

Socio-economic Vulnerability Assessment of the Burnett-Mary Horticultural Sector

Key Points

What's at Stake?

- Almost one-quarter (22%) of Queensland's horticultural workforce lived in the Burnett-Mary region in 2011.
- 24% of the gross value of Queensland's horticultural production occurred in the region (2010-11).

Potential Vulnerability

- The horticultural sector located along the Burnett River west of Biggenden is characterised by high potential vulnerability to the impacts of climate change. The potential vulnerability of this subregion is revealed by the intersection of several lines of evidence including: a) high percentages of the labour force employed in horticulture; b) a high percentage of the value of horticultural commodities produced in the region; c) high levels of socio-economic disadvantage; and c) low economic diversity.
- The eastern horticultural sector surrounding Bundaberg supports the largest horticultural workforce and contributes the highest percentage to the value of horticultural products produced in Burnett-Mary, which suggests there is more at stake when compared to the western area if a downturn in the horticultural sector occurs. However, fewer lines of evidence intersect in the eastern section, which suggests lower potential vulnerability when compared to the western section.

Implications for the Future

- The difference in geographic remoteness between the eastern and western horticultural sectors suggests that each subregion will be impacted differently by emerging social, economic and environmental trends. The eastern horticultural sector may benefit from better access to labour markets, services and supply chains than the horticultural sector in the west. However, advances in digital technologies may counteract these challenges in the western area.
- Burnett-Mary's proximity to Brisbane suggests that the horticultural sector may be able to capitalise upon new and emerging markets. However, horticulturalists will likely need to innovate and to closely manage production costs in the face of increased resource scarcity (e.g., water, energy) to remain competitive with horticultural production located even closer to major markets and infrastructure.

Introduction

This commentary reports an assessment of socio-economic vulnerability to the impacts of climate change focusing upon the horticultural sector in the Burnett-Mary Natural Resource Management (NRM) Region. The agricultural focus of the vulnerability assessment was guided by the premise that

economic sectors and populations which are more dependent upon natural resources are likely to be more sensitive to climate change impacts than sectors and populations which are less dependent upon natural resources.¹

This commentary should be read alongside the Burnett-Mary NRM Region Horticultural Sector Fact

Sheet.² Appended to this commentary are a set of maps that show the 2010-11 regional distribution of various characteristics of the sector (Maps 1-7).³ When combined, these maps provide a snapshot of the sector's potential vulnerability to the impacts of climate change.

The assessment is then contextualised against six megatrends. “A megatrend is defined as a major shift in environmental, social and economic conditions that will substantially change the way people live” (Hajkowicz et al., 2012). Each megatrend is discussed in terms of how it may influence the potential vulnerability of the horticultural sector in the future.

The six megatrends were identified by CSIRO in the report *Our future world: Global megatrends that will change the way we live* (Hajkowicz et al., 2012). These megatrends are: a) More from less; b) Going, going... gone?; c) The silk highway; d) Forever young; e) Virtually here; and f) Great expectations.

It is recommended that this commentary be read and interpreted in the context of more detailed knowledge of local circumstances.

What’s at Stake?

The Burnett-Mary horticultural sector comprises three subsectors: a) Vegetable Growing; b) Fruit & Tree Nut Growing; and c) Nursery & Floriculture Production.⁴ In 2011, Agriculture, Forestry & Fishing⁵ was the sixth highest employing economic sector by percentage of the labour force (7.3%), the majority of which comprised agricultural employment (6.4%). More than one-third of the Burnett-Mary agricultural workforce worked in the horticultural sector (36.7%). This represented 2.3% of the region’s labour force. In 2011, 6% of Australia’s horticultural workforce lived in Burnett-Mary, which represented almost one-quarter (22%) of Queensland’s horticultural workforce (Figure 1). Similarly, in 2010-11, 6% of Australia’s gross value of horticultural production occurred in Burnett-Mary, or 24% of the gross value of Queensland’s horticultural production (Figure 2).

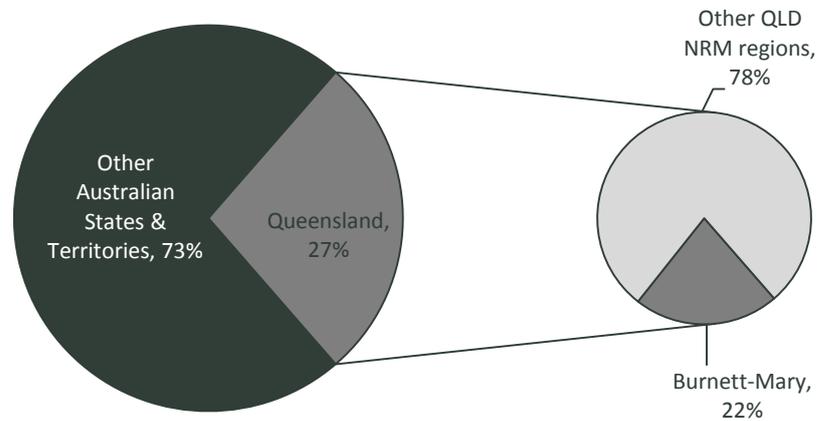


Figure 1: Place of Residence by Percentage of the Australian Horticultural Workforce (2011)



Figure 2: Place of Production by Percentage of Australia’s Gross Value of Horticultural Commodities Produced (2010-11)



Figure 3: Place of Residence by Percentage of the Australian Horticultural Workforce (Vegetable Growing)

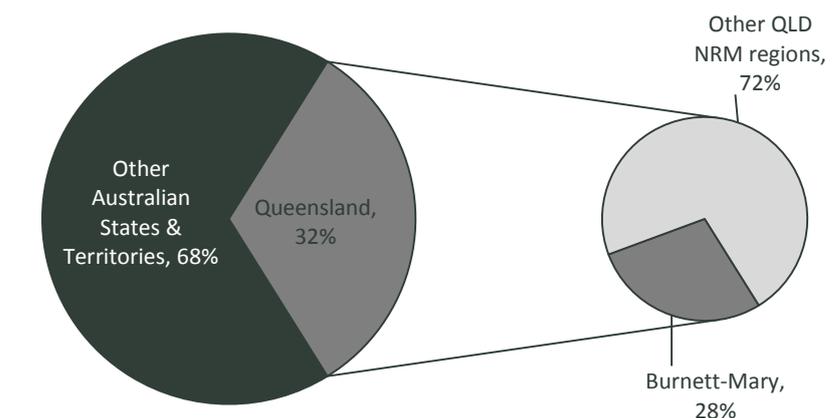


Figure 4: Place of Production by Percentage of Australia’s Gross Value of Horticultural Commodities Produced (Vegetables for Human Consumption)

Vegetable Growing

Almost one-third (30%) of Australia's Vegetable Growing workforce lived in Queensland. The Burnett-Mary Vegetable Growing workforce represented 22% of the Queensland's Vegetable Growing workforce, which equated to 7% of the national Vegetable Growing workforce (Figure 3). Queensland produced almost one-third (32%) of Australia's value of production from Vegetables for Human Consumption. Burnett-Mary contributed 28% of Queensland's value of production from Vegetables for Human Consumption, which represented 9% of the national value of production (Figure 4).

Fruit & Tree Nut Growing

Just over one-quarter (27%) of Australia's Fruit & Tree Nut Growing workforce lived in Queensland. The Burnett-Mary Fruit & Tree Nut Growing workforce accounted for 24% of the Queensland Fruit & Tree Nut Growing workforce, which represented 6% of all Australians who worked in the Fruit & Tree Nut Growing sector (Figure 5). Queensland produced just over one-fifth (21%) of Australia's value of Fruit & Nut production. Burnett-Mary contributed 23% of Queensland's value of agricultural production from Fruit & Nuts, which represented 5% of the value of national production from Fruit & Nuts (Figure 6).

