# Technical information supporting the 2023 Soil protection: adoption of no-till environmental trend and condition report card

Department for Environment and Water
August, 2023

DEW Technical note 2023/55

Government of South Australia
Department for Environment and Water

Department for Environment and Water

Government of South Australia

August 2023

81-95 Waymouth St, ADELAIDE SA 5000

Telephone +61 (8) 8463 6946

Facsimile +61 (8) 8463 6999

ABN 36702093234

**www.environment.sa.gov.au**

*Disclaimer*

The Department for Environment and Water and its employees do not warrant or make any representation regarding the use, or results of the use, of the information contained herein as regards to its correctness, accuracy, reliability, currency or otherwise. The Department for Environment and Water and its employees expressly disclaims all liability or responsibility to any person using the information or advice. Information contained in this document is correct at the time of writing.



*Preferred way to cite this publication*

Department for Environment and Water (2023). *Technical information supporting the 2023 Soil protection: adoption of no-till environmental trend and condition report card*, DEW Technical report 2023/55, Government of South Australia, Department for Environment and Water, Adelaide.

*Download this document at* https://data.environment.sa.gov.au

# Acknowledgement of Country

We acknowledge and respect the Traditional Custodians whose ancestral lands we live and work upon and we pay our respects to their Elders past and present. We acknowledge and respect their deep spiritual connection and the relationship that Aboriginal and Torres Strait Islanders people have to Country. We also pay our respects to the cultural authority of Aboriginal and Torres Strait Islander people and their nations in South Australia, as well as those across Australia.

# Acknowledgements

This document was prepared by Giles Forward (DEW). Tim Herrmann (DEW) provided principal oversight throughout and technical review of this report. Improvements were made to this report and associated report card based on an external review by Mary-Anne Young (PIRSA), reviews by Tim Herrmann and Amy Ide, and mapping support from Brady Stead.

# Contents

## List of figures



## List of tables

# Summary

The 2023 release of South Australia's environmental trend and condition report cards summarises our understanding of the current condition of the South Australian environment, and how it is changing over time.

This document describes the indicators, information sources, analysis methods and results used to develop this report and the associated 2023 Soil protection: adoption of no-till report card. The reliability of information sources used in the report card is also described.

The Soil protection: adoption of no-till report card sits within the report card Land theme and Agrricultural land sub-theme. Report cards are published by the Department for Environment and Water and can be accessed at www.environment.sa.gov.au.

# 1 Introduction

## 1.1 Environmental trend and condition reporting in SA

The Minister for Climate, Environment and Water under the *Landscape South Australia Act 2019* is required to 'monitor, evaluate and audit the state and condition of the State's natural resources, coasts and seas; and to report on the state and condition of the State's natural resources, coasts and seas' (9(1(a-b)). Environmental trend and condition report cards are produced as the primary means for the Minister to undertake this reporting. Trend and condition report cards are also a key input into the State of the Environment Report for South Australia, which must be prepared under the *Environment Protection Act 1993*. This Act states that the State of the Environment Report must:

- include an assessment of the condition of the major environmental resources of South Australia (112(3(a))), and
- include a specific assessment of the state of the River Murray, especially taking into account the Objectives for a Healthy River Murray under the *River Murray Act 2003* (112(3(ab))), and
- identify significant trends in environmental quality based on an analysis of indicators of environmental quality (112(3(b))).

## 1.2 Purpose and benefits of SA's trend and condition report cards

South Australia's environmental trend and condition report cards focus on the state's priority environmental assets and the pressures that impact on these assets. The report cards present information on trend, condition, and information reliability in a succinct visual summary.

The full suite of report cards captures patterns in trend and condition, generally at a state scale, and gives insight to changes in a particular asset over time. They also highlight gaps in our knowledge on priority assets that prevent us from assessing trend and condition and might impede our ability to make evidence-based decisions.

Although both trend and condition are considered important, the report cards give particular emphasis to trend. Trend shows how the environment has responded to past drivers, decisions, and actions, and is what we seek to influence through future decisions and actions.

The benefits of trend and condition report cards include to:

- provide insight into our environment by tracking its change over time
- interpret complex information in a simple and accessible format
- provide a transparent and open evidence base for decision-making
- provide consistent messages on the trend and condition of the environment in South Australia
- highlight critical knowledge gaps in our understanding of South Australia's environment
- support alignment of environmental reporting, ensuring we 'do once, use many times'.

Environmental trend and condition report cards are designed to align with and inform state of the environment reporting at both the South Australian and national level. The format, design and accessibly of the report cards has been reviewed and improved with each release.

## 1.3 Soil erosion on agricultural land

Erosion is a natural process, however the clearance and cultivation of land for agriculture has resulted in rates of soil loss many times higher than in undisturbed environments. Soil erosion is the highest priority threat to the agricultural soils in South Australia (SA) (Forward 2021). Approximately 5.4 million hectares of agricultural land (60% of cleared land) in SA are inherently susceptible to wind erosion, and 2.9 million hectares (32%) are inherently susceptible to water erosion (DEW State Land and Soil Information Framework (SLASIF)). The soil's inherent susceptibility to erosion varies depending on soil characteristics and landscape features such as texture, slope and exposure (or elevation).

Without intervention, soil erosion can have adverse social, economic and environmental impacts. Soil erosion depletes the productive capacity of land as it removes nutrients, organic matter and clay from soil, which are most important for plant growth. Soil erosion has a wide range of costly off-site impacts including damage to roads, disruption to transport and electricity supply, contamination of wetlands, watercourses and marine environments, and human health impacts caused by raised dust.

Soil is predisposed to a risk of erosion by physical disturbance or removal of surface vegetative cover. Very dry seasonal conditions, particularly during successive dry seasons, increase the risk of erosion where there is reduced vegetative cover resulting from poor crop and pasture growth. Fires remove surface vegetation, exposing the soil to erosion until new cover can be established.

Critical management practices that affect the risk of soil erosion are:

- the occurrence, intensity and timing of tillage operations
- the quantity and nature of surface cover.

