irrigated.
- Drip irrigation increased by 6,710 ha, a 2,917% increase from 230 ha in 1997 to 6,940 ha in 2015.
 - Drip irrigation was the dominant irrigation method from 2003 to 2015.
- Low level irrigation increased by 580 ha, an 80% increase from 725 ha in 1997 to 1,305 ha in 2015.
- Overhead irrigation increased by 470 ha, a 47% increase from 1,005 ha in 1997 to 1,475 ha in 2015.
 - Overhead irrigation was the dominant method in 1997.
- Furrow irrigation decreased by 165 ha, a 94% decrease from 175 ha in 1997 to 10 ha in 2015.

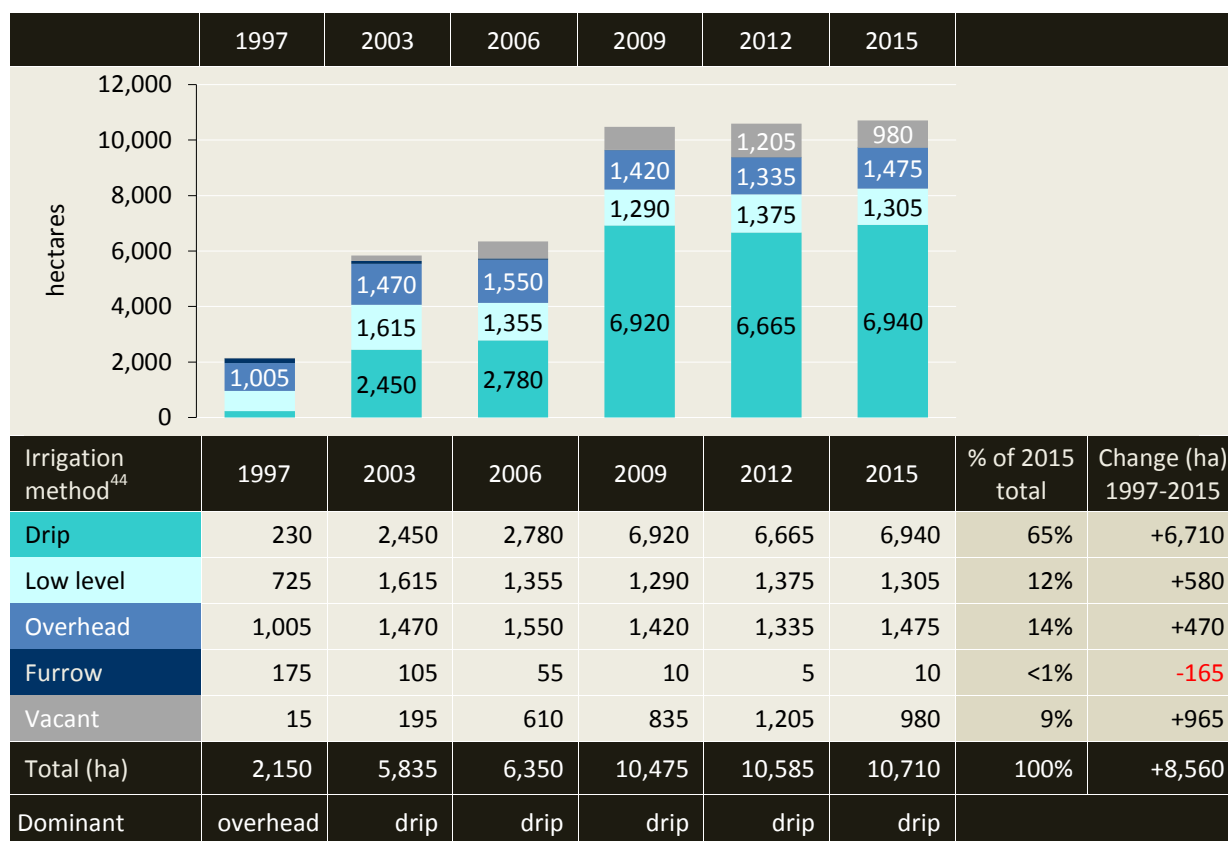


Figure 71: Wemen river reach - irrigation methods from 1997 to 2015

⁴⁴ Overhead irrigation includes pivots and lateral move systems. Furrow includes flood irrigation. (Table 8)

3.4.5 Wemen river reach – salinity impact zones

Figure 72 summarises the irrigable area in each river salinity impact zone in the Wemen river reach from 1997 to 2015.

- In 2015, the irrigable area of 10,710 ha comprised:
 - 30% (3,160 ha) in the lowest salinity impact zone, LIZ 1;
 - 69% (7,425 ha) in LIZ 2; and
 - 1% (125 ha) in LIZ 3.
- The area irrigated in:
 - LIZ 1 increased by 2,940 ha, a 1,729% increase from 170 ha in 1997 to 3,110 ha in 2015;
 - LIZ 2 increased by 4,750 ha, a 256% increase from 1,855 ha in 1997 to 6,605 ha in 2015; and
 - LIZ 3 decreased by 95 ha, an 86% decrease from 110 ha in 1997 to 15 ha in 2015.
- The irrigable area in:
 - LIZ 1 increased by 2,990 ha, a 1,759% increase from 170 ha in 1997 to 3,160 ha in 2015;
 - LIZ 2 increased by 5,570 ha, a 300% increase from 1,855 ha in 1997 to 7,425 ha in 2015; and
 - LIZ 3 was 125 ha in 1997 and 2015.
- Irrigation development from 1997 to 2015 occurred predominantly in LIZ 2.

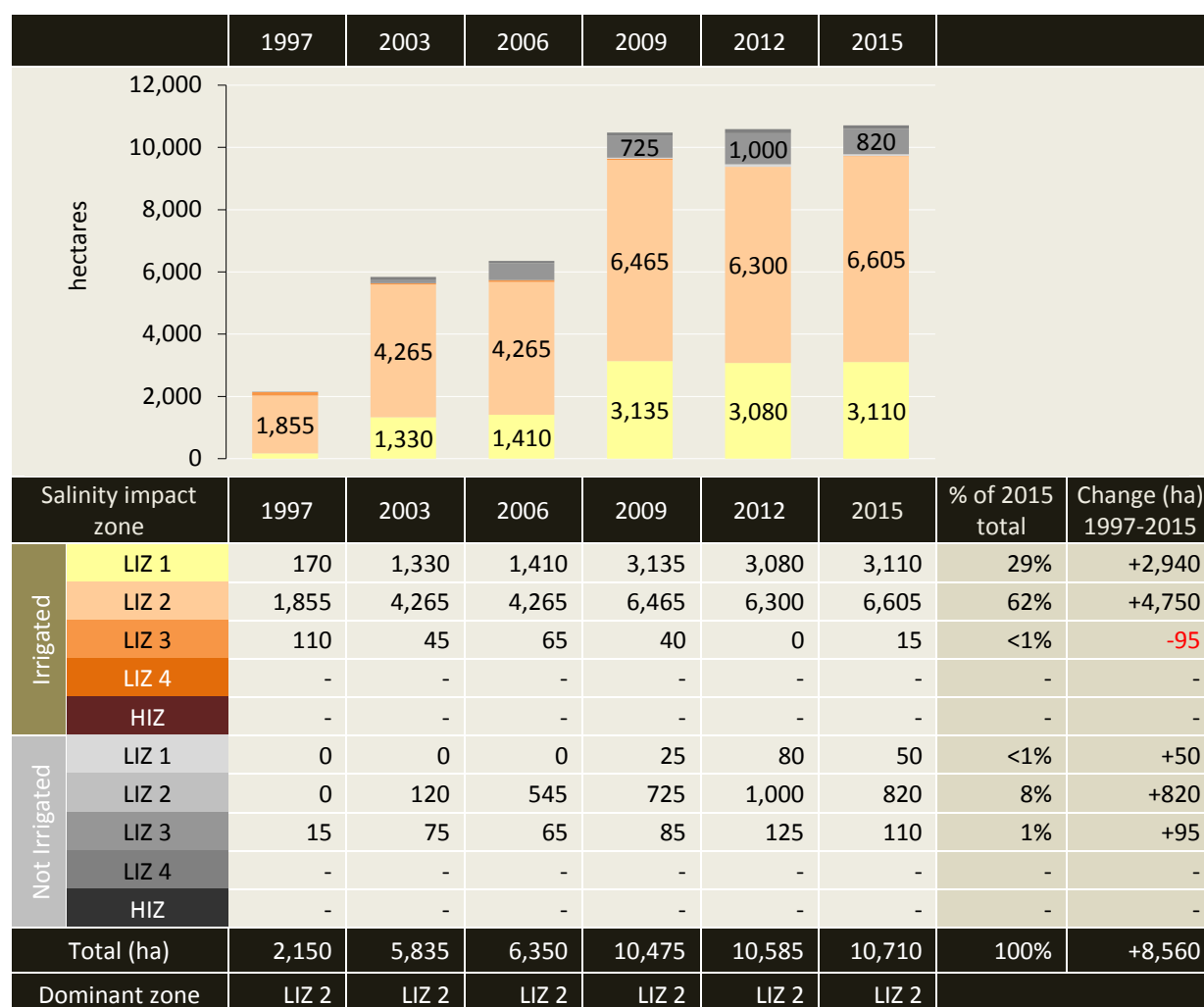


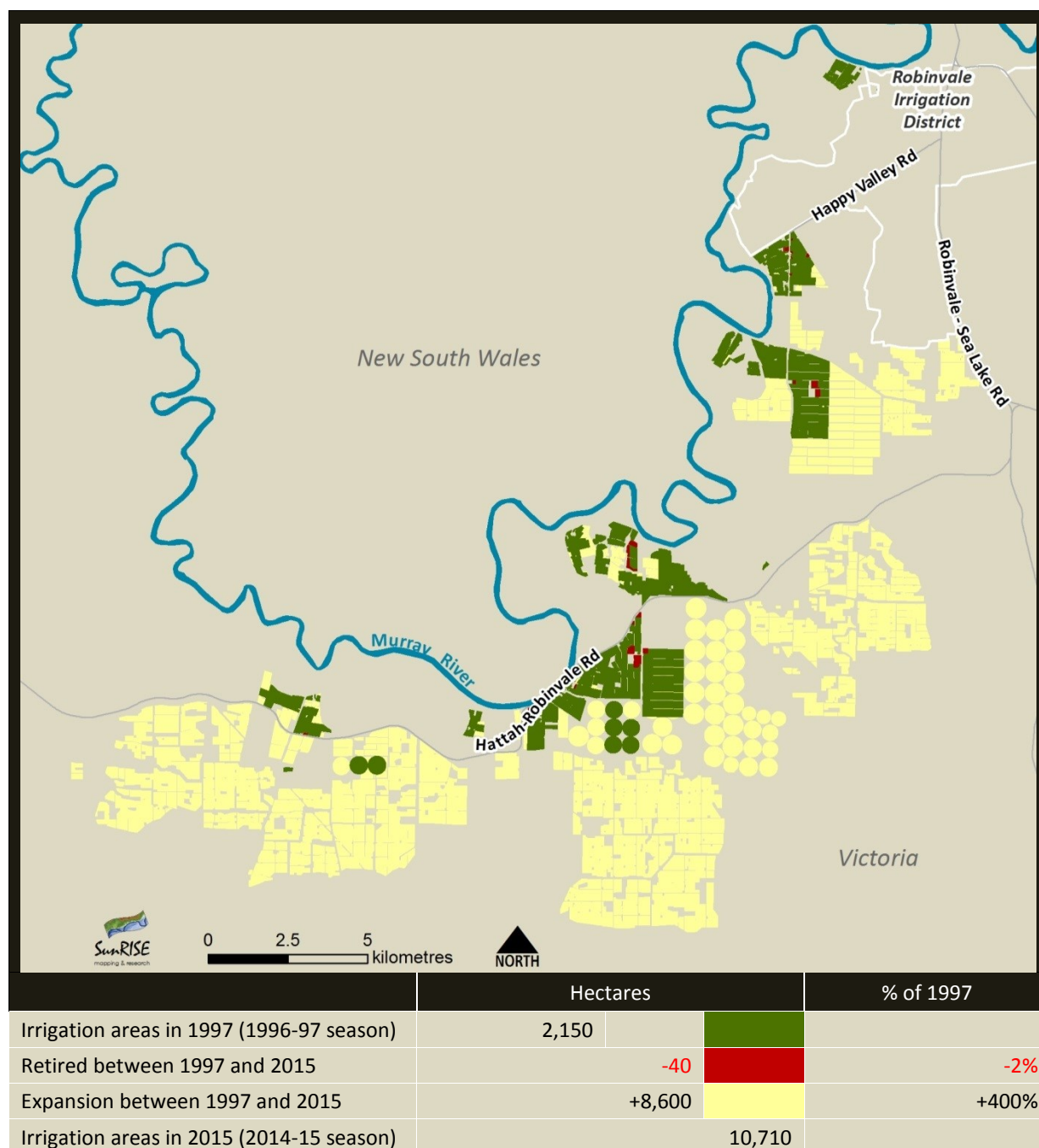
Figure 72: Wemen river reach - irrigable area in each salinity impact zone from 1997 to 2015

3.4.6 Wemen river reach – irrigation development

Map 17 shows irrigation development from 1997 to 2015 in the Wemen river reach with respect to new development (expansion) and areas retired⁴⁵ from irrigation.

- The irrigable area increased by 8,560 ha, a 398% increase from 2,150 ha in 1997 to 10,710 ha in 2015.
- The net increase of 8,560 ha comprised 40 ha retired from irrigation and 8,600 ha of expansion.

Map 17: Wemen river reach – irrigation development from 1997 to 2015



⁴⁵ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

3.4.7 Wemen river reach – property change

Figure 73 provides estimates of property numbers and average property size (irrigable area) in the Wemen river reach from 1997 to 2015.

- There were approximately 38 irrigation properties (land holdings) in the Wemen river reach in 2015.
- Property numbers declined by 1, a 3% decrease from 39 in 1997 to 38 in 2015.
- The number of properties less than 40 ha (irrigable area) declined by 7, while the number over 40 ha increased by 6.
- Average property size (irrigable area) increased from 55 ha in 1997 to 282 ha in 2015.