Nursery & Floriculture Production

Almost one-quarter (23%) of Australia's Nursery & Floriculture Production workforce lived in Queensland. The Burnett-Mary Nursery & Floriculture Production workforce accounted for only 12% of the Queensland Nursery & Floriculture Production workforce, which represented just 3% of all Australians who worked in the Nursery & Floriculture Production sector (Figure 7). Queensland produced almost one-quarter (23%) of Australia's production from Nurseries, Cut Flowers & Cultivated



Figure 5: Place of Residence by Percentage of the Australian Horticultural Workforce (Fruit & Tree Nut Growing)

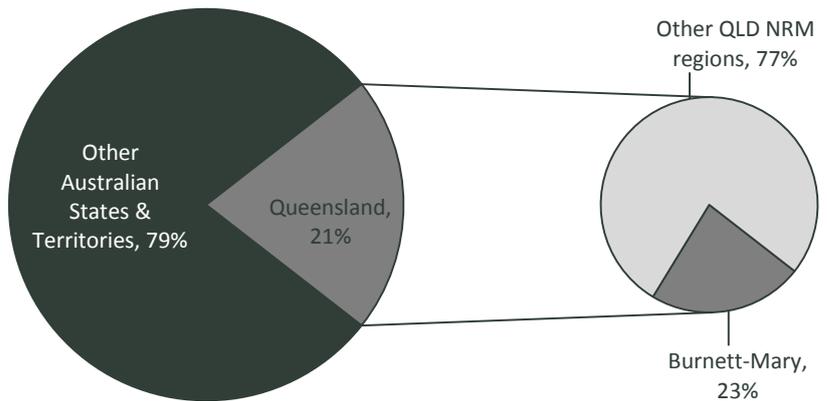


Figure 6: Place of Production by Percentage of Australia's Gross Value of Horticultural Commodities Produced (Fruit & Nuts)

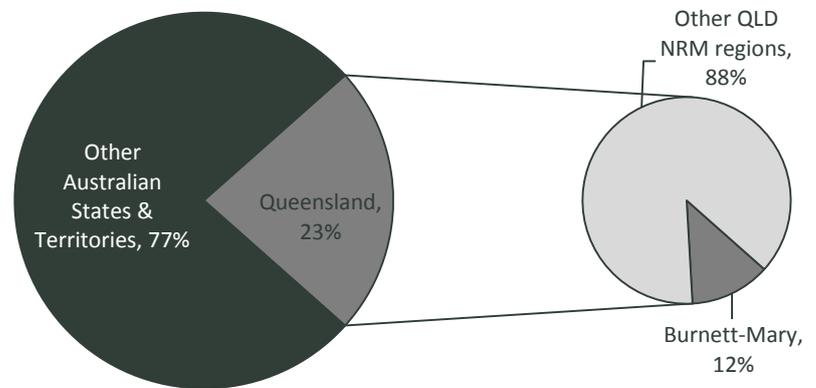


Figure 7: Place of Residence by Percentage of the Australian Horticultural Workforce (Nursery & Floriculture Production)

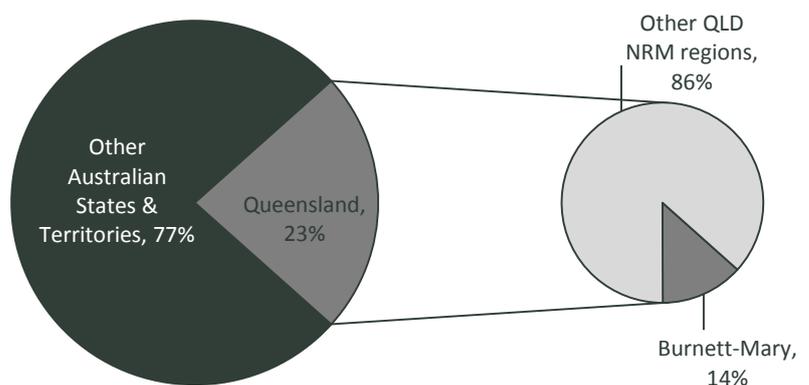


Figure 8: Place of Production by Percentage of Australia's Gross Value of Horticultural Commodities Produced (Nurseries, Cut Flowers & Cultivated Turf)

Turf. Burnett-Mary contributed only 14% of Queensland's value of production from Nurseries, Cut Flowers & Cultivated Turf, which represented just 3% of the national value of production from Nurseries, Cut Flowers & Cultivated Turf (Figure 8).

What are the Potential Vulnerabilities?

The potential vulnerability of the horticulture sector was assessed using five factors known to shape socio-economic vulnerability: a) percentage of the labour force employed in agriculture (Map 1); b) geographic remoteness (Map 2); c) socio-economic advantage/disadvantage (Map 3); d) economic diversity (Map 4); and e) age (Map 5). Each factor is considered one line of evidence. Areas in which multiple lines of evidence intersect suggest higher potential vulnerability than areas in which fewer lines intersect. Areas of potential high vulnerability are then compared to the areas that are characterised by high reliance upon the horticultural sector. Reliance upon the horticultural sector is indicated by: a) percentage of the gross value of horticultural commodities produced (Map 6); and b) percentage of the labour force employed in horticulture (Map 7).³

Two areas within Burnett-Mary were characterised by the intersection of multiple lines of evidence, which suggest high potential socio-economic vulnerability, including: a) north west Burnett-Mary (generally north west of Gayndah); and, b) an area forming a narrow band from Biggenden through Gayndah to the western boundary. In these areas there were: a) high percentages of the labour force employed in agriculture (typically more than 40.1%, Map 1); b) relatively specialised economies (Hachman Scores 0.40 or lower, Map 4); and c) high levels of remoteness ('outer regional' or 'remote', Map 2).⁶ A fourth line of evidence was also

present in the area trending westward from Biggenden and representing high levels of socio-economic disadvantage (deciles 1-4, Map 3), which suggests it may have a higher level of potential vulnerability than the north west.

Multiple lines of evidence also intersected in other parts of Burnett-Mary, but the spatial patterns were more differentiated than in the areas identified above. For example, in the south west, the area immediately west of Proston was typically characterised by high percentages of the labour force employed in agriculture; as well as, high levels of socio-economic disadvantage (deciles 1-2, Map 3) but was also characterised by a more diverse economy (Hachman Scores 0.41-0.60, Map 4) than other parts of the south west. Similarly, the central area bounded by Biggenden, Gayndah and Kilkivan had a high percentage of the labour force employed in agriculture (Map 1) but the economy was more specialised and it was characterised by lower levels of socio-economic disadvantage (deciles 3-6, Map 3) than the area west of Proston.

In general, the eastern part of the region trending southwards from Moore Park displays low potential socio-economic vulnerability when compared to the areas identified above. This is largely a reflection of its categorisation as 'inner regional' and the low percentages of the labour force employed in agriculture.

The horticultural sector was concentrated along an arc stretching from Moore Park in the north east, south through Bundaberg and Childers, then south west up the Burnett River to Gayndah, Mundubbera and the western boundary (Maps 6 & 7). For the purposes of this discussion, this arc is separated into a western section (west of Biggenden) and an eastern section (the area immediately north and south of Bundaberg). These two sections represent Burnett-Mary's main horticultural region.

The western section, comprising a narrow band westward from Biggenden, is characterised by high potential vulnerability. This area contributed approximately 17% of the gross value of horticultural commodities produced in Burnett-Mary (Map 6), and the percentage of the labour force employed in horticulture was typically 10.1%-30.0% (Map 7). The eastern section of the arc along which the horticultural sector was located contributed approximately two-thirds of the gross value of horticultural commodities produced in the region (Map 6). The horticultural workforce was concentrated mainly between Bundaberg and Childers, as well as immediately north and south of Moore Park. Typically, 10.1-20.0% of the labour force was employed in horticulture in these areas, but there was a small area immediately south of Bundaberg in which 30.1%-40.0% of the labour force was employed in horticulture (Map 7).

In both areas, the percentage of the labour force employed in horticulture was generally less than the percentage of the labour force employed in agriculture. This characteristic may reduce the potential vulnerability of these areas because it suggests that there are other agricultural employment opportunities should a downturn in the horticultural sector occur.

The horticultural sector in the eastern section (Bundaberg & Surrounds; Bundaberg Regions North & South combined, Map 5) supports the largest workforce in absolute numbers (1,161 employees; 258 owner managers). The western section supports a smaller number of people (372 employees; 65 owner managers) (Map 5). Thus, a downturn in the horticultural sector may directly affect a higher number of people in these areas than in the other parts of the region.

With regards to the age profiles of the workforce, in the western section, approximately two-thirds (68%) of owner managers were aged 25-54 years. In the eastern section, the percentage of owner

managers aged 25-54 years was more variable. In the southern portion of the Bundaberg Region, 71% of owner managers were in these age groups, while in the north (and including Bundaberg itself) there were lower percentages of owner managers aged 25-54 years (41% and 61% respectively) (Map 5). Owner managers in these age groups may have increased vulnerability because of reduced adaptive capacity arising from potential adverse climate-related impacts on their business property combined with potential adverse social impacts with their having dependent children (Clemens et al., 2013).