In the past, most erosion risk was due to cropping practices such as tillage (traditionally often multiple tillage passes) and stubble burning, which mainly occurred in late autumn to early winter. These practices nowadays are usually carried out on only a small proportion of rain-fed cropping land. The practices of no-till and stubble retention are now widely adopted across SA's agricultural lands. Threats such as pests (e.g. mice, snails), and herbicide resistant weeds can lead to increased use of tillage or burning at times. Grazing management is also an important factor, especially in dry seasons. The highest risks associated with grazing occur in late summer and autumn when feed availability and the cover of annual crop and pasture residues dwindle.

The incidence of actual soil erosion is highly variable spatially and temporally, and is impractical to measure. The risk of erosion (or corresponding protection from erosion) is monitored at a broad scale across the agricultural areas of SA. Any trend in erosion risk/protection is likely to result in a corresponding change in actual soil erosion in the longer term. Soil erosion risk is reported in the 2023 Days at risk of soil erosion report card.

'No-till' is a seeding method for broadacre annual crops, mainly cereals, grain legumes and oilseeds. Crop sowing using 'no-till' methods potentially minimises the risk of soil erosion compared to when sowing crops using more traditional, full tillage methods. No-till sowing uses specifically designed agricultural implements that only disturb a narrow band of soil into which seed and fertiliser are placed. This leaves the inter-row area relatively undisturbed, enabling stubbles or pasture residues and their root crowns to remain intact, protecting the soil from erosion. A single sowing pass with a narrow band of disturbance also minimises the period that disturbed soil is exposed to wind and water erosion.

Besides reducing soil erosion risk, no-till cropping systems also enable more timely, earlier sowing which tends to increase yields and crop water use efficiency.

# 2 Methods

## 2.1 Indicator

The indicator used for the Soil protection: adoption of no-till report card is the proportion of agricultural crops sown using no-till methods in South Australia, according to the Department for Environment and Water's (DEW) Land manager telephone surveys.

## 2.2 Data sources

Department for Environment and Water (DEW) Land manager telephone surveys (2000–2017)

Department for Environment and Water (DEW) Erosion protection field surveys (2000–2022)

Department of Primary Industries and Regions (PIRSA) Crop area data (1998-99 to 2021-22) Crop and pasture reports - PIRSA

Primary Industries Scorecard 2021–22, SA Department of Primary Industries and Regions (PIRSA 2023). Primary Industries Scorecard 2021–22 (pir.sa.gov.au)

## 2.3 Data collection

### 2.3.1 Land manager telephone surveys

DEW commissioned a series of 7 telephone surveys of randomly selected, commercial agricultural land managers (dryland cropping, grazing, dairy) in agricultural regions of SA from 2000 to 2017 to obtain data on soil-management related issues including their awareness and understanding of these issues, and practices used to manage them (Forward unpublished draft). No-till is one of these key practices.

Data obtained from these surveys includes the proportion (percentage) of the crop area sown using no-till methods. This was defined as sowing without prior tillage, using some form of narrow disturbance implement, including narrow points or a low disturbance disc opener seeding implement.

Trends in no-till sowing are an indicator of practice change that relate closely to trends in erosion risk in the Days at risk of soil erosion report card.

The survey questions specifically asked respondents the area they cropped last season, whether no-till methods were used, and what area of their crop was sown using no-till.

## 2.4 Data analysis

Survey respondents' data were geolocated by postcode, then analysed by SA landscape region, and the state mean calculated by area-weighting. There is no meaningful data for Green Adelaide because it contains only a very small area of agricultural land, of which little or none is cropped. No assessment was undertaken for the Alinytjara Wilurara and South Australian Arid Lands landscape regions which lie almost entirely outside the SA agricultural zone.

Data for no-till was obtained from these surveys for the period 1999 to 2016 (i.e. practices carried out the year prior to the survey conducted in autumn). For years from 2017 to 2022, the approximate percentage of crop area sown using no-till was estimated from:

- 'Disturbance rating' data and general observations in DEW's erosion protection field surveys.
- General observations and knowledge of regionally based soil and land management staff in PIRSA and landscape boards.

Erosion protection field surveys do not capture the actual use of no-till sowing, but it can be inferred from 'soil disturbance rating' observations. The proportion of sites with a 'partial disturbance' rather than 'full disturbance' in June surveys provides a guide to the proportion of no-till sowing, but this is confounded by other factors (e.g. sites partially stabilised following earlier sowing or cultivation; disturbance due to heavy livestock trampling or wind erosion). These data are therefore only used as a broad guide rather than a direct measure to support land manager survey data.

## 2.5 Methods to assign trend, condition and reliablity

### 2.5.1 Trend

Based on expert opinion, trends in percentage of crop area sown with no-till were classified as stable, getting better or getting worse if the rate of change in the 5 year trend (estimated 2018 to 2022) was calculated as a ≤10% change, >10% increase, or >10% decrease, respectively (Table 2.1).

**Table 2.1. Definition of trend classes used**

| Trend | Description |
|---|---|
| Getting better | Over a scale relevant to tracking change in the indicator it is improving in status with good confidence |
| Stable | Over a scale relevant to tracking change in the indicator it is neither improving nor declining in status |
| Getting worse | Over a scale relevant to tracking change in the indicator it is declining in status with good confidence |
| Unknown | Data are not available, or are not available at relevant temporal scales, to determine any trend in the status of this resource |
| Not applicable | This indicator of the natural resource does not lend itself to being classified into one of the above trend classes |

### 2.5.2 Condition

Based on expert opinion, the condition classifications of percentage of crop area sown with no-till are: Very good ≥75%; Good ≥60%–75%; Fair ≥40%–60%; Poor <40% (Table 2.2).