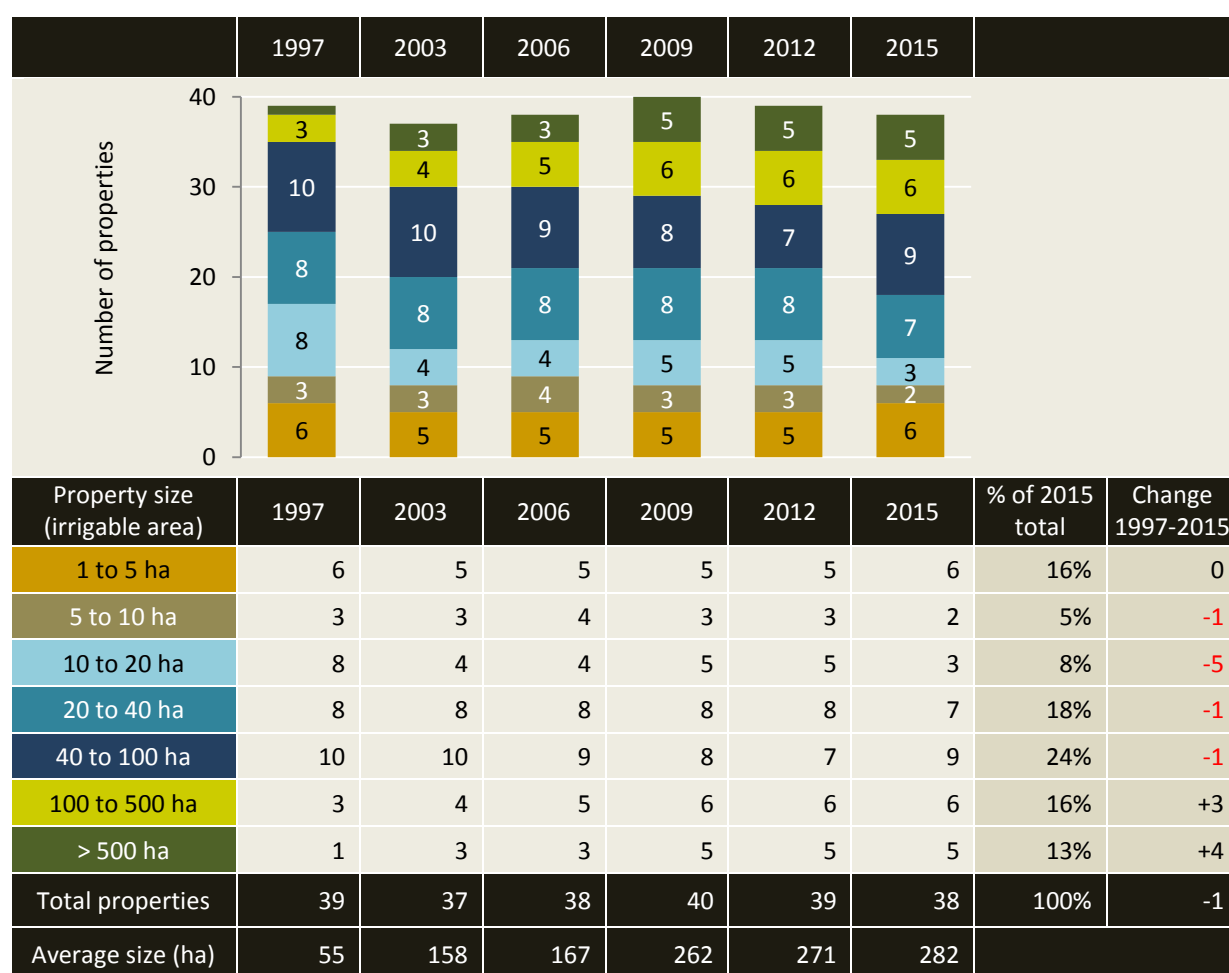


Figure 73: Wemen river reach - property numbers and sizes from 1997 to 2015

3.5 Colignan river reach (*Colignan to Yatpool*)

In summary for the Colignan river reach

Crop types

- Grapevines were the dominant crop type in the Colignan river reach from 1997 to 2015. Plantings peaked around 2006, but continued to decline from 2006 to 2015.
- In 2015, the irrigable area was 11,400 ha comprising:
 - 74% (8,465 ha) irrigated permanent plantings;
 - 10% (1,100 ha) irrigated seasonal crops;
 - 14% (1,630 ha) vacant or not irrigated for less than 10 years; and
 - 2% (205 ha) vacant or not irrigated for more than 10 years.

Grapevines

- Grapevines in the Colignan river reach were predominantly grown for wine production from 1997 to 2015.
- The area of grapevines increased by 1,765 ha, a 63% increase from 2,810 ha in 1997 to 4,575 ha in 2015.
- In 2015, the 4,575 ha of grapevines comprised:
 - 69% (3,170 ha) wine grape plantings;
 - 15% (670 ha) table grape plantings; and
 - 16% (735 ha) dried grape plantings.

Irrigation methods

- Drip irrigation was the dominant irrigation method in the Colignan river reach from 2003 to 2015. Overhead irrigation was the dominant method in 1997.
- In 2015, the irrigable area of 11,400 ha comprised:
 - 61% (6,915 ha) drip irrigation;
 - 9% (990 ha) low level irrigation;
 - 14% (1,630 ha) overhead sprinklers;
 - < 1% (30 ha) furrow irrigation; and
 - 16% (1,835 ha) not irrigated.

Salinity impact zones

- The Colignan river reach is in the low salinity impact zones, LIZ 1 and LIZ 4, and in the high impact zone, HIZ.
- In 2015, the irrigable area of 11,400 ha comprised:
 - 16% (1,785 ha) in the lowest salinity impact zone, LIZ 1;
 - 74% (8,445 ha) in LIZ 4; and
 - 10% (1,170 ha) in the high salinity impact zone, HIZ.
- Irrigation development from 1997 to 2015 occurred predominantly in LIZ 4.
- The irrigable area in HIZ increased by 135 ha, a 13% increase from 1,035 ha in 1997 to 1,170 ha in 2015.

In summary for the Colignan river reach

Irrigation development

- In the Colignan river reach the irrigable area increased by 4,475 ha, a 65% increase from 6,925 ha in 1997 to 11,400 ha in 2015.
- The net increase of 4,475 ha comprised 70 ha retired from irrigation and 4,545 ha of expansion.

Irrigation properties

- There were approximately 147 irrigation properties (land holdings) in the Colignan river reach in 2015.
- Change in property numbers and size from 1997 to 2015:
 - Property numbers increased by 3, a 2% increase from 144 in 1997 to 147 in 2015.
 - Properties with an irrigable area of less than 40 ha declined by 11, while the number over 40 ha increased by 14.
 - Average property size (irrigable area) increased from 48 ha in 1997 to 78 ha in 2015.

3.5.1 Colignan river reach - crop types in 2015

Table 20 and Map 18 show crop types in 2015 in the Colignan river reach.

- Dominant plantings in the Colignan river reach in 2015 were:
 - Wine grapes, 28% of the irrigable area; and
 - Citrus, 25% of the irrigable area.

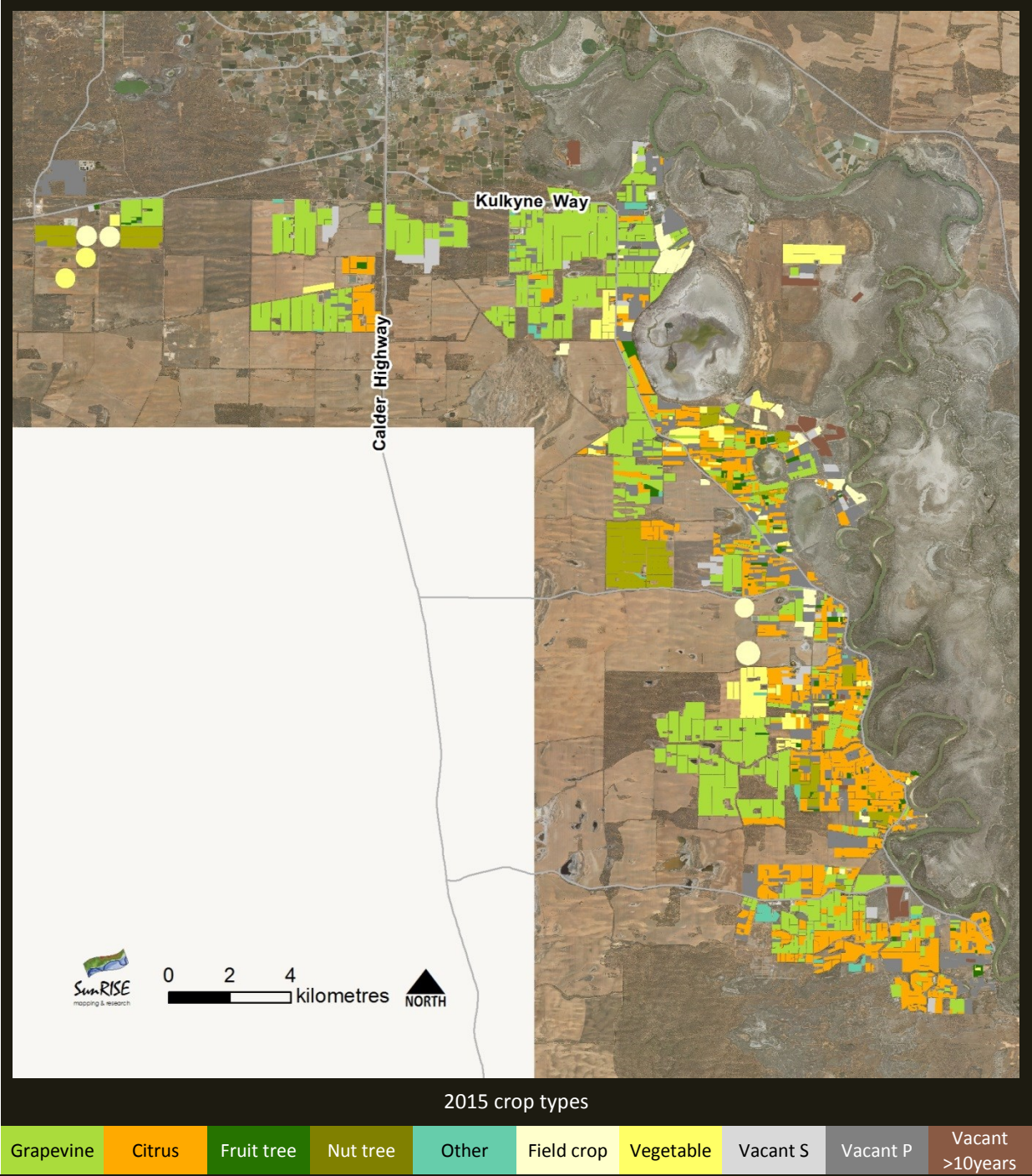
Table 20: Colignan river reach - crop types in 2015

	Crop type	Category	2015 (ha)	2015 %	Description
Permanent crops	Grapevine	Wine	3,170	28%	
		Table	670	6%	
		Dried	735	6%	
		Other	-	-	
	Citrus		2,815	25%	Grapefruit, Lemon, Lime, Mandarin, Navel, other Orange, Tangelo, Valencia
	Fruit tree	<i>unspecified</i>	-	-	
		Avocado	115	1%	
		Olive	5	<1%	
		Stone fruit	5	<1%	
		Other	25	<1%	Mango, Persimmon, Pome fruit, Pomegranate
	Nut tree	Almond	800	7%	
		Other	15	<1%	Pistachio, Walnut
	Other	Nursery	20	<1%	
		Woodlot	85	1%	
		Misc.	5	<1%	
	Permanent crops	(sub-total)	8,465	74%	
Seasonal crops	Vacant P	≤ 10 years	1,355	12%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	15	<1%	Vacant (not irrigated) for over ten years
	Field crop	<i>unspecified</i>	30	<1%	Field crop category unknown
		Cereal	110	1%	
		Lucerne	190	2%	
		Pasture	55	<1%	
		Other	15	<1%	Maize
	Vegetable	<i>unspecified</i>	35	<1%	Vegetable category unknown
		Asparagus	140	1%	
		Carrot	160	1%	
		Cucurbit	325	3%	
		Potato	35	<1%	
		Other	5	<1%	
	Seasonal crops	(sub-total)	1,100	10%	
	Vacant S	≤ 10 years	275	2%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	190	2%	Vacant (not irrigated) for over ten years
	Total all crop areas		11,400	100%	

Note: '*unspecified*' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Colignan river reach 2015 crop types

Map 18: Colignan river reach showing 2015 crop types



3.5.2 Colignan river reach - change in crop types

Figure 74 summarises crop types in the Colignan river reach from 1997 to 2015.

- Grapevines were the dominant crop type in the Colignan river reach from 1997 to 2015. Plantings peaked around 2006, but continued to decline from 2006 to 2015.
- In 2015, the irrigable area of 11,400 ha comprised:
 - 74% (8,465 ha) irrigated permanent plantings;
 - 10% (1,100 ha) irrigated seasonal crops;
 - 14% (1,630 ha) vacant or not irrigated for less than 10 years; and
 - 2% (205 ha) vacant or not irrigated for more than 10 years.

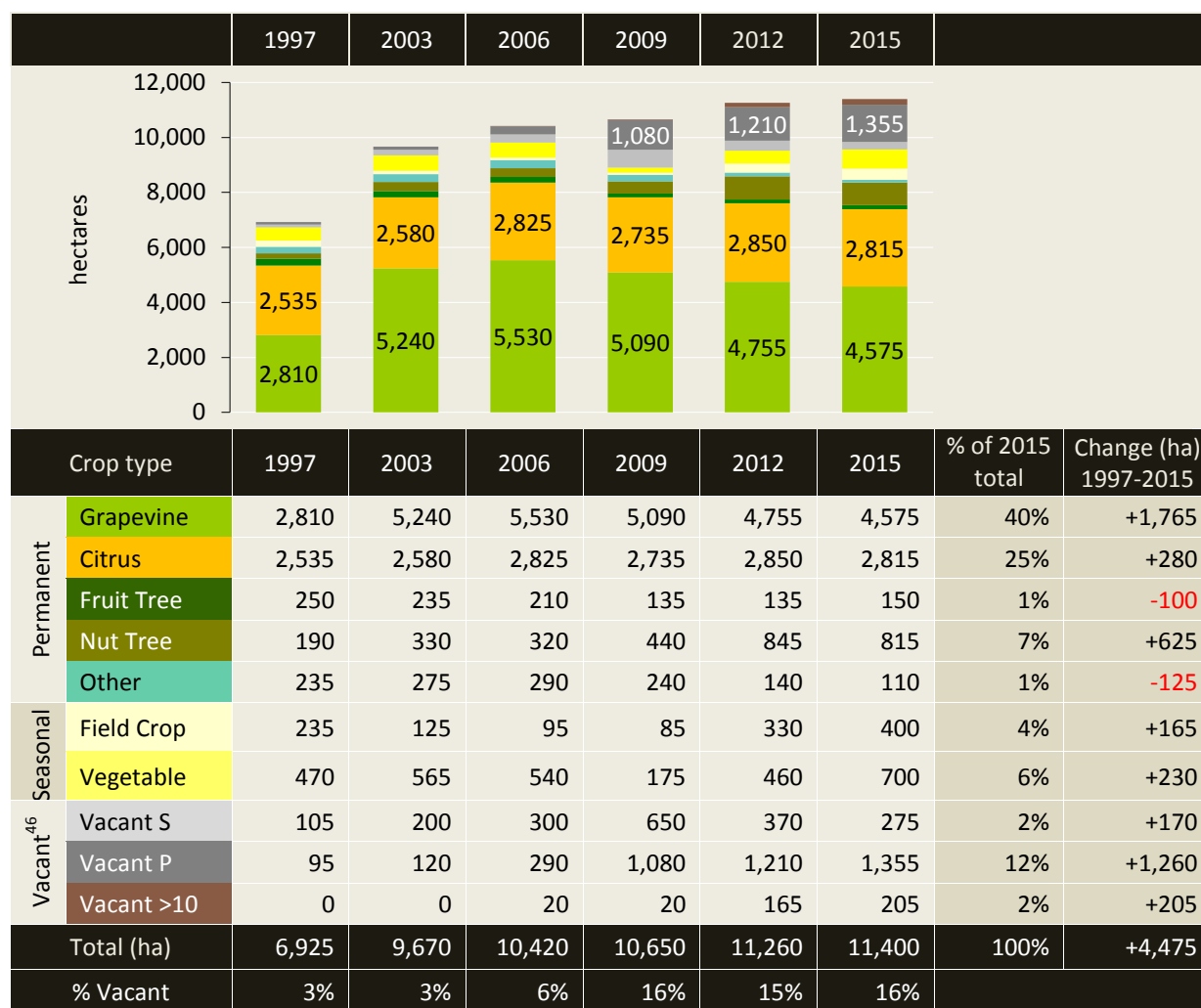


Figure 74: Colignan river reach - crop types from 1997 to 2015

⁴⁶ Vacant S: not irrigated but previously an irrigated seasonal crop. Vacant P: not irrigated but previously an irrigated permanent planting. Vacant >10: not irrigated for over ten years but previously an irrigated area.