Throughout the western and eastern sections of the horticultural sector, 50-60% of employees were aged 15-44 years. The exception was Bundaberg and Surrounds, which had a higher percentage of employees aged 15-44 years (70%). Employees in these age groups may be more vulnerable because research has demonstrated that they disproportionately experience income loss during weather-related disasters when compared to older people (Clemens et al., 2013).

Older aged members of the workforce may not have the same vulnerabilities as younger cohorts. The workforce in the eastern section had a lower percentage of employees aged 55 years or older (17%) when compared to the western section (24%). In the case of owner managers, approximately one-third were in the two oldest aged groups (western section = 32%; eastern section = 36%). These sub-groups of the workforce may have increased vulnerability in other areas. For example, older

people have increased physical sensitivity to climate changes (e.g., increased temperatures) (Vaneckova et al., 2008).

Table 1 below summarises the individual influence of each factor upon the potential vulnerability of the Burnett-Mary horticultural sector. It shows each of the variables assessed with respect to their having limited or substantial influence upon the potential vulnerability of the sector.

Vulnerability Assessment

The vulnerability of the Burnett-Mary horticultural sector is spatially differentiated. This differentiation is best described by considering the horticultural sector in terms of two main areas: a) a western section, stretching westward from Biggenden to the regional boundary; and, b) an eastern section surrounding Bundaberg and Childers. In the context of the wider region, these areas are the most socially and economically reliant upon the horticultural sector (i.e., they have high percentages of the labour force employed in horticulture and produce high percentages of the value of horticultural commodities, Maps 6 & 7).

Although the western and eastern sections of the horticultural sector corresponded with areas in which there were: a) high levels of socio-economic disadvantage (Map 3); and b) economies with low levels of diversity (Map 4), consideration of all the factors used to assess socio-economic vulnerability suggests that the western section is potentially more vulnerable than the eastern section. This is a

reflection of the western section also corresponding to areas that are: a) more remote ('outer regional' vs 'inner regional'); and b) characterised by high percentages of the labour force employed in agriculture. The age profiles of the horticultural workforces in these two sections suggest similar levels of potential vulnerability. Both regions are characterised by similar percentages of owner managers who are aged 25-54 years. With regards to the employee workforces, however, the way the sectors' vulnerabilities are constituted may differ. For example, the employee workforce in the western section comprises a higher percentage of employees aged 55 years or older (24%) when compared to the eastern section. In contrast, the eastern section is characterised by a higher percentage of younger employees (65% were aged 15-44 years) when compared to the western section.

The horticultural sector is dispersed more widely throughout Burnett-Mary including: a) the far south west; and b) the south east surrounding Gympie and Maryborough. The horticultural sectors in these two regions employ similar percentages of the labour force as some areas on the periphery of the eastern and western sections. However, unlike the western and eastern sections further north in the region, the horticultural sectors in the south west and south east contributed minimally to the value of horticultural commodities produced; thus, have not been included in the above discussion.

Table 1: Summary of the influence of each factor upon the potential vulnerability of the Burnett-Mary horticultural sector

	Influence upon the potential vulnerability of the horticultural sector
Percentage of the Labour Force Employed in Agriculture (Map 1)	Limited influence: The percentage of the labour force employed in agriculture increased westwards in Burnett-Mary's main horticultural region, which suggests that the western section may be more vulnerable than the eastern section because of a higher dependence upon agriculture (Marshall et al., 2013; 2014). However, throughout the western and eastern sections, the percentage of the labour force employed in horticulture was generally less than the percentage employed in agriculture (with the exception of a small area south of Bundaberg). This suggests that there may be other agricultural employment opportunities in these areas, increasing people's capacity to adapt to a downturn in the horticultural sector.
Geographic Remoteness (Map 2)	Limited influence in the eastern section; Substantial influence in the western section. Burnett-Mary's main horticultural region traverses two categories of geographic remoteness. The eastern section was classified as 'inner regional', which suggests that there is good access to services. In contrast, the western section was located in an 'outer regional' area, which suggests higher potential vulnerability when compared to the eastern section because of reduced access to services. People living in more remote areas are likely to be disproportionately affected by weather/climate related disasters or events (Clemens et al., 2013).
Socio-economic Advantage & Disadvantage (Map 3)	Substantial influence: Burnett-Mary's main horticultural region corresponded with areas of high socio-economic disadvantage (deciles 1-4) when compared to other parts of Burnett-Mary, suggesting that people living in these areas may have reduced adaptive capacity (Sano et al., 2011; Clemens et al., 2013).
Economic Diversity (Map 4)	Substantial influence: Burnett-Mary's main horticultural region corresponded with areas that had less diverse local economies than other parts of the region, suggesting higher potential vulnerability to downturns in the horticultural sector because job opportunities are likely to be more specialised and may be more limited (Alston & Witney-Soanes, 2008). These dynamics may be counteracted in the eastern section by its close proximity to the regional centre of Bundaberg.
Age (Map 5)	Substantial influence: The western and eastern sections of Burnett-Mary's main horticultural region were characterised by workforces with more than two-thirds of owner managers aged 25-54 years (68% and 64% respectively). Owner managers in these age groups may be more vulnerable because of the potential for damage to income producing property combined with their responsibility for dependent family members (Clemens et al., 2013). In addition, almost two-thirds (65%) of employees in the eastern section were in the three youngest age groups. This characteristic of the workforce may increase the potential vulnerability of the eastern section because people in these age groups tend to be disproportionately affected by income loss during weather-related disasters when compared to older people (Clemens et al., 2013). In the western section, a smaller percentage of employees aged 15-44 years (55%) may be counteracted by the vulnerabilities associated with a higher percentage of older aged employees (24%) when compared to the employee work force in the eastern section (17% were aged 55 years or older).

What May Change?

Recognising that adaptations to climate change will be carried out in the context of other social, environmental and economic influences on the sustainability of the horticultural sector, it is useful to consider some key trends in more detail. CSIRO reports that 'megatrends', comprising the

interaction between many trends, represent major shifts in "environmental, social and economic conditions that will substantially change the way people live" (Hajkowicz et al., 2012, p. 4).

CSIRO identify six megatrends that will influence contemporary decision-making and shape the future of Australia:

1. The 'More from Less' megatrend considers the limits to natural resources and how quality of life for current and future generations will be facilitated by companies, governments and communities.
2. The 'Going, Going... Gone?' megatrend considers the implications of declining ecological habitats and

biodiversity due, in part, to climate change.

3. 'The Silk Highway' megatrend considers how the world economy will shift from west to east and north to south, changing export markets, trade ties and business models.
4. The 'Forever Young' megatrend focuses upon the advantages and the challenges posed by Australia's ageing population.
5. The 'Virtually Here' megatrend considers the implications of increased connectivity of individuals, communities and governments through virtual platforms.
6. The 'Great Expectations' megatrend considers the implications of increasing demand—particularly in relation to demand for experiences over products – and the importance of social relationships in financially wealthy segments of society. At the same time, people in impoverished parts of the world will have expectations for basic necessities.

In this section, we consider the implications for the agricultural sector in light of CSIRO's megatrends alongside the indicators of socio-economic vulnerability. The associations and conclusions made below are not meant to be definitive; rather they are intended to demonstrate an approach to deliberating the potential implications of trends and system drivers that might not otherwise be traditionally applied to regional NRM practice.

Percentage of the Labour Force Employed in Agriculture

The impact of the six megatrends upon the percentage of the labour force employed in agriculture will likely be complex and multifaceted. The composition of the agricultural workforce will likely change, even if the percentage of the labour force employed in the sector remains stable. These changes may be driven by the new/different skill sets required and the changing

location of agricultural production due to wider changes in the sector (e.g., residential expansion, competing land uses, increased corporatisation of supply chains, and investment cycles).

An increase in the ageing but active population offers the sector new (and potentially flexible) labour markets but may limit opportunities for younger people as increased numbers of older people intensify competition for employment. These dynamics may have flow-on effects for agricultural innovation. For example, an ageing but more active labour force may also limit the opportunities for new, entrepreneurial workers to enter the agricultural sector, thereby inhibiting new ideas and innovation (see Florida, 2002, for an analysis of 'The Creative Class').

