

# Maps of Organic Agriculture in Australia

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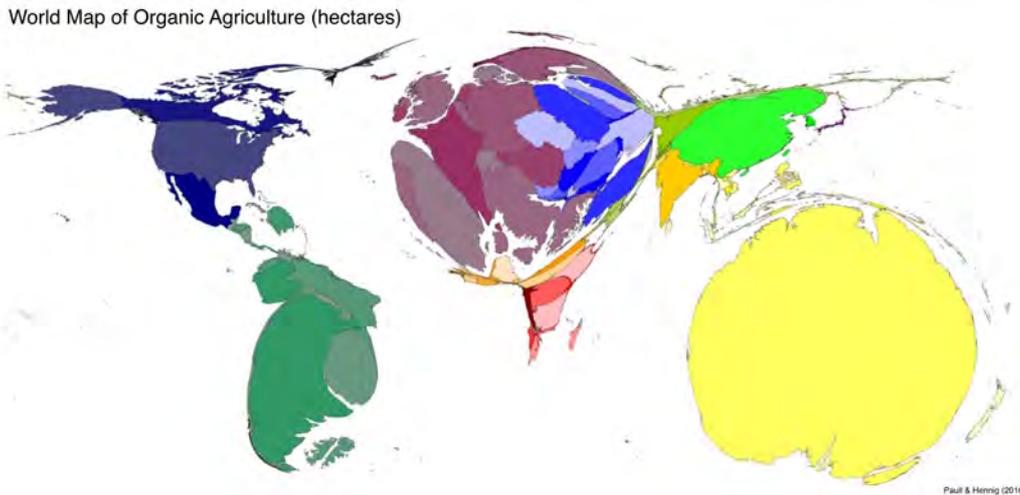
## Abstract

Australia is the world leader in organic agriculture, based on certified organic hectares. This has been the case since global organic statistics were first published (in 2000). Australia now accounts for more than half of the world's certified organic hectares (54%). Australia has 35,645,000 certified organic hectares which is 8.8% of Australia's agricultural land. In the present paper, three maps (cartograms, 'maps with attitude') of organic agriculture in Australia are presented. These three maps illustrate the data, at the state and territory level, for (a) certified organic hectares (35,645,037 hectares) (b) certified organic producers (n = 1,998), and (c) certified organic operators (producers + handlers + processors) (n = 4,028). States and territories are resized according to their measure for each attribute. The base-map for Australia, with states and territories coloured according to their state colours (or a variation thereof), is the standard cartographic representation of the country. The three organics maps are density-equalising cartograms (area cartograms) where equal areas on the map represent equal measures (densities) of the parameter under consideration. This mapping protocol creates distorted yet recognisable new maps that reveal where there is a high presence of the parameter under consideration (and the state or territory is 'fat'), or a low presence (and the state or territory is 'skinny'). These three maps visually reveal the uneven distribution of the metrics of organics across Australia, and, on a state by state basis, they suggest unrealised opportunities and potentials.

**Keywords:** Organic farming, Queensland (QLD), New South Wales (NSW), Australian Capital Territory (ACT), Victoria (VIC), Tasmania (TAS), South Australia (SA), Western Australia (WA), Northern Territory (NT), worldmapper.org, cartogram, cartography.

## Introduction

Australia is the world leader in organic agriculture, based on the tally of certified organic hectares (Paull & Hennig, 2016; Willer & Lernoud, 2018) (Figure 1). Every year since global statistics of organic agriculture were first published by Willer & Yussefi (2000), Australia has occupied this lead position. Organic agriculture has grown at 16.5% per annum, in Australia, year on year, for the past 18 years (based on certified organic hectares growing from 1,736,000 ha to 27,145,021 ha as reported by: Willer & Lernoud, 2018; Willer & Yussefi, 2000). In that period, the percentage of agricultural land of Australia devoted to certified organic growing has grown from 0.38% to 6.7% (Willer & Lernoud, 2018; Willer & Yussefi, 2000). Certified organic hectares in Australia are now at 35,645,000 ha (Christie, 2018) which accounts for 8.8% of Australia's agricultural land.