3.5.3 Colignan river reach – grapevines

Figure 75 summarises grapevine types in the Colignan river reach from 1997 to 2015.

- The area of grapevines increased by 1,765 ha, a 63% increase from 2,810 ha in 1997 to 4,575 ha in 2015.
- In 2015, the 4,575 ha of grapevines comprised:
 - 69% (3,170 ha) wine grape plantings;
 - 15% (670 ha) table grape plantings; and
 - 16% (735 ha) dried grape plantings.
- Wine grape plantings increased by 580 ha, a 22% increase from 2,590 ha in 1997 to 3,170 ha in 2015.
 - Wine grape plantings were the dominant grapevine type from 1997 to 2015.
- Table grape plantings increased by 495 ha, a 283% increase from 175 ha in 1997 to 670 ha in 2015.
- Dried grape plantings increased by 690 ha, from 45 ha in 1997 to 735 ha in 2015.

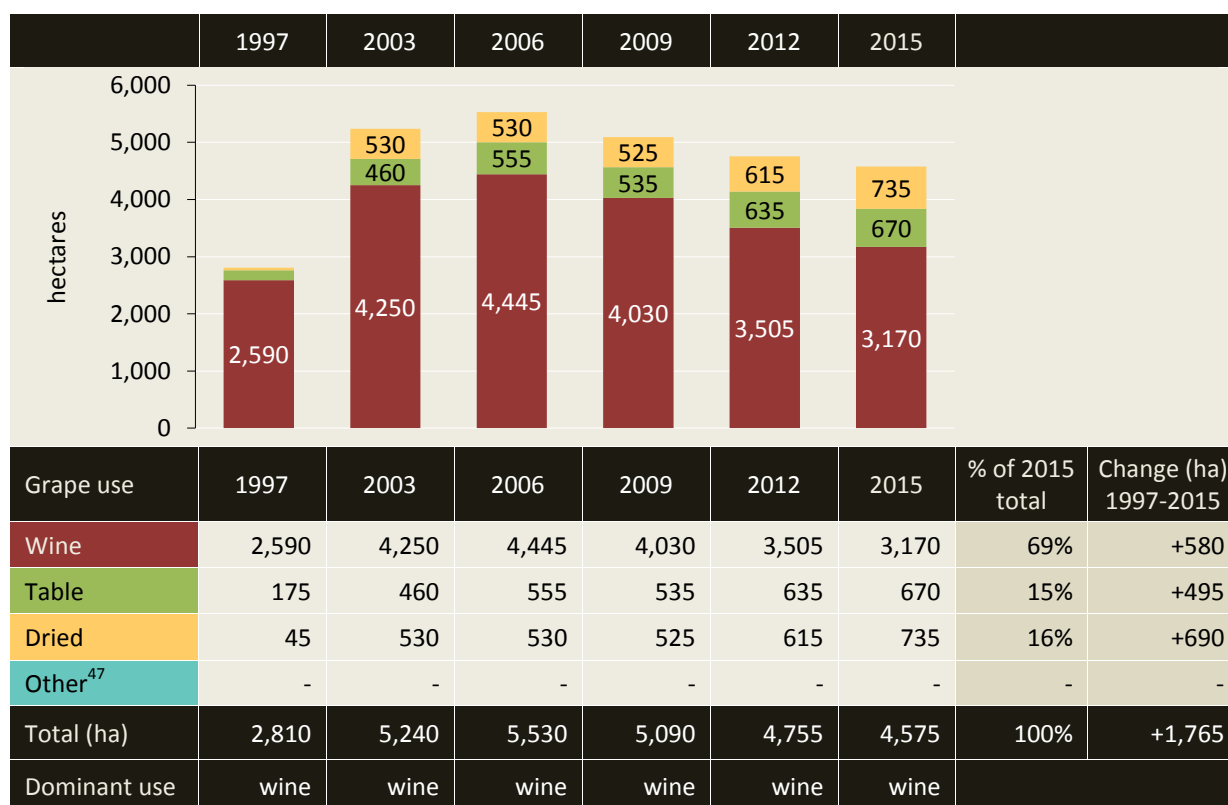


Figure 75: Colignan river reach - grapevine plantings from 1997 to 2015

⁴⁷ Other: grapes for juicing, cannery, research and trial varieties.

3.5.4 Colignan river reach – irrigation methods

Figure 76 summarises irrigation methods in the Colignan river reach from 1997 to 2015.

- In 2015, the irrigable area of 11,400 ha comprised:
 - 61% (6,915 ha) drip irrigation;
 - 9% (990 ha) low level irrigation;
 - 14% (1,630 ha) overhead sprinklers;
 - < 1% (30 ha) furrow irrigation; and
 - 16% (1,835 ha) not irrigated.
- Drip irrigation increased by 5,285 ha, a 324% increase from 1,630 ha in 1997 to 6,915 ha in 2015.
 - Drip irrigation was the dominant irrigation method from 2003 to 2015.
- Low level irrigation increased by 475 ha, a 92% increase from 515 ha in 1997 to 990 ha in 2015.
- Overhead irrigation decreased by 2,775 ha, a 63% decrease from 4,405 ha in 1997 to 1,630 ha in 2015.
 - Overhead irrigation was the dominant method in 1997.
- Furrow irrigation decreased by 145 ha, an 83% decrease from 175 ha in 1997 to 30 ha in 2015.

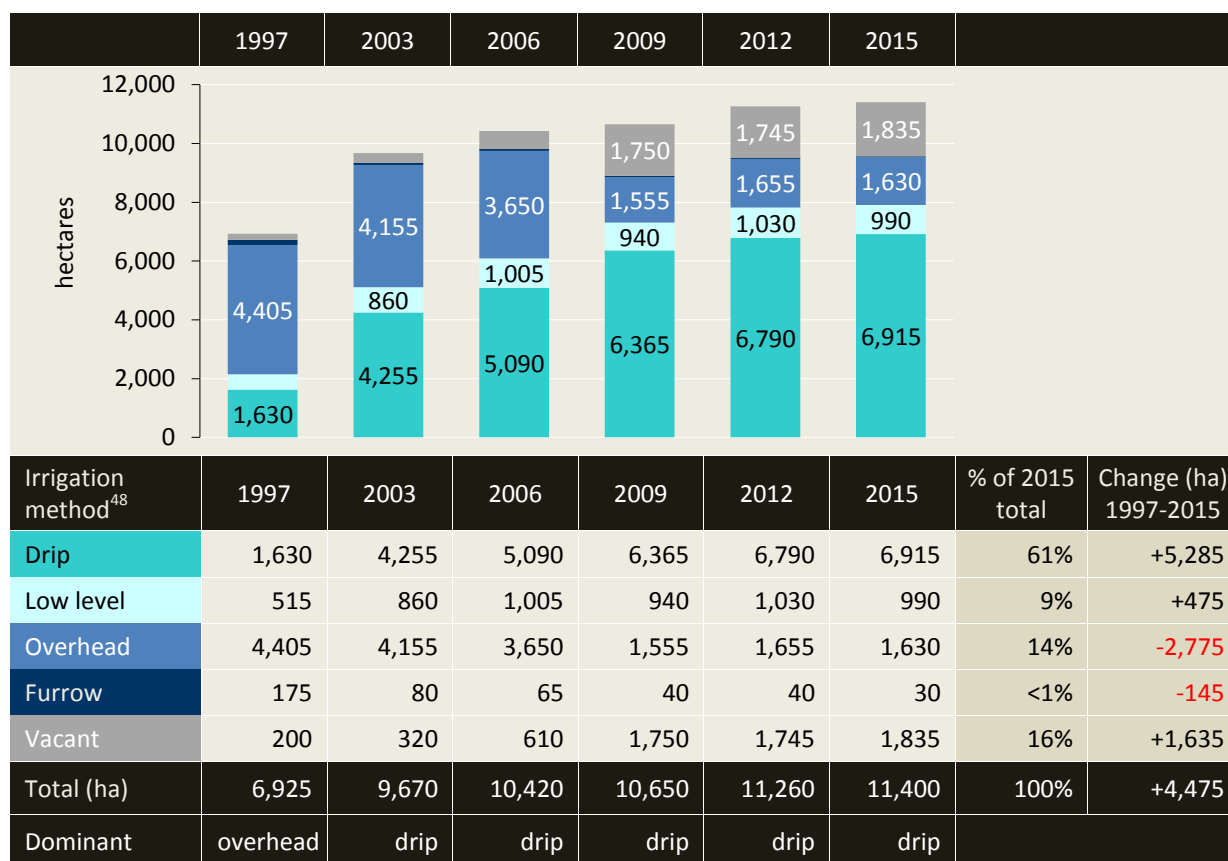


Figure 76: Colignan river reach - irrigation methods from 1997 to 2015

⁴⁸ Overhead irrigation includes pivots and lateral move systems. Furrow includes flood irrigation. (Table 8)

3.5.5 Colignan river reach – salinity impact zones

Figure 77 summarises the irrigable area in each river salinity impact zone in the Colignan river reach from 1997 to 2015.

- In 2015, the irrigable area of 11,400 ha comprised:
 - 16% (1,785 ha) in the lowest salinity impact zone, LIZ 1;
 - 74% (8,445 ha) in LIZ 4; and
 - 10% (1,170 ha) in the high salinity impact zone, HIZ.
- The area irrigated in:
 - LIZ 1 increased by 1,245 ha, a 422% increase from 295 ha in 1997 to 1,540 ha in 2015;
 - LIZ 4 increased by 1,755 ha, a 32% increase from 5,450 ha in 1997 to 7,205 ha in 2015; and
 - HIZ decreased by 160 ha, a 16% decrease from 980 ha in 1997 to 820 ha in 2015.
- The irrigable area in:
 - LIZ 1 increased by 1,490 ha, a 505% increase from 295 ha in 1997 to 1,785 ha in 2015;
 - LIZ 4 increased by 2,850 ha, a 51% increase from 5,595 ha in 1997 to 8,445 ha in 2015; and
 - HIZ increased by 135 ha, a 13% increase from 1,035 ha in 1997 to 1,170 ha in 2015.
- Irrigation development from 1997 to 2015 occurred predominantly in LIZ 4.