As people's economic and social expectations increase, those who are able to leave the agricultural sector for higher paying employment may do so, potentially reducing skill levels among agricultural workers. At the same time, adoption of digital technologies (e.g., precision farming techniques), and continued automation of production processes and supply chains may reduce the need for labour. These same technologies, however, offer opportunities for increased productivity and cost efficiencies, increased collaboration across scales, and access to new but more distant markets.

The effects of these trends will be experienced differently between regions. Agricultural industries located in more urbanised regions (e.g., Hawkesbury-Nepean and South East Queensland) will likely have better access to more diverse labour markets than more regional or remote areas (e.g., Fitzroy and Northern Rivers).

Geographic Remoteness

A growing population and increased urbanisation may intensify the differentiation between metropolitan areas and regional/rural/remote areas. These

trends may be more acutely experienced in Fitzroy, Burnett-Mary and areas of Northern Rivers where large areas are already classified as 'outer regional or 'remote'.

In addition, increased levels of foreign investment will likely concentrate in particular areas where prevailing conditions are more conducive to investment needs—meaning that other areas will be bypassed, potentially exacerbating existing disadvantage (Pritchard & Tonts, 2011). The implication for NRM managers is that they may need to consider the likely cycles of foreign investment, the differential impacts these cycles will have within and between regions, and the potential implications for changes in land use.

Akin to urbanisation trends, these changes will also potentially intensify the differential between regions in different remoteness categories. Any adverse effects may be mediated by increased access to digital technologies in the regions providing agricultural businesses with better access to information, markets and professional networks (e.g., national broadband network).

Altered growing conditions shaped by climatic changes (e.g., increased temperatures, increased evapotranspiration, and reduced soil moisture),⁷ may force or allow for crop and/or farm system changes. In turn, there may be positive, but spatially differentiated, consequences for agricultural production and the economic value generated, potentially making some remote, marginal agricultural areas less marginal. However, any advantages may be counteracted by increased water scarcity which will likely drive changes in growing seasons and farm systems.

An ageing population is a marked feature of many rural and regional areas, but there are different dynamics with regards to the key drivers (e.g., people ageing in place, high in-migration of older people or high out-migration of young people) (Regional Australia Institute, 2014). The implication for NRM managers

is to recognise the likely continued ageing of many regional/rural areas and the associated implications for the agricultural labour force, as well as agricultural support services.

Socio-economic Advantage/Disadvantage

The megatrends will likely increase the overall wealth of a population, but its distribution will likely be uneven, intensifying current socio-economic inequalities. The differentiation between advantaged populations and disadvantaged populations may be exacerbated by increasing energy costs and food prices. The challenges experienced by socio-economically disadvantaged cohorts may be further intensified by increased wealth and demand originating in Asia, with flow-on impacts to higher living costs.

The potential limitations to increasing economic diversity arising from resource scarcity (in particular water) may increase socio-economic disadvantage of marginal agricultural areas. Despite there being increased opportunities for innovation and use of digital technologies, higher levels of socio-economic disadvantage may continue to limit the capacity of some population groups to reap the benefits. Socio-economic disadvantage may also be exacerbated in some areas where retirees have limited financial resources. These adverse impacts may be off-set by older people being more active and, therefore, able to stay in the workforce for longer. These trends may simply displace socio-economic disadvantage to younger people who may be unable to find employment.

Economic Diversity

Diverse economies are often less vulnerable than economies characterised by lower levels of economic diversity (Alston &

Witney-Soanes, 2008). It is unclear how the megatrends may affect wider economic diversity at the local scale; however, the potential implications for diversity within the agricultural sector are clearer.

Population growth at domestic and global scales, combined with changing patterns of consumption, will potentially create pressure for agricultural businesses and regions to diversify their product base to satisfy consumer demands from emerging markets (e.g., South East Asia). However, increases to agricultural production and production efficiencies in emerging nations may increase competition for agricultural products in the global market. The success of Australian producers in this context will continue to be influenced by global trading rules and the agricultural policies of individual nations. Adverse consequences may be mitigated by: a) increased demand through the increasing population of middle classes in nations such as China and India; and b) increased demand for high value-added products linked to healthy lifestyles and rural experiences (e.g., agri-tourism).

The capacity of individual businesses and regions to capitalise on these opportunities may be hindered in light of increased resource scarcity (e.g., water), which may inflate the costs of production. The way in which these trends intersect will likely differ between places; in particular, diversification in already marginal agricultural areas may be especially difficult.

Innovation in business models and farm systems is likely to be a critical influence upon economic diversity. New digital technologies offer scope for innovation in supply chains, collaboration, access to knowledge and marketing. However, longer life spans combined with an ageing agricultural workforce may

constrain workforce turnover, reducing the number of new entrants with new knowledge and skills and, subsequently, impede sector innovation (see above).

Age

The implications of the megatrends for the age profile of the agricultural sector will not be linear. In general, longer lifespans and an ageing population, combined with social expectations related to higher living standards (e.g., services and experiences), will likely result in an older agricultural workforce as people seek to maintain income levels beyond the official retirement age. These dynamics may further entrench aged workforces in some agricultural sectors.

At the same time, it is well established that older people tend to be more vulnerable to temperature extremes (Vaneckova et al., 2008). Thus, increases in extreme climate-related events may reduce older people's capacity to participate in the labour force. These potential adverse effects upon the agricultural workforce may be counteracted by older people who are more active. In the short- to medium-term, an ageing agricultural workforce may have reduced capacity with which to deploy and use digital technologies that may provide diversification benefits, improve business management and enhance productivity.

More extreme climate-related events may also heighten adverse impacts for owners of income producing property who also have dependent family members (Clemens et al., 2013).

In Table 2 below we highlight the aspects of CSIRO's megatrends that seem most relevant to the potential vulnerability of the Burnett-Mary horticultural sector.

Table 2: Possible implications of the megatrends for the Burnett-Mary horticultural sector

	Implications of the megatrends
Percentage of the Labour Force Employed in Agriculture (Map 1)	<p>The close proximity of the eastern section of the horticultural sector to Bundaberg makes it susceptible to sustained urbanisation pressures, particularly with regards to competition for land. These dynamics may create an agricultural sector that is more dependent upon horticulture (perhaps even greater dependence upon individual horticultural subsectors) as a result of a decline in more extensive agricultural industries that currently operate alongside horticulture. In the eastern section, the agricultural sector that employed the second highest percentage of the labour force was sugar cane growing. In sum, the megatrends may reduce the differential between the percentage of the labour force in agriculture and the percentage of the labour force in horticulture. The outcome of these processes may exacerbate socio-economic vulnerability to the impacts of climate change because in the future there may be fewer alternative agricultural employment opportunities if there is a downturn in the horticultural sector.</p>
Geographic Remoteness (Map 2)	<p>The way in which the megatrends impact upon the western and eastern sections of the horticultural sector will likely differ given the difference in geographic remoteness between the two subregions. Urbanisation pressures may increase the differential between the 'outer regional' western section and the 'inner regional' eastern section. In the case of the horticultural sector in the western section, any adverse impacts may be counteracted by better access to technology enabling information sharing, collaboration and innovation in marketing.</p> <p>In the case of the horticultural sector surrounding Bundaberg, it is suitably located near tertiary education facilities (Central Queensland University Bundaberg campus, TAFE Queensland Maryborough campus) that offer agribusiness and horticultural courses, which may be used to address workforce skill shortages and/or increase innovation in the sector. In contrast, the horticultural sector in the western section is located further from education services; thus, horticultural businesses in the western section may need to innovate with regards to training opportunities for its workforce.</p>
Socio-economic Advantage & Disadvantage (Map 3)	<p>The dominant influence of the megatrends upon socio-economic advantage/disadvantage may be one of entrenching existing inequalities. That is, the potential vulnerability of these horticultural sectors may increase as they are already located in areas of high socio-economic disadvantage. Thus, on the one hand, the horticultural sector may benefit from increased consumer demand and wealth, but on the other, its workforce may be negatively impacted by associated increases in energy and food costs imposed by increased demand and resource scarcity.</p>
Economic Diversity (Map 4)	<p>The horticultural sector is located reasonably close to Brisbane (approx. four hours to Bundaberg and five hours to Mundubbera by road), creating opportunities to take advantage of emerging domestic and international markets. Increased demand for higher value added products among the increasing middle class in Asia, as well as increased demand for products associated with the burgeoning health industry in Australia provides opportunities for horticultural diversification. However, the horticultural sector's locational disadvantage with respect to market access when compared to the horticultural sector in South East Queensland means that the Burnett-Mary horticultural sector may need to innovate in order to manage production costs to remain competitive. These demands will need to be negotiated in the context of increased resource scarcity, in particular water.</p>
Age (Map 5)	<p>The wider Burnett-Mary population is characterised by one of the fastest rates of ageing in Australia, driven by local residents ageing in place and in migration of older aged people (Regional Australia Institute, 2014). This suggests that these horticultural sectors may become more reliant upon older workers in the future. These dynamics may create the circumstances for low workforce turnover and flow-on challenges for innovation as discussed above. In addition, the eastern section of the Burnett-Mary horticultural sector is particularly reliant upon younger-aged workers. Continued trends of out-migration from regional Australia on the part of younger people may further intensify the vulnerabilities associated with older workforces.</p>

Endnotes

¹ Using resource dependency as a proxy for sensitivity to climate change impacts follows recent Australian work (see Marshall et al., 2014; Marshall et al., 2013).