**Table 2.2. Definition of condition classes used**

| Condition | Description | Threshold |
|---|---|---|
| Very good | The natural resource is in a state that meets all environmental, economic and social expectations, based on this indicator. Thus, desirable function can be expected for all processes/services expected of this resource, now and into the future, even during times of stress (e.g. prolonged drought) | Higher than or equal to 75% |
| Good | The natural resource is in a state that meets most environmental, economic and social expectations, based on this indicator. Thus, desirable function can be expected for only some processes/services expected of this resource, now and into the future, even during times of stress (e.g. prolonged drought) | Between 60% and less than 75% |
| Fair | The natural resource is in a state that does not meet some environmental, economic and social expectations, based on this indicator. Thus, desirable function cannot be expected from many processes/services expected of this resource, now and into the future, particularly during times of stress (e.g. prolonged drought) | Between 40% and less than 60% |
| Poor | The natural resource is in a state that does not meet most environmental, economic and social expectations, based on this indicator. Thus, desirable function cannot be expected from most processes/services expected of this resource, now and into the future, particularly during times of stress (e.g. prolonged drought) | Lower than 40% |
| Unknown | Data are not available to determine the state of this natural resource, based on this indicator | - |
| Not applicable | This indicator of the natural resource does not lend itself to being classified into one of the above condition classes | - |

### 2.5.3 Limitation

The surveys were designed to obtain a sufficiently representative sample of the commercial farming businesses (dryland crops, grazing, dairy) in agricultural regions of the state's agricultural zone, to enable comparisons and trends from the results to be obtained. Responses were obtained from 1000 land managers in most surveys (600 in the initial survey in 2000), which was on average approximately 10% of this population according to data from the Australian Bureau of Statistics (ABS).

Absolute data values for regions or the state may therefore vary slightly from the actual means for the whole farming businesses.

There could also be some degree of respondent bias in such surveys, whereby respondents may tend to exaggerate their responses according to their perceived objective of the survey, e.g. inflate use of no-till in a survey targeting use of sustainable land management practices such as no-till. It is also possible that farmers committed to improved soil management were more willing to participate in the surveys.

Survey questions regarding use of no-till specifically excluded land that was tilled (cultivated) prior to sowing or land sown with a 'full (width) cut' implement, but did not exclude the use of other pre-sowing operations that could have increased erosion risk such as prickle chaining or harrowing.

### 2.5.4 Reliability

Information is scored for reliability based on the minimum of subjective scores (1 [worst] to 5 [best]) given for information currency, applicability, level of spatial representation and accuracy. Definitions guiding the application of these scores are provided in Table 2.3 for currency, Table 2.4 for applicability, Table 2.5 for spatial representation and Table 2.6 for accuracy.

**Table 2.3. Guides for applying information currency**

| Currency score | Criteria |
|---|---|
| 1 | Most recent information >10 years old |
| 2 | Most recent information up to 10 years old |
| 3 | Most recent information up to 7 years old |
| 4 | Most recent information up to 5 years old |
| 5 | Most recent information up to 3 years old |

**Table 2.4. Guides for applying information applicability**

| Applicability score | Criteria |
|---|---|
| 1 | Data are based on expert opinion of the measure |
| 2 | All data based on indirect indicators of the measure |
| 3 | Most data based on indirect indicators of the measure |
| 4 | Most data based on direct indicators of the measure |
| 5 | All data based on direct indicators of the measure |

**Table 2.5. Guides for applying spatial representation of information (sampling design)**

| Spatial score | Criteria |
|---|---|
| 1 | From an area that represents less than 5% the spatial distribution of the asset within the region/state or spatial representation unknown |
| 2 | From an area that represents less than 25% the spatial distribution of the asset within the region/state |
| 3 | From an area that represents less than half the spatial distribution of the asset within the region/state |
| 4 | From across the whole region/state (or whole distribution of asset within the region/state) using a sampling design that is not stratified |
| 5 | From across the whole region/state (or whole distribution of asset within the region/state) using a stratified sampling design |

**Table 2.6. Guides for applying accuracy information**

| Accuracy score | Criteria |
|---|---|
| 1 | Better than could be expected by chance |
| 2 | > 60% better than could be expected by chance |
| 3 | > 70 % better than could be expected by chance |
| 4 | > 80 % better than could be expected by chance |
| 5 | > 90 % better than could be expected by chance |

## 2.6 Data transparency

Data transparency for this report card is represented in Appendix A.

# 3 Results

## 3.1 Trend

The trend in adoption of no-till in the past 5 years (2018–2022) is considered to be stable in the state and all agricultural landscape regions for which data are available (Table 3.1, Figure 3.1). The change in percentage of crop area sown with no-till is estimated to be less than 10% over this period in all agricultural landscape regions. The survey data for the state and all regions show a strong improving trend from 1999 to 2016, and this is estimated to have levelled off at approximately 80% of crop area, on average, since then (Figures 3.2, 3.3; Table 3.2).