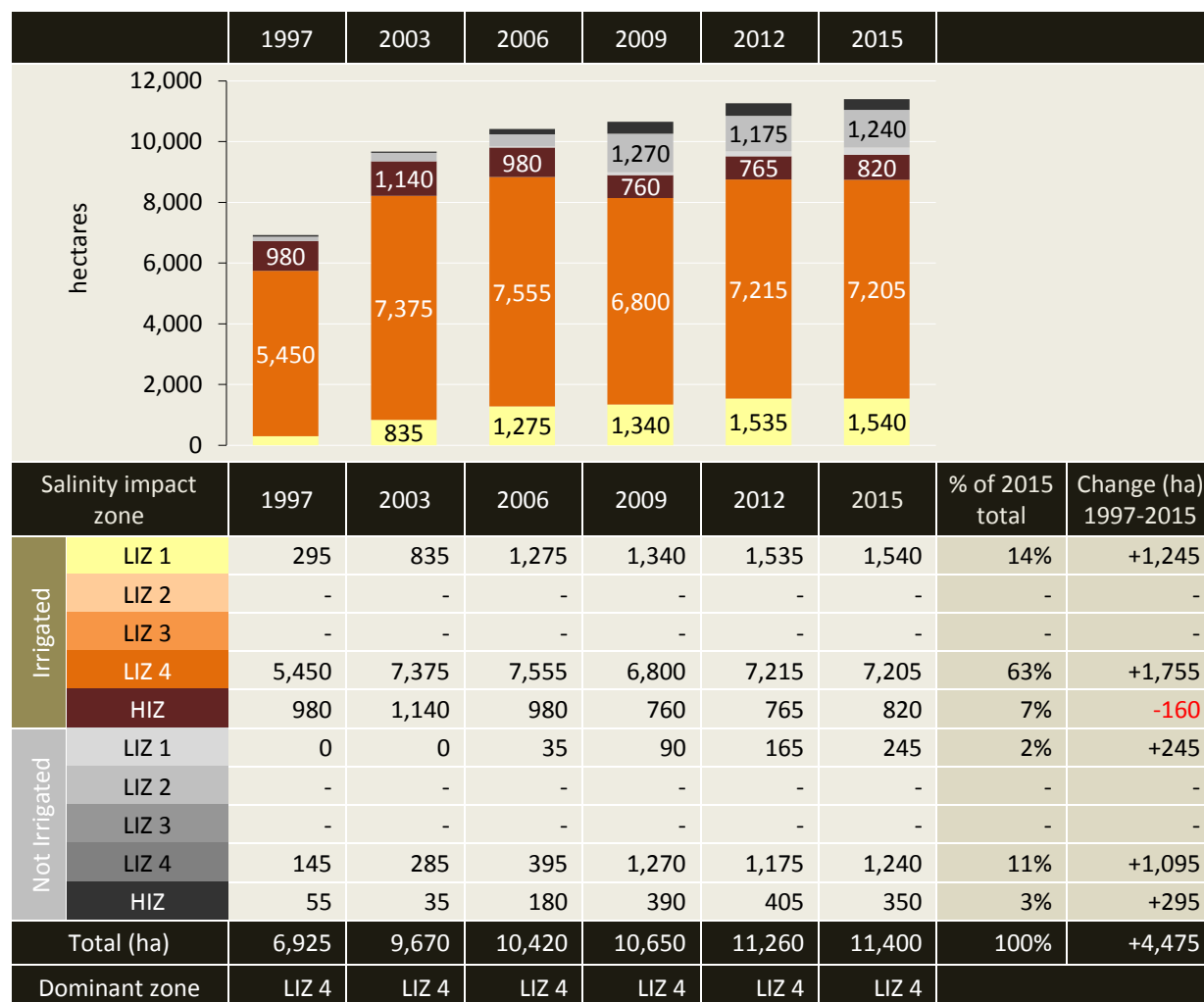


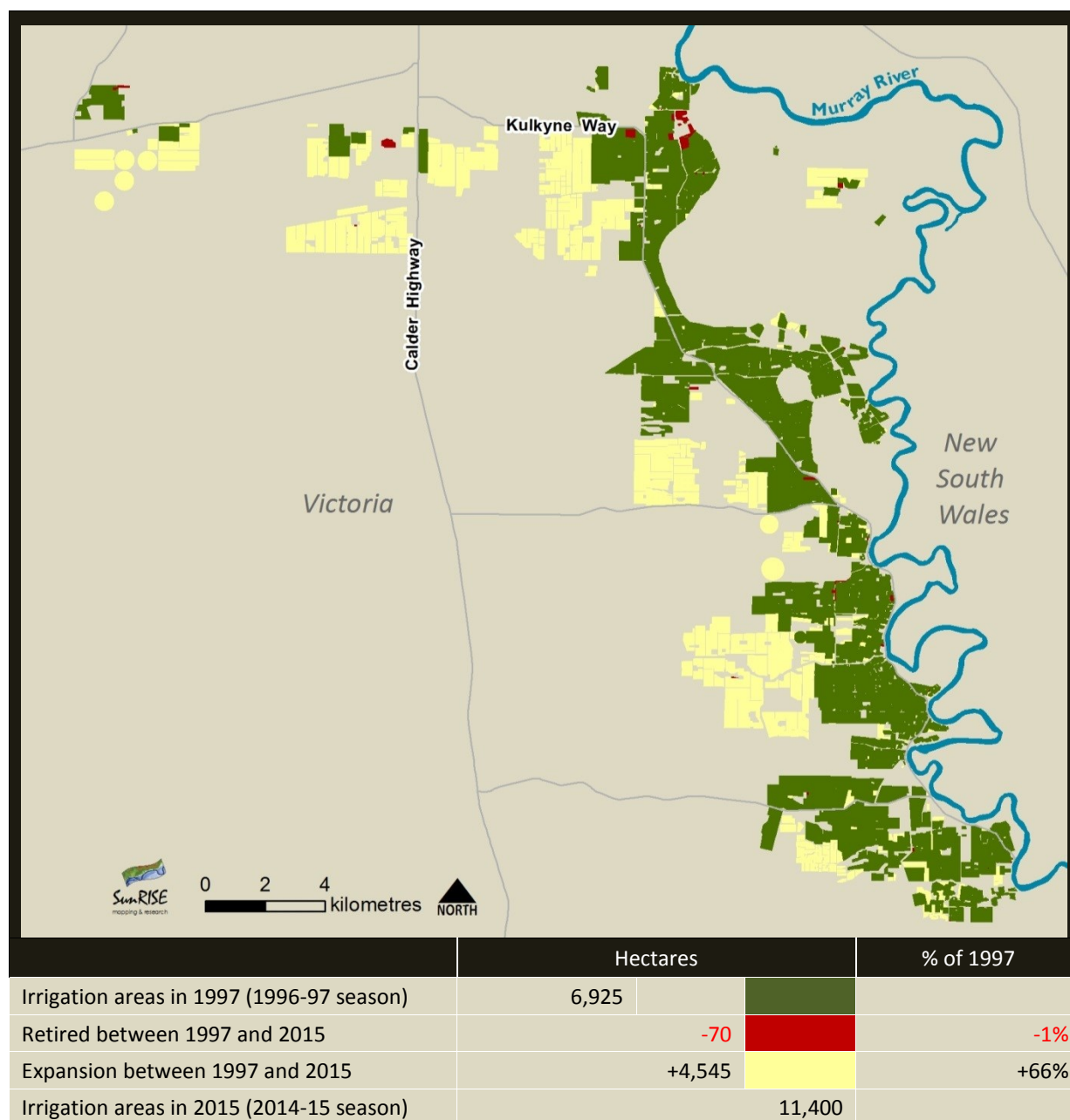
Figure 77: Colignan river reach - irrigable area in each salinity impact zone from 1997 to 2015

3.5.6 Colignan river reach – irrigation development

Map 19 shows irrigation development from 1997 to 2015 in the Colignan river reach with respect to new development (expansion) and areas retired⁴⁹ from irrigation.

- The irrigable area increased by 4,475 ha, a 65% increase from 6,925 ha in 1997 to 11,400 ha in 2015.
- The net increase of 4,475 ha comprised 70 ha retired from irrigation and 4,545 ha of expansion.

Map 19: Colignan river reach – irrigation development from 1997 to 2015



⁴⁹ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

3.5.7 Colignan river reach – property change

Figure 78 provides estimates of property numbers and average property size (irrigable area) in the Colignan river reach from 1997 to 2015.

- There were approximately 147 irrigation properties (land holdings) in the Colignan river reach in 2015.
- Property numbers increased by 3, a 2% increase from 144 in 1997 to 147 in 2015.
- The number of properties less than 40 ha (irrigable area) declined by 11, while the number over 40 ha increased by 14.
- Average property size (irrigable area) increased from 48 ha in 1997 to 78 ha in 2015.

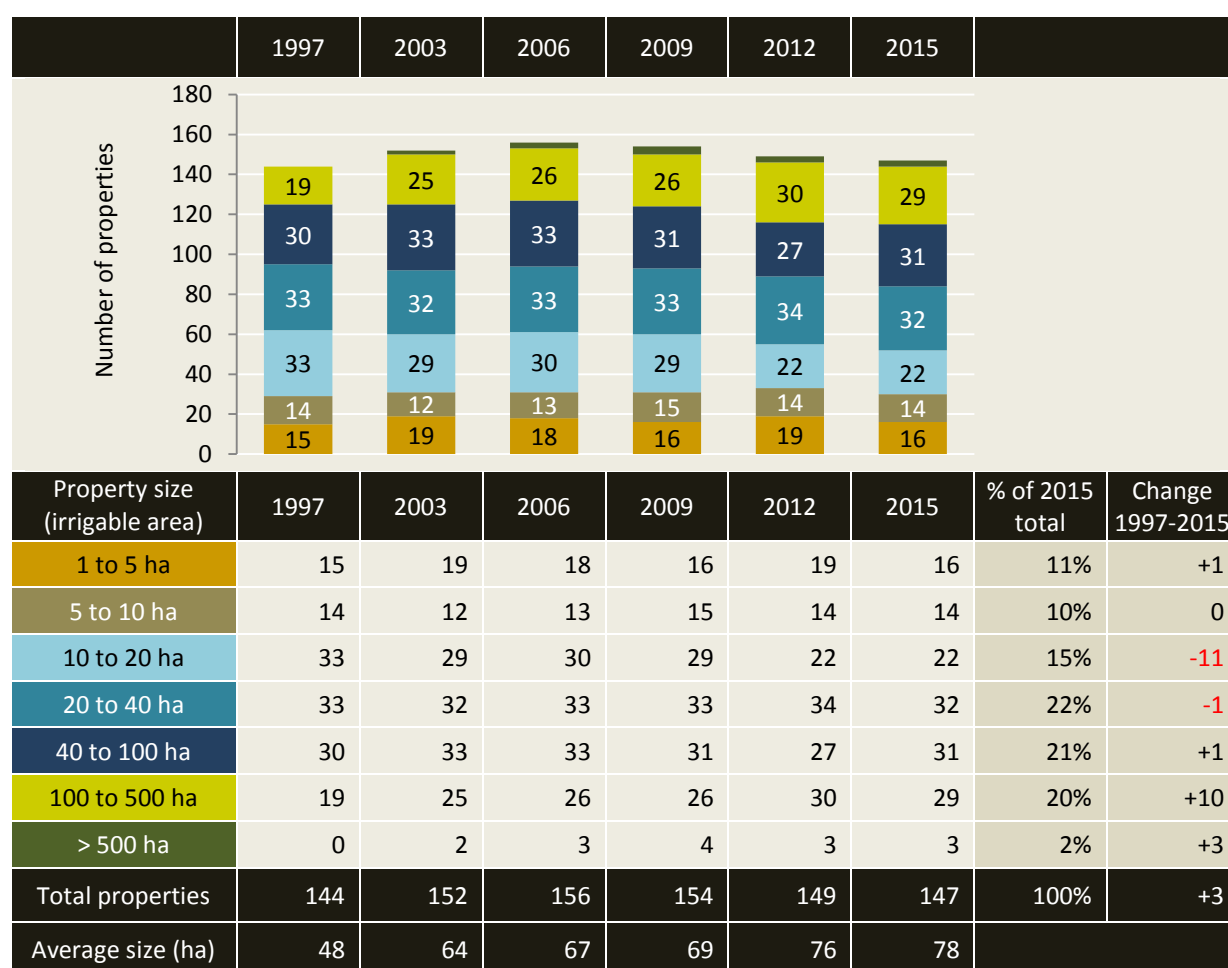


Figure 78: Colignan river reach - property numbers and sizes from 1997 to 2015

3.6 Mildura river reach (*Mildura to Lock 10*)

In summary for the Mildura river reach

Crop types

- Grapevines were the dominant crop type in the Mildura river reach from 1997 to 2015. Plantings peaked around 2006, declined from 2006 to 2012, then increased slightly between 2012 and 2015 due to table grape development (Figure 80).
- In 2015, the irrigable area was 1,885 ha comprising:
 - 51% (965 ha) irrigated permanent plantings;
 - 20% (365 ha) irrigated seasonal crops;
 - 23% (435 ha) vacant or not irrigated for less than 10 years; and
 - 6% (120 ha) vacant or not irrigated for more than 10 years.

Grapevines

- Grapevines in the Mildura river reach were predominantly grown for wine production from 1997 to 2015.
- The area of grapevines increased by 40 ha, a 5% increase from 735 ha in 1997 to 775 ha in 2015.
- In 2015, the 775 ha of grapevines comprised:
 - 46% (355 ha) wine grape plantings;
 - 39% (300 ha) table grape plantings; and
 - 15% (120 ha) dried grape plantings.

Irrigation methods

- Drip irrigation was the dominant irrigation method in the Mildura river reach from 2006 to 2015. Prior to 2006, the dominant method changed from furrows in 1997 to overhead sprinklers in 2003.
- In 2015, the irrigable area of 1,885 ha comprised:
 - 36% (680 ha) drip irrigation;
 - 11% (205 ha) low level irrigation;
 - 13% (235 ha) overhead sprinklers;
 - 11% (210 ha) furrow irrigation; and
 - 29% (555 ha) not irrigated.

Salinity impact zones

- The Mildura river reach is in the lowest salinity impact zone, LIZ 1 and the high impact zone, HIZ.
- In 2015, the irrigable area of 1,885 ha comprised:
 - 34% (635 ha) in LIZ 1; and
 - 66% (1,250 ha) in HIZ.
- The irrigable area in the HIZ decreased by 15 ha, a 1% decrease from 1,265 ha in 1997 to 1,250 ha in 2015. The decrease was mostly due to areas retired from irrigation for urban development.
- Irrigation development from 1997 to 2015 occurred predominantly in LIZ 1.

In summary for the Mildura river reach

Irrigation development

- In the Mildura river reach the irrigable area increased by 440 ha, a 30% increase from 1,445 ha in 1997 to 1,885 ha in 2015.
- The net increase of 440 ha comprised 55 ha retired from irrigation and 495 ha of expansion.

Irrigation properties

- There were approximately 103 irrigation properties (land holdings) in the Mildura river reach in 2015.
- Change in property numbers and size from 1997 to 2015:
 - Property numbers declined by 7, a 6% decrease from 110 in 1997 to 103 in 2015.
 - Properties with an irrigable area of less than 40 ha declined by 14, while the number over 40 ha increased by 7.
 - Average property size (irrigable area) increased from 13 ha in 1997 to 18 ha in 2015.

3.6.1 Mildura river reach - crop types in 2015

Table 21 and Map 20 show crop types in the Mildura river reach in 2015.

- Dominant plantings in the Mildura river reach in 2015 were:
 - Wine grapes, 19% of the irrigable area; and
 - Table grapes, 16% of the irrigable area.

Table 21 : Mildura river reach - crop types in 2015

	Crop type	Category	2015 (ha)	2015 %	Description
Permanent crops	Grapevine	Wine	355	19%	
		Table	300	16%	
		Dried	120	6%	
		Other	-	-	
	Citrus		80	4%	Grapefruit, Lemon, Mandarin, Navel, Blood Orange, Valencia
	Fruit tree	<i>unspecified</i>	-	-	
		Avocado	10	1%	
		Olive	15	1%	
		Stone fruit	-	-	
	Nut tree	Other	10	1%	Date Palm, Jujube, Mango
		Almond	-	-	
	Other	Other	10	1%	Pistachio, Walnut
		Nursery	5	<1%	
		Woodlot	60	3%	
		Misc.	-	-	
	Permanent crops	(sub-total)	965	51%	
Seasonal crops	Vacant P	≤ 10 years	225	12%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	10	1%	Vacant (not irrigated) for over ten years
	Field crop	<i>unspecified</i>	35	2%	Field crop category unknown
		Cereal	95	5%	
		Lucerne	50	3%	
		Pasture	110	6%	
		Other	-	-	
	Vegetable	<i>unspecified</i>	20	1%	Vegetable category unknown
		Asparagus	-	-	
		Carrot	-	-	
		Cucurbit	45	2%	
		Potato	-	-	
		Other	10	1%	
	Seasonal crops	(sub-total)	365	19%	
	Vacant S	≤ 10 years	210	11%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	110	6%	Vacant (not irrigated) for over ten years
	Total all crop areas		1,885	100%	

Note: '*unspecified*' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Mildura river reach 2015 crop types

Map 20: Mildura river reach showing 2015 crop types



3.6.2 Mildura river reach – change in crop types

Figure 79 summarises crop types in the Mildura river reach from 1997 to 2015.

- Grapevines were the dominant crop type in the Mildura river reach from 1997 to 2015. Plantings peaked around 2006, declined from 2006 to 2012, then increased slightly between 2012 and 2015 due to table grape development (Figure 80).
- In 2015, the irrigable area of 1,885 ha comprised:
 - 51% (965 ha) irrigated permanent plantings;
 - 20% (365 ha) irrigated seasonal crops;
 - 23% (435 ha) vacant or not irrigated for less than 10 years; and
 - 6% (120 ha) vacant or not irrigated for more than 10 years.