² Smith E., Keys N., Lieske S., & Smith T. (2014a). *Burnett-Mary Natural Resource Management Region: Horticultural Sector*, prepared as part of the East Coast NRM Cluster, University of the Sunshine Coast, Sippy Downs, Queensland, Australia.

³ An earlier report describes in detail the methods used to compile the data from which the maps are derived (Smith et al., 2014b).

⁴ The sub-sectors were derived from Australian Bureau of Statistics' classifications used to report data from the 'Census of Population and Housing 2011' and the 'Agricultural Census 2010-11' (see Smith et al., 2014b).

⁵ Defined according to the Australian Bureau of Statistics' classification.

⁶ The same claim can be made about Fraser Island off the east coast. However, there is no agricultural activity on the island (Maps 1 & 7). Given the agricultural focus of this assessment, interpretations are made accordingly.

⁷ See The East Coast Cluster Climate Projections report for a comprehensive assessment of anticipated climatic changes in the region.

References

Alston, M. & Witney-Soanes, K. (2008). *Social impacts of drought and declining water availability in the Murray Darling Basin*. Institute for Land, Water and Society, Charles Sturt University, NSW, Australia.

Barclay, L. (2014, 13 March). Unravelling why geography is Australia's biggest silent killer. *The Conversation*. Retrieved 13 May, 2014 from <http://theconversation.com/unravelling-why-geography-is->

[australias-biggest-silent-killer-23238](http://theconversation.com/unravelling-why-geography-is-australias-biggest-silent-killer-23238)

Clemens, S.L., Berry, H.L., McDermott, B.M., & Harper, C. (2013). Summer of sorrow: Measuring exposure to and impacts of trauma after Queensland's natural disasters of 2010–2011. *Medical Journal of Australia*, 199(8), 552-555.

Florida, R. (2002). *The rise of the Creative Class: And how it's transforming work, leisure, community and everyday life*. New York: Perseus Book Group.

Gray, I., & Lawrence, G. (2001). *A future for regional Australia: Escaping global misfortune*. Cambridge: Cambridge University Press.

Hajkowicz, S.A., Cook, H., & Littleboy, A. (2012). *Our future world: Global megatrends that will change the way we live. The 2012 Revision*. CSIRO, Australia.

Marshall, N.A., Stokes, C.J., Webb, N.P., Marshall, P.A., & Lankester, A.J. (2014). Social vulnerability to climate change in primary producers: A typology approach. *Agriculture, Ecosystems and Environment*, 186, 86-93.

Marshall, N. A., Tobin, R. C., Marshall, P. A., Gooch, M., & Hobday, A. J. (2013). Social vulnerability of marine resource users to extreme weather events. *Ecosystems*, 16(5), 797-809.

Pritchard, B., & Tonts, M. (2011). Market efficiency, agriculture and prosperity in rural Australia. In Tonts, M and Siddique, MAB (eds), *Globalisation, agriculture and development: Perspectives from the Asia-Pacific*. Edward Elgar Publishing Ltd: UK, pp. 29-53.

Regional Australia Institute. (2014). *Talking Point: An ageing (regional) Australia and the rise of the Super Boomer*. Retrieved 8 October, 2014 from <http://www.regionalaustralia.org.au/wp-content/uploads/2014/07/Talking-Point-Super-Boomers-FINAL.pdf>

Sano, M., Golshani, A., Splinter, K.D., Strauss, D., Thurston, W., & Tomlinson, R. (2011). A detailed

assessment of vulnerability to climate change in the Gold Coast, Australia. *Journal of Coastal Research*, 51 64, 245-249.

Smith, E., Keys, N., Lieske, S., & Smith, T. (2014a). *Burnett-Mary Natural Resource Management Region: Horticultural Sector*, prepared as part of the East Coast NRM Cluster, University of the Sunshine Coast, Sippy Downs, Queensland, Australia.

Smith, E., Keys, N., Lieske, S., & Smith, T. (2014b). *Socio-Economic Vulnerability in the East Coast Cluster Natural Resource Management Regions: Assessment Approach (Interim Report)*, prepared as part of the East Coast NRM Cluster, University of the Sunshine Coast, Sippy Downs, Queensland, Australia.

Vaneckova, P., Hart, M. A., Beggs, P. J., & de Dear R. J. (2008). Synoptic analysis of heat-related mortality in Sydney, Australia, 1993–2001. *International Journal of Biometeorology*, 52(6), 439-451.

Further Information

This commentary should be referenced as:

Smith, E., Keys, N., Lieske, S. & Smith, T. (2014) *Socio-economic Vulnerability Assessment of the Burnett-Mary Horticultural Sector*, prepared as part of the East Coast NRM Cluster, University of the Sunshine Coast, Sippy Downs, Queensland, Australia.

This commentary forms part of the activities of the Climate Change Adaptation for Natural Resource Management in East Coast Australia project. It is the fourth and final product from the socio-economic vulnerability component of the project. The three other products from the socio-economic vulnerability component are:

1. Six sector-based Fact Sheets (one for each NRM region in the East Coast Cluster)
2. An interim Report (Smith, Lieske, Keys & Smith, 2014b)
3. Six sets of maps (one for each NRM region in the East Coast Cluster)

The Climate Change Adaptation for Natural Resource Management in

East Coast Australia project aims to foster and support an effective "community of practice" for climate adaptation within the East Coast Cluster regions that will increase the capacity for adaptation to climate and ocean change through enhancements in knowledge and skills and through the establishment of long term collaborations. The East Coast Cluster consists of the coastal Natural Resource Management (NRM) bodies in Queensland and New South Wales between Rockhampton and Sydney. The Research Consortium comprises: University of Queensland (Consortium leader); Griffith University; University of Sunshine Coast; CSIRO; University of Wollongong; New South Wales Office of Environment and Heritage; and Queensland Department of Science, IT, Innovation and the Arts (Queensland Herbarium). The views expressed herein are not necessarily the views of the consortium partners, and the consortium partners do not accept responsibility for any information or advice contained herein. The East Coast NRM Cluster received funding from the Department of Industry, Innovation, Climate Change,