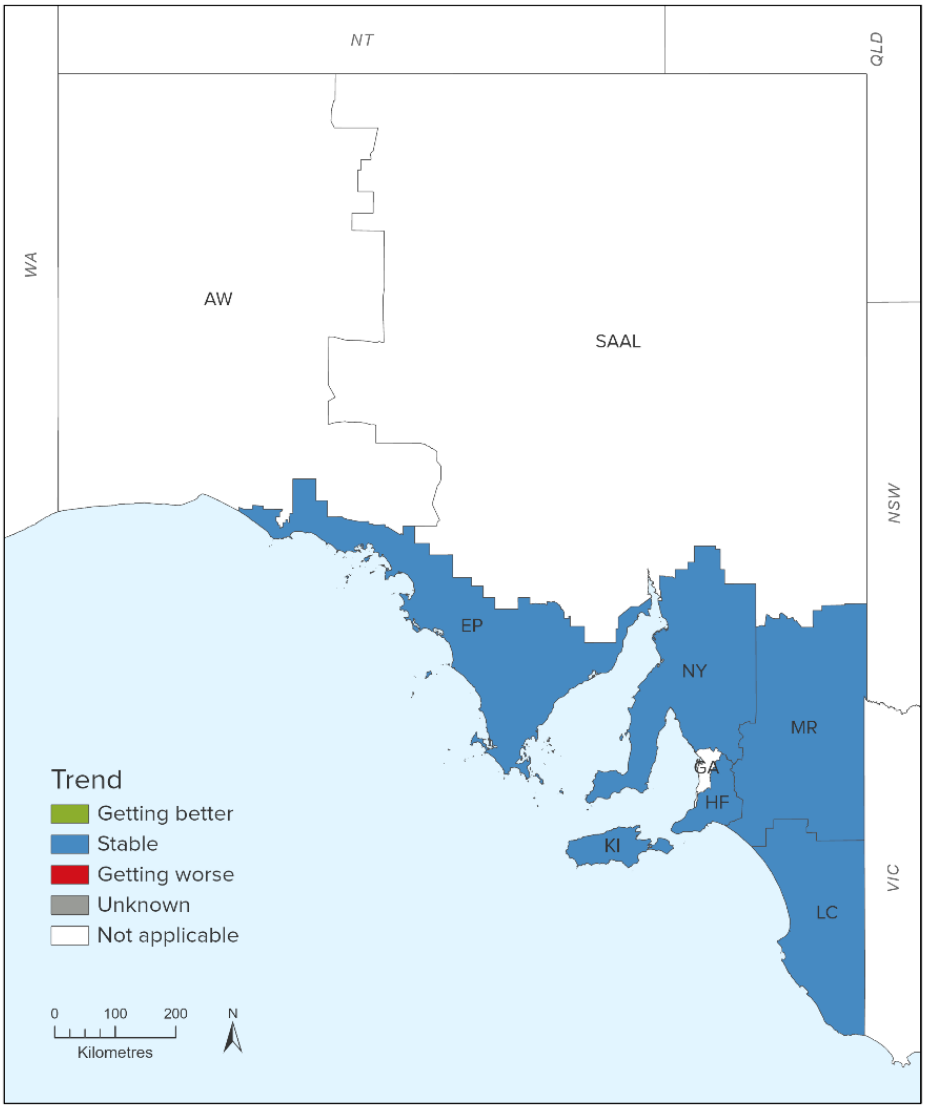



**Figure 3.1. Map of no-till adoption trend ratings by SA landscape region, 2018–2022. Landscape region abbreviations: Alinytjara Wilurara (AW), South Australian Arid Lands (SAAL), Eyre Peninsula (EP), Northern and Yorke (NY), Murraylands and Riverland (MR), Green Adelaide (GA), Hills and Fleurieu (HF), Kangaroo Island (KI), Limestone Coast (LC)**

The estimated no-till percentages from 2018 to 2022 (Figure 3.2; Tables 3.1, 3.2) are based on a combination of observational data and general observations from the erosion protection field surveys, as well as knowledge of regionally based soil and land management staff in PIRSA and landscape boards. These indicate a generally stable trend of adoption of no-till over this period, as a practically achievable maximum level has been reached in most areas of the state (Tables 3.1, 3.2).

For the most recent comparable period with the actual no-till data (7 year period from 2010 to 2016), there was an improving ('getting better') trend in the proportion of crop area sown with no-till for the state and all agricultural landscape regions (Tables 3.1, 3.2). The improvement from 2010 was 26% across the state, and ranged from 12% in Eyre Peninsula region to 41% in Kangaroo Island.

**Table 3.1. Seven-year change (2010–2016) and 5 year change (2018–2022) in proportion of crop area sown using no-till and respective trend ratings; for state and landscape regions**

| | 7 year change 2010–2016 | | 5 year change 2018–2022 | |
|---|---|---|---|---|
| **Landscape region** | **% crop no-till** | **Trend rating** | **% crop no-till** | **Trend rating** |
| State (agricultural zone) | 26 | Getting better | Less than 10% | Stable |
| Eyre Peninsula | 12 | Getting better | Less than 10% | Stable |
| Northern and Yorke | 33 | Getting better | Less than 10% | Stable |
| Hills and Fleurieu | 40 | Getting better | Less than 10% | Stable |
| Kangaroo Island | 41 | Getting better | Less than 10% | Stable |
| Murraylands and Riverland | 30 | Getting better | Less than 10% | Stable |
| Limestone Coast | 35 | Getting better | Less than 10% | Stable |

**Table 3.2. Proportion of crop area sown with no-till for the state, 1999–2016 and estimated average at 2022**

| Year | 1999 | 2001 | 2004 | 2007 | 2010 | 2013 | 2016 | 2022 |
|---|---|---|---|---|---|---|---|---|
| Percentage | 16 | 23 | 47 | 62 | 66 | 67 | 83 | 80 |

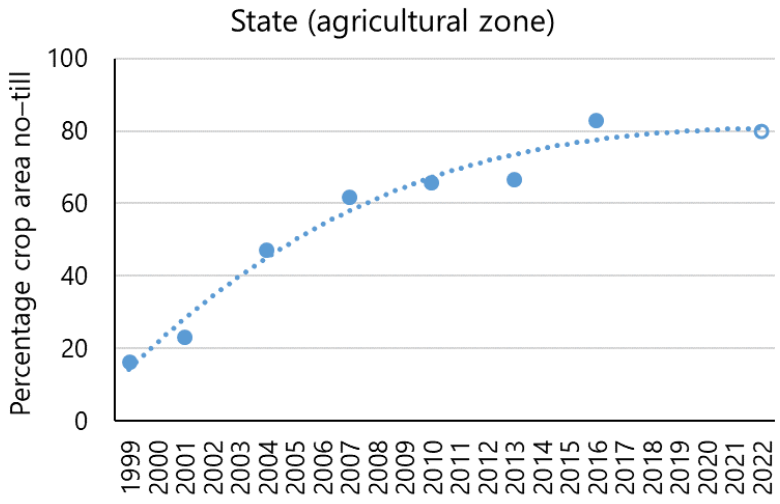
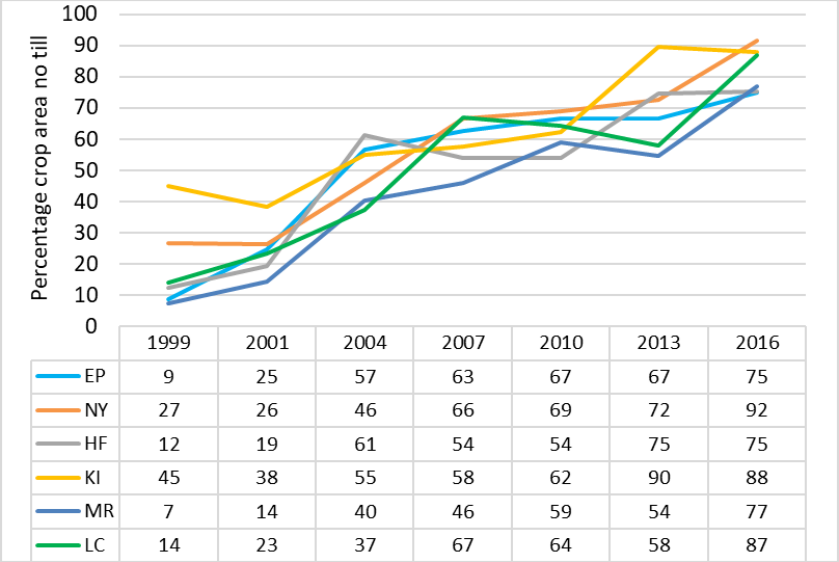