**Figure 1. World map of organic agriculture hectares (density-equalizing cartogram) (source: Paull & Hennig, 2016).**

In 1912, German chemists, Fritz Haber and Carl Bosch, demonstrated a process for capturing nitrogen from the air ('fixing' nitrogen'). The products of the Haber-Bosch process could be used as fertiliser or for explosives (Charles, 2005; Leigh, 2004). This disruptive technology ushered in an era of industrial-scale warfare, as well as cheap and abundant synthetic fertiliser, and thereby 'chemical farming'. The First World War (1914-1918), gave a massive impetus to the Haber-Bosch process, as the unprecedented military appetite for explosives wreaked havoc across Europe. When the war finally came to an end, the manufacturing facilities were promptly repurposed to produce synthetic fertilizer.

In 1924, Dr Rudolf Steiner spoke against the retreat from traditional and natural farming practices and the uptake of chemical farming. Steiner's ideas were published as the *Agriculture Course* (1924). At his course, at Koberwitz (now Kobierzyce, Poland), Steiner called for an agriculture that differentiated itself from that of the prevailing fervour for synthetic chemicals (Paull, 2011). In the following decade, in Switzerland, Dr Ehrenfried Pfeiffer, and others, developed Steiner's ideas, and Pfeiffer's account was published as *Bio-dynamic Farming and Gardening* (1938). Shortly after that, and influenced directly by Pfeiffer and Steiner, Lord Northbourne, an Oxford University trained agriculturalist, coined the term 'organic farming' and published a manifesto of organic agriculture, *Look to the Land*, (1940). He described a contest of 'organic versus chemical farming', a contest that he suggested might be waged for decades or even centuries (Northbourne, 1940; Paull, 2014b).

Australia was an early adopter of the organics ideas of Steiner, Pfeiffer and Northbourne. The Italian artist, Ernesto Genoni, spent 1924 studying with Rudolf Steiner at the headquarters of Anthroposophy, at the Goetheanum, Dornach, Switzerland. Genoni migrated to Australia in 1926. In 1928 he joined Rudolf Steiner's Experimental Circle of Anthroposophic Farmers and Gardeners, which was based at Dornach. This marks the beginning of biodynamics - and hence organics - in Australia (Paull, 2014a).

The world's first association dedicated to the advocacy of organic agriculture, was the Australian Organic Farming and Gardening Society (AOFGS), founded in 1944 in Sydney. The AOFGS adopted Northbourne's terminology of 'organic farming'. The AOFGS journal, *Organic Farming Digest*, successfully disseminated their advocacy for organics across Australia (Paull, 2015).

Cartograms are 'maps with attitude'. They offer a fresh view of a geographic domain and the interplay between cells of that domain (for example, where (a) domain = the world & cells = countries, or (b) domain = a country & cells = states or territories). An area-cartogram (a density equalising cartogram) takes the domain, along with its cells, as a 'bladder' and inflates the cells of the bladder according to some parameter other than the actual territorial area (while conserving the total area of the territorial map, the base map). Area cartograms of global organic agriculture have been published where the domain = 'the world', and the cells = 'the countries of the world' (Paull & Hennig, 2013, 2016).

*The Atlas of Organics* presented maps of the world of organic agriculture (Paull & Hennig, 2016). The present paper adopts the same process to produce organics maps of Australia (where the domain = Australia and the cells = the states and territories of Australia). This process creates new maps (on the basis of the parameter of interest) that may appear distorted - but that nevertheless retain some familiarity so that they are visually informative and revelatory. In the event that the parameter under examination is distributed within the cells (in the present case, the states and territories) in proportion to the actual territorial area, then there will be no 'distortion' in the cartogram (and it will be no different to the base-map). In the event that the parameter under examination is more densely represented in a cell than in the whole region, then that cell will appear inflated ('fat'). Contrariwise, in the event that the parameter under examination is less densely represented in a cell than in the whole domain, then the cell will appear deflated ('skinny'). In a density-equalising cartogram, the density of the parameter is equally distributed across the map so that equal areas represent equal measures of the parameter under examination (and the total area of the domain, as it appears in the base-map, is conserved).