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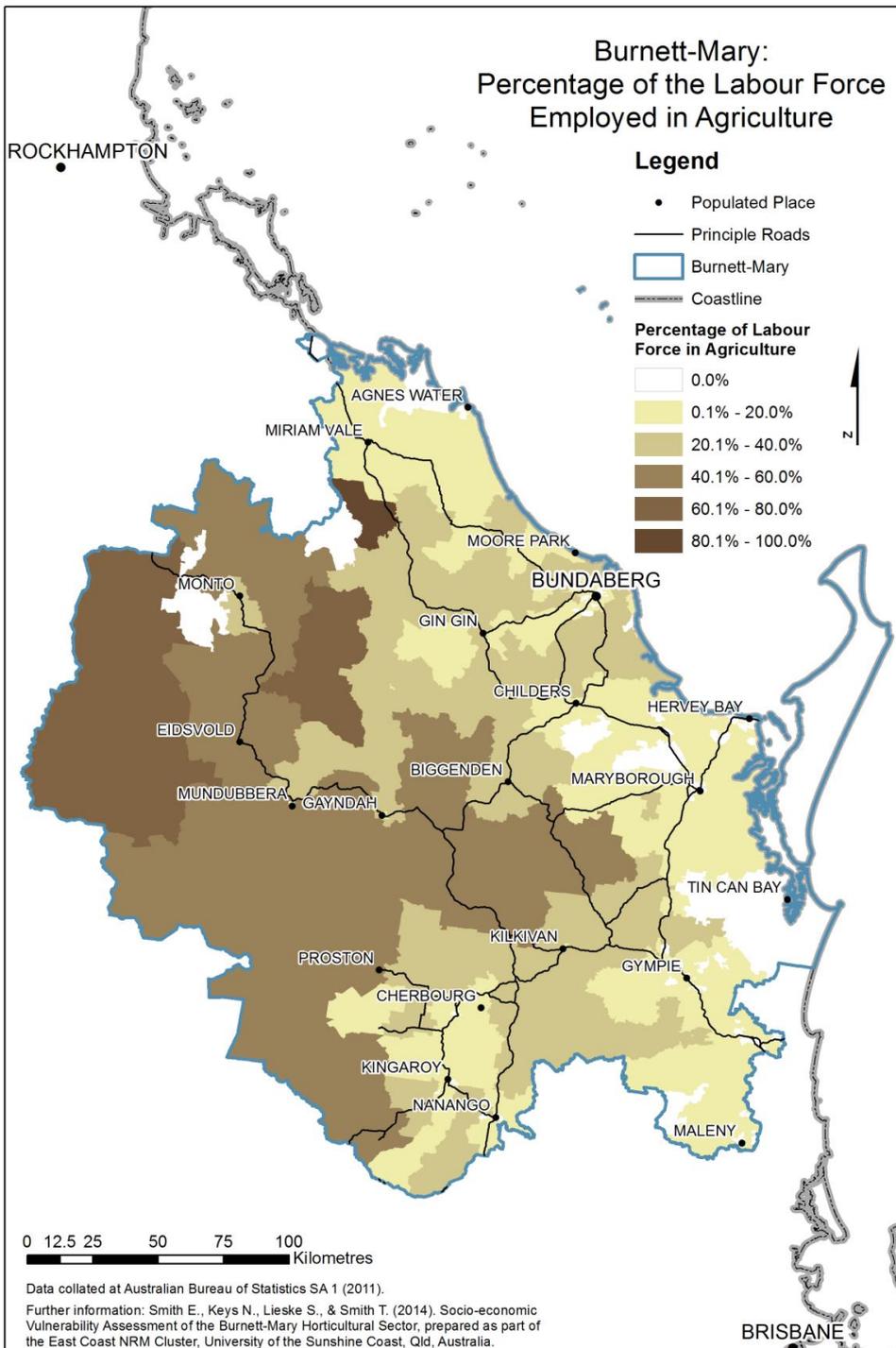


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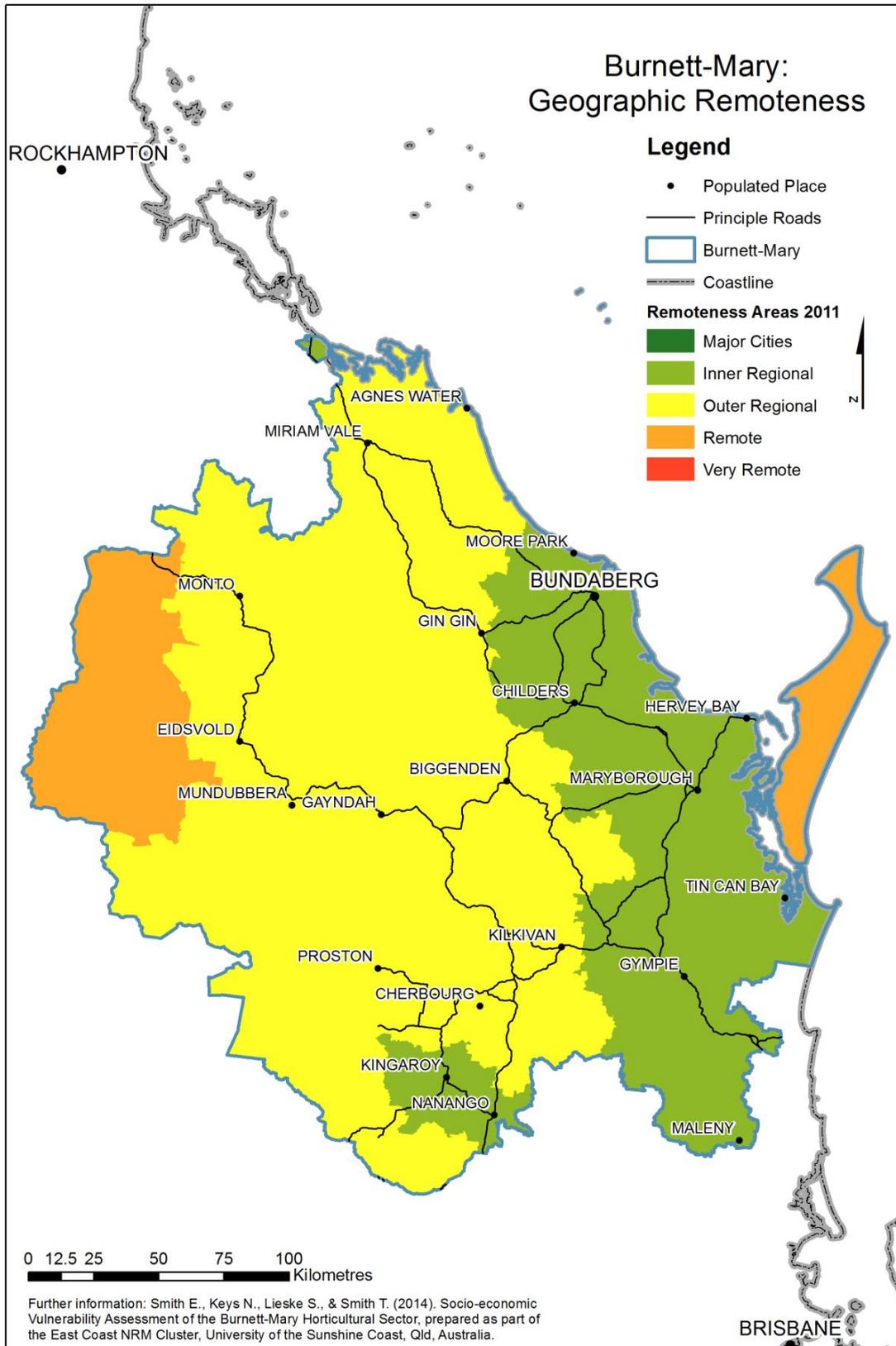
Map 1: Percentage of the Labour Force Employed in Agriculture

Why consider the percentage of the labour force employed in agriculture? Sensitivity to the impacts of climate change has been associated with the degree to which a population is dependent upon natural resources (Marshall et al., 2013; Marshall et al., 2014). Populations dependent upon economic sectors that are characterised as being highly resource dependent may be highly sensitive to climatic variability. Agriculture, broadly defined, is highly dependent upon natural resources; thus, populations in which a high percentage of the labour force is employed in agriculture may be more vulnerable to downturns in one or more agricultural sectors. Assessing the percentage of the labour force employed in agriculture enables comparisons to the percentage of the labour force employed in individual agricultural sectors (e.g., horticulture, grazing) and, therefore, provides an indication of the diversity of the agricultural sector.