**Figure 3.2. Proportion of crop area sown with no-till for the state, 1999–2016 and estimated average at 2022, with approximate trend line**




| | 1999 | 2001 | 2004 | 2007 | 2010 | 2013 | 2016 |
|---|---|---|---|---|---|---|---|
| EP | 9 | 25 | 57 | 63 | 67 | 67 | 75 |
| NY | 27 | 26 | 46 | 66 | 69 | 72 | 92 |
| HF | 12 | 19 | 61 | 54 | 54 | 75 | 75 |
| KI | 45 | 38 | 55 | 58 | 62 | 90 | 88 |
| MR | 7 | 14 | 40 | 46 | 59 | 54 | 77 |
| LC | 14 | 23 | 37 | 67 | 64 | 58 | 87 |

**Figure 3.3. Proportion of crop area sown with no-till for landscape regions, 1999–2016. See Figure 3.1 for landscape region names and abbreviations**

According to PIRSA crop estimate data (PIRSA crop and pasture reports), most of the agricultural land area cropped in the state occurs in 4 landscape regions (in descending order): Northern and Yorke (NY), Eyre Peninsula (EP), Murraylands and Riverland (MR), and Limestone Coast (LC). The impact of no-till adoption in terms of land area (hence area protected from erosion) is therefore greater in these regions, particularly NY and EP, than in the Hills and Fleurieu (HF) or Kangaroo Island (KI) regions (Figure 3.4).

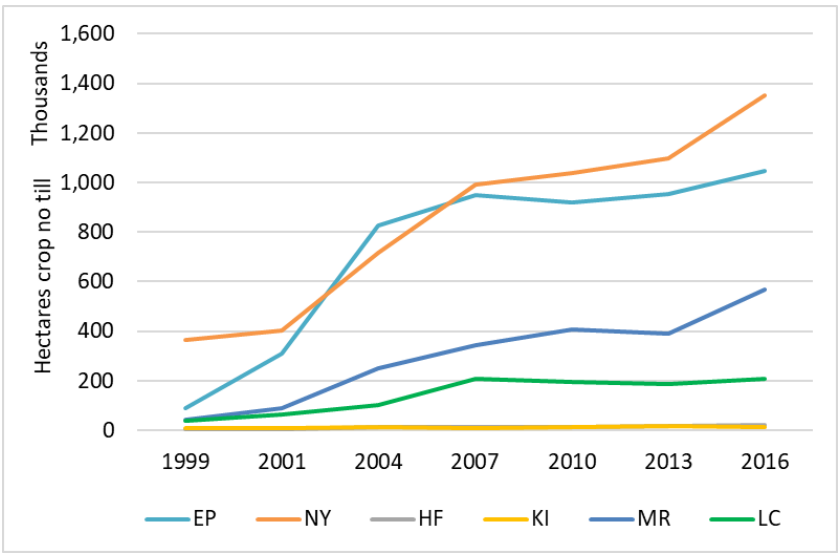



**Figure 3.4. Estimated crop area sown with no-till for landscape regions, 1999–2016. See Figure 3.1 for landscape region names and abbreviations**

*Note: Data estimated from PIRSA crop area data by crop district (PIRSA crop and pasture reports); estimates for NY and HF are not exact due to slight misalignment of landscape region boundaries with crop districts.*

## 3.2 Condition

The current condition for use of no-till is 'very good' for the state and all agricultural landscape regions, based on an estimated average of 80% crop area no-till in 2022 (Figure 3.5; Table 3.3).