## Methods

Statistics are available for organic agriculture in Australia, reported at the level of states and territories (Table 1). Data are available for six states: Queensland (QLD), New South Wales (NSW), Victoria (VIC), Tasmania (TAS), South Australia (SA), and Western Australia (WA); and two territories: Northern Territory (NT) and the Australian Capital Territory (ACT) (Christie, 2018).

For the purposes of creating the present organics maps, the domain is 'Australia', and the cells are 'the states and territories of Australia'. The Worldmapper algorithm (Hennig, 2013) was applied to the data of Australian organic agriculture to produce three maps.

Three cartograms are presented: (i) organic area (ii) organic producers (iii) organic operators (producers + handlers + processors), as well as a base-map of Australia. The colour of each state or territory is, in each case, the official state or territory colour (or a variation thereof). The organics statistics includes both certified organic and in-conversion organic.

**Table 1. Statistics for organic agriculture in Australia (Christie, 2018).**

Region	Organic hectares	Organic producers	Organic Operators
QLD	10,667,052	485	852
NSW	3,601,789	615	1,267
VIC	413,925	425	1039
TAS	4,769	72	127
SA	14,102,866	212	421
WA	4,698,791	165	287
ACT	2766	1	8
NT	2,153,079	23	27
<b>Total</b>	<b>35,645,037</b>	<b>1,998</b>	<b>4,028</b>

## Results

The base map of Australia appears as Figure 2. The cartograms of organic agriculture are presented as certified organic hectares (Figure 3), certified organic producers (Figure 4) and certified organic operators (Figure 5).



**Figure 2. Australia: base-map (six states and two territories).**

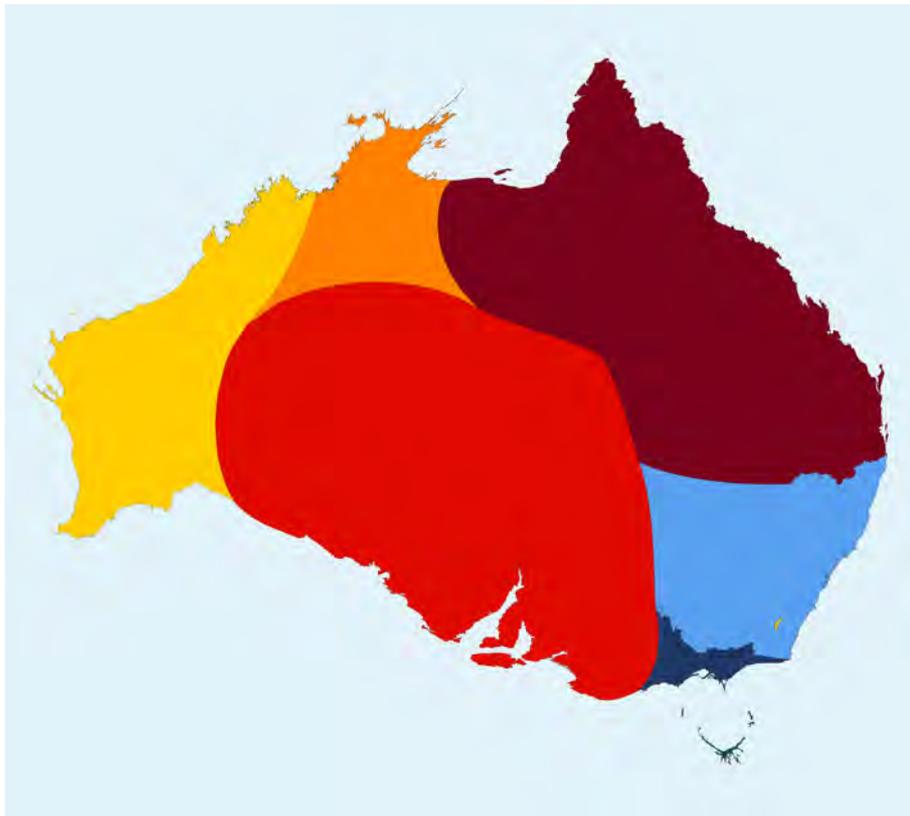


Figure 3. Australia: Certified organic agriculture hectares (n = 35,645,037 hectares).