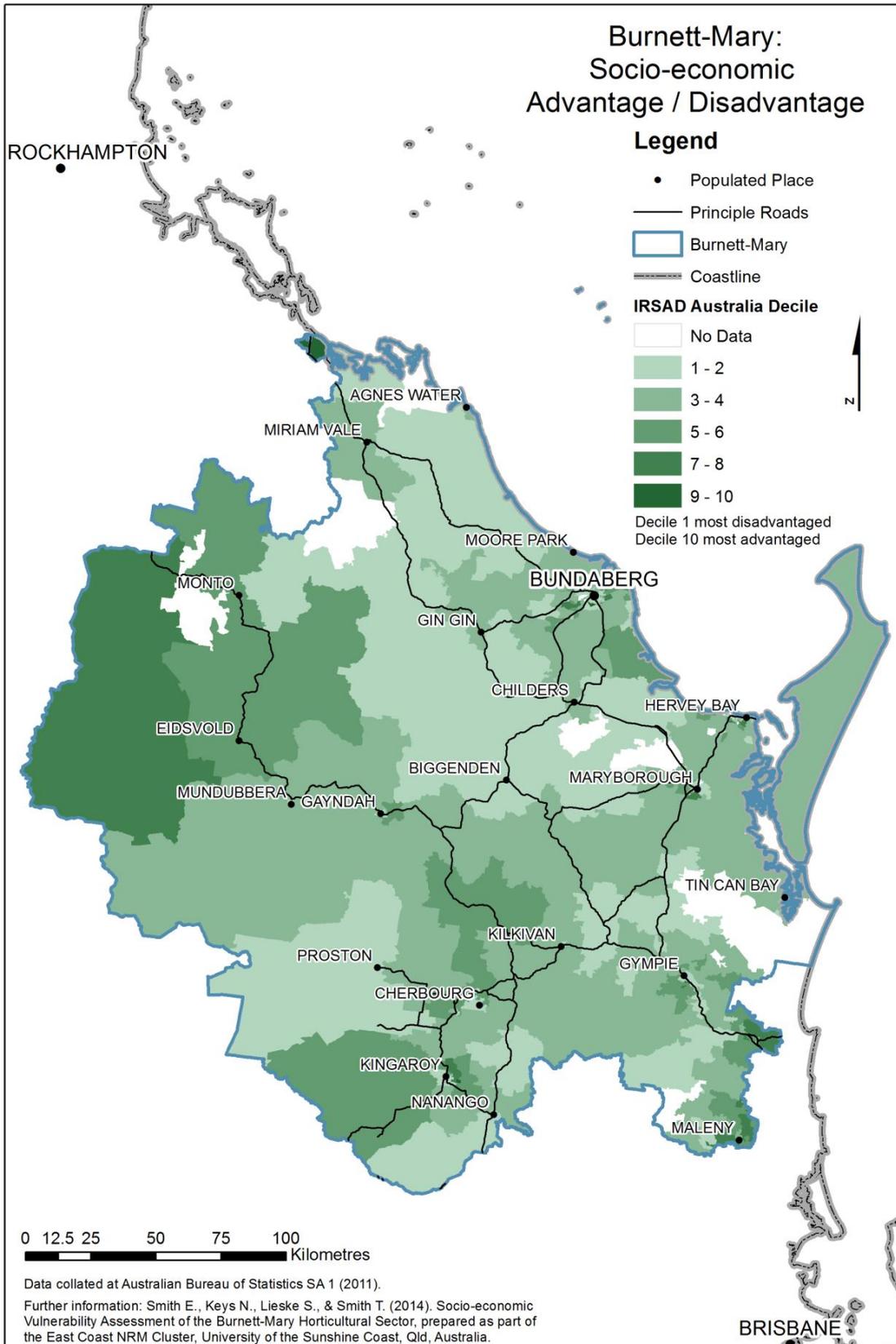
Map 2: Geographic Remoteness

Why consider geographic remoteness? Rural and regional areas are often characterised by higher levels of disadvantage than urban areas because of the interaction between socio-economic characteristics of the population and the characteristics of particular places (Gray & Lawrence, 2001; Barclay, 2014). After the natural disasters in Queensland in 2010-11, researchers found that higher proportions of people living in rural and remote areas reported suffering adverse impacts when compared to people living in larger urban areas (Clemens, et al., 2013).



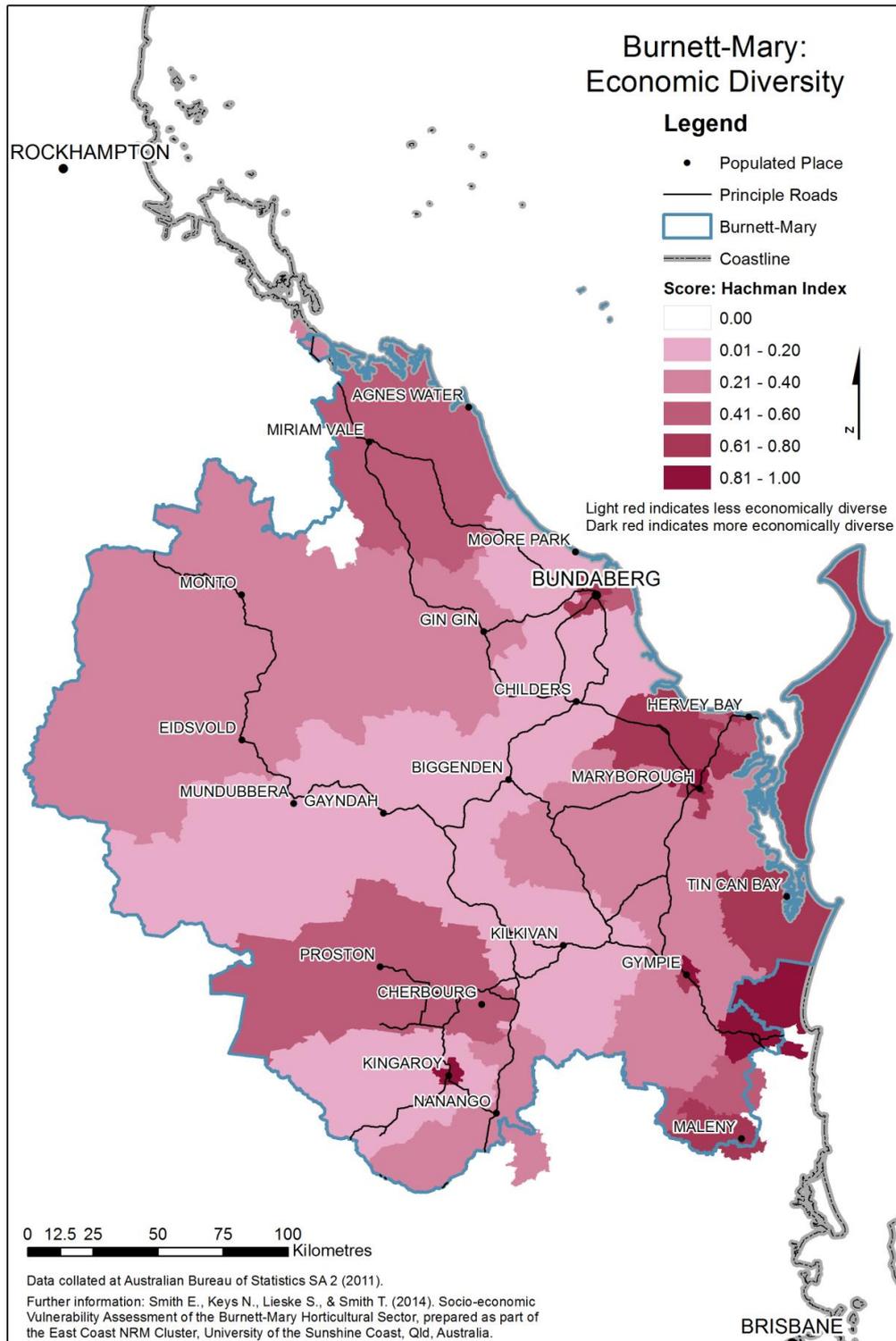
Map 3: Socio-economic Advantage / Disadvantage

Populations with higher levels of socio-economic disadvantage may have increased sensitivity (and reduced adaptive capacity) to the impacts of climatic and environmental changes. For example, in a study of the impacts of trauma after Queensland’s floods in 2010-11, Clemens et al., (2013) reported that people in socio-economically disadvantaged areas were disproportionately likely to report exposure to property damage and emotional impacts when compared to more advantaged subpopulations.