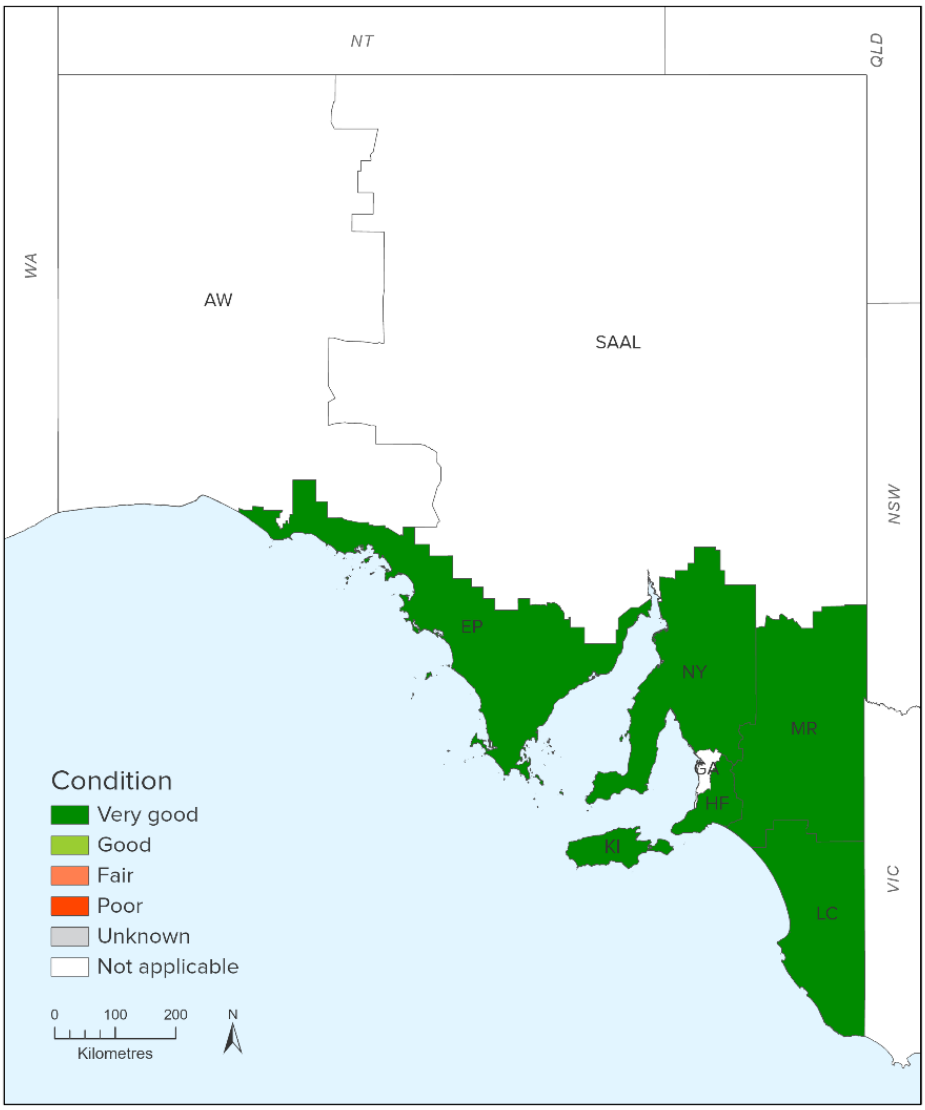



**Figure 3.5. Map of no-till adoption condition ratings by SA landscape region, 2022. See Figure 3.1 for landscape region names and abbreviations**

The estimated 80% no-till is an average, and may vary from year to year according to the effects of seasonal conditions on use of tillage (e.g. amount of summer–autumn weed growth). The estimated yearly variation and variation between regions is considered to be approximately of the order +/- 10%.

For the most recent actual no-till data in 2016, the condition rating for the state was 'very good', and was 'very good' in most regions (Table 3.4). The 'good' condition rating for the EP and HF regions with 75% no-till was borderline with 'very good'. This reflects the level of no-till adoption which was at or approaching a maximum practically achieveable level.

**Table 3.3. Estimated total hectares of crop (PIRSA crop and pasture reports) and estimated percentage crop area sown using no-till in 2022, with condition rating for state and agricultural landscape regions**

| Landscape region | Total estimated hectares of crop 2022 ('000) | Estimated % crop area no-till 2022 | Estimated hectares of no-till crop 2022 ('000) | Condition rating | Trend rating |
|---|---|---|---|---|---|
| State (agricultural zone) | 3,932 | 80% | 3,146 | Very good | Stable |
| Eyre Peninsula | 1,342 | 80% | 1,073 | Very good | Stable |
| Northern and Yorke | 1,500 | 80% | 1,200 | Very good | Stable |
| Hills and Fleurieu | 26 | 80% | 21 | Very good | Stable |
| Kangaroo Island | 19 | 80% | 15 | Very good | Stable |
| Murraylands and Riverland | 736 | 80% | 589 | Very good | Stable |
| Limestone Coast | 309 | 80% | 247 | Very good | Stable |

**Table 3.4. Estimated total hectares of crop (PIRSA crop and pasture reports) and proportion of crop area sown using no-till in 2016, with condition rating for state and agricultural landscape regions**

| Landscape region | Total estimated hectares of crop 2016 ('000) | Percentage crop area no-till 2016 | Estimated hectares of no-till crop 2016 ('000) | Condition rating | Trend rating |
|---|---|---|---|---|---|
| State (agricultural zone) | 3,892 | 83 | 3,226 | Very good | Getting better |
| Eyre Peninsula | 1,397 | 75 | 1,046 | Good | Getting better |
| Northern and Yorke | 1,475 | 92 | 1,351 | Very good | Getting better |
| Hills and Fleurieu | 26 | 75 | 20 | Good | Getting better |
| Kangaroo Island | 16 | 88 | 14 | Very good | Getting better |
| Murraylands and Riverland | 738 | 77 | 567 | Very good | Getting better |
| Limestone Coast | 239 | 87 | 207 | Very good | Getting better |

## 3.3 Reliability

The overall reliability score for this report card is 1 out of 5 based on the minimum of the following two reliability scores, one for each of the data periods and respective type of data used, as explained in Section 2:

- Actual no-till data 1999–2016, reliability score of 2 (Table 3.5).
- Estimated no-till data 2018–2022, reliability score of 1 (Table 3.6).

The overall reliability score is considered to be 'Poor' reliability.

**Table 3.5. Information reliability scores for actual no-till data 1999–2016**

| Indicator | Applicability | Currency | Spatial | Accuracy | Reliability |
|---|---|---|---|---|---|
| Indicator: | 5 | 3 | 2 | 4 | 2 |

**Table 3.6. Information reliability scores for estimated no-till data 2018–2022**

| Indicator | Applicability | Currency | Spatial | Accuracy | Reliability |
|---|---|---|---|---|---|
| Indicator: | 2 | 5 | 1 | 2 | 1 |

### 3.3.1 Notes on reliability

**Actual no-till data 1999–2016**

The actual no-till data (1999–2016) have been given an overall 'reliability' score of 2 out of 5.

The 'applicability' score is 5 (all direct) as the land manager survey questionnaires directly asked interviewees their use of no-till methods for sowing crops.

The 'currency' score is 3 (up to 7 years old) because the most recent actual no-till data from the land manager surveys is from 2016.

The 'spatial representation' score for these data is 2 (<25% representation), as about 10% of the relevant land manager population was interviewed in the land manager telephone surveys.

The 'accuracy' rating of these data was considered to be 4 (substantial accuracy) due to the direct questions and responses relating to use of no-till in the surveys.

**Estimated no-till data 2018–2022**

The estimated no-till data (2018–2022) have been given an overall 'reliability' score of 1 out of 5.

The 'applicability' score was estimated to be 2 (all indirect) as the estimated percentage no-till for 2018–2022 is based on inferred no-till data from the erosion protection field surveys in combination with anecdotal observations and expert opinion. These estimates also take into consideration the actual no-till data from 1999–2016.