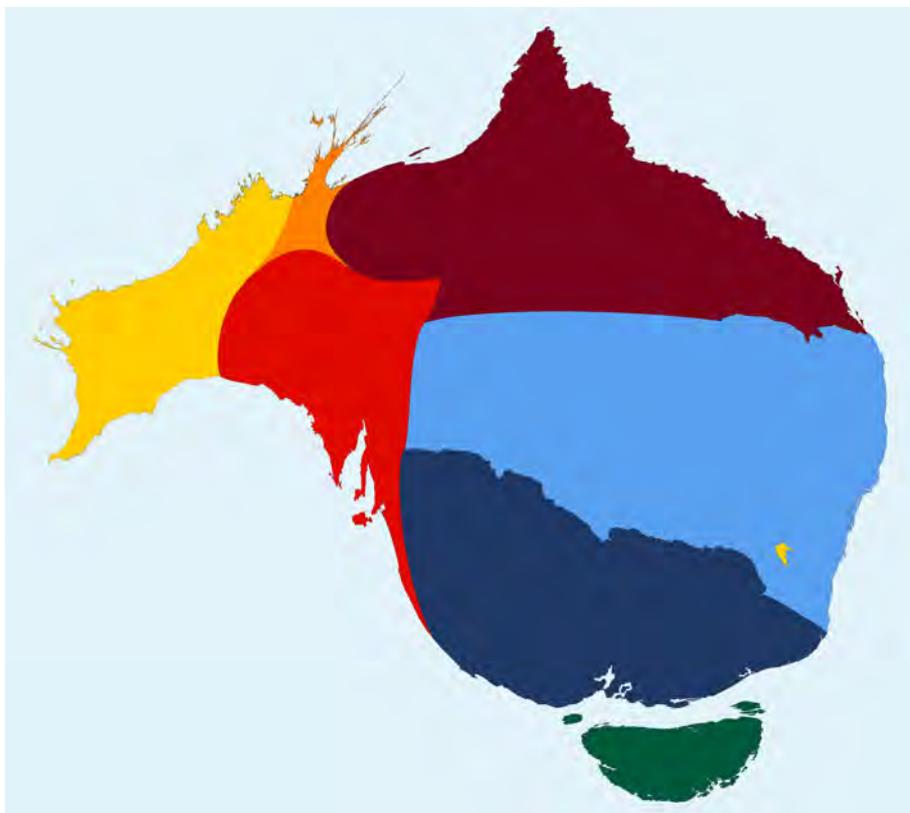


Figure 4. Australia: Certified organic producers (n = 1,998).