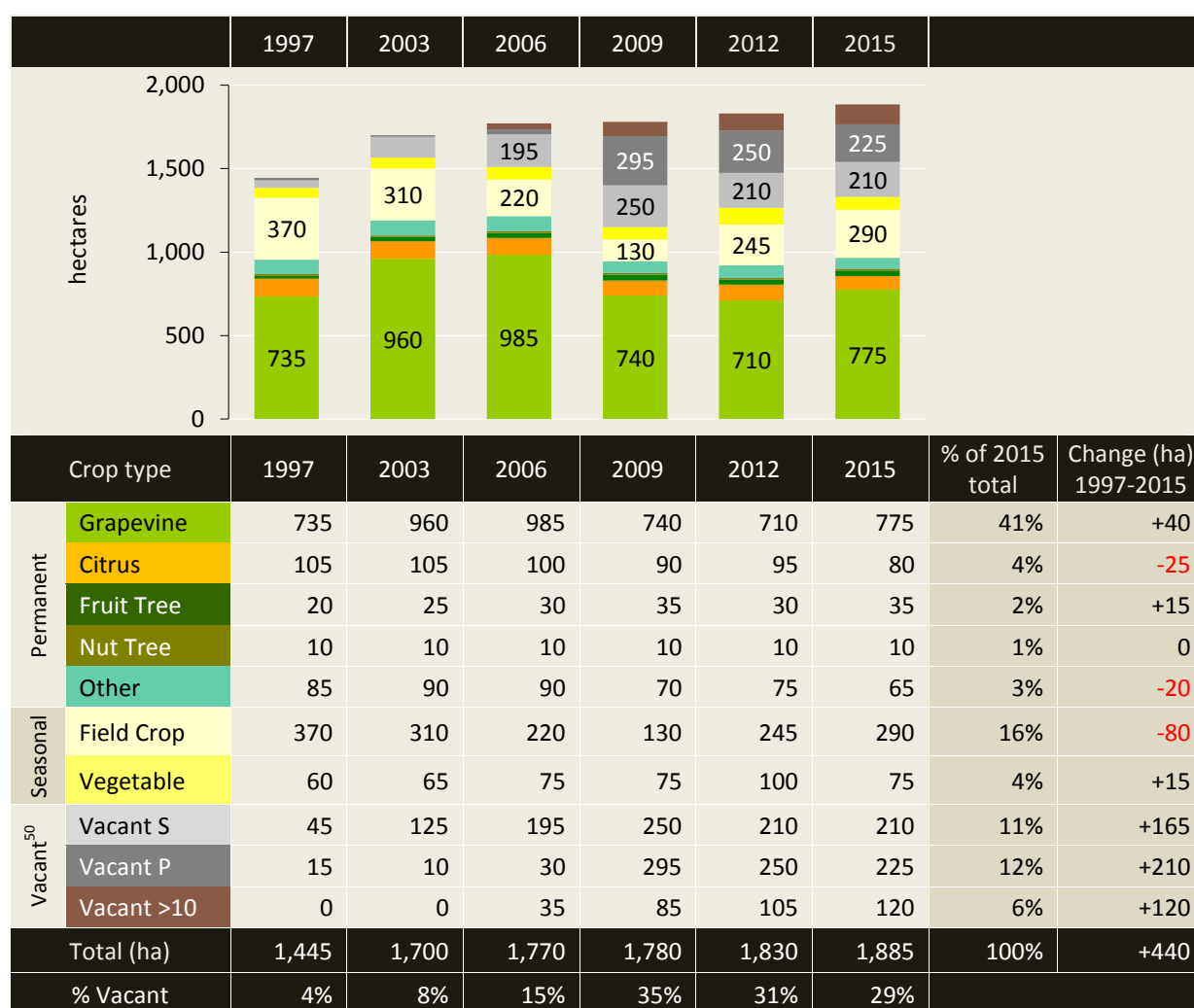


Figure 79: Mildura river reach - crop types from 1997 to 2015

⁵⁰ Vacant S: not irrigated but previously an irrigated seasonal crop. Vacant P: not irrigated but previously an irrigated permanent planting. Vacant >10: not irrigated for over ten years but previously an irrigated area.

3.6.3 Mildura river reach – grapevines

Figure 80 summarises grapevine types in the Mildura river reach from 1997 to 2015.

- The area of grapevines increased by 40 ha, a 5% increase from 735 ha in 1997 to 775 ha in 2015.
- In 2015, the 775 ha of grapevines comprised:
 - 46% (355 ha) wine grape plantings;
 - 39% (300 ha) table grape plantings; and
 - 15% (120 ha) dried grape plantings.
- Wine grape plantings decreased by 75 ha, a 17% decrease from 430 ha in 1997 to 355 ha in 2015.
 - Wine grape plantings were the dominant grapevine type from 1997 to 2015. Plantings peaked around 2003 at 640 ha.
- Table grape plantings increased by 235 ha, a 362% increase from 65 ha in 1997 to 300 ha in 2015.
- Dried grape plantings decreased by 120 ha, from 240 ha in 1997 to 120 ha in 2015.



Figure 80: Mildura river reach - grapevine plantings from 1997 to 2015

⁵¹ Other: grapes for juicing, cannery, research and trial varieties.

3.6.4 Mildura river reach – irrigation methods

Figure 81 summarises irrigation methods in the Mildura river reach from 1997 to 2015.

- In 2015, the irrigable area of 1,885 ha comprised:
 - 36% (680 ha) drip irrigation;
 - 11% (205 ha) low level irrigation;
 - 13% (235 ha) overhead sprinklers;
 - 11% (210 ha) furrow irrigation; and
 - 29% (555 ha) not irrigated.
- Drip irrigation increased by 460 ha, a 209% increase from 220 ha in 1997 to 680 ha in 2015.
 - Drip irrigation was the dominant irrigation method from 2006 to 2015.
- Low level irrigation increased by 55 ha, a 37% increase from 150 ha in 1997 to 205 ha in 2015.
- Overhead irrigation decreased by 190 ha, a 45% decrease from 425 ha in 1997 to 235 ha in 2015.
 - Overhead irrigation was the dominant method in 2003.
- Furrow irrigation decreased by 380 ha, a 64% decrease from 590 ha in 1997 to 210 ha in 2015.
 - Furrow, including flood, irrigation was the dominant method in 1997.

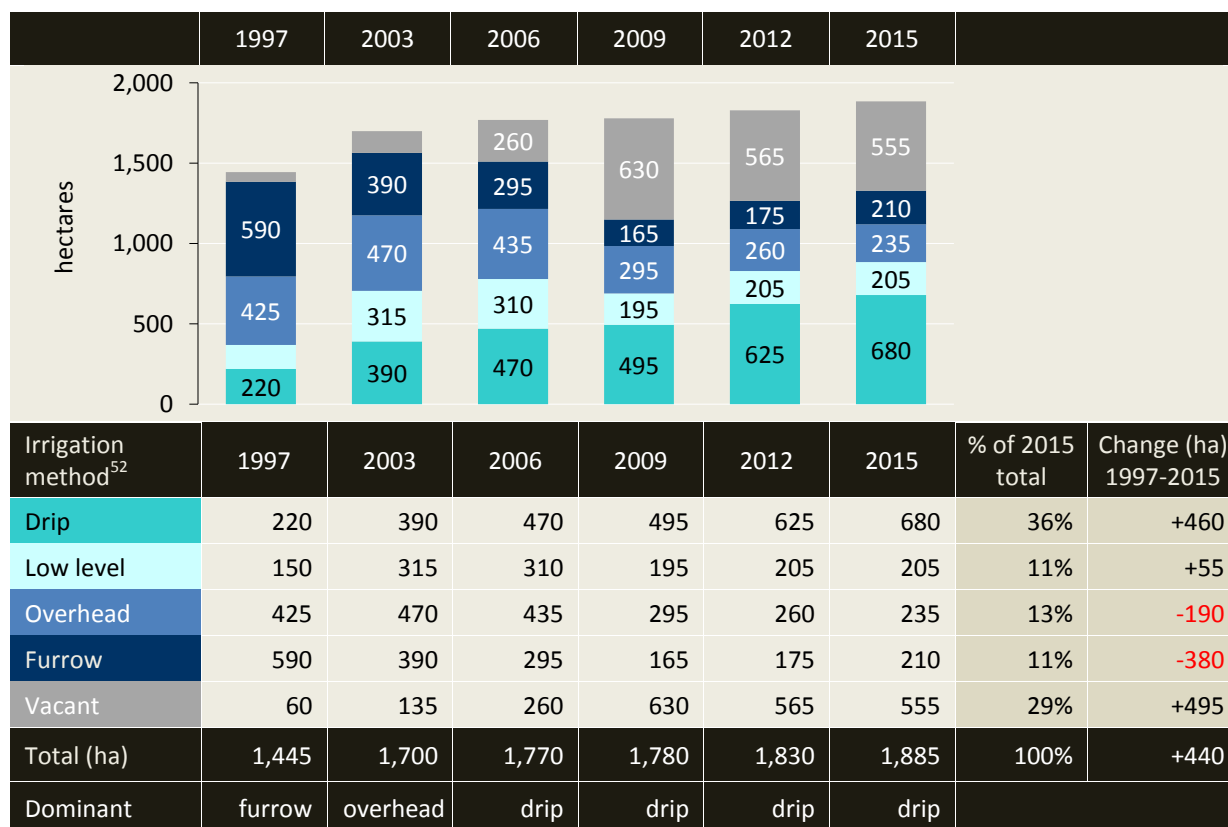


Figure 81: Mildura river reach - irrigation methods from 1997 to 2015

⁵² Overhead irrigation includes pivots and lateral move systems. Furrow includes flood irrigation. (Table 8)

3.6.5 Mildura river reach – salinity impact zones

Figure 82 summarises the irrigable area in each river salinity impact zone in the Mildura river reach from 1997 to 2015.

- In 2015, the irrigable area of 1,885 ha comprised:
 - 34% (635 ha) in the lowest salinity impact zone, LIZ 1; and
 - 66% (1,250 ha) in the high salinity impact zone, HIZ.
- The area irrigated in:
 - LIZ 1 increased by 290 ha, a 166% increase from 175 ha in 1997 to 465 ha in 2015; and
 - HIZ decreased by 345 ha, a 29% decrease from 1,210 ha in 1997 to 865 ha in 2015.
- The irrigable area in:
 - LIZ 1 increased by 455 ha, a 253% increase from 180 ha in 1997 to 635 ha in 2015; and
 - HIZ decreased by 15 ha, a 1% decrease from 1,265 ha in 1997 to 1,250 ha in 2015. The decrease was predominantly due to areas retired from irrigation for urban development and housing.