The 'currency' score is 5 (up to 3 years old) because field survey observations are ongoing, carried out 4 times each year.

The 'spatial representation' score for these data is 1 (<5% representation) referring to the erosion protection field survey transect sites, which cover less than 5% of the agricultural cropping area.

The 'accuracy' rating of these data was considered to be 2 (fair accuracy) considering the use of expert opinion in combination with field survey observations relating to use of no-till.

# 4 Discussion

## 4.1 Trend and condition

Over the survey period, the survey data clearly showed a strong upward trend in the proportion of the rain-fed (dryland) crop area sown using no-till methods. This generally followed a sigmoidal form, with slower initial uptake, increasing to faster uptake, then slowing and levelling off to a plateau. This was closely related to an increase in the proportion of crop farmers who used no-till sowing methods (on at least some of their cropped area). In the state overall, this increased from 28% in 1999 to 85% in 2016. This trend occurred similarly in all agricultural landscape regions. These results are also generally consistent with the trends in uptake of no-till methods in Australian dryland cropping regions reported by Llewellyn and D'Emden (2009) and, for example, in a number of (non-DEW) landholder surveys conducted in the Murray Mallee area and former SA Murray–Darling Basin Natural Resources Management Region from 1992 to 2011 (McDonough 1992, 2006, 2010; Nelson unpublished (2011)).

The agricultural industry has been very proactive in promoting and facilitating the adoption of no-till seeding technology over the last 20 years. This has been a major driver of the adoption process.

Apart from the overall trends, survey-by-survey no till proportions were somewhat variable. This could be partly due to the random sampling of properties each survey, but could also be due to seasonal rainfall variation. After wetter/higher producing seasons, or after significant summer weed growth, tillage may be more likely to be used to manage higher stubble volumes and/or weeds, respectively.

Further analysis of the land manager survey data showed that the uptake of no-till was slightly lower overall in the low rainfall zone (<325 mm per annum) than medium (325–600 mm) or high rainfall (>600 mm) zones. This tends to support general observations that tillage is more commonly used in the low rainfall or marginal cropping areas for cropping preparation and/or summer weed control. In some of these areas, land may be less frequently cropped, contributing to higher indicidence of weeds (e.g. onion weed) that are difficult to control with herbicides, and require tillage for physical breakdown of the plant residues and root crowns to enable crop sowing.

Tillage before sowing is also more likely to be used on hard-setting soils, particularly where land is cropped following one or more years of pasture, and where soils have become compacted by grazing livestock.

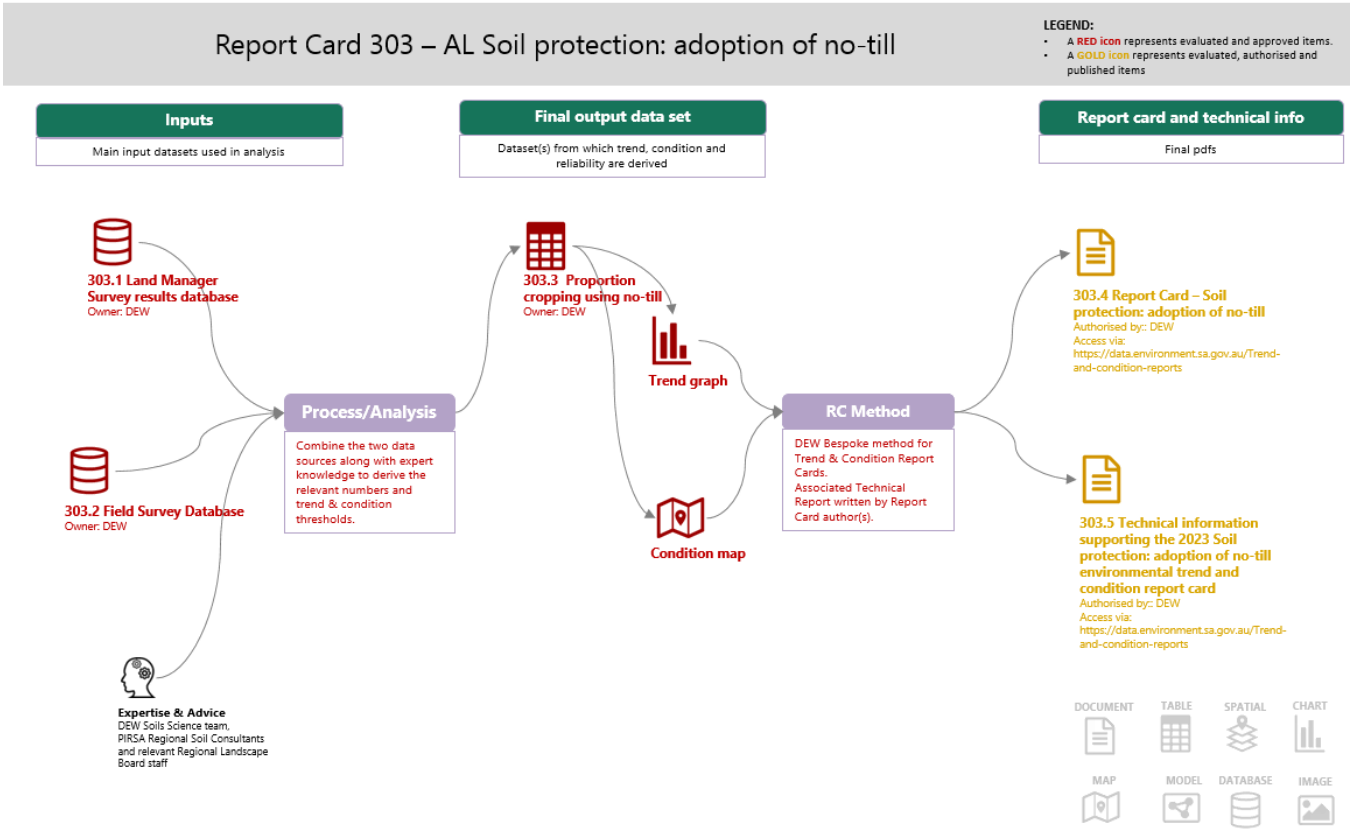
Soil may be tilled 'once-off' or occasionally for particular purposes such as clay delving/spreading/incorporation, or for incorporation of lime or other soil amendments.