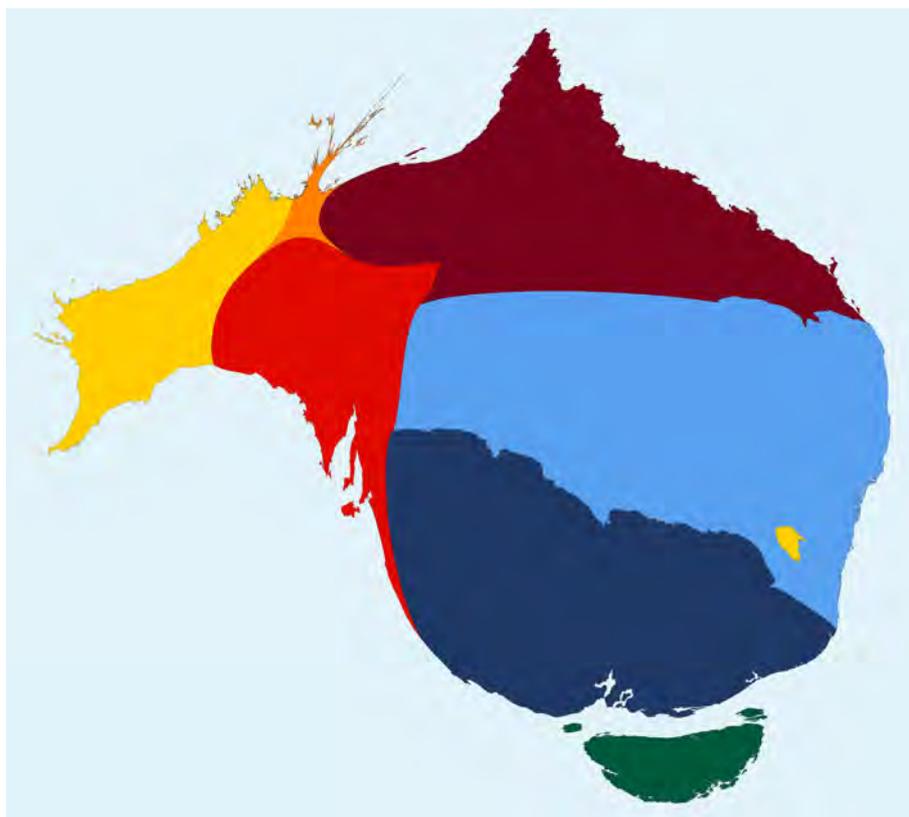


Figure 5: Australia: Certified organic operators (producers+handlers+processors) (n = 4,028).

## Discussion and Conclusions

The three maps of organic agriculture in Australia (Figs. 3,4 & 5) demonstrate that organic agriculture parameters are unequally distributed across the states and territories of Australia. The maps make it easy to differentiate the leaders from the laggards. In the event that the metric under consideration (e.g. certified organic hectares) is evenly distributed across the whole country, then the cartogram will be identical to the 'base map' (Fig. 2). Otherwise, states will appear 'fatter' (inflated) or 'skinnier' (deflated). A 'fat' state (a leader) means that the parameter is more dense in that state than it is across the country as a whole. A 'skinny' state (a lagger) means that the parameter is less dense in that state than it is across the country as a whole.

For the map of certified organic agriculture area (Fig. 3), South Australia and Queensland dominate. These states have large swathes of rangeland, with low-carrying capacity, certified as organic and used for cattle. The New South Wales of Figure 3 is comparable to the NSW of Figure 2 which indicates its 'average' performance on this metric. Western Australia, Victoria, and Northern Territory are revealed as under-performers. Historically WA has been a producer of high-volume low-value commodities, whether in mining or agriculture, selling bulk output in the market rather than offering premium-differentiated or value-added product. Victoria and Northern Territory are under-performers on this metric. It is a disappointing result for Victoria given that the State Government has expressed support for organics (Brumby, 2007). ACT and Tasmania are just a vestigial presence for certified organic hectares. For ACT, that is expected since its *raison d'être* is as the seat

of federal governance (it hosts the national capital, Canberra), and agriculture is a modest endeavour in that small territory. It is a disappointing result for Tasmania.