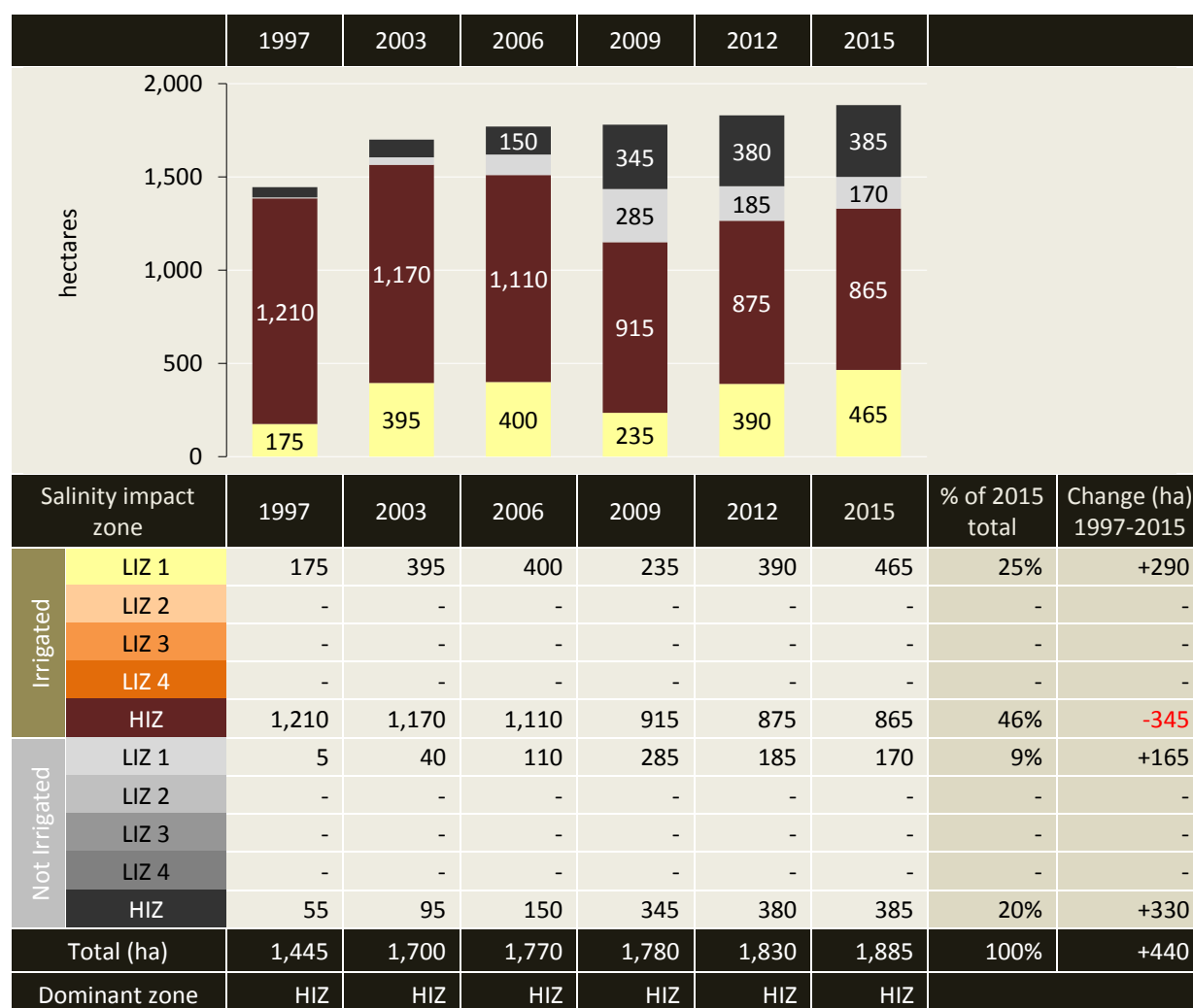


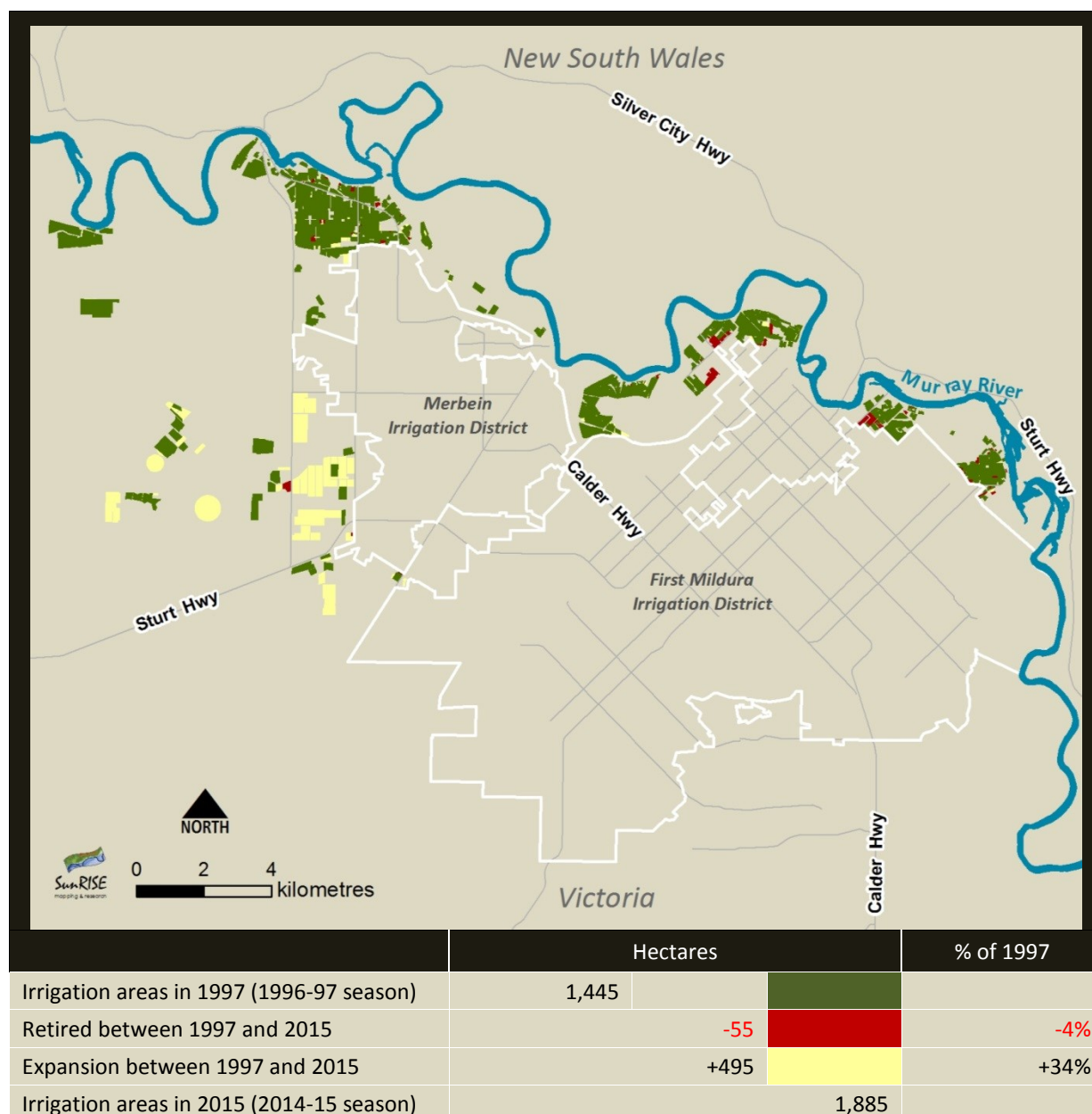
Figure 82: Mildura river reach - irrigable area in each salinity impact zone from 1997 to 2015

3.6.6 Mildura river reach – irrigation development

Map 21 shows irrigation development from 1997 to 2015 in the Mildura river reach with respect to new development (expansion) and areas retired⁵³ from irrigation.

- The irrigable area increased by 440 ha, a 30% increase from 1,445 ha in 1997 to 1,885 ha in 2015.
- The net increase of 440 ha comprised 55 ha retired from irrigation and 495 ha of expansion.

Map 21: Mildura river reach – irrigation development from 1997 to 2015



⁵³ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

3.6.7 Mildura river reach – property change

Figure 83 provides estimates of property numbers and average property size (irrigable area) in the Mildura river reach from 1997 to 2015.

- There were approximately 103 irrigation properties (land holdings) in the Mildura river reach in 2015.
- Property numbers declined by 7, a 6% decrease from 110 in 1997 to 103 in 2015.
- The number of properties less than 40 ha (irrigable area) declined by 14, while the number over 40 ha increased by 7.
- Average property size (irrigable area) increased from 13 ha in 1997 to 18 ha in 2015.

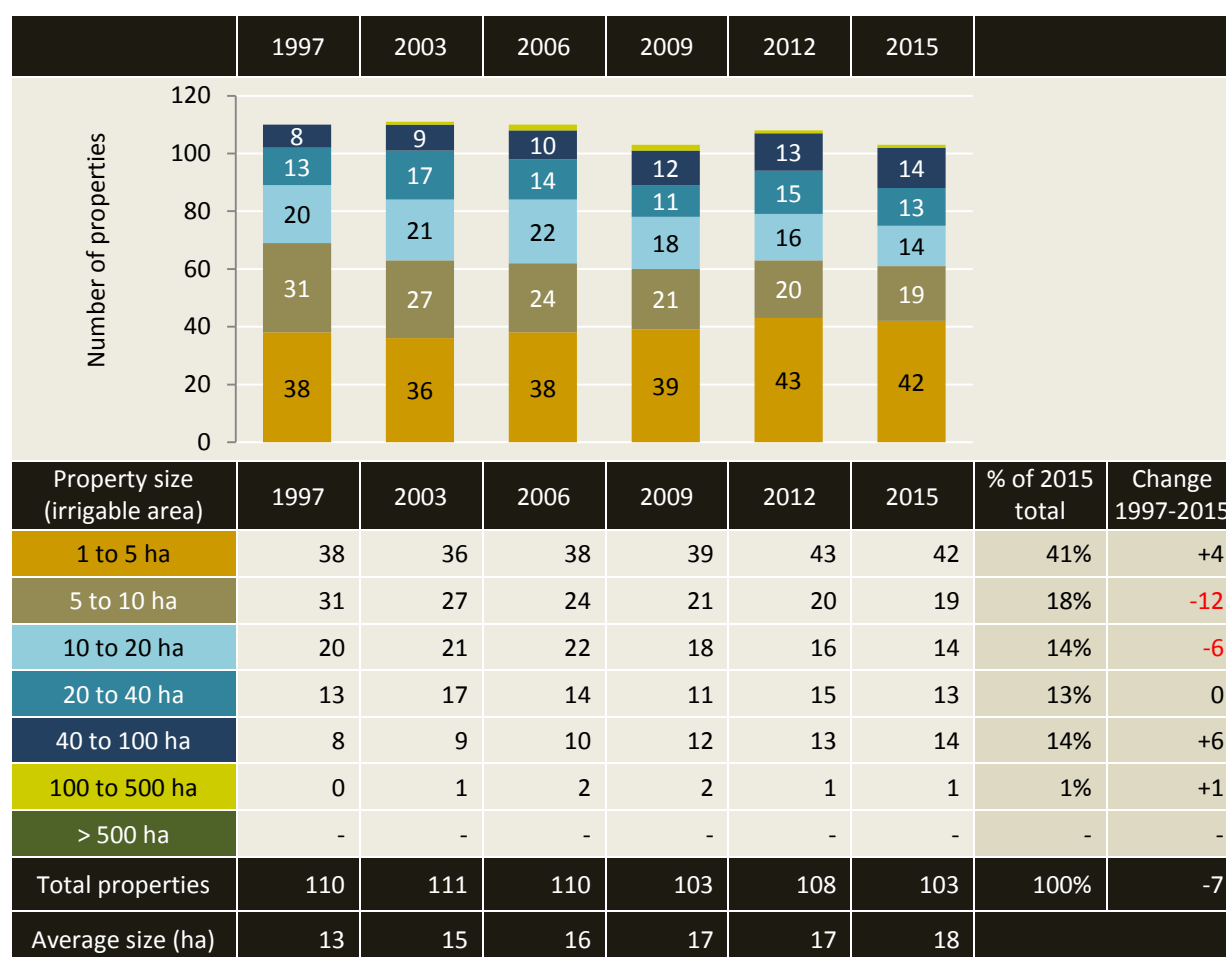


Figure 83: Mildura river reach - property numbers and sizes from 1997 to 2015

3.7 Lock 10 to the South Australian Border

In summary for the Lock 10 to South Australia river reach

Crop types

- Nut trees (almonds) were the dominant crop type from 1997 to 2015 in the Lock 10 to South Australia river reach. Plantings increased by 880 ha, a 134% increase from 655 ha in 1997 to 1,535 ha in 2015.
- In 2015, the irrigable area was 3,095 ha comprising:
 - 81% (2,490 ha) irrigated permanent plantings;
 - 1% (35 ha) irrigated seasonal crops;
 - 5% (170 ha) vacant or not irrigated for less than 10 years; and
 - 13% (400 ha) vacant or not irrigated for more than 10 years.

Grapevines

- Grapevines in the Lock 10 to South Australia river reach were predominantly grown for wine production from 1997 to 2015.
- The area of grapevines increased by 530 ha, a 180% increase from 295 ha in 1997 to 825 ha in 2015.
- In 2015, the 825 ha of grapevines comprised:
 - 98% (805 ha) wine grape plantings; and
 - 2% (20 ha) dried grape plantings.

Irrigation methods

- Drip irrigation was the dominant irrigation method in the Lock 10 to South Australia river reach from 2009 to 2015. Prior to 2009, low level sprinklers were the dominant method from 1997 to 2003, and were equally dominant with drippers in 2006.
- In 2015, the irrigable area of 3,095 ha comprised:
 - 52% (1,600 ha) drip irrigation;
 - 29% (905 ha) low level irrigation;
 - < 1% (10 ha) overhead sprinklers;
 - < 1% (10 ha) furrow irrigation; and
 - 18% (570 ha) not irrigated.

Salinity impact zones

- The Lock 10 to South Australia river reach is in the lowest salinity impact zone, LIZ 1 and in the high salinity impact zone, HIZ.
- In 2015, the irrigable area of 3,095 ha comprised:
 - 79% (2,640 ha) in LIZ 1; and
 - 21% (635 ha) in the HIZ.
- The irrigable area in the HIZ was 635 ha in both 1997 and 2015.
- Irrigation development from 1997 to 2015 occurred predominantly in LIZ 1.

In summary for the Lock 10 to South Australia river reach

Irrigation development

- In the Lock 10 to South Australia reach the irrigable area increased by 1,455 ha, an 89% increase from 1,640 ha in 1997 to 3,095 ha in 2015.
- The net increase of 1,455 ha comprised 145 ha retired from irrigation and 1,600 ha of expansion.

Irrigation properties

- There were approximately 21 irrigation properties (land holdings) in the Lock 10 to South Australia river reach in 2015.
- Change in property numbers and size from 1997 to 2015:
 - Property numbers increased by 4, a 24% increase from 17 in 1997 to 21 in 2015.
 - The number of properties with an irrigable area of less than 40 ha did not change, while the number over 40 ha increased by 4.
 - Average property size (irrigable area) increased from 96 ha in 1997 to 147 ha in 2015.

3.7.1 Lock 10 to South Australia - crop types in 2015

Table 22 and Map 22 show crop types in the Lock 10 to South Australia study area in 2015.

- Dominant plantings in the Lock 10 to South Australia river reach in 2015 were:
 - Almond trees, 50% of the irrigable area; and
 - Wine grapes, 26% of the irrigable area.

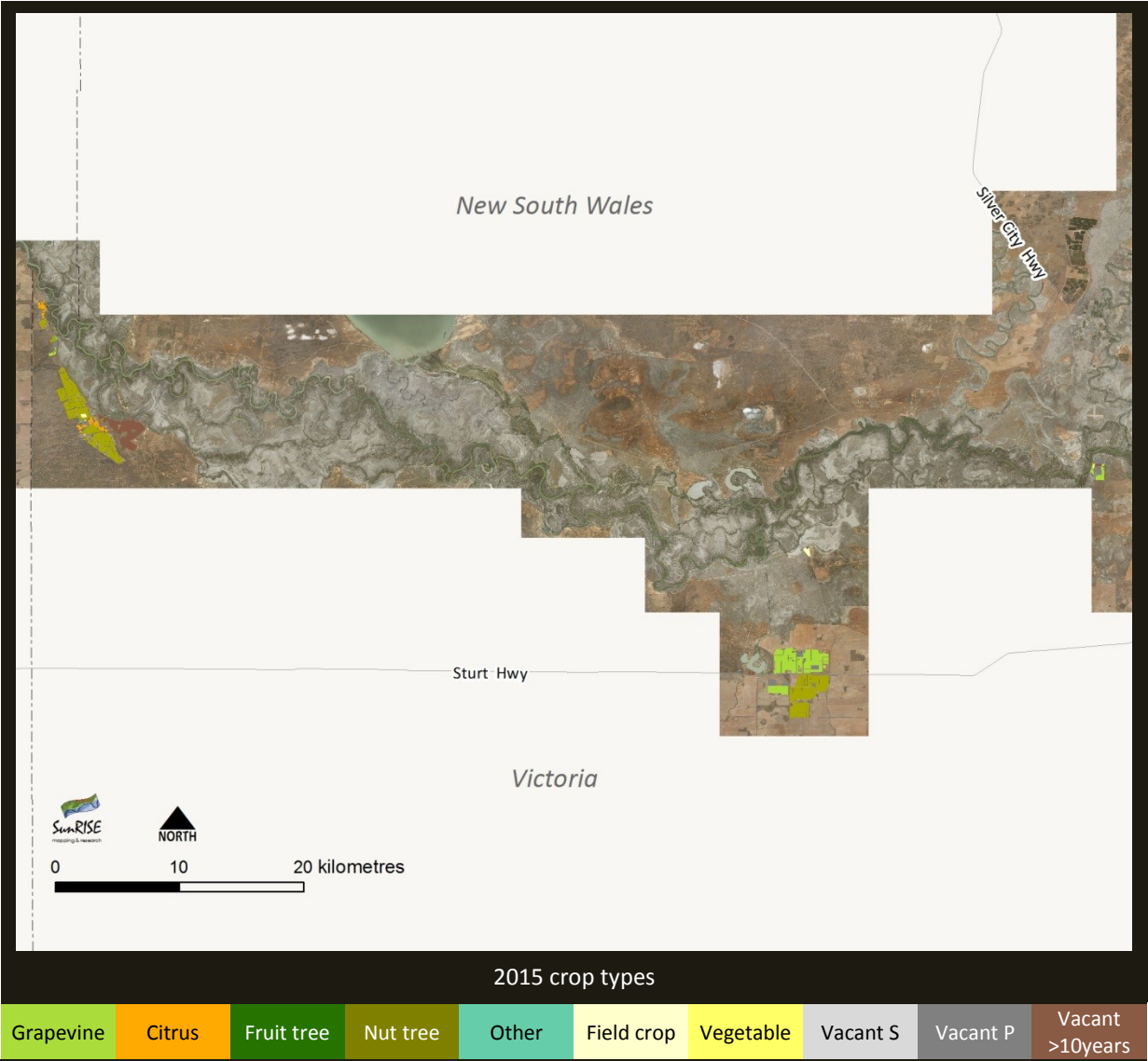
Table 22: Lock 10 to South Australia - crop types in 2015

	Crop type	Category	2015 (ha)	2015 %	Description
Permanent crops	Grapevine	Wine	805	26%	
		Table	-	-	
		Dried	20	1%	
		Other	-	-	
	Citrus		125	4%	Grapefruit, Lemon, Mandarin, Navel, Blood Orange, Valencia
	Fruit tree	<i>unspecified</i>	-	-	
		Avocado	-	-	
		Olive	-	-	
		Stone fruit	-	-	
		Other	-	-	
	Nut tree	Almond	1,535	50%	
		Other	-	-	
	Other	Nursery	5	<1%	
		Woodlot	-	-	
		Misc.	-	-	
	Permanent crops	(sub-total)	2,490	80%	
Seasonal crops	Vacant P	≤ 10 years	170	5%	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	-	-	Vacant (not irrigated) for over ten years
	Field crop	<i>unspecified</i>	-	-	
		Cereal	-	-	
		Lucerne	-	-	
		Pasture	20	1%	
		Other	10	<1%	Cover crop
	Vegetable	<i>unspecified</i>	-	-	
		Asparagus	-	-	
		Carrot	-	-	
		Cucurbit	-	-	
		Potato	-	-	
		Other	5	<1%	Lettuce
	Seasonal crops	(sub-total)	35	1%	
	Vacant S	≤ 10 years	-	-	Vacant (not irrigated) for ten years or less
	Vacant >10	> 10 years	400	13%	Vacant (not irrigated) for over ten years
	Total all crop areas		3,095	100%	

Note: '*unspecified*' refers to unknown crop categories that may be categories already listed OR other categories not listed.