Map 4: Economic Diversity

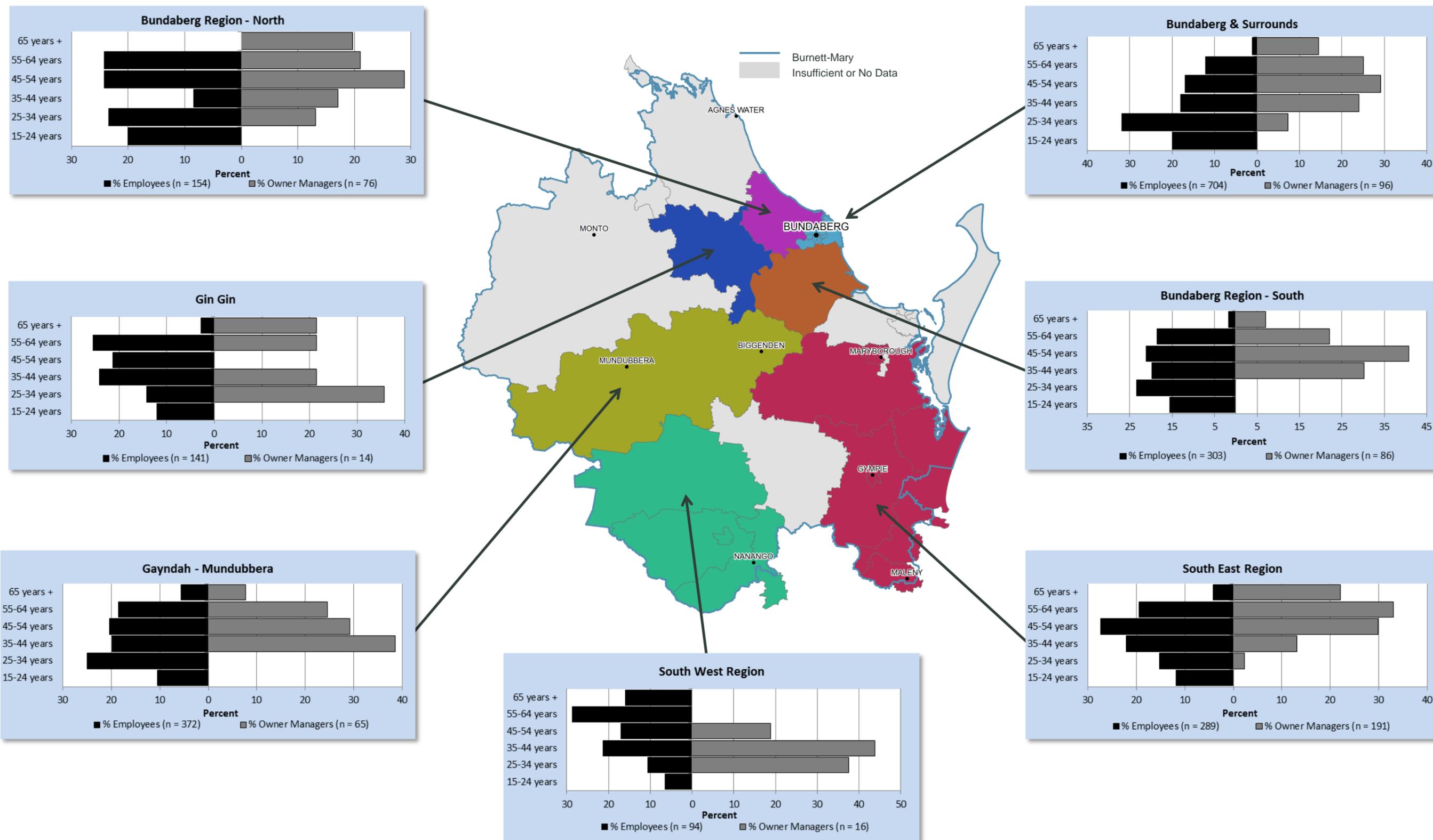
Why consider economic diversity? A diverse economy may contribute toward reduced socio-economic vulnerability because it provides a broader range of employment opportunities if individual sectors experience a downturn due to economic or environmental factors. Researchers found that farming and small communities in the Murray-Darling Basin tended to experience more acutely negative social impacts of drought if they were almost totally reliant on agricultural sectors, with almost no alternative avenues of employment (Alston & Witney-Soanes, 2008). The Hachman Index is a measure of how closely the employment distribution of a region resembles the distribution of employment in a benchmark region. Hachman scores range from 0.00-1.00, where the economic diversity of the Australian economy is assumed to be equal to 1.00.



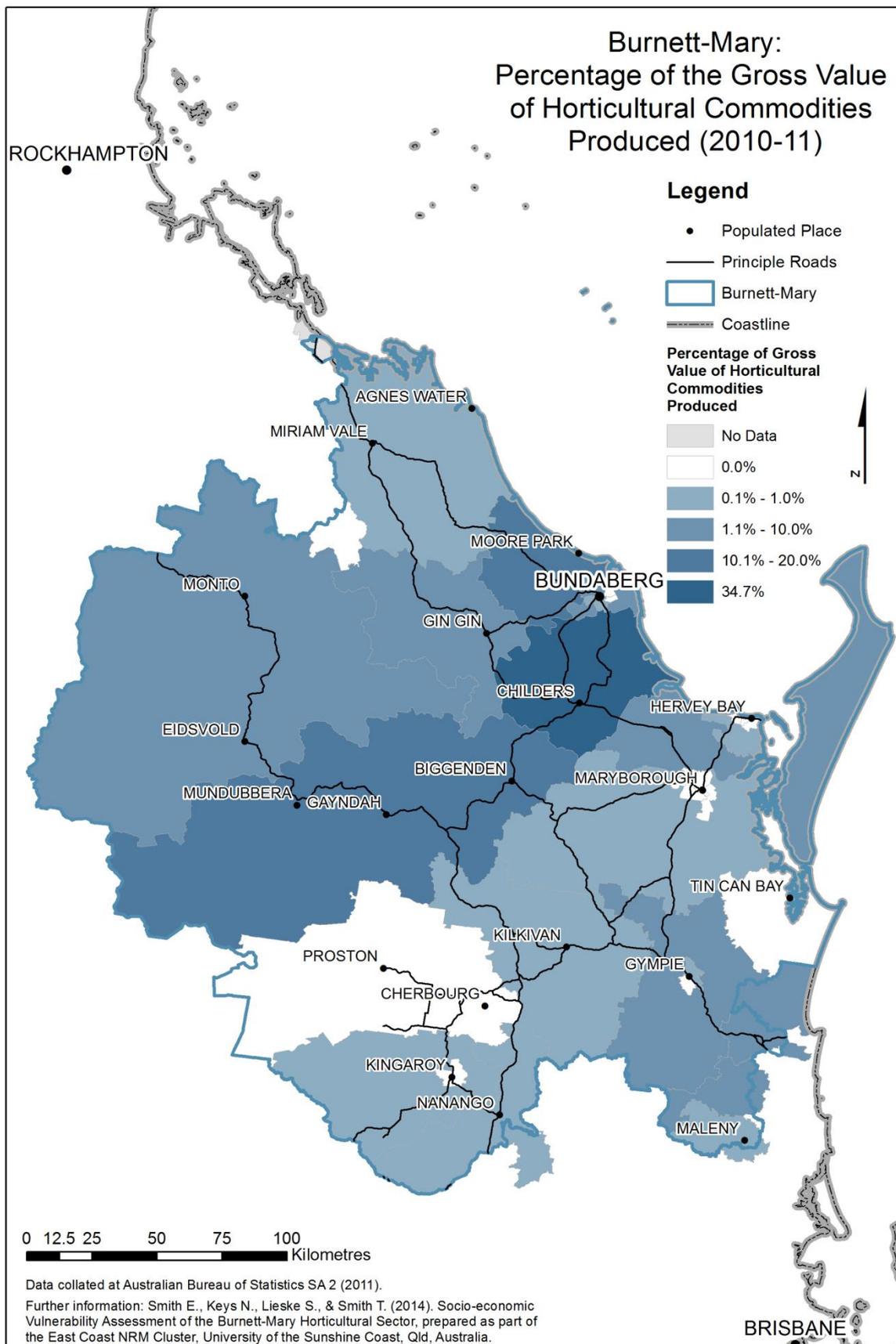


Map 5: Burnett-Mary: Age Profiles of the Horticultural Workforce

Why consider age? In general, older people may be more vulnerable to climate impacts than younger people because of their increased sensitivity to negative health impacts of climate changes (e.g., increased temperatures) (Vaneckova et al., 2008). Middle-aged owner managers may also be more vulnerable than employees because of reduced adaptive capacity arising from potential adverse climate-related impacts on their business property combined with potential adverse social impacts with their having dependent children (Clemens et al., 2013). For this reason, the age profiles of owner managers are separated from employees, as well as to capture differences/similarities in the age distribution of people who have decision-making responsibility when compared to the wider workforce.



Map 6: Percentage of the Gross Value of Horticultural Commodities Produced (2010-11)



Map 7: Percentage of the Labour Force Employed in Horticulture (2011)