Tasmania is the standout under-performer of Figure 3. Tasmania spawned one of the earliest organics advocacy groups in the world, the *Living Soil Association of Tasmania*, founded in 1946 (Paull, 2009). It had one of the longest-lived organics advocacy groups, the *Organic Gardening and Farming Society of Tasmania* (OGFST) (1972-2009) (Paull, 2013; Stevenson, 2009). Tasmania is an island state with strong biosecurity in place, it actively promotes its image as 'clean and green', and it maintains Australia's most robust moratorium against genetically modified organisms (GMOs). Tasmania is an excellent 'fit' for organic agriculture. It is an agriculture-dependent state, and it is disappointing to see it as a commodity producer and a price-taker rather than as a premium producer of differentiated products and a price-setter. This might be put down to complacency, inertia, lack of vision, absence of Government and institutional interest and/or support, and even to an antagonism towards organics in some quarters. Perhaps with recent inbound Chinese investment, coupled with high demand in China for organic (and premium) produce, a spin-off can be greater penetration by organics into the agriculture sector of Tasmania and manifested by more organic hectares. Moonlake Investments recently purchased a large cluster of dairy farms in the north west of Tasmania. It is an example of a Chinese-led agricultural operation with plans to export organic milk and dairy products to China (Baker-Dowdell, 2018). Three Moonlake farms are the first farms in Tasmania to achieve organic certification by a Chinese certifier (in 2018). A further three Tasmanian-owned dairy farms in northern Tasmania have also very recently achieved organic certification (certified by Australian certifier NASAA in 2018) and are contracted to supply Australian Consolidated Milk (ACM) (from November 2018). So, although the present results for Tasmania (based on hectares) are disappointing (Fig. 3), perhaps this laggard state is on the cusp of an organics renaissance?

The maps of organic producers and organic operators are quite similar to each other (Figs. 4 & 5) and they are distinctly different from Figure 3. This indicates that the relationship between organic hectares, on the one hand, and organic producers and operators, on the other, is a loose relationship, whereas the relationship between organic producers and operators is quite tight (half of the data for 'operators' is accounted for by the presence of 'producers' in that data set). The eastern states of Australia (QLD, NSW, VIC & TAS) dominate the maps for producers and operators and reveal their leadership on these metrics. SA is the 'average' performer exhibiting a presence comparable to the base-map. WA and NT are the significant under-performers when it comes to organic producers as well as operators (Figs 4 & 5).

Northern Territory is an under-performer on all three metrics, under-performing in terms of certified organic area (Fig. 2), more so for producers (Fig. 4), and even more so for operators (Fig. 5). This indicates unrealised opportunities for growing all aspects of the organics sector for this territory.

The Australian Capital Territory (ACT) is a mere vestigial presence in terms of organic hectares (Fig. 3) but Figure 5, organic operators, demonstrates that a territory of very modest size and one underperforming in terms of area devoted to certified organic agriculture can nevertheless 'punch above its weight' for organic operators. The ACT has the highest personal median income of all of Australia's states and territories (ABS 2018)

and this appears to be one factor creating an opportunity for organics operators to meet a local demand even with a paucity of organic producers within the ACT.

Tasmania exhibits the greatest dissonance across the metrics, under-performing for organic hectares with a mere vestigial presence (Fig. 3), while over-performing for organic producers and operators (Figs. 4 & 5). For Tasmania, the landholding dedicated to organic is disproportionately low, while the number of operators is disproportionately high. This suggests that there is latent potential for substantial growth for organics in the Tasmania as knowledgeable producers and operators holding 'organic values' may have the capacity to grow their own operations and/or engage with other amenable producers.

A limitation of the data, and hence these maps, is that only certified organic entities are accounted for. The use of the terms 'organic farming' and 'organic agriculture', and their associated practices in Australia, long predate the development of organic standards and certification, which (in Australia) is a phenomenon dating from the 1980s (Paull, 2013). In Australia, the use of 'organic' as a qualifier of a farming operation has been in the public domain for eight decades, and it is not a restricted term, as it is, for example, in China (Paull, 2007, 2013). In Australia, a farm is entitled to be organic and call itself 'organic' provided that that is not a misleading or deceptive claim under the Competition and Consumer Act 2010 (previously known as the Trade Practices Act 1974) (CoA, 2010). A producer meeting the conditions of an organic standard (say the standard of one of Australia's certifiers) can legally and with justification call their produce 'organic'. However, organic exports require third-party certification, and Australian supermarkets are unlikely to stock other than third-party-certified organic. Other producers may be organic, by decision or by default, without making any such claim. This all means that certified organic statistics underestimate the size of the organic sector in Australia. Since the uncertified organic sector is unmeasured and there is no reliable estimate of its size (and it appears never to have been estimated), just how much the 'certified organic' statistics underestimate the whole domain of organics is undetermined.