Lock 10 to South Australia 2015 crop types

Map 22: Lock 10 to South Australia showing 2015 crop types



3.7.2 Lock 10 to South Australia - change in crop types

Figure 84 summarises crop types in the Lock 10 to South Australia river reach from 1997 to 2015.

- Nut trees (almonds) were the dominant crop type in the Lock 10 to South Australia river reach from 1997 to 2015. Plantings increased by 880 ha, a 134% increase from 655 ha in 1997 to 1,535 ha in 2015.
- In 2015, the irrigable area of 3,095 ha comprised:
 - 81% (2,490 ha) irrigated permanent plantings;
 - 1% (35 ha) irrigated seasonal crops;
 - 5% (170 ha) vacant or not irrigated for less than 10 years; and
 - 13% (400 ha) vacant or not irrigated for more than 10 years.

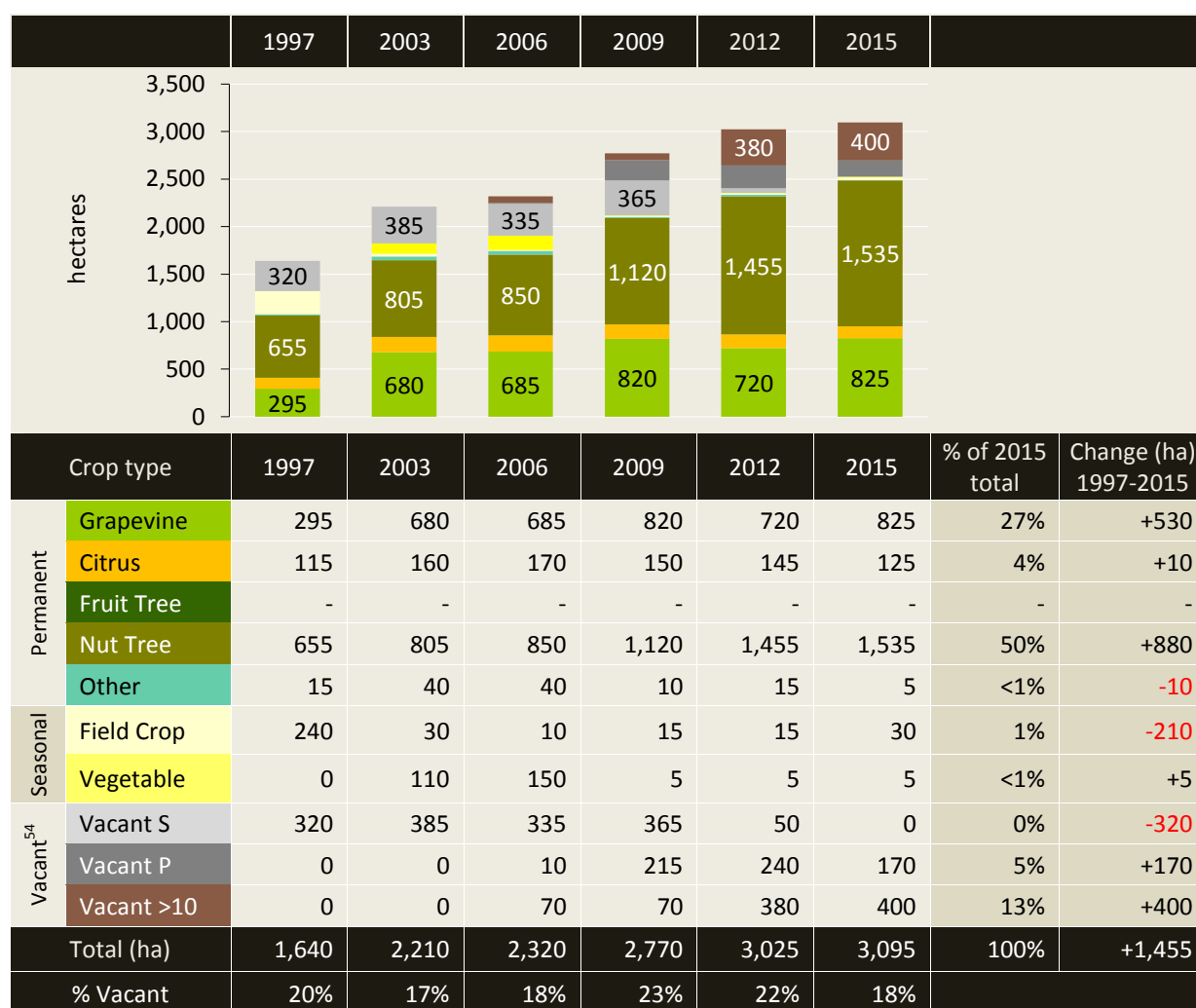


Figure 84: Lock 10 to South Australia - crop types from 1997 to 2015

⁵⁴ Vacant S: not irrigated but previously an irrigated seasonal crop. Vacant P: not irrigated but previously an irrigated permanent planting. Vacant >10: not irrigated for over ten years but previously an irrigated area.

3.7.3 Lock 10 to South Australia – grapevines

Figure 85 summarises grapevine types in the Lock 10 to South Australia river reach from 1997 to 2015.

- The area of grapevines increased by 530 ha, a 180% increase from 295 ha in 1997 to 825 ha in 2015.
- In 2015, the 825 ha of grapevines comprised:
 - 98% (805 ha) wine grape plantings; and
 - 2% (20 ha) dried grape plantings.
- Wine grape plantings increased by 515 ha, a 178% increase from 290 ha in 1997 to 805 ha in 2015.
 - Wine grape plantings were the dominant grapevine type from 1997 to 2015.
- Dried grape plantings increased by 15 ha, a 300% increase from 5 ha in 1997 to 20 ha in 2015.

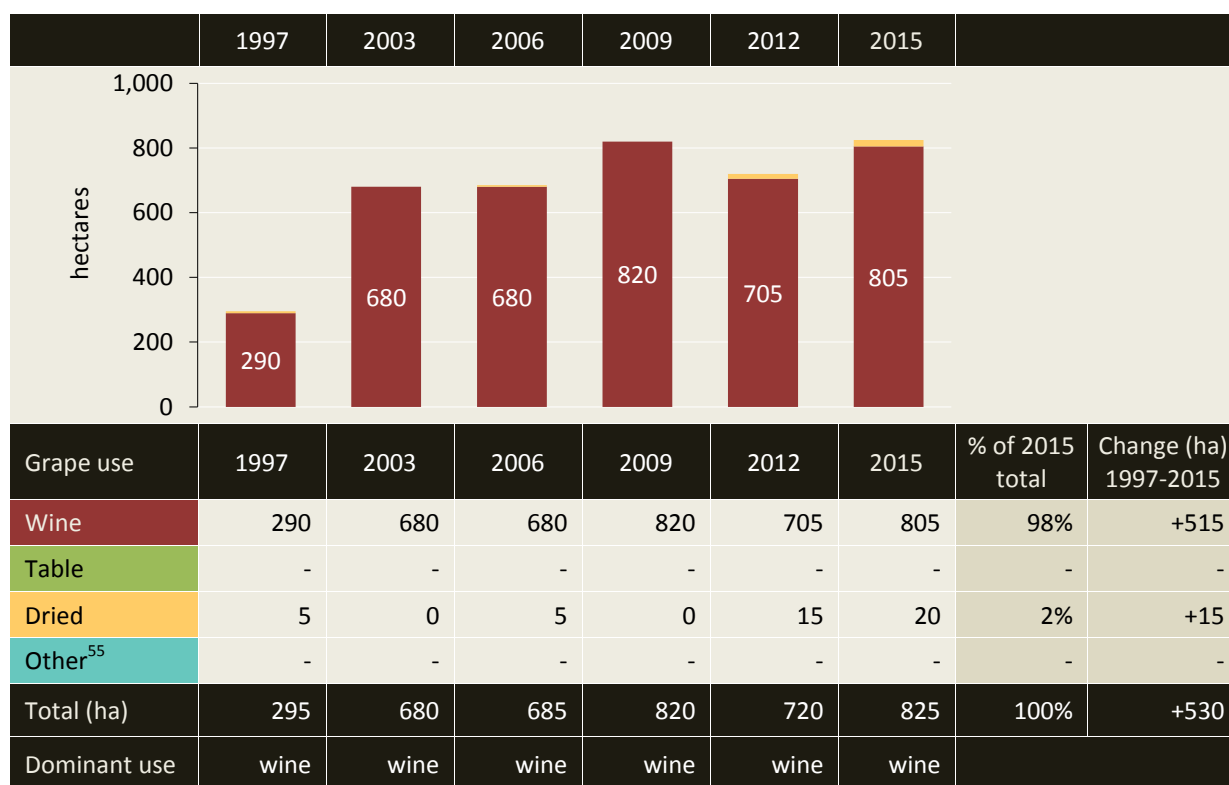


Figure 85: Lock 10 to South Australia - grapevine plantings from 1997 to 2015

⁵⁵ Other: grapes for juicing, cannery, research and trial varieties.

3.7.4 Lock 10 to South Australia – irrigation methods

Figure 86 summarises irrigation methods in the Lock 10 to South Australia river reach from 1997 to 2015.

- In 2015, the irrigable area of 3,095 ha comprised:
 - 52% (1,600 ha) drip irrigation;
 - 29% (905 ha) low level irrigation;
 - < 1% (10 ha) overhead sprinklers;
 - < 1% (10 ha) furrow irrigation; and
 - 18% (570 ha) not irrigated.
- Drip irrigation increased by 1,310 ha, a 452% increase from 290 ha in 1997 to 1,600 ha in 2015.
 - Drip irrigation was the dominant irrigation method from 2009 to 2015.
 - Drip and low level irrigation were the dominant methods in 2006.
- Low level irrigation increased by 120 ha, a 15% increase from 785 ha in 1997 to 905 ha in 2015.
 - Low level irrigation was the dominant method from 1997 to 2003.
- Overhead irrigation decreased by 5 ha, a 33% decrease from 15 ha in 1997 to 10 ha in 2015.
- Furrow irrigation decreased by 220 ha, a 96% decrease from 230 ha in 1997 to 10 ha in 2015.

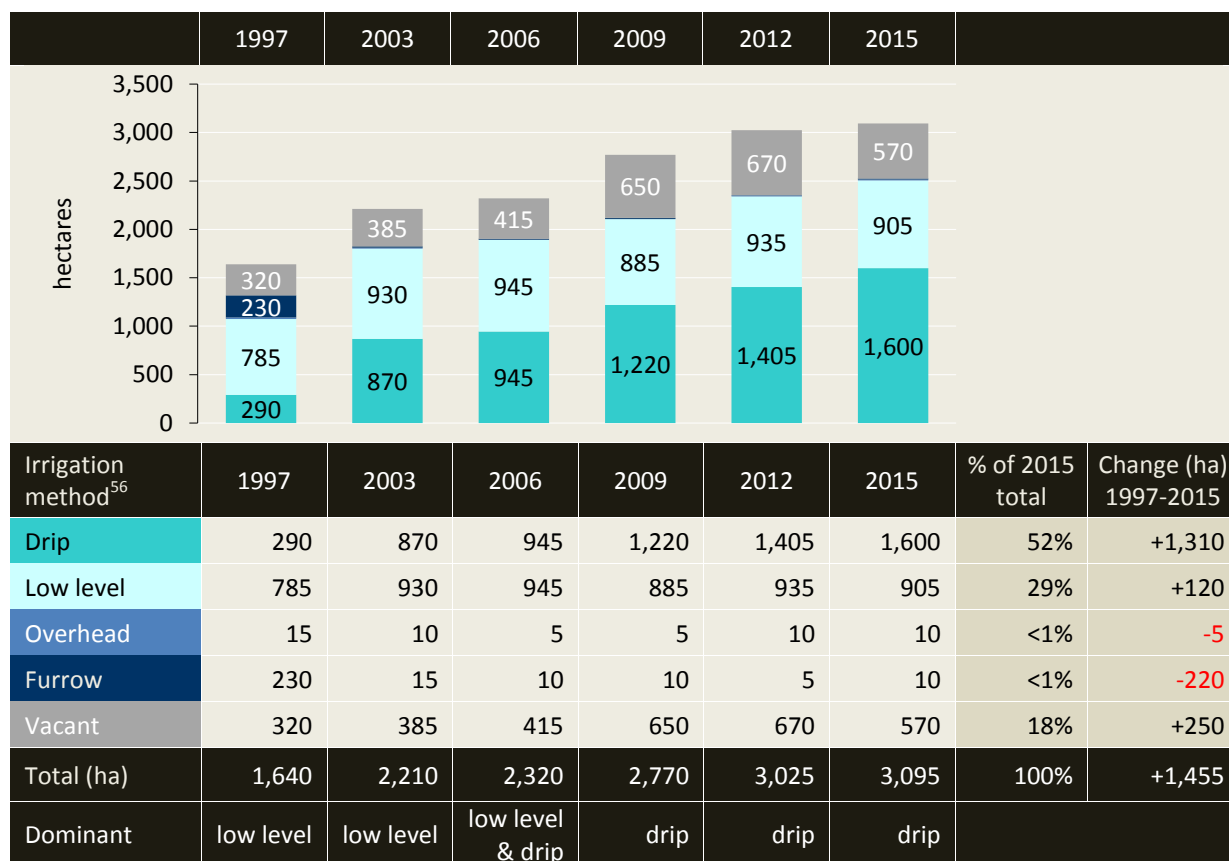


Figure 86: Lock 10 to South Australia - irrigation methods from 1997 to 2015

⁵⁶ Overhead irrigation includes pivots and lateral move systems. Furrow includes flood irrigation. (Table 8)

3.7.5 Lock 10 to South Australia – salinity impact zones

Figure 87 summarises the irrigable area in each river salinity impact zone in the Lock 10 to South Australia river reach from 1997 to 2015.