For these reasons, it is unreasonable to assume that no-till adoption could reach 100%. The condition rating thresholds set for this report card take these factors into account. There is no evidence that no-till use has increased or decreased significantly in the last 5 years. Apart from seasonal issues (e.g. summer/autumn rain producing extra weed growth) there have not been any dominant pressures to permanently reduce use of no-till.

The substantial change of cropping management from more traditional methods (tillage–based, with more common stubble burning) to low disturbance, no-till methods (usually with higher stubble retention) is expected to result in a reduction in the average erosion risk on cropping lands in the state (see the 2023 Days at risk of soil erosion report card).

# 5 Appendices

## A. Managing environmental knowledge chart for Soil protection: adoption of no-till



# 6 References

Forward GR (2021). Soil protection progress report July 2021, South Australia's agricultural lands, DEW Techniccal note 2021–-20, Government of South Australia, Department for Environment and Water, Adelaide.

Forward, GR (unpublished draft). Land manager surveys, summary results of telephone surveys of agricultural land managers in South Australia, 2000–2017, Department for Environment and Water, Adelaide.

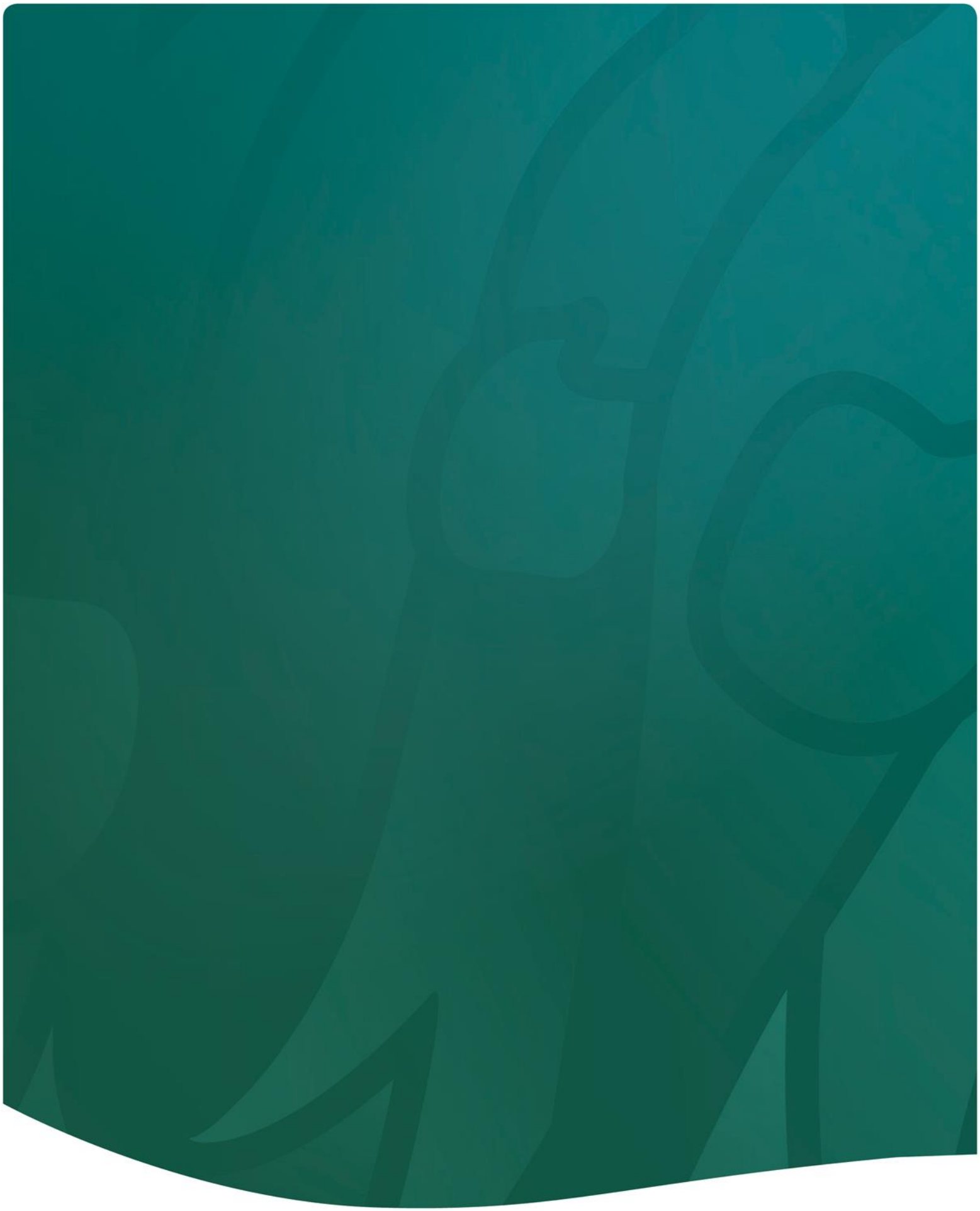
Llewellyn, RS & D'Emden, FH (2009). Adoption of no-tillage cropping practices in Australian grain growing regions, Grains Research and Development Corporation, Kingston, ACT, pp. 1-31. www.grdc.com.au/notill_adoption

McDonough, C (1992). Murraylands Agricultural Bureaux soil management survey summary, PISA, for the 'Sustainable Land Management for the Murray Mallee' Project.

McDonough, C (2006). Murraylands Soil Management Survey, Rural Solutions SA, PIRSA.

McDonough, C (2010). Report on the tillage practice and cropping intensities in the SA Murray Mallee, 2010 update, for DWLBC, Rural Solutions SA, PIRSA.

Nelson, J (unpublished draft). Mallee Landholder Survey Results Summary (draft) 2010–11, South Australian Murray–Darling Basin Natural Resources Management Board in conjunction with Caring for Our Country and the Department of Environment and Natural Resources.



Government
of South Australia

Department for
Environment and Water