Australia's uptake of organics is impressive, growing at 16.5% per annum year-on-year for the past two decades, it accounts for 8.8% of Australia's agricultural land (versus the global figure of 1.2%, and 21.9% in Austria), and now accounts for 54% of the world's certified organic agriculture land. Yet, there has been no 'engine room' or 'central driver' of this growth. Elsewhere there have been government (e.g. Ireland's DAFM, 2013) and institutional support for organics, but this continues to be lacking in Australia. While governments, universities, and farming organisations in Australia have mostly been absent from the field of organics advocacy, Australian supermarkets are taking fresh initiatives. The ALDI supermarket chain has, from the outset, offered organic products under its home brand of 'Just Organic' and it has in 2018 been vigorously promoting its organics range (ALDI, 2018). The Woolworths supermarket chain has established (in October 2018) the 'Woolworths Organic Growth Fund' to grow the organics sector (Woolworths Group, 2018) and has awarded its first grant to R&R Smith, Tasmania's largest grower of organic apples (TBR, 2018).

Sikkim is the world's first 100% organic state. This northern Indian state demonstrates what can be achieved where there is the political will. The goal was set by the State Government in 2003, it was achieved in 2016 (Chief Minister's Office, 2016). Now, other states of India are seeking to emulate Sikkim's achievement (Paull, 2017). The Australian state most comparable to Sikkim is Tasmania. If there was the political will to 'go organic',

it would be a decision that could potentially double the value of Tasmania's agriculture sector and deliver collateral benefits to health, environment, reputation, employment and tourism.

Australia has natural advantages for being a powerhouse for organics: it is surrounded by ocean (a natural biosecurity barrier); it is territorially vast, it spans more than thirty degrees of latitude (c.10°S to c.44°S); it hosts a great many climatic and growing conditions, with landscapes ranging from verdant to desert; it has a long history of producing premium-quality food and fibre for export; there are a number of Australian states with moratoriums against genetically modified crops (globally, all organic certification excludes GMOs); it is nearby to the fast-growing organic markets of Asia; Australia's produce is counter-seasonal to that of the Northern Hemisphere (the largest market for organics) and this creates an export market advantage. Australia is a 'good fit' for organics and the 91.2% of agricultural land that is currently not certified organic is a measure of the potential for growth.

## Acknowledgements

The present paper, *Maps of Organic Agriculture in Australia*, relies on data reported and published by Australian Organic Ltd (Christie, 2018), on global data reported by the Research Institute of Organic Agriculture (FiBL), Switzerland (Willer & Lernoud, 2018), and on the method for producing density-equalising maps proposed by Gastner & Newman (2004) and implemented by the Worldmapper project (worldmapper.org). Open source high resolution image files of the five figures of this paper will be available for download at <www.orgprints.org>.

## References

- ABS. (2018). 6524.0.55.002 - Estimates of Personal Income for Small Areas, 2011-2016. Canberra: Australian Bureau of Statistics, 19 June.
- ALDI. (2018). Just Organic - Organic goodness, available every day: [www.aldi.com.au](http://www.aldi.com.au).
- Baker-Dowdell, J. (2018). VAN Dairy to export organic milk to China. *The Australian Dairy Farmer*, 9 April.
- Brumby, J. (2007). Minister's Forward in Victorian Organic Food Products Directory 2007. Melbourne, Australia: Regional Development Victoria, Victorian Government.
- Charles, D. (2005). *Master Mind: The rise and fall of Fritz Haber, the Nobel laureate who launched the age of chemical warfare*. New York: Ecco, HarperCollins Publishers.
- Chief Minister's Office. (2016). Sikkim: Under the leadership of India's greenest Chief Minister Shri Pawan Chamling - Sustainable Development through Greening, Organic Farming and Unique Social Engineering. Gangtok, India: Chief Minister's Office, Government of Sikkim.
- Christie, R. (Ed.). (2018). *Australian Organic Market Report 2018*. Nundah, Qld: Australian Organic Ltd.
- CoA. (2010). *Competition and Consumer Act 2010 (Cth) (An Act relating to competition, fair trading and consumer protection, and for other purposes)*. Canberra: Commonwealth of Australia.
- DAFM. (2013). *Organic Farming Action Plan 2013-2015*. Wexford, IE: Department of Agriculture, Food and the Marine (DAFM).
- Gastner, M. T., & Newman, M. E. J. (2004). Diffusion-based method for producing density-equalizing maps. *Proceedings of the National Academy of Sciences (PNAS)*, 101(20), 7499-7504.
- Hennig, B. (2013) *Rediscovering the World: Map Transformations of Human and Physical Space*. Heidelberg / New York / Dordrecht / London: Springer Verlag.