- In 2015, the irrigable area of 3,095 ha comprised:
 - 79% (2,460 ha) in the lowest salinity impact zone, LIZ 1; and
 - 21% (635 ha) in the high salinity impact zone, HIZ.
- The area irrigated in:
 - LIZ 1 increased by 1,330 ha, a 132% increase from 1,005 ha in 1997 to 2,335 ha in 2015; and
 - HIZ decreased by 125 ha, a 40% decrease from 315 ha in 1997 to 190 ha in 2015.
- The irrigable area in:
 - LIZ 1 increased by 1,455 ha, a 145% increase from 1,005 ha in 1997 to 2,460 ha in 2015; and
 - HIZ was 635 ha in both 1997 and 2015.
- Some areas classed as HIZ in 1997 were retired from irrigation, while others were brought into irrigation production, resulting in no net change to the total irrigable area in the HIZ zone.

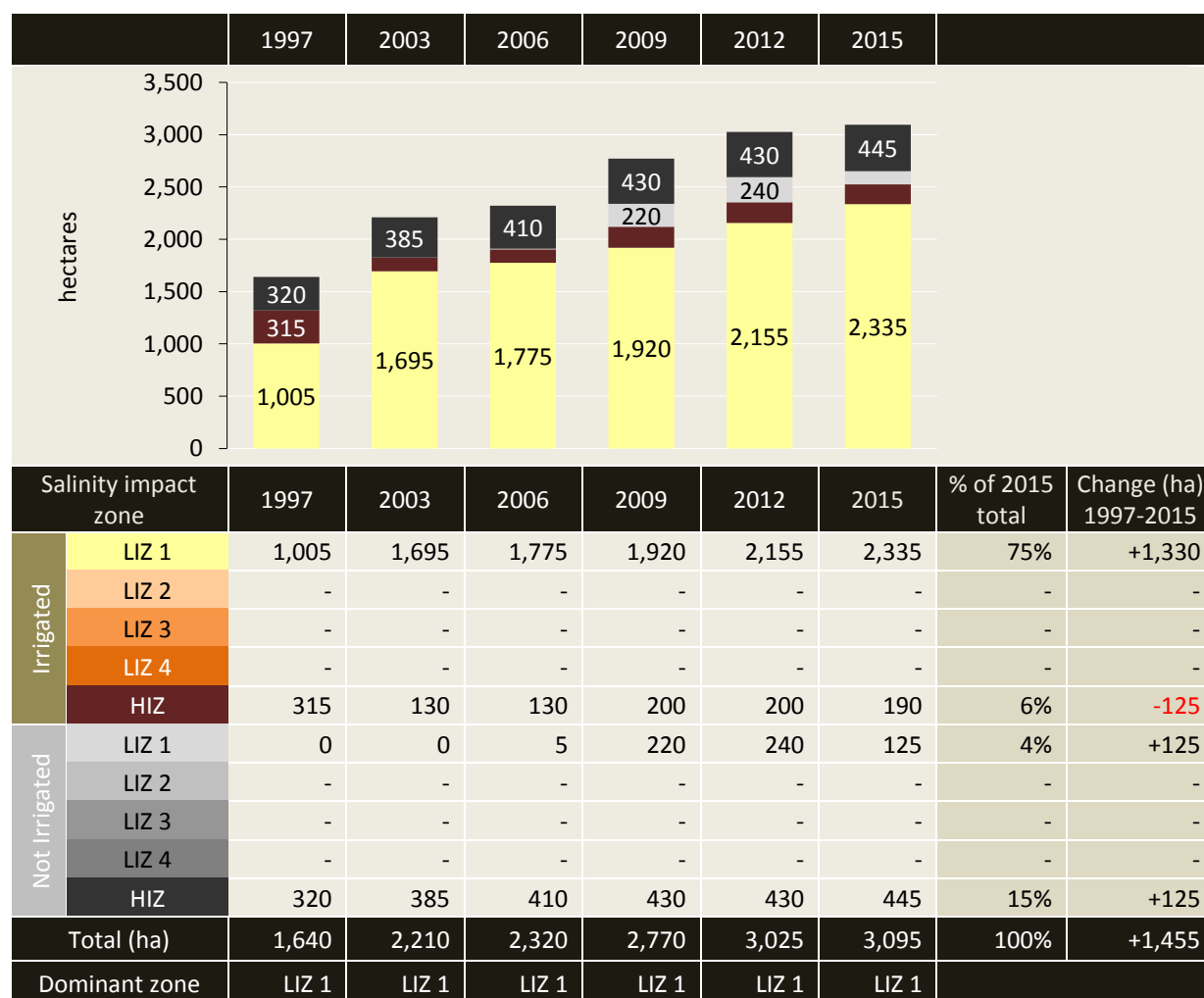


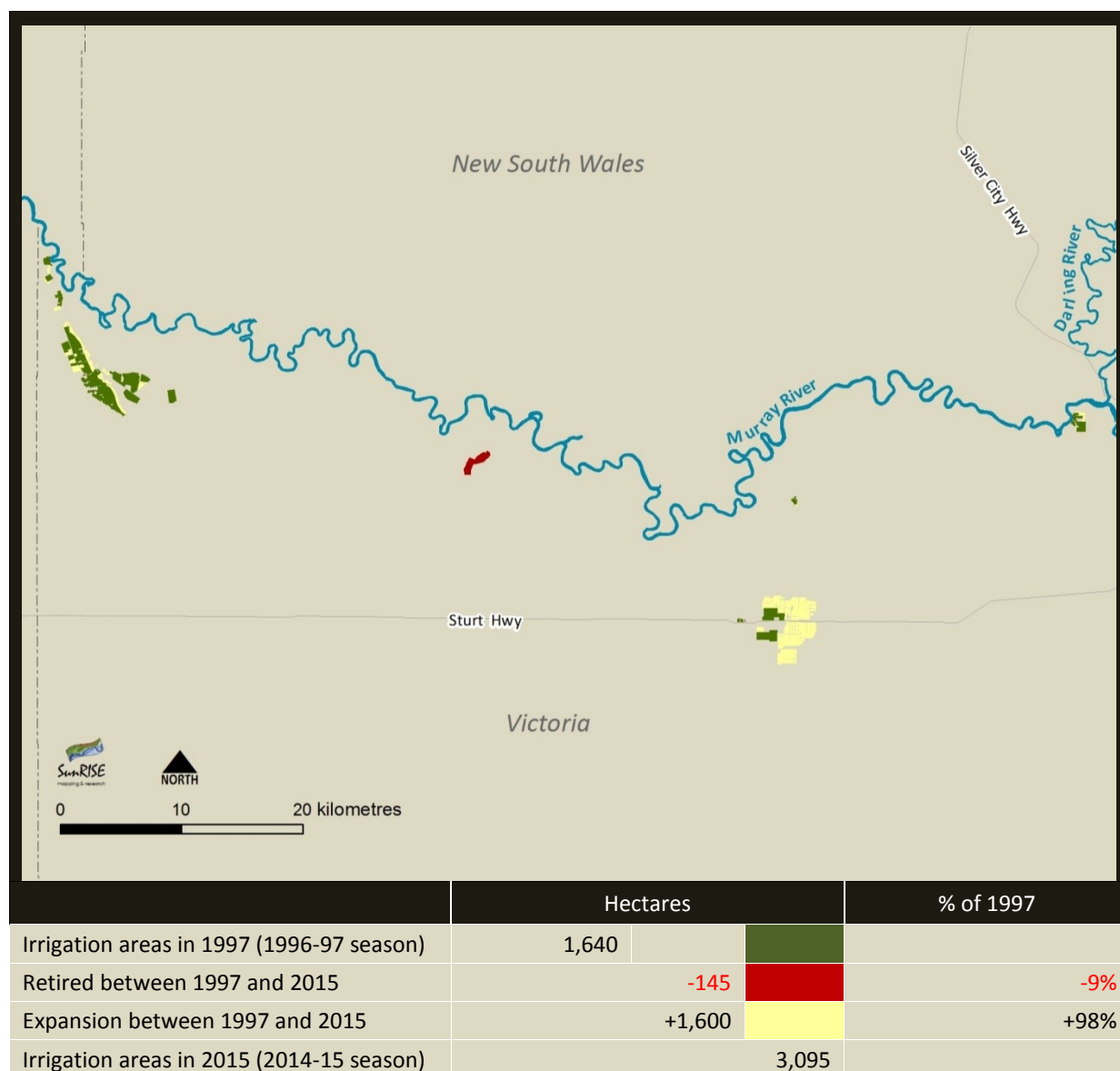
Figure 87: Lock 10 to South Australia - irrigable area in each salinity impact zone from 1997 to 2015

3.7.6 Lock 10 to South Australia – irrigation development

Map 23 shows irrigation development from 1997 to 2015 in the Lock 10 to South Australia river reach with respect to new development (expansion) and areas retired⁵⁷ from irrigation.

- The irrigable area increased by 1,455 ha, an 89% increase from 1,640 ha in 1997 to 3,095 ha in 2015.
- The net increase of 1,455 ha comprised 145 ha retired from irrigation and 1,600 ha of expansion.

Map 23: Lock 10 to South Australia – irrigation development from 1997 to 2015



⁵⁷ Retired areas were previously irrigated but have undergone a change in land use that precludes use for irrigation e.g. urban development, housing, sheds, dams and land set aside for conservation purposes.

3.7.7 Lock 10 to South Australia – property change

Figure 88 provides estimates of property numbers and average property size (irrigable area) in the Lock 10 to South Australia river reach from 1997 to 2015.

- There were approximately 21 irrigation properties (land holdings) in the Lock 10 to South Australia river reach in 2015.
- Property numbers increased by 4, a 24% increase from 17 in 1997 to 21 in 2015.
- The total number of properties less than 40 ha (irrigable area) did not change, while the number over 40 ha increased by 4.
- Average property size (irrigable area) increased from 96 ha in 1997 to 147 ha in 2015.

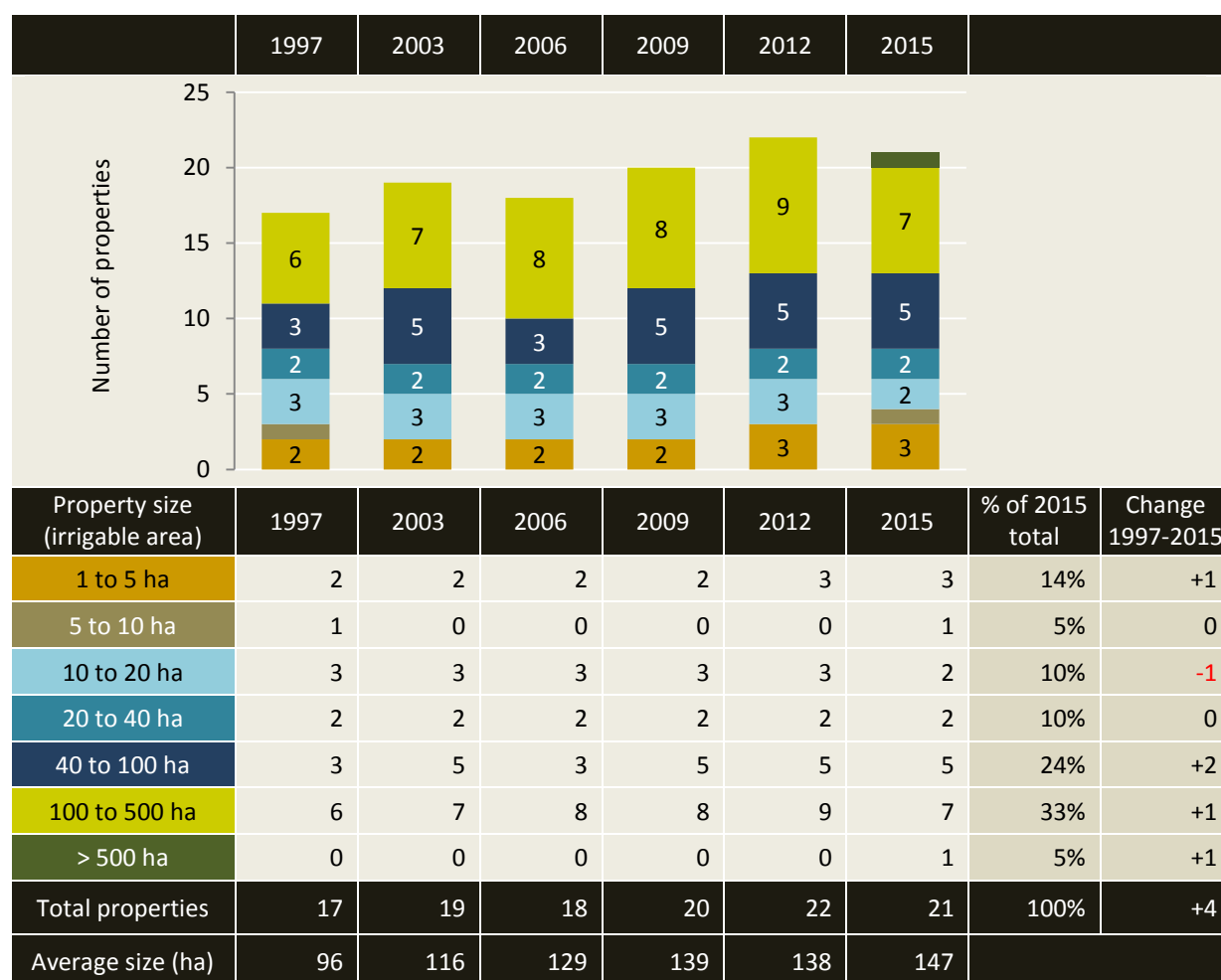


Figure 88: Lock 10 to South Australia - property numbers and sizes from 1997 to 2015

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Disclaimer

This report has been prepared by SunRISE Mapping and Research in consultation with individuals and regional organisations. Information contained herein is based on data and information from a range of sources. Whilst SunRISE Mapping and Research has endeavoured to correctly interpret, analyse and present the information, SunRISE Mapping and Research does not warrant that this report is definitive nor free of error and does not accept liability for any loss caused or arising from use of or reliance upon information contained herein.



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