- Leigh, G. J. (2004). *The World's Greatest Fix: A History of Nitrogen and Agriculture*. Oxford: Oxford University Press.
- Northbourne, Lord. (1940). *Look to the Land*. London: Dent.
- Paull, J. (2007). China's organic revolution. *Journal of Organic Systems*, 2(1), 1-11.
- Paull, J. (2009). The Living Soil Association: Pioneering organic farming and innovating social inclusion. *Journal of Organic Systems*, 4(1), 15-33.
- Paull, J. (2011). Attending the first organic agriculture course: Rudolf Steiner's Agriculture Course at Koberwitz, 1924. *European Journal of Social Sciences*, 21(1), 64-70.
- Paull, J. (2013). A history of the organic agriculture movement in Australia. In B. Mascitelli & A. Lobo (Eds.), *Organics in the Global Food Chain* (pp. 37-60). Ballarat: Connor Court Publishing.
- Paull, J. (2014a). Ernesto Genoni: Australia's pioneer of biodynamic agriculture. *Journal of Organics*, 1(1), 57-81.
- Paull, J. (2014b). Lord Northbourne, the man who invented organic farming, a biography. *Journal of Organic Systems*, 9(1), 31-53.
- Paull, J. (2015). Organic farming: The arrival of the dissident agriculture meme in Australia. *Journal of Organics*, 2(1), 49-64.
- Paull, J. (2017). Four new strategies to grow the organic agriculture sector. *Agrofor International Journal*, 2(3), 61-70.
- Paull, J., & Hennig, B. (2013). The World of Organic Agriculture - Density-equalizing map. In H. Willer, J. Lernoud, & L. Kilcher (Eds.), *The World of Organic Agriculture: Statistics and Emerging Trends 2013* (pp. 129). Frick, Switzerland: Research Institute of Organic Agriculture (FiBL) & Bonn: International Federation of Organic Agriculture Movements (IFOAM).
- Paull, J., & Hennig, B. (2016). Atlas of Organics: Four maps of the world of organic agriculture. *Journal of Organics*, 3(1), 25-32.
- Pfeiffer, E. (1938). *Bio-Dynamic Farming and Gardening: Soil Fertility Renewal and Preservation* (F. Heckel, Trans.). New York: Anthroposophic Press.
- Steiner, R. (1924). *Agriculture Course*. (1929, first English language edition; trans George Kaufmann). Dornach, Switzerland: Goetheanum.
- Stevenson, G. (2009). *Ahead of their Time: A History of the Organic Gardening and Farming Society of Tasmania*. Somerset, Tas: Dunghill Press.
- TBR. (2018). Organic path bears fruit. *Tasmanian Business Reporter (TBR)*, November, 10.
- Willer, H., & Lernoud, J. (Eds.). (2018). *The World of Organic Agriculture: Statistics and Emerging Trends 2018*: Frick, Switzerland: Research Institute of Organic Agriculture (FiBL) & Bonn: IFOAM-Organics International.
- Willer, H., & Yussefi, M. (Eds.). (2000). *Organic Agriculture World-Wide: Statistics and Perspectives*. Bad Durkheim, Germany: Stiftung Ökologie & Landbau (SÖL).
- Woolworths Group. (2018). \$30 million fund launched by Woolworths to help Aussie farmers meet the growing customer demand for organic fruit and vegetables. Bella Vista, NSW: 17 October.